2006-2009 LINCOLN MKZ SERVICE & REPAIR MANUAL

GENERAL INFORMATION

Commonly Used Abbreviations

* PLEASE READ THIS FIRST *

NOTE: **This article is intended for general information purposes only. This information may not apply to all makes and models. Not all abbreviations are covered as manufacturers add new ones every day.**

"A"

A

Amperes

ABS

Anti-Lock Brakes

ABRS

Air Bag Restraint System

AC

Alternating Current

A/C

Air Conditioning

ACCS

A/C Cycling Switch

ACCUM

Accumulator

ACCY

Accessory

ACT

Air Charge Temperature Sensor

ADJ

Adjust or Adjustable

ADV

Advance

AFS

Airflow Sensor

AI

Air Injection

AIR or A.I.R.

Air Injection Reactor

AIS

Air Injection System

Alt.

Alternator or Altitude

Amp./amp/amps

Ampere

ASCS

Air Suction Control Solenoid

ASD

Auto Shutdown

ASDM

Air Bag System Diagnostic Module

ASV

Air Suction Valve

A/T

Automatic Transmission/Transaxle

ATC

Automatic Temperature Control

ATDC

After Top Dead Center

ATF

Automatic Transmission Fluid

ATS

Air Temperature Sensor

Aux.

Auxiliary

Avg.

Average

AXOD

Automatic Transaxle Overdrive (Ford Models Only)

"B"

BAC

By-Pass Air Control

BAP

Barometric Absolute Pressure Sensor

BARO

Barometric

Batt.

Battery

Bbl.

Barrel (Example: 4-Bbl.)

BCM

Body Control Module

BHP

Brake Horsepower

BMAP

Barometric and Manifold Absolute Pressure Sensor

BOO

Brake On-Off Switch

B/P

Backpressure

BPS

Barometric Pressure Sensor

BPT

Backpressure Transducer

BTDC

Before Top Dead Center

BTSI

Brake Transmission Shift Interlock

BTU

British Thermal Unit

BVSV

Bimetallic Vacuum Switching Valve

"C"

° C

Celsius (Degrees)

Calif.

California

CANP

Canister Purge

CARB

California Air Resources Board

CAT

Catalytic Converter

CB

Circuit Breaker

CBD

Closed Bowl Distributor

cc

cubic centimeter

CCC

Close Coupled Catalyst

CCC

Computer Command Control

CCD

Computer Controlled Dwell

CCOT

Cycling Clutch Orifice Tube

CCW

Counterclockwise

CDI

Capacitor Discharge Ignition

CEC

Computerized Engine Control

CID

Cubic Inch Displacement

cm

Centimeter

CMP

Camshaft Position Sensor

CO

Carbon Monoxide

CO_2

Carbon Dioxide

Cont.

Continued

CONV

Convertible

CP

Canister Purge

CKP

Crankshaft Position Sensor

CTS

Coolant Temperature Sensor

Cu. In.

Cubic Inch

CVC

Constant Vacuum Control

CV

Check Valve or Constant Velocity

CW

Clockwise

CYL or Cyl.

Cylinder

C^3 I

Computer Controlled Coil Ignition

C^4

Computer Controlled Catalytic Converter

"D"

"D"

Drive

DC

Direct Current Or Discharge

DDD

Dual Diaphragm Distributor

Def.

Defrost

Defog.

Defogger

DERM

Diagnostic Energy Reserve Module

DFI

Digital Fuel Injection

Diag.

Diagnostic

DTC

Diagnostic Trouble Code

DIC

Driver Information Center

DIS

Distributorless Ignition System

DIST

Distribution

DLC

Data Link Connector

DOC

Diesel Oxidation Catalyst

DOHC

Double Overhead Cam

DOT

Department of Transportation

DPF

Diesel Particulate Filter

DRB-II

Diagnostic Readout Box

DVOM

Digital Volt-Ohmmeter

"E"

EACV

Electric Air Control Valve

EATX

Electronic Automatic Transaxle

EBCM

Electronic Brake Control Module

EBL

Electronic Back Light

ECM

Engine Control Module

ECT

Engine Coolant Temperature Sensor

EDIS

Electronic Distributorless Ignition System

EEC

Electronic Engine Control

EECS

Evaporative Emission Control System

EEPROM

Electronically Erasable PROM

EFE

Early Fuel Evaporation

EGO

Exhaust Gas Oxygen Sensor

EGR

Exhaust Gas Recirculation

EOT

Engine Oil Temperature

ESA

Electronic Spark Advance

ESC

Electronic Spark Control

EST

Electronic Spark Timing

EVAP

Fuel Evaporative System

EVIC

Electronic Vehicle Information Center

EVP

EGR Valve Position Sensor

EWMA

Exponentially Weighted Moving Average (MODE 6)

Exc.

Except

"F"

° F

Fahrenheit (Degrees)

F/B

Fuse Block

Fed.

Federal

FI

Fuel Injection

FICU

Fuel Injection Control Unit

FIPL

Fuel Injector Pump Lever

FLI

Fuel Level Indicator

FPR-VSV

Fuel Pressure Regulator Vacuum Switching Valve

Ft. Lbs.

Foot Pounds

FWD

Front Wheel Drive

"G"

g

grams

Gals.

gallons

GND or GRND

Ground

"H"

HAC

High Altitude Compensation

HC

Hydrocarbons

H/D

Heavy Duty

HO2S

Heated Exhaust Gas Oxygen Sensor

Hg

Mercury

Hgt.

Height

HLDT

Headlight

HO

High Output

HO2S

Heated Oxygen Sensor

HP

High Performance

HSC

High Swirl Combustion

HSO

High Specific Output

HTR

Heater

Hz

Hertz (Cycles Per Second)

"I"

IAC

Idle Air Control

IACV

Idle Air Control Valve

IAT

Intake Air Temperature

IC

Integrated Circuit

ID

Identification

I.D.

Inside Diameter

IFS

Independant Front Suspension

IFS

Inertia Fuel Shutoff (Ford)

Ign.

Ignition

IMRC

Intake Manifold Runner Control

In.

Inches

INCH Lbs.

Inch Pounds

in. Hg

Inches of Mercury

Inj.

Injector

IP

Instrument Panel

IRS

Independant Rear Suspension

ISC

Idle Speed Control

IVD

Interactive Vehicle Dynamics (Ford)

IVSV

Idle Vacuum Switching Valve

"J"

J/B

Junction Block

"K"

KAPWR

Keep Alive Power

k/ohms

kilo-ohms (1000 ohms)

kg

Kilograms (weight)

kg/cm^2

Kilograms Per Square Centimeter

KM/H

Kilometers Per Hour

KOEO

Key On, Engine Off

KOER

Key On, Engine Running

KS

Knock Sensor

kW

Kilowatt

kV

Kilovolt

"L"

L

Liter

lbs. (Lbs. when used in table)

Pounds

LCD

Liquid Crystal Display

L/D

Light Duty

LDP

Leak Detection Pump (Part of EVAP system.)

LED

Light Emitting Diode

LH

Left Hand

"M"

mA

Milliamps

MA or MAF

Mass Airflow

MAFS

Mass Airflow Sensor

MAP

Manifold Absolute Pressure

MAT

Manifold Air Temperature

Mem.

Memory

MEM-CAL

Memory Calibration Chip

mfd.

Microfarads

MFI

Multiport Fuel Injection

MICU

Multiplex Integrated Control Unit (Acura/Honda)

MIL

Malfunction Indicator Light

MPI

Multi-Point (Fuel) Injection

mm

Millimeters

MPH

Miles Per Hour

mV

Millivolts

"N"

NA

Not Available

NAC

NOx Adsorber Catalyst

NCA

No Color Available (Wiring Diagrams)

NGS

New Generation Star

N.m

Newton Meter

No.

Number

Nos.

Numbers

NOx

Oxides of Nitrogen

"O"

O_2

Oxygen

OBD

On-Board Diagnostics

OC

Oxidation Catalyst

OD

Overdrive

O.D.

Outside Diameter

OHC

Overhead Camshaft

OSS

Output Speed Sensor

O/S

Oversize

oz.

Ounce

ozs.

Ounces

"P"

"P"

Park

P/C

Printed Circuit

PCM

Powertrain Control Module

PCS

Purge Control Solenoid

PC-SOL

Purge Control Solenoid

PCV

Positive Crankcase Ventilation

PFI

Port Fuel Injection

PGM-FI

Programmed Fuel Injection

PID

Parameter Identification

PIP

Profile Ignition Pick-up

PNP

Park Neutral Position Switch

P/N

Park/Neutral

PRNDL

Park Reverse Neutral Drive Low

PROM

Programmable Read-Only Memory

psi

Pounds Per Square Inch

P/S

Power Steering

PSPS

Power Steering Pressure Switch

PTC

Positive Temperature Coefficient

PTO

Power Take-Off

Pts.

Pints

Pwr.

Power

"Q"

Qts.

Quarts

"R"

RABS

Rear Anti-Lock Brake System

RECIRC

Recirculation

RH

Right Hand

RPM

Revolutions Per Minute

RWAL

Rear Wheel Anti-Lock Brake

RWD

Rear Wheel Drive

"S"

SAS

Steering Angle Sensor

SBC

Single Bed Converter

SBEC

Single Board Engine Controller

SDARS

Satellite Digital Audio Radio Service

SES

Service Engine Soon

SFI

Sequential (Port) Fuel Injection

SIL

Shift Indicator Light

SIR

Supplemental Inflatable Restraint

SOHC

Single Overhead Cam

SOL or Sol.

Solenoid

SPFI

Sequential Port Fuel Injection

SPK

Spark Control

SPOUT

Spark Output

SRI

Service Reminder Indicator

SRS

Supplemental Restraint System (Air Bag)

STAR

Self-Test Automatic Readout

STO

Self-Test Output

SUB-O_2

Sub Oxygen Sensor

Sw.

Switch

Sys.

System

"T"

TAB

Thermactor Air By-Pass

TAC

Throttle Actuator Module

TAD

Thermactor Air Diverter

TBC

Body Control Module (General Motors)

TBI

Throttle Body Injection

TCC

Torque Converter Clutch

TDC

Top Dead Center

Temp.

Temperature

TFI

Thick Film Ignition

THERMAC

Thermostatic Air Cleaner

TPM

Tire Pressure Monitor

TPMS

Tire Pressure Monitor System

TPS

Throttle Position Sensor/Switch

TS

Temperature Sensor

TV

Thermovalve

TWC

Three-Way Catalyst

"V"

V

Valve

Vac.

Vacuum

VAF

Vane Airflow

VAPS

Variable Assist Power Steering

VCC

Viscous Converter Clutch

VCRM

Variable Control Relay Module

VIN

Vehicle Identification Number

VM

Vacuum Modulator

Volt.

Voltage

VOM

Volt-Ohmmeter (Analog)

VRV

Vacuum Regulator Valve

VSS

Vehicle Speed Sensor

VSV

Vacuum Switching Valve

"W"

W/

With

W/O

Without

WAC

Wide Open Throttle A/C Switch

WOT

Wide Open Throttle

EMISSION CONTROL ABBREVIATIONS

Gasoline & Diesel

"A"

A/C

Air Conditioning

A/C-ISUS

A/C Idle Speed-Up Solenoid

A/F

Air/Fuel

AAI

Air Assist Injector

ACL

Air Cleaner (Thermostatic Air Cleaner)

ACL-BMS

ACL Bimetallic Sensor

ACL-CKV

ACL Check Valve

ACL-DV

ACL Delay Valve

ACL-PVS

ACL Ported Vacuum Switch

ACL-RDV

ACL Reverse Delay Valve

ACL-RDVS

ACL Reverse Delay Valve (Single)

ACL-TCV

ACL Thermal Control Valve

ACL-TS

ACL Temperature Sensor

ACL-TSOV

ACL Temperature Sensor Override Valve

ACL-TVS

ACL Thermal Vacuum Switch

ACL-TVV

ACL Thermal Vacuum Valve

ACL-VCDV

ACL Vacuum Control Delay Valve

ACL-VCV

ACL Vacuum Control Valve

ACL-VM

ACL Vacuum Motor

ACL-WP

ACL Wax Pellet Type Motor

ADS

Anti-Dieseling Solenoid

AFR

Air/Fuel Ratio Sensor

AFS

Air/Fuel Ratio Sensor

AIH

Air Intake Heaters

AIH-TS

AIH Temperature Sensor

AIR

Air Injection System

AIS

Air Injection System

AIS-ACV

AIS Air Control Valve

AIS-AMV

AIS Air Management Valve

AIS-ASV

AIS Air Switching Valve

AIS-BPV

AIS By-Pass Valve

AIS-CC

AIS Computer Controlled

AIS-CKV

AIS Check Valve

AIS-CSV

AIS Control Solenoid Valve

AIS-CV

AIS Combination Valve

AIS-DV

AIS Diverter Valve

AIS-IMCV

AIS Intake Manifold Change-Over Valve

AIS-MCV

AIS Manifold Change-Over Valve

AIS-PAF

AIS Pulse Air Feeder

AIS-PM

AIS Pump Motor

AIS-PV

AIS Pneumatic Valve

AIS-RV

AIS Relief Valve

AIS-SAV

AIS Secondary Air Valve

AIS-SOL

AIS Solenoid

AIS-SV

AIS Solenoid Valve

AIS-VCV

AIS Vacuum Control Valve

AIS-VSV

AIS Vacuum Switching Valve

AIS-VT

AIS Vacuum Tank

AIS-VCV

AIS Vacuum Control Valve

AIS-VSV

AIS Vacuum Switching Valve

AIV

Air Injection Valve

AIV-SOL

Air Injection Valve Solenoid

ALVW

Adjusted Loaded Vehicle Weight

AMV

Air Management Valve

AP

Air Pump Injection System

AP-ACV

AP Air Control Valve

AP-AMV

AP Air Management Valve

AP-ASRV

AP Air Switching Relief Valve

AP-ASS

AP Air Switching Solenoid

AP-ASV

AP Air Switching Valve

AP-BPV

AP By-Pass Valve

AP-CKV

AP Check Valve

AP-CS

AP Control Solenoid

AP-DCTO

AP Dual Coolant Temperature Override

AP-DLY

AP Delay Valve

AP-DV

AP Diverter Valve

AP-EADV

AP Electric Air Control Diverter Valve

AP-EAMR

AP Electric Air Management Relay

AP-EAMS

AP Electric Air Management Solenoid

AP-EAP

AP Electric Air Pump

AP-EC

AP Electromagnetic Clutch

AP-ERLY

AP Electric Air Pump Relay

AP-RDV

AP Reed Valve

AP-RV

AP Relief Valve

AP-SOL

AP Solenoid

AP-SOV

AP Shut-Off Valve

AP-SV

AP Solenoid Valve

AP-SWV

AP Switchover Valve

AP-TV

AP Transmitting Valve

AP-VCS

AP Vacuum Control Solenoid

AP-VCSV

AP Vacuum Controlled Air Shut-Off Valve

AP-VCV

AP Vacuum Control Valve

AP-VSV

AP Vacuum Switching Valve

A/T

Automatic Transmission

ATCV

Air Temperature Control Valve

"B"

BP/EGR

Backpressure EGR System

BP/EGR-BPS

BP/EGR Backpressure Sensor

BP/EGR-BPT

BP/EGR Backpressure Transducer

BP/EGR-BPV

BP/EGR Backpressure Valve

BP/EGR-BS

BP/EGR Bleed Solenoid

BP/EGR-BVSV

BP/EGR Bimetallic Vacuum Switching Valve

BP/EGR-C

BP/EGR Controller

BP/EGR-CLR

BP/EGR Cooler

BP/EGR-CS

BP/EGR Control Solenoid

BP/EGR-CTO

BP/EGR Coolant Temperature Override

BP/EGR-CV

BP/EGR Control Valve

BP/EGR-DCTO

BP/EGR Dual Coolant Temperature Override

BP/EGR-DS

BP/EGR Diagnostic Solenoid

BP/EGR-DSOL

BP/EGR Duty Solenoid

BP/EGR-DTVSW

BP/EGR Distributor Thermal Vacuum Switch

BP/EGR-DV

BP/EGR Delay Valve

BP/EGR-EET

BP/EGR Electric Transducer

BP/EGR-EPV

BP/EGR External Pressure Valve

BP/EGR-FDV

BP/EGR Forward Delay Valve

BP/EGR-LC

BP/EGR Load Control Valve

BP/EGR-PS

BP/EGR Position Sensor

BP/EGR-PT

BP/EGR Pressure Tranducer

BP/EGR-PVS

BP/EGR Ported Vacuum Switch

BP/EGR-RES

BP/EGR Reservoir

BP/EGR-RST

BP/EGR Restrictor

BP/EGR-SOL

BP/EGR Solenoid

BP/EGR-TCTVS

BP/EGR Torque Converter Thermal Vacuum Switch

BP/EGR-TCV

BP/EGR Thermal Control Valve

BP/EGR-TCVLV

BP/EGR Temperature Control Valve

BP/EGR-TS

BP/EGR Temperature Sensor

BP/EGR-TVS

BP/EGR Thermal Vacuum Switch

BP/EGR-TVV

BP/EGR Thermal Vacuum Valve

BP/EGR-VCV

BP/EGR Vacuum Control Valve

BP/EGR-VM

BP/EGR Vacuum Modulator

BP/EGR-VRV

BP/EGR Vacuum Regulator Valve

BP/EGR-VS

BP/EGR Vacuum Switch

BP/EGR-VSOL

BP/EGR Vent Solenoid

BP/EGR-VSV

BP/EGR Vacuum Switching Valve

"C"

C-4

Computer Controlled Catalytic Converter

CAC

Charge Air Cooler

CAS

Clean Air System

CB

Crankcase Breather

CB-VC

Crankcase Breather-Vapor Canister

CBPS

Coasting By-Pass System

CBVC

Crankcase Breather Vapor Canister

CCIEV

Coolant Controlled Idle Enrichment Valve

CCS

Controlled Combustion System

CCV

Closed Crankcase Ventilation

CD-REGVLV

Crankcase Depression Regulator Valve

CDRV

Crankcase Depression Relief Valve

CEAB

Cold Engine Air Bleed

CEAB-TVS

CEAB Thermal Vacuum Switch

CEAB-TVV

CEAB Thermal Vacuum Valve

CEC

Computerized Engine Controls

CESS

Cold Engine Sensor Switch

CETS

Cold Engine Temperature Switch

CFI

Continuous Fuel Injection

CMH

Cold Mixture Heater

CNG

Compressed Natural Gas

CO

Carbon Monoxide

CO2

Carbon Dioxide

CPI

Central Port Injection

CRV

Coasting Richer Valve

CSI

Central Sequential Injection

CTAVS

Cold Temperature Activated Vacuum System

CTOX

Continous Trap Oxidizer

"D"

DCLV

Deceleration Valve

DCS

Deceleration Control System

DDI

Direct Diesel Injection

DFI

Direct Diesel Injection

DI

Direct Injection

DKV

Deceleration Kick Valve

DMCV

Deceleration Mixture Control Valve

DMS

Dual Manifold System

DOC

Diesel Oxidation Catalyst

DOHC

Dual Overhead Cam

DPF

Diesel Particulate Filter

DPFE

Differential Pressure Feedback EGR Valve

DPFEGR

Differential Pressure Feedback EGR Valve

DTM

Deceleration Throttle Modulator

"E"

EAIR

Electric Air Injection System

EAIR-DV

EAIR Diverter Valve

ECM

Electronic Control Module

ECU

Electronic Control Unit

EDC

Electronic Diesel Control

EDS

Electronic Diesel System

EEC

Electronic Engine Control

EFE

Early Fuel Evaporation

EFE-CKV

EFE Check Valve

EFE-CV

EFE Control Valve

EFE-DTVS

EFE Delay Thermal Vacuum Switch

EFE-HTR

EFE Heater

EFE-HCV

EFE Heat Control Valve

EFE-OTS

EFE Oil Temperature Switch

EFE-PTC

EFE Positive Temperature Coefficient (Intake Heater Grid)

EFE-PVS

EFE Ported Vacuum Switch

EFE-SOL

EFE Solenoid

EFE-TVS

EFE Thermal Vacuum Switch

EFE-TVV

EFE Thermal Vacuum Valve

EFE-VSV

EFE Vacuum Switching Valve

EFI

Electronic Fuel Injection

EFI-MA

EFI Mass Airflow Sensor

EFI-MAF

EFI Mass Airflow Sensor

EGR

Exhaust Gas Recirculation System

EGR-BCS

EGR Boost Check Solenoid

EGR-BPBV

EGR By-Pass Backpressure Valve

EGR-BPT

EGR Backpressure Transducer

EGR-BPV

EGR By-Pass Valve

EGR-BS

EGR Bleed Solenoid

EGR-BSSV

EGR Boost Sensor Solenoid Valve

EGR-BVSV

EGR Bimetallic Vacuum Switching Valve

EGR-C

EGR Controller

EGR-CC

EGR Coolant Controlled

EGR-CLR

EGR Cooler

EGR-VSOL

EGR Vacuum Solenoid

EGR-CKV

EGR Check Valve

EGR-CS

EGR Control Solenoid

EGR-CSOL

EGR Cut-Off Solenoid

EGR-CSV

EGR Control Solenoid

EGR-CTO

EGR Coolant Temperature Override

EGR-CTS

EGR Charge Temperature Sensor

EGR-CTSW

EGR Charge Temperature Switch

EGR-CTTS

EGR Coolant Temperature Thermoswitch

EGR-CV

EGR Control Valve

EGR-CVCV

EGR Constant Vacuum Control Valve

EGR-CVS

EGR Control Vent Solenoid

EGR-DC

EGR Digital Control

EGR-DCTO

EGR Dual Coolant Temperature Override

EGR-DPFE

Differential Pressure Feedback EGR Sensor

EGR-DPFS

EGR Differential Pressure Feedback Sensor

EGR-DS

EGR Diagnostic Solenoid

EGR-DSOL

EGR Duty Solenoid

EGR-DTVS

EGR Delay Thermal Vacuum Switch

EGR-DTVSW

EGR Distributor Thermal Vacuum Switch

EGR-DV

EGR Delay Valve

EGR-EPRS

EGR Exhaust Pressure Regulator Solenoid

EGR-EPRV

EGR Exhaust Pressure Regulator Valve

EGR-EPV

EGR External Pressure Valve

EGR/EVAP-CSV

EGR/EVAP Control Solenoid Valve

EGR-EVR

EGR Vacuum Regulator

EGR-EVRV

EGR Electronic Vacuum Regulator Valve

EGR-FDV

EGR Forward Delay Valve

EGR-FJS

EGR Floor Jet System

EGR-FPS

EGR Feedback Pressure Sensor

EGR-LCV

EGR Load Control Valve

EGR-MAP

EGR Manifold Absolute Pressure Sensor

EGR-PFE

EGR-PFE Sensor

EGR-PS

EGR Position Sensor

EGR-PSW

EGR Pulse Switch

EGR-PVS

EGR Ported Vacuum Switch

EGR-REG

EGR Regulator

EGR-RES

EGR Reservoir

EGR-RST

EGR Restrictor

EGR-SC

EGR Signal Converter

EGR-SEC

EGR, Secondary

EGR-SEN

EGR Sensor

EGR-SOL

EGR Solenoid

EGR-SU

EGR Switchover Valve

EGR-SUB

Sub-EGR Valve

EGR-SVV

EGR Solenoid Vacuum Valve

EGR-T

EGR Temperature Sensor

EGR-TC

EGR Transmission Controlled

EGR-TCTVS

EGR Torque Converter Thermal Vacuum Switch

EGR-TCV

EGR Thermal Control Valve

EGR-TCVLV

EGR Temperature Control Valve

EGR-TRANS

EGR Transducer

EGR-TS

EGR Temperature Sensor

EGR-TSW

EGR Temperature Switch

EGR-TVD

EGR Throttle Valve Diaphragm

EGR-TVS

EGR Thermal Vacuum Switch

EGR-TVSOL

EGR Throttle Valve Solenoid

EGR-TVV

EGR Thermal Vacuum Valve

EGR-VA

EGR Vacuum Amplifier

EGR-VCV

EGR Vacuum Control Valve

EGR-VM

EGR Vacuum Modulator

EGR-VR

EGR Vacuum Regulator

EGR-VRS

EGR Vacuum Regulator Solenoid

EGR-VRSV

EGR Vacuum Regulator Solenoid Valve

EGR-VRV

EGR Vacuum Regulator Valve

EGR-VS

EGR Vacuum Switch

EGR-VSDV

EGR Vacuum Switch Dump Valve

EGR-VSEN

EGR Vacuum Sensor

EGR-VSOL

EGR Vent Solenoid

EGR-VSS

EGR Vacuum Switching Solenoid

EGR-VST

EGR Vacuum Surge Tank

EGR-VSV

EGR Vacuum Switching Valve

EGR-VVCS

EGR Venturi Vacuum Control System

EGRB

EGR Boost Sensor

EGRC

EGR Control Solenoid

EGRC-BPT

EGR Control Backpressure Transducer

EGRC-SV

EGR Control Solenoid Valve

EHOC

Electronically Heated Oxidation Catalyst

EHTWC

Electronically Heated Three-Way Catalyst

EI

Electronic Ignition System

EIS

Electronic Ignition System

ELB

Electronic Lean Burn

EPR

Exhaust Pressure Regulator

EPR-SOL

EPR Solenoid

ESA

Electronic Spark Advance

EVAP

Fuel Evaporative System

EVAP-AAC

EVAP Auxiliary Air Control

EVAP-BPSV

EVAP By-Pass Solenoid Valve

EVAP-BVSV

EVAP Bimetallic Vacuum Switching Valve

EVAP-CAV

EVAP Canister Air Valve

EVAP-CCV

EVAP Control Canister Close Valve

EVAP-CCVSV

EVAP Control Canister Vent Shut Valve

EVAP-CCVVSV

EVAP Closed Canister Valve Vacuum Switching Valve

EVAP-CDCV

EVAP Canister Drain Cut Valve

EVAP-CKV

EVAP Check Valve

EVAP-CPCS

EVAP Canister Purge Control Solenoid

EVAP-CPCSV

EVAP Canister Purge Control Solenoid Valve

EVAP-CPCV

EVAP Canister Purge Control Valve

EVAP-CPRV

EVAP Canister Purge Regulator Valve

EVAP-CPSV

EVAP Canister Vent Shut Valve

EVAP-CPT

EVAP Canister Purge Timer

EVAP-CPTVS

EVAP Canister Purge Thermal Vacuum Switch

EVAP-CPV

EVAP Canister Vent Valve

EVAP-CPVCSV

EVAP Canister Purge Volume Control

EVAP-CPVCV

EVAP Canister Purge Volume Control Valve

EVAP-CPVDV

EVAP Canister Purge Vacuum Delay Valve

EVAP-CPVR

EVAP Canister Purge Valve Resonator

EVAP-CS

EVAP Control Solenoid

EVAP-CSPS

EVAP Control System Pressure Sensor

EVAP-CST

EVAP Canister Surge Tank

EVAP-CT

EVAP Catch Tank

EVAP-CVCS

EVAP Canister Vent Control Solenoid

EVAP-CVCV

EVAP Canister Vent Control Valve

EVAP-CVS

EVAP Canister Vent Solenoid

EVAP-CVSV

EVAP Carburetor Vent Switching Valve

EVAP-CVV

EVAP Canister Vent Valve

EVAP-DCTO

EVAP Dual Coolant Temperature Override

EVAP-DF

EVAP Drain Filter

EVAP-DPS

EVAP Differential Pressure Sensor

EVAP-DV

EVAP-Drain Valve

EVAP-EV

EVAP Emission Valve

EVAP-FBVV

EVAP Fuel Bowl Vent Valve

EVAP-FBVS

EVAP Fuel Bowl Vent Solenoid

EVAP-FCV

EVAP Fuel Cut Valve

EVAP-FLS

EVAP Fuel Level Sensor

EVAP-FOLV

EVAP Fuel Overflow Limiter Valve

EVAP-FS

EVAP Flow Switch

EVAP-FSV

EVAP Flow Switchover Valve<

EVAP-FTEV

EVAP Fuel Tank EVAP Valve

EVAP-FTPCSV

EVAP Fuel Tank Pressure Control Solenoid Valve

EVAP-FTPS

EVAP Fuel Tank Pressure Sensor

EVAP-FTS

EVAP Fuel Temperature Sensor

EVAP-FVCV

EVAP Fuel Vapor Control Valve

EVAP-FVS

EVAP Fuel Vapor Separator

EVAP-FVTS

EVAP Fuel Vapor Temperature Sensor

EVAP-FVV

EVAP Fuel Vent Valve

EVAP-FVVV

EVAP Fuel Vapor Vent Valve

EVAP-IVS

EVAP Inner Vent Solenoid

EVAP-LDP

EVAP Leak Detection Pump

EVAP-LDPAF

EVAP Leak Detection Pump Air Filter

EVAP-LDPF

EVAP Leak Detection Pump Filter

EVAP-LDPVV

EVAP Leak Detection Pump Vent Valve

EVAP-LSEP

EVAP Liquid Separator

EVAP-NVLD

EVAP Natural Vacuum Leak Detection

EVAP-ORVR

Evaporative On-Board Refueling Vapor Recovery System

EVAP-ORVRCV

Evaporative On-Board Refueling Vapor Recovery Check Valve

EVAP-ORVRFTVRV

EVAP-ORVR Fuel Tank Vapor Recirculation

EVAP-OVCV

EVAP Outer Vent Control Valve

EVAP-OWV

EVAP One-Way Valve

EVAP-PCDV

EVAP Purge Control Diaphram Valve

EVAP-PCSV

EVAP Purge Cut-Off Solenoid Valve

EVAP-PFS

EVAP Purge Flow Sensor

EVAP-PFSVVSV

EVAP Purge Flow Switching Valve Vacuum Switching Valve

EVAP-PRRV

EVAP Pressure Relief Rollover Valve

EVAP-PSVVSV

EVAP Pressure Switching Valve Vacuum Switching Valve

EVAP-PSOL

EVAP Purge Solenoid

EVAP-PSSV

EVAP Pressure Switching Solenoid

EVAP-PSVVSV

EVAP Pressure Switching Valve Vacuum Switching Valve

EVAP-PV

EVAP Purge (Frequency) Valve

EVAP-PVS

EVAP Ported Vacuum Switch

EVAP-RV

EVAP Rollover Valve

EVAP-RV/FTPS

EVAP Rollover Valve/Fuel Tank

EVAP-RVSV

EVAP Rollover Vapor Separator Valve

EVAP-SNR

EVAP Canister Sensor

EVAP-SOL

EVAP Solenoid

EVAP-SOV

EVAP Shutoff Valve

EVAP-SSV

EVAP Shut-Off Solenoid Valve

EVAP-SV

EVAP Solenoid Valve

EVAP-TC

EVAP Trap Canister

EVAP-TS

EVAP Temperature Switch

EVAP-TPBPV

EVAP Tank Pressure By-Pass Valve

EVAP-TPCS

EVAP Tank Pressure Control Solenoid

EVAP-TPCV

EVAP Tank Pressure Control Valve

EVAP-TRWV

EVAP Tree-Way Valve

EVAP-TV

EVAP Thermal Valve

EVAP-TVS

EVAP Thermal Vacuum Switch

EVAP-TVV

EVAP Thermal Vacuum Valve

EVAP-TWV

EVAP Two-Way Valve

EVAP-VC

EVAP Vapor Canister

EVAP-VCAT

EVAP Vapor Canister Air Tank

EVAP-VCF

EVAP Vapor Canister Filter

EVAP-VCSV

EVAP Vapor Canister Shut-off Valve

EVAP-VCTV

EVAP Vacuum Control Valve

EVAP-VCV

EVAP Vacuum Canister Valve

EVAP-VCVS

EVAP Vapor Canister Vent Solenoid

EVAP-VM

EVAP Vacuum Motor

EVAP-VPS

EVAP Vapor Pressure Sensor

EVAP-VPSVSV

EVAP Vapor Pressure Sensor Vacuum Switching Valve

EVAP-VS

EVAP Vacuum Sensor

EVAP-VSOL

EVAP Ventilation Solenoid

EVAP-VSOL/LDP

EVAP Ventilation Solenoid/Leak Detection Pump

EVAP-VST

EVAP Vacuum Surge Tank

EVAP-VSV

EVAP Vacuum Switching Valve

EVAP-VV

EVAP Ventilation Valve

EVRS

EGR Vacuum Regulator Solenoid

"F"

FBC

Feedback Carburetor

FCOV

Fuel Change Over Valve

FF

Flex Fuel

FF-CKV

Fuel Fill Check Valve

FF-FCV

Fuel Tank Fuel Cut-Off Valve

FF-FLVV

Fuel Tank Fill Limit Vent Valve

FGOV

Fuel Gravity/Overflow Valve

FGVV

Fuel Gravity Vent Valve

FI

Fuel Injected

FICD

Fast Idle Control Device

FISR

Fast Idle Solenoid Relay

FLV

Fill Limit Valve

FLVV

Fill Limiting Vent Valve

FP-CKV

Fill Pipe Check Valve

FP-RV

Fill Pipe Rollover Valve

FR

Fill Pipe Restrictor

FT-FLVV

Fuel Tank Fill Limit Vent Valve

FT-GVV

Fuel Tank Grade Vent Valve

FT-OPRV

Fuel Tank Over Pressure Vent Valve

FT-PCV

Fuel Tank Pressure Control Valve

FT-VCV

Fuel Tank Vapor Control Valve

FT-VRV

Fuel Tank Vapor Recirculation Valve

FTCV

Fuel Tank Check Valve

FTDPS

Fuel Tank Differential Pressure Sensor

FTEV

Fuel Tank EVAP Valve

FTPS

Fuel Tank Pressure Sensor

FTT

Fuel Tank Temperature Sensor

FTTS

Fuel Tank Temperature Sensor

FTV/LSV

Fuel Tank Vapor/Liquid Seperation Valve

FTVCV

Fuel Tank Vapor Control Valve

FTVPRV

Fuel Tank Ventilation Pressure Retention Valve

FVPS

Fuel Vapor Pressure Sensor

FTVV

Fuel Tank Vent Valve

FVV

Fuel Vapor Valve

"G"

GVWR

Gross Vehicle Weight Rating

"H"

HAC

High Altitude Compensator

HAFS

Heated Air Fuel Ratio Sensor

HAI

Hot Air Intake

HAS

High Altitude System

HC

Hydrocarbons

HCAC-VSV

Hydrocarbon Absorber Catalyst Vacuum Switching Valve

HDC

Heavy Duty Cooling

HDC-CTO

HDC Coolant Temperature Override

HFM-SFI

Hot Film Engine Management SFI

HIC

Hot Idle Compensator

HIM

Heated Intake Manifold

HO

High Output

HO2S

Heated Oxygen Sensor

HP

High Performance

HP

Horsepower

HPCA

Housing Pressure Cold Advance

HSC

High Swirl Combustion

"I"

IAC

Idle Air Control Valve

IACV-SW

IACV Switch

ICOM

Idle Compensator

IDI

Indirect Diesel Injection

IES

Idle Enrichment System

IMCO

Improved Combustion System

"K"

KS

Knock Sensor

"L"

LH-SFI

Hot Wire Sequential Multiport Fuel Injection

LVFD

Liquid/Vapor Fuel Discriminator

LVW

Loaded Vehicle Weight

"M"

MD-TICS

Timing & Injection rate Control System

MDP

Manifold Differential Pressure sensor

ME-SFI

Motor Electronics Sequential Fuel Injection

MFI

Multiport Fuel Injection

MFI-MAF

MFI Mass Airflow Sensor

MFLS

Main Fuel Level Sensor

MI

Mechanical Fuel Injection

MIL

Malfunction Indicator Light

M/T

Manual Transmission

"N"

NAC

Nitrogen Oxides (NOx) Adsorbing Catalyst

NLV

Non-Linear Valve

NOS

NOx Sensor

NOx

NOx Emission Control

NOxC

Nitrogen Oxide Catalyst

NOxS

Nitrogen Oxide Sensor

NOxTWC

NOx adsorptive TWC

NSC

Nitrogen Oxides (NOx) Storage Catalyst

"O"

OBD

On-Board Diagnostic System

PBD (F)/(P)

Full/Partial On-Board Diagnostic

OC

Oxidation Catalytic Converter

OHC

Overhead Cam

ORVR

On-Board Refueling Vapor Recovery

ORVR-COV

ORVR Cut-Off Valve

ORVR-CV

ORVR Control Valve

ORVR-FMV

ORVR Flow Management Valve

ORVR-FTVCV

ORVR Fuel Tank Vapor Control Valve

ORVR-FTVRV

ORVR Fuel Tank Vapor Recirculation Valve

ORVR-LV

ORVR Leveling Valve

ORVR-OCKV

ORVR Overfill Check Valve

ORVR-RCV

ORVR Refueling Control Valve

ORVR-VCV

ORVR Vapor Cut Valve

ORVR-VRV

ORVR Vapor Recirculating Valve

ORVR-VSV

ORVR Vent Shut Valve

ORVR-VV

ORVR Vent Valve

OVCV

Outer Vent Control Valve

O2S

Oxygen Sensor

"P"

PAIR

Pulsed Secondary Air Injection

PAIR-ABV

PAIR Anti-Backfire Valve

PAIR-ACOV

PAIR Air Cut-Off Valve

PAIR-ACS

PAIR Air Control Solenoid

PAIR-ACV

PAIR Air Control Valve

PAIR-AIV

PAIR Air Injection Valve

PAIR-ASCS

PAIR Air Suction Control Solenoid

PAIR-ASOV

PAIR Air Shutoff Valve

PAIR-ASS

PAIR Air Switching Solenoid

PAIR-ASV

PAIR Air Switching Valve

PAIR-ASVL

PAIR Air Suction Valve

PAIR-AVCS

PAIR Air Valve Control Solenoid

PAIR-CSV

PAIR Control Solenoid Valve

PAIR-CKV

PAIR Check Valve

PAIR-DV

PAIR Diverter Valve

PAIR-PAF

PAIR Pulse Air Feeder

PAIR-PAV

PAIR Pulse Air Valve

PAIR-RES

PAIR Resonator

PAIR-RV

PAIR Reed Valve

PAIR-SCSV

PAIR Swirl Control Solenoid Valve

PAIR-SCV

PAIR Swirl Control Valve

PAIR-SOL

PAIR Solenoid

PAIR-VSV

PAIR Vacuum Switching Valve

PCM

Powertrain Control Module

PCV

Positive Crankcase Ventilation

PCV-DOV

PCV Dual Orifice Valve

PCV-HCB

PCV Heated Crankcase Breather

PCV-HE

PCV Heating Element

PCV-PRV

PCV Pressure Regulator Valve

PCV-SOL

PCV Solenoid

PEVR

Power Enrichment Vacuum Regulator

PPM

Parts Per Million

PTOX

Periodic Trap Oxidizer

PURCV

Purge Crankcase Ventilation

PVCS

Ported Valve Control System

PVCS-A

PVCS Actuator

PVCS-CS

PVCS Control Solenoid

PVLCS

Power Valve Control System

"R"

ROV

Rollover Valve

"S"

SAI-SV

Secondary Air Injection Shutoff Valve

SAIR-CV

Secondary Air Injection Control Valve

SC

Supercharged or Super Charger

SC MFI

Supercharged Multiport Fuel Injection

SCR

Selective Catalytic Reduction

SCSV

Swirl Control Solenoid Valve

SCV

Swirl Control Valve

SCV-A

SCV Actuator

SFI

Sequential Multiport Fuel Injection

SFI-MAF

SFI Mass Airflow Sensor

SFLS

Sub-Fuel Level Sensor

SOHC

Single Overhead Cam

SPK

Spark Controls

SPK-AVM

SPK Advance Vacuum Modulator

SPK-BVSV

SPK Bimetal Vacuum Switching Valve

SPK-CC

SPK Computer Controlled

SPK-CKV

SPK Check Valve

SPK-CSSA

SPK Cold Start Spark Advance System

SPK-CSSH

SPK Cold Start Spark Hold System

SPK-CTO

SPK Coolant Temperature Override

SPK-DAVS

SPK Distributor Vacuum Advance Solenoid

SPK-DCKV

SPK Distributor Check Valve

SPK-DCTO

SPK Dual Coolant Temperature Override

SPK-DDD

SPK Dual Diaphragm Distributor

SPK-DMV

SPK Distributor Modulator Valve

SPK-DPD

SPK Dual Point Distributor

SPK-DPVS

SPK Distributor Ported Vacuum Switch

SPK-DRCV

SPK Distributor Retard Control Valve

SPK-DRS

SPK Distributor Retard Solenoid

SPK-DSVMV

SPK Distributor Spark Vacuum Modulator Valve

SPK-DTVS

SPK Distributor Thermal Vacuum Switch

SPK-DTVV

SPK Distributor Thermal Vacuum Valve

SPK-DV

SPK Delay Valve

SPK-DVA

SPK Distributor Vacuum Advance

SPK-DVAS

SPK Distributor Vacuum Advance Solenoid

SPK-DVCS

SPK Distributor Vacuum Control Solenoid

SPK-DVCSW

SPK Distributor Vacuum Controlled Switch

SPK-DVCV

SPK Distributor Vacuum Control Valve

SPK-DVDV

SPK Distributor Vacuum Delay Valve

SPK-DVRS

SPK Distributor Vacuum Retard Switch

SPK-DVRV

SPK Distributor Vacuum Regulating Valve

SPK-DVVV

SPK Distributor Vacuum Vent Valve

SPK-EAVS

SPK Electronically Actuated Vacuum Switch

SPK-EDM

SPK Electronic Distributor Modulator

SPK-EI

SPK Electronic Ignition

SPK-ESA

SPK Electronic Spark Advance

SPK-ESC

SPK Electronic Spark Control (Retard)

SPK-ESS

SPK Electronic Spark Selection

SPK-EST

SPK Electronic Spark Timing

SPK-FDV

SPK Forward Delay Valve

SPK-HPCA

SPK Housing Pressure Cold Advance

SPK-ITCS

SPK Ignition Timing Control System

SPK-ITVS

SPK Ignition Timing Vacuum Switch

SPK-NLVR

SPK Non-Linear Vacuum Regulator

SPK-OSAC

SPK Orifice Spark Advance Control

SPK-PVA

SPK Ported Vacuum Advance

SPK-PVS

SPK Ported Vacuum Switch

SPK-RDO

SPK Retard Delay Orifice

SPK-RDV

SPK Reverse Delay Valve

SPK-RDVD

SPK Reverse Delay Valve (Dual)

SPK-RDVLV

SPK Retard Delay Valve

SPK-RDVS

SPK Reverse Delay Valve (Single)

SPK-RETS

SPK Retard Switch

SPK-SC

SPK Speed Controlled

SPK-SOL

SPK Solenoid

SPK-SRRV

SPK Spark Relay Regulator Valve

SPK-TAVIA

SPK Temperature Activated Vacuum Ignition Advance

SPK-TCS

SPK Transmission Controlled Spark

SPK-TCSYS

SPK Timing Control System

SPK-TIDC

SPK Thermostatic Ignition Distributor Control

SPK-TV

SPK Thermal Valve

SPK-TVS

SPK Thermal Vacuum Switch

SPK-VACTO

SPK Vacuum Advance Coolant Temperature Override

SPK-VAS

SPK Vacuum Advance Solenoid

SPK-VAV

SPK Vacuum Advance Valve

SPK-VR

SPK Vacuum Retard

SPK-VRSW

SPK Vacuum Retard Switch

SPK-VSV

SPK Vacuum Switching Valve

SPK-VTCS

SPK Vacuum Timing Control System

SPL

Smoke Puff Limiter

SRI

Service Reminder Indicator

SSCA

Stepped Speed Control Actuator

SSCS

Stepped Speed Control Solenoid

STS

Service Throttle Soon Light

STVS

Secondary Throttle Valve System

SUB-HO2S

Sub-Heated Oxygen Sensor (after CAT)

SUB-O2S

Sub-Oxygen Sensor

SUB-TWC

Sub Three-Way Catalytic Converter

"T"

TAA

Turbo Air-To-Air

TAA

Throttle Actuator Assembly

TAB

Thermactor Air By-Pass

TAD

Thermactor Air Diverter

TAC

Thermostatic Air Cleaner

TBI

Throttle Body Injection

TBPCS

Throttle By-Pass Control System

TC

Turbo Charger

TCC

Torque Converter Clutch

TCCL

Torque Converter Control

TCD

Throttle Closing Dashpot

TC-DV

TC Delay Valve

TC-TVC

TC Thermal Vacuum Switch

TC-VS

TC Vacuum Switch

TD

Thermactor Diverter

TFT

Tank Fuel Temperature Sensor

THOS2

Third Heated Oxygen Sensor

TICV

Thermal Ignition Control Valve

TIV

Thermal Idle Valve

TK

Throttle Kicker

TLUC

Transmission Lock-Up Converter

TLUC-TVS

TLUC Thermal Vacuum Switch

TLUC-VS

TLUC Vacuum Switch

TM

Throttle Modulator

TOS

Throttle Opener System

TP

Throttle Positioner

TPI

Tuned Port Fuel Injection

TPV

Throttle Poppet Valve

TR

Thermal Reactor

TRC

Throttle Return Control

TRCS

Throttle Return Control Solenoid

TRCTL

Throttle Return Control Throttle Lever Actuator

TRSCV

Throttle Return Solenoid Control Valve

TRTVV

Temperature Regulator Thermal Vacuum Valve

TRVV

Transmission Vacuum Valve

TSOL

Throttle Solenoid

TVISD

Throttle Vacuum Idle Speed Diaphragm

TVM

Transmission Vacuum Modulator

TWC

Three-Way Catalytic Converter

TWC+OC

Three-Way + Oxidation Catalytic Converter

"V"

VA

Vacuum Advance Unit

VAC-AMP

Vacuum Amplifier

VA-CTO

VA Coolant Temperature Override

VCV

Vacuum Cut Valve

VCV-BV

VCV By-Pass Valve

VLFR

Vent Line Flow Restrictor/Anti-Trickle Fill Valve

"W"

WU

Warm-Up Catalyst

WU-OC

Warm-Up Oxidation Converter

WU-TWC

Warm-Up Three-Way Catalytic Converter

2008 ENGINE PERFORMANCE

Acceleration Control - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Accelerator pedal and sensor assembly nuts	9	80

DESCRIPTION AND OPERATION

ACCELERATION CONTROL

The acceleration controls consist of an accelerator pedal and sensor assembly.

The engine management system electronically operates the accelerator of the engine in response to accelerator pedal movements initiated by the driver. In the event of a system failure, the engine management system provides a "limp home" mode which allows the vehicle to be driven with limited performance.

DIAGNOSTIC TESTS

ACCELERATION CONTROL

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

ACCELERATOR PEDAL AND BRACKET

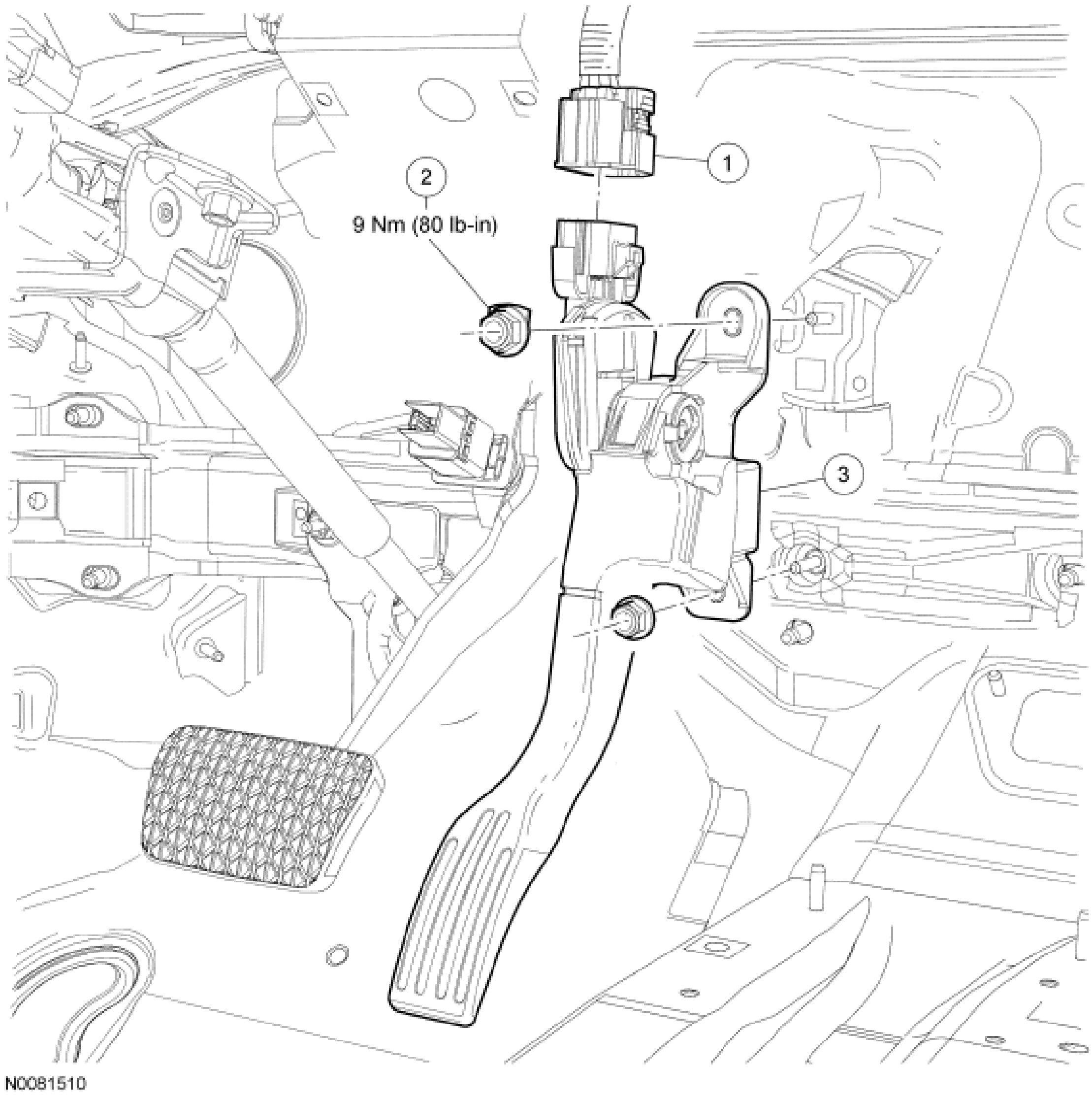


Fig. 1: Exploded View Of Accelerator Pedal & Bracket With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Accelerator pedal sensor electrical connector
2	W706131	Accelerator pedal and sensor assembly nut (2 required)
3	9F836	Accelerator pedal and sensor assembly

REMOVAL AND INSTALLATION

1. Disconnect the accelerator pedal sensor electrical connector.
2. Remove the 2 nuts and the accelerator pedal and sensor assembly.
   - To install, tighten to 9 Nm (80 lb-in).

3. To install, reverse the removal procedure.

2008 ENGINE

Accessory Drive - 3.5L - Fusion, Milan & MKZ

SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Accessory drive belt	6 ribs
Power steering pump drive belt	4-ribbed

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Accessory drive belt tensioner bolts	11	97

DESCRIPTION AND OPERATION

ACCESSORY DRIVE

This vehicle is equipped with the following components:

- V-ribbed serpentine accessory drive belt
- Automatic drive belt tensioner
- V-ribbed power steering pump drive belt

The accessory drive system provides power to operate components which power other systems. These could include components such as the generator, power steering pump and A/C compressor. Each of these components is equipped with a pulley which is driven by the accessory drive belt. The accessory drive belt is driven by the engine crankshaft pulley. The automatic belt tensioner maintains correct belt tension and compensates for component wear and changes in system load. System load changes can be caused by the A/C compressor clutch engaging or disengaging or demand changes on other systems powered by the accessory drive belt. To maintain correct operation of this system, it is critical that the correct length drive belt be installed. The pulleys must also be correctly aligned and kept clean.

Accessory Drive Belt Routing

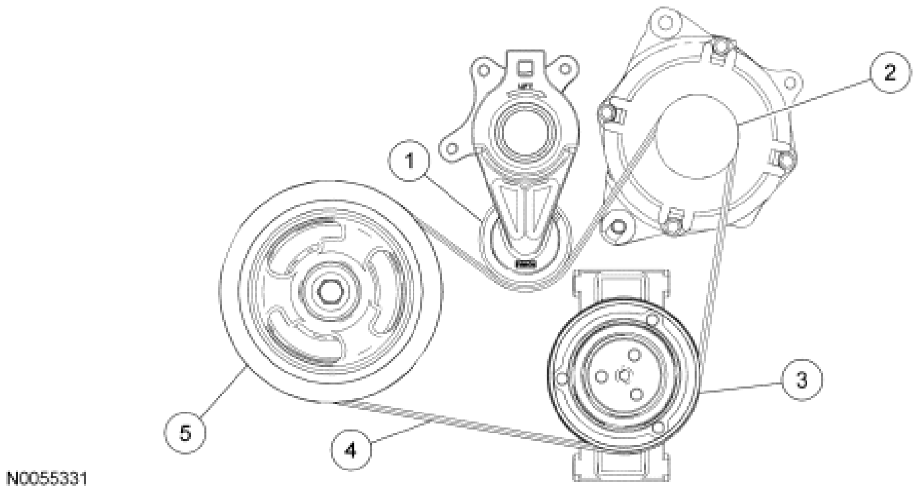


Fig. 1: Accessory Drive Belt Routing & Components (Front)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6B209	Accessory drive belt tensioner pulley
2	10300	Generator pulley
3	19D784	A/C clutch pulley
4	8620	Accessory drive belt
5	6316	Crankshaft pulley

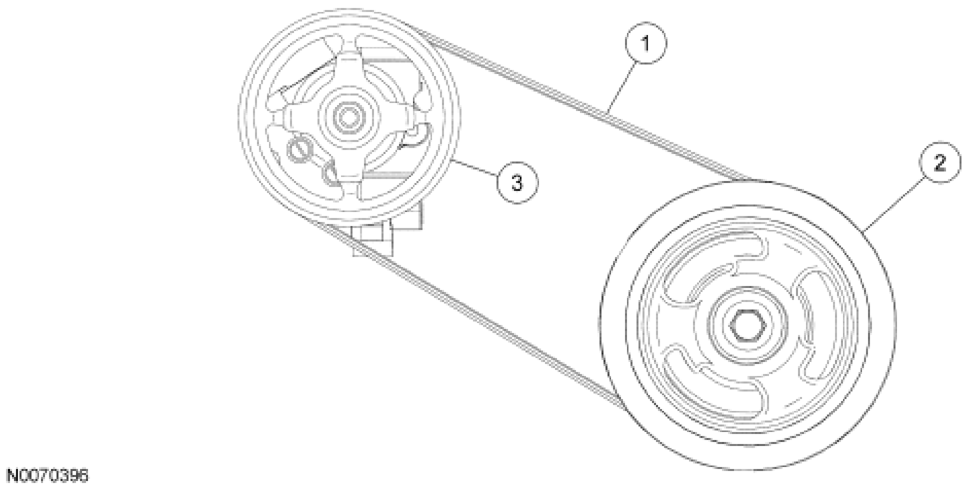


Fig. 2: Accessory Drive Belt Routing & Components (Power Steering Pump)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6C301	Power steering pump drive belt
2	6316	Crankshaft pulley
3	3D639	Power steering pump pulley

Belt Tensioner

Automatic tensioners are calibrated to provide the correct amount of tension to the belt for a given accessory drive system. Unless a spring or damping band within the tensioner assembly breaks or some other mechanical part of the tensioner fails, there is no need to check the tensioner for correct tension.

DIAGNOSTIC TESTS

ACCESSORY DRIVE

Inspection and Verification

NOTE: **Under no circumstances should the accessory drive belt, tensioner or pulleys have any fluids or belt dressing applied to them as damage to the belt material and tensioner damping mechanism may occur.**

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical damage.

VISUAL INSPECTION CHART

Mechanical
• Drive belt cracking/chunking/wear • Belt/pulley contamination • Incorrect accessory drive belt • Incorrectly routed accessory drive belt • Pulley misalignment or excessive pulley runout • Loose or mislocated hardware • Incorrectly routed power steering tubes (rubbing) • Loose accessory drive belt • Damaged pulleys • Tensioner arm misalignment

NOTE: **Modular engine (without A/C) belt tensioner shown, others similar.**

NOTE: **Belt tensioner is shown in the free-state position against the arm travel stops.**

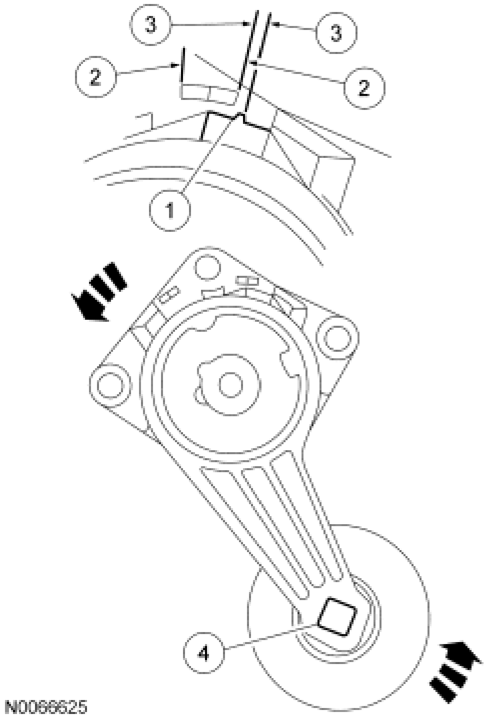


Fig. 3: Belt Tensioner With Belt Length Indicator
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Belt length indicator
2	-	Acceptable belt installation and wear range
3	-	Belt replacement range
4	-	Belt tension relief point

3. Check that the belt length indicator, if equipped, on the belt tensioner is in the acceptable belt installation and wear range. If the indicator is in the belt replacement range, either an incorrect belt is installed or the belt is worn beyond the service limit. Install a new belt as necessary.
4. Eliminate all other non-belt related noises that could cause belt misdiagnosis, such as A/C compressor engagement chirp, A/C slugging noise, power steering cavitations at low temperatures, Variable Camshaft Timing (VCT) tick or generator whine.
5. If a concern is found, correct the condition before proceeding to the next step.

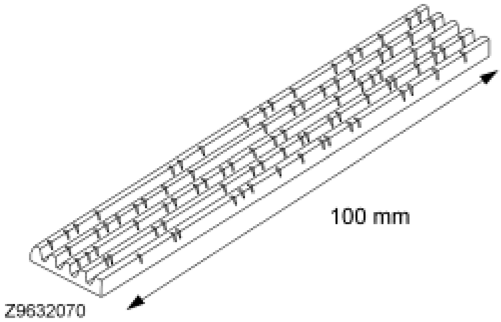


Fig. 4: V-Ribbed Serpentine Drive Belt With Cracks Across Ribs
Courtesy of FORD MOTOR CO.

6. Check the belt for cracks. Up to 15 cracks in a rib over a distance of 100 mm (4.0 in) can be considered acceptable. If cracks exceed this standard, install a new belt.

NOTE: Piling is an excessive buildup in the V-grooves of the belt.

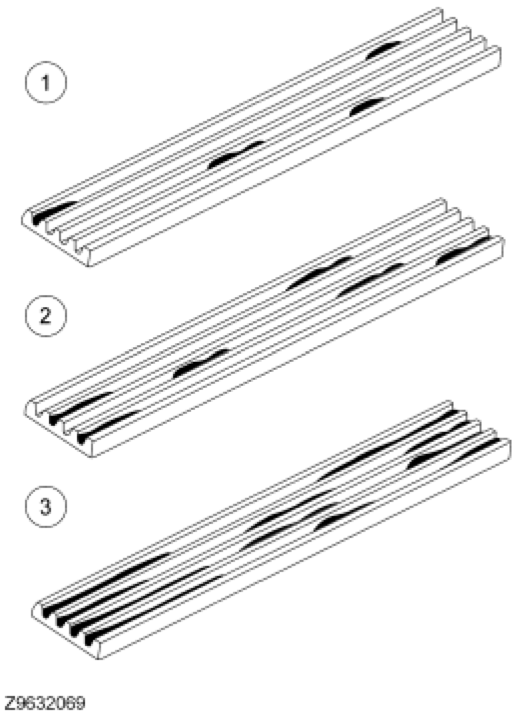
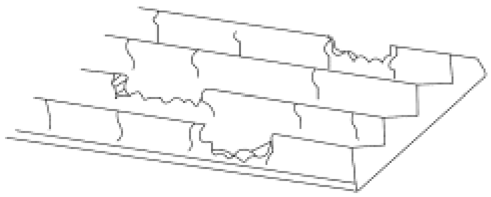


Fig. 5: Identifying V-Ribbed Serpentine Belt With Piling
Courtesy of FORD MOTOR CO.

7. The condition of the V-ribbed drive belt should be compared against the illustration and appropriate action taken.
   1. Small scattered deposits of rubber material. This is not a concern, therefore, installation of a new belt is not required.
   2. Longer deposit areas building up to 50% of the rib height. This is not considered a durability

concern, but it can result in excessive noise. If noise is apparent, install a new belt.

3. Heavy deposits building up along the grooves resulting in a possible noise and belt stability concern. If heavy deposits are apparent, install a new belt.



A0002723

Fig. 6: Identifying V-Ribbed Serpentine Belt With Chunks of Rib Missing
Courtesy of FORD MOTOR CO.

8. There should be no chunks missing from the belt ribs. If the belt shows any evidence of this, install a new accessory drive belt.
9. If the concern is not visually evident, verify the symptom and Go to **Symptom Chart**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Accessory drive belt cracking (over 15 cracks in a rib over a distance of 100 mm [4.0 in])	• Accessory drive belt	• INSPECT the accessory drive belt. REFER to **Inspection and Verification**. INSTALL a new accessory drive belt as necessary.
• Accessory drive belt chunking	• Accessory drive belt	• INSPECT the accessory drive belt. REFER to **Inspection and Verification**. INSTALL a new accessory drive belt as necessary.
	• Damaged pulley grooves	• INSPECT the accessory drive belt pulley grooves for damage. INSTALL a new pulley or component as necessary.
• Accessory drive belt noise, squeal, chirping	• Defective/worn or incorrect accessory drive belt • Misaligned pulley(s) • Pulley runout • Damaged or worn accessory	• REFER to **Drive Belt - Noise/Flutter**. REPAIR or INSTALL new parts as

or flutter	drive component or idler • Fluid contamination of accessory drive belt or pulleys	necessary.
	• Damaged or worn accessory drive belt tensioner	• REFER to **Belt Tensioner - Mechanical** and **Belt Tensioner - Dynamics**. INSTALL a new accessory drive belt tensioner as necessary.
	• Damaged pulley grooves	• INSPECT the accessory drive belt pulley grooves for damage. INSTALL a new pulley or component as necessary.
	• Accessory drive component failure	• CHECK the accessory drive components. INSTALL new components as necessary.
	• Accessory drive belt idler pulley bearing failure	• INSPECT the accessory drive belt idler pulley for freedom of rotation and damage. INSTALL a new accessory drive belt idler pulley as necessary.
• Premature accessory drive belt wear	• Defective or incorrect accessory drive belt • Misaligned pulley(s) • Pulley runout • Damaged accessories • Incorrectly installed drive belt • Fluid contamination	• REFER to **Drive Belt - Noise/Flutter** and **Drive Belt - Incorrect Installation**. REPAIR or INSTALL new parts as necessary.
	• Damaged pulley grooves	• INSPECT the accessory drive belt pulley grooves for damage. INSTALL a new pulley or component as necessary.

Component Tests

Drive Belt - Noise/Flutter

NOTE: Under no circumstances should the accessory drive belt, tensioner or pulleys have any fluids or belt dressing applied to them as damage to the belt material and tensioner damping mechanism may occur.

Drive belt chirp occurs due to pulley misalignment or excessive pulley runout. It can be the result of a damaged or incorrectly aligned grooved pulley.

To correct, determine the area where the noise comes from. Check each of the pulleys in that area with a straightedge to the crankshaft pulley. Look for accessory pulleys out of position in the fore/aft direction or at an angle to the straightedge.

Drive belt squeal may be an intermittent or constant noise that occurs when the drive belt slips on an accessory pulley under certain conditions.

A short intermittent squeal may occur during engine start up and shut down or during very rapid engine acceleration and decelerations, such as:

- Wide Open Throttle (WOT) 1-2 and 2-3 shifts or 2-3 and 3-4 back-out shifts on automatic transmissions.
- WOT 1-2 and 2-3 shifts and any combination of rapid downshifting on manual transmissions.

These special short-term transient events are expected, and are due to the higher system inertias required to meet the electrical and cooling demands on today's vehicle systems. Constant or reoccurring drive belt squeal can occur:

- if the A/C discharge pressure goes above specifications:
  - the A/C system is overcharged.
  - the A/C condenser core airflow is blocked.
  - the A/C anti-slugging strategy executes after a long hot heat soak.
- if the A/C off equalized pressure (the common discharged and suction pressure that occurs after several minutes) exceeds specifications.
- if any of the accessories or idler pulley(s) are damaged or have a worn or damaged bearing. All accessories should be rotatable by hand in the unloaded condition. If not, inspect the accessory.
- if there is evidence of fluid contamination on the accessory drive belt. When the drive belt has been exposed to fluid contamination during vehicle operation, such as leaks from the power steering system, A/C system or cooling system, clean all pulleys with soap and water, rinse with clean water and install a new accessory drive belt. If the drive belt has been exposed to fluids in a localized area during routine vehicle service, such as replacement of hoses or fluids, the drive belt and pulleys should be washed with soap and water immediately (prior to starting the engine), and rinsed with clean water.
- if the accessory drive belt is too long. A drive belt that is too long will allow the accessory drive belt tensioner arm to go all the way to the arm travel stop under certain load conditions, which will release tension to the drive belt. If the accessory drive belt tensioner indicator is outside the normal installation wear range window, install a new accessory drive belt.

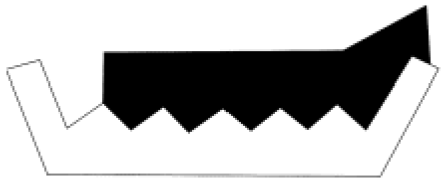
NOTE: The accessory drive belt tensioner arm should rotate freely without binding.

- Install a new accessory drive belt tensioner if the drive belt tensioner is worn or damaged.

Drive Belt - Incorrect Installation

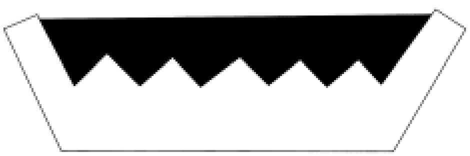
NOTE: Incorrect accessory drive belt installation will cause excessive drive belt wear and may cause the drive belt to come off the pulleys.

Non-standard accessory drive belts can track differently or incorrectly. If an accessory drive belt tracks incorrectly, install a new accessory drive belt to avoid performance failure or loss of the drive belt.



N0017169

Fig. 7: Identifying Incorrect Drive Belt Installation
Courtesy of FORD MOTOR CO.



N0017168

Fig. 8: Identifying Correct Installation Of Drive Belt
Courtesy of FORD MOTOR CO.

With the engine running, check accessory drive belt tracking on all pulleys. If the edge of the accessory drive belt rides beyond the edge of the pulleys, noise and premature wear will occur. Make sure the accessory drive belt rides correctly on the pulley. If an accessory drive belt tracking condition exists, proceed with the following:

- Visually check the accessory drive belt tensioner for damage and wear, especially the mounting pad surface and arm alignment. If the accessory drive belt tensioner is not installed correctly, the mounting surface pad will be out of position. If the tensioner arm is worn, the arm will be out of alignment. Either of these conditions will result in chirp and squeal noises.
- With the engine running, visually observe the grooves in the pulleys (not the pulley flanges or the pulley forward faces) for excessive wobble. Install new components as necessary.
- Check all accessories, mounting brackets and the accessory drive belt tensioner for any interference that would prevent the component from mounting correctly. Correct any interference condition and recheck the accessory drive belt tracking.
- Tighten all accessories, mounting brackets and accessory drive belt tensioner retaining hardware to

specification. Recheck the accessory drive belt tracking.

Belt Tensioner - Mechanical

The only mechanical check that needs to be made is a check for tensioner stick, grab or bind.

1. With the engine off, check routing of the accessory drive belt. Refer to the illustrations under **Accessory Drive** in the Description and Operation portion of this section.

NOTE: The accessory drive belt tensioner spring is very strong and requires substantial force to release.

2. Using a suitable, commercially available serpentine belt tensioner release tool, release the tension on the belt and detach the accessory drive belt from the tensioner. Carry out the following tests:
   - Using the release tool, move the tensioner from its relaxed position, through its full stroke and back to the relaxed position to make sure there is no stick, grab or bind, and to make sure that there is tension on the tensioner spring.
   - Rotate the tensioner pulley by hand and check for a binding, contaminated or seized condition.
   - Inspect the area surrounding the accessory drive belt tensioner for oil leaks or contamination and repair any leaks.
3. If the accessory drive belt tensioner does not meet the criteria in the previous step, install a new tensioner. If the accessory drive belt tensioner meets the criteria in the previous step, proceed to testing the tensioner dynamically.
4. If the tensioner is saturated with oil and grease internally, install a new tensioner.

Belt Tensioner - Dynamics

The accessory drive belt tensioner can be checked dynamically as follows:

1. With the engine running, observe the accessory drive belt tensioner movement. The accessory drive tensioner should move (respond) when the A/C clutch cycles (if equipped), or when the engine is accelerated rapidly. If the accessory drive belt tensioner movement is excessive without A/C clutch cycling or engine acceleration, check belt ride out. Excessive belt ride out (uneven depth of grooves in the belt) can cause excessive accessory drive belt tensioner movement. Check ride out condition by installing a new belt. If excessive accessory drive belt tensioner movement still exists, install a new accessory drive belt tensioner.

REMOVAL AND INSTALLATION

FRONT END ACCESSORY DRIVE (FEAD) - EXPLODED VIEW

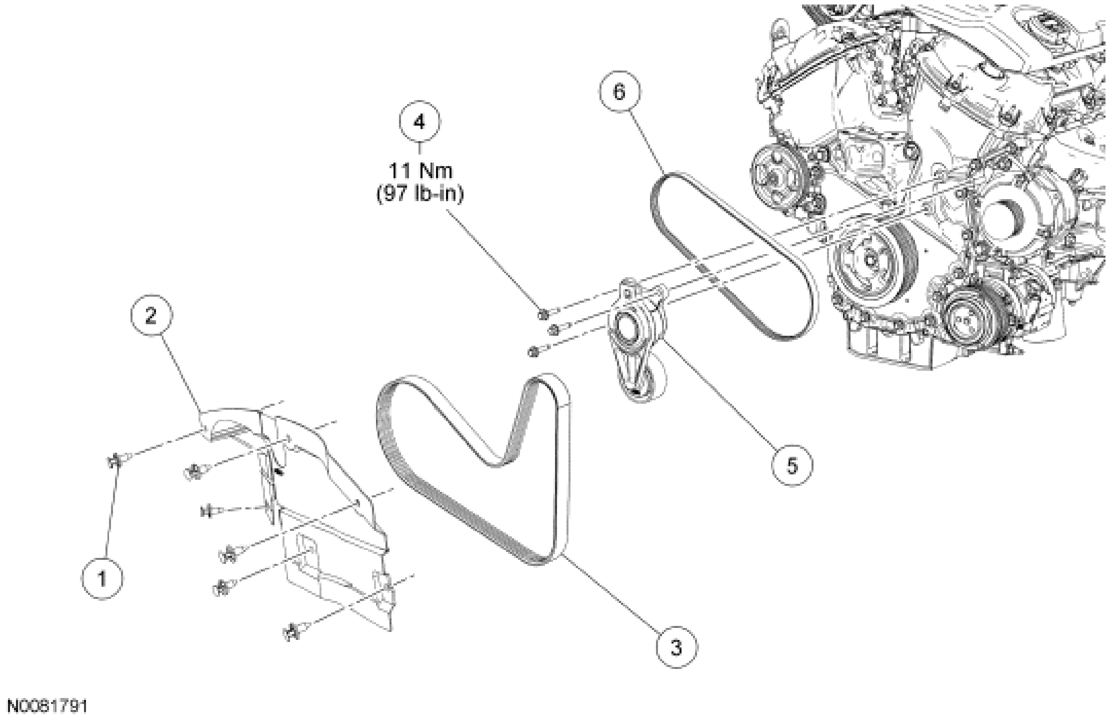


Fig. 9: Exploded View Of Front End Accessory Drive (FEAD) With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N807389	Pin-type retainer (6 required)
2	010204	RH splash shield
3	8620	Accessory drive belt
4	W503278	Accessory drive belt tensioner bolt (3 required)
5	6B209	Accessory drive belt tensioner
6	6C301	Power steering pump drive belt

1. For additional information, refer to the procedures.

ACCESSORY DRIVE BELT

REMOVAL

NOTE: Under no circumstances should the accessory drive belt, tensioner or pulleys be lubricated as potential damage to the belt material and tensioner damping mechanism will occur. Do not apply any fluids or belt dressing to the accessory drive belt or pulleys.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

2. Working from the top of the vehicle, using a suitable belt tensioner release tool, rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt from the generator pulley.
3. Remove the 4 screws and position the RH fender splash shield aside.

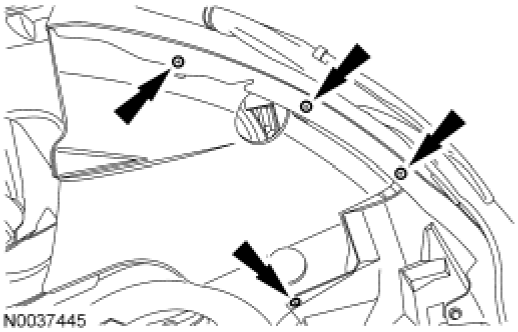


Fig. 10: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

4. Remove the 6 pin-type retainers and the RH splash shield.
5. Working from under the vehicle, remove the accessory drive belt.

INSTALLATION

1. Working from under the vehicle, position the accessory drive belt on all pulleys, with the exception of the generator pulley.

NOTE: After installation, make sure the accessory drive belt is correctly seated on all pulleys.

2. Working from the top of the vehicle, using a suitable belt tensioner release tool, rotate the accessory drive belt tensioner clockwise and install the accessory drive belt on the generator pulley.
3. Install the RH splash shield and the 6 pin-type retainers.
4. Position the RH fender splash shield and install the 4 screws.

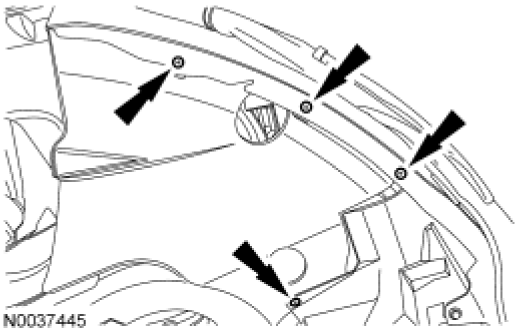


Fig. 11: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

ACCESSORY DRIVE BELT TENSIONER

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Working from the top of the vehicle, using a suitable belt tensioner release tool, rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt from the generator pulley.
3. Remove the 4 screws and position the RH fender splash shield aside.

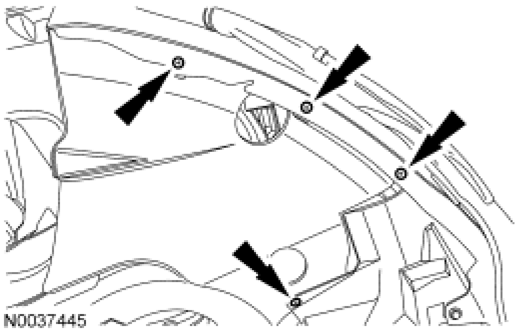


Fig. 12: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

4. Remove the 6 pin-type retainers and the RH splash shield.
5. Remove the 3 bolts and the accessory drive belt tensioner.

INSTALLATION

1. Install the accessory drive belt tensioner and the 3 bolts.
   - Tighten to 11 Nm (97 lb-in).

NOTE: After installation, make sure the accessory drive belt is correctly seated on all pulleys.

2. Working from the top of the vehicle, using a suitable belt tensioner release tool, rotate the accessory drive belt tensioner clockwise and install the accessory drive belt on the generator pulley.
3. Install the RH splash shield and the 6 pin-type retainers.
4. Position the RH fender splash shield and install the 4 screws.

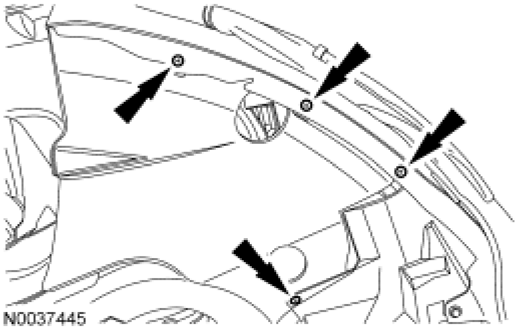
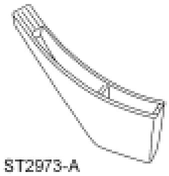


Fig. 13: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

POWER STEERING PUMP BELT

Special Tools

Illustration	Tool Name	Tool Number
	Power Steering Belt Installation Tool	303-1252/2
	Power Steering Belt Removal Tool	303-1252/1

REMOVAL

NOTE: Under no circumstances should the accessory drive belt, tensioner or pulleys be lubricated as potential damage to the belt material and tensioner damping mechanism will occur. Do not apply any fluids or belt dressing to the accessory drive belt or pulleys.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Working from the top of the vehicle, using a suitable belt tensioner release tool, rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt from the generator pulley.
3. Remove the 4 screws and position the RH fender splash shield aside.

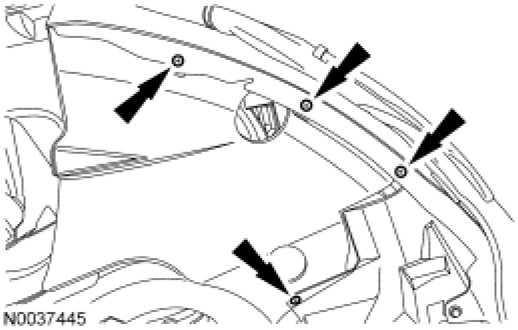


Fig. 14: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

4. Remove the 6 pin-type retainers and the RH splash shield.
5. Position the accessory drive belt off the crankshaft pulley.
6. Install the Power Steering Belt Removal Tool between the power steering pump belt and pulley, turning the crankshaft bolt clockwise to remove the power steering belt.

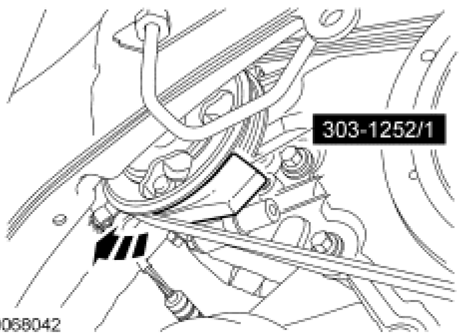


Fig. 15: Installing Removal Tool (303-1252/1) Between Belt & Pulley & Turn Crankshaft Bolt Clockwise
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install the power steering belt on the crankshaft pulley.

NOTE: After installation, make sure the belt is correctly seated on the crankshaft and power steering pulleys.

2. Position the power steering belt around the Power Steering Belt Installation Tool and the power steering pulley. Make sure the belt is engaged with the power steering pulley and rotate the crankshaft clockwise to install the power steering belt.

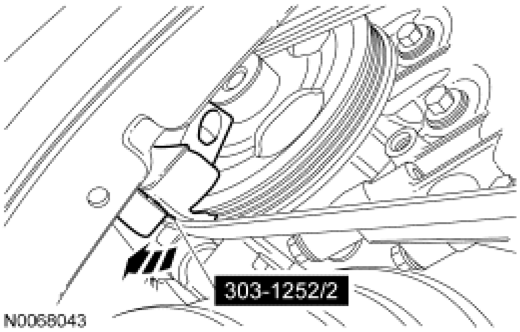


Fig. 16: Installing Power Steering Belt Onto Power Steering Pump Pulley Using Special Tool (303-1252/2)
Courtesy of FORD MOTOR CO.

3. Position the accessory drive belt on the crankshaft pulley.

NOTE: After installation, make sure the accessory drive belt is correctly seated on all pulleys.

4. Working from the top of the vehicle, using a suitable belt tensioner release tool, rotate the accessory drive belt tensioner clockwise and install the accessory drive belt on the generator pulley.
5. Install the RH splash shield and the 6 pin-type retainers.
6. Position the RH fender splash shield and install the 4 screws.

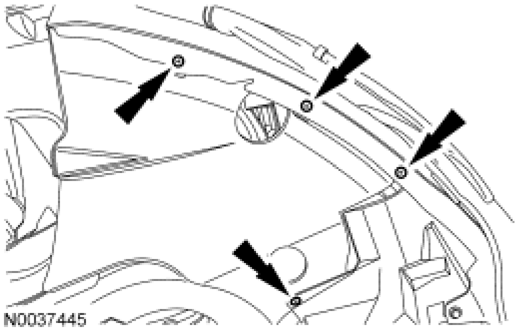


Fig. 17: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

2008 ACCESSORIES & BODY, CAB

Anti-Theft - Passive Anti-Theft System (PATS) - Fusion, Milan & MKZ

DESCRIPTION AND OPERATION

ANTI-THEFT

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The passive anti-theft system (PATS) consists of the following components:

- Anti-theft indicator (located in the instrument cluster [IC])
- Encoded ignition integrated key head transmitter (IKT) PATS key(s) (the key contains a transponder and a remote keyless entry [RKE] transmitter)
- Encoded (the key contains a transponder) ignition PATS keys (not factory equipped, but may be used in place of IKT keys)
- PATS transceiver
- IC
- PCM

PATS uses radio frequency identification technology to deter a drive-away theft. Passive means that it does not require any activity by the user.

The vehicle is equipped with 2 IKT PATS keys. The IKTs operate as a standard PATS key with an RKE transmitter incorporated into the key head. The IKTs require batteries for the RKE transmitter to operate. A maximum of 4 IKT keys can be programmed to operate the vehicle. If more than 4 IKT keys are programmed, the RKE portion of the additional keys do not operate and the SJB and the IC set a memory full DTC (B1138 - Memory Full). These additional keys will start the vehicle, but will not operate the RKE system. If additional PATS keys are desired, a standard PATS key (a non-IKT key) can be used. For the purposes of this part, the PATS portion of the IKT key is referred to as a PATS key.

PATS Function

NOTE: If the IC or the PCM (or both) is replaced, the parameters must be reset in both modules or the vehicle will experience a PATS no-start. Refer to <u>Passive Anti-Theft System (PATS) Parameter Reset</u>.

The PATS function is controlled by the IC. The PATS uses the IC to carry out all of the PATS functions such as receiving the identification code from the PATS key, issuing a signal to the PCM to control the starter and fuel injectors enable, and initiating the key interrogation sequence when the ignition key is turned to the ON or START position. Because of the interaction between the IC and the PCM, there are parameters that must be set if the IC or the PCM (or both) are replaced. Refer to **<u>Passive Anti-Theft System (PATS) Parameter Reset</u>**. If the IC must be replaced for any reason (PATS concerns or an IC concern), the PATS keys also must be

programmed into the new IC. Refer to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**. All elements of PATS must be functional before the vehicle will start. If any of the components are not working correctly, the vehicle will not start.

PATS is active only for a few seconds when the vehicle is starting. It is not a PATS concern if the vehicle stalls after it has been running for a minimum of 3 seconds. PATS will not disable a running vehicle.

PATS may cause a vehicle no start due to either the fuel injectors or the starter not operating (starter relay does not close) or both. Always check for PATS DTCs from the IC and DTCs from the PCM when a no-crank or no-start condition exists. A low state of charge (SOC) in the vehicle battery may cause the PATS to allow starter operation, but prevent the fuel injectors from operating.

If the theft light does not prove out (it may be either flashing or glowing steadily) and one (or both) of the previous conditions (fuel injectors and/or starter inoperative) are present, it may be due to a PATS issue. If the theft light proves out, it may not be a PATS issue. If the theft light does not illuminate at all, it may be an IC issue. Go to **Symptom Chart**.

PATS is not compatible with aftermarket remote start systems, which allow the vehicle to be started from the exterior of the vehicle. These systems may reduce the security of the vehicle, and also may be the cause of no-start concerns. Remote start systems must be removed from the vehicle before any PATS-related no-start concerns are investigated.

Unlimited Key Mode

PATS contains a feature called unlimited key mode. This feature allows a customer to program more than 8 vehicle keys, if requested. Each vehicle in unlimited key mode is set up with a special unlimited transponder security key code. This allows all the customer vehicles to share the same mechanically cut keys. For an individual customer, any randomly selected security key that has been previously mechanically cut and electronically programmed to the vehicle is acceptable.

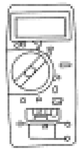
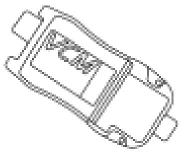
If unlimited key mode is enabled, a maximum of 4 IKT keys can be programmed to the vehicle for RKE functionality. If more keys are required, they should be standard PATS keys. If more than 4 IKT keys are programmed to the vehicle, the SJB and the IC will set DTC B1138 (memory full) and only 4 IKT keys will have RKE functionality, however, all of them will start the vehicle, if programmed correctly. Refer to **Spare Key Programming - Unlimited Key Mode**.

DIAGNOSTIC TESTS

ANTI-THEFT

Special Tools

Illustration	Tool Name	Tool Number
	73III Automotive Meter	105-R0057 or equivalent

 ST1137-A		
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Anti-Theft Indicator

NOTE: Replacement of the passive anti-theft system (PATS) transceiver does not require the PATS keys to be programmed into the instrument cluster (IC) again.

NOTE: Make sure any aftermarket remote start systems have been removed from the vehicle before any PATS-related no-start concerns are investigated.

NOTE: A minimum of 2 PATS keys must be programmed into the IC before the vehicle will start. They do not need to be integrated key head transmitter (IKT) keys. Either 2 IKT keys, or 2 standard PATS keys, or a combination of an IKT key and a standard PATS key will be sufficient for the vehicle to start.

NOTE: If the IC or the PCM is being replaced (or both), the parameters must be reset in both modules or the vehicle will experience a PATS no-start. Refer to Passive Anti-Theft System (PATS) Parameter Reset .

NOTE: When using a standard (non-IKT) PATS key to start the vehicle, an IKT key (from another vehicle) on the same key ring may possibly be programmed into the vehicle for remote entry functionality, resulting in the IKT key being able to operate the lock and unlock functions of the vehicle (but the IKT key can not start the vehicle). This should not cause a PATS no-start of either the first or the

second vehicle, but the IKT key may be able to operate the lock and unlock functions of both vehicles. The IKT key will be able to start the original vehicle to which it is programmed and will not be able to start the second vehicle. At this time, it will be necessary to carry out an Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment procedure and then to make certain the IKT key for the second vehicle is removed from the key ring in order to prevent this issue from occurring again. Also, if an IKT key is used to start the vehicle, the vehicle will only read the IKT in the ignition lock cylinder and will not read the second IKT on the key ring. Using an IKT key to start both vehicles, rather than standard PATS keys, will prevent the second IKT from being programmed into the first vehicle.

NOTE: **Some Fusion and Milan vehicles built with a 2.3L engine may exhibit an intermittent crank no start along with a PATS light flashing during cranking and various codes stored in memory. The root cause has been found to be related to radio interference due to a shopping cart anti-theft device installed at some store parking lots. Refer to all Technical Service Bulletins (TSB) that pertain to the concern and follow the procedure(s) outlined.**

PATS uses a visual anti-theft indicator located in the IC. The indicator proves out for 3 seconds when the ignition key is in the ON or START position under normal operation. If there is a PATS concern, this indicator either flashes rapidly or glows steadily when the ignition key is turned to the ON or START position. PATS also flashes the anti-theft indicator every 2 seconds when the ignition key is in the OFF position to act as a visual theft deterrent. Refer to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article for additional information on the anti-theft indicator.

Encoded PATS Keys

PATS uses a special ignition key, called an integrated key head transmitter (IKT) key that is larger than a conventional ignition key. It contains a permanently installed electronic device called a transponder and also has the remote keyless entry (RKE) transmitter integrated into the key head. Each transponder contains a unique encrypted identification code which is one of a very large number of combinations. The addition of this transponder to the key makes it an "encoded" key. The PATS key does not require batteries and should last the lifetime of the vehicle. The transmitter portion of the IKT key has a battery. Each PATS key must be programmed into the IC before it can be used to start the vehicle. A maximum of 4 IKT keys can be programmed to start the vehicle and also operate the RKE functions. If more than 4 IKT keys are programmed, the RKE portion of the additional IKT keys do not operate and the smart junction box (SJB) sets a memory full DTC (B1138 - Memory Full). These additional keys will start the vehicle, but will not operate the RKE system. If additional PATS keys are desired, a standard PATS key (a non-IKT key) can be used. There are specific general procedures described that must be carried out if a new PATS key is necessary. Refer to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment** or **Key Programming Using Two Programmed Keys**.

PATS Transceiver

The PATS transceiver is located under the steering column shroud and communicates with the encoded ignition key. During each vehicle start sequence, the PATS transceiver reads the encoded ignition key identification

code and sends data to the IC. The IC validates the code, and if it is the correct code, will send a message to the PCM to ground the starter relay solenoid coil and to also allow the fuel injectors to operate. Refer to **Passive Anti-Theft System (PATS) Transceiver**.

PATS Operation

The PATS function is controlled by the IC. With this type of PATS, there are parameters that need to be reset if either the IC or the PCM (or both) are replaced. Refer to **Passive Anti-Theft System (PATS) Parameter Reset**. When the PATS key is turned to the ON or START position, the IC initiates the key interrogation sequence by sending a voltage signal to the PATS transceiver. The transceiver then uses its antenna to bounce a signal off the transponder in the PATS key. This process "reads" the PATS key identification code and sends the key identification code back to the IC, which interprets it and determines if it matches one of the stored key codes. If it does match one of the stored key codes, the IC will send a message to the PCM to ground the starter relay solenoid coil and to also allow the fuel injectors to operate. If it does not match one of the stored key codes, or it is only a partial key read or no key read, the IC will send a message to the PCM to not ground the starter relay solenoid coil and not allow fuel injector operation. The anti-theft indicator in the IC will flash (or may glow steadily) and the IC will store one or more DTCs. All elements of PATS must be functional before the vehicle will start. If any of the components are not working correctly, the vehicle will not start. If the IC must be replaced for any reason (PATS concerns or instrument cluster [IC] concerns), the PATS keys must also be programmed into the new IC. Refer to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**.

PATS disables the vehicle from starting if there is:

- a damaged PATS key.
- a non-programmed PATS key.
- a non-PATS key (key has no electronics).
- damaged wiring.
- a damaged transceiver.
- a damaged IC.
- a damaged PCM.

PATS PIDs

Monitoring the PATS PIDs can be very useful in determining which diagnostic steps to follow. Viewing the MASTERKEY (master key) PID with both keys will determine if the key is a programmed key and may also be used to prove out the transceiver, circuitry and the IC. A master key is a key that is programmed into the IC. Viewing the MIN_KEY (minimum number of keys) PID (this PID does not change) determines the minimum number of keys that must be programmed into the IC. There must be at least 2 keys programmed into the IC in this type of PATS before the vehicle will start. Viewing the N_KEYCODE (number of keys programmed) PID will determine if the minimum number of keys have been programmed into the IC. If the N_KEYCODE PID reads 0 or 1, additional key(s) will need to be programmed into the IC in order to meet the minimum of 2 keys. If the N_KEYCODE PID reads 0 or 1, and the MASTERKEY PID reads NOTPREST, that particular key must be programmed into the IC. If the N_KEYCODE PID reads 1, and the MASTERKEY PID reads PRESNT, that particular key is already programmed into the IC. In this particular case, though, there are not enough keys programmed (a minimum of 2 are needed before the vehicle will start) into the IC and at least 1 more key will need to be programmed before the vehicle will start. Refer to **Integrated Key head Transmitter (IKT) Key**

Programming Using Diagnostic Equipment.

Also, if the unlimited key mode has been enabled, the N_KEYCODE PID will always read 2, after the first 2 keys are programmed into the IC, regardless of how many additional keys are added.

If the IC was replaced, the parameters in the IC, and the parameters in the PCM will need to be reset. When the parameters in the IC are reset, it clears (erases) the PCM ID from the IC. A PCM parameter reset will cause the PCM to send a PCM ID to the IC that is necessary for the system to operate. Make sure to cycle the key at least once, then turn the key ON and make an attempt to start the vehicle for 3-5 seconds before attempting more procedures. If only a PCM parameter reset occurs, the ID stored in the IC will not match the ID being sent by the PCM, and may cause a PATS-related no-start. Carry out a PATS parameter reset, then turn the key ON and make an attempt to start the vehicle for 3-5 seconds before attempting more procedures.

If the PCM ID (PCM id status) PID reads STORED, the IC has a PCM ID stored. If it reads NOTSTRD, a parameter reset of the PCM may resolve this issue. If the PATSENABL (vehicle enable status) PID reads DISABLED, and the N_KEYCODE PID reads 2 or more and the MASTERKEY PID reads PRESNT, the IC, and the PCM will need to have their parameters reset. Refer to **Passive Anti-Theft System (PATS) Parameter Reset**.

If the PATSENABL PID reads DISABLED, and the N_KEYCODE PID reads 1 and the MASTERKEY PID reads PRESNT, or if the N_KEYCODE PID reads 0 and the MASTERKEY PID reads NOTPRESNT, a minimum of 2 keys will need to be programmed into the IC. Refer to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**.

If the MASTERKEY PID continues to read NOTPRESNT after programming, this may indicate a defective key. The SPAREKEY PID is defaulted to ENABLED. With the SPAREKEY PID displaying ENABLED, the IC will accept more than 2 keys (up to a maximum of 8) being programmed into the IC using **Key Programming Using Two Programmed Keys**. It can be toggled to DISABLED if the customer wants to disable the customer spare key programming function. Refer to **Key Programming Switch State Control**. This switch state control does not affect the Key Programming Using Diagnostic Equipment procedure.

In summary, for the PATS PIDs and their correct state in order for the vehicle to start:

PID	Normal State
N_KEYCODE	must read 2 or more
MASTERKEY	must read PRESNT
PATSENABLE	must read ENABLED
PCM_ID	must read STORED

Unlimited Key Mode

PATS contains a feature called unlimited key mode and uses the UNL_KEY_ID PID. This feature allows a customer to program more than 8 keys to their vehicle if they request it. Each vehicle in unlimited key mode is set up with a special unlimited transponder security key code. This allows all the customer vehicles to share the same keys, but no other keys from outside can be used to operate the vehicles. For an individual customer, any randomly selected security key is acceptable. Refer to **Spare Key Programming - Unlimited Key Mode**.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Large metallic objects, a second passive anti-theft system (PATS) key on the same key ring as the PATS key, or electronic devices on the key ring that can be used to purchase gasoline or similar items • Ignition lock cylinder • PATS key • Use of a non-PATS key or incorrect PATS key • More than one PATS key on key ring • Remote start system installed	• Smart junction box (SJB) fuse(s): ○ 13 (7.5A) ○ 23 (7.5A) ○ 26 (7.5A) • Wiring, terminals or connectors • PATS transceiver • Ignition switch • Instrument cluster (IC) • PCM

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.

- Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.

7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the IC.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

INSTRUMENT CLUSTER (IC) DTC CHART

DTC	Description	Action
B1137	Data Not Programmed	The integrated key head transmitter (IKT) data has not transferred from the instrument cluster (IC) into the smart junction box (SJB). PROGRAM the IKT keys. CARRY OUT the **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment** in this article. CLEAR the DTCs. REPEAT the self-test. If DTC B1137 is retrieved again, REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B1138	Memory Full	The SJB has 4 IKTs stored in memory and cannot program any more IKTs into the memory. A maximum of 4 IKT keys can be programmed to start the vehicle and also operate the RKE functions. If more than 4 IKT keys are programmed, the RKE portion of the additional IKT keys do not operate and the SJB sets a memory full DTC (B1138 - Memory Full). These additional keys will start the vehicle, but will not operate the RKE system. If additional PATS keys are desired, a standard PATS key (a non-IKT key) can be used.
B1139	Invalid Transmitter Identification Code	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B1213	Anti-Theft Number of Programmed Keys is Below Minimum	If DTCs B1600, B1601, B1602, B1681 or B2103 are present, they must be addressed first. If DTC B1213 is the only DTC present, PROGRAM additional keys. REFER to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment** in this article. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.
B1342	ECU is Faulted	CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. PROGRAM the PATS keys into the IC. REFER to **Integrated Key head Transmitter (IKT) Key**

		Programming Using Diagnostic Equipment in this article. CYCLE the ignition. REPEAT the self-test.
B1600	PATS Ignition Key Transponder Signal is Not Received	No PATS key has been read by the IC. Go to **Pinpoint Test B**.
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	There is an unprogrammed PATS key. Go to **Pinpoint Test C**.
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	Only a partial PATS key was read. Go to **Pinpoint Test D**.
B1681	PATS Transceiver Module Signal is Not Received	The IC did not receive the PATS transceiver signal. Go to **Pinpoint Test E**.
B2103	Antenna Not Connected	There has been a PATS transceiver antenna failure. Go to **Pinpoint Test A**.
B2141	NVM Configuration Failure	There is no PCM ID stored in the IC. CARRY OUT a parameter reset of the IC and PCM, then CYCLE the ignition and make an attempt to start the vehicle. REFER to **Passive Anti-Theft System (PATS) Parameter Reset** in this article.
B2431	Transponder Programming Failed	The ignition key was not programmed. Attempt to RE-PROGRAM the key. REFER to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment** in this article. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.
U0100	Lost Communication With ECM/PCM	**NOTE:** **If DTCs U0100 and U2510 are both present, address DTC U2510 first.** Go to **Pinpoint Test G**.
U2510	CAN - Invalid Data for Vehicle Security	CARRY OUT a parameter reset of the IC and the PCM and CYCLE the ignition 3-5 times, making an attempt to start the vehicle each key cycle. REFER to **Passive Anti-Theft System (PATS) Parameter Reset**. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.
U2511	CAN - Data Mis-Match (Receive Data Does Not Match Expected)	**NOTE:** **If DTCs U2510 and U2511 are both present, address DTC U2510 first.** Go to **Pinpoint Test G**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

PCM DTC CHART

DTC	Description	Action

P1260	Theft Detected, Vehicle Immobilized	If there are any PATS DTCs present, ADDRESS them first. This DTC may also indicate a CAN issue. Be sure to verify if there are any communication issues/DTCs with any modules. If DTC P1260 is the only DTC present, there may be a power or ground concern with the PCM. REFER to the **Introduction - Gasoline Engines** article.
All other DTCs	-	REFER to the **Introduction - Gasoline Engines** article.

Symptom Chart

NOTE: Some Fusion and Milan vehicles built with a 2.3L engine may exhibit an intermittent crank no start along with a PATS light flashing during cranking and various codes stored in memory. The root cause has been found to be related to radio interference due to a shopping cart anti-theft device installed at some store parking lots. Refer to all Technical Service Bulletins (TSB) that pertain to the concern and follow the procedure(s) outlined.

Symptom Chart

Condition	Possible Sources	Action
• No communication with the instrument cluster (IC)	• Fuse(s) • Wiring, terminals or connectors • IC	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The anti-theft indicator is always/never on	• IC	• Go to **Pinpoint Test F**.
• The vehicle does not start	• Starting system concern • PATS concern	• Go to **Pinpoint Test H**.

Pinpoint Tests

Pinpoint Test A: DTC B2103 - Antenna Not Connected

Normal Operation

The passive anti-theft system (PATS) transceiver reads the PATS key when the key is turned to START or ON.

- DTC B2103 (Antenna Not Connected) - sets when there has been a PATS transceiver antenna failure. The PATS transceiver may need to be replaced.

This pinpoint test is intended to diagnose the following:

- PATS transceiver

PINPOINT TEST A: DTC B2103 - ANTENNA NOT CONNECTED

A1 INSPECT THE PATS TRANSCEIVER FOR CORRECT INSTALLATION

NOTE: Replacement of the PATS transceiver does not require the PATS keys to be programmed into the instrument cluster (IC) again.

- Key in OFF position.
- Verify the PATS transceiver is correctly installed. Refer to **Passive Anti-Theft System (PATS) Transceiver**.
- Connect the diagnostic tool.
- Key in ON position.
- Clear the IC DTCs.
- Key in OFF position.
- Key in ON position.
- Retrieve the IC DTCs.
- **Is DTC B2103 retrieved?**

  YES : INSTALL a new PATS transceiver. REFER to **Passive Anti-Theft System (PATS) Transceiver**. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

  NO : The system is OK.

Pinpoint Test B: DTC B1600 - PATS Ignition Key Transponder Signal Is Not Received

Normal Operation

During each vehicle start sequence, the passive anti-theft system (PATS) transceiver reads the PATS key identification code and sends the data to the instrument cluster (IC).

- DTC B1600 (PATS Ignition Key Transponder Signal is Not Received) - sets when no PATS key has been read by the IC.

This pinpoint test is intended to diagnose the following:

- PATS key
- PATS transceiver
- IC

PINPOINT TEST B: DTC B1600 - PATS IGNITION KEY TRANSPONDER SIGNAL IS NOT RECEIVED

NOTE: Large metallic objects, electronic devices on the key ring that can be used to purchase gasoline or similar items, or a second key on the same key ring as the PATS key may cause a vehicle starting concern and record DTCs under certain conditions. If a fault cannot be identified, examine the customer key ring for such objects or devices. If present, inform the customer that they need to keep

these objects from touching the PATS key while starting the engine. These objects and devices cannot damage the PATS key, but can cause a momentary concern if they are too close to the key during engine start. If a concern occurs, turn the key off and restart the engine with all other objects on the key ring held away from the ignition key. Check to make sure the PATS key used by the customer is an approved Ford PATS key (PATS keys from Ford, Rotunda, Strattec, and HUF are approved Ford PATS keys).

B1 RETRIEVE THE DTCs

- Key in OFF position.
- Connect the diagnostic tool.
- Key in ON position.
- Clear the IC DTCs.
- Key in OFF position.
- Key in ON position.
- Retrieve the IC DTCs.
- **Is DTC B1600 retrieved?**

  YES : Go to B2.

  NO : If DTCs other than PATS DTCs are retrieved, REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

  If no DTCs are retrieved, the system is OK.

B2 CHECK BOTH PATS KEYS

NOTE: **Make sure the new PATS keys are approved Ford encoded PATS keys. Unapproved PATS keys do not always operate correctly over various temperature ranges (PATS keys from Ford, Rotunda, Strattec, and HUF are approved Ford PATS keys).**

- Obtain both PATS keys from the customer and follow the procedure using one PATS key, then the other. If the customer only has one PATS key, it will be necessary to cut a new PATS key.
- If it is necessary to cut a new PATS key, program the new PATS key. Refer to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**.
- Key in ON position.
- Clear the IC DTCs.
- Key in OFF position.
- Key in ON position.
- Retrieve the IC DTCs.
- **Using all existing keys, then the newly programmed key, is DTC B1600 present?**

  YES : If DTC B1600 was present for both existing keys and the new key, go to B3.

If DTC B1600 was not present for all keys, the key may be damaged and should be replaced. CUT a new key to replace the damaged key. REFER to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test. TEST the system for normal operation.

NO : If DTCs other than PATS DTCs are retrieved, REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

If no DTCs are retrieved, the system is OK.

B3 INSTALL A NEW PATS TRANSCEIVER

NOTE: Replacement of the PATS transceiver does not require the PATS keys to be programmed into the IC again.

NOTE: Do not use the PATS key that may have been programmed in Step B2.

- Key in OFF position.
- Install a new PATS transceiver. Refer to **Passive Anti-Theft System (PATS) Transceiver**.
- Key in ON position.
- Clear the IC DTCs.
- Key in OFF position.
- Key in ON position.
- Retrieve the IC DTCs.
- **Is DTC B1600 retrieved?**

  YES : Go to B4.

  NO : The system is OK.

B4 CHECK FOR CORRECT IC OPERATION

NOTE: When a new IC is installed, the PATS keys must be programmed into the IC.

NOTE: When a new IC is installed, the parameters must be reset in the IC and the PCM.

- Disconnect the IC connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the IC connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.

- **Is the concern still present?**

  YES : INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. RESET the parameters in both the IC and the PCM. REFER to **Passive Anti-Theft System (PATS) Parameter Reset**. PROGRAM the PATS keys into the new IC. REFER to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test C: DTC B1601 - PATS Received Incorrect Key-Code From Ignition Key Transponder

Normal Operation

During each vehicle start sequence, the passive anti-theft system (PATS) transceiver reads the PATS key identification code and sends the data to the instrument cluster (IC).

- DTC B1601 (PATS Received Incorrect Key-Code From Ignition Key Transponder) - sets when there is an unprogrammed PATS key. The concern is not with the PATS key itself, but the key must be programmed into the PATS memory (unless the maximum number of keys are already programmed).

This pinpoint test is intended to diagnose the following:

- PATS key
- IC

PINPOINT TEST C: DTC B1601 - PATS RECEIVED INCORRECT KEY-CODE FROM IGNITION KEY TRANSPONDER

NOTE:	**Large metallic objects, electronic devices on the key ring that can be used to purchase gasoline or similar items, or a second key on the same key ring as the PATS key may cause a vehicle starting concern and record DTCs under certain conditions. If a fault cannot be identified, examine the customer key ring for such objects or devices. If present, inform the customer that they need to keep these objects from touching the PATS key while starting the engine. These objects and devices cannot damage the PATS key, but can cause a momentary concern if they are too close to the key during engine start. If a concern occurs, turn the ignition switch off and restart the engine with all other objects on the key ring held away from the ignition key. Check to make sure the PATS key used by the customer is an approved Ford PATS key (PATS keys from Ford, Rotunda, Strattec, and HUF are approved Ford PATS keys).**

NOTE:	**Only 8 PATS keys can be programmed into the IC during normal programming procedures (unless the unlimited key mode is enabled). If the N_KEYCODE PID reads more than 2 and less than 8, the concern may be the PATS key being used is an unprogrammed key. Verify this by also viewing the MASTERKEY PID. It must read PRESNT for the key to be valid.**

C1 RETRIEVE THE DTCs

NOTE: Follow this procedure using both PATS keys (using one at a time).

- If only one key is available, cut a new key and program the keys. Refer to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**.
- If both keys are available, program the keys. Refer to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**.
- Key in OFF position.
- Connect the diagnostic tool.
- Key in ON position.
- Clear the IC DTCs.
- Key in OFF position.
- Key in ON position.
- Retrieve the IC DTCs.
- **Is DTC B1601 retrieved for either of the PATS keys?**

  YES : If DTC B1601 is retrieved for one PATS key, REPLACE that key and PROGRAM all the keys. REFER to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

  If DTC B1601 is retrieved for both PATS keys, go to C2 .

  NO : The system is OK. CHECK all the customer PATS keys by attempting to start the vehicle with each key to VERIFY all other PATS keys are programmed.

C2 CHECK FOR CORRECT IC OPERATION

NOTE: When a new IC is installed, the PATS keys must be programmed into the new IC.

NOTE: When a new IC is installed, the parameters must be reset in the IC and the PCM.

- Disconnect the IC connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the IC connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER,**

AND WARNING CHIMES article. RESET the parameters in both the IC and the PCM. REFER to **Passive Anti-Theft System (PATS) Parameter Reset**. PROGRAM the PATS keys into the new IC. REFER to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**. REPEAT the self-test.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test D: DTC B1602 - PATS Received Invalid Format Of Key-Code From Ignition Key Transponder

Normal Operation

During each vehicle start sequence, the passive anti-theft system (PATS) transceiver reads the PATS key identification code and sends the data to the instrument cluster (IC).

- DTC B1602 (PATS Received Invalid Format of Key-Code From Ignition Key Transponder) - sets when only a partial PATS key was read. Remote starter equipment can also cause this DTC.

This pinpoint test is intended to diagnose the following:

- PATS key
- PATS transceiver
- IC

PINPOINT TEST D: DTC B1602 - PATS RECEIVED INVALID FORMAT OF KEY-CODE FROM IGNITION KEY TRANSPONDER

NOTE: **Large metallic objects, electronic devices on the key ring that can be used to purchase gasoline or similar items, or a second key on the same key ring as the PATS key may cause a vehicle starting concern and record DTCs under certain conditions. If a fault cannot be identified, examine the customer key ring for such objects or devices. If present, inform the customer that they need to keep these objects from touching the PATS key while starting the engine. These objects and devices cannot damage the PATS key, but can cause a momentary concern if they are too close to the key during engine start. If a concern occurs, turn the ignition off and restart the engine with all other objects on the key ring held away from the ignition key. Check to make sure the PATS key used by the customer is an approved Ford PATS key (PATS keys from Ford, Rotunda, Strattec, and HUF are approved Ford PATS keys).**

D1 RETRIEVE THE DTCs

NOTE: **Follow this procedure using both PATS keys (using one at a time).**

- If only one key is available, cut a new key and program the keys. Refer to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**.
- Key in OFF position.

- Connect the diagnostic tool.
- Key in ON position.
- Clear the IC DTCs.
- Key in OFF position.
- Key in ON position.
- Retrieve the IC DTCs.
- **Is DTC B1602 retrieved for one or both PATS keys?**

  YES : If DTC B1602 is retrieved for one key, REPLACE that key and PROGRAM the new key. REFER to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

  If DTC B1602 is retrieved for both PATS keys, go to D2.

  NO : The system is OK. CHECK all the customer PATS keys by attempting to start the vehicle with each key to VERIFY all other PATS keys are programmed.

D2 INSTALL A NEW PATS TRANSCEIVER

NOTE: Replacement of the PATS transceiver does not require the PATS keys to be programmed into the IC again.

- Key in OFF position.
- Install a new PATS transceiver. Refer to **Passive Anti-Theft System (PATS) Transceiver**.
- Key in ON position.
- Clear the IC DTCs.
- Key in OFF position.
- Key in ON position.
- Retrieve the IC DTCs.
- **Are any PATS DTCs retrieved?**

  YES : Go to D3.

  NO : The system is OK. CHECK all the customer PATS keys by attempting to start the vehicle with each key to VERIFY all other PATS keys are programmed.

D3 CHECK FOR CORRECT IC OPERATION

NOTE: When a new IC is installed, the PATS keys must be programmed into the new IC.

NOTE: When a new IC is installed, the parameters must be reset in the IC and the PCM.

- Disconnect the IC connector.
- Check for:

- corrosion
- damaged pins
- pushed-out pins
- Connect the IC connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. RESET the parameters in both the IC and the PCM. REFER to **Passive Anti-Theft System (PATS) Parameter Reset**. PROGRAM the PATS keys into the new IC. REFER to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test E: DTC B1681 - PATS Transceiver Module Signal Is Not Received

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Passive Anti-Theft System for schematic and connector information.

Normal Operation

The passive anti-theft system (PATS) transceiver receives voltage from the SJB on circuit CBP18 (GY/OG) and is grounded on circuit GD116 (BK/VT). The PATS transceiver and the instrument cluster (IC) communicate on the TX and RX circuits VRT23 (VT/GY) and VRT24 (YE/OG). The IC compares the key code stored in memory and sends a message to the PCM to enable the starter and fuel injectors if the key code is correct.

- DTC B1681 (PATS Transceiver Module Signal is Not Received) - sets when the PATS transceiver signal is not received by the IC. This DTC can be caused by circuits between the PATS transceiver and the IC, or circuits to the PATS transceiver. This can also be caused by using the incorrect PATS transceiver part number.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- PATS transceiver
- IC

PINPOINT TEST E: DTC B1681 - PATS TRANSCEIVER MODULE SIGNAL IS NOT RECEIVED

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

E1 CHECK THE PATS TRANSCEIVER POWER CIRCUIT CBP18 (GY/OG) FOR VOLTAGE

- Key in OFF position.
- Disconnect: PATS Transceiver C252
- Key in ON position.

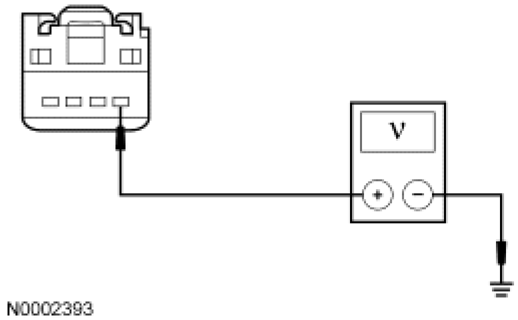


Fig. 1: Checking PATS Transceiver Power Circuit CBP18 (GY/OG) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the PATS transceiver C252-1, circuit CBP18 (GY/OG), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to E2.

  NO : VERIFY the SJB fuse 26 (7.5A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

E2 CHECK THE PATS TRANSCEIVER GROUND CIRCUIT GD116 (BK/VT) FOR AN OPEN

- Key in OFF position.

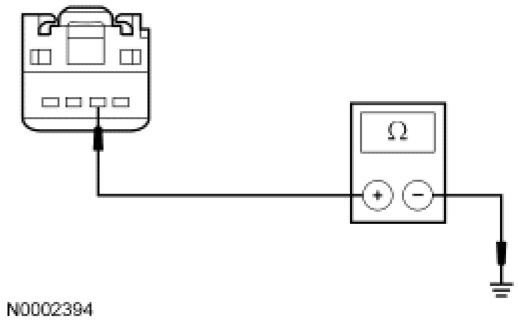


Fig. 2: Checking PATS Transceiver Ground Circuit GD116 (BK/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PATS transceiver C252-2, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to E3.

  NO : REPAIR the circuit. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

E3 CHECK THE PATS TRANSCEIVER RECEIVE CIRCUIT VRT24 (YE/OG) FOR VOLTAGE

- Connect: PATS Transceiver C252
- Key in ON position.

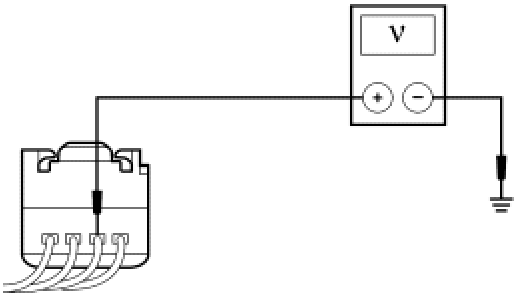


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Fig. 3: Checking PATS Transceiver Receive Circuit VRT24 (YE/OG) For Voltage
Courtesy of FORD MOTOR CO.

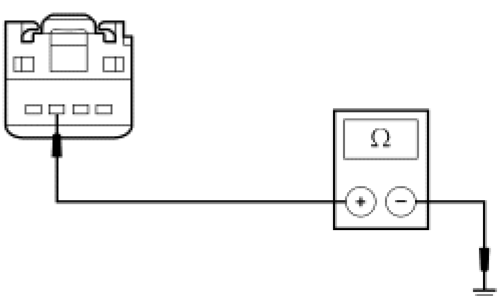
- Measure the voltage by backprobing between the PATS transceiver C252-3, circuit VRT24 (YE/OG), harness side and ground.
- **Is the voltage greater than 8 volts?**

  YES : Go to E6.

  NO : Go to E4.

E4 CHECK THE PATS TRANSCEIVER RECEIVE CIRCUIT VRT24 (YE/OG) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: IC C220
- Disconnect: PATS Transceiver C252



N0002396

Fig. 4: Checking PATS Transceiver Receive Circuit VRT24 (YE/OG) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PATS transceiver C252-3, circuit VRT24 (YE/OG), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to E5.

  NO : REPAIR the circuit. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

If DTC B1681 is retrieved again, go to E12 .

E5 CHECK THE PATS TRANSCEIVER RECEIVE CIRCUIT VRT24 (YE/OG) FOR AN OPEN

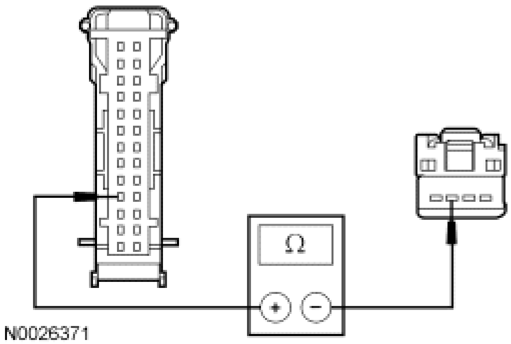


Fig. 5: Checking PATS Transceiver Receive Circuit VRT24 (YE/OG) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the IC C220-4, circuit VRT24 (YE/OG), harness side and the PATS transceiver C252-3, circuit VRT24 (YE/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to E12.

  NO : REPAIR the circuit. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

E6 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT23 (VT/GY) FOR VOLTAGE

NOTE:	**Replacement of the PATS transceiver does not require the PATS keys to be programmed into the IC again.**

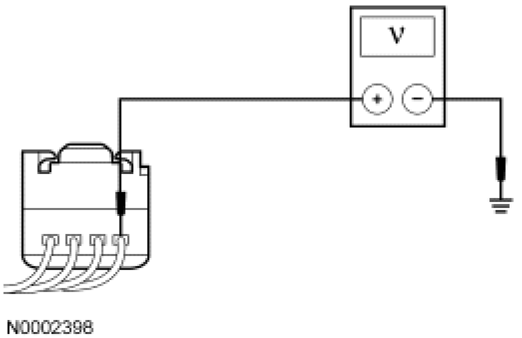


Fig. 6: Checking PATS Transceiver Transmit Circuit VRT23 (VT/GY) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage by backprobing between the PATS transceiver C252-4, circuit VRT23 (VT/GY), harness side and ground.
- **Is the voltage greater than 8 volts?**

  YES : INSTALL a new PATS transceiver. REFER to **Passive Anti-Theft System (PATS) Transceiver**. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

If DTC B1681 is retrieved again, go to E12 .

NO : Go to E7.

E7 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT23 (VT/GY) FOR A SHORT TO GROUND WITH THE PATS TRANSCEIVER CONNECTED

- Key in OFF position.
- Disconnect: IC C220

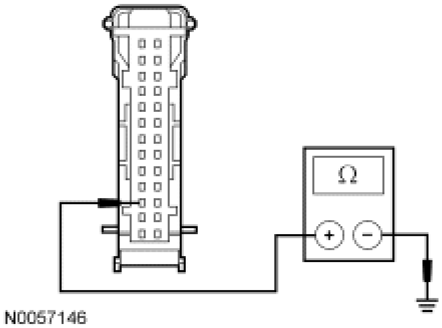


Fig. 7: Checking PATS Transceiver Transmit Circuit VRT23 (VT/GY) For A Short To Ground With PATS Transceiver Connected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the IC C220-3, circuit VRT23 (VT/GY), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to E9.

NO : Go to E8.

E8 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT23 (VT/GY) FOR A SHORT TO GROUND WITH THE PATS TRANSCEIVER DISCONNECTED

NOTE: **Replacement of the PATS transceiver does not require the PATS keys to be programmed into the IC again.**

- Disconnect: PATS Transceiver C252

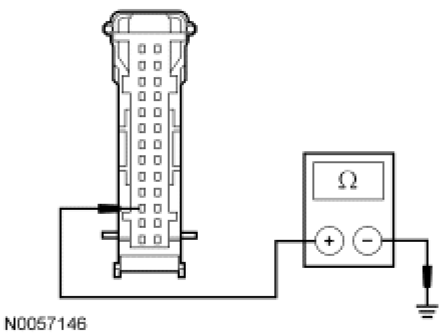


Fig. 8: Checking PATS Transceiver Transmit Circuit VRT23 (VT/GY) For A Short To Ground With PATS Transceiver Disconnected

Courtesy of FORD MOTOR CO.

- Measure the resistance between the IC C220-3, circuit VRT23 (VT/GY), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new PATS transceiver. REFER to **Passive Anti-Theft System (PATS) Transceiver**. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

  NO : REPAIR the circuit. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

E9 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT23 (VT/GY) FOR AN OPEN

- Disconnect: PATS Transceiver C252

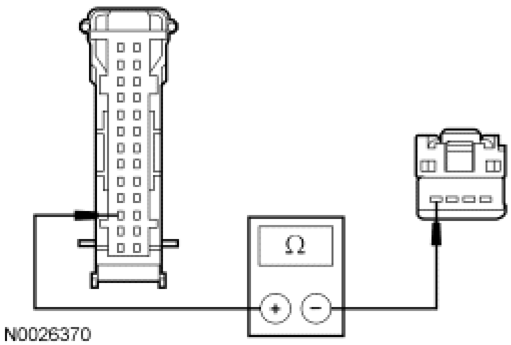


Fig. 9: Checking PATS Transceiver Transmit Circuit VRT23 (VT/GY) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the IC C220-3, circuit VRT23 (VT/GY), harness side and the PATS transceiver C252-4, circuit VRT23 (VT/GY), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to E10.

  NO : REPAIR the circuit. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

E10 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT23 (VT/GY) FOR VOLTAGE

NOTE:	**Replacement of the PATS transceiver does not require the PATS keys to be programmed into the IC again.**

- Connect: PATS Transceiver C252
- Connect: IC C220
- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: IC DataLogger
- Trigger the IC active command Transmit Signal to on.

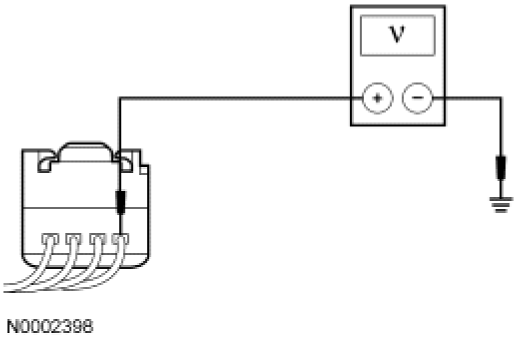


Fig. 10: Checking PATS Transceiver Transmit Circuit VRT23 (VT/GY) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage by backprobing between the PATS transceiver C252-4, circuit VRT23 (VT/GY), harness side and ground.
- **Is the voltage less than 5 volts?**

  YES : INSTALL a new PATS transceiver module. REFER to **Passive Anti-Theft System (PATS) Transceiver**. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

  NO : Go to E11.

E11 CHECK THE PATS TRANSCEIVER TRANSMIT CIRCUIT VRT23 (VT/GY) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: IC C220
- Disconnect: PATS Transceiver C252
- Key in ON position.

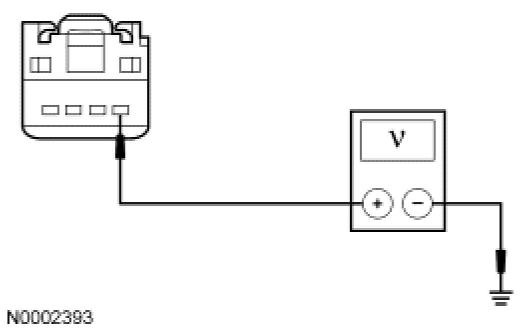


Fig. 11: Checking PATS Transceiver Transmit Circuit VRT23 (VT/GY) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the PATS transceiver C252-4, circuit VRT23 (VT/GY), harness side and ground.
- **Is any voltage indicated?**

  YES : REPAIR the circuit. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

  NO : Go to E12.

E12 CHECK FOR CORRECT IC OPERATION

NOTE: When a new IC is installed, the PATS keys must be programmed into the new IC.

NOTE: When a new IC is installed, the parameters must be reset in the IC and the PCM.

- Disconnect the IC connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the IC connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. RESET the parameters in both the IC and the PCM. REFER to **Passive Anti-Theft System (PATS) Parameter Reset**. PROGRAM the PATS keys into the new IC. REFER to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test F: The Anti-Theft Indicator Is Always/Never On

Normal Operation

The passive anti-theft system (PATS) uses a visual anti-theft indicator located in the instrument cluster (IC). This indicator proves out for 3 seconds when the key is turned to the ON or START position under normal operation. If there is a PATS concern, this indicator either flashes rapidly or glows steadily (for more than 3 seconds) when the key is turned to the ON or the START position. PATS also flashes the anti-theft indicator every 2 seconds at key off to act as a visual theft deterrent. The anti-theft indicator operation is controlled by the IC.

This pinpoint test is intended to diagnose the following:

- IC

PINPOINT TEST F: THE ANTI-THEFT INDICATOR IS ALWAYS/NEVER ON

NOTE: When a new IC is installed, the PATS keys must be programmed into the new IC.

NOTE: When a new IC is installed, the parameters must be reset in the IC and the PCM.

F1 CHECK THE ANTI-THEFT INDICATOR FOR CORRECT OPERATION

- Key in OFF position.
- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: IC DataLogger
- Trigger the active command ALL LAMPS to ON, then OFF.
- **Does the anti-theft indicator illuminate, then turn off?**

  YES : Go to F2.

  NO : INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. RESET the parameters in both the IC and the PCM. REFER to **Passive Anti-Theft System (PATS) Parameter Reset**. PROGRAM the PATS keys into the new IC. REFER to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**. CYCLE the ignition. REPEAT the self-test.

F2 CHECK FOR CORRECT IC OPERATION

- Disconnect the IC connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the IC connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. RESET the parameters in both the IC and the PCM. REFER to **Passive Anti-Theft System (PATS) Parameter Reset**. PROGRAM the PATS keys into the new IC. REFER to **Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment**. CYCLE the ignition. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test.

Pinpoint Test G: DTC U0100 and U2511 - CAN - Data Mis-Match (Receive Data Does Not Match Expected) & Lost Communication With ECM/PCM

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Normal Operation

The passive anti-theft system (PATS) uses a visual anti-theft indicator located in the IC. This indicator proves out for 3 seconds when the key is turned to the ON or START position under normal operation. If there is a

PATS concern, this indicator either flashes rapidly or glows steadily (for more than 3 seconds) when the key is turned to the ON or the START position. PATS also flashes the anti-theft indicator every 2 seconds at key off to act as a visual theft deterrent. The anti-theft indicator operation is controlled by the IC.

If DTC U2510 is present, refer to DTC Charts.

- DTC U0100 (Lost Communication With ECM/PCM) - sets in continuous memory only when the instrument cluster (IC) loses communication with the PCM and the fault may not be present at the time of testing. This DTC may be caused by a high speed controller area (HS-CAN) network circuit issue or by the IC or the PCM.
- DTC U2511 (CAN - Data Mis-Match [Receive Data Does Not Match Expected]) - sets in continuous memory only when the IC does not receive the expected response from the PCM over the HS-CAN network and the fault may not be present at the time of testing. The data sent by the PCM does not match the data expected by the IC and this DTC is set. This DTC can be caused by the HS-CAN circuits between the IC and the PCM or by either module. This DTC can also be set if the battery voltage is low.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Low battery state of charge (SOC)
- IC
- PCM

PINPOINT TEST G: DTC U0100 - LOST COMMUNICATION WITH ECM/PCM, DTC U2511 - CAN - DATA MIS-MATCH (RECEIVE DATA DOES NOT MATCH EXPECTED)

NOTE: **When a new IC is installed, the PATS keys must be programmed into the new IC.**

NOTE: **When a new IC is installed, the parameters must be reset in the IC and the PCM.**

G1 CHECK THE BATTERY STATE OF CHARGE (SOC)

- Key in OFF position.
- Check the battery state of charge (SOC) with the battery condition test. Refer to **BATTERY, MOUNTING AND CABLES** article.
- **Does the battery pass the battery condition test?**

  YES : Go to G2.

  NO : REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnose the low battery voltage condition.

G2 CHECK FOR MODULE COMMUNICATION ON THE HS-CAN

- Connect the diagnostic tool.
- Key in ON position.
- Carry out the network test using the scan tool.
- **Is the scan tool unable to communicate with any of the modules on the HS-CAN?**

YES : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the module that is not communicating with the scan tool.

NO : Go to G3.

G3 INSPECT THE HS-CAN CIRCUITRY

- Key in OFF position.
- Inspect all of the HS-CAN network, including the pin crimps, connector fit, corroded/bent/pushed-out/damaged pins and splice integrity in the 10 splices and 12 connections (6 connectors) between the IC and the PCM. This includes:
  - C220 (IC)
  - S220, S221
  - C3047
  - S333, S334
  - S331, S332
  - C219
  - S137, S138
  - C133
  - S105, S106
  - C138 (3.0L)
  - C133 (3.5L)
  - C175B (PCM)
- **Does the HS-CAN network pass the component inspection?**

  YES : Go to G4.

  NO : REPAIR the HS-CAN circuitry as necessary. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test. TEST the system for normal operation.

G4 CHECK FOR CORRECT PCM OPERATION

NOTE: **When a new PCM is installed, the PATS keys do not need to be programmed into the IC.**

NOTE: **When a new PCM is installed, the parameters must be reset in the IC and the PCM.**

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.

- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article or **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article. RESET the parameters in both the IC and the PCM. REFER to **Passive Anti-Theft System (PATS) Parameter Reset**. CYCLE the ignition. REPEAT the self-test. TEST the system for normal operation. If the concern is still present, Go to G5.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test. TEST the system for normal operation.

G5 CHECK FOR CORRECT IC OPERATION

NOTE: When a new IC is installed, the PATS keys must be programmed into the new IC.

NOTE: When a new IC is installed, the parameters must be reset in the IC and the PCM.

- Disconnect all the IC connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the IC connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. RESET the parameters in both the IC and the PCM. REFER to **Passive Anti-Theft System (PATS) Parameter Reset**. PROGRAM the PATS keys into the new IC. REFER to **Spare Key Programming - Using Diagnostic Equipment**. CYCLE the ignition. REPEAT the self-test. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CYCLE the ignition. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test H: The Vehicle Does Not Start

Normal Operation

The passive anti-theft system (PATS) uses a visual anti-theft indicator located in the IC. This indicator proves out for 3 seconds when the key is turned to the ON or START position under normal operation. If there is a PATS concern, this indicator either flashes rapidly or glows steadily (for more than 3 seconds) when the key is turned to the ON or the START position. PATS also flashes the anti-theft indicator every 2 seconds at key off to act as a visual theft deterrent. The anti-theft indicator operation is controlled by the IC.

This pinpoint test is intended to diagnose the following:

- Starting system concern
- PATS concern

PINPOINT TEST H: THE VEHICLE DOES NOT START

H1 CHECK FOR COMMUNICATION WITH THE PCM AND INSTRUMENT CLUSTER (IC)

- Connect the diagnostic tool.
- Key in ON position.
- Carry out the network test using the scan tool.
- **Does the scan tool establish communication with the PCM and the IC?**

  YES : Go to H2.

  NO : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the module that is not communicating with the scan tool.

H2 CHECK FOR INSTRUMENT CLUSTER (IC) DTCs

- Retrieve the IC continuous and on-demand DTCs.
- **Are any IC DTCs present?**

  YES : REFER to **DTC Charts**.

  NO : The no-start condition is not PATS-related. REFER to the **Introduction - Gasoline Engines** article to diagnose the cause of the no-start condition.

GENERAL PROCEDURES

KEY PROGRAMMING USING TWO PROGRAMMED KEYS

NOTE: **This procedure works only if 2 or more programmed ignition keys (they do not have to be integrated key head transmitter [IKT] keys) are present. If 2 programmed passive anti-theft system (PATS) keys are not available, refer to Integrated Key head Transmitter (IKT) Key Programming Using Diagnostic Equipment.**

NOTE: **The PID SPAREKEY must be enabled for this procedure to operate. If this PID is not enabled, refer to Key Programming Switch State Control, then select CUSTOMER SPARE KEY PROGRAMMING ENABLE and select the tick mark. The PID SPAREKEY is set to ENABLE when the vehicle is built.**

NOTE: **If the programming procedure is successful, the new key(s) will start the vehicle and the anti-theft indicator will prove-out for approximately 3 seconds. If the programming procedure is not successful and the new key(s) does not start the engine, leave the key in the ON position for at least 3 seconds, then turn the key off. Repeat the key programming procedure from Step 1. If the failure repeats, refer to Anti-Theft in the Diagnosis and Testing portion of this part to review the**

DTCs and carry out the appropriate pinpoint tests.

NOTE: **A minimum of 2 PATS keys must be programmed into the instrument cluster (IC) before the vehicle will start.**

NOTE: **If the vehicle is in unlimited key mode, this spare key programming procedure still functions. Any 2 keys that can start the vehicle can be used to program an additional unlimited key.**

NOTE: **If additional keys are to be programmed, and the remaining keys are with the customer, or are not available, instruct the customer to refer to the Owner's Literature for instructions on programming the remaining keys. In this case, the PID SPAREKEY must be enabled.**

NOTE: **If the steps are not carried out as outlined, the programming procedure will end.**

NOTE: **Ignition keys must have a correct mechanical key cut for the vehicle and must be PATS encoded keys (contain a transponder). The key does not have to be an IKT key.**

NOTE: **This procedure is not necessary if only the PATS transceiver was replaced. Replacement of the transceiver does not erase the PATS key codes in the IC.**

NOTE: **A maximum of 8 ignition keys can be programmed to a PATS vehicle, of which up to 4 can be IKTs. If an attempt to program more than 4 IKTs occurs, the smart junction box (SJB) and the IC set a memory full DTC (B1138), and the additional IKTs will not have any RKE function capability. If the vehicle is equipped with a message center, the IC displays the message INT KEY COULD NOT PROGRAM. The PATS portion of the additional key will function, but the RKE transmitter function will be inoperative.**

1. Insert a programmed ignition key (can be an IKT or a standard PATS key) into the ignition lock cylinder and turn the key from the OFF position to the ON position.
2. Leave the key in the ON position for 3 seconds, but not longer than 10 seconds.
3. Turn the key to the OFF position and remove the first key.
4. Within 10 seconds of turning the key to the OFF position, insert a second programmed ignition key (can be an IKT or a standard PATS key) into the ignition lock cylinder and turn the key from the OFF position to the ON position.
5. Leave the key in the ON position for 3 seconds, but not longer than 10 seconds.
6. Turn the key to the OFF position and remove the second key.
7. Within 20 seconds of turning the key to the OFF position, insert the unprogrammed ignition key (new PATS or IKT key) into the ignition lock cylinder and turn the key from the OFF position to the ON position. Leave the key in the ON position for a minimum of 6 seconds (this additional 3 second time

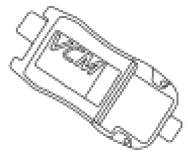
frame allows for the RKE data transfer to take place, if programming an IKT key).

NOTE: The new key will now start the vehicle and will also operate the RKE functions, if there are 4 or fewer IKT keys programmed to the vehicle (if it is an IKT key).

8. Attempt to start the vehicle.
9. If additional programmed keys are desired, repeat Steps 1-7.

INTEGRATED KEY HEAD TRANSMITTER (IKT) KEY PROGRAMMING USING DIAGNOSTIC EQUIPMENT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

NOTE: This procedure is used when a customer needs keys programmed into the system and does not have 2 programmed ignition keys available. This procedure is also useful when a programmed ignition key(s) is lost or the ignition lock cylinder is replaced, and it is desired to erase key code(s) from the passive anti-theft system (PATS) memory.

NOTE: This procedure erases all programmed ignition keys from the vehicle memory and the vehicle will not start until 2 keys are programmed to the vehicle. This procedure also erases the integrated key head transmitter (IKT) identification codes (TICs) from the smart junction box (SJB), preventing the erased IKT from operating the remote keyless entry (RKE) functions on the vehicle.

NOTE: A minimum of 2 PATS keys must be programmed into the instrument cluster (IC) before the vehicle will start.

NOTE: Two PATS encoded (contains a transponder) keys (or IKTs) with the correct mechanical cut must be available to carry out this procedure. One or both of them may be the customer's original keys. One or both of them may be an IKT or a standard PATS key.

NOTE: If additional keys are to be programmed, refer to Key Programming Using Two Programmed Keys. If the remaining keys are with the customer and are not available with the vehicle, instruct the customer to refer to the Owner's Literature for instructions on programming the remaining keys. In this case, the

PID SPAREKEY must be enabled.

NOTE: This procedure is not necessary if only the PATS transceiver was replaced. Replacement of the transceiver does not erase the PATS key codes in the IC.

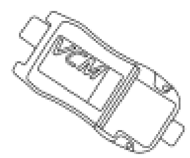
1. Turn the key from the OFF position to the ON position.
2. From the scan tool, enter TOOLBOX. Select BODY-SECURITY-PATS Functions and follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to **Anti-Theft Security Access**.
3. From the scan tool menu select: IGNITION KEY CODE ERASE. Press the tick mark.
4. Turn the key to the OFF position and disconnect the scan tool.

   NOTE: The RKE data transfer will take place between the key and the IC first. After both keys are programmed into the IC, then the RKE data will transfer from the IC to the SJB. Until the final data transfer takes place to the SJB, the RKE functions will not operate.

5. Insert the first PATS key into the ignition lock cylinder and turn the key to the ON position for a minimum of 6 seconds (this additional 3 second time frame allows for the RKE data transfer to take place).
6. Remove the first PATS key from the ignition lock cylinder.
7. Insert the second PATS key into the ignition lock cylinder and turn the key to the ON position for a minimum of 6 seconds (this additional 3 second time frame allows for the RKE data transfer to take place).
8. Remove the second encoded key from the ignition lock cylinder.
9. The vehicle should now start with both ignition keys and the RKE transmitter portion of an IKT should function.
10. If it is desired to program additional key(s) (only up to 8 keys total can be programmed into the instrument cluster [IC]), refer to **Key Programming Using Two Programmed Keys** for each additional key that needs to be programmed.

KEY PROGRAMMING SWITCH STATE CONTROL

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

NOTE: The spare key programming switch is a programmable switch which provides the capability to enable/disable the normal customer spare key programming

procedure detailed in the Owner's Literature. It must read ENABLE if more than 2 keys need to be programmed into the instrument cluster (IC). For additional information, refer to Key Programming Using Two Programmed Keys. This programmable switch is provided as a convenience for rental company fleets or other fleet purchasers who may not want the spare key programming procedure available to the vehicle driver.

NOTE: The spare key programming switch state can be viewed with the IC SPAREKEY PID.

NOTE: If the SPAREKEY PID reads ENABLE, up to 8 keys total can be programmed into the IC using Key Programming Using Two Programmed Keys. If the SPAREKEY PID reads DISABLED, the Key Programming Using Two Programmed Keys procedure will not function. This switch is set to ENABLE when the vehicle is built. This PID does not affect the Key Programming Using Diagnostic Equipment or the Spare Key Programming - Unlimited Key Mode procedures.

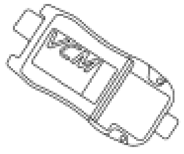
1. Insert a programmed passive anti-theft system (PATS) key (or integrated key head transmitter [IKT]) into the ignition lock cylinder and turn the key from the OFF position to the ON position.
2. From the scan tool, enter TOOLBOX. Select BODY-SECURITY-PATS Functions and follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to **Anti-Theft Security Access**.

   NOTE: The default setting on delivery of all new vehicles is ENABLED, when viewing the IC SPAREKEY PID.

3. From the scan tool menu select: CUSTOMER SPARE KEY PROGRAMMING ENABLE and press the tick mark.
   - CUSTOMER SPARE KEY PROGRAMMING ENABLE - spare key programming procedure is accessible.
   - CUSTOMER SPARE KEY PROGRAMMING DISABLE - spare key programming procedure is not accessible.

SPARE KEY PROGRAMMING - UNLIMITED KEY MODE

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Enabling Unlimited Key Mode

NOTE: Unlimited key mode is intended for use by those customers who need more than 8 keys for their vehicle.

NOTE: If unlimited key mode is enabled, a maximum of 4 IKT keys can be programmed to the vehicle for RKE functionality. If more keys are required, they should be standard PATS keys. If more than 4 IKT keys are programmed to the vehicle, the smart junction box (SJB) and the instrument cluster (IC) will set DTC B1138 (memory full) and only 4 IKT keys will have RKE functionality, however, all of them will start the vehicle, if programmed correctly.

NOTE: Before programming, the new key(s) must have the correct mechanical cut for the ignition lock cylinder.

NOTE: The unlimited key mode is set up by creating a special, unique unlimited transponder security key code and programming this key code into all of the vehicle keys so they contain the same key code.

1. The customer must choose an 8-digit number (except for 00000000 or 00000001) to be programmed to all of their vehicles. All customer vehicles need to use the same number. Valid digits are 0-9 and the letters A-F.

   NOTE: If the PID UNL_KEY_ID is not available, unlimited key mode is turned on, and must be turned off before viewing the stored code. At this time, unlimited keys may be programmed to the vehicle. To view/change the stored code, follow the procedure for disabling the unlimited key mode below.

2. Monitor the PID UNL_KEY_ID and compare its value against the code chosen in Step 1. It should not be the same key code.
3. From the scan tool, follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to **Anti-Theft Security Access**.
4. Once in security access, select: "program unlimited key code" and press the tick mark. Enter the 8-digit code chosen by the customer in Step 1 of this procedure and press the tick mark.
5. Select: "unlimited key mode ON" and press the tick mark.
6. Select: "Ignition Key Code Erase" and press the tick mark.
7. Disconnect the scan tool and turn the ignition switch to OFF.
8. Insert the first PATS key into the ignition lock cylinder and turn the key to the ON position for 3 seconds (6 seconds if it is an IKT key).
9. Remove the first PATS key from the ignition lock cylinder.
10. Insert the next PATS key into the ignition lock cylinder and turn the key to the ON position for 3 seconds (6 seconds if it is an IKT key).
11. If it is desired to program additional key(s), refer to **Key Programming Using Two Programmed Keys** for each additional key that needs to be programmed.

Disabling Unlimited Key Mode

NOTE: By disabling the unlimited key mode, the previous access code no longer operates the vehicle.

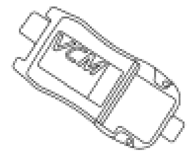
1. From the scan tool, follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to **Anti-Theft Security Access**.
2. Select: "unlimited key mode OFF" and press the tick mark.
3. Select: "Ignition Key Code Erase" and press the tick mark.
4. Disconnect the scan tool and turn the ignition switch to OFF.
5. Insert the first PATS key into the ignition lock cylinder and turn the key to the ON position for 3 seconds (6 seconds if it is an IKT key).
6. Remove the first PATS key from the ignition lock cylinder.
7. Insert the next PATS key into the ignition lock cylinder and turn the key to the ON position for 3 seconds (6 seconds if it is an IKT key).

   NOTE: With the unlimited key mode turned off, a maximum of 8 keys can be programmed into the IC using the Key Programming Using Two Programmed Keys procedure. The PID SPAREKEY must be enabled.

8. If it is desired to program additional key(s), refer to **Key Programming Using Two Programmed Keys** for each additional key that needs to be programmed. The PID SPAREKEY must be enabled.

SPARE KEY PROGRAMMING - USING DIAGNOSTIC EQUIPMENT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

NOTE: This procedure is used when a customer needs to have an additional key programmed into the vehicle without erasing stored key codes, but does not have 2 programmed keys available. This procedure is also useful when attempting to determine if an ignition key is defective, as a new key can be installed without erasing keys or without having 2 programmed keys available.

NOTE: Before programming, the new key must have the correct mechanical cut for the ignition lock cylinder.

NOTE: If 8 keys are already programmed, this procedure does not allow any more

ignition keys to be programmed. The number of keys that are programmed into the passive anti-theft system (PATS) can be determined by viewing the N_KEYCODE PID.

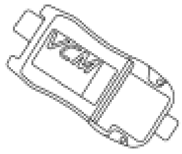
1. Turn the new key to be programmed from the OFF position to the ON position.
2. From the scan tool, follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to **Anti-Theft Security Access**.

NOTE: Make sure the selection made is "PROGRAM". If "ERASE" selection is made, all of the keys will be erased from the system.

3. From the scan tool menu select: "Program additional ignition key".
4. Turn the key to the OFF position and disconnect the scan tool.
5. Start the vehicle with the new PATS key. The vehicle will now start with the new PATS key and also with the original PATS keys.

ANTI-THEFT SECURITY ACCESS

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

NOTE: The anti-theft security access procedure is used to obtain passive anti-theft system (PATS) security access. PATS security access must be granted to erase ignition key codes, program ignition key codes, enable/disable unlimited key mode, set unlimited transponder key ID and enable/disable the spare key programming switch (PID SPAREKEY). The anti-theft security access procedure invokes a 10-minute time delay prior to granting security access during which the scan tool must remain connected to the vehicle. Once security access is granted, a security access command menu is displayed which offers various command options.

NOTE: Once security access has been granted, multiple security access commands should be executed (if necessary) prior to exiting the command menu. This avoids an additional security access procedure and the associated 10 minute time delay.

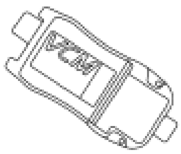
1. From the scan tool, enter TOOLBOX. Select: BODY - SECURITY - PATS Functions, and follow the on-screen instructions to ENTER SECURITY ACCESS. This procedure takes approximately 10 minutes to carry out, during which time the ignition switch must be in the ON position and the scan tool must be

connected to the vehicle.

2. After the 10-minute security access procedure is completed, click on the tick mark and a new menu is displayed with command options. Select only those functions required before exiting out of this menu. Do not select more functions than the procedure calls for. Once exited out of this menu, the security access procedure must be repeated again to carry out additional commands.

PASSIVE ANTI-THEFT SYSTEM (PATS) PARAMETER RESET

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

NOTE: When using the IDS, the instrument cluster (IC) and the PCM parameters are reset at the same time.

NOTE: Once security access has been granted, multiple security access commands should be executed (if necessary) prior to exiting the command menu. This avoids an additional security access procedure and the associated 10 minute time delay.

1. Turn the key from the OFF position to the ON position.
2. From the scan tool, enter TOOLBOX. Select BODY-SECURITY-PATS Functions and follow the on-screen instructions to ENTER SECURITY ACCESS. For additional information, refer to **Anti-Theft Security Access**.
3. From the scan tool, select: Parameter Reset and press the tick mark.

    NOTE: If the IC was replaced, follow Steps 4-9. If the IC and the PCM were replaced, follow Steps 4-9. If only the PCM was replaced, cycle the key off, then back on, to complete the procedure.

    NOTE: If steps 4-9 are followed, 2 keys must be present.

4. From the scan tool, select: Ignition Key Code Erase and press the tick mark.
5. Turn the key to the OFF position and disconnect the scan tool.

    NOTE: Integrated key head transmitter (IKT) keys require a 6-second programming time frame for the remote keyless entry (RKE) data transfer to take place, while standard PATS keys only require a minimum of 3 seconds.

6. Turn the key to the ON position for a minimum of 6 seconds (if it is an IKT key).
7. Turn the key to the OFF position and remove it from the ignition lock cylinder.
8. Insert the second key and turn it to the ON position for a minimum of 6 seconds (if it is an IKT key).
9. Both keys will now start the vehicle and will also operate the RKE functions of the vehicle (if they are IKT keys).

NOTE: The RKE data transfer will take place between the key and the IC first. After both keys are programmed into the IC, the RKE data will transfer from the IC to the smart junction box (SJB). Until the final data transfer takes place into the SJB, the RKE functions will not operate.

10. If more keys are required to be programmed, refer to **Key Programming Using Two Programmed Keys**.

REMOVAL AND INSTALLATION

PASSIVE ANTI-THEFT SYSTEM (PATS) TRANSCEIVER

NOTE: MKZ shown, Fusion and Milan similar.

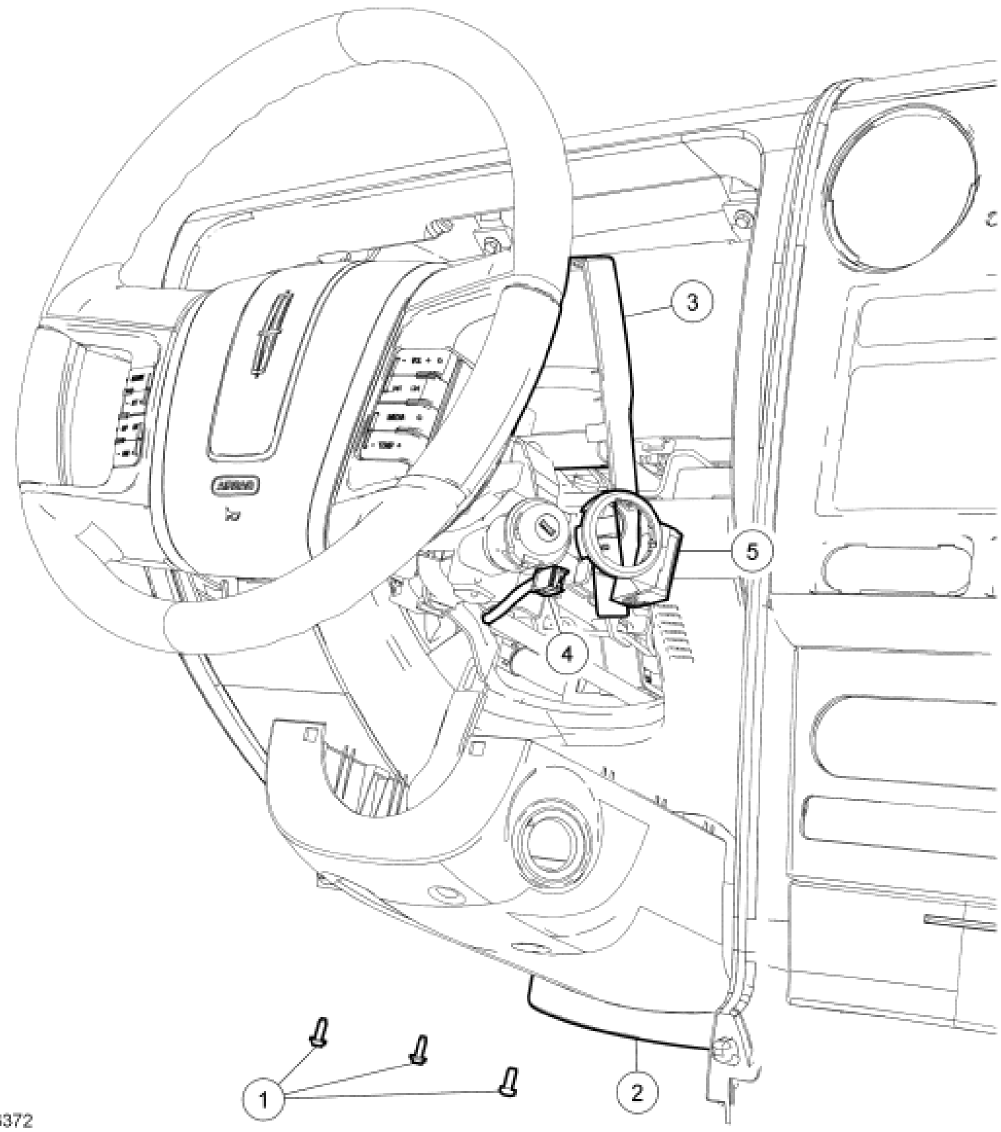


Fig. 12: Exploded View Of Passive Anti-Theft System (PATS) Transceiver
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Steering column shroud screws (3 required)
2	3530	Steering column shroud (lower)
3	3531	Steering column shroud (upper)
4	-	Passive anti-theft system (PATS) transceiver electrical connector (part of 14401)
5	15607	PATS transceiver

REMOVAL AND INSTALLATION

1. Remove the 3 screws and the lower steering column shroud.
2. Position the upper steering column shroud aside.
3. Disconnect the electrical connector and remove the passive anti-theft system (PATS) transceiver.

NOTE: **Replacement of the PATS transceiver does not require the PATS keys to be programmed into the instrument cluster (IC) again.**

4. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Anti-Theft - Perimeter - Fusion, Milan & MKZ

DESCRIPTION AND OPERATION

ANTI-THEFT

NOTE:	**The integrated key head transmitter (IKT) key is a standard passive anti-theft system (PATS) key with a remote keyless entry (RKE) transmitter incorporated into the key head. For additional information on PATS, refer to ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS) article. For additional information on RKE, refer to HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS article.**

NOTE:	**The smart junction box (SJB) is also known as the generic electronic module (GEM).**

The perimeter anti-theft system consists of the following:

- Door ajar switches
- Door disarm switch
- Exterior lamps
- Hood switch
- Horn
- Key-in-ignition switch
- Keyless entry keypad (if equipped)
- Luggage compartment lid disarm switch
- IKT key
- Smart junction box (SJB)

The perimeter anti-theft feature is controlled by the SJB. The alarm can be armed by using 1 of 3 commands:

- Pressing the LOCK button on the IKT key
- Pressing the door lock control switch to LOCK with the accompanying door open, then close the door
- Pressing the 7/8 and 9/0 buttons simultaneously on the keyless entry keypad (if equipped)

The SJB monitors the door ajar switches, the hood ajar switch, the door disarm switch and the luggage compartment lid disarm switch (all doors, hood, luggage compartment lid must be closed and the key must be out of the ignition switch). The SJB arms the perimeter alarm after all of the inputs are closed for 20 seconds. From the time each individual input is closed, to the time the perimeter alarm is armed for that particular input (approximately 20 seconds), is the "pre-arm phase". The pre-arm phase is separate for each individual input. If the door lock control switch is pressed to LOCK with the accompanying door open, all of the inputs that are closed (hood, luggage compartment lid) immediately begin their pre-arm phase. After the door that was open is closed, that door begins its pre-arm phase. This causes all other entry points to be armed a few seconds before

the last open entry point. The perimeter alarm arms in stages in relation to which input was closed first after the arming command was given. In the event of an unauthorized entry, the alarm will be activated by the SJB. When the alarm is activated, the SJB intermittently grounds the horn relay, causing the horn to sound in regular intervals, and intermittently powers the turn signals, causing the turn signals to flash in regular intervals.

The perimeter alarm can be disarmed only by:

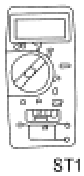
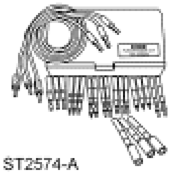
- pressing the UNLOCK button on the IKT key.
- turning the door lock cylinder to the UNLOCK position.
- using a valid programmed key to turn the ignition switch to the ON position.
- entering the correct vehicle unlock code on the keyless entry keypad (if equipped).

The perimeter alarm can be deactivated (not disarmed), by pressing the PANIC button on the RKE transmitter. This action will not disarm the alarm, but will stop the alarm from activation (horn sounding and turn signals flashing). The perimeter alarm will continue to be armed.

DIAGNOSTIC TESTS

ANTI-THEFT

Special Tools

Illustration	Tool Name	Tool Number
	73III Automotive Meter	105-R0057 or equivalent
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

Perimeter Anti-Theft

NOTE:	**The smart junction box (SJB) is also known as the generic electronic module (GEM).**

The perimeter anti-theft system (integral to the SJB) provides for vehicle security through an audible and visual notification if the vehicle doors, luggage compartment lid, or hood is opened without the system being disarmed. The system arms when:

- the doors, the luggage compartment lid, and the hood are closed.
- the key is in the OFF position.
- the vehicle is electronically locked using the integrated key head transmitter (IKT) key, the keyless entry keypad (if equipped), or the driver door lock control switch (with a front door open, then closed).

There is a 20-second pre-arm delay after which each door, luggage compartment lid, and hood is armed. If a door, luggage compartment lid, or hood is open, the system still arms all the other closures. Only the open door, luggage compartment lid, or hood remains disarmed until it is closed. When the open entry point is closed, that entry point enters a 20-second pre-arm delay, then arms.

The hood switch and door ajar switches register as normally closed. The luggage compartment lid ajar switch registers as a normally closed switch. The SJB monitors the status of the hood switch, the luggage compartment lid ajar switch and door ajar switches. If these switches indicate an open entry point, the SJB energizes the horn and flasher relays, causing the horn to sound and the turn signal lamps to flash. The SJB disarms the perimeter alarm when it receives:

- an UNLOCK command through the keyless entry keypad (if equipped).
- an UNLOCK command through the IKT key.
- a disarm signal from the driver door disarm switch (part of the driver door latch) that is hardwired to the SJB.
- a network message from the driver door module (DDM) to the SJB that the driver door disarm switch (part of the driver door latch) was operated (if equipped with memory).
- a valid PATS ignition key is turned to the ON position.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Hood switch • Driver door disarm switch (part of the driver door latch) • Luggage compartment disarm switch	• Wiring, terminals or connectors • Door latches • Driver door module (DDM) (MKZ only) • Smart junction box (SJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before

proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1520	Hood Switch Circuit Open	Go to **Pinpoint Test C**.
B2108	Trunk Key Cylinder Switch Failure	Go to **Pinpoint Test E**.
B2116	Door Driver Reset Switch Stuck Failure	Go to **Pinpoint Test A**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

DRIVER DOOR MODULE (DDM) DTC CHART

DTC	Description	Action

B2116	Door Driver Reset Switch Stuck Failure	Go to **Pinpoint Test A**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Fuse(s) • Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• No communication with the driver door module (DDM)	• Fuse(s) • Wiring, terminals or connectors • DDM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The alarm system does not disarm - from the driver door	• Wiring, terminals or connectors • Driver door disarm switch (part of the driver door latch) • DDM (vehicles with memory feature) • SJB	• Go to **Pinpoint Test A**.
• The alarm system does not arm/disarm - using the integrated key head transmitter (IKT) key	• IKT key • IKT key battery • SJB	• Go to **Pinpoint Test B**.
• The alarm system does not arm/disarm - using the keyless entry keypad	• Keyless entry keypad • SJB	• REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
• The alarm system does not operate correctly - alarm does not activate with hood ajar/open	• Wiring, terminals or connectors • Hood switch • SJB	• Go to **Pinpoint Test C**.
• The alarm system does not operate correctly - flashers or horn do not cycle during anti-theft activation	• Turn signal lamps • Horn • SJB	• Go to **Pinpoint Test D**.

• The alarm system does not operate correctly - the alarm does not inhibit from the luggage compartment disarm switch	• Wiring, terminals or connectors • Luggage compartment disarm switch • SJB	• Go to **Pinpoint Test E**.

Pinpoint Tests

Pinpoint Test A: The Alarm System Does Not Disarm - From The Driver Door

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

On vehicles without the memory feature, the driver door disarm switch provides a ground signal to the smart junction box (SJB) through circuit CPL28 (VT/BN), the switch, and ground circuit GD126 (BK/WH) allowing entry without activating the alarm. The switch must operate before the mechanical lock unlocks. This is to prevent the anti-theft alarm from activating when it should have been disarmed.

On vehicles with the memory feature, the driver door disarm switch provides a ground signal to the driver door module (DDM) through circuit CPL28 (VT/BN), the switch, and ground circuit GD126 (BK/WH). The DDM sends a network message to the SJB, which allows entry without setting off the alarm. The switch must operate before the mechanical lock unlocks. This is to prevent the anti-theft alarm from activating when it should have been disarmed.

- DTC B2116 (Door Driver Reset Switch Stuck Failure) - sets when there is a short to ground in the circuit between the door lock actuator and the SJB (vehicles without memory), or the DDM (vehicles with memory), or the switch is stuck closed.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver door disarm switch (part of the driver door latch)
- DDM (vehicles with memory feature)
- SJB

PINPOINT TEST A: THE ALARM SYSTEM DOES NOT DISARM - FROM THE DRIVER DOOR

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 CHECK THE DRIVER DOOR DISARM SWITCH INPUT

- Key in OFF position.
- Disconnect: SJB C2280c (Vehicles Without Memory) or DDM C568b (Vehicles With Memory)

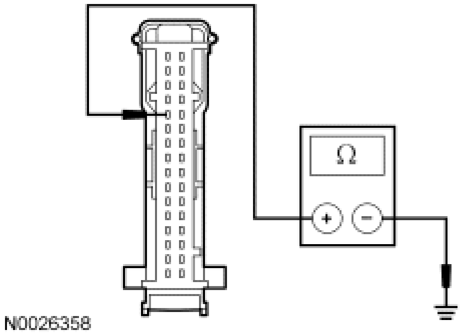


Fig. 1: Checking Driver Door Disarm Switch Input To SJB (1 Of 2)
Courtesy of FORD MOTOR CO.

- On vehicles without memory, measure the resistance between the SJB C2280c-5, circuit CPL28 (VT/BN), harness side and ground while turning the driver door lock cylinder to UNLOCK, and with the lock cylinder in the AT-REST position.

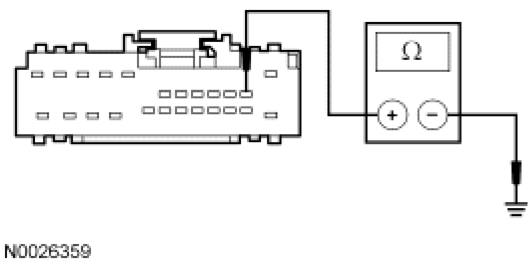


Fig. 2: Checking Driver Door Disarm Switch Input To SJB (2 Of 2)
Courtesy of FORD MOTOR CO.

- On vehicles with memory, measure the resistance between the DDM C568b-2, circuit CPL28 (VT/BN), harness side and ground while turning the driver door lock cylinder to UNLOCK, and with the lock cylinder in the AT-REST position.
- **Is the resistance less than 5 ohms with the door lock cylinder in the UNLOCK position and greater than 10,000 ohms with the door lock cylinder in the AT-REST position?**

  YES : For vehicles without memory, go to A6 .

  For vehicles with memory, go to A4 .

  NO : Go to A2.

A2 CHECK CIRCUIT CPL28 (VT/BN) FOR AN OPEN OR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: Driver Door Latch C525

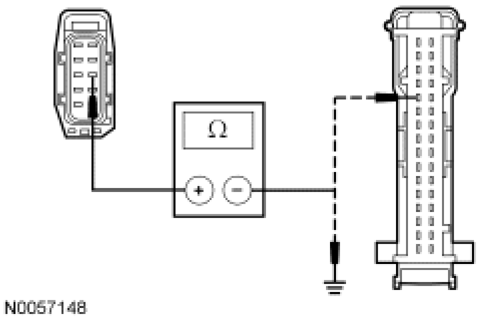


Fig. 3: Checking Circuit CPL28 (VT/BN) For An Open Or A Short To Ground (1 Of 2)
Courtesy of FORD MOTOR CO.

- On vehicles without memory, measure the resistance between the driver door latch C525-5, circuit CPL28 (VT/BN), harness side and the SJB C2280c-5, circuit CPL28 (VT/BN), harness side; and between the driver door latch C525-5, circuit CPL28 (VT/BN), harness side and ground.

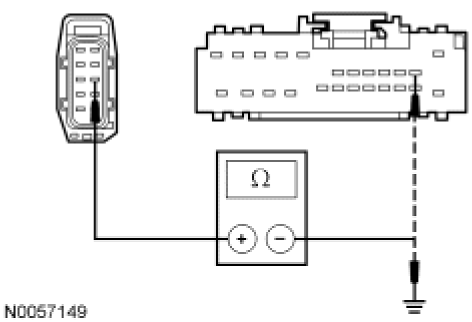


Fig. 4: Checking Circuit CPL28 (VT/BN) For An Open Or A Short To Ground (2 Of 2)
Courtesy of FORD MOTOR CO.

- On vehicles with memory, measure the resistance between the driver door latch C525-5, circuit CPL28 (VT/BN), harness side and the DDM C568b-2, circuit CPL28 (VT/BN), harness side; and between the driver door latch C525-5, circuit CPL28 (VT/BN), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to A3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

A3 CHECK THE DRIVER DOOR DISARM SWITCH GROUND

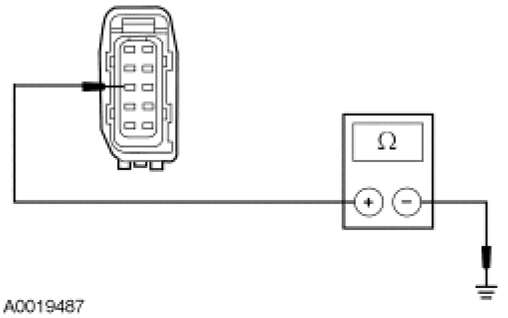


Fig. 5: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the driver door latch C525-6, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new driver door latch. REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

A4 CHECK THE SJB ALARM STATUS PID

- Connect: DDM C568b
- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB PID RESETSW (reset switch) while unlocking the door with the key.
- **Does the PID indicate active?**

  YES : Go to A6.

  NO : Go to A5.

A5 CHECK THE DDM FOR CORRECT OPERATION

- Disconnect all the DDM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the DDM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DDM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. INFORM the customer that all memory feature settings have to be reset and the integrated key head transmitters (IKT) keys reset to the new memory feature settings. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose

or corroded connector. CLEAR the DTCs. REPEAT the self-test.

A6 CHECK THE SJB FOR CORRECT OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each key to the ON position for a minimum of 6 seconds to PROGRAM the remote keyless entry (RKE) function of the IKT key. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test B: The Alarm System Does Not Arm/Disarm - Using The Integrated Keyhead Transmitter (IKT) Key

Normal Operation

The smart junction box (SJB) receives lock/unlock commands from the IKT key. The SJB then arms/disarms the perimeter alarm system.

This pinpoint test is intended to diagnose the following:

- IKT key battery
- IKT key
- SJB

PINPOINT TEST B: THE ALARM SYSTEM DOES NOT ARM/DISARM - USING THE INTEGRATED KEYHEAD TRANSMITTER (IKT) KEY

NOTE: **All IKT keys must be present before diagnosing the remote keyless entry (RKE) system.**

B1 CHECK THE ALARM SYSTEM USING THE DRIVER DOOR DISARM SWITCH

- Arm the alarm system using the driver door lock control switch.
- Disarm the alarm system using the driver door disarm switch.
- **Does the alarm system arm and disarm correctly?**

  YES : REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article to continue the diagnosis of the IKT keys.

NO : Go to **Pinpoint Test A**.

Pinpoint Test C: The Alarm System Does Not Operate Correctly - Alarm Does Not Activate With Hood Ajar/Open

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

The hood switch is a normally closed switch. The smart junction box (SJB) receives the hood switch status through circuit CPL25 (BU/OG), the hood switch, and the hood switch ground circuit GD123 (BK/GY). When the hood is open, the hood switch opens, removing the ground to the SJB.

- DTC B1520 (Hood Switch Circuit Open) - sets when there is an open in the circuit between the hood switch and the SJB, an open in the ground circuit to the hood switch, or the hood switch is stuck open during the on-demand self-test. If the hood is detected as always being open, the perimeter alarm will never arm for the hood.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Hood switch
- SJB

PINPOINT TEST C: THE ALARM SYSTEM DOES NOT OPERATE CORRECTLY - ALARM DOES NOT ACTIVATE WITH HOOD AJAR/OPEN

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CHECK THE HOOD SWITCH CIRCUIT CPL25 (BU/OG) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280a
- Disconnect: Hood Switch C127

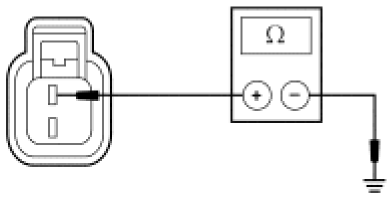


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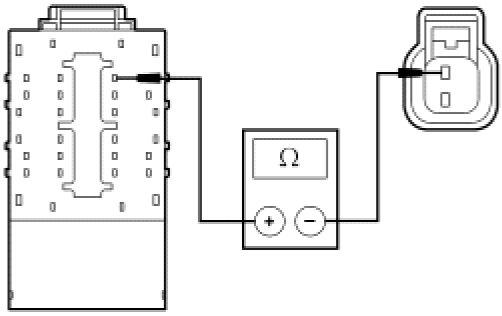
Fig. 6: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the hood switch C127-1, circuit CPL25 (BU/OG), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to C2.

NO : REPAIR the circuit. TEST the system for normal operation.

C2 CHECK CIRCUIT CPL25 (BU/OG) FOR AN OPEN



N0026365

Fig. 7: Checking Circuit CPL25 (BU/OG) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280a-27, circuit CPL25 (BU/OG), harness side and the hood switch C127-1, circuit CPL25 (BU/OG), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to C3.

NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C3 CHECK CIRCUIT GD123 (BK/GY) FOR AN OPEN

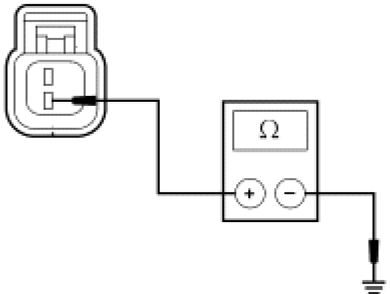


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Fig. 8: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the hood switch C127-2, circuit GD123 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to C4.

NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C4 CHECK THE HOOD SWITCH

- Connect: Hood Switch C127
- Make sure the hood is closed.

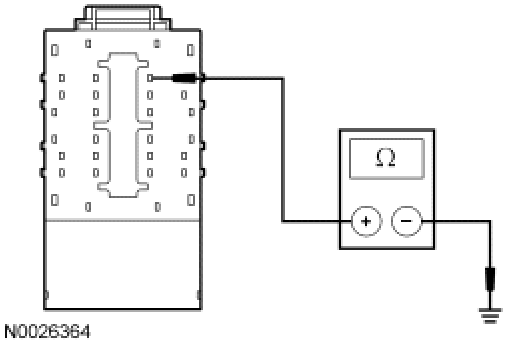

Fig. 9: Checking Hood Ajar Switch
Courtesy of FORD MOTOR CO.

- With the hood closed, measure the resistance between the SJB C2280a-5, circuit CPL25 (BU/OG), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to C5.

  NO : INSTALL a new hood switch. TEST the system for normal operation.

C5 CHECK THE SJB FOR CORRECT OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each key to the ON position for a minimum of 6 seconds to PROGRAM the remote keyless entry (RKE) function of the integrated key head transmitters (IKT) keys. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test D: The Alarm System Does Not Operate Correctly - Flashers Or Horn Do Not Cycle During Anti-Theft Activation

Normal Operation

When an alarm event occurs, the smart junction box (SJB) triggers the turn signals and the horn to signal an attempted theft.

This pinpoint test is intended to diagnose the following:

- Horn system concern
- Turn signals system concern
- SJB

PINPOINT TEST D: THE ALARM SYSTEM DOES NOT OPERATE CORRECTLY- FLASHERS OR HORN DO NOT CYCLE DURING ANTI-THEFT ACTIVATION

D1 CHECK THE ALARM ACTIVATION

- Roll down the driver window and arm the perimeter alarm. After the alarm is armed, open the driver door with the interior door handle to trigger the alarm.
- **Do the horn and turn signals cycle on and off?**

  YES : The alarm outputs are functioning correctly. TEST the system for normal operation.

  NO : If the turn signal lamps do not flash, go to D2.

  If the horn does not cycle, go to D3.

D2 CHECK THE TURN SIGNAL LAMPS OPERATION

- Key in ON position.
- Use the turn signal switch and observe the turn signal lamps.
- **Do the turn signal lamps operate correctly?**

  YES : Go to D4.

  NO : REFER to **EXTERIOR LIGHTING** article.

D3 CHECK THE HORN OPERATION

- Key in ON position.
- Operate the horn from the steering wheel.
- **Does the horn operate correctly?**

  YES : Go to D4.

  NO : REFER to **HORN** article.

D4 CHECK THE SJB FOR CORRECT OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.

- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each key to the ON position for a minimum of 6 seconds to PROGRAM the remote keyless entry (RKE) function of the integrated key head transmitters (IKT) keys. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test E: The Alarm System Does Not Operate Correctly - The Alarm Does Not Inhibit From The Luggage Compartment Disarm Switch

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

The smart junction box (SJB) monitors the luggage compartment disarm switch on circuit CRT18 (YE/GY) for a ground signal. The luggage compartment disarm switch is a normally open switch. When the key is turned to the unlock position, the disarm switch completes the circuit to ground on circuit GD171 (BK/GY) signaling the SJB that an authorized entry to the luggage compartment is occurring. The SJB inhibits the alarm from activating until the luggage compartment lid is closed, then adds the luggage compartment lid to the protected entry points.

- DTC B2108 (Trunk Key Cylinder Switch Failure) - sets when there is a short to ground in the circuit between the luggage compartment disarm switch and the SJB, or the luggage compartment disarm switch is shorted closed internally.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Luggage compartment disarm switch
- SJB

PINPOINT TEST E: THE ALARM SYSTEM DOES NOT OPERATE CORRECTLY - THE ALARM DOES NOT INHIBIT FROM THE LUGGAGE COMPARTMENT DISARM SWITCH

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

E1 CHECK CIRCUIT CRT18 (YE/GY) FOR AN OPEN OR A SHORT TO GROUND

NOTE: The luggage compartment disarm switch does not disarm (only inhibits) the perimeter alarm system. Once armed, the perimeter alarm can only be

disarmed using the integrated key head transmitter (IKT) key, driver door disarm switch, the keyless entry keypad (if equipped), or if a valid passive anti-theft system (PATS) key is turned to the ON position.

- Key in OFF position.
- Disconnect: Luggage Compartment Disarm Switch C4320
- Disconnect: SJB C2280c

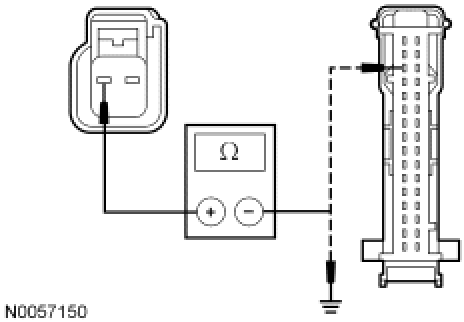

Fig. 10: Checking Circuit CRT18 (YE/GY) For An Open Or A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the luggage compartment disarm switch C4320-2, circuit CRT18 (YE/GY), harness side and the SJB C2280c-3, circuit CRT18 (YE/GY), harness side; and between the luggage compartment disarm switch C4320-2, circuit CRT18 (YE/GY), harness side and ground.
- **Is the resistance less than 5 ohms between the luggage compartment disarm switch and the SJB; and greater than 10,000 ohms between the luggage compartment disarm switch and ground?**

  YES : Go to E2.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

E2 CHECK CIRCUIT GD171 (BK/GY) FOR AN OPEN

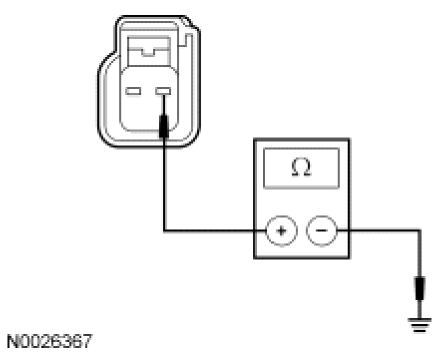

Fig. 11: Checking Circuit GD171 (BK/RD) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the luggage compartment lid disarm switch C4320-1, circuit GD171 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to E3.

  NO : REPAIR the circuit. TEST the system for normal operation.

E3 CHECK THE LUGGAGE COMPARTMENT DISARM SWITCH

- Connect: Luggage Compartment Disarm Switch C4320

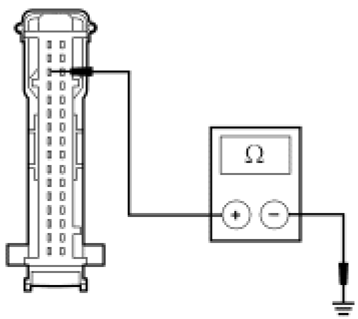

Fig. 12: Checking Luggage Compartment Disarm Switch
Courtesy of FORD MOTOR CO.

- While turning the key in the luggage compartment lid lock cylinder to the UNLOCK and AT-REST positions, measure the resistance between the SJB C2280c-3, circuit CRT18 (YE/GY), harness side and ground.
- **Is the resistance less than 5 ohms with the luggage compartment lid lock cylinder in the UNLOCK position; and greater than 10,000 ohms with the luggage compartment lid lock cylinder in the AT-REST position?**

  YES : Go to E4.

  NO : INSTALL a new luggage compartment disarm switch. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

E4 CHECK THE SJB FOR CORRECT OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each key to the ON position for a minimum of 6 seconds to PROGRAM the remote keyless entry (RKE) function of the integrated key head transmitters (IKT) keys. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

REMOVAL AND INSTALLATION

ANTI-THEFT INHIBIT SWITCH - LUGGAGE COMPARTMENT

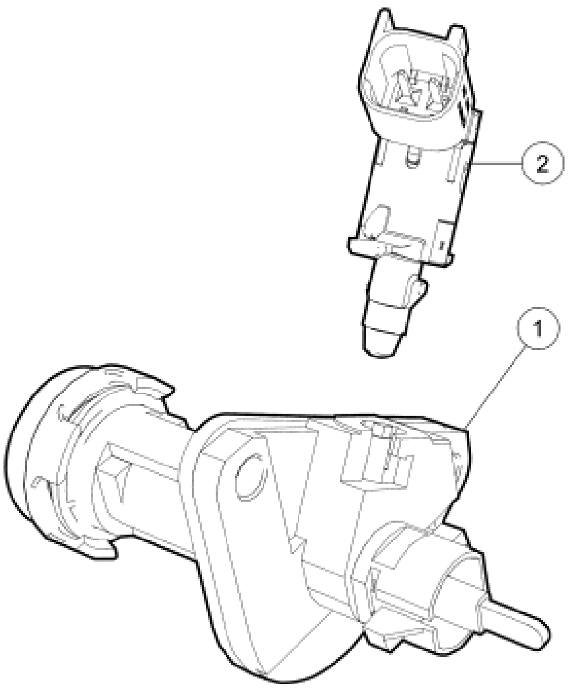

Fig. 13: Exploded View Of Luggage Compartment Anti-Theft Inhibit Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5443262	Luggage compartment lid lock cylinder
2	-	Luggage compartment anti-theft inhibit switch

REMOVAL AND INSTALLATION

1. Remove the luggage compartment lid lock cylinder. For additional information, refer to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
2. Lift the retaining tabs, turn the switch clockwise and remove the luggage compartment anti-theft inhibit switch.
3. To install, reverse the removal procedure.

2008 TRANSMISSIONS

Automatic Transaxle/Transmission - Aisin AW21 - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	-	-
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A	7.0L (7.4 qt)
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B	-
Threadlock and Sealer TA-25	WSK-M2G351-A5	-
Ultra Silicone Sealant TA-29	-	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Fluid	
NOTICE: MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid and Motorcraft Continuously Variable Chain Type Transmission Fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage. Refer to the owner/schedule maintenance publication to determine the correct service interval for the specific vehicle.	
NOTICE: Do not use water-based cleaners to clean or flush the transmission fluid cooler tubes or transaxle damage will occur. Mineral spirits can be used to clean the transmission fluid cooler tubes, providing the transmission fluid cooler tubes are flushed with clean transmission fluid and blown dry with shop air. Use only clean transmission fluid designated for this transaxle.	

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Torque Converter End Play	
New or rebuilt	0.355-1.04 mm (0.014-0.041 in)
Used	0.355-1.87 mm (0.014-0.074 in)

Transmission Fluid Filter	
Internal to the transmission	-

GEAR AND SOLENOID OPERATION CHART

GEAR AND SOLENOID OPERATION CHART

Gear	SSC	SSD	SSE	SSF	SSA	SSB
1st	OFF	ON	ON	ON	OFF	OFF
1st Engine Braking	OFF	ON	ON	ON	ON	ON
2nd	OFF	ON	ON	OFF	OFF	OFF
3rd	OFF	ON	OFF	ON	OFF	OFF
4th	OFF	OFF	ON	ON	OFF	OFF
5th	ON	OFF	OFF	ON	OFF	OFF
6th	ON	OFF	ON	OFF	OFF	OFF

GEAR RATIO

GEAR RATIO

Gear	Ratio
1st	4.148 to 1
2nd	2.370 to 1
3rd	1.556 to 1
4th	1.155 to 1
5th	0.859 to 1
6th	0.686 to 1
Reverse	3.394 to 1
Final Drive	3.46 to 1

SHIFT SPEED MANUAL D POSITION 3.0L ENGINE (MINIMUM THROTTLE)

SHIFT SPEED MANUAL D POSITION 3.0L ENGINE (MINIMUM THROTTLE)

Manual D	km/h	mph
1-2 upshift	11-16	7-10
2-3 upshift	18-24	11-15
3-4 upshift	26-34	16-21
4-5 upshift	35-43	22-27
5-6 upshift	48-61	30-38
2-1 downshift	14-22	9-14
3-2 downshift	24-37	15-23
4-3 downshift	39-48	24-30
5-4 downshift	50-56	31-35
6-5 downshift	58-80	36-50

SHIFT SPEED MANUAL L POSITION 3.0L ENGINE (MINIMUM THROTTLE)

SHIFT SPEED MANUAL L POSITION 3.0L ENGINE (MINIMUM THROTTLE)

Manual L	km/h	mph
1-2 upshift	29-39	18-24
2-3 upshift	74-89	46-55
3-4 upshift	113-130	70-81
4-5 upshift	N/A	N/A
5-6 upshift	N/A	N/A
2-1 downshift	21-27	13-17
3-2 downshift	61-69	38-43
4-3 downshift	100-114	62-71
5-4 downshift	N/A	N/A
6-5 downshift	N/A	N/A

SHIFT SPEED MANUAL D POSITION 3.5L ENGINE (MINIMUM THROTTLE)

SHIFT SPEED MANUAL D POSITION 3.5L ENGINE (MINIMUM THROTTLE)

Manual D	km/h	mph
1-2 upshift	14-21	9-13
2-3 upshift	21-29	13-18
3-4 upshift	33-40	20-25
4-5 upshift	49-55	30-35
5-6 upshift	65-70	40-44
3-1 downshift	7-17	4-11
4-3 downshift	26-36	16-24
5-4 downshift	38-46	24-29
6-5 downshift	56-63	35-39

SHIFT SPEED MANUAL L POSITION 3.5L ENGINE (MINIMUM THROTTLE)

SHIFT SPEED MANUAL L POSITION 3.5L ENGINE (MINIMUM THROTTLE)

Manual L	km/h	mph
1-2 upshift	45-55	28-34
2-3 upshift	90-100	55-62
3-4 upshift	130-138	81-86
4-5 upshift	190-198	118-123
2-1 downshift	15-23	9-14
3-2 downshift	66-75	41-47
4-3 downshift	98-110	61-68
5-4 downshift	163-175	101-109

STALL SPEED

STALL SPEED

Engine	rpm
3.0L (4V)	1,878-2,678
3.5L	1,878-2,678

SOLENOID RESISTANCE READING

SOLENOID RESISTANCE READING

Component	Readings (ohm) @ 20°C (68°F)
Shift Solenoid A (SSA) and Shift Solenoid B (SSB)	11-15 ohms
Shift Solenoid C (SSC), Shift Solenoid D (SSD), Shift Solenoid E (SSE), Shift Solenoid F (SSF), Pressure Control Solenoid A (PCA) and Torque Converter Clutch (TCC)	5.0-5.6 ohms

CLUTCH AND BRAKE PRESSURE CHART

CLUTCH AND BRAKE PRESSURE CHART

Clutch	Range	Pressure
C1	Drive (1st-4th)	196-1,372 kPa (28-199 psi)
C2	Drive (4th-6th)	196-1,372 kPa (28-199 psi)
C3	Drive (3rd-5th)	196-1,372 kPa (28-199 psi)
C3	Reverse	392-1,863 kPa (57-270 psi)
B2	Low, manual 1st	588-1,372 kPa (85-199 psi)
B2	Reverse	392-1,863 kPa (57-270 psi)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Brake caliper hose retaining bracket bolt	22	16	-
Catalyst monitor sensor	48	35	-
Catalytic converter band clamp bolts	20	-	177
Catalytic converter band clamp LH half bolts	40	30	-
Catalytic converter band clamp RH half nuts	20	-	177
Catalytic converter bracket bolts	20	-	177
Catalytic converter support bracket nuts	23	17	-
Catalytic converter-to-engine block bracket bolts	35	26	-
Catalytic converter-to-exhaust manifold nuts	40	30	-
Driveshaft bolts	70	52	-
EGR tube	40	30	-

EGR valve bolts	25	18	-
Exhaust flexible pipe-to-catalytic converter nuts	40	30	
Front wheel hub nut	225	185	-
Ground wire bolts	12	-	106
Heated Oxygen Sensor (HO2S)	48	35	-
HO2S bracket bolt	12	-	106
Lower control arm nuts	200	148	-
Main control valve body bolts[a]	-	-	-
Manual control lever nut	12	-	106
Power steering gear bolts	107	79	-
Power steering line bracket retaining bolts	9	-	80
Power steering line bracket-to-cylinder head retaining bolt	7	-	62
Power Transfer Unit (PTU) bolts	90	66	-
PTU support bracket bolts	70	52	-
RH damper fork through bolt	103	76	-
RH exhaust manifold heat shield bolts	11	-	97
RH halfshaft bearing support bracket bolts All-Wheel Drive (AWD)	23	17	-
RH halfshaft bearing support bracket bolts Front Wheel Drive (FWD)	55	41	-
Selector lever cable bracket bolts	12	-	106
Selector lever cable bracket nut	12	-	106
Stabilizer link nuts	40	30	-
Starter B+ cable	12	-	106
Starter bolts	26	19	-
Starter cable (small)	5	-	44
Subframe nuts	150	111	-
Subframe support bracket bolts	103	76	-
Torque converter nuts	36	27	-
Transaxle insulator-to-frame bolts[b]	62	46	-
Transaxle roll restrictor bolts[b]	90	66	-
Transaxle support insulator bracket bolt	80	59	-
Transaxle support insulator bracket nuts	80	59	-
Transaxle support insulator bracket through bolt (3.5L engine)	130	96	-
Transaxle support insulator-to-bracket bolts (3.0L engine)	90	66	-
Transaxle-to-engine bolts (3.0L engine)	40	30	-
Transaxle-to-engine bolts (3.5L engine)	48	35	-
Transmission fluid cooler tubes	10	-	89
Transmission fluid drain plug	47	35	-
Transmission fluid fill plug	39	29	-
Transmission fluid pan bolts	13	-	115
Transmission Fluid Temperature (TFT) sensor	10	-	89
Transmission Control Module (TCM) sensor	24	18	-

Y-pipe bolts	40	30	-
Y-pipe nuts	40	30	-

[a] Refer to the procedure.

[b] When reinstalling fasteners originally coated with loctite, clean the fasteners with a wire brush prior to applying new threadlock. Apply threadlock and sealer to threads of the bolt.

DESCRIPTION AND OPERATION

TRANSAXLE DESCRIPTION

This transaxle is a compact, lightweight, next generation electronically controlled, 6-speed automatic transaxle that employs Ravigeneaux-type and one single planetary gear set.

This transaxle contains a high-precision clutch hydraulic control system for a smooth, highly responsive gear shift feel.

All hydraulic functions are directed by electronic solenoids to control:

- engagement feel.
- shift feel.
- shift scheduling.
- modulated Torque Converter Clutch (TCC) applications.
- engine braking, utilizing the coast clutch.

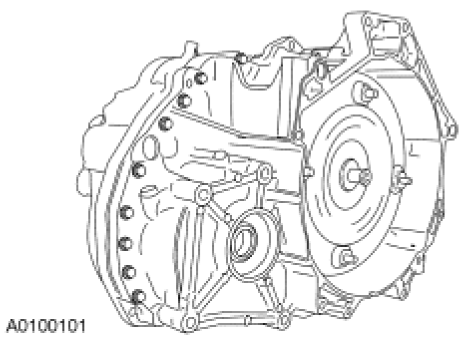

Fig. 1: Automatic Transmission
Courtesy of FORD MOTOR CO.

IDENTIFICATION TAGS

When servicing the automatic transaxle, use the bar code identification label located on side of the transaxle case.

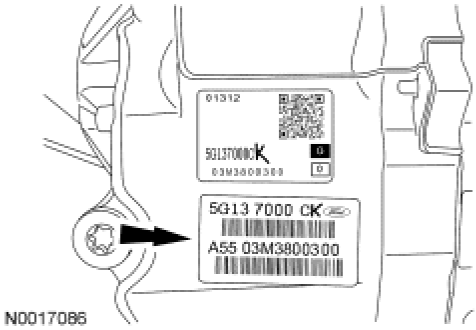

Fig. 2: Identifying Identification Tags
Courtesy of FORD MOTOR CO.

RANGE SELECTION

Fusion and Milan - This transaxle has 5 selector lever positions: P, R, N, D and L.

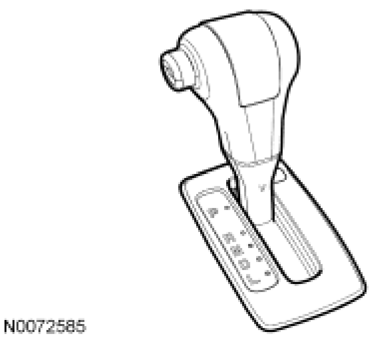

Fig. 3: Identifying Range Selection
Courtesy of FORD MOTOR CO.

MKZ - This transaxle has 5 selector lever positions: P, R, N, D (with an overdrive cancel button) and L.

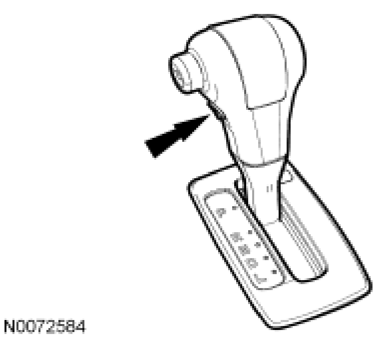

Fig. 4: Identifying Range Selection Overdrive Button
Courtesy of FORD MOTOR CO.

Park

In the PARK position:

- there is no powerflow through the transaxle.
- the parking pawl locks the final drive.
- the engine may be started.
- the ignition key may be removed.

Reverse

In the REVERSE position:

- the vehicle may be operated in a rearward direction, at a reduced gear ratio.
- engine braking will occur.
- the reverse lamps will be activated.

Neutral

In the NEUTRAL position:

- there is no powerflow through the transmission.
- the output shaft is not held and is free to turn.
- the engine may be started.

Drive

DRIVE is the normal position for the best fuel economy.

DRIVE provides:

- automatic shifts gears 1st through 6th.
- apply and release of the torque converter clutch.
- maximum fuel economy during normal operation.

Manual Low (L) Position

In this position the transaxle will upshift and downshift 1st through 4th gear with extended shift scheduling. Engine braking will occur in 1st through 4th gears.

This position:

- provides increased engine braking during downhill/mountain driving.
- provides extended shift scheduling, allowing both upshifts and downshifts at a higher overall rpm to provide optimum engine braking.
- is not intended for use under extended or normal driving conditions and results in lower fuel economy.

Overdrive Cancel

NOTE: When pressing the overdrive cancel button (engaged) and using manual low, the transaxle will actually operate in 1st - 3rd gears until either the selector lever is moved out of the manual low position or the overdrive cancel button is turned off (disengaged).

Pressing the overdrive off button on the selector lever handle will allow:

- automatic shifts, gears 1st - 4th.
- increased engine braking.

SHIFT PATTERNS

Based on signals from the sensors, the system controls gear shift lockup.

Downshifts

Under certain conditions the transaxle will downshift automatically to a lower gear range (without moving the selector lever). There are 3 categories of automatic downshifts:

- Coastdown
- Torque demand
- Forced or kickdown shifts

Coastdown

The coastdown downshift occurs when the vehicle is coasting down to a stop.

Torque Demand

The torque demand downshift occurs (automatically) during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio. If applied, the transaxle will disengage the Torque Converter Clutch (TCC) to provide added acceleration.

Kickdown

For maximum acceleration, the driver can force a downshift by pressing the accelerator pedal to the floor. A forced downshift into a lower gear is possible below calibrated speeds. Specifications for downshift speeds are subject to variations due to tire size, engine and transmission calibration requirements.

TRANSAXLE OPERATIONAL STRATEGIES

Automatic Gearshift Control

In automatic gearshift control, based on each gearshift pattern, Shift Solenoid A (SSA) and Shift Solenoid B (SSB) turn ON or OFF and Shift Solenoid C (SSC), Shift Solenoid D (SSD), Shift Solenoid E (SSE) and Shift Solenoid F (SSF) are operated linearly according to information that includes vehicle speed, the degree to which the accelerator is open and brake signal.

Driver Adaptive Shift Control

This automatic transaxle does not have a driving mode selection switch that allows drivers to select a mode themselves. The vehicle is ordinarily in adaptive mode. However, when specific conditions are met, the Transmission Control Module (TCM) selects a shifting pattern appropriate to driving conditions from all of the shifting patterns and switches automatically.

- GREEN - Mode 1 - Switched from mode 2 to warm up the transmission fluid. This mode acts to protect the transaxle before the adaptive mode.
- GREEN - Mode 2 - After engine start-up, warm-up speed is increased for a certain period when transmission fluid temperature is low and the vehicle speed is 0.
- HIGH TEMP - When transmission fluid temperature becomes too high, this mode activates lock-up at an earlier timing to stop the temperature rise and lower the temperature.
- DOWN SLOPE - When driving down a slope, the TCM detects a down slope based on the engine control unit signal and output rpm. TCM switches to down slope mode to alleviate the load to the brake by downshifting.

Gear Shift Control

When the selector lever is moved from N to D or from N to R, after the engine is started, a shift control solenoid assembly SSC, SSD or SSE is used for the fluid pressure required by C1 clutch or C3 clutch and appropriately regulated fluid pressure is supplied to the clutch, engaging smoothly without shock.

Reverse Converter Control

If the selector lever is moved from N to R while the vehicle is moving forward and the transaxle shifts into REVERSE, the wheels will be locked, which is extremely dangerous. In order to avoid this, the TCM inhibits the transaxle from shifting into REVERSE while moving forward.

Torque Converter Clutch (TCC)

Based on output rpm signals, signals from the engine control unit (engine rpm and throttle opening) and vehicle speed, a smooth engagement is carried out through linear control of the Torque Converter Clutch (TCC) solenoid. Also, the slip rate is detected by adding input rpm signals and slip control is carried out.

- Engagement Control - control is carried out using a TCC solenoid. The TCC solenoid is linearly turned ON and OFF. The clutch inside the torque converter is operated and the pump impeller and turbine runner are connected. Through this, the engine and the transaxle are coupled and engine output is connected directly to the transaxle, eliminating transaxle loss and enhancing fuel economy
- Slip Control - control is carried out using a TCC solenoid. The TCC solenoid is linearly turned ON and OFF and the clutch within the torque converter is operated outside of the engagement range. The clutch slides without being in a completely coupled condition, increasing transaxle efficiency and enhancing fuel economy.

TORQUE CONVERTER

The torque converter transmits and multiplies torque by means of transmission fluid inside the torque converter. The torque converter is composed of the following:

- Converter case
- Pump impeller assembly
- Turbine assembly
- Stator assembly/one-way clutch
- Lock-up clutch

In addition, the use of the lock-up clutch is intended to improve fuel economy as a direct coupling between the engine and the transaxle.

The standard torque converter components operate as follows:

- Rotation of the converter housing and impeller sets the transmission fluid in motion.
- The turbine reacts to the transmission fluid motion from the impeller, transferring rotation to the geartrain through the input shaft.
- The reactor redirects transmission fluid going back into the impeller, providing for torque multiplication.
- The clutch and damper assembly dampens powertrain torsional vibration and provides a direct mechanical connection for improved efficiency.
- Power is transmitted from the torque converter to the planetary gearsets and other components through the input shaft.

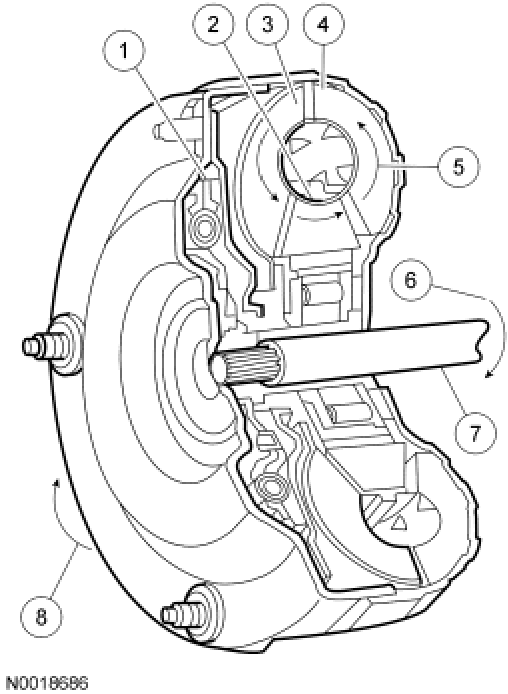

Fig. 5: Cut-Away View Of Torque Converter
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Converter clutch and damper (part of 7902)
2	-	Reactor (part of 7902)
3	-	Turbine (part of 7902)
4	-	Impeller (part of 7902)
5	-	Transmission fluid motion
6	-	Transmission input rotation
7	-	Input shaft
8	-	Engine rotation

GEARTRAIN

The geartrain consists of the planetary gearsets, apply components, final drive gearset and differential.

GEAR RATIO

Gear	Ratio
1st	4.148 to 1
2nd	2.370 to 1
3rd	1.556 to 1
4th	1.155 to 1
5th	0.859 to 1
6th	0.686 to 1
Reverse	3.394 to 1
Final drive	3.46 to 1

Differential

The differential allows the halfshafts and wheels to rotate at different speeds during cornering.

The differential assembly consists of the following components:

- Differential case (part of the final drive carrier)
- Two pinion gears supported by a pinion shaft
- Two side gears supported by the differential case and halfshafts

When driving in a straight line, both front wheels rotate at relatively the same speed. This means both side gears are rotating at the same speed, as well, while both pinion gears revolve (but do not rotate) with the side gears. During cornering, the wheel on the outside of the turn is forced to rotate faster than the wheel on the inside of the turn. Since the side gears must now rotate at different speeds, the pinion gears rotate on the pinion shaft allowing the drive axles to rotate at different speeds while still transferring output torque.

APPLY COMPONENTS

C1 Clutch

The C1 clutch connects the front planetary carrier to the rear sun gear of the rear planetary set. The C1 clutch is applied in 1st (typical operation during engine braking), 2nd, 3rd and 4th gears.

C2 Clutch

The C2 clutch connects the intermediate shaft to the rear planetary carrier. The C2 clutch is applied in 4th, 5th and 6th gears.

C3 Clutch

The C3 clutch connects the front planetary carrier to the middle sun gear of the rear planetary set. The C3 clutch is applied in 3rd and 5th gears, and also in REVERSE when the vehicle speed is 7 km/h (4 mph) or less.

B1 Brake

The B1 brake locks the middle sun gear of the rear planetary gear set. The B1 brake is applied in 2nd and 6th gears.

B2 Brake

The B2 brake locks the rear planetary carrier in REVERSE gear when the vehicle speed is 7 km/h (4 mph) or less.

F1 One-Way Clutch

The F1 one-way clutch locks the counterclockwise rotation of the rear planetary carrier during 1st gear operation (during both normal operation and engine braking).

Hydraulic Systems

Valve Body

The valve body supplies transmission fluid by switching the transmission fluid circuit for the hydraulic pressure that is generated by the transmission fluid pump. Based on the hydraulic pressure generated by the transmission fluid pump the Transmission Control Module (TCM) sends control signals to the solenoid valves in accordance with vehicle conditions. When the solenoid valve is activated, the control hydraulic pressure to the clutch and brakes is determined (according to the equilibrium with the obtained hydraulic pressure) and gear shift and lockup are accomplished. In addition, an appropriate amount of transmission fluid is supplied to the torque converter, planetary gears and lubricating parts.

TRANSAXLE ELECTRONIC CONTROL SYSTEM

Electronic System Description

The Transmission Control Module (TCM) and its input/output network controls the following operations:

- Shift timing
- Line pressure (shift feel)
- Torque Converter Clutch (TCC)

The transaxle control is separate from the engine control strategy in the PCM, although some of the input signals are shared between the TCM and PCM. When determining the best operating strategy for transaxle operation, the TCM uses input information from certain engine-related and driver-demand related sensors and switches supplied by the PCM.

In addition, the TCM receives input signals from certain transaxle-related sensors and switches. The TCM also uses these signals when determining transaxle operating strategy.

Using all of these input signals, the TCM can determine when the time and conditions are right for a shift, or when to apply or release the torque converter clutch. It will also determine the best line pressure needed to optimize shift feel. To accomplish this the TCM uses output solenoids to control transaxle operation.

The following provides a brief description of each of the sensors and actuators used to control transaxle operation.

Transmission Control Module (TCM) Control Function

In automatic gear shift control, based on each gear shift pattern, Shift Solenoid A (SSA) and Shift Solenoid B (SSB) turn ON or OFF and Shift Solenoid C (SSC), Shift Solenoid D (SSD), Shift Solenoid E (SSE) and Shift Solenoid F (SSF) are operated linearly according to information that includes vehicle speed, the degree to which the accelerator is open and brake signals. For the gear and solenoid operation chart, refer to **SPECIFICATIONS**.

The Transmission Range (TR) sensor is built in the TCM, it detects the automatic transmission range information via the Hall-effect sensor and outputs the information to the TCM. The TCM reads the voltage and adjusts the automatic transmission range.

Brake Pedal Position (BPP)

The Brake Pedal Position (BPP) switch tells the PCM when the brakes are applied. The Torque Converter Clutch (TCC) disengages when the brakes are applied and the BPP switch closes when the brakes are applied and opens when they are released.

Transmission Fluid Temperature (TFT) Sensor

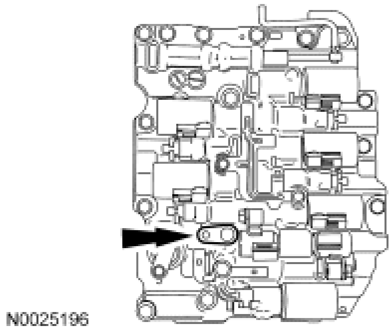

Fig. 6: Locating Transmission Fluid Temperature (TFT) Sensor
Courtesy of FORD MOTOR CO.

The Transmission Fluid Temperature (TFT) sensor, which is integrated within the transmission wiring, is installed on the front of the valve body. It directs the transmission fluid temperature within the hydraulic pressure control circuit and transmits a signal based on that temperature to the Transmission Control Module (TCM). Through this it controls gear shift, lockup and slip in response to changes in transmission fluid temperature for smooth shifting across wide fluid temperature zones.

Transaxle Shift Solenoids SSA, SSB

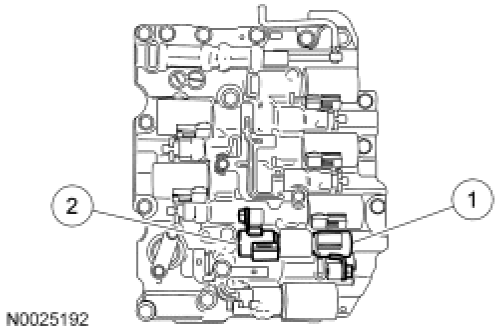

Fig. 7: Identifying Transaxle Shift Solenoids (SSA, SSB)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Shift Solenoid A (SSA)
2	-	Shift Solenoid B (SSB)

The transaxle SSA is installed on the middle valve body. The transaxle solenoid assembly SSB is installed on the front valve body. The solenoids turn ON and OFF in response to signals output from the TCM. According to the ON or OFF status of SSA or SSB, the 1st gear engine brake operates or the gear shifts into REVERSE. As a fail-safe function, if any transaxle solenoid assembly abnormality occurs, the TCM will disable the current to the solenoids.

Shift Control Solenoids (SSC, SSD, SSE, SSF)

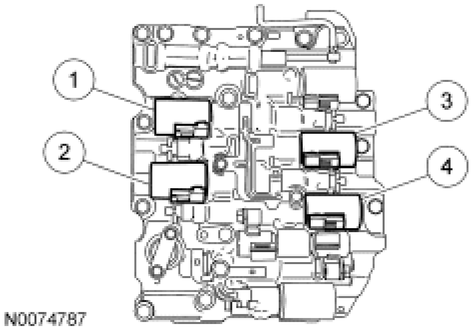

Fig. 8: Identifying Shift Control Solenoids (SSC, SSD, SSE, SSF)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Shift Solenoid C (SSC)
2	-	Shift Solenoid D (SSD)
3	-	Shift Solenoid E (SSE)
4	-	Shift Solenoid F (SSF)

The shift control solenoid assembly (SSC, SSD, SSE, SSF) is installed on the front valve body. The solenoids linearly control hydraulic pressure in response to signals, output from the TCM. Through this, it controls hydraulic pressure to the clutch (C1, C2, C3) and brakes (B1) for smooth shifting. According to the combination of ON or OFF status of the shift control solenoid assembly, the transaxle shifts from 1st gear into 6th gear and vice versa. As a fail-safe function, if any shift control solenoid assembly abnormality occurs, the TCM will disable the current to the shift control solenoids.

Pressure Control Solenoid A (PCA)

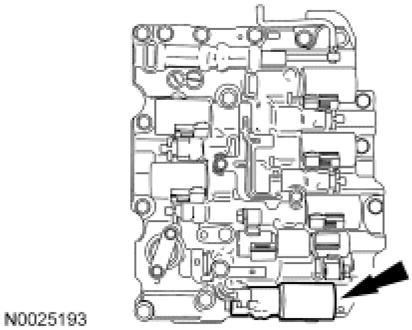

Fig. 9: Identifying Pressure Control Solenoid (PCA)
Courtesy of FORD MOTOR CO.

The Pressure Control Solenoid A (PCA) is installed on the front valve body. Based on a signal indicating the degree to which the throttle is opened, engine torque, and according to a duty ratio predetermined in the TCM, the solenoids control line hydraulic pressure by linearly changing the comparable throttle hydraulic pressure. Through this, it controls operating hydraulic pressure to the clutch and brakes for smooth shifting. As a fail-safe function, if any shift control solenoid assembly abnormality occurs, the TCM will disable the current to the shift control solenoids. The line pressure is maximized, if the shift control solenoid assembly current is disabled

when any abnormality other than locking occurs.

Speed Sensor

The 2 speed sensors are installed in the transaxle case. One speed sensor detects revolutions of the intermediate shaft's C2 drum as input shaft revolutions. The other speed sensor detects the counterdrive gear as output shaft revolutions. These signals are transmitted to the TCM. Based on these signals, the TCM controls engine torque, shift timing and lockup.

Adaptive Shift Control

The TCM has an adaptive learning strategy to electronically control the transaxle which will automatically adjust the shift feel. The first few hundred miles of operation of the transaxle may have abrupt shifting. This is a normal operation. If the battery has been disconnected for any reason it will need to be kept disconnected for approximately 20 minutes to reset the adaptive shift pressure strategy or use the scan tool to carry out the keep alive memory (KAM) reset.

Torque Converter Clutch (TCC) Solenoid

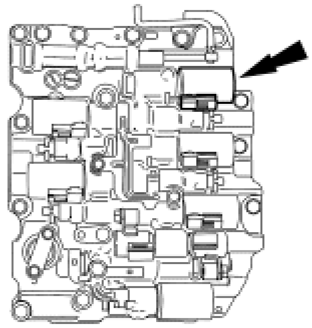

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Fig. 10: Locating Torque Converter Clutch (TCC) Solenoid
Courtesy of FORD MOTOR CO.

The Torque Converter Clutch (TCC) solenoid is used in the transaxle control system to control the application, modulation and release of the torque converter clutch.

The TCC control solenoid is installed on the front valve body. Based on engine rpm, throttle opening degree signals and speed sensor signals, it linearly controls clutch hydraulic pressure. Through this, engagement and slip are controlled. As a fail-safe function, if any control solenoid assembly abnormality occurs, the TCM will disable the current to the TCC solenoid.

Transmission Control (TC) Switch (MKZ)

The Transmission Control (TC) switch is a momentary contact switch that allows the driver to cancel operation of overdrive.

The TC switch is located on the selector lever.

When the driver initially presses the TC switch, a signal is sent to the PCM.

The PCM uses the shift solenoids to disengage/disable overdrive operation.

At the same time, the PCM illuminates the Transmission Control Indicator Lamp (TCIL) to notify the driver that overdrive is canceled.

When the TC switch is pressed again, overdrive operation is enabled, the converter clutch is released and the TCIL is turned OFF.

Whenever the ignition is cycled (vehicle shut OFF, then started again), the TC switch is turned OFF and overdrive will be enabled, even if the TC switch had been on when the ignition was shut off.

Transmission Control Indicator Lamp (TCIL)

The Transmission Control Indicator Lamp (TCIL) is located in the instrument panel and is labeled Overdrive OFF. It is illuminated in conjunction with the TC switch.

DIAGNOSTIC TESTS

DIAGNOSTIC STRATEGY

Troubleshooting an electronically controlled automatic transaxle is simplified by using the proven method of diagnosis. One of the most important things to remember is that there is a definite procedure to follow.

NOTE: Do not take short cuts or assume that critical checks or adjustments have already been made.

Follow the procedures as written to avoid missing critical components or steps.

To correctly diagnose a concern, have the following publications available:

- **Introduction - Gasoline Engines** article
- TSBs
- Wiring Diagrams article

These publications provide the information required when diagnosing transaxle concerns.

Use the Diagnostic Flow Chart as a guide and follow the steps as indicated.

Preliminary Inspection

- Know and understand the customer's concern.
- Verify the concern by operating the vehicle.
- Check the fluid levels and condition.
- Check for non-factory-installed items and verify correct installation
- Check selector lever linkages for correct adjustment.

- Check TSBs regarding the concern.
- Carry out Self Tests, both Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER).
- Record all codes.

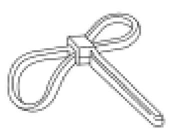
Diagnostics

- Carry out on-board diagnostic procedures KOEO and KOER.
- Record all DTCs.
- Repair all non-transaxle codes first.
- Repair all transaxle codes second.
- Erase all continuous codes and attempt to repeat them.
- Repair all continuous codes.
- If only pass codes are obtained, proceed to the **Diagnosis By Symptom** for further information and diagnosis.

Follow the diagnostic sequence to diagnose and repair the concern the first time.

DIAGNOSTIC FLOW CHART

Special Tools

Illustration	Tool Name	Tool Number
 ST1438-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Prior to carrying out the flow test, the following items should be checked:

- Know and understand the customer concerns
- Check the transmission fluid level and condition
- Verify the concern by operating the vehicle
- Check for non-factory-installed items and verify correct installation
- Check the selector lever linkage adjustments
- Check technical service bulletins (TSBs) for vehicle concerns
- Carry out Self Tests, both Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER)
- Record all codes
- Verify that the vehicle Transmission Control Module (TCM) is at the latest calibration release level

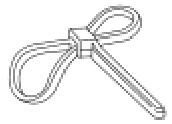
DIAGNOSTIC FLOW CHART

Test	Result	Action
1) DTCs recorded?	Yes	REPAIR all hard DTCs. FOLLOW the pinpoint

		tests. REFER to the **Introduction - Gasoline Engines** article first, then this workshop article, then Go to Step 2.
	No	REFER to **Diagnosis By Symptom**, then Go to Step 5.
2) Are any continuous test memory codes present?	Yes	CLEAR codes and CARRY OUT the drive cycle test.
	No	Go to Step 4.
3) Did the continuous test memory codes reappear?	Yes	REPAIR all continuous test memory codes. FOLLOW the pinpoint tests. REFER to the **Introduction - Gasoline Engines** article, then the transmission reference article, then this workshop article, then Go to Step 4.
	No	Go to Step 4.
4) Is the concern repaired?	Yes	CARRY OUT the final quick test to verify that no DTCs are present. CLEAR memory codes.
	No	REFER to **Diagnosis By Symptom**.
5) Was the transmission concern corrected when the scan tool was installed?	Yes	REFER to the **Introduction - Gasoline Engines** article, intermittent fault diagnosis part and use the scan tool to diagnose cause of concern in the processor, vehicle harness or external inputs (sensors or switches).
	No	REFER to the hydraulic and mechanical routine to diagnose the concern, then Go to Step 6.
6) Is the concern repaired?	Yes	CARRY OUT the final Self Test to verify that no DTCs are present. CLEAR memory codes.
	No	Concern should have been repaired. GO back through the diagnostic flow chart and REVIEW other components that may have contributed to the concern. CHECK and DIAGNOSE those components. GET assistance from other sources.

PRELIMINARY INSPECTION

Special Tools

Illustration	Tool Name	Tool Number
 ST1438-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Material

Item	Specification
Motorcraft Premium Automatic Transmission Fluid	

XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A

The following items must be checked prior to beginning the diagnostic procedures.

Know and Understand the Concern

In order to correctly diagnose a concern, first understand the customer complaint or condition. Customer contact may be required in order to begin to verify the concern. Understand the conditions as to when the concern occurs. For example:

- Hot or cold vehicle temperature
- Hot or cold ambient temperatures
- Vehicle driving conditions
- Vehicle loaded/unloaded

After understanding when and how the concern occurs, proceed to verifying the concern.

Verification of Condition

This part provides information which must be used in both determining the actual cause of customer concerns and carrying out the appropriate procedures.

The following procedures must be used when verifying customer concerns for the transmission.

Determine Customer Concern

NOTE: Some transaxle conditions may cause engine concerns. An Electronic Pressure Control (EPC) short circuit can cause engine misfiring. The Torque Converter Clutch (TCC) not disengaging will stall the engine.

Determine customer concerns relative to vehicle use and dependent driving conditions, paying attention to the following items:

- Hot or cold vehicle operating temperature
- Hot or cold ambient temperatures
- Type of terrain
- Vehicle loaded/unloaded
- City/highway driving
- Upshift
- Downshift
- Coasting
- Engagement (harsh or soft)
- Noise/vibration - check for dependencies, either rpm dependent, vehicle speed dependent, shift dependent, gear dependent, range dependent or temperature dependent

Check Transmission Fluid Level and Condition

NOTE: The vehicle should not be driven if the transmission fluid level indicator shows the transmission fluid below the DO NOT DRIVE mark or internal failure could result.

If the vehicle has been operated for an extended period of time at highway speeds, in city traffic, in hot weather or while pulling a trailer, the transmission fluid needs to cool down to obtain an accurate reading.

The transmission fluid level reading on the transmission fluid level indicator will differ depending on operating and ambient temperatures. The correct reading should be within the normal operating temperature range.

Transmission Fluid Level Check

NOTE: The transmission fluid should be checked at normal operating temperature 60°C-70°C (140°F-158°F) on a level surface. Normal operating temperature can be reached after approximately 32 km (20 mi) of driving.

Under normal circumstances, the transmission fluid level should be checked during normal maintenance. If the transaxle starts to slip, shifts slowly or shows signs of transmission fluid leaking, the transmission fluid level should be checked.

1. Using the scan tool, verify the correct Transmission Fluid Temperature (TFT) range.
2. With the transaxle in PARK, the engine at idle, foot pressed on the brake, move the selector lever through each gear and allow engagement of each gear. Place the selector lever in the PARK position.
3. Wipe the transmission fluid level indicator cap and remove the transmission fluid level indicator.
4. Wipe the transmission fluid level indicator with a clean cloth.
5. Install the transmission fluid level indicator back in the transmission fluid filler tube until it is fully seated, then remove the indicator. The transmission fluid level should be within the normal operating range.

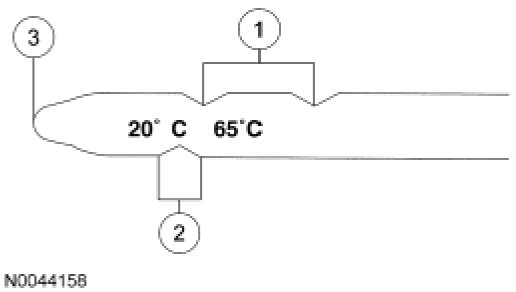


Fig. 11: Transmission Fluid Level Check
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
		Transmission fluid level at operating

1	-	temperature 60°C-70°C (140°F-158°F)
2	-	Transmission fluid level cold 15°C-25°C (59°F-77°F)
3	-	Do not drive mark

High Transmission Fluid Level

A transmission fluid level that is too high may cause the transmission fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of transmission fluid from the vent tube and possible transaxle malfunction and/or damage. If an overfill reading is indicated, refer to **Transmission Fluid Drain and Refill**.

Low Transmission Fluid Level

A low transmission fluid level could result in poor transaxle engagement, slipping, malfunction and/or damage. This could also indicate a leak in one of the transaxle seals or gaskets.

Adding Transmission Fluid

NOTE: The use of any other type of transmission fluid than specified could result in transaxle malfunction and/or damage.

If transmission fluid needs to be added, add transmission fluid in 0.25L (1/2 pt) increments through the transmission fluid filler tube. Do not overfill the transmission fluid. For transmission fluid type, refer to **SPECIFICATIONS**.

Transmission Fluid Condition Check

1. Check the transmission fluid level.
2. Observe the color and the odor. The color under normal circumstances should be a dark red color, not brown or black or have a burnt odor.
3. Hold the transmission fluid level indicator over a white facial tissue and allow the transmission fluid to drip onto the facial tissue and examine the stain.
4. If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.
5. If the stain is a foamy pink color this may indicate coolant in the transaxle. The engine cooling system should also be inspected at this time.
6. If transmission fluid contamination or transaxle failure is confirmed by the sediment in the bottom of the transmission fluid pan, install a new transaxle. If installing a new transaxle the transmission fluid cooler bypass valve, transmission fluid coolers and transmission cooler tubes should be cleaned.
7. Carry out diagnostic checks and adjustments. Refer to **Diagnosis By Symptom**.

Water in Transmission Fluid

To correctly repair an automatic transaxle that has had water or coolant introduced into the system, only install a new transaxle for the units that cannot be disassembled and cleaned. Prior to installing the transaxle, the transmission fluid cooler(s), transmission fluid cooler tubes and transmission fluid cooler hoses need to be

flushed and cleaned.

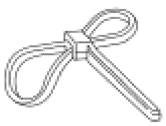
ROAD TESTING VEHICLE

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

The Shift Point Road Test and Torque Converter Operation Tests provide diagnostic information on shift controls and torque converter operation.

SHIFT POINT ROAD TEST

Special Tools

Illustration	Tool Name	Tool Number
 ST1438-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

NOTE: Shift speed ranges are approximate for all applications.

This test verifies that the shift control system is operating correctly.

1. Bring engine and transaxle up to normal operating temperature.
2. Operate vehicle with selector lever in D range.
3. Using the shift speed charts, apply minimum throttle and observe the speeds at which the transaxle upshifts. The transaxle will upshift 1st through 6th gears.
4. Press the accelerator pedal to the floor, Wide Open Throttle (WOT). The transaxle should downshift to the next lower gear depending on the vehicle speed. The Torque Converter Clutch (TCC) should release.

SHIFT SPEED MANUAL D POSITION 3.0L ENGINE (MINIMUM THROTTLE)

Manual D	km/h	mph
1-2 upshift	11-16	7-10
2-3 upshift	18-24	11-15
3-4 upshift	26-34	16-21
4-5 upshift	35-43	22-27
5-6 upshift	48-61	30-38

2-1 downshift	14-22	9-14
3-2 downshift	24-37	15-23
4-3 downshift	39-48	24-30
5-4 downshift	50-56	31-35
6-5 downshift	58-80	36-50

SHIFT SPEED MANUAL L POSITION 3.0L ENGINE (MINIMUM THROTTLE)

Manual L	km/h	mph
1-2 upshift	29-39	18-24
2-3 upshift	74-89	46-55
3-4 upshift	113-130	70-81
4-5 upshift	N/A	N/A
5-6 upshift	N/A	N/A
2-1 downshift	21-27	13-17
3-2 downshift	61-69	38-43
4-3 downshift	100-114	62-71
5-4 downshift	N/A	N/A
6-5 downshift	N/A	N/A

SHIFT SPEED MANUAL D POSITION 3.5L ENGINE (MINIMUM THROTTLE)

Manual D	km/h	mph
1-2 upshift	14-21	9-13
2-3 upshift	21-29	13-18
3-4 upshift	33-40	20-25

4-5 upshift	49-55	30-35
5-6 upshift	65-70	40-44
3-1 downshift	7-17	4-11
4-3 downshift	26-36	16-24
5-4 downshift	38-46	24-29
6-5 downshift	56-63	35-39

SHIFT SPEED MANUAL L POSITION 3.5L ENGINE (MINIMUM THROTTLE)

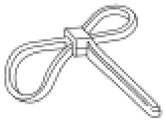
Manual L	km/h	mph
1-2 upshift	45-55	28-34
2-3 upshift	90-100	55-62
3-4 upshift	130-138	81-86
4-5 upshift	190-198	118-123
2-1 downshift	15-23	9-14
3-2 downshift	66-75	41-47
4-3 downshift	98-110	61-68
5-4 downshift	163-175	101-109

5. If the transaxle fails to upshift/downshift or the Torque Converter Clutch (TCC) does not apply and release, refer to **Diagnosis By Symptom** for possible causes.

TORQUE CONVERTER DIAGNOSIS

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent	

 ST1438-A	scan tool	

Prior to torque converter installation, all diagnostic procedures must be followed. This is to prevent the unnecessary installation of new or remanufactured torque converters. Only after a complete diagnostic evaluation can the decision be made to install a new or remanufactured torque converter.

Begin with the normal diagnostic procedures as follows:

1. Preliminary Inspection
2. Know and Understand the Customer's Concern
3. Verify the Concern - carry out the torque converter operation test
4. Carry out Diagnostic Procedures:
    - Run On-Board Diagnostics. Refer to **Diagnostics**.
        - Repair all non-transaxle related DTCs first.
        - Repair all transaxle DTCs.
        - Rerun On-Board Diagnostic to verify repair.
        - Carry out Line Pressure Test. Refer to **Special Testing Procedures**.
        - Carry out Stall Speed Test. Refer to **Special Testing Procedures**.
        - Carry out diagnostic routines. Refer to **Diagnosis By Symptom**.
        - Use the index to locate the appropriate routine that best describes the symptom(s). The routine will list all possible components that may cause or contribute to the symptom. Check each component listed, diagnose and repair as required, before repairing the torque converter.

Torque Converter Operation Test

NOTE: The Torque Converter Clutch (TCC) will not engage if the Transmission Fluid Temperature (TFT) is below 0°C (32°F).

1. Using the scan tool, make sure that the TFT is within specification 43°C-47°C (109°F-117°F).
2. Accelerate the vehicle to 35-60 km/h (22-37 mph) and maintain a consistent speed.
3. Release the accelerator pedal to close the throttle and press the accelerator to partially open the throttle while monitoring the scan tool engine speed and TCCAMP_MES. The PID will read 0 when the Torque Converter Clutch (TCC) is released, and 1 when the TCC is applied. The engine speed will increase when the TCC is released and decrease when the TCC is applied.
4. If these actions do not occur, see torque converter operation concerns, refer to **Diagnosis By Symptom**.

VISUAL INSPECTION

This inspection will identify modifications or additions to the vehicle operating system that may affect

diagnosis. Inspect the vehicle for non-Ford factory add-on devices such as:

- Electronic add-on items:
    - A/C
    - Generator (alternator)
    - Engine turbo
    - Cellular telephone
    - Cruise control
    - CB radio
    - Linear amplifiers
    - Backup alarm signal
    - Computer
- Vehicle modification:
    - These items, if not installed correctly, will affect the PCM or transmission function. Pay particular attention to add-on wiring splices in the PCM harness or transmission wiring harness, abnormal tire size or axle ratio changes.
    - Leaks. Refer to **Leakage Inspection**.
    - Correct selector lever linkage adjustments. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.

Selector Lever Linkage Check

Hydraulic leakage at the manual control valve can cause delay in engagements and/or slipping while operating if the selector lever linkage is not correctly adjusted. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article for selector lever linkage adjustment.

Check TSBs

Refer to all TSBs which pertain to the concern and follow the procedure.

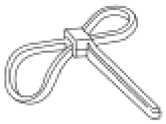
Carry Out On-Board Diagnostics Key ON Engine OFF (KOEO), Key ON Engine Running (KOER)

After a road test, with the vehicle warm and before disconnecting any connectors, carry out the Self Test using the scan tool. Refer to the **Introduction - Gasoline Engines** article for diagnosis and testing of the powertrain control system.

DIAGNOSTICS

Special Tools

Illustration	Tool Name	Tool Number
	73 III Automotive Meter	105-R0057 or equivalent

 ST1185-A		
 ST1438-A	Vehicle Communication Module and Integrated Diagnostic System software with appropriate hardware, or equivalent scan tool	

Self Diagnosis Function

The Transmission Control Module (TCM) monitors the communication status of each sensor, electronic component and the PCM. If any malfunction should occur, the TCM function warns the driver and stores the malfunction as a diagnosis code.

Fail-Safe

With the fail-safe function, if any malfunction should occur in the transaxle system, the TCM will output a control signal, and control will be carried out to make traveling a minimum distance possible. If all shift solenoids malfunction, the TCM will cancel the output of control signals to the solenoids. If this happens, the automatic transmission gear shifting will be controlled by transmission fluid pressure circuits only and the gears will shift as shown in the following table.

Selector Lever Position	Gear Position
R	Reverse
D	3rd or 5th gear

On-Board Diagnostic With Scan Tool

NOTE: **For detailed instruction and other diagnostic methods using the scan tool or equivalent, refer to the scan tool tester article and the Introduction - Gasoline Engines article.**

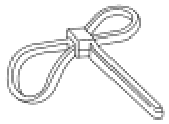
These Self Tests should be used to diagnose the PCM and should be carried out in order.

- Self Test - Key ON Engine OFF (KOEO)
- Self Test - Continuous Memory Codes
- Self Test - Key ON Engine Running (KOER)
- Special Test Modes
  - Wiggle Test Mode
  - Output Test Mode
- PCM Reset Mode

- Clearing DTCs P1000
- On-Board Diagnostic (OBD) II Drive Cycle
- Other scan tool features

DIAGNOSTIC PARAMETERS IDENTIFICATION (PID) CHART

Special Tools

Illustration	Tool Name	Tool Number
 ST1438-A	Vehicle Communication Module and Integrated Diagnostic System software with appropriate hardware, or equivalent scan tool	

PID Name	Description	Units
TORQUE	Net engine torque	Torque (lb-ft)
TCC_AMP	Torque converter clutch pressure control	Current (amps)
SSE_AMP	Shift Solenoid Pressure Control E (SSPCE)	Current (amps)
TCCPC	Converter pressure control	Pressure (psi)
SSPCE	SSPCE	Pressure (psi)
SSPCE_F	SSPCE status	• 00 is not fault detected • 01 is short circuit to ground • 02 is open circuit load • 04 is short circuit to battery power • 80 is general (non-specific) fault
GEAR_OSC	Gear commanded by output state control	• 0 = commanded gear is not controlled by OSC • 2 = 1st gear is commanded by OSC • 4 = 2nd gear is commanded by OSC • 12 = 6th gear is commanded by OSC
TCC_OSC	Output state control of torque converter	• 00 Torque Converter Clutch (TCC) not controlled by OSC • 01 TCC is disengaged by OSC • 02 TCC is engaged by OSC
		• 00 is not fault detected

SSPCD_F	Shift Solenoid Pressure Control D (SSPCD) status	• 01 is short circuit to ground • 02 is open circuit load • 04 is short to battery power • 80 is general (non specific) fault
TSS_SRC	Turbine Shaft Speed (TSS)	rpm
OSS_SRC	Output Shaft Speed (OSS)	rpm
PCA_F	Pressure Control Solenoid A (PCA)	INT
SSPCD	SSPCD	Pressure (psi)
PCA	PCA	Pressure (psi)
SSD_AMP	Shift Solenoid D (SSD)	Current (amps)
PCA_AMP	PCA	Current (amps)
TP_REL	Relative throttle position	Percentage
DTCTCM	Continuous codes	Number of DTCs
TCCSLPDSD	TCC slip desired	rpm
SHFTCTRL	Shift control	• 00 Economy mode • 01 Sport mode • 02 Up slope 1 mode • 03 Up slope 2 mode • 04 Down slope mode • 05 Hot 1 (over temperature 1) mode • 06 Hot 2 (over temperature 2) mode • 07 Cruise mode • 08 Traction mode • 09 l Position mode • 0A Tiptronic mode • 0B Coast shift • Flexible Fuel (FF) Invalid data
SSPCF_F	Shift Solenoid Pressure Control F (SSPCF) status	• 00 is not fault detected • 01 is short to ground • 02 is open circuit load • 04 is short circuit to battery power • 80 is general (non-specific) fault
SSFAMP_MES	Measured current Shift Solenoid F (SSF)	Current (amps)
SSFAMP_CMD	Commanded current SSF	Current (amps)

SSPCF_CMD	Commanded pressure SSPCF	Pressure (psi)
SSEAMP_MES	Measured current Shift Solenoid E (SSE)	Current (amps)
SSDAMP_MES	Measured current SSD	Current (amps)
SSCAMP_MES	Measured current Shift Solenoid C (SSC)	Current (amps)
TCCAMP_MES	Measured current for the TCC pressure control	Current (amps)
PCAAMP_MES	Measured current for PCA	Current (amps)
SSPCC_F	Shift Solenoid Pressure Control C (SSPCC) status	• 00 is not fault detected • 01 is short to ground • 02 is open circuit load • 04 is short circuit to battery power • 80 is general (non-specific) fault
SSPCC	SSPCC	Pressure (psi)
SSC_AMP	SSPCC current	Current (amps)
SSB_F	Shift solenoid 2 status	• 00 is not fault detected • 01 is short to ground • 02 is open circuit load • 04 is short circuit to battery power • 40 is stack failure • 80 is general (non-specific) fault
SSA_F	Shift solenoid 1 status	• 00 is not fault detected • 01 is short to ground • 02 is open circuit load • 04 is short circuit to battery power • 80 is general (non-specific) fault
TFT	Transmission Fluid Temperature (TFT)	Temperature (°C, °F)
TRAN_RAT	Transmission gear ratio	Ratio
TCC_F	TCC fault	• 00 is not fault detected • 01 is short to ground • 02 is open circuit load • 04 is short circuit to battery power • 80 is general (non-specific) fault

VSS	Vehicle Speed Sensor (VSS)	Speed (mph)
TFT	TFT	Voltage
TCC_RAT	Transmission slip ratio	Ratio
TC_SLIPACT	Torque converter slip actual TCCMACT	rpm
TR	Transmission Range (TR)	• P = 7 • R = 6 • N = 5 • D = 4 • L = 1
OSS	OSS	rpm
TSS	TSS	rpm
Gear	Gear commanded by module	Gear (1-6)
VPWRTCM	Module supply voltage VBAT	Voltage
RPMTCM	Engine revolutions per minute	rpm
TR_V	TR	Voltage

TRANSAXLE DRIVE CYCLE TEST

NOTE: Prior to carrying out the Transaxle Drive Cycle Test, make sure that the transaxle is full of transmission fluid or damage to the transaxle may occur.

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

After carrying out the Self Test, use the following Transaxle Drive Cycle Test for checking continuous codes:

NOTE: The Transaxle Drive Cycle Test must be followed exactly. Malfunctions must occur multiple times consecutively for shift error or Torque Converter Clutch (TCC) code to set.

NOTE: When carrying out the Transaxle Drive Cycle Test, see the solenoid operation chart for correct solenoid operation. Refer to <u>Pinpoint Tests - Non OSC Equipped Vehicle</u>.

1. Record and then erase Self Test codes.
2. Warm engine to normal operating temperature.
3. Make sure transmission fluid level is correct.
4. With the selector lever in DRIVE, moderately accelerate from stop to 80 km/h (50 mph). This allows the transaxle to shift into 6th gear. Hold speed and throttle steady for minimum of 15 seconds. Brake to a stop

and remain stopped for minimum of 20 seconds.

5. Repeat Step 4 at least 5 times.
6. Carry out Self Test and record continuous codes.
   - If DTCs are present, refer to **Diagnostic Trouble Code (DTC) Charts**. Service all non-transaxle DTCs first as they can directly affect the operation of the transaxle. Repeat the Self Test and Road Test to verify the correction. Erase DTCs, carry out the Transaxle Drive Cycle Test, and repeat the Self Test after completing service on the DTCs.
   - If the continuous test passes (system pass) and a concern is still present, refer to **Diagnosis By Symptom** and check TSBs for diagnostic concern.

After On-Board Diagnostics

NOTE: The vehicle wiring harness, PCM and non-transaxle sensors may affect transaxle operations. Service these concerns first.

After the On-Board Diagnostic procedures are completed, service all DTCs.

Begin with non-transaxle related DTCs, then service any transaxle related DTCs. Refer to the **Diagnostic Trouble Code (DTC) Charts** for information on Condition and Symptoms. This chart will be helpful in referring to the correct article(s) and to aid in diagnosing internal transaxle concerns and external non-transaxle inputs. The pinpoint tests are used in diagnosing electrical concerns of the transaxle. Make sure that the vehicle wiring harness and the PCM are diagnosed as well. Refer to the **Introduction - Gasoline Engines** article for diagnosing non-transaxle electronic components. The diagnostic routine hydraulic/mechanical charts will help in diagnosing internal transaxle concerns and external non-transaxle inputs.

Before Pinpoint Tests

NOTE: Prior to entering pinpoint tests, check the PCM wiring harness for correct connections, bent or broken pins, corrosion, loose wires, correct routing, correct seals and their condition. Check the PCM, sensors and actuators for damage. Refer to the Introduction - Gasoline Engines article.

NOTE: If a concern still exists after electrical diagnosis has been carried out, refer to Diagnosis By Symptom.

If DTCs appear while carrying out the on-board diagnostics, refer to the **Diagnostic Trouble Code (DTC) Charts** for the appropriate repair procedure. Prior to entering pinpoint tests, refer to any TSBs for transaxle concerns.

DIAGNOSTIC TROUBLE CODE (DTC) CHARTS

DIAGNOSTIC TROUBLE CODE (DTC) CHART

Five Digit DTC	Component	Description	Condition	Symptom	Action

P0562	Battery	System voltage low.	PCM detected a voltage level below 9 volts.	No engagements, no adaptive or self-learning strategy.	CHECK charging system, REFER to **BATTERY, MOUNTING AND CABLES** article.
P0563	Battery	System voltage high.	PCM detected a voltage level above 18 volts.	No adaptive or self-learning strategy.	CHECK charging system, REFER to **BATTERY, MOUNTING AND CABLES** article.
P0601	Transmission Control Module (TCM)	TCM Read-Only Memory (ROM) error.	TCM detected an internal software concern with ROM.	No engagements, no adaptive or self-learning strategy.	INSTALL a new TCM.
P0603	TCM	TCM Keep Alive Memory (KAM) error.	TCM detected an internal software concern with KAM.	No engagements, no adaptive or self-learning strategy.	INSTALL a new TCM.
P0604	TCM	TCM Random Access Memory (RAM) error.	TCM detected an internal software concern with RAM.	No engagements, no adaptive or self-learning strategy.	INSTALL a new TCM.
P0706	Transmission Range (TR)	TR sensor range or performance error.	TR sensor signal is out of normal range.	TR sensor indicates a stuck position (D-3rd gear), no adaptive or self learning strategy.	INSTALL a new TCM.
P0707	TR Sensor	TR sensor circuit low input.	TR sensor signal is below threshold of 0.127 volt, sensor/circuit electrical malfunction.	TR sensor indicates a stuck position (D-3rd gear), no adaptive or self learning strategy.	INSTALL a new TCM.
P0708	TR Sensor	TR sensor circuit high input.	TR sensor signal is above threshold of 4.87 volts, sensor/circuit electrical malfunction.	TR sensor indicates a stuck position (D-3rd gear), no adaptive or self learning strategy.	INSTALL a new TCM.
P0711	Transmission Fluid Temperature (TFT) Sensor	No change in TFT during operation.	PCM has detected no TFT change during operation. TFT value stuck at some normal reading.	TFT indicates 80°C (176°F) at all times, no self learning strategy, no Torque Converter Clutch (TCC) engagement.	Go to **Pinpoint Test B**.

P0712	TFT Sensor	200°C (329°F) indicated, TFT sensor circuit grounded.	Voltage drop across TFT sensor exceeds scale set for temperature -43°C (-45°F).	TFT indicates 80°C (176°F) at all times, no self learning strategy, no TCC engagement.	Go to **Pinpoint Test B**.
P0713	TFT Sensor	-43°C (-45°F) indicated, TFT sensor circuit grounded.	Voltage drop across TFT sensor exceeds scale set for temperature -43°C (-45°F).	TFT indicates 80°C (176°F) at all times, no self learning strategy, no TCC engagement.	Go to **Pinpoint Test B**.
P0716	Turbine Shaft Speed (TSS) Sensor	TSS range out of performance, insufficient input from TSS.	PCM has detected a loss or noisy TSS signal during operation.	No TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test D**.
P0717	TSS Sensor	No TSS signal.	PCM has not detected a TSS signal. No TSS signal when Output Shaft Speed (OSS) signal present.	No TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test D**.
P0721	OSS Sensor	OSS range out of performance, insufficient input from OSS.	PCM has detected a loss or noisy OSS signal during operation.	No adaptive or self learning strategy.	Go to **Pinpoint Test C**.
P0722	OSS Sensor	No OSS signal.	PCM has detected no OSS signal.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test C**.
P0729	Transaxle	6th gear ratio.	No 6th gear ratio detected by TCM.	No 6th gear, no TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0730	Clutch Control Solenoids or Internal Parts	Gear ratio error.	PCM has detected a gear ratio error.	No self learning strategy.	Go to **Pinpoint Test A**.
P0731	Solenoid or Internal Parts	1st gear ratio.	No 1st gear ratio detected by TCM.	No 1st gear, no TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0732	Solenoid or Internal Parts	2nd gear ratio.	No 2nd gear ratio detected by	No 2nd gear, no TCC engagements,	Go to **Pinpoint Test A**.

			TCM.	no adaptive or self learning strategy.	
P0733	Solenoid or Internal Parts	3rd gear ratio.	No 3rd gear ratio detected by TCM.	No 3rd gear, no TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0734	Solenoid or Internal Parts	4th gear ratio.	No 4th gear ratio detected by TCM.	No 4th gear, no TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0735	Solenoid or Internal Parts	5th gear ratio.	No 5th gear ratio detected by TCM.	No 5th gear, no TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0736	Transaxle	Reverse gear ratio.	No reverse gear ratio detected by TCM.	No reverse gear, no self learning strategy.	Go to **Pinpoint Test A**.
P0780	Solenoid or Valve Internal to Transaxle	Universal shifting (stuck valve).	Valve stuck.	Increase rpm during shifts. Slipping or erratic shifting.	Go to **Main Control Valve Body**.
P0817	TCM/PCM Starter Circuit	Starter disable circuit open or shorted to power/ground.	TCM detected a failure in the starter lock circuit, failed ON or OFF Ignition switch is ON, TCM and PCM communication is normal. No voltage is detected on the start lock circuit for more than 0.1 second or a continuous 12-volt output is detected for more than 0.1 second. Conditions present 2 times to set DTC.	DTC is set. Warning lamp is illuminated.	Go to **Pinpoint Test E**.
P0961	Pressure Control Solenoid A (PCA)	PCA circuit or solenoid failure.	PCA circuit or solenoid (SLT) failed during operation.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.

			Incorrect commanded current detected by TCM.		
P0962	PCA	PCA solenoid signal or grounded circuits either short or open, solenoid circuit failure.	Voltage through PCA (SLT) is checked. An error will be noted if tolerance is exceeded.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0963	PCA	PCA solenoid short to power circuit failure.	Voltage through PCA (SLT) is checked. An error will be noted if tolerance is exceeded.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0973	Shift Solenoid A (SSA)	SSA solenoid or circuit shorted to ground.	Voltage through SSA (S1) circuit is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0974	SSA	SSA or circuit shorted to power or open.	Voltage through SSA (S1) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0976	Shift Solenoid B (SSB)	SSB solenoid or circuit shorted to ground.	Voltage through SSB (S2) circuit is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0977	SSB	SSB solenoid or	Voltage through	No engagements, no	Go to **Pinpoint Test A**.

		circuit shorted to power or open.	SSB solenoid (S2) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	adaptive or self learning strategy.	
P0978	Shift Solenoid C (SSC)	SSC circuit or solenoid failure.	SSC circuit or solenoid (SLC1) failed during operation. Incorrect commanded current detected by TCM.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0979	SSC	SSC solenoid signal or grounded circuits either shorted or open, solenoid circuit failure.	Voltage through SSC (SLC1) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0980	SSC	SSC solenoid or circuit shorted to power.	Voltage through SSC (SLC1) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0981	Shift Solenoid D (SSD)	SSD circuit or solenoid failure.	SSD circuit or solenoid (SLC2) failed during operation. Incorrect commanded current detected	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.

			by TCM.		
P0982	SSD	SSD signal or grounded circuits either shorted or open, solenoid circuit failure.	Voltage through SSD (SLC2) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0983	SSD	SSD or circuit shorted to power.	Voltage through SSD (SLC2) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0984	Shift Solenoid E (SSE)	SSE circuit or solenoid failure.	SSE circuit or solenoid (SLC3) failed during operation. Incorrect commanded current detected by TCM.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0985	SSE	SSE signal or grounded circuits either shorted or open, solenoid circuit failure.	Voltage through SSE (SLC3) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0986	SSE	SSE or circuit shorted to power.	Voltage through SSE (SLC3) circuit is checked. An error will be	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.

			noted if tolerance is exceeded. Short to power failure or open circuit detected.		
P0997	Shift Solenoid F (SSF)	SSF circuit or solenoid failure.	SSF circuit or solenoid (SLB1) failed during operation. Incorrect commanded current detected by TCM.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0998	SSF	SSF signal or grounded circuits either shorted or open, solenoid circuit failure.	Voltage through SSF (SLB1) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P0999	SSF	SSF or circuit shorted to power.	Voltage through SSF (SLB1) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P1573	Accelerator Pedal Position (APP) Sensor	APP sensor input error.	PCM has detected an input error from the APP sensor.	No adaptive or self learning strategy.	**NOTE:** **If this DTC is displayed, a malfunction occurred in the vehicle not the TCM. Do not install a new TCM.** REFER to the **Introduction - Gasoline Engines** article.
P1657	TCM	TCM	Controller Area	No engagements, no	INSTALL a new TCM.

		communication link error.	Network (CAN) link error detected by PCM.	adaptive or self learning strategy. Limited fuel and spark.	
P1700	Transaxle	Drive engagement error.	TCM detected neutral in the DRIVE position.	No engagements, no adaptive or self learning strategy.	REFER to **Diagnosis By Symptom**.
P1701	Transaxle	Reverse engagement error.	TCM detected neutral in the REVERSE position.	No self learning strategy.	REFER to **Diagnosis By Symptom**.
P1719	PCM	Engine torque signal.	Torque engine accuracy from PCM inaccurate.	Firm shifts and no adaptive learning.	PERFORM self-test of PCM. REFER to the **Introduction - Gasoline Engines** article to diagnose any DTCs present. If no DTCs, IDENTIFY the driveability symptom present and REFER to the **Introduction - Gasoline Engines** article for further diagnosis.
P1919	Engine Coolant Temperature (ECT)	Sensor signal error.	PCM/TCM have detected an error in the CAN ECT information.	No TCC engagements, ECT set to 80°C (176°F).	**NOTE:** **If this DTC is displayed, a malfunction occurred in the vehicle not, the TCM. Do not install a new TCM.** REFER to the **Introduction - Gasoline Engines** article.
P1920	Engine rpm	Engine rpm sensor signal error.	PCM/TCM have detected an error in the engine rpm information.	No adaptive or self learning strategy. Limited fuel and spark.	**NOTE:** **If this DTC is displayed, a malfunction occurred in the vehicle not the TCM. Do not install a new TCM.** REFER to the **Introduction - Gasoline Engines** article.
P2544	PCM	Torque management request input signal A.	Data received from the PCM or engine components are	Transmission may enable limp-home strategies or increase pressures.	**NOTE:** **If this DTC is displayed, a malfunction occurred in the vehicle not the**

			not correct for the vehicle operating conditions. Incorrect engine torque calculation may result.	Engine components and PCM may or may not set additional DTCs. P2544, fuel monitor error, ECT sensor failure and Mass Air Flow (MAF) sensor failures may be present. Malfunction Indicator Lamp (MIL) may illuminate.	**TCM. Do not install a new TCM.** REFER to the **Introduction - Gasoline Engines** article.
P2757	TCC Solenoid	TCC solenoid circuit failure, stuck OFF.	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit open, shorted or PCM driver failure during on-board diagnostic.	No TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P2758	TCC Solenoid	TCC solenoid circuit failure, stuck ON.	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit open, shorted or PCM driver failure during on-board diagnostics.	No TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P2762	TCC Solenoid	TCC circuit or solenoid failure.	TCC circuit or solenoid failed during operation. Incorrect commanded current detected by TCM.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
P2763	TCC Solenoid	TCC circuit shorted to power.	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit	No TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.

			shorted to power.		
P2764	TCC Solenoid	TCC solenoid signal or grounded circuits either short or open solenoid circuit failure.	TCC solenoid circuit fails to provide voltage drop across solenoid.	No TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A**.
U0073	TCM CAN	TCM communication link error.	CAN link error detected by PCM.	No engagements, no adaptive or self learning strategy.	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0100	TCM CAN	TCM communication link error.	CAN link error detected by PCM.	No engagements, no adaptive or self learning strategy.	**NOTE:** **If this DTC is displayed, a malfunction occurred in the vehicle not the TCM. Do not install a new TCM.** **A module cannot communicate with other modules on the communication network while being reprogrammed. CLEAR any network communication DTCs which may have been set in other modules during reprogramming.** CHECK CAN harness between TCM and other modules. For diagnostic information, REFER to the **Introduction - Gasoline Engines** article and REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0101	TCM/PCM	TCM Communication error.	PCM lost communication with the TCM.	• Engine driveability concerns. • Will turn on MIL and driver warning	**NOTE:** **A module cannot communicate with other modules on the communication network while being reprogrammed. CLEAR any network**

				lamp.	**communication DTCs which may have been set in other modules during reprogramming.** CHECK CAN harness between TCM and other modules. For diagnostic information, REFER to the **Introduction - Gasoline Engines** article and REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0121	ABS	TCM communication link error.	PCM/TCM have detected an error in the CAN wheel rpm information from the ABS system.	No engagements, no adaptive or self learning strategy.	**NOTE:** **If this DTC is displayed, a malfunction occurred in the vehicle not the TCM. Do not install a new TCM.** REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0401	PCM/TCM	Invalid data received from the PCM or engine components.	Data received from the PCM or engine components is not correct for the vehicle operating conditions.	Transmission may enable limp-home strategies or increase pressures. Engine components and PCM may or may not set additional DTCs. P2544, fuel monitor error, ETC sensor failure and MAF sensor failures may be present. MIL may illuminate.	**NOTE:** **If this DTC is displayed, a malfunction occurred in the vehicle not the TCM. Do not install a new TCM.** REFER to the **Introduction - Gasoline Engines** article.
U0415	Wheel Speed Sensor	TCM communication link error.	PCM/TCM have detected an error in the CAN wheel rpm information from the ABS system.	No adaptive or self learning strategy.	**NOTE:** **If this DTC is displayed, a malfunction occurred in the vehicle not the TCM. Do not install a new TCM.** REFER to the **Introduction - Gasoline**

					Engines article.

TRANSAXLE CONNECTOR LAYOUTS

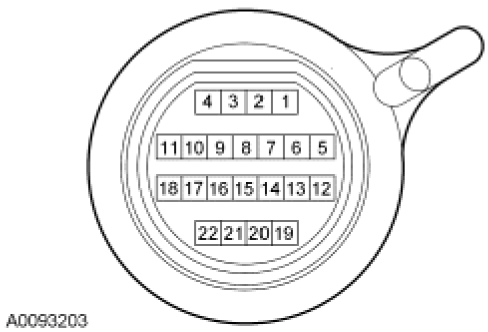


Fig. 12: Transaxle Bulkhead Electrical Connector

Pin Number	Circuit	Circuit Function
1	-	Pressure Control Solenoid A (PCA) ground
2	-	Shift Solenoid B (SSB)
3	-	PCA signal
4	-	Torque Converter Clutch (TCC) ground
5	-	Shift Solenoid A (SSA)
6	-	NOT USED
7	-	Transmission Fluid Temperature (TFT) ground
8	-	TFT
9	-	TCC signal
10	-	Shift Solenoid C (SSC) ground
11	-	SSC signal
12	-	Turbine Shaft Speed (TSS) sensor signal
13	-	TSS sensor signal ground
14	-	Shift Solenoid E (SSE) signal
15	-	NOT USED
16	-	Shift Solenoid F (SSF) ground
17	-	Shift Solenoid D (SSD) signal
18	-	SSD ground
19	-	Output Shaft Speed (OSS) sensor signal
20	-	OSS sensor signal ground
21	-	SSF signal
22	-	SSE ground

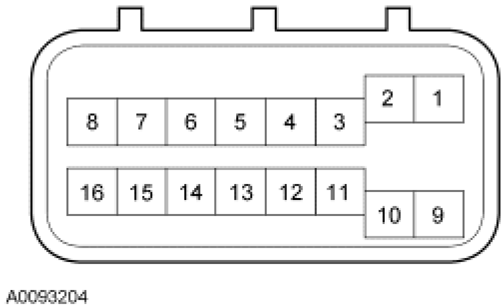


Fig. 13: Transmission Range (TR) Transmission Control Module (TCM) C1533 (A) Vehicle Harness
Courtesy of FORD MOTOR CO.

Pin Number	Circuit	Circuit Function
1	-	Battery feed
2	-	NOT USED
3	-	NOT USED
4	-	NOT USED
5	-	Start lock signal out
6	-	Controller Area Network (CAN) -
7	-	NOT USED
8	-	NOT USED
9	-	Transmission Control Module (TCM) ground
10	-	NOT USED
11	-	Ignition switch signal input
12	-	NOT USED
13	-	NOT USED
14	-	CAN +
15	-	NOT USED
16	-	NOT USED

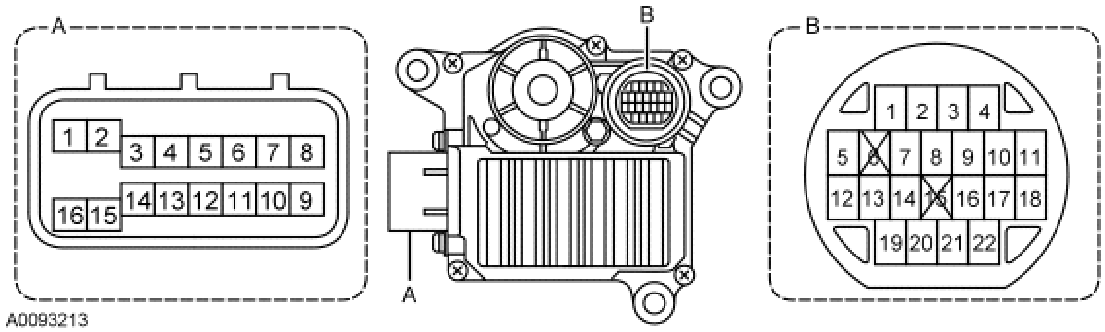


Fig. 14: Transaxle Control Module Terminal Testing
Courtesy of FORD MOTOR CO.

NOTE: For testing, place the positive lead on the terminal with the + sign and place the

negative lead on the terminal with the - sign.

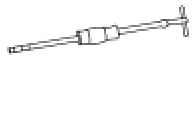
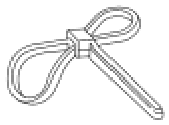
Pin Number	Pin Acronym	Descrip- tion	Input / Output to Trans- mission Control Module (TCM)	Measure pins	Condition For Testing	Reference Value
A1	B+	Battery voltage	-	+A1 to ground	Hot at all times	10-14 volts
A5	STLK	Start lock signal output	Output	+A5 to -A9	Ignition ON in PARK Ignition ON in other than PARK	0-0.8 volt 9-14 volts
A6	CAN L	Controller Area Network (CAN) communi- cation low	Input/output	+A6 to -A9	Engine idling	-
A7	LIN	LIN line communi- cation signal	Input	+A7 to -A9	-	-
A8	CAN H	Controller Area Network (CAN) communication high	Input/output	+A8 to -A9	Engine idling	-
A9	GRND	Transmission Control Module (TCM) ground	-	+ground to chassis ground	-	-
A11	IG	Ignition switch signal input	Input	+A11 to -A9	Ignition ON	10-14 volts
A14	K	Diagnostic signal	Input/output	+A14 to -A9	-	-
B1	PCA ground	Pressure Control Solenoid A (PCA) ground (SLTG)	-	-	-	-
B2	SSB	Shift Solenoid B (SSB) (S2)	Output	+B2 to ground	Vehicle in PARK, engine idling	0-1.5 volts
B3	PCA	PCA	Output	+B3 to -B1	Vehicle in PARK, engine idling	-
B4	TCC solenoid ground	Torque Converter Clutch (TCC) solenoid ground (SLUG)	-	-	-	-
B5	SSA	Shift Solenoid A (SSA) (S1)	Output	+B5 to ground	Vehicle in PARK, engine idling	0-1.5 volts

B7	TFT ground	Transmission Fluid Temperature (TFT) sensor ground (OTG)	-	-	-	-
B8	TFT	TFT sensor (OT)	Input	+B8 to -B7	TFT at 10°C to 110°C (50°F to 230°F)	4.0 to 0.0 volts
B9	TCC	TCC solenoid (SLU)	Output	+B9 to -B4	Vehicle in PARK, engine idling	-
B10	SSC ground	Shift Solenoid C (SSC) ground (SLC1G)	-	-	-	-
B11	SSC	SSC (SLC1)	Output	+B11 to -B10	Vehicle in PARK, engine idling	-
B12	ISS	Input shaft speed sensor signal (NIN)	Input	+B12 to -B13	Vehicle in PARK, engine idling	-
B13	ISS ground	Input shaft speed sensor signal (NIN)	-	-	-	-
B14	SSE	Shift Solenoid E (SSE)	Output	+B14 to -B22	Vehicle in PARK, engine idling	-
B16	SSF ground	Shift Solenoid F (SSF) ground (SLB1G)	-	-	-	-
B17	SSD	Shift Solenoid D (SSD) (SLC2)	Output	+B17 to -B18	Vehicle in PARK, engine idling	-
B18	SSD ground	SSD ground (SLC2G)	-	-	-	-
B19	OSS	Output Shaft Speed (OSS) sensor signal (SP+)	Input	+B19 to -B20	Vehicle speed approximately 20 km/h (12 mph)	-
B20	OSS ground	OSS sensor ground (SP-)	-	-	-	-
B21	SSF	SSF (SLB1G)	Output	+B21 to -B16	Vehicle in PARK, engine idling	-
B22	SSE ground	SSE ground (SLC3G)	-	-	-	-

PINPOINT TESTS - NON OSC EQUIPPED VEHICLE

Special Tools

Illustration	Tool Name	Tool Number

 ST1185-A	73 III Automotive Meter	105-R0057 or equivalent
 ST1438-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Anytime an electrical connector or solenoid body is disconnected, inspect the connector for pin condition, corrosion and contamination. Also inspect the connector seal for damage. Clean, repair or install a new connector as required.

Prior to carrying out the pinpoint tests, check the following:

- Transmission fluid level
- Transmission fluid condition (burned, metal particles or discolored)
- Engine cooling system
- Other non-related transmission DTCs

Pinpoint Tests

Refer to **SYSTEM WIRING DIAGRAMS** for schematic and connector information.

PINPOINT TEST A: SHIFT SOLENOIDS

NOTE: Refer to the Transaxle Vehicle Harness Connector illustration Transaxle Connector Layouts.

A1 ELECTRONIC DIAGNOSTICS

- Check to make sure the transaxle harness connector is fully seated, pins are fully engaged in the connector and in good condition before proceeding.
- Key in OFF position.
- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Retrieve DTCs
- **Are there any transmission DTC faults present?**

  YES : For Shift Solenoid A (SSA) and Shift Solenoid B (SSB), go to A2 . For the Pressure Control Solenoid A (PCA), Shift Solenoid C (SSC), Shift Solenoid D (SSD), Shift Solenoid E (SSE), Shift Solenoid F (SSF) and Torque Converter Clutch (TCC), Go to A4 .

  NO : CLEAR all DTCs. ROAD TEST to verify if concern is still present. Concern could be

intermittent. If concern is still present or reappears, go to the appropriate pinpoint test steps: For shift solenoids SSA and SSB, go to A2 . For shift solenoids PCA, SSC, SSD, SSE, SSF and TCC, Go to A4 .

A2 CHECK RESISTANCE OF THE ON/OFF SOLENOID CIRCUIT

- Key in OFF position.
- Remove the Transmission Control Module (TCM).

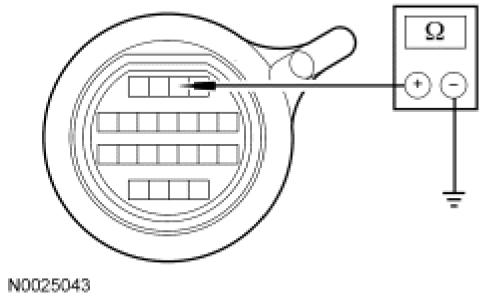


Fig. 15: Checking Resistance Of ON/OFF Solenoid Circuit (SSB)
Courtesy of FORD MOTOR CO.

- Measure the resistance at the transaxle bulkhead electrical connector between pin 2 and ground for SSB.

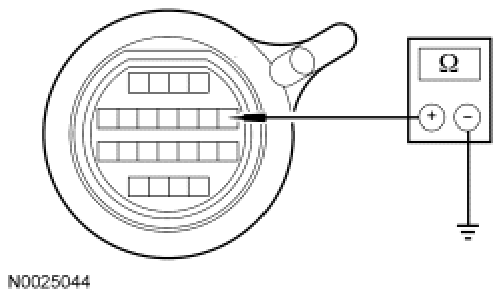


Fig. 16: Checking Resistance Of ON/OFF Solenoid Circuit (SSA)
Courtesy of FORD MOTOR CO.

- Measure the resistance at the transaxle bulkhead electrical connector between pin 5 and ground for SSA.
- **Is the resistance between 11-15 ohms?**

  YES : INSTALL a new TCM and REFLASH to the latest level calibration. CLEAR all DTCs. ROAD TEST to verify concern is not present. Concern could be intermittent. If concern is still present or reappears, go to A3 .

  NO : Go to A3.

A3 CHECK RESISTANCE OF THE ON/OFF SOLENOIDS

- Remove the transaxle side cover.

- Remove the wiring connector from the affected solenoid (SSA or SSB).

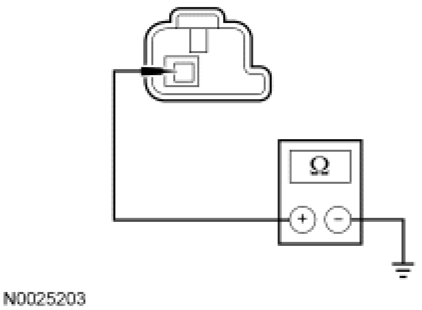


Fig. 17: Checking Resistance Of ON/OFF Solenoids
Courtesy of FORD MOTOR CO.

- Measure the resistance between solenoid pin 1 and ground of the affected solenoid.
- **Is each solenoid resistance between 11-15 ohms?**

  YES : INSTALL a new internal wire harness or REPAIR affected circuit.

  NO : INSTALL a new main control.

A4 CHECK LINEAR SOLENOID SHORT TO GROUND

- Key in OFF position.
- Remove the TCM.

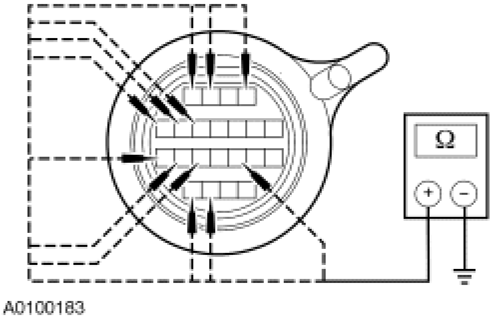


Fig. 18: Measuring Resistance At Transaxle Bulkhead Electrical Connector Between Pins And Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the pins in the following chart:

TRANSAXLE BULKHEAD ELECTRICAL CONNECTOR

Pin Number	Circuit Function
1	Pressure Control Solenoid

	A (PCA) ground
3	PCA signal
4	Torque Converter Clutch (TCC) ground
9	TCC signal
10	Shift Solenoid C (SSC) ground
11	SSC signal
14	Shift Solenoid E (SSE) signal
16	Shift Solenoid F (SSF) ground
17	Shift Solenoid D (SSD) signal
18	SSD ground
21	SSF signal
22	SSE ground

- **Is each resistance greater than 10,000 ohms?**

  YES : Go to A5.

  NO : Go to A6.

A5 CHECK RESISTANCE OF THE LINEAR SOLENOID(S)

- Inspect both sides of the TCM for damaged or pushed-out pins, corrosion or damaged seals.

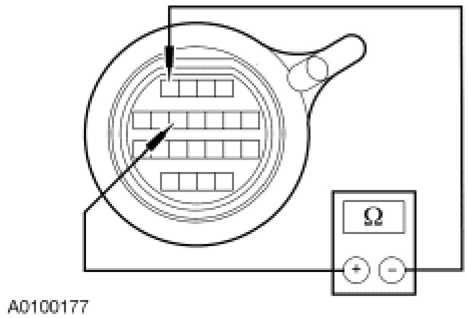


Fig. 19: Checking Resistance Of Linear Solenoid (TCC)
Courtesy of FORD MOTOR CO.

- For the TCC solenoid, measure the resistance between pin 4 and pin 9 at the transaxle.

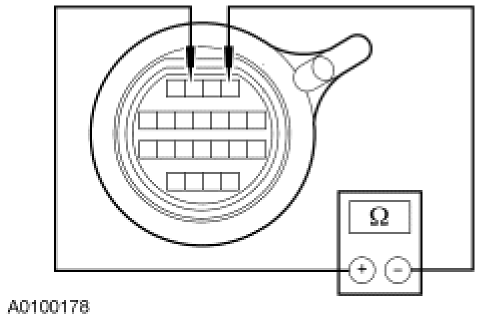


Fig. 20: Checking Resistance Of Linear Solenoid (PCA)
Courtesy of FORD MOTOR CO.

- For the PCA solenoid, measure the resistance between pin 3 and pin 1 at the transaxle.

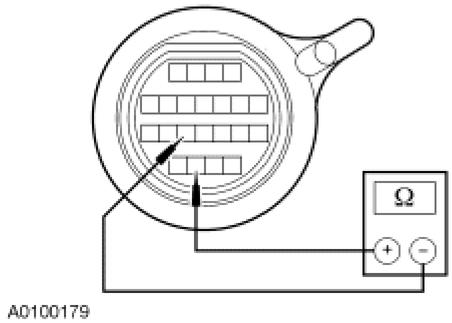


Fig. 21: Checking Resistance Of Linear Solenoid (SSF)
Courtesy of FORD MOTOR CO.

- For the SSF solenoid, measure the resistance between pin 21 and pin 16 at the transaxle.

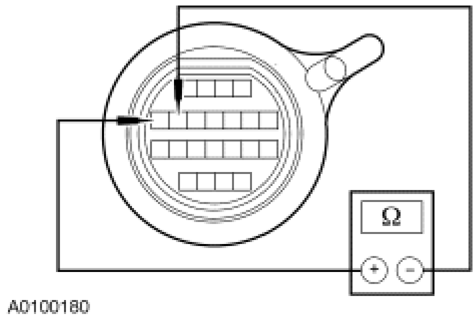


Fig. 22: Checking Resistance Of Linear Solenoid (SSC)
Courtesy of FORD MOTOR CO.

- For the SSC solenoid, measure the resistance between pin 11 and pin 10 at the transaxle.

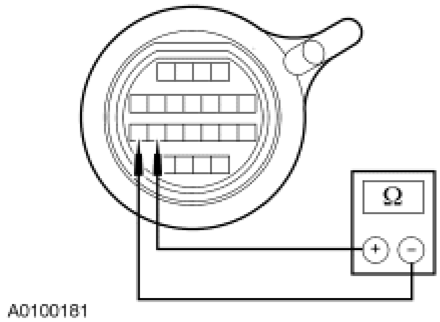


Fig. 23: Checking Resistance Of Linear Solenoid (SSD)
Courtesy of FORD MOTOR CO.

- For the SSD solenoid, measure the resistance between pin 17 and pin 18 at the transaxle.

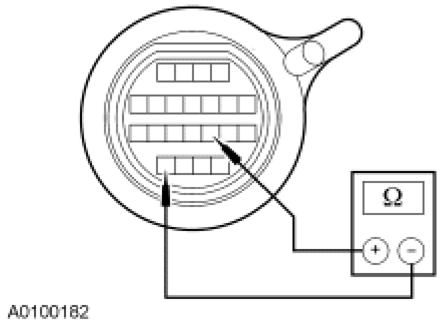


Fig. 24: Checking Resistance Of Linear Solenoid (SSE)
Courtesy of FORD MOTOR CO.

- For the SSE solenoid, measure the resistance between pin 14 and pin 22 at the transaxle.
- **Is the resistance between 5.0 - 5.6 ohms?**

  YES : INSTALL a new TCM and REFLASH to the latest level calibration. CLEAR all DTCs. ROAD TEST to verify concern is not present. Concern could be intermittent. If concern is still

present or reappears, go to A6 .

NO : Go to A6.

A6 CHECK CONTINUITY OF THE INTERNAL HARNESS

- Remove the transaxle side cover.
- Remove the wiring connector from the affected solenoid(s) (PCA, SSC, SSD, SSE, SSF and TCC).
- Measure the resistance between the bulkhead connector and the affected solenoid electrical connector.
- **Is each solenoid resistance less than 5 ohms?**

  YES : INSTALL a new main control.

  NO : INSTALL a new internal wire harness or repair affected circuit.

PINPOINT TEST B: Transmission Fluid Temperature (TFT) SENSOR

B1 ELECTRONIC DIAGNOSTICS

- Connect the diagnostic tool.
- Check to make sure the transaxle harness connector is fully seated, pins are fully engaged in connector and in good condition before proceeding.
- Key in ON position.
- Select Diagnostic Data Link.
- Select Transmission Control Module (TCM).
- Select PID/TFT.
- Enter the following diagnostic mode on the diagnostic tool: PIDs; TFT
- **Does the vehicle enter PID/TFT?**

  YES : Go to B2.

  NO : REPEAT procedure to enter PID. If vehicle did not enter PID, REFER to the **Introduction - Gasoline Engines** article.

B2 TEMPERATURE SIGNAL CHECK

- Key in ON position.
- Select Diagnostic Data Link.
- Select TCM.
- Select PID/TFT.
- Enter the following diagnostic mode on the diagnostic tool: PIDs; TFT
- Monitor the TFT PID. The temperature value should be within -55°C to 175°C (-65°F to 347°F).
- **Is the Transmission Fluid Temperature (TFT) within specified range?**

  YES : Go to B3.

  NO : Go to B4.

B3 WARM-UP/COOL-DOWN CYCLE

- While monitoring the TFT PIDs, carry out the following test: If transmission is cold, run transmission to warm it up. If transmission is warm, allow transmission to cool down.
- **Do the TFT PIDs increase as the transmission is warmed up, decrease as the transmission is**

cooled and does the TFT stay within the specified range?

YES : INSTALL a new TCM and REFLASH to the latest level calibration. CLEAR all DTCs. ROAD TEST to verify concern is not present. Concern could be intermittent. If concern is still present or reappears, go to B4 .

NO : Go to B4.

B4 SIGNAL RESISTANCE

- Remove the TCM.
- Inspect both sides of the TCM for damaged or pushed-out pins, corrosion or damaged seals.

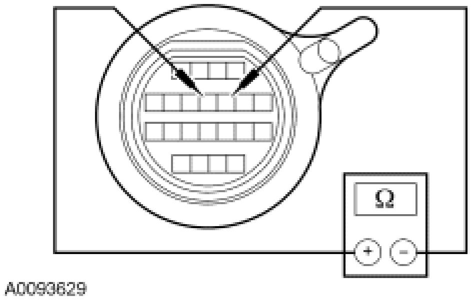


Fig. 25: Checking Signal Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between pins 7 and 8 at the transaxle bulkhead electrical connector. Refer to the following table.

TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR RESISTANCE

°C	°F	Resistance (Ohms)
10	50	6.445
25	77	3.5
110	230	0.247

- Record the resistance.
- **Is the resistance within range?**

YES : Go to B5.

NO : INSTALL a new internal harness and TFT assembly.

B5 SHORT TO GROUND

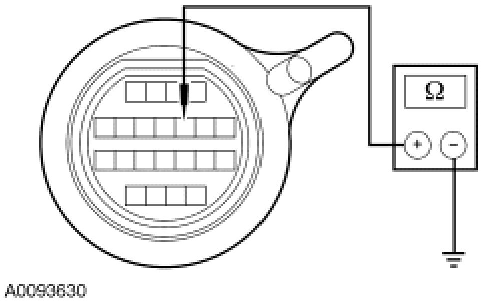


Fig. 26: Measuring Resistance Between Pin 7 & Ground At Transaxle Bulkhead Electrical Connector
Courtesy of FORD MOTOR CO.

- Measure the resistance between pin 7 and ground at the transaxle bulkhead electrical connector.

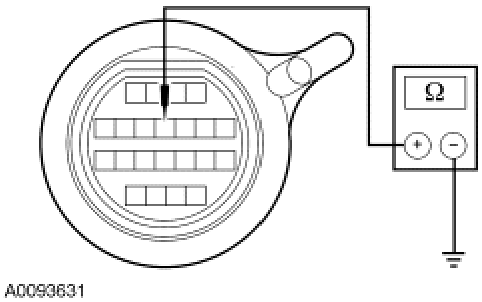


Fig. 27: Measuring Resistance Between Pin 8 & Ground At Transaxle Bulkhead Electrical Connector
Courtesy of FORD MOTOR CO.

- Measure the resistance between pin 8 and ground at the transaxle bulkhead electrical connector.
- Record the resistances.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new TCM and REFLASH to the latest level calibration.

  NO : INSTALL a new internal harness and TFT assembly.

PINPOINT TEST C: Output Shaft Speed (OSS) SENSORS

C1 ELECTRONIC DIAGNOSTICS

- Check to make sure the Transmission Control Module (TCM) connector is fully seated, pins are fully engaged in the connector and in good condition before proceeding.
- Connect the diagnostic tool.
- Key in ON position.
- Monitor the PID for the Output Shaft Speed (OSS) sensor.
- Monitor and record speed.

- **Does the OSS match the vehicle speed?**

  YES : CLEAR all DTCs. ROAD TEST to verify concern is not present. Concern could be intermittent. If concern is still present or reappears, go to C2 .

  NO : Go to C2.

C2 CHECK OSS SENSOR RESISTANCE

- Remove the TCM.

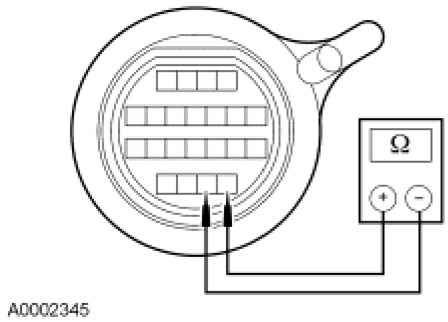


Fig. 28: Checking OSS Sensor Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance at the transaxle bulkhead electrical connector between pin 19 and 20.
- **Is the resistance less than 5 ohms?**

  YES : CLEAR all DTCs. ROAD TEST to verify concern is not present. Concern could be intermittent. If concern is still present or reappears, go to C3 .

  NO : Go to C4.

C3 CHECK OSS SENSOR FOR SHORT TO GROUND

- Remove the TCM.

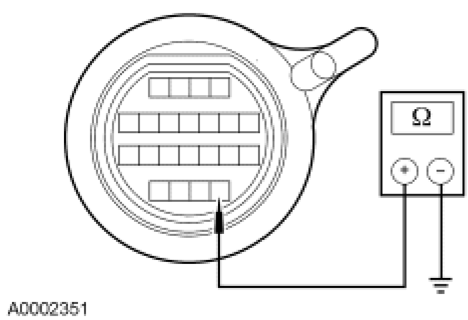


Fig. 29: Measuring Resistance At Transaxle Bulkhead Electrical Connector Between Pin 19 & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance at the transaxle bulkhead electrical connector between pin 19 and ground.

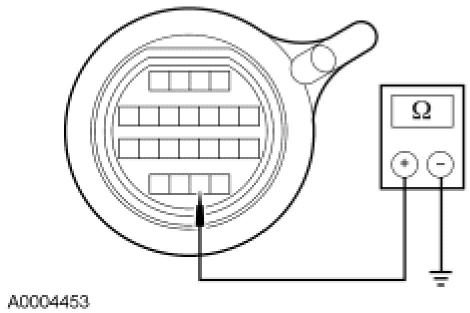


Fig. 30: Measuring Resistance At Transaxle Bulkhead Electrical Connector Between Pin 20 & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance at the transaxle bulkhead electrical connector between pin 20 and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new TCM and REFLASH to the latest level calibration. CLEAR all DTCs. ROAD TEST to verify concern is not present. Concern could be intermittent. If concern is still present or reappears, go to C4 .

  NO : Go to C4.

C4 CHECK OSS SENSOR RESISTANCE

- Remove the transaxle side cover.

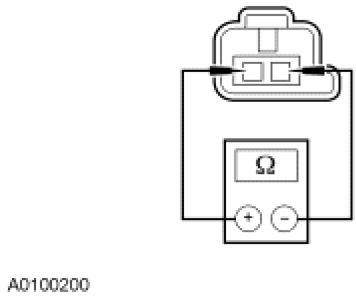


Fig. 31: Checking OSS Sensor Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance at the speed sensor electrical connector between pin 1 and 2.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new internal harness.

  NO : INSTALL a new transaxle assembly.

PINPOINT TEST D: Turbine Shaft Speed (TSS) SENSOR

D1 ELECTRONIC DIAGNOSTICS

- Check to make sure the Transmission Control Module (TCM) connector is fully seated, pins are fully engaged in connector and in good condition before proceeding.

- Connect the diagnostic tool.
- Key in ON position.
- Monitor the PID for the Turbine Shaft Speed (TSS) sensor.
- Monitor and record speed.
- **Does the TSS match the engine rpm?**

  YES : CLEAR all DTCs. ROAD TEST to verify concern is not present. Concern could be intermittent. If concern is still present or reappears, go to D2 .

  NO : Go to D2.

D2 CHECK TSS SENSOR RESISTANCE

- Remove the TCM.

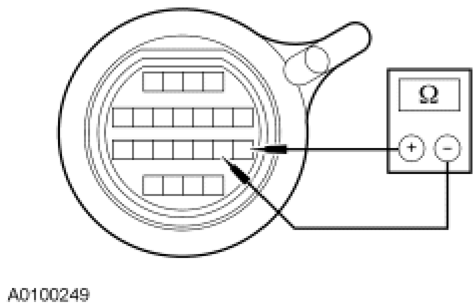


Fig. 32: Checking TSS Sensor Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance at the transaxle bulkhead electrical connector between pin 12 and 13.
- **Is the resistance less than 5 ohms?**

  YES : CLEAR all DTCs. ROAD TEST to verify concern is not present. Concern could be intermittent. If concern is still present or reappears, go to D3 .

  NO : Go to D4.

D3 CHECK TSS SENSOR CIRCUIT FOR SHORT TO GROUND

- Remove the TCM.

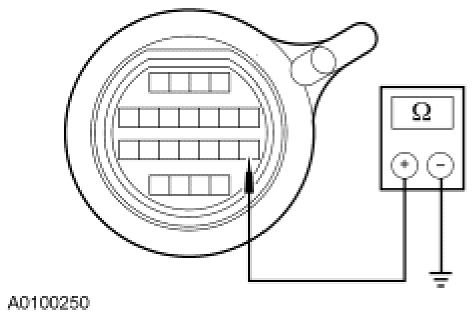


Fig. 33: Measuring Resistance At Transaxle Bulkhead Electrical Connector Between Pin 12 & Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance at the transaxle bulkhead electrical connector between pin 12 and ground.

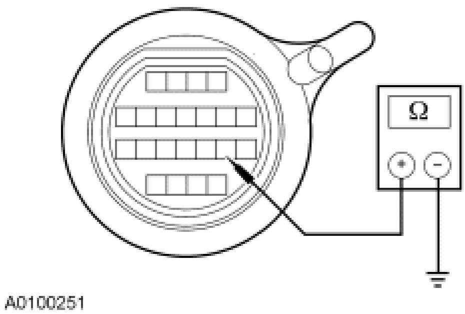


Fig. 34: Measuring Resistance At Transaxle Bulkhead Electrical Connector Between Pin 13 & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance at the transaxle bulkhead electrical connector between pin 13 and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new TCM and REFLASH to the latest level calibration. CLEAR all DTCs. ROAD TEST to verify concern is not present. Concern could be intermittent. If concern is still present or reappears, go to D4 .

  NO : Go to D4.

D4 ELECTRONIC DIAGNOSTICS

- Remove the transaxle side cover.
- Measure the resistance at the TSS sensor electrical connector between pin 1 and 2.
- **Is the resistance less than 5 ohms?**

  YES : CLEAR all DTCs. ROAD TEST to verify concern is not present. Concern could be intermittent. If concern is still present or reappears, INSTALL a new internal harness.

  NO : The sensor is defective, INSTALL a new TSS sensor.

PINPOINT TEST E: PARK NEUTRAL SIGNAL

E1 CHECK FOR VOLTAGE ON CIRCUIT CET40 (GN/OG)

- Disconnect: Transmission Control Module (TCM) C1533
- Key in ON position.
- Selector lever in PARK or NEUTRAL.

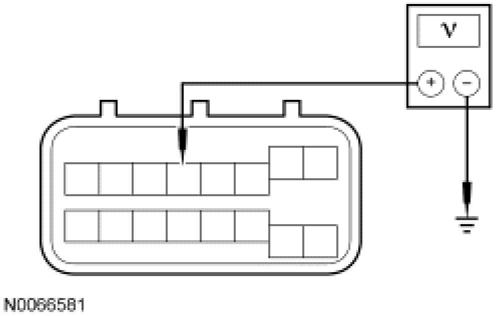


Fig. 35: Checking For Voltage On Circuit CET40 (GN/OG)
Courtesy of FORD MOTOR CO.

- Measure the voltage between C1533-5, circuit CET40 (GN/OG) and chassis ground.
- **Is the voltage between 0-0.8 volt?**

  YES : Go to E2.

  NO : Go to E3.

E2 CHECK FOR VOLTAGE ON CIRCUIT CET40 (GN/OG)

- Selector lever in REVERSE, DRIVE or LOW.

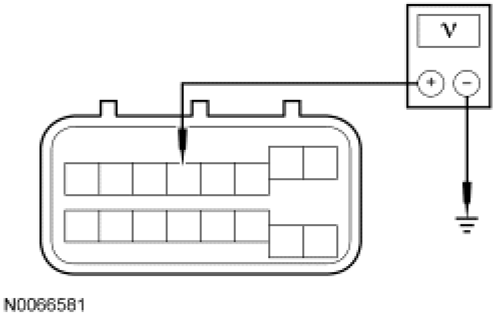


Fig. 36: Checking Voltage On Circuit CET40 (GN/OG)
Courtesy of FORD MOTOR CO.

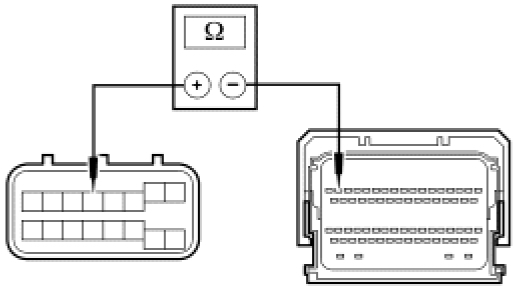
- Measure the voltage between C1533-5, circuit CET40 (GN/OG) and chassis ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new TCM. After installing the new TCM, VERIFY that the starting system is operating correctly. If not, REFER to **ENGINE COOLING** article to check starting system.

  NO : Go to E3.

E3 CHECK VEHICLE HARNESS CIRCUIT CET40 (GN/OG) FOR AN OPEN

- Disconnect: PCM C175B



N0073560

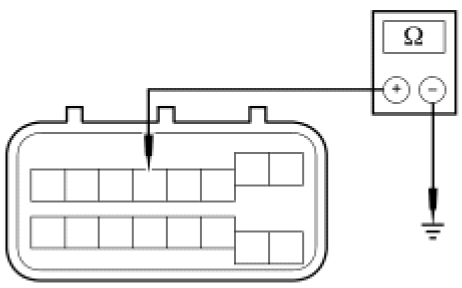
Fig. 37: Measuring Resistance Between C1533-5, Circuit CET40 (GN/OG) & C175B-16
Courtesy of FORD MOTOR CO.

- Measure the resistance between C1533-5, circuit CET40 (GN/OG) and C175B-16.
- **Is the resistance less than 5 ohms?**

  YES : Go to E4.

  NO : REPAIR circuit CET40 (GN/OG) for an open.

E4 CHECK VEHICLE HARNESS CIRCUIT CET40 (GN/OG) FOR A SHORT TO GROUND



N0066583

Fig. 38: Checking Vehicle Harness Circuit CET40 (GN/OG) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between C1533-5, circuit CET40 (GN/OG) and chassis ground.
- **Is the resistance greater than 10,000 ohms?**

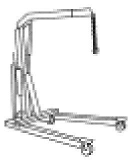
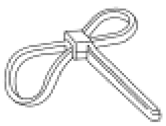
  YES : REPAIR circuit CET40 (GN/OG) for a short to ground.

  NO : INSTALL a new PCM. After installing the new PCM, VERIFY that the starting system is operating correctly. If not, REFER to **ENGINE COOLING** article to check starting system.

SPECIAL TESTING PROCEDURES

Special Tools

Illustration	Tool Name	Tool Number
	73 III Automotive Meter	105-R0057 or equivalent

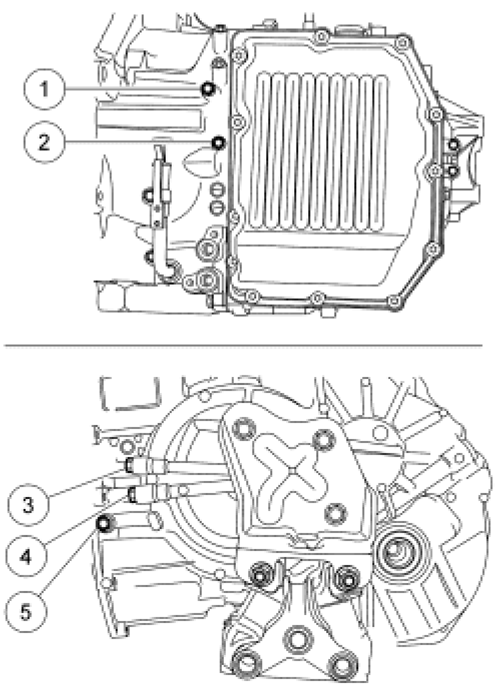
 ST1185-A		
 ST1341-A	Transmission Fluid Pressure Gauge	307-004 (T57L-77820-A)
 ST1438-A	Vehicle Communication Module and Integrated Diagnostic System software with appropriate hardware, or equivalent scan tool	

The special tests are designed to aid the technician in diagnosing the hydraulic and mechanical portions of the transaxle.

Engine Idle Speed Check

Refer to the **Introduction - Gasoline Engines** article for diagnosis and testing of the engine idle speed.

Pressure Test



N0043352

Fig. 39: Pressure Tap Location
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Clutch C1
2	-	Clutch C3
3	-	Clutch C2
4	-	Lube circuit
5	-	Clutch B2

NOTE: If the pressure is low at stall, do not continue with the test or further transaxle damage will occur. Do not maintain Wide Open Throttle (WOT) in any transaxle range for more than 5 seconds.

This test verifies that the pressure is within specification.

1. Connect the Transmission Fluid Pressure Gauge to the appropriate pressure tap.
2. Start the engine and check the pressures, see the pressure charts to determine if the pressures are within specification.

CLUTCH AND BRAKE PRESSURE CHART

Clutch	Range	Pressure
C1	Drive (1st-4th)	196-1,372 kPa (28-199 psi)
C2	Drive (4th-6th)	196-1,372 kPa (28-199 psi)
C3	Drive (3rd-5th)	196-1,372 kPa (28-199 psi)
C3	Reverse	392-1,863 kPa (57-270 psi)
B2	Low manual (1st)	588-1,372 kPa (85-199 psi)
B2	Reverse	392-1,863 kPa (57-

		270 psi)

PRESSURE DIAGNOSTIC CHART

Test Results	Possible Source
Values of both DRIVE and REVERSE ranges are lower than the standards	• Pressure Control Solenoid A (PCA) • Primary regulator valve failure • Transmission oil pump failure • Leak from hydraulic circuit of DRIVE or REVERSE range
Only the value of DRIVE range is lower than the standards	• DRIVE range hydraulic circuit failure • C1 clutch failure
Only the value of REVERSE range is lower than the standards	• REVERSE range hydraulic circuit failure • C3 clutch failure • B2 brake failure

3. If the pressure is not within specification, install a new main control valve body.
4. If the pressures are OK, clear all DTCs. Test drive vehicle, code could be intermittent. If DTC returns, install a new valve body.

Stall Speed Test

WARNING: **Block all wheels, set the parking brake and firmly apply the service brake to reduce the risk of vehicle movement during this procedure. Failure to follow these instructions may result in serious personal injury.**

The Stall Speed Test checks:

- torque converter clutch operation and installation.
- holding ability of the forward clutch.
- reverse clutch (the low-reverse bands).
- planetary one-way clutch.
- engine driveability concerns.

Conduct this test with the engine coolant and transmission fluid at correct levels and at normal operating temperature.

Apply the parking brake firmly for each Stall Speed Test.

1. Find the specified stall rpm for the vehicle, see the Stall Speed Chart. Use a grease pencil to mark the rpm on the dial of a tachometer.

STALL SPEED

Engine	rpm
3.0L (4V)	1,878-2,678
3.5L	1,878-2,678

2. Connect a scan tool.

NOTE: If the rpm recorded by the scan tool exceeds the maximum limits, release the accelerator pedal immediately because clutch or band slippage is indicated.

3. In each of the following ranges REVERSE, DRIVE and LOW, press the accelerator pedal to the floor and hold it just long enough to let the engine get to Wide Open Throttle (WOT). While making this test, do not hold the throttle open for more than 5 seconds at a time.
4. Note the results in each range.
5. After each range, move the selector lever to NEUTRAL and run the engine at 1,000 rpm for about 15 seconds to cool the torque converter before making the next test.
6. Use the stall speed diagnosis chart for corrective actions.

NOTE: The stall speed in REVERSE will be lower.

7. If stall speeds were too high, see the Stall Speed Chart. If stall speeds were too low, first check engine idle speed and tune up. If engine is OK, remove torque converter and check torque converter clutch for slippage.

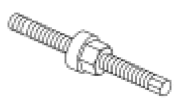
PRESSURE DIAGNOSTIC CHART

Test Results	Possible Source
Values of both DRIVE and REVERSE ranges are lower than the standards	• Insufficient engine power • Torque converter stator one-way clutch slipping
Only the value of DRIVE range is higher than the standards	• Low line pressure. Shift control solenoid assembly (SLT) failure, primary regulator valve failure • Valve body failure (SLC3 hydraulic pressure system) • C1 clutch slipping • One-way clutch F1 failure
Only the value of REVERSE range is higher than the standards	• Low line pressure. Shift control solenoid assembly (SLT) failure, primary regulator valve failure • Valve body failure (SLC3 hydraulic pressure system)

	• C3 clutch failure • B2 brake failure
Values of both DRIVE and REVERSE ranges are higher than the standards	• Low line pressure. Shift control solenoid assembly (SLT) failure, primary regulator valve failure • Primary regulator valve failure • Oil pump failure • Oil strainer clogging

LEAKAGE INSPECTION

Special Tools

Illustration	Tool Name	Tool Number
 ST1287-A	100W/12 Volt DC UV Lamp	164-R0751

Material

Item	Specification
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	-
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A

NOTE: **Do not try to stop the fluid leak by increasing the torque beyond specifications. This may cause damage to the case threads.**

Use the following chart to inspect and correct any external transmission fluid leaks.

EXTERNAL TRANSMISSION FLUID LEAKS

Description	Action
Leaks at the transmission fluid pan to case	Tighten to specification or install a new transmission fluid gasket.
Transmission fluid filler plug leaks	Install a new transmission fluid filler plug.
Transmission fluid cooler or fittings leaking	Tighten to specification or install new transmission fluid cooler tubes. Refer to **TRANSAXLE/TRANSMISSION COOLING** article.
Transmission fluid cooler nut to case fitting leaking	Inspect for damage or missing O-ring seals. Tighten to specification, install new transmission fluid cooler tubes or install new O-rings. Refer to **TRANSAXLE/TRANSMISSION COOLING** article.

Leaks at the transmission fluid cooler	Inspect the transmission fluid cooler for damage, if damaged, install a new transmission fluid cooler. Refer to **TRANSAXLE/TRANSMISSION COOLING** article.
Leaks at the manual control lever seal	Install a new manual control lever seal.
Leaks at the solenoid body harness connector	Install a new solenoid body harness connector O-ring seal, either on the harness end or the solenoid body.

External Sealing

The transaxle has the following parts to prevent external transmission fluid leakage:

- Gaskets
- Lip type seals
- O-ring seals
- Seal rings
- Seal grommets
- Thread sealant

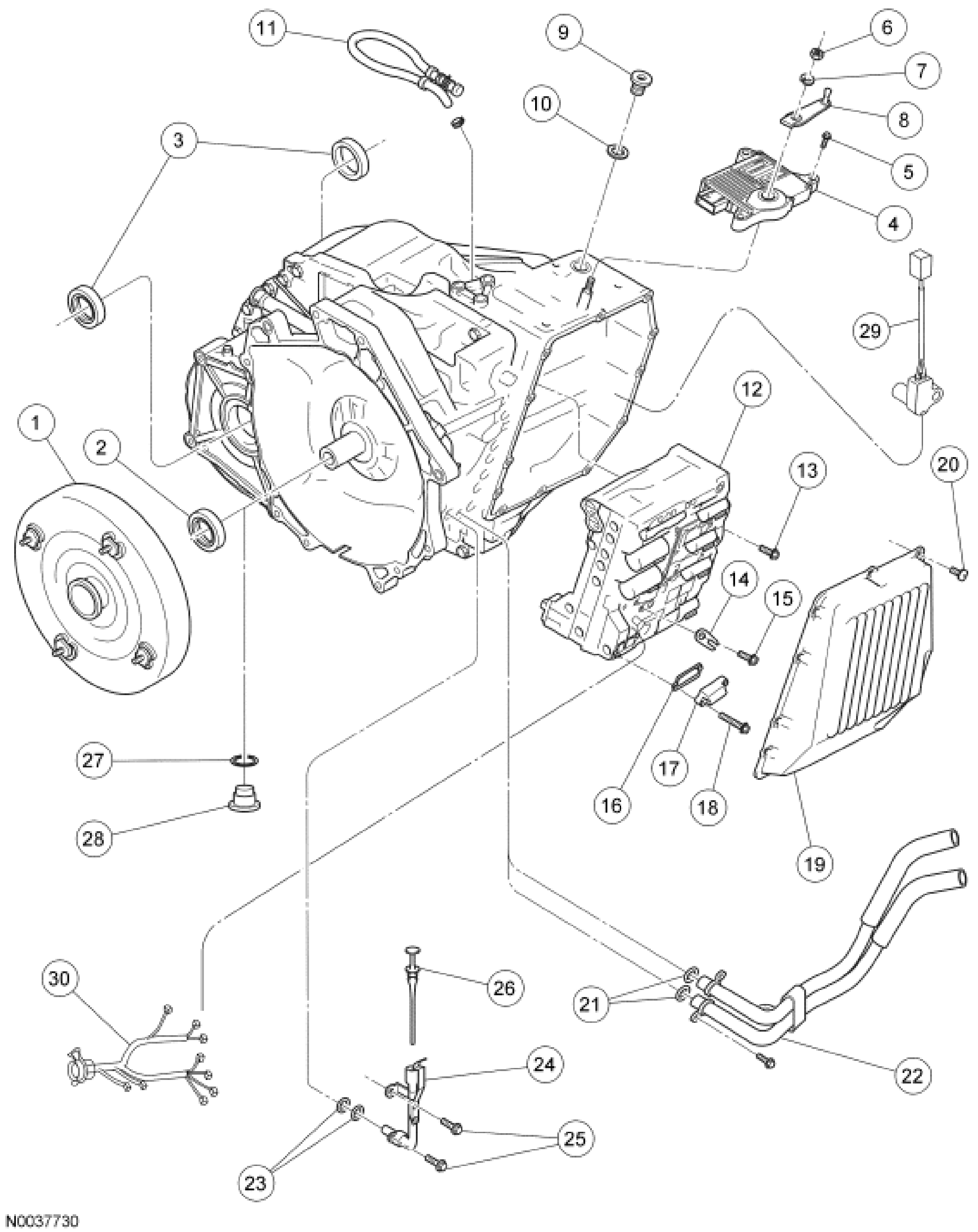


Fig. 40: External Sealing
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7902	Torque converter
2	-	Torque converter hub seal
3	1177	Axle shaft seals

4	-	Transmission Control Module (TCM)
5	-	TCM bolt
6	7045	Manual control lever shaft nut
7	7C208	Manual control lever shaft nut washer
8	7A256	Manual control lever
9	7A010	Transmission fluid fill plug
10	7E050	Transmission fluid fill plug O-ring
11	-	Breather hose
12	-	Main control valve body assembly
13	-	Main control valve body bolt
14	-	Lock plate
15	-	Lock plate bolt
16	-	Suction cover gasket
17	-	Suction cover
18	-	Suction cover bolt
19	-	Main control valve body side cover
20	-	Main control valve body side cover bolt
21	7J227	Transmission fluid cooler O-rings
22	7R081	Transmission fluid cooler tube
23	7E050	Transmission fluid level indicator tube O-rings
24	7A228	Transmission fluid level indicator tube
25	7A443	Transmission fluid level indicator tube bolts
26	7A228	Transmission fluid level indicator tube
27	7L101	Transmission fluid drain plug gasket
28	7A010	Transmission fluid drain plug
29	7M101	Turbine Shaft Speed (TSS) sensor
30	7G276	Internal wire harness and Transmission Fluid Temperature (TFT) sensor

Transmission Fluid Leakage in Torque Converter Area

Leakage at the front of transmission, as evidenced by transmission fluid around the torque converter housing part of the case, may have several sources. By careful observation it is possible, in many instances, to pinpoint the source of a leak before removing the transmission from the vehicle. The paths which the transmission fluid takes to reach the bottom of the torque converter housing are shown in the illustration. The 5 numbers in the illustration correspond with the 5 flow path steps.

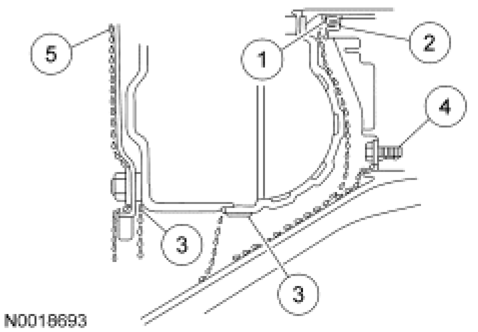


Fig. 41: Identifying Torque Converter Fluid Leakage Area
Courtesy of FORD MOTOR CO.

Leak Path	Symptom	Possible Source
1, 2 and 4	Leak at front of transmission	Torque converter hub seal
1, 2 and 4	Leak at front of transmission	Vent
1, 2 and 4	Leak at front of transmission	Converter hub weld
1, 2 and 4	Leak at front of transmission	External pump seal (large)
1, 2 and 4	Leak at front of transmission	Pump to case screws
1, 2 and 4	Leak at front of transmission	Pump gasket
3	Leak at front of transmission	Torque converter seal weld
3	Leak at front of transmission	Torque converter stud
5	Leak at front of transmission	Engine oil leak; rear main seal
5	Leak at front of transmission	Engine valve cover
5	Leak at front of transmission	Oil galley
5	Leak at front of transmission	Pump lip seal
5	Leak at front of transmission	Engine Oil Pressure (EOP) sensor

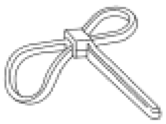
Leak Check Test With UV Lamp

Dye-Lite® ATF Steering Fluid Leak Detection Dye 164-R3701 or equivalent (specifically formulated for ATF) is used to detect a transmission fluid leak.

1. Add dye to the transmission fluid. Use 30.0 mL (1 oz) of dye solution for every 3.8L (4 qt) of transmission fluid.
2. Start and run the engine until the transaxle reaches its normal operating temperature. Observe the back of the cylinder block and top of the torque converter housing for evidence of fluid leakage. Raise the vehicle on a hoist and run the engine at fast idle, then at engine idle, occasionally shifting to the DRIVE and REVERSE ranges to increase pressure within the transaxle. Observe the front of the flexplate, back of the cylinder block (in as far as possible), and inside the torque converter housing and front of the case. Continue running the engine until fluid leakage is evident and the probable source of leakage can be determined.

DIAGNOSIS BY SYMPTOM

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	73 III Automotive Meter	105-R0057 or equivalent
 ST1438-A	Vehicle Communication Module and Integrated Diagnostic System software with appropriate hardware, or equivalent scan tool	

The Diagnosis by Symptom charts give the technician diagnostic information, direction and suggest possible components, using a symptom as a starting point.

The Diagnosis by Symptom charts are divided into 2 categories: Electrical Routines, indicated by 200 series numbers, and Hydraulic/Mechanical Routines, indicated by 300 series numbers. The Electrical Routines list the possible electrical components that could cause or contribute to the symptom described. The Hydraulic/Mechanical Routines list the possible hydraulic or mechanical components that could cause or contribute to the symptom described.

Diagnosis by Symptom Chart Directions

1. Using the Symptom Index, select the concern/symptom that best describes the condition.
2. See the routine indicated in the diagnosis by Symptom Index.
3. Always begin diagnosis of a symptom with:
   1. Preliminary inspections.
   2. Verifications of condition.
   3. Checking the fluid levels.
   4. Carry out other test procedures as directed.

NOTE: Not all concerns and conditions with electrical components will set a DTC. Be aware that the components listed may still be the cause. Verify correct function of these components prior to proceeding to the routine listed.

4. Begin with the routine indicated. Follow the reference or action required statements. Always carry out the on-board diagnostic tests as required. Never skip steps. Repair as required. These components are listed in the removal sequence and by the most probable cause. All components listed must be inspected to make sure of correct repair.

DIAGNOSIS BY SYMPTOM INDEX

Title	Routines
Engagement Concerns	

No forward and/or No reverse	207
Harsh	208
Soft	209
Torque Converter Clutch Operation Concerns	
Does not apply	240
Cycling/shudder/chatters	242
NVH	
Noise/vibration - forward or reverse	254
Other Concerns	
Transmission fluid level	286
Transmission fluid condition	287
Transmission control module software	288

Diagnostic Routines

ENGAGEMENT CONCERNS: NO FORWARD AND/OR NO REVERSE

Possible Component	Reference/Action
207 - ROUTINE	
No Forward, No Reverse, No Forward or Reverse	
Selector lever linkage damaged or out of position	Using a scan tool, check selector lever position. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
Incorrect neutral switch position	Carry out neutral position learning. Refer to **Neutral Position Learning**.
	Disconnect the Transmission Control Module (TCM) electrical connector. If concern still exists, this indicates an internal mechanical problem. Connect the TCM and carry out pressure checks.
	If concern is resolved by disconnecting the TCM, this indicates an electrical concern. Install a new TCM. Refer to **Transmission Control Module (TCM)**. Check wiring harness (external and internal) valve body connections.
Halfshafts broken	Inspect for damaged or broken halfshafts. Refer to **FRONT DRIVE HALFSHAFTS** article.

ENGAGEMENT CONCERNS: HARSH

Possible Component	Reference/Action
208 - ROUTINE	
Harsh Engagements	
Initial learn values wrong	Carry out Transmission Control Module (TCM) initial learning procedure. Refer to **Transmission Control Module (TCM) Initial Learning**.
Damaged internal transaxle components causing high or low pressures	Carry out pressure test. Refer to **Special Testing Procedures**.

Damaged or malfunctioning solenoids	Carry out pinpoint test. Refer to **Pinpoint Tests - Non OSC Equipped Vehicle**.

ENGAGEMENT CONCERNS: SOFT

Possible Component	Reference/Action
209 - ROUTINE	
Soft Engagements	
Initial learn values wrong	Carry out Transmission Control Module (TCM) initial learning procedure. Refer to **Transmission Control Module (TCM) Initial Learning**.
Damaged internal transaxle components causing high or low pressures	Carry out pressure test. Refer to **Special Testing Procedures**.
Damaged or malfunctioning solenoids	Carry out pinpoint test. Refer to **Pinpoint Tests - Non OSC Equipped Vehicle**.

TORQUE CONVERTER CLUTCH OPERATIONS CONCERNS: DOES NOT APPLY

Possible Component	Reference/Action
240 - ROUTINE	
Torque Converter Does Not Apply	
Damaged or malfunctioning solenoid	Carry out pinpoint test. Refer to **Pinpoint Tests - Non OSC Equipped Vehicle**. Install a new main control valve body. Refer to **Main Control Valve Body**.
Damaged or disconnected wire harness	Inspect wire harness. Check connections to the Torque Converter Clutch (TCC) solenoid.
Damaged or malfunctioning torque converter	Install a new torque converter. Refer to **Torque Converter**.

TORQUE CONVERTER CLUTCH OPERATIONS CONCERNS: CYCLING/SHUTTER/CHATTERS

Possible Component	Reference/Action
242 - ROUTINE	
Torque Converter Cycling, Shudders or Chatters	
Damaged or malfunctioning Torque Converter Clutch (TCC) solenoid	Install a new main control valve body. Refer to **Main Control Valve Body**.
Damaged or disconnected wire harness	Inspect wire harness. Check connections to the TCC solenoid.
Damaged or malfunctioning torque converter	Install a new torque converter. Refer to **Torque Converter**.

NOTE: **NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to**

pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

OTHER CONCERNS: NOISE/VIBRATION - FORWARD OR REVERSE

Possible Component	Reference/Action
254 - ROUTINE	
Powertrain Control System	
Transmission Control Module (TCM) , vehicle wiring harnesses, Shift Solenoid A (SSA) and Shift Solenoid B (SSB).	Carry out on-board diagnostic tests. Refer to the **Introduction - Gasoline Engines** article for diagnosis and testing of the TCM. Go to **Pinpoint Test A**. Repair as required. Clear the DTCs, road test and rerun on-board diagnostic test.
Incorrect Transmission Fluid Level	
Transmission fluid level low/overfilled	Check the transmission fluid level. Adjust the transmission fluid level as necessary. Refer to **Preliminary Inspection**.
Torque Converter	
Worn or damaged torque converter	Refer to **Torque Converter Diagnosis**.
Transaxle Support Insulator	
Worn or damaged transaxle support insulator	Inspect the transaxle support insulator for damage. Install new as necessary. Refer to **Transaxle Support Insulator**.

OTHER CONCERNS: TRANSMISSION FLUID LEVEL

Possible Component	Reference/Action
286 - ROUTINE	
Low Transmission Fluid Level	
Axle shaft seal leaking	Install new axle shaft seals. Refer to **Differential Seals - LH**, **Differential Seals - RH, Front Wheel Drive (FWD)** and **Differential Seals - RH, All Wheel Drive (AWD)**.
Transmission fluid pan leaking	Reseal the transmission fluid pan.
Torque converter hub seal leaking	Install a new torque converter hub seal. Refer to **Torque Converter Hub Seal**.
Transmission fluid cooler tubes leaking	Install new transmission fluid cooler tube O-rings.
Manual control lever seal leaking	Install a new manual control lever seal. Refer to **Manual Control Lever Shaft and Seal**.
Transmission fluid drain plug leaking	Install a new transmission fluid drain plug seal.

OTHER CONCERNS: TRANSMISSION FLUID CONDITION

Possible Component	Reference/Action
287 - ROUTINE	
Transmission Fluid Burnt or Contaminated	
Internal components damaged (clutch plate	Install a new transaxle. Refer to **Transaxle - 3.0L** or

material)	**Transaxle - 3.5L**.

OTHER CONCERNS: TRANSMISSION CONTROL MODULE (TCM) SOFTWARE

Possible Component	Reference/Action
288 - ROUTINE	
Shifting and Driveability Concerns	
Transmission Control Module (TCM) not at current software level	Reflash the TCM to current software level.

GENERAL PROCEDURES

TRANSMISSION FLUID COOLER - BACKFLUSHING AND CLEANING

Material

Item	Specification
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A

NOTE: **MERCON®, MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid and Motorcraft Continuously Variable Chain Type Transmission Fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage. Refer to the transmission fluid specification for the correct transmission fluid.**

1. Carry out backflushing with a suitable torque converter/fluid cooler cleaner. Test equipment to make sure that a vigorous transmission fluid flow is present before proceeding. Install a new system transmission fluid filter if flow is weak or contaminated.
2. To aid in attaching the cleaner to the transmission fluid cooler tube, connect 2 additional rubber hoses to the transaxle end of the transmission fluid cooler tube as follows:
    1. Connect the cleaner tank pressure tube to the transmission fluid cooler return tube.
    2. Connect a tank return hose to the transmission fluid cooler pressure tube. Place the outlet end of this hose in the transmission fluid tank reservoir.
3. Turn on the pump and allow the transmission fluid to circulate a minimum of 5 minutes (cycling switch on and off will help dislodge contaminants in cooler system).
4. Switch off the pump and disconnect the transmission fluid pressure hose from the transmission fluid cooler return tube.
5. Use compressed air to blow out the transmission fluid cooler and tubes (blow air into the transmission fluid cooler return tube) until all transmission fluid is removed.
6. Remove the rubber return hose from the remaining transmission fluid cooler tube.

TORQUE CONVERTER

1. A new or remanufactured torque converter must be installed if one or more of the following statements

are true:

- A torque converter malfunction has been determined based on complete diagnostic procedures.
- Converter stud(s), impeller hub or bushing are damaged.
- Discoloration of the torque converter (due to overheating).
- The torque converter is found to be out of specification when carrying out one of the following torque converter checks:
  - One-Way Clutch Check
  - End Play Check
  - Stator to Turbine Interference Check
  - Stator to Impeller Interference Check
  - Torque Converter Leak Check
- Evidence of transmission assembly or fluid contamination due to the following transmission or converter failure modes:
  - Major Metallic Failure
  - Multiple Clutches or Clutch Plate Failures
  - Sufficient Component Wear which results in Metallic Contamination

TORQUE CONVERTER CONTAMINATION INSPECTION

Material

Item	Specification
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A

1. If a new or remanufactured torque converter is not being installed, the following procedures must be carried out:
   - The torque converter must be thoroughly cleaned.
   - Torque converters with drain plugs can be cleaned by using a suitable torque converter/fluid cooler cleaner.
   - Torque converters without drain plugs can be cleaned by hand. Partially fill the torque converter using only recommended transmission fluid for the applicable transmission. Hand agitate the torque converter and then thoroughly drain the transmission fluid. Refill the torque converter with new transmission fluid specified for transmission and reinstall.

TRANSMISSION FLUID DRAIN AND REFILL

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent	

	scan tool	

Material

Item	Specification
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A

NOTE: MERCON®, MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid and Motorcraft Continuously Variable Chain Type Transmission Fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage.

Draining

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the transmission fluid drain plug and allow the transmission fluid to drain.

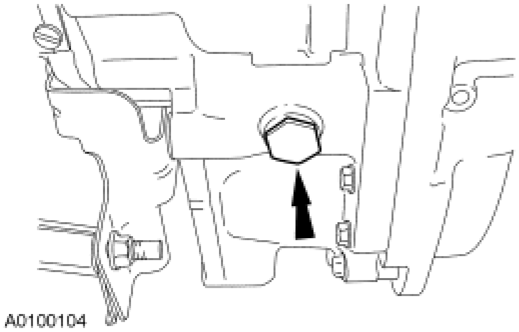


Fig. 42: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

Refill

3. Install the transmission fluid drain plug.
   - Tighten to 47 Nm (35 lb-ft).

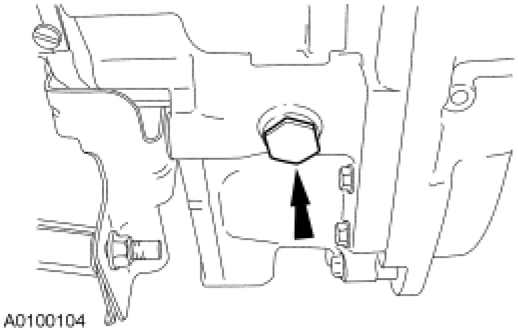


Fig. 43: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

4. Remove the transmission fluid fill plug.

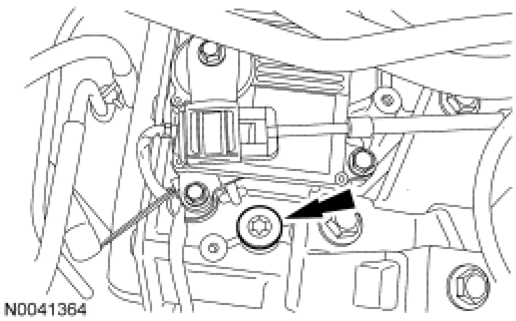


Fig. 44: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

5. Fill the transaxle with approximately 4.7L (5 qt) of clean transmission fluid.
6. Install the transmission fluid fill plug.
   - Tighten to 39 Nm (29 lb-ft).

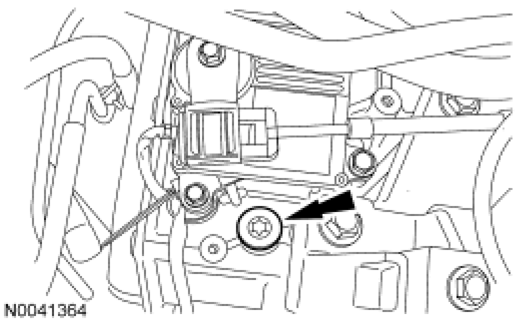


Fig. 45: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

7. With the selector lever in PARK, the vehicle should be on a level surface, the engine at idle (680-780 rpm), foot pressed on the brake, move the selector lever through each gear and allow engagement of each

gear. Place the selector lever back in the PARK position.

8. Wipe the transmission fluid level indicator cap and remove the transmission fluid level indicator.
9. Wipe the transmission fluid level indicator with a clean cloth.

NOTE: In order to get an accurate transmission fluid level reading, the vehicle should be on a level surface. Idle the engine to reach the normal operating temperature. Using the scan tool, verify that the transaxle is at normal operating temperature 60°C-70°C (140°F-158°F), prior to adjusting the transmission fluid level.

10. If transmission fluid needs to be added, add transmission fluid in 0.25L (1/2 pt) increments through the transmission fluid fill plug located on the top of the transaxle near the transmission fluid level indicator. Do not overfill the transmission fluid. Install the transmission fluid level indicator back in the transmission fluid filler tube until it is fully seated, then remove the transmission fluid lever indicator. The transmission fluid level should be at the uppermost mark on the transmission fluid level indicator. Only fill to the uppermost mark on the transmission fluid indicator. Do not overfill. Damage to the transaxle will occur.

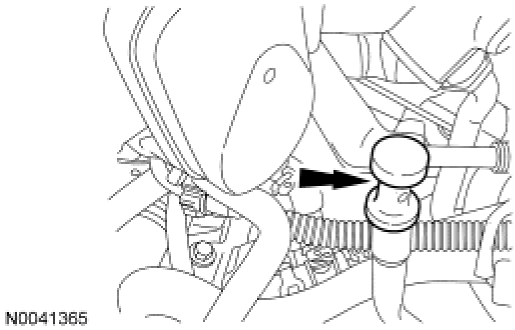


Fig. 46: Locating Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: The correct transmission fluid at normal operating temperature of 60°C-70°C (140°F-158°F) is between the top 2 marks on the fluid level indicator.

11. Fill the transaxle to the correct transmission fluid level.

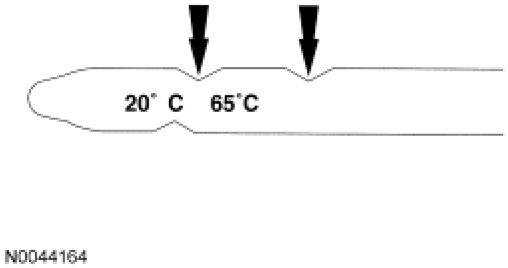


Fig. 47: Locating Temperature Marks On Fluid Level Indicator

Courtesy of FORD MOTOR CO.

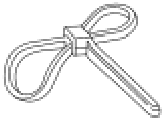
NOTE: The correct transmission fluid level at cool operating temperature of 15°C-25°C (59°F-77°F), is at the bottom mark on the transmission fluid level indicator.

12. If the Transmission Fluid Temperature (TFT) is low, fill the transaxle with transmission fluid to the cold range on the transmission fluid level indicator. Recheck the transmission fluid level when the transaxle has reached the normal operating temperature.

Fig. 48: Locating Bottom Mark On Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NEUTRAL POSITION LEARNING

Special Tools

Illustration	Tool Name	Tool Number
 ST1438-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

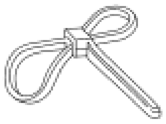
NOTE: When installing a new Transmission Control Module (TCM), the initialized learned values will need to be carried out.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Install the scan tool.
3. Turn the ignition ON.
4. The scan tool should indicate NEUTRAL.
   - If the scan tool does not indicate NEUTRAL, carry out TCM adjustment. For additional information, refer to **Transmission Control Module (TCM)**.
5. If NEUTRAL is indicated on the scan tool, move the selector lever to PARK and turn the ignition OFF.

6. Turn the ignition ON and move the selector lever from PARK to DRIVE.
    - The scan tool should indicate each PRNDL position.
7. If the diagnostic display indicates each PRNDL position, check for any DTCs.
8. If the diagnostic display does not indicate each PRNDL position, carry out **Transmission Control Module (TCM) Initial Learning**.

TRANSMISSION CONTROL MODULE (TCM) INITIAL LEARNING

Special Tools

Illustration	Tool Name	Tool Number
 ST1438-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

NOTE: **Do not raise the Transmission Fluid Temperature (TFT) by stalling the engine, internal transaxle damage will occur.**

NOTE: **Clear all DTCs first.**

NOTE: **When installing a new transmission, Transmission Control Module (TCM) or reflashing the TCM, the initialized learned values will need to be carried out.**

NOTE: **This procedure cannot be carried out if the transmission fluid is not within the correct temperature specification.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Install the scan tool.
3. Monitor and note the engagement and shift harshness on the scan tool.
4. With the engine idling, monitor the Transmission Fluid Temperature (TFT). The TFT should be between 66°C-110°C (151°F-230°F).
5. With your foot on the brake, move the selector lever to NEUTRAL and hold for 3 seconds. Then move the selector lever to DRIVE and hold for 3 seconds. Carry this out 5 times. Then move the selector lever to PARK.
6. With your foot on the brake, move the selector lever to NEUTRAL and hold for 3 seconds. Then move the selector lever to REVERSE and hold for 3 seconds. Carry this out 5 times. Then move the selector lever to PARK.
7. Drive the vehicle and monitor the scan tool.
8. Drive the vehicle with the throttle opening between 25-30%. Drive until the vehicle reaches 6th gear, not to exceed 80 km/h (50 mph). Then release the accelerator and coast to a stop within 60 seconds. Carry

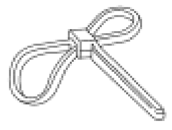
this out 10 times.

9. The engagement and shift harshness have decreased.

IN-VEHICLE SERVICING

MAIN CONTROL VALVE BODY

Special Tools

Illustration	Tool Name	Tool Number
 ST1438-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Material

Item	Specification
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A
Ultra Silicone Sealant TA-29	-

REMOVAL

NOTE: MERCON®, MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid and Motorcraft Continuously Variable Chain Type Transmission Fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the transmission fluid drain plug and allow the transmission fluid to drain.

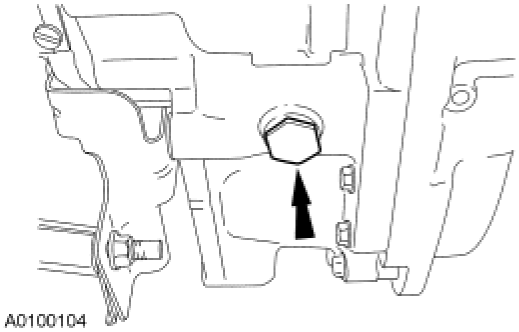


Fig. 49: Locating Transmission Fluid Drain Plug

Courtesy of FORD MOTOR CO.

3. Disconnect the transmission fluid cooler tubes at the transaxle and position the tubes aside.

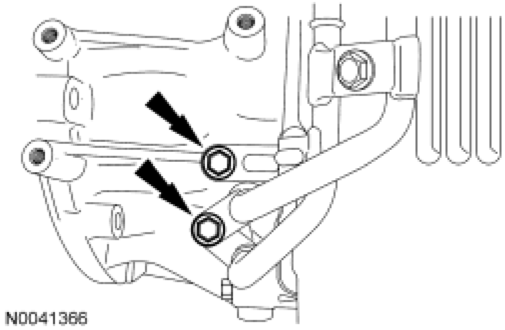


Fig. 50: Locating Transmission Fluid Cooler Tube Bolts
Courtesy of FORD MOTOR CO.

4. Remove and discard the transmission fluid pan bolts and remove the pan.

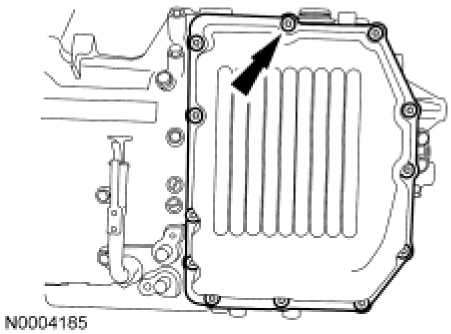


Fig. 51: Locating Transmission Fluid Pan Bolts
Courtesy of FORD MOTOR CO.

NOTE: When removing the sealer, use care not to damage the sealing surfaces.

5. Remove the sealer off the fluid pan.

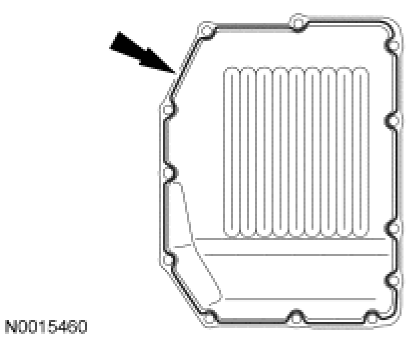
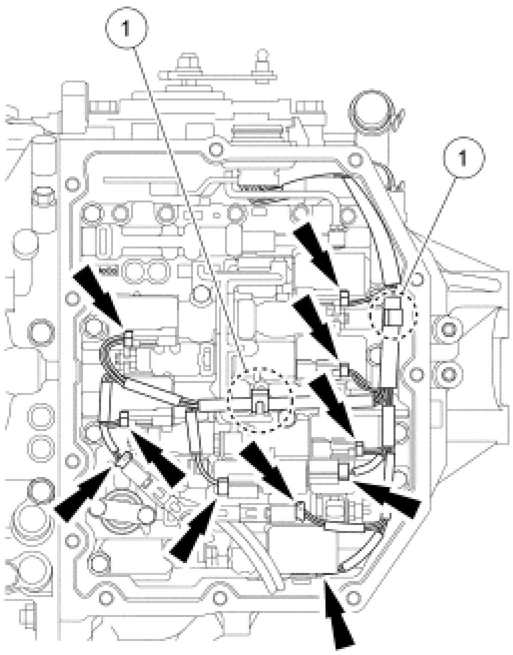


Fig. 52: Locating Fluid Pan Sealer

Courtesy of FORD MOTOR CO.

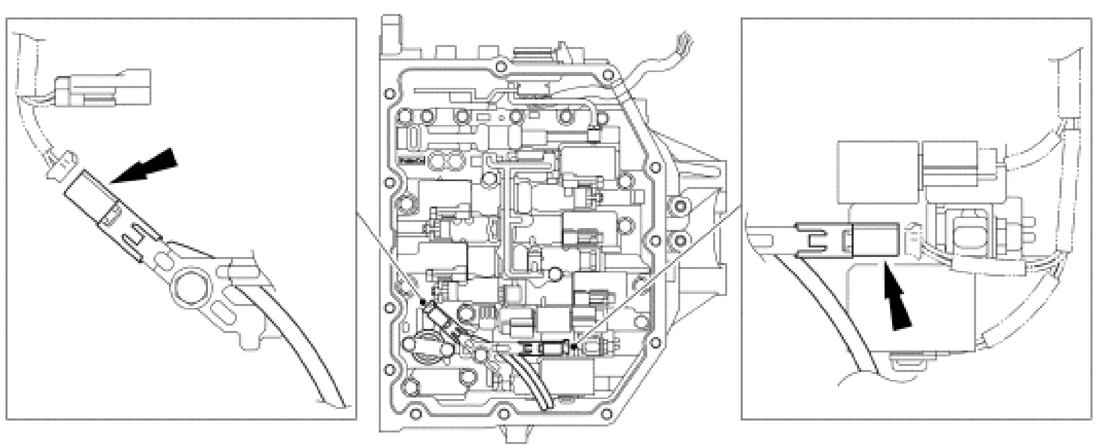
6. Disconnect the wire harness from the solenoids.
    1. Remove the wire harness from the clamps.
    2. Disconnect the 8 solenoid connectors and the 2 speed sensor connectors.



N0015461

Fig. 53: Locating Solenoid Connectors & Speed Sensor Connectors
Courtesy of FORD MOTOR CO.

7. Remove the 2 speed sensor wires from the solenoid clamp.



N0015462

Fig. 54: Locating Speed Sensor Wires

Courtesy of FORD MOTOR CO.

8. Remove the bolt and the lock plate and pull out the Transmission Fluid Temperature (TFT) sensor.

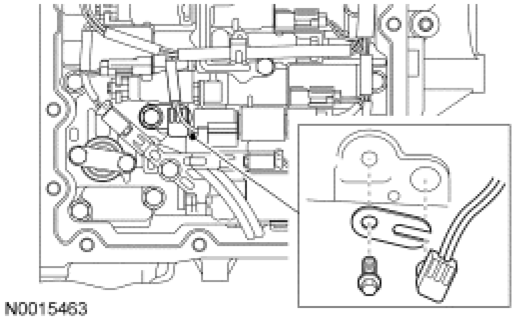


Fig. 55: Identifying Transmission Fluid Temperature Sensor, Bolt & Lock Plate
Courtesy of FORD MOTOR CO.

9. Remove the 2 bolts, suction cover and gasket.

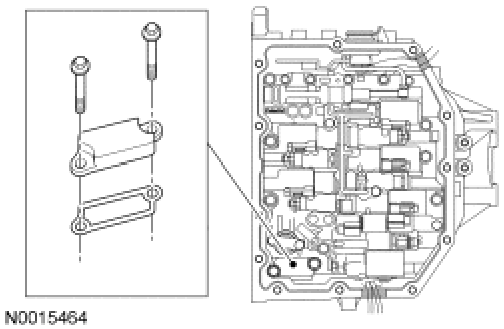


Fig. 56: Identifying Suction Cover, Gasket & Bolts
Courtesy of FORD MOTOR CO.

10. Remove the 6 main control valve body bolts in the sequence shown.

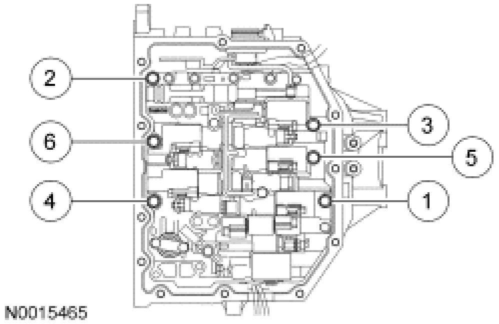


Fig. 57: Identifying Main Control Valve Body Bolts Sequence
Courtesy of FORD MOTOR CO.

NOTE: **Be careful when removing the main control valve body, the manual control lever will fall out of its bore. Also, once all the bolts are removed, the main control valve body will fall out of the transaxle.**

11. Remove the main control valve body.

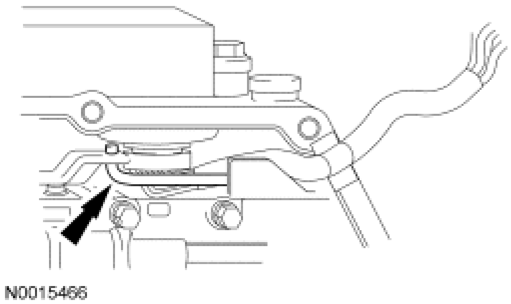


Fig. 58: Locating Manual Control Lever
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: **When installing the main control valve body, place the wire harness in the open space of the separate plate, being careful not to pinch the harness. Damage to the harness will occur.**

1. Connect the manual valve link and position the main control valve body in place.

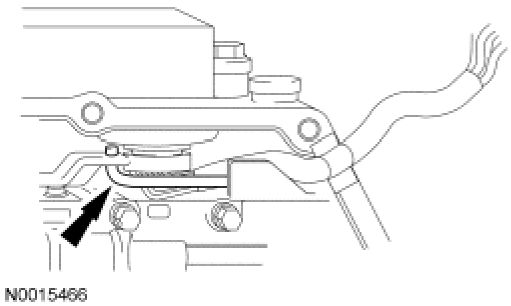


Fig. 59: Locating Manual Control Lever
Courtesy of FORD MOTOR CO.

2. Loosely install the 6 main control valve body bolts in the sequence shown.

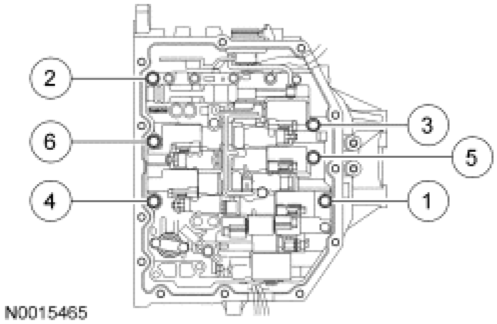


Fig. 60: Identifying Main Control Valve Body Bolts Sequence
Courtesy of FORD MOTOR CO.

3. Install the suction cover gasket, cover and loosely install the 2 bolts.

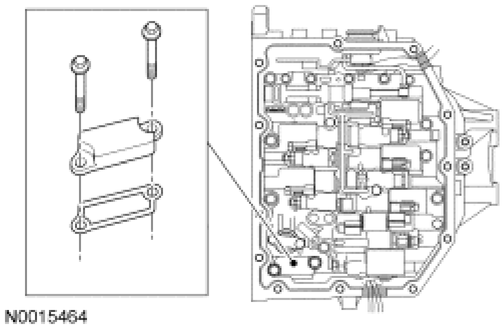


Fig. 61: Identifying Suction Cover, Gasket & Bolts
Courtesy of FORD MOTOR CO.

4. Tighten the 8 bolts to 10 Nm (89 lb-in) in the sequence shown.

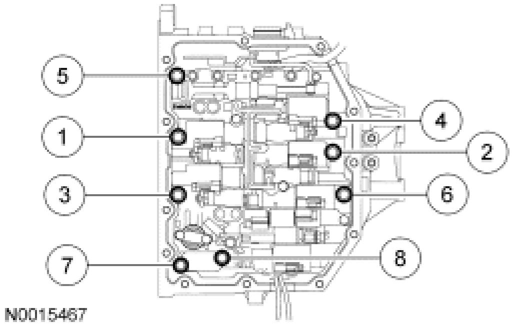


Fig. 62: Identifying Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

5. Lubricate the O-ring and install the TFT sensor.
   - Tighten to 10 Nm (89 lb-in).

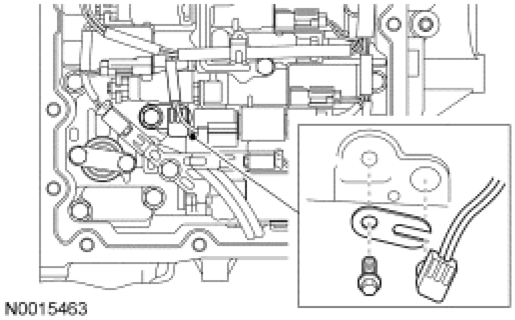


Fig. 63: Identifying Transmission Fluid Temperature Sensor, Bolt & Lock Plate
Courtesy of FORD MOTOR CO.

6. Connect the 2 speed sensor wires.

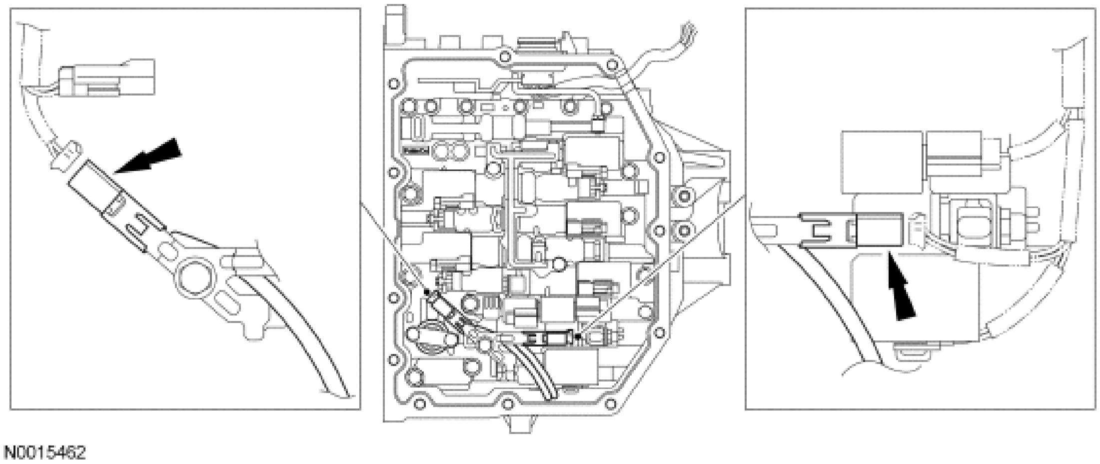


Fig. 64: Locating Speed Sensor Wires
Courtesy of FORD MOTOR CO.

7. Connect the wire harness to the solenoids.
    1. Install the wire harness into the clamps.
    2. Connect the 8 solenoid connectors and the 2 speed sensor connectors.

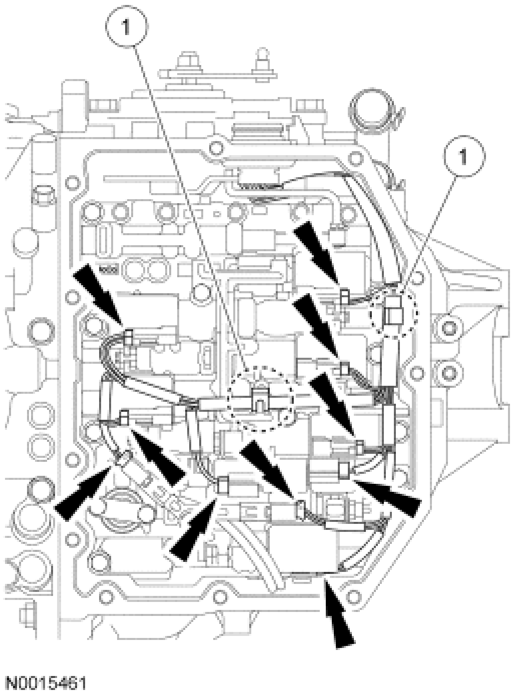


Fig. 65: Locating Solenoid Connectors & Speed Sensor Connectors
Courtesy of FORD MOTOR CO.

8. Install a bead of sealer to the fluid pan.

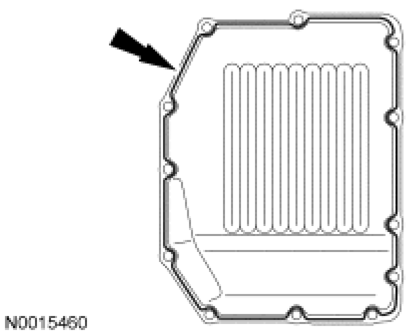


Fig. 66: Locating Fluid Pan Sealer
Courtesy of FORD MOTOR CO.

9. Using new pan bolts, install the fluid pan.
    - Tighten to 13 Nm (115 lb-in).

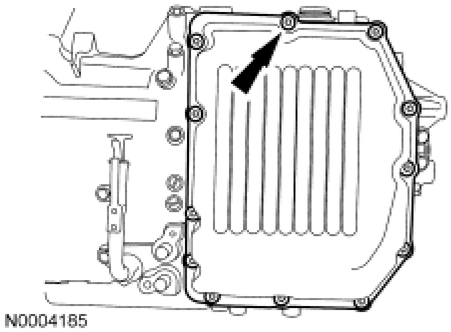


Fig. 67: Locating Transmission Fluid Pan Bolts
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the new O-rings with clean automatic transmission fluid and install them onto the transmission fluid cooler tubes.

10. Connect the transmission fluid cooler tubes to the transaxle.
    - Tighten to 10 Nm (89 lb-in).

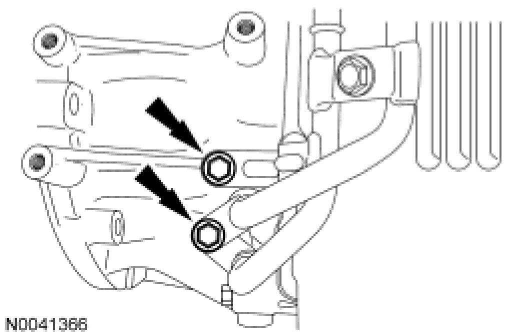


Fig. 68: Locating Transmission Fluid Cooler Tube Bolts
Courtesy of FORD MOTOR CO.

11. Install the transmission fluid drain plug.
    - Tighten to 47 Nm (35 lb-ft).

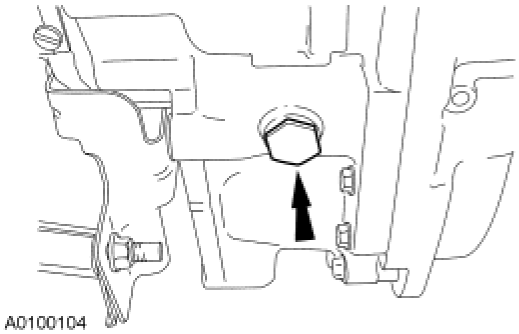


Fig. 69: Locating Transmission Fluid Drain Plug
Courtesy of FORD MOTOR CO.

12. Remove the transmission fluid fill plug.

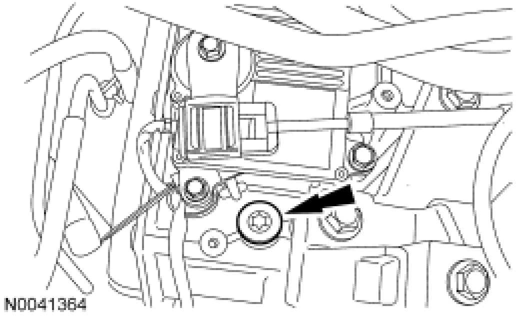


Fig. 70: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

13. Fill the transaxle with approximately 4.7L (5 qt) of clean transmission fluid.
14. Install the transmission fluid fill plug.
    - Tighten to 39 Nm (29 lb-ft).

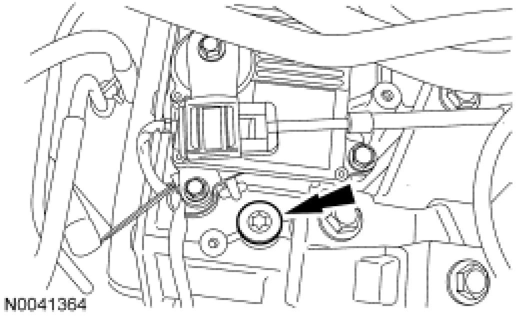


Fig. 71: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

15. With the transaxle in PARK, the vehicle on a level surface, the engine at idle (680-780 rpm) and foot pressed on the brake, move the selector lever through each gear and allow engagement of each gear. Place the selector lever back in the PARK position.
16. Wipe the transmission fluid level indicator cap and remove the transmission fluid level indicator.
17. Wipe the transmission fluid level indicator with a clean cloth.

NOTE: **In order to get an accurate transmission fluid level reading, the vehicle should be on a level surface. Idle the engine to reach the normal operating temperature. Using the scan tool, verify that the transaxle is at normal operating temperature 60°C-70°C (140°F-158°F), prior to adjusting the transmission fluid level.**

18. If transmission fluid needs to be added, add transmission fluid in 0.25L (1/2 pt) increments through the transmission fluid fill plug located on the top of the transaxle near the transmission fluid level indicator.

Do not overfill the transmission fluid. Install the transmission fluid level indicator back in the transmission fluid filler tube until it is fully seated, then remove the transmission fluid level indicator. The transmission fluid level should be at the upper most mark on the transmission fluid level indicator. Only fill to the upper most mark on the transmission fluid level indicator. Do not overfill. Damage to the transaxle will occur.

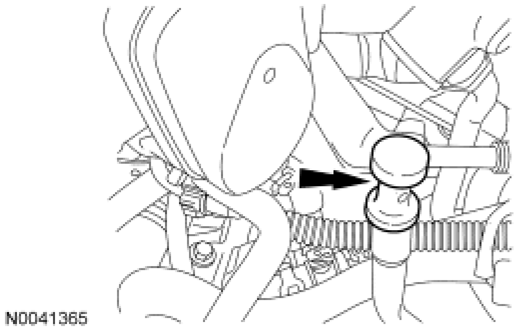


Fig. 72: Locating Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: **The correct transmission fluid level at normal operating temperature of 60°C-70°C (140°F-158°F) is between the top 2 marks on the transmission fluid level indicator.**

19. Fill the transaxle to the correct transmission fluid level.

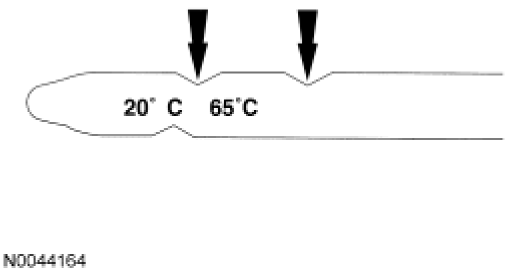


Fig. 73: Locating Temperature Marks On Fluid Level Indicator
Courtesy of FORD MOTOR CO.

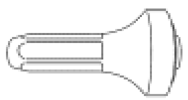
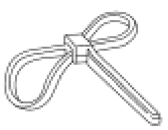
NOTE: **The correct transmission fluid level at cool operating temperature of 15°C-25°C (59°F-77°F), is at the bottom mark on the transmission fluid level indicator.**

20. If the TFT is low, fill the transaxle with transmission fluid to the cold range on the transmission fluid level indicator. Recheck the transmission fluid level when the transaxle has reached the normal operating temperature.

Fig. 74: Locating Bottom Mark On Fluid Level Indicator
Courtesy of FORD MOTOR CO.

DIFFERENTIAL SEALS - LH

Special Tools

Illustration	Tool Name	Tool Number
	Output Shaft Seal Installer	307-567
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Material

Item	Specification
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A

REMOVAL

NOTE: MERCON®, MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid and Motorcraft Continuously Variable Chain Type Transmission Fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage.

1. Remove the LH halfshaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.

NOTE: Be careful not to damage the case while removing the seal.

2. Using a suitable awl, poke a small hole in the seal.

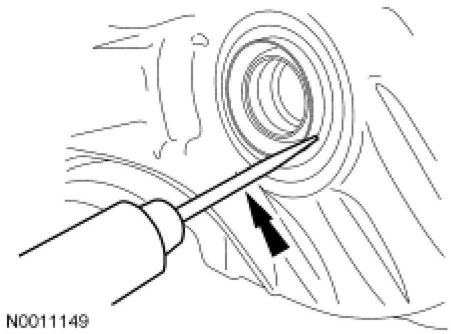


Fig. 75: Poking Small Hole In Seal
Courtesy of FORD MOTOR CO.

3. Using a suitable dent puller, remove the LH differential fluid seal.

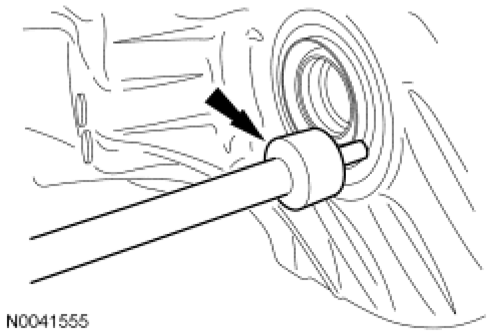


Fig. 76: Locating Dent Puller
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Position the new differential fluid seal in place.

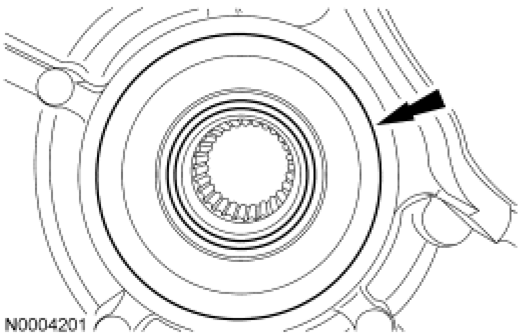


Fig. 77: Positioning Differential Fluid Seal
Courtesy of FORD MOTOR CO.

2. Using the Output Shaft Seal Installer, install the outer differential fluid seal.

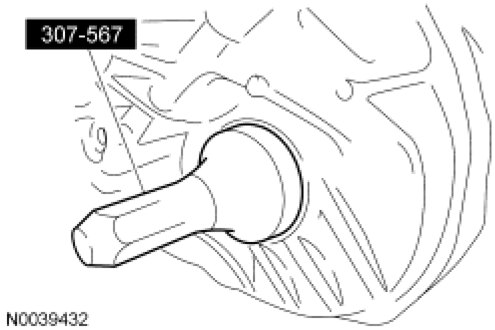


Fig. 78: Identifying Special Tool (307-567)
Courtesy of FORD MOTOR CO.

3. Install the LH halfshaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.
4. With the transaxle in PARK, the vehicle on a level surface, the engine at idle (680-780 rpm) and foot pressed on the brake, move the selector lever through each gear and allow engagement of each gear. Place the selector lever back in the PARK position.
5. Wipe the transmission fluid level indicator cap and remove the transmission fluid level indicator.
6. Wipe the transmission fluid level indicator with a clean cloth.

NOTE: **In order to get an accurate transmission fluid level reading, the vehicle should be on a level surface. Idle the engine to reach the normal operating temperature. Using the scan tool, verify that the transaxle is at normal operating temperature 60°C-70°C (140°F-158°F), prior to adjusting the transmission fluid level.**

7. If transmission fluid needs to be added, add transmission fluid in 0.25L (1/2 pt) increments through the transmission fluid fill plug located on the top of the transaxle near the transmission fluid level indicator. Do not overfill the transmission fluid. Install the transmission fluid level indicator back in the transmission fluid filler tube until it is fully seated, then remove the transmission fluid level indicator. The transmission fluid level should be at the uppermost mark on the transmission fluid level indicator. Only fill to the uppermost mark on the transmission fluid level indicator. Do not overfill. Damage to the transaxle will occur.

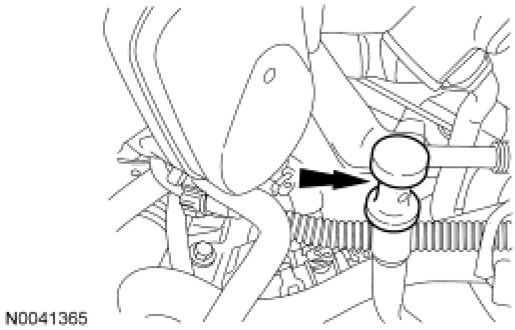


Fig. 79: Locating Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: **The correct transmission fluid level at normal operating temperature of 60° C-70°C (140°F-158°F) is between the top 2 marks on the transmission fluid level indicator.**

8. Fill the transaxle to the correct transmission fluid level.

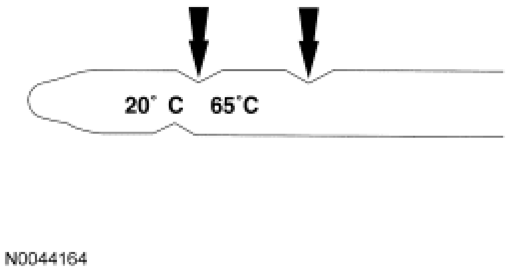


Fig. 80: Locating Temperature Marks On Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: **The correct transmission fluid level at cold operating temperature of 15°C-25°C (59°F-77°F) is at the bottom mark on the transmission fluid level indicator.**

9. If the Transmission Fluid Temperature (TFT) is low, fill the transaxle with transmission fluid to the cold range on the transmission fluid level indicator. Recheck the transmission fluid level when the transaxle has reached the normal operating temperature.

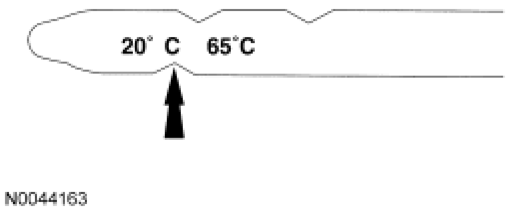


Fig. 81: Locating Bottom Mark On Fluid Level Indicator
Courtesy of FORD MOTOR CO.

10. Remove the transmission fluid fill plug.

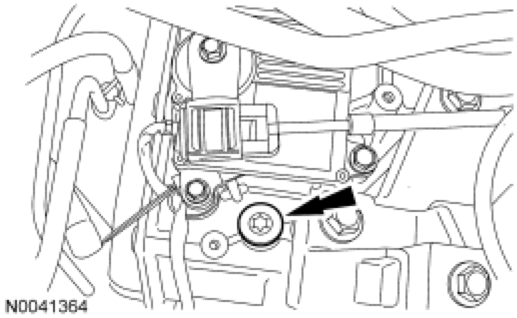


Fig. 82: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

11. Fill the transaxle with clean transmission fluid.
12. Install the transmission fluid fill plug.
    - Tighten to 39 Nm (29 lb-ft).

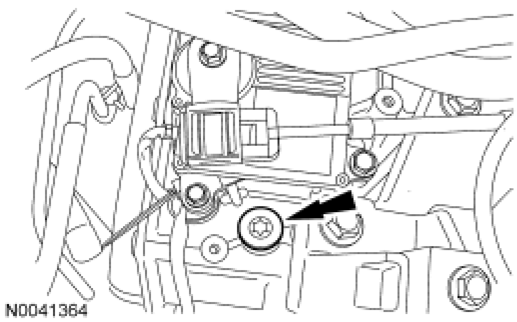
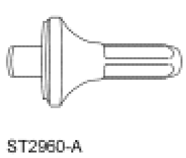


Fig. 83: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

DIFFERENTIAL SEALS - RH, FRONT WHEEL DRIVE (FWD)

Special Tools

Illustration	Tool Name	Tool Number
	Output Seal Installer	307-568
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Material

Item	Specification
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A

REMOVAL

NOTE: MERCON®, MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid and Motorcraft Continuously Variable Chain Type Transmission Fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage.

1. Remove the RH halfshaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.

   NOTE: Be careful not to damage the case while removing the seal.

2. Using a suitable dent puller, remove the differential fluid seal.

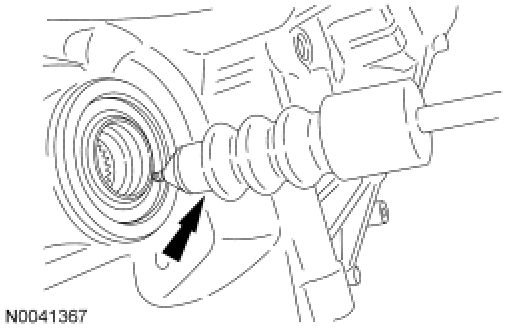


Fig. 84: Locating Dent Puller
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Position the new differential fluid seal on the Output Seal Installer.

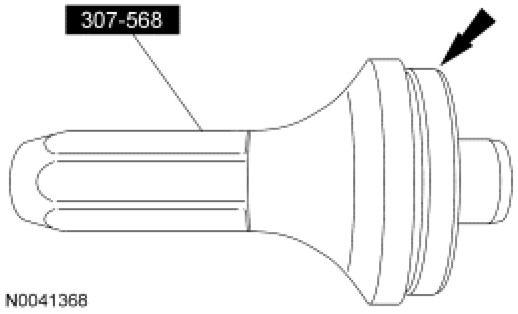


Fig. 85: Locating Differential Fluid Seal On Special Tool

Courtesy of FORD MOTOR CO.

2. Using the Output Seal Installer, install the outer differential fluid seal.

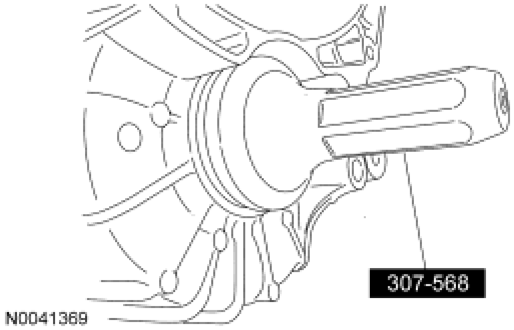


Fig. 86: Identifying Special Tool (307-568)
Courtesy of FORD MOTOR CO.

3. Install the RH halfshaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.
4. With the transaxle in PARK, the vehicle on a level surface, the engine at idle (680-780 rpm) and foot pressed on the brake, move the selector lever through each gear and allow engagement of each gear. Place the selector lever back in the PARK position.
5. Wipe the transmission fluid level indicator cap and remove the transmission fluid level indicator.
6. Wipe the transmission fluid level indicator with a clean cloth.

NOTE: In order to get an accurate transmission fluid level reading, the vehicle should be on a level surface. Idle the engine to reach the normal operating temperature. Using the scan tool, verify that the transaxle is at normal operating temperature 60°C-70°C (140°F-158°F), prior to adjusting the transmission fluid level.

7. If transmission fluid needs to be added, add transmission fluid in 0.25L (1/2 pt) increments through the transmission fluid fill plug located on the top of the transaxle near the transmission fluid level indicator. Do not overfill the transmission fluid. Install the transmission fluid level indicator back in the transmission fluid filler tube until it is fully seated, then remove the transmission fluid lever indicator. The transmission fluid level should be at the uppermost mark on the transmission fluid level indicator. Only fill to the uppermost mark on the transmission fluid level indicator. Do not overfill. Damage to the transaxle will occur.

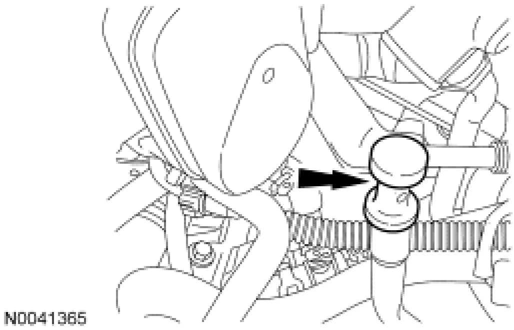


Fig. 87: Locating Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: **The correct transmission fluid level at normal operating temperature of 60°C-70°C (140°F-158°F) is between the top 2 marks on the transmission fluid level indicator.**

8. Fill the transaxle to the correct transmission fluid level.

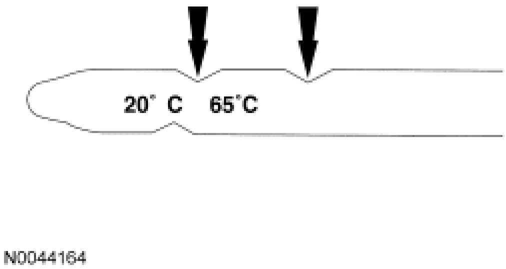


Fig. 88: Locating Temperature Marks On Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: **The correct transmission fluid level at cold operating temperature of 15°C-25°C (59°F-77°F) is at the bottom mark on the transmission fluid level indicator.**

9. If the Transmission Fluid Temperature (TFT) is low, fill the transaxle with transmission fluid to the cold range on the transmission fluid level indicator. Recheck the transmission fluid level when the transaxle has reached the normal operating temperature.

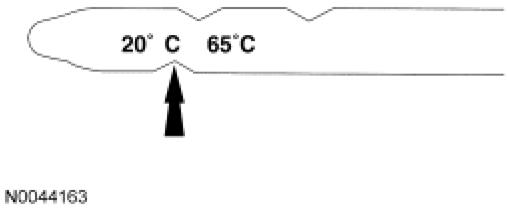


Fig. 89: Locating Bottom Mark On Fluid Level Indicator
Courtesy of FORD MOTOR CO.

10. Remove the transmission fluid fill plug.

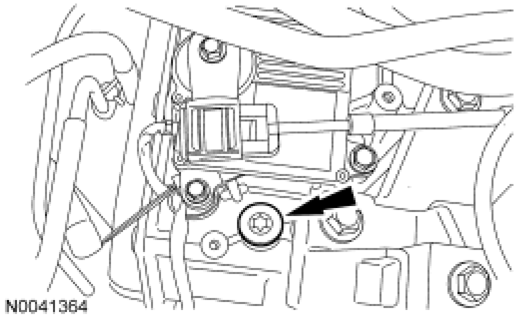


Fig. 90: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

11. Fill the transaxle with clean transmission fluid.
12. Install the transmission fluid fill plug.
    - Tighten to 39 Nm (29 lb-ft).

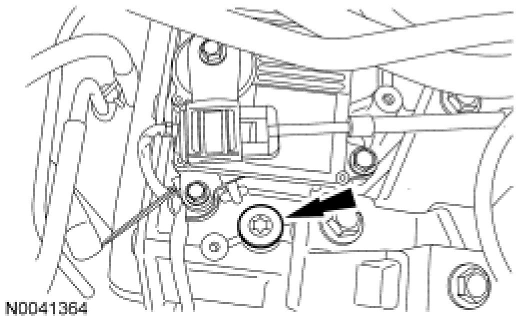
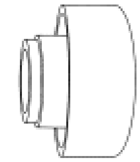
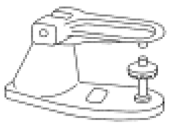
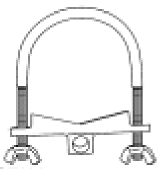
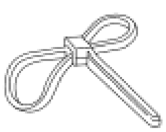


Fig. 91: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

DIFFERENTIAL SEALS - RH, ALL WHEEL DRIVE (AWD)

Special Tools

Illustration	Tool Name	Tool Number
 ST2978A	Differential Seal Installer	307-593
 ST1278-A	Handle	205-153 (T80T-4000-W)
 ST2934-A	Remover, Input Shaft Oil Seal	308-375
 ST1187-A	Slide Hammer	307-005 (T59L-100-B)
 ST1438-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Material

Item	Specification
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A

REMOVAL

NOTE: **MERCON®, MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid and Motorcraft Continuously Variable Chain Type Transmission Fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage.**

1. Remove the Power Transfer Unit (PTU). For additional information, refer to **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.

NOTE: Transaxle removed for clarity.

2. Using the Input Shaft Oil Seal Remover and Slide Hammer, remove the differential fluid seals.

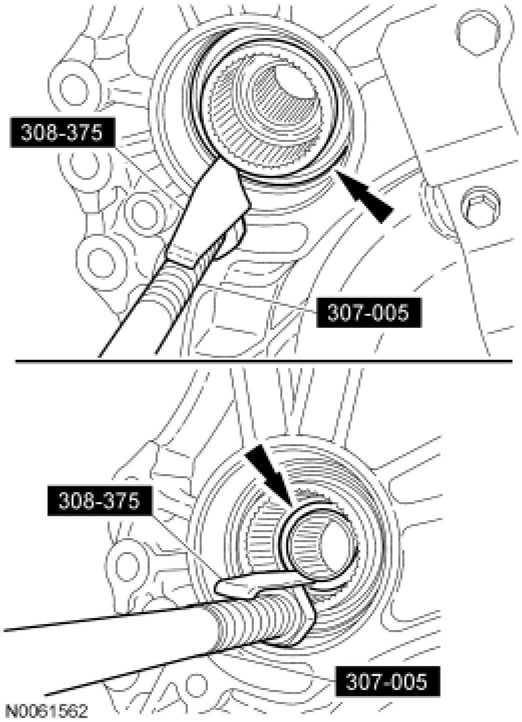


Fig. 92: Identifying Differential Fluid Seals & Special Tools (307-005, 308-375)
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Position the new inner differential fluid seal in place.

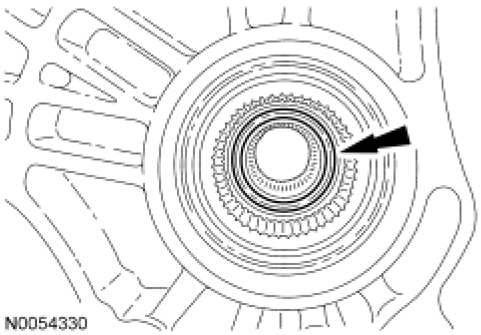


Fig. 93: Identifying Inner Differential Fluid Seal
Courtesy of FORD MOTOR CO.

2. Using the Differential Seal Installer and Handle, install the inner differential fluid seal.

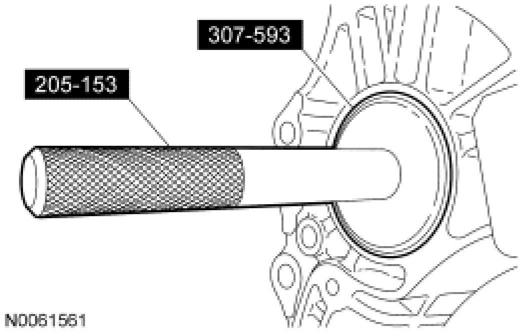


Fig. 94: Identifying Differential Fluid Seal & Special Tools (307-593, 205-153)
Courtesy of FORD MOTOR CO.

3. Position the new outer differential fluid seal in place.

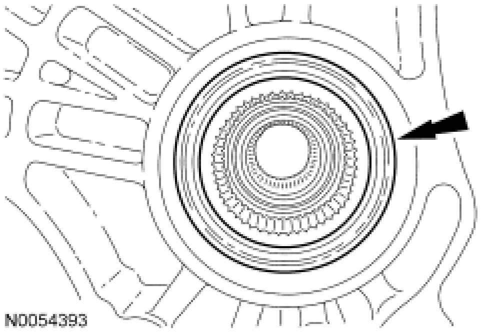


Fig. 95: Identifying Outer Differential Fluid Seal
Courtesy of FORD MOTOR CO.

4. Using the Differential Seal Installer and Handle, install the outer differential fluid seal.

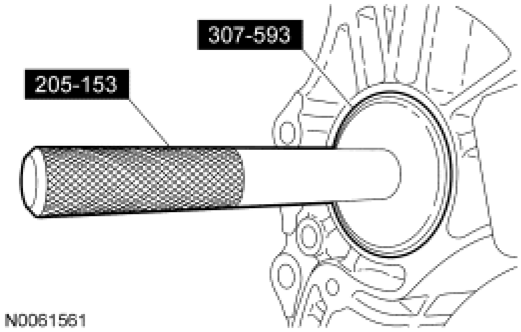


Fig. 96: Identifying Differential Fluid Seal & Special Tools (307-593, 205-153)
Courtesy of FORD MOTOR CO.

5. Install the PTU. For additional information, refer to **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.
6. With the transaxle in PARK, the vehicle on a level surface, the engine at idle (680-780 rpm) and foot pressed on the brake, move the selector lever through each gear and allow engagement of each gear. Place the selector lever back in the PARK position.

7. Wipe the transmission fluid level indicator cap and remove the transmission fluid level indicator.
8. Wipe the transmission fluid level indicator with a clean cloth.

NOTE: **In order to get an accurate transmission fluid level reading, the vehicle should be on a level surface. Idle the engine to reach the normal operating temperature. Using the scan tool, verify that the transaxle is at normal operating temperature 60°C-70°C (140°F-158°F), prior to adjusting the transmission fluid level.**

9. If transmission fluid needs to be added, add transmission fluid in 0.25L (1/2 pt) increments through the transmission fluid fill plug located on the top of the transaxle near the transmission fluid level indicator. Do not overfill the transmission fluid. Install the transmission fluid level indicator back in the transmission fluid filler tube until it is fully seated, then remove the transmission fluid level indicator. The transmission fluid level should be at the uppermost mark on the transmission fluid level indicator. Only fill to the uppermost mark on the transmission fluid level indicator. Do not overfill. Damage to the transaxle will occur.

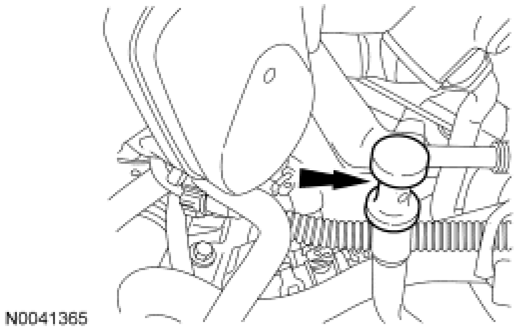


Fig. 97: Locating Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: **The correct transmission fluid level at normal operating temperature of 60°C-70°C (140°F-158°F) is between the top 2 marks on the transmission fluid level indicator.**

10. Fill the transaxle to the correct transmission fluid level.

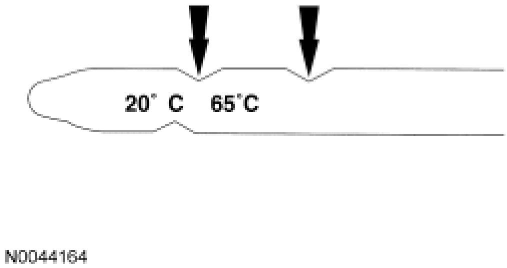


Fig. 98: Locating Temperature Marks On Fluid Level Indicator

Courtesy of FORD MOTOR CO.

NOTE: **The correct transmission fluid level at cold operating temperature of 15°C-25°C (59°F-77°F) is at the bottom mark on the transmission fluid level indicator.**

11. If the Transmission Fluid Temperature (TFT) is low, fill the transaxle with transmission fluid to the cold range on the transmission fluid level indicator. Recheck the transmission fluid level when the transaxle has reached the normal operating temperature.

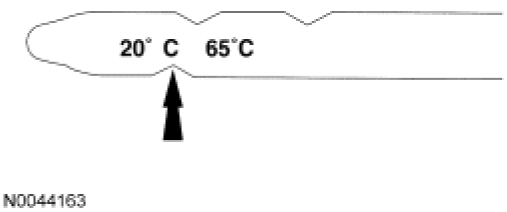


Fig. 99: Locating Bottom Mark On Fluid Level Indicator
Courtesy of FORD MOTOR CO.

12. Remove the transmission fluid fill plug.

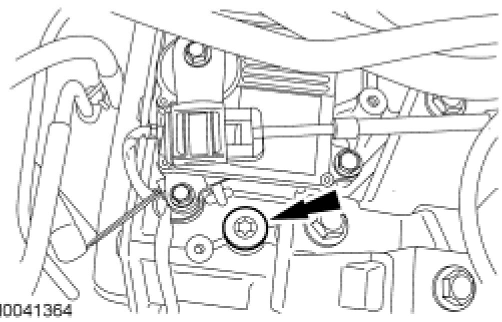


Fig. 100: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

13. Fill the transaxle with clean transmission fluid.
14. Install the transmission fluid fill plug.
    - Tighten to 39 Nm (29 lb-ft).

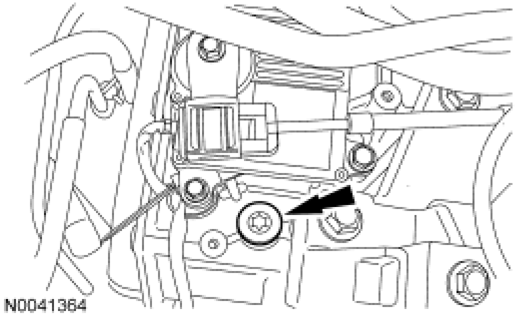


Fig. 101: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

TRANSMISSION CONTROL MODULE (TCM)

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Remove the air cleaner assembly. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 2.3L** article or **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article.
4. Disconnect the selector lever cable end.

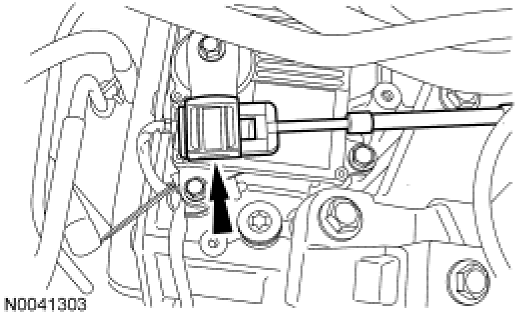


Fig. 102: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

5. Disconnect the Transmission Control Module (TCM) electrical connector.

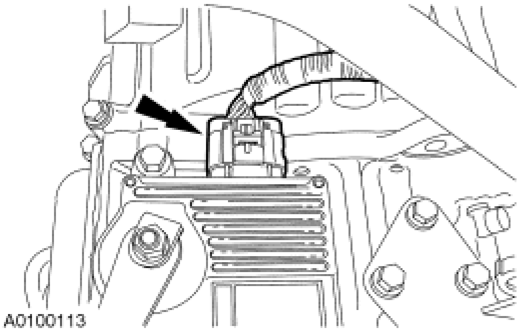


Fig. 103: Locating TCM Electrical Connector
Courtesy of FORD MOTOR CO.

6. Remove the manual control lever nut.

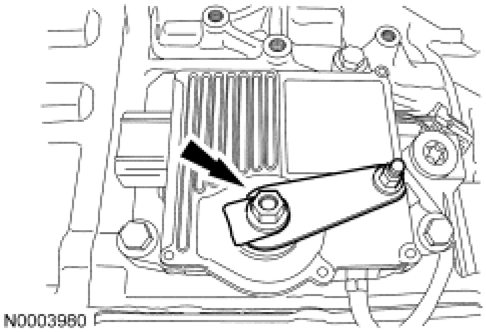


Fig. 104: Locating Manual Control Lever Nut
Courtesy of FORD MOTOR CO.

7. Remove the manual control lever.

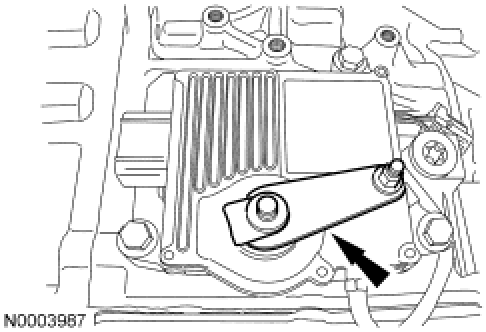


Fig. 105: Locating Manual Control Lever
Courtesy of FORD MOTOR CO.

8. Remove the bolts and remove the TCM.

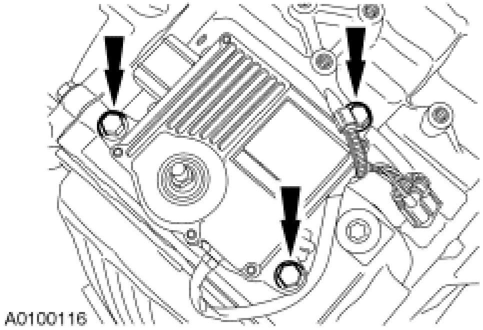


Fig. 106: Locating TCM Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Verify that the manual lever position markings are aligned. Markings should indicate that the manual lever is in the OVERDRIVE position.

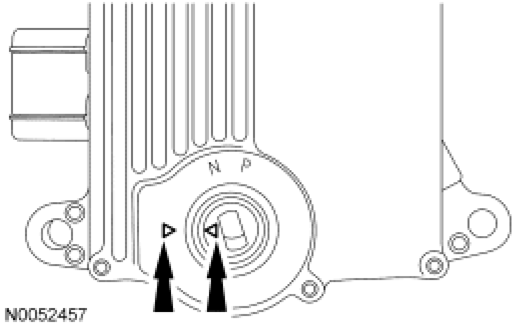


Fig. 107: Locating Manual Lever Position Markings
Courtesy of FORD MOTOR CO.

2. Install the TCM.
   - Tighten to 24 Nm (18 lb-ft).

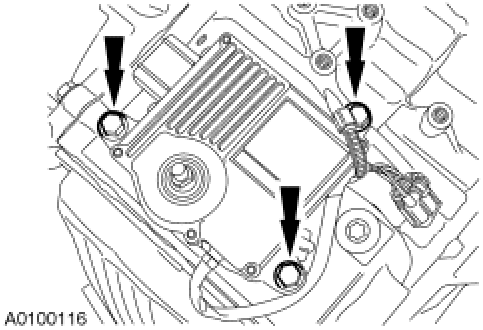


Fig. 108: Locating TCM Bolts
Courtesy of FORD MOTOR CO.

3. Install the manual control lever.

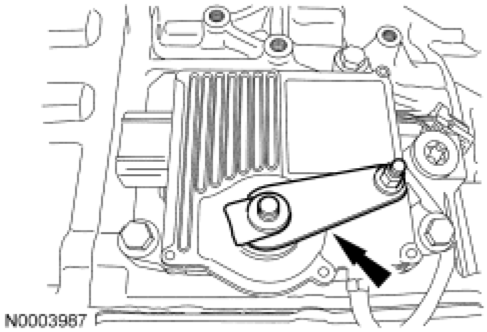


Fig. 109: Locating Manual Control Lever
Courtesy of FORD MOTOR CO.

4. Install the manual control lever nut.
   - Tighten to 12 Nm (106 lb-in).

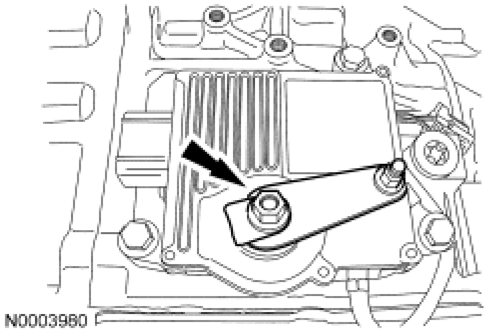


Fig. 110: Locating Manual Control Lever Nut
Courtesy of FORD MOTOR CO.

5. Connect the TCM electrical connector.

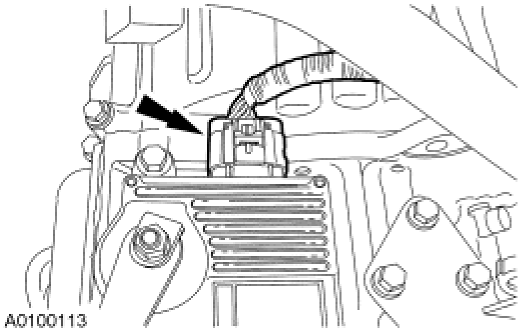


Fig. 111: Locating TCM Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: **Support the underside of the manual control lever when installing the selector lever cable or damage to the manual control lever or shaft may occur.**

6. Connect the selector lever cable end.

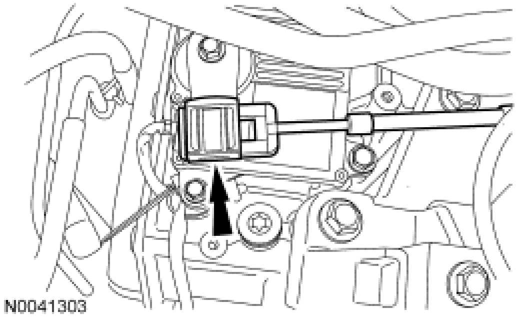
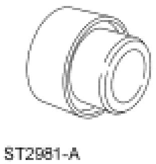
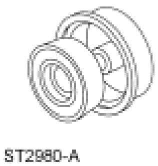
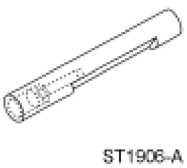


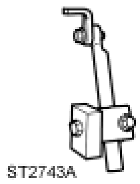
Fig. 112: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

7. Install the air cleaner assembly. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 2.3L** article or **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article.
8. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
9. Carry out the TCM initial learning procedure. For additional information, refer to **Transmission Control Module (TCM) Initial Learning**.
10. Check for correct vehicle operation.

TRANSAXLE SUPPORT INSULATOR

Special Tools

Illustration	Tool Name	Tool Number
	Lifting Bracket, Engine	303-050 (T70P-6000)
	Oil Pan Holding Fixture	303-1295
	Support Bar, Engine	303-F072

	Universal Adapter Brackets	014-0001

Material

Item	Specification
Threadlock and Sealer TA-25	WSK-M2G351-A5

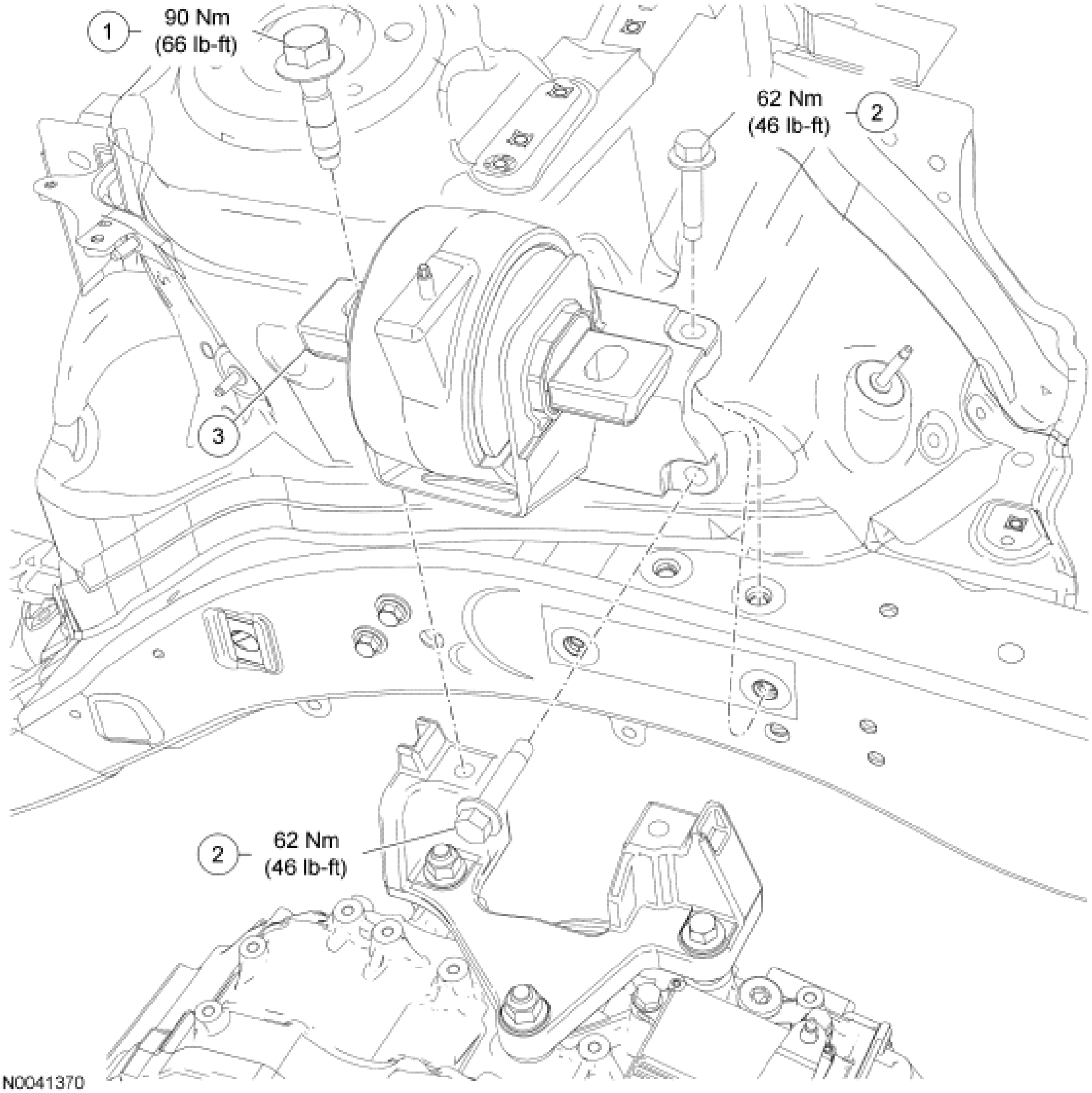


Fig. 113: Exploded View Of Transaxle Support Insulator With Torque Specifications - 3.0L Engine
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711724	Transaxle support insulator-to-bracket bolt (2 required)
2	W709234	Transaxle insulator-to-frame bolts (4 required)
3	6F020	Transaxle insulator

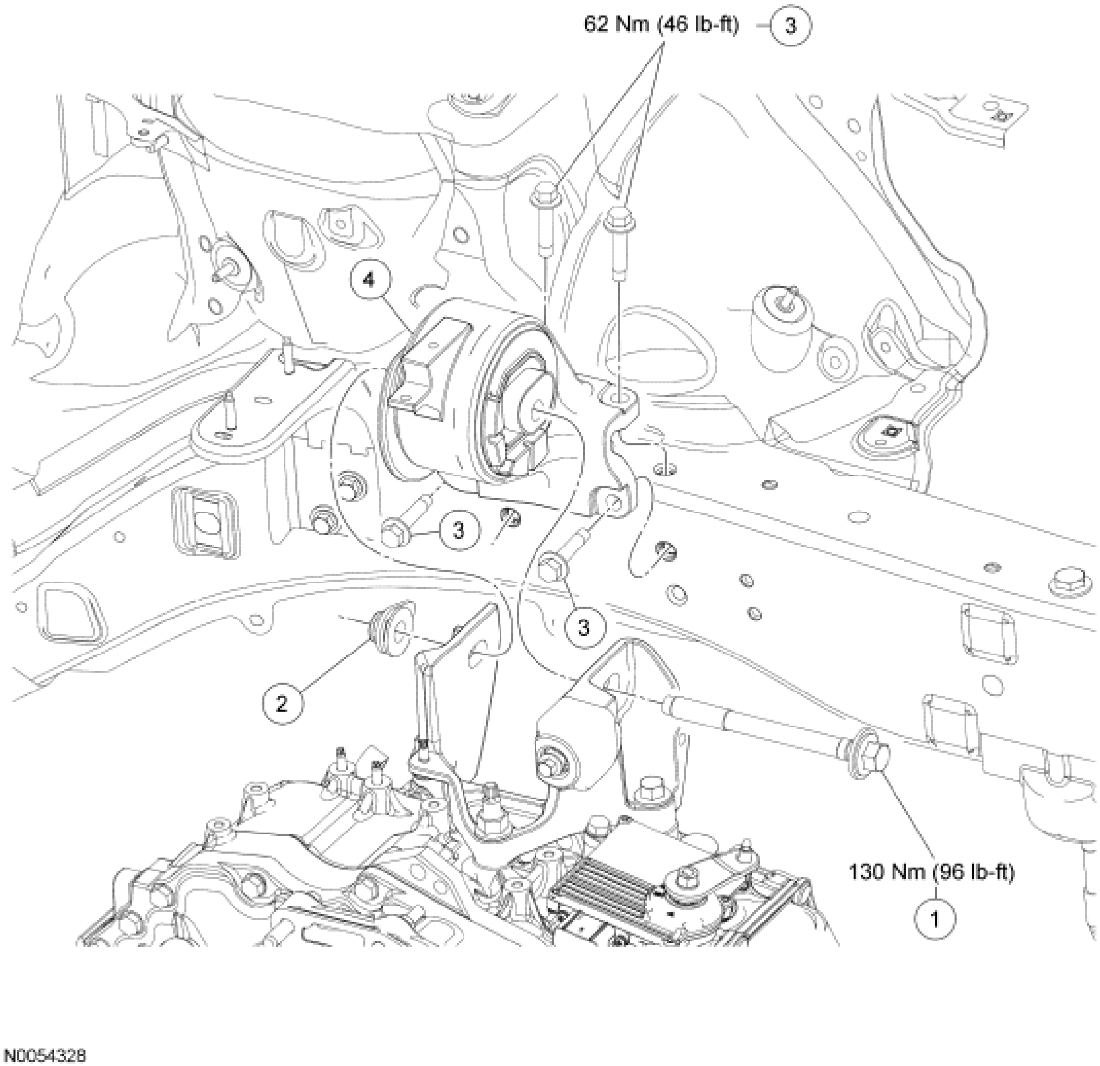


Fig. 114: Exploded View Of Transaxle Support Insulator With Torque Specifications - 3.5L Engine
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711873	Transaxle insulator through bolt
2	W711872	Transaxle insulator through bolt flagnut
3	W709234	Transaxle insulator-to-frame bolts
4	6F020	Transaxle insulator

REMOVAL

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the battery and battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Remove the 4 screws and position the LH fender splash shield aside.

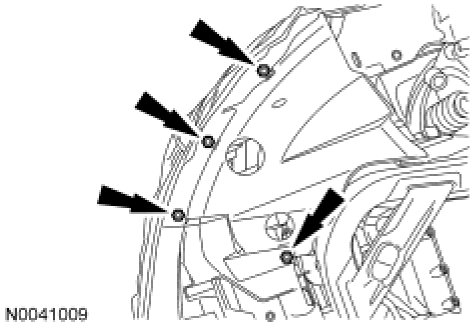


Fig. 115: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

4. Remove the 6 pin-type retainers and the LH front structure-to-subframe splash shield.

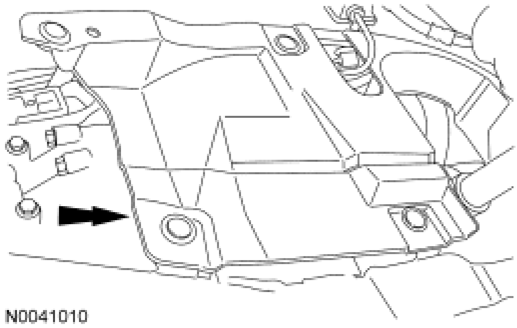


Fig. 116: Locating LH Front Structure-To-Subframe Splash Shield
Courtesy of FORD MOTOR CO.

5. Remove the lower 2 transaxle insulator-to-frame bolts.

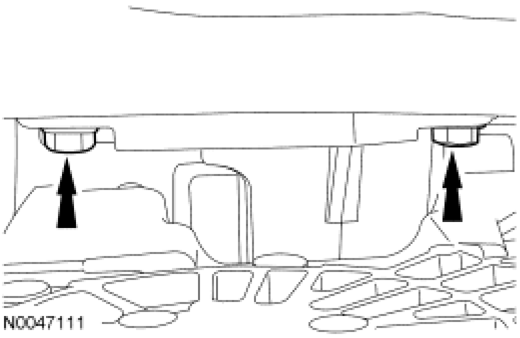


Fig. 117: Locating Bolts On Rear Transaxle Insulator
Courtesy of FORD MOTOR CO.

3.0L engine

6. Install the Engine Lifting Bracket and Universal Adapter Bracket "L" hook on the LH side of the engine.

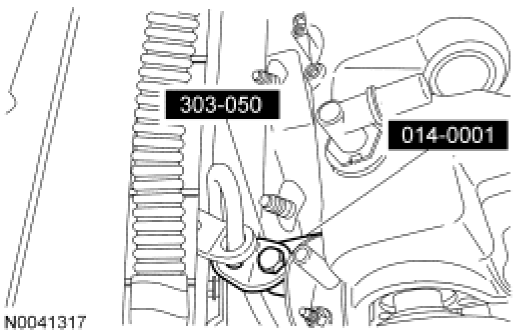


Fig. 118: Identifying Universal Lifting Brackets
Courtesy of FORD MOTOR CO.

7. Install the Engine Support Bar to support the engine.

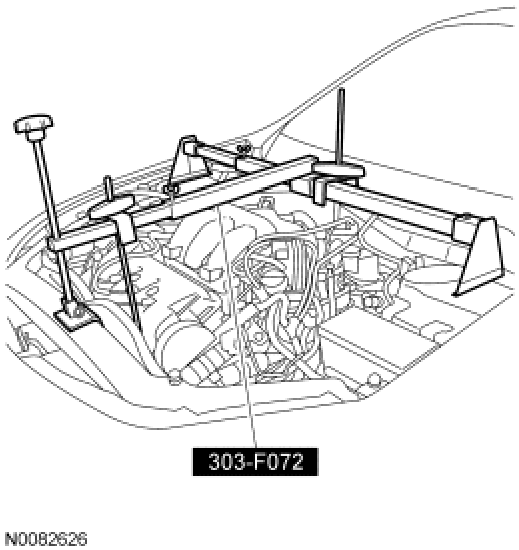


Fig. 119: Installing Engine Support Bar To Support Engine
Courtesy of FORD MOTOR CO.

8. Remove the 2 transaxle support insulator-to-bracket bolts.

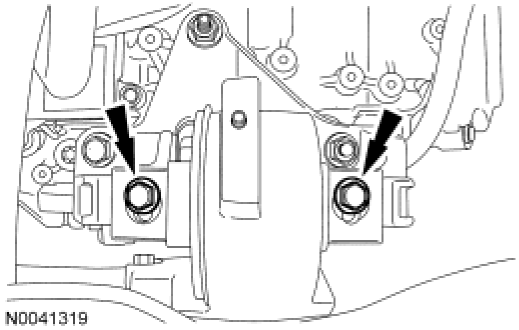


Fig. 120: Locating Transaxle Insulator Bolts
Courtesy of FORD MOTOR CO.

3.5L engine

9. Remove the exhaust Y-pipe. For additional information, refer to **EXHAUST SYSTEM** article.

NOTE: **The Oil Pan Holding Fixture must be carefully aligned to the mounting bosses on the oil pan. Failure to follow these instructions may result in damage to the oil pan.**

10. Position a floor jack and the Oil Pan Holding Fixture under the oil pan.

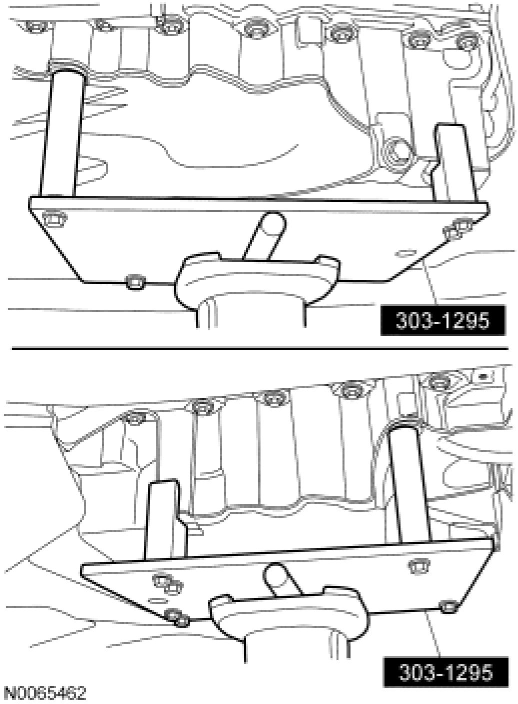


Fig. 121: Positioning Floor Jack & Special Tool (303-1295) Under Oil Pan
Courtesy of FORD MOTOR CO.

11. Remove the air cleaner. For additional information, refer to **ENGINE - 3.5L** article.
12. Remove the transaxle support insulator through bolt.

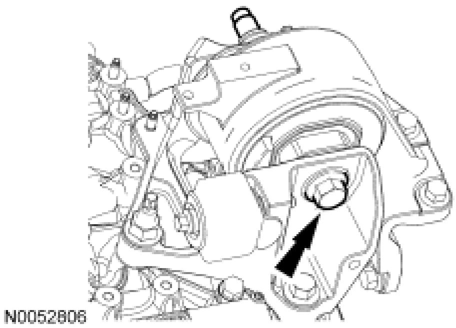


Fig. 122: Identifying Transaxle Support Insulator Through Bolt
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: 3.0L engine shown, 3.5L engine similar.

13. Remove the upper 2 transaxle insulator-to-frame bolts and remove the transaxle insulator.

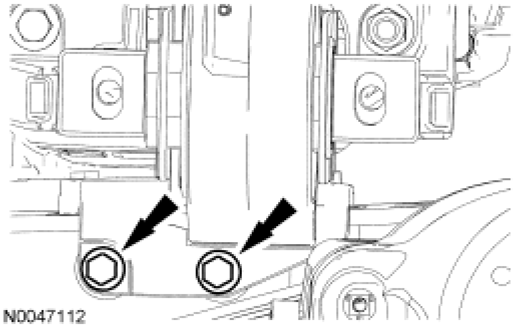


Fig. 123: Locating Upper Bolts On Rear Transaxle Insulator
Courtesy of FORD MOTOR CO.

INSTALLATION

All vehicles

1. Clean the rear transaxle support insulator bolts using a wire brush and apply new threadlock to the threads.

NOTE: **3.0L engine shown, 3.5L engine similar.**

2. Position the transaxle support insulator in place and install the upper 2 transaxle insulator-to-frame bolts.
   - Tighten to 62 Nm (46 lb-ft).

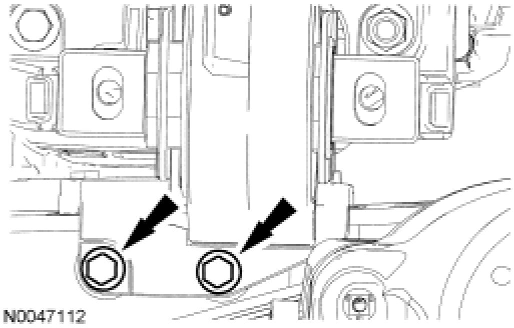


Fig. 124: Locating Upper Bolts On Rear Transaxle Insulator
Courtesy of FORD MOTOR CO.

3.5L engine

3. Install the transaxle insulator through bolt and flagnut.
   - Tighten to 130 Nm (96 lb-ft).

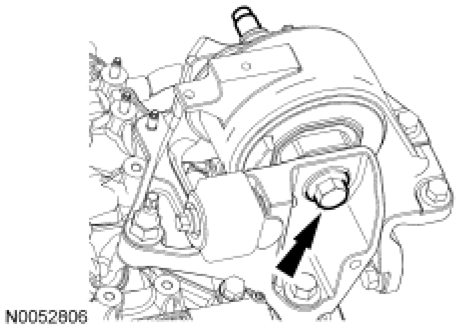


Fig. 125: Identifying Transaxle Support Insulator Through Bolt
Courtesy of FORD MOTOR CO.

4. Remove the floor jack and the Oil Pan Holding Fixture.

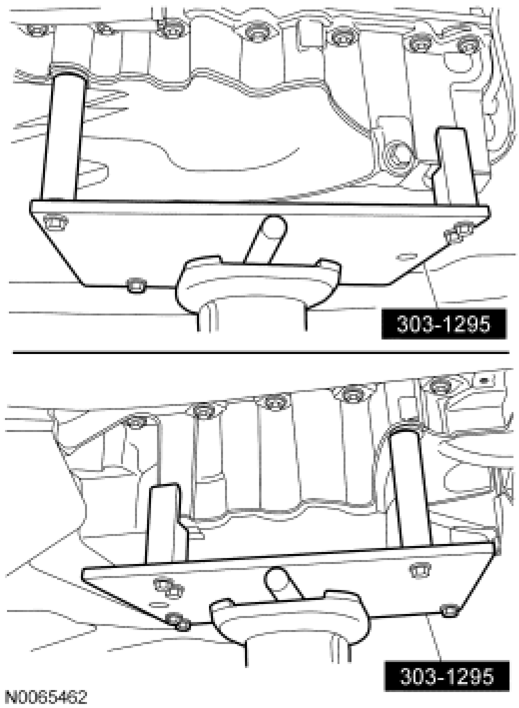


Fig. 126: Positioning Floor Jack & Special Tool (303-1295) Under Oil Pan
Courtesy of FORD MOTOR CO.

5. Install the air cleaner. For additional information, refer to **ENGINE - 3.5L** article.
6. Install the exhaust Y-pipe. For additional information, refer to **EXHAUST SYSTEM** article.

All vehicles

7. Position the transaxle support insulator in place and install the lower 2 transaxle insulator-to-frame bolts.
    - Tighten to 62 Nm (46 lb-ft).

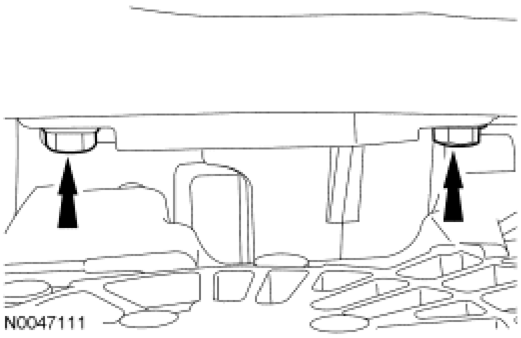


Fig. 127: Locating Bolts On Rear Transaxle Insulator
Courtesy of FORD MOTOR CO.

8. Position the LH front structure-to-subframe splash shield in place and install the 6 pin-type retainers.

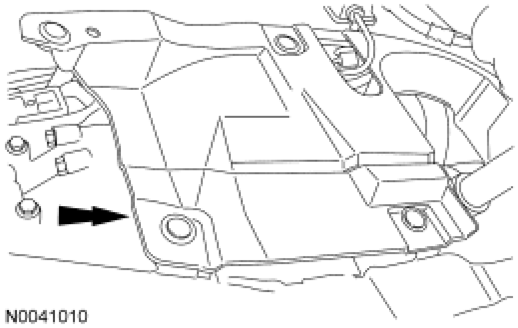


Fig. 128: Locating LH Front Structure-To-Subframe Splash Shield
Courtesy of FORD MOTOR CO.

9. Position the LH splash shield in place and install the 4 screws.

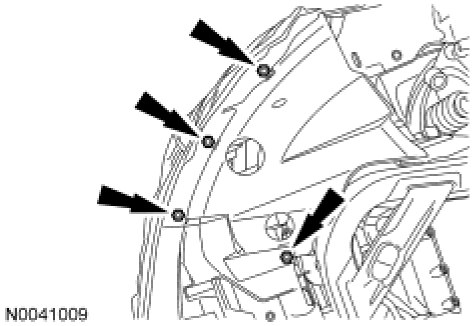


Fig. 129: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

3.0L engine

10. Install the 2 transaxle support insulator-to-bracket bolts.
    - Tighten to 90 Nm (66 lb-ft).

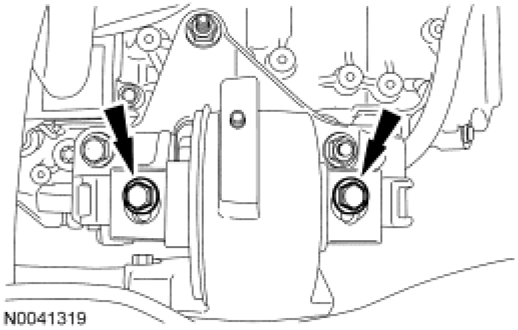


Fig. 130: Locating Transaxle Insulator Bolts
Courtesy of FORD MOTOR CO.

11. Remove the Engine Support Bar.

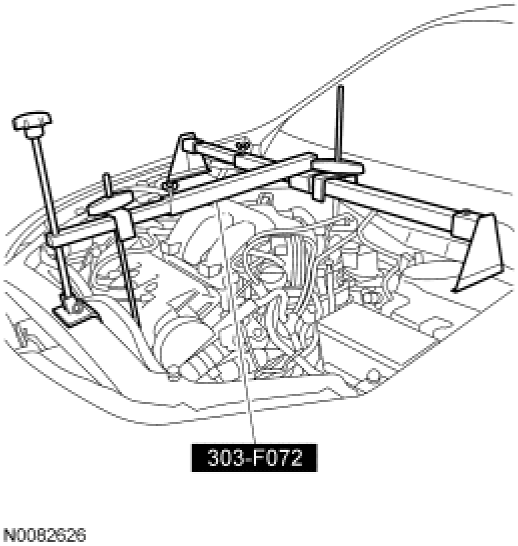


Fig. 131: Installing Engine Support Bar To Support Engine
Courtesy of FORD MOTOR CO.

12. Remove the Engine Lifting Bracket and Universal Adapter Bracket "L" hook from the LH side of the engine.

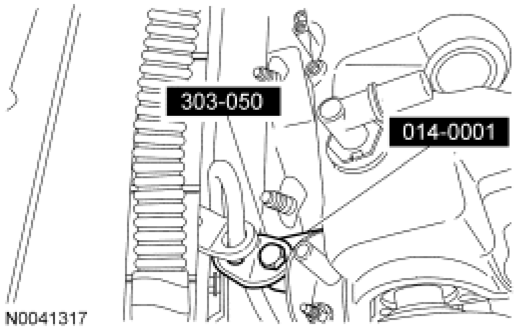


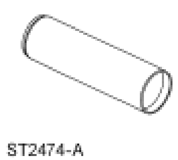
Fig. 132: Identifying Universal Lifting Brackets
Courtesy of FORD MOTOR CO.

All vehicles

13. Install the battery and battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

MANUAL CONTROL LEVER SHAFT AND SEAL

Special Tools

Illustration	Tool Name	Tool Number
	Installer, Shift Shaft Fluid Seal	307-549

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Remove the air cleaner assembly. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 2.3L** article or **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article.
4. Disconnect the selector lever cable end.

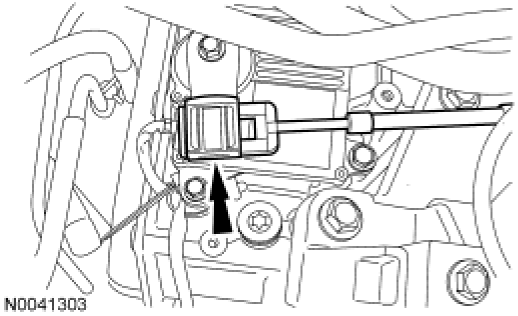


Fig. 133: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

5. Disconnect the Transmission Control Module (TCM) electrical connector.

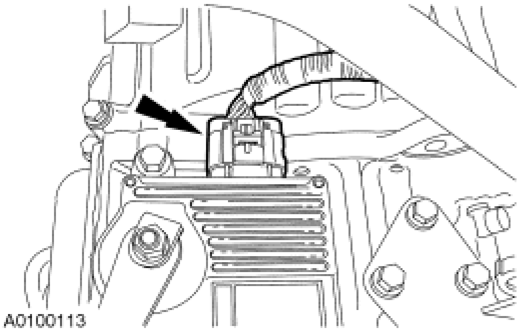


Fig. 134: Locating TCM Electrical Connector
Courtesy of FORD MOTOR CO.

6. Remove the manual control lever nut.

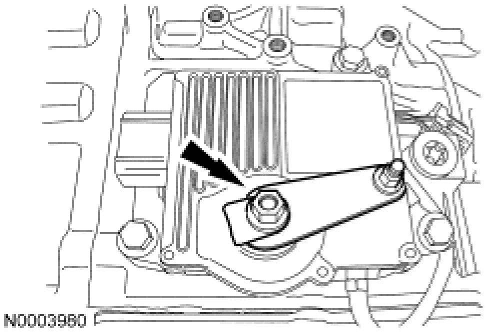
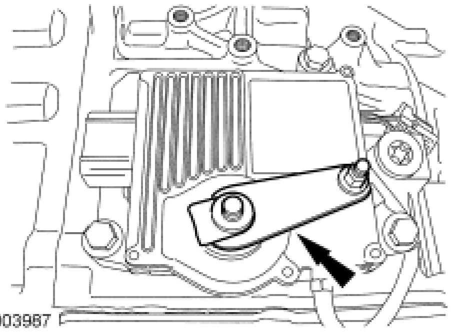


Fig. 135: Locating Manual Control Lever Nut
Courtesy of FORD MOTOR CO.

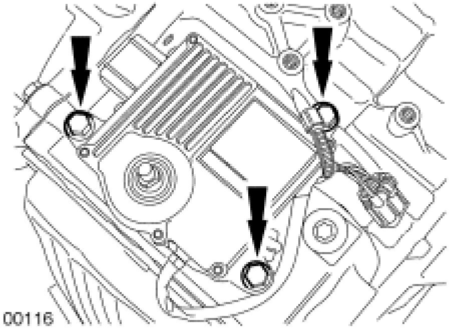
7. Remove the manual control lever.



N0003987

Fig. 136: Locating Manual Control Lever
Courtesy of FORD MOTOR CO.

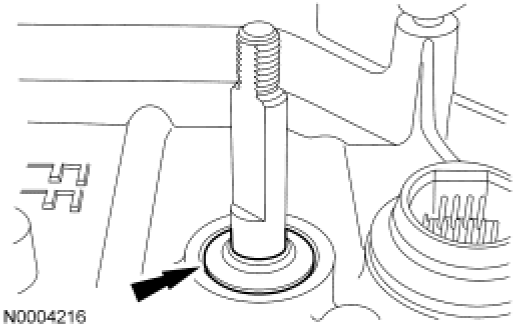
8. Remove the bolts and remove the TCM.



A0100116

Fig. 137: Locating TCM Bolts
Courtesy of FORD MOTOR CO.

9. Using a suitable pick, remove the manual control lever seal.



N0004216

Fig. 138: Locating Manual Control Lever Seal
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Using the Shift Shaft Fluid Seal Installer, install the manual control lever seal.

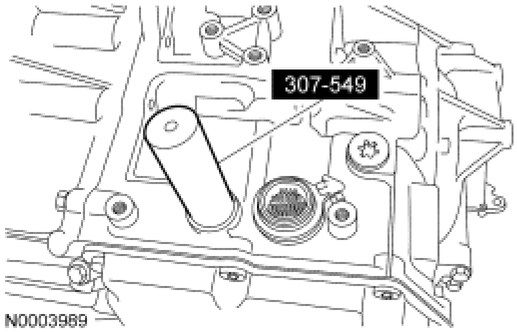


Fig. 139: Installing Manual Control Lever Seal
Courtesy of FORD MOTOR CO.

2. Verify that the manual lever position markings are aligned. Markings should indicate that the manual lever is in the OVERDRIVE position.

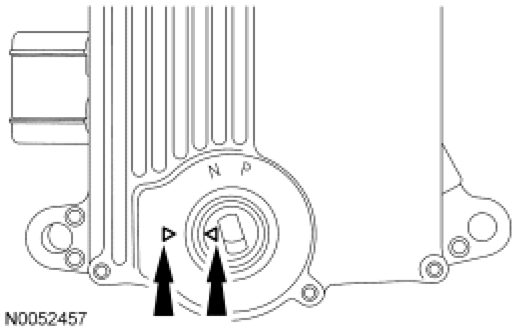


Fig. 140: Locating Manual Lever Position Markings
Courtesy of FORD MOTOR CO.

3. Install the TCM.
   - Tighten to 24 Nm (18 lb-ft).

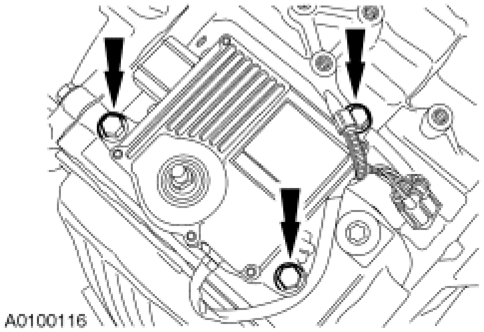


Fig. 141: Locating TCM Bolts
Courtesy of FORD MOTOR CO.

4. Install the manual control lever.

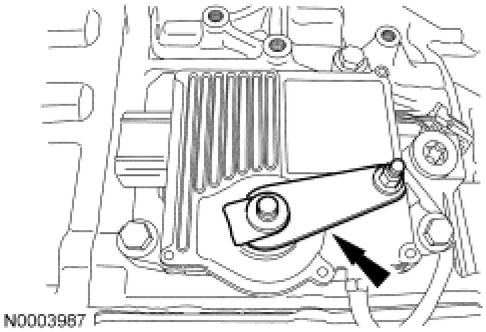


Fig. 142: Locating Manual Control Lever
Courtesy of FORD MOTOR CO.

5. Install the manual control lever nut.
    - Tighten to 12 Nm (106 lb-in).

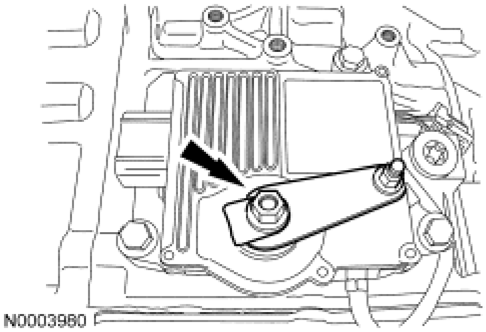


Fig. 143: Locating Manual Control Lever Nut
Courtesy of FORD MOTOR CO.

6. Connect the TCM electrical connector.

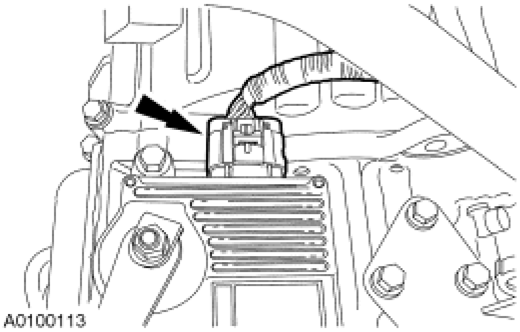


Fig. 144: Locating TCM Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: **Support the underside of the manual control lever when installing the selector lever cable or damage to the manual control lever or shaft may occur.**

7. Connect the selector lever cable end.

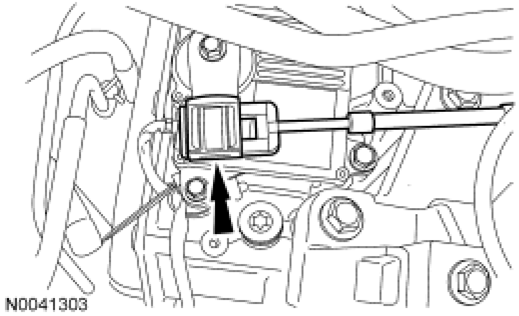


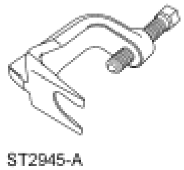
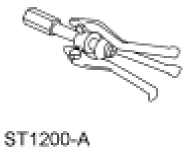
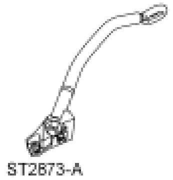
Fig. 145: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

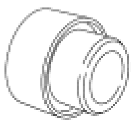
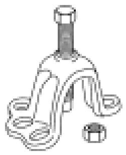
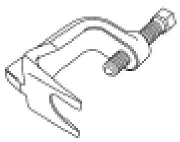
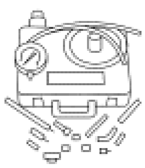
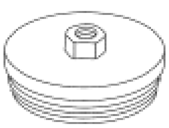
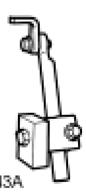
8. Install the air cleaner assembly. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 2.3L** article or **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article.
9. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
10. Check for correct vehicle operation.

REMOVAL

TRANSAXLE - 3.0L

Special Tools

Illustration	Tool Name	Tool Number
	Adapter for 204-592	204-592/1
	Bearing Cup Puller	308-047 (T77F-1102-A)
	Engine Lifting Bracket Set	303-1140

 ST2981-A	Lifting Bracket, Engine	303-050 (T70P-6000)
 ST2272-A	Remover, Front Wheel Hub	205-D070 (D93P-1175-B) or equivalent
 ST2945-A	Separator, Ball Joint	204-592
 ST1298-A	Slide Hammer	100-001 (T50T-100-A)
 ST1382-A	Socket, Exhaust Gas Oxygen Sensor	303-476 (T94P-9472-A)
 ST1602-A	Support Bar, Engine	303-F072
 ST2743A	Universal Adapter Brackets	014-0001

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the battery and battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

3. Remove the air cleaner and the outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 2.3L** article or **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article.
4. Disconnect the selector lever cable end.

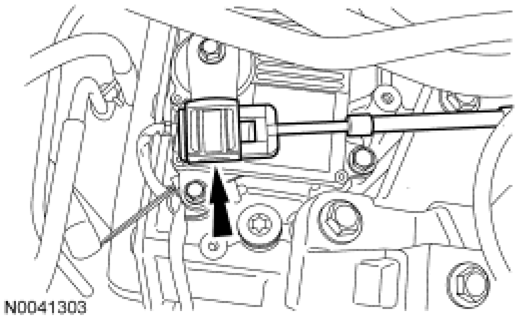


Fig. 146: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

5. Remove the 3 bolts for the selector lever cable bracket and position the cable and bracket aside.

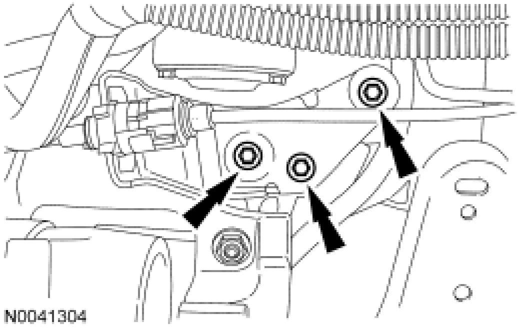


Fig. 147: Locating Transaxle Control Cable Bracket Bolts
Courtesy of FORD MOTOR CO.

6. Disconnect the wire harness from the Transmission Control Module (TCM).

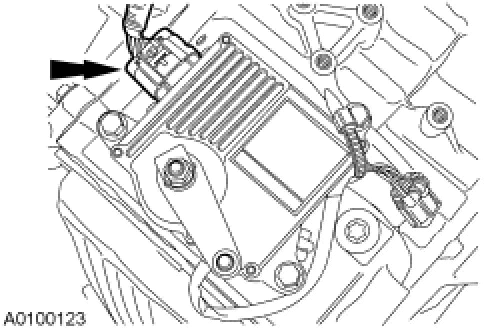


Fig. 148: Identifying Transmission Control Module Electrical Connector
Courtesy of FORD MOTOR CO.

7. Remove the 2 ground strap bolts and position aside the ground straps.

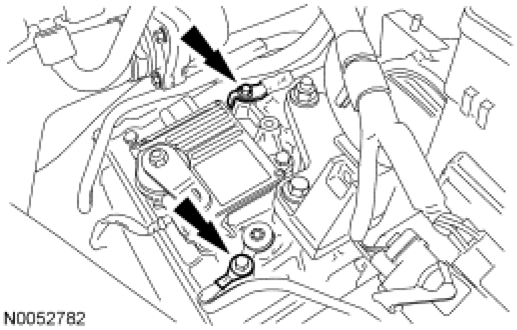


Fig. 149: Identifying Ground Straps & Ground Strap Bolts
Courtesy of FORD MOTOR CO.

8. Remove the electrical terminal cover for the starter motor electrical connectors.

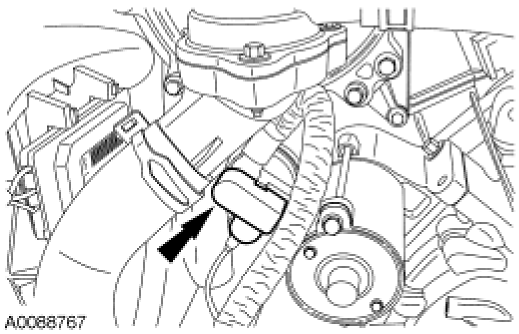


Fig. 150: Identifying Electrical Cover For Starter Motor Electrical Connectors
Courtesy of FORD MOTOR CO.

9. Remove the starter terminals.

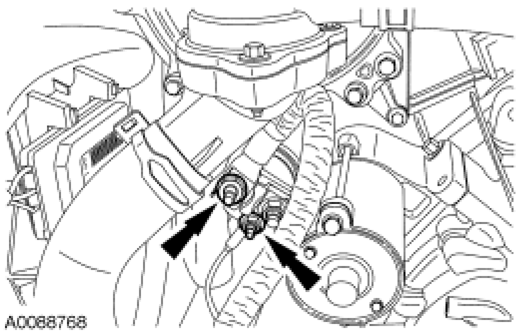


Fig. 151: Identifying Starter Motor Electrical Connectors
Courtesy of FORD MOTOR CO.

10. Remove the 2 bolts and the starter.

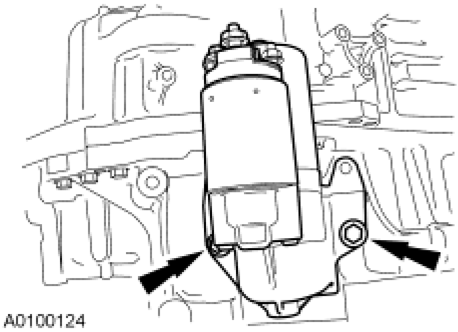


Fig. 152: Locating Starter Bolts
Courtesy of FORD MOTOR CO.

11. Remove the 3 upper torque converter housing bolts.

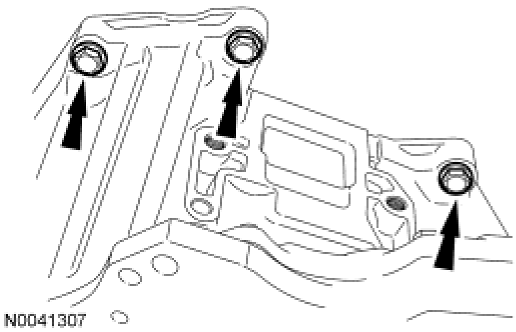


Fig. 153: Locating Upper Torque Converter Housing Bolts
Courtesy of FORD MOTOR CO.

12. Disconnect the EGR valve electrical connector.

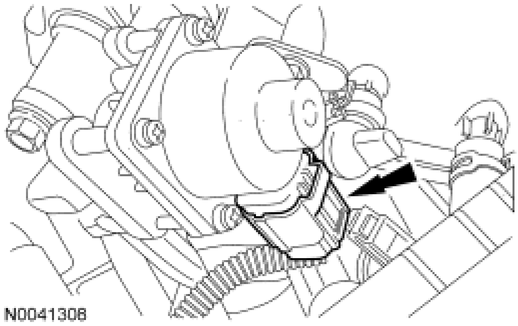


Fig. 154: Locating EGR Valve Electrical Connector
Courtesy of FORD MOTOR CO.

13. Disconnect the EGR tube nut from the valve.

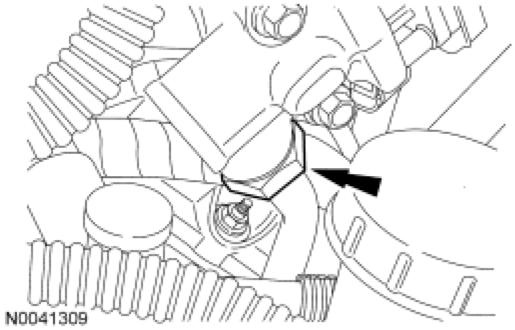


Fig. 155: Locating EGR Tube Nut
Courtesy of FORD MOTOR CO.

14. Remove the 2 bolts and the EGR valve. Discard the gasket.

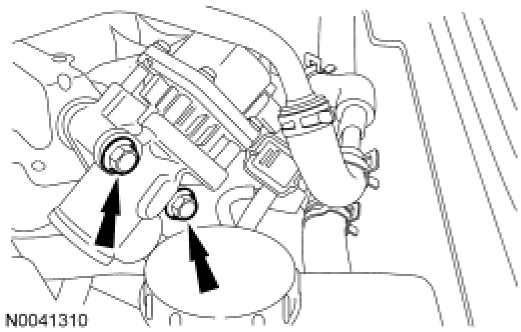


Fig. 156: Locating EGR Valve And Bolts
Courtesy of FORD MOTOR CO.

15. Remove the bolt from the power steering line bracket and position it aside.

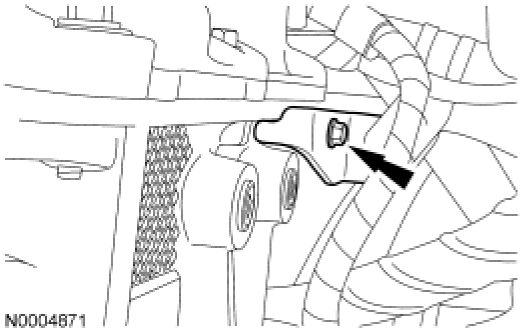


Fig. 157: Locating Bracket For Power Steering Hose
Courtesy of FORD MOTOR CO.

16. Remove the 4 screws and position the RH fender splash shield aside.

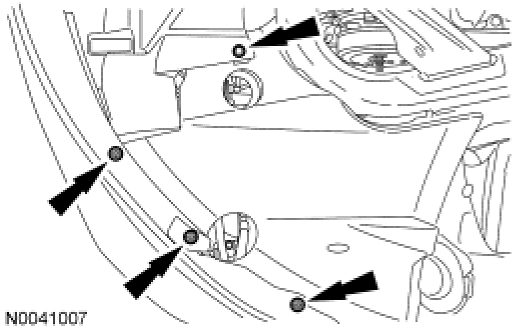


Fig. 158: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

17. Remove the 6 pin-type retainers and remove the RH front structure to subframe splash shield.

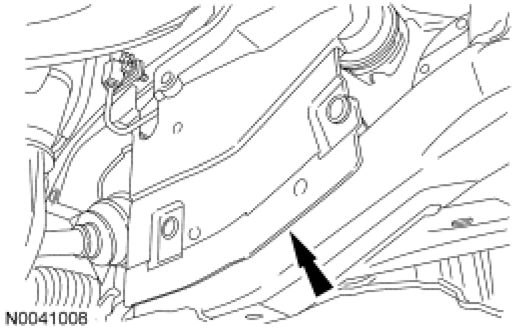


Fig. 159: Locating RH Front Structure-To-Subframe Splash Shield
Courtesy of FORD MOTOR CO.

18. Remove the 4 screws and position the LH fender splash shield aside.

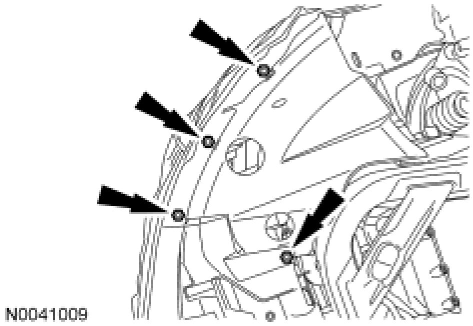


Fig. 160: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

19. Remove the pin-type retainers and remove the LH front structure to subframe splash shield.

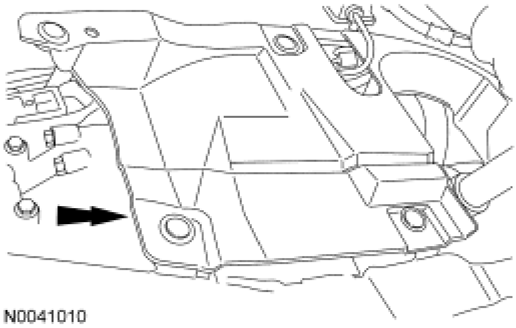


Fig. 161: Locating LH Front Structure-To-Subframe Splash Shield
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

20. Remove the 2 nuts and separate the sway bar links from the struts.

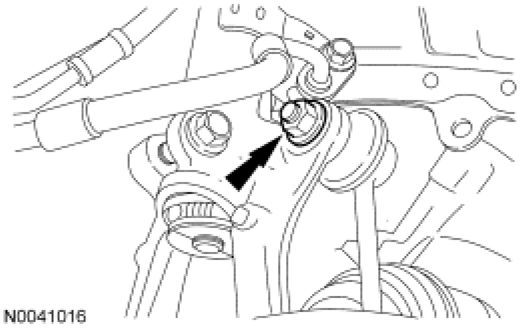


Fig. 162: Locating Sway Bar Links Nut
Courtesy of FORD MOTOR CO.

21. If a transaxle exchange or overhaul is required, the transmission fluid must be drained.
    - Remove the transmission fluid drain plug and allow the transmission fluid to drain.

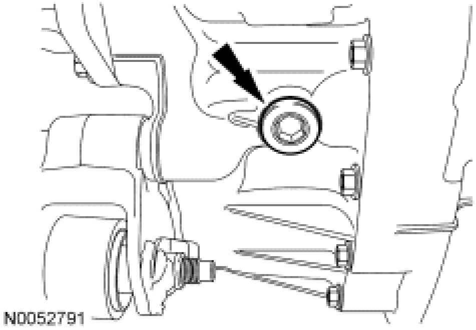


Fig. 163: Identifying Transmission Drain Plug
Courtesy of FORD MOTOR CO.

22. If removed, install the transmission fluid drain plug.

- Tighten to 47 Nm (35 lb-ft).

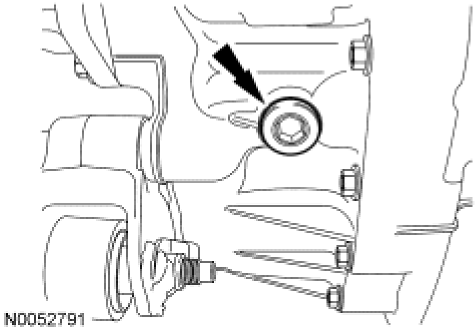


Fig. 164: Identifying Transmission Drain Plug
Courtesy of FORD MOTOR CO.

23. Remove the LH halfshaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.

All-Wheel Drive (AWD) vehicles

24. Remove and discard the front wheel hub nut.

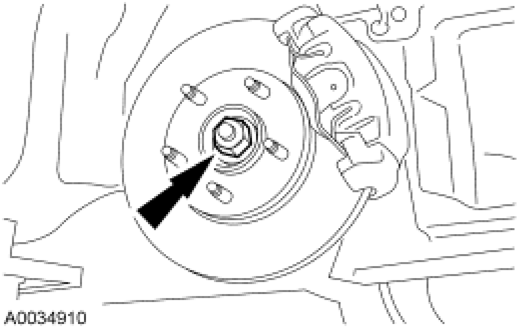


Fig. 165: Locating Front Wheel Hub Nut
Courtesy of FORD MOTOR CO.

All vehicles

25. Remove the RH lower control arm nuts.

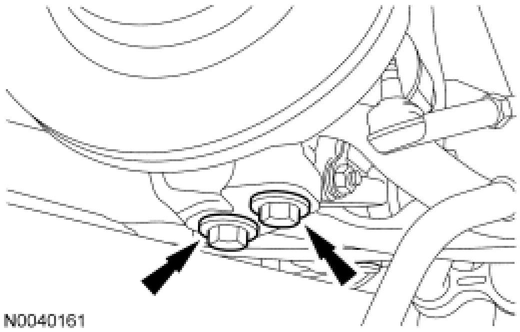


Fig. 166: Locating Front And Rear Lower Control Arm Nuts
Courtesy of FORD MOTOR CO.

NOTE:	**When the lower ball joint is separated from the wheel knuckle, the lower arm may strike the outer constant velocity (CV) joint boot with enough force to damage the boot clamp. This will result in a loss of grease from the outer CV joint. Place a block of wood, or similar item, between the lower arm and the outer CV joint to prevent the lower arm from striking the outer CV joint.**

NOTE:	**Once pressure is applied to the ball joint with the Ball Joint Separator and Adapter, it may be necessary to tap the wheel knuckle at the ball joint area to separate the ball joint from the wheel knuckle.**

26. Using the Ball Joint Separator and Adapter, separate the 2 lower ball joints from the wheel knuckle and remove the wheel knuckle.

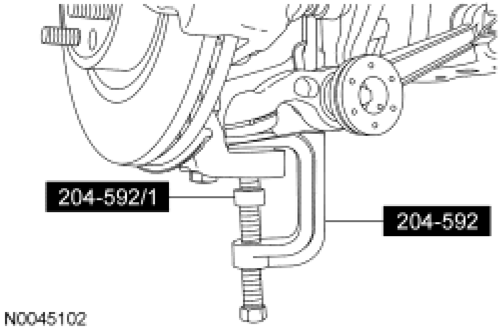


Fig. 167: Identifying Special Tool 204-592/1 And 204-592
Courtesy of FORD MOTOR CO.

27. Remove the bolt connecting the RH damper fork to the lower control arm.

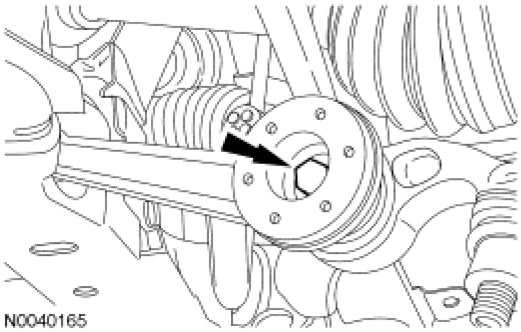


Fig. 168: Locating Damper Fork Bolt
Courtesy of FORD MOTOR CO.

NOTE:	**Front Wheel Drive (FWD) shown, All-Wheel Drive (AWD) similar.**

28. Remove the 2 Y-pipe bolts and nuts.

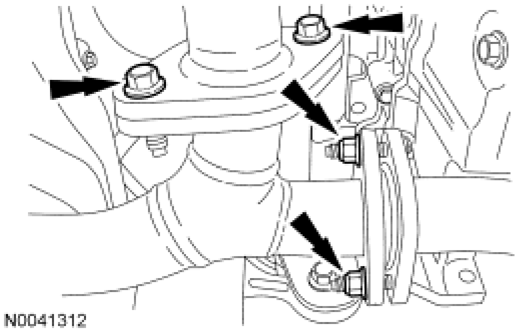


Fig. 169: Locating Y-Pipe Bolts And Nuts
Courtesy of FORD MOTOR CO.

NOTE: FWD shown, AWD similar.

29. Remove the flexpipe nuts and the Y-pipe assembly.

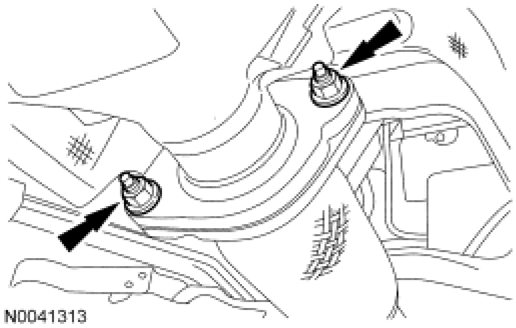


Fig. 170: Locating Flex Pipe Nuts
Courtesy of FORD MOTOR CO.

30. If equipped, remove the 2 bolts and the roll restrictor heat shield.

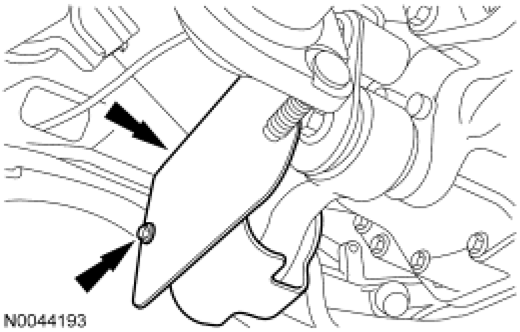


Fig. 171: Locating Heat Shield And Bolts
Courtesy of FORD MOTOR CO.

NOTE: FWD shown, AWD similar.

31. Remove the 2 bolts from the engine roll restrictor bracket.

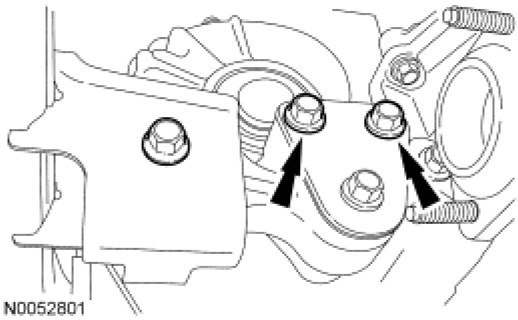


Fig. 172: Locating Engine Roll Restrictor Bracket Bolts
Courtesy of FORD MOTOR CO.

32. Remove the bolts and position the power steering cooler tube aside.

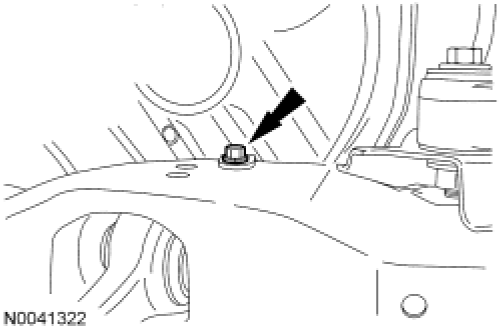


Fig. 173: Locating Power Steering Cooler Tube Bolts
Courtesy of FORD MOTOR CO.

33. Remove the 3 steering gear bolts and position the steering gear aside with mechanic's wire.

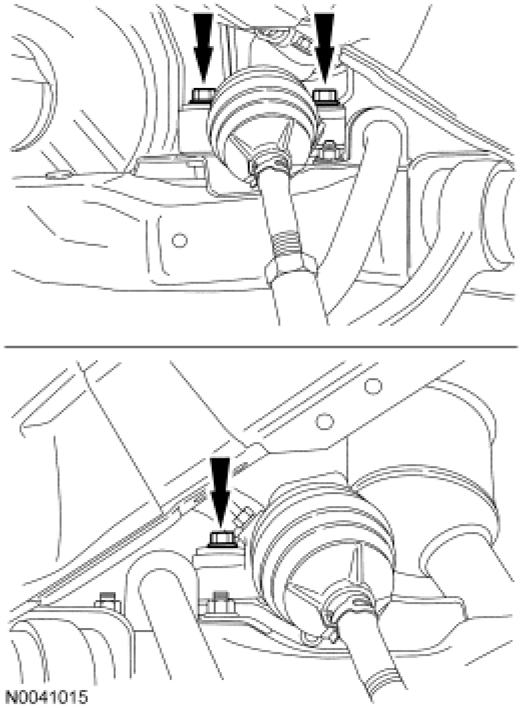


Fig. 174: Locating Steering Gear Bolts
Courtesy of FORD MOTOR CO.

34. Position a suitable drivetrain lift table under the subframe.
35. Remove the 2 rear subframe nuts.

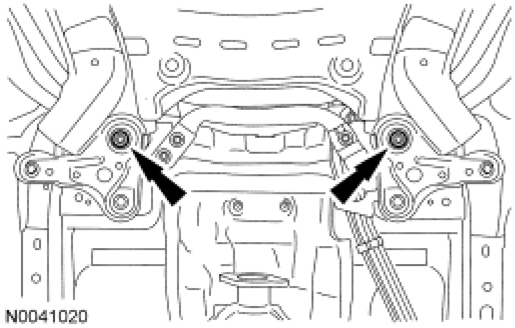


Fig. 175: Locating Rear Subframe Nuts
Courtesy of FORD MOTOR CO.

36. Remove the 4 bolts and the 2 subframe support brackets.

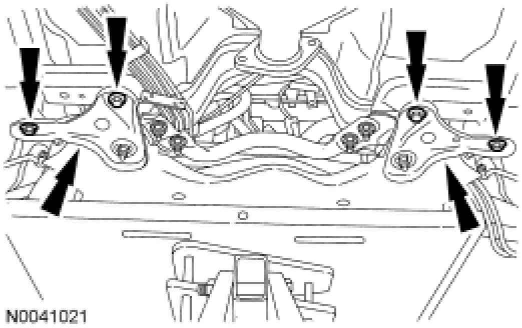


Fig. 176: Locating Subframe Support Brackets And Bolts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

37. Remove the 2 front subframe nuts and remove the subframe.

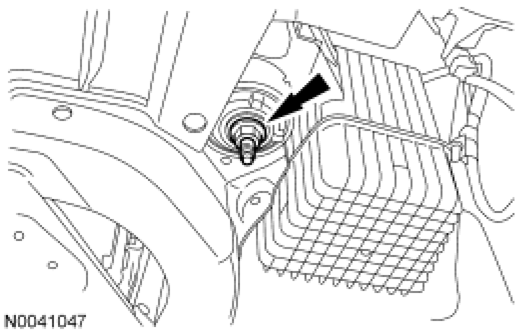


Fig. 177: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

NOTE: FWD shown, AWD similar.

38. Loosen the EGR tube nut at the RH exhaust manifold and remove the EGR tube.

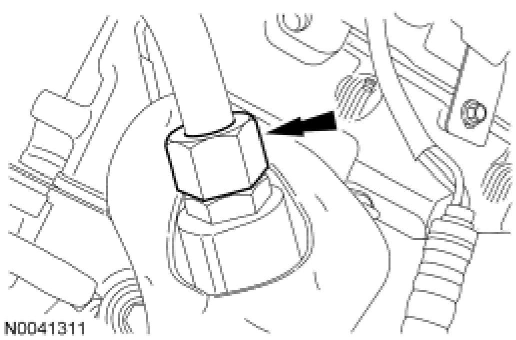


Fig. 178: Locating EGR Tube Nut At RH Exhaust Manifold
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

39. Remove the 2 bolts and the RH exhaust manifold heat shield.

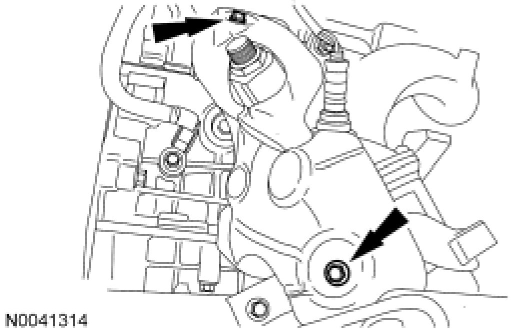


Fig. 179: Locating RH Exhaust Manifold Heat Shield And Bolts
Courtesy of FORD MOTOR CO.

40. Remove the 2 bolts and the catalytic converter band clamp.

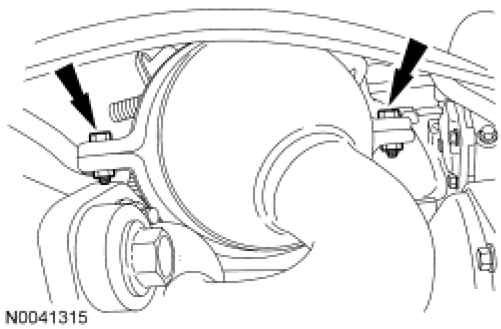


Fig. 180: Locating Catalytic Converter Band Clamp And Bolts
Courtesy of FORD MOTOR CO.

41. Remove the 2 bolts and the catalytic converter-to-engine block bracket.

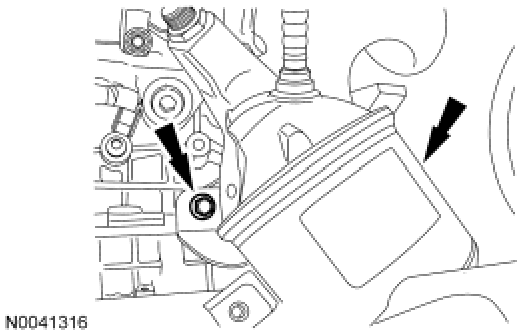


Fig. 181: Locating Catalytic Converter-To-Engine Block Bracket And Bolts
Courtesy of FORD MOTOR CO.

42. Disconnect the Heated Oxygen Sensor (HO2S) electrical connector from the RH halfshaft bearing

support bracket.

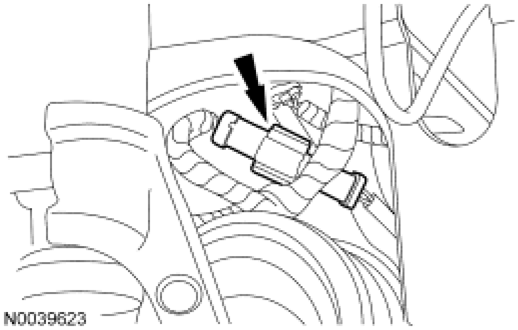


Fig. 182: Locating Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

43. Remove the bolt retaining the brake caliper hose.

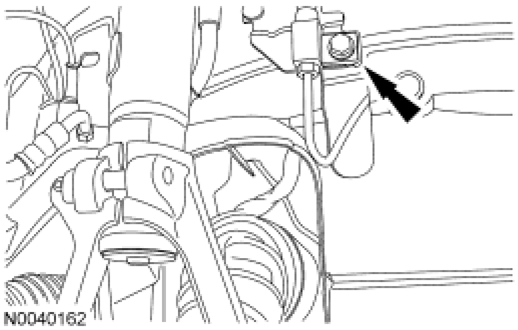


Fig. 183: Locating Brake Caliper Hose Bolt
Courtesy of FORD MOTOR CO.

44. Remove the 2 bolts and remove the RH halfshaft from the transaxle and position it aside with mechanic's wire.

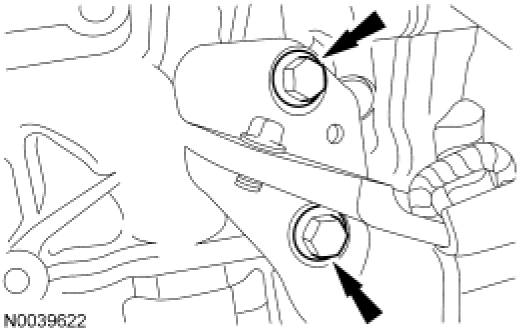


Fig. 184: Locating RH Halfshaft Carrier Bearing Bracket Bolts
Courtesy of FORD MOTOR CO.

AWD vehicles

45. Using the Front Wheel Hub Remover, separate the halfshaft from the wheel hub.

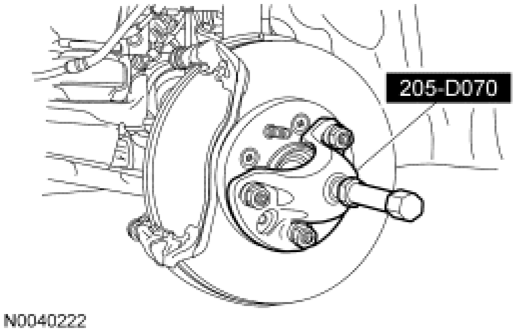


Fig. 185: Separating Halfshaft From Wheel Hub Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

46. Remove the 2 bolts and the RH halfshaft.

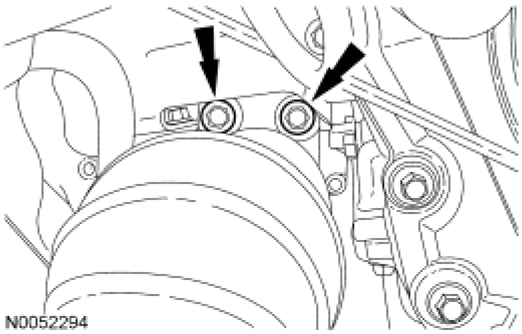


Fig. 186: Locating RH Halfshaft Bearing Support Bracket Bolts
Courtesy of FORD MOTOR CO.

47. Index the driveshaft, remove the 4 bolts from the driveshaft and position the driveshaft aside.

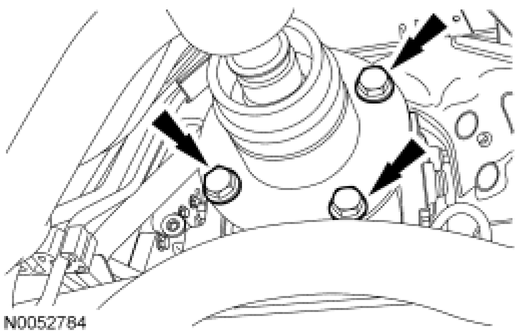


Fig. 187: Identifying Drive Shaft Bolts
Courtesy of FORD MOTOR CO.

48. Disconnect the RH catalyst monitor sensor electrical connector and detach the wiring retainer.

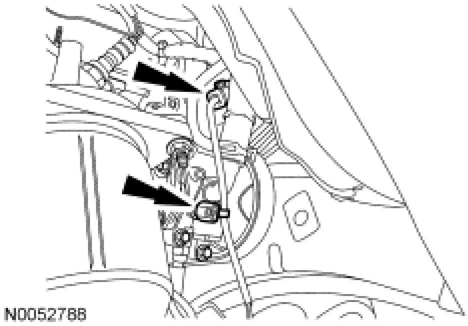


Fig. 188: Locating RH Catalyst Monitor Sensor Electrical Connector & Wiring Retainer
Courtesy of FORD MOTOR CO.

49. Using the Exhaust Gas Oxygen Sensor Socket, remove the RH catalyst monitor sensor.

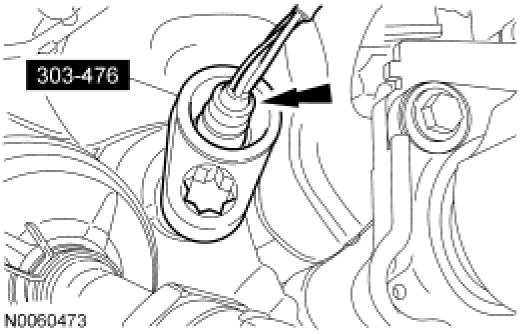


Fig. 189: Identifying RH Catalyst Monitor Sensor & Special Tool (303-476)
Courtesy of FORD MOTOR CO.

50. Disconnect the RH HO2S electrical connector.

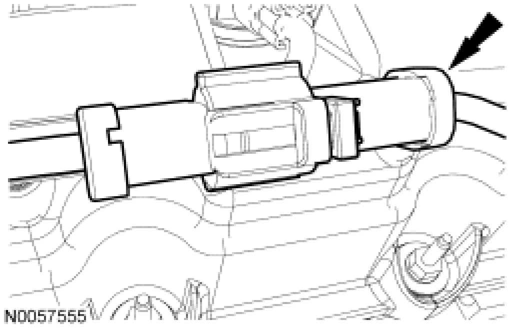


Fig. 190: Identifying RH HO2S Electrical Connector
Courtesy of FORD MOTOR CO.

51. Using the Exhaust Gas Oxygen Sensor Socket, remove the RH HO2S.

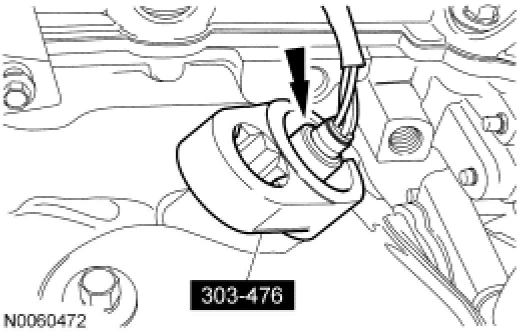


Fig. 191: Identifying RH HO2S & Special Tool (303-476)
Courtesy of FORD MOTOR CO.

52. Remove the 6 bolts and the RH exhaust heat shield.

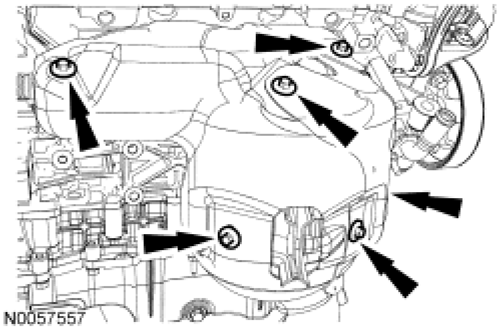


Fig. 192: Locating RH Exhaust Heat Shield Bolts
Courtesy of FORD MOTOR CO.

53. Remove the 3 nuts and the catalytic converter band clamp RH half.

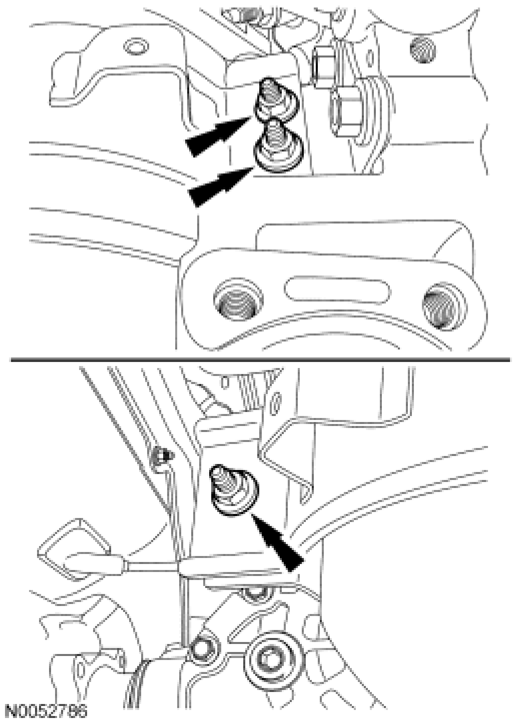


Fig. 193: Locating RH Exhaust Heat Shield Bracket Nuts - Inboard Half
Courtesy of FORD MOTOR CO.

54. Remove the 2 bolts and the catalytic converter band clamp LH half.

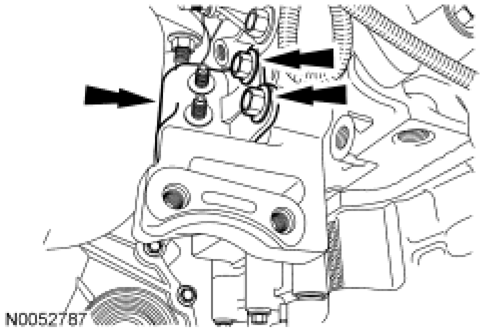


Fig. 194: Locating Catalytic Converter Band Clamp LH Half Nuts
Courtesy of FORD MOTOR CO.

55. Remove the nuts and the RH catalytic converter.

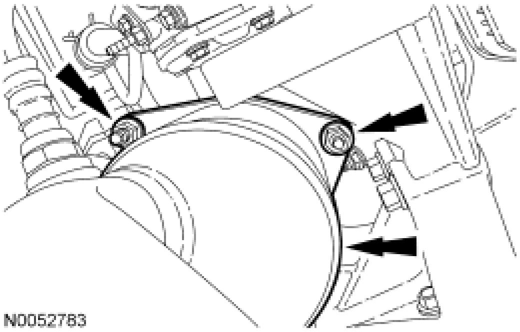


Fig. 195: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

56. Remove the 5 bolts and the Power Transfer Unit (PTU) support bracket.

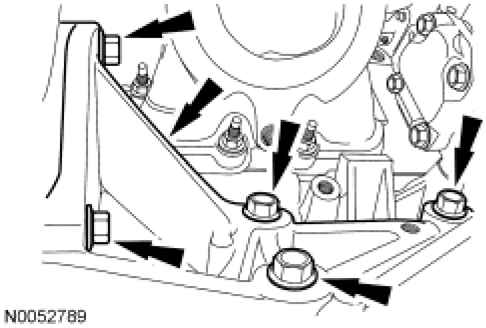


Fig. 196: Identifying PTU Support Bracket Bolts
Courtesy of FORD MOTOR CO.

NOTE: **A new halfshaft seal must be installed anytime the RH halfshaft is removed.**

NOTE: **The seal deflector will be damaged during removal. Be careful not to damage the cover seal directly behind the seal deflector.**

57. Remove the seal deflector.

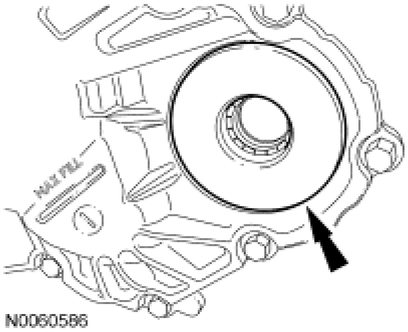


Fig. 197: Identifying Seal Deflector

Courtesy of FORD MOTOR CO.

58. Using the Bearing Cup Puller and Slide Hammer, remove the halfshaft seal from the PTU.

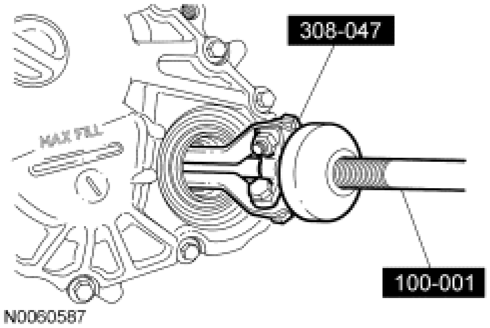


Fig. 198: Removing Intermediate Shaft Seal Using Special Tools (100-001) & (308-047)
Courtesy of FORD MOTOR CO.

59. Remove the 5 bolts and the PTU.

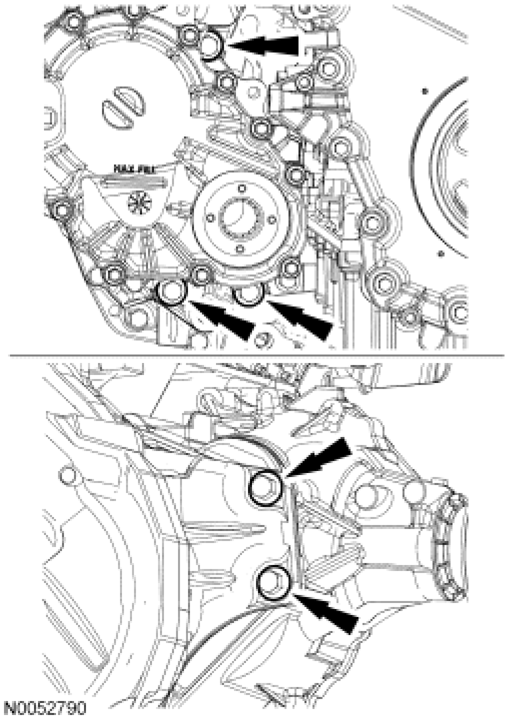


Fig. 199: Locating PTU Bolts
Courtesy of FORD MOTOR CO.

All vehicles

NOTE:	**When installing the Engine Lifting Bracket Set, it will be easier to loosely install the upper bolt first, then install the lower bolt.**

60. Install the lower half of the Engine Lifting Bracket Set.

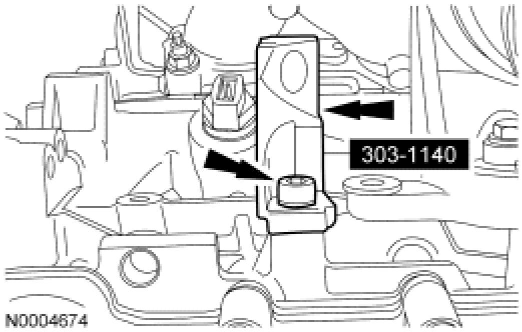


Fig. 200: Identifying Lower Half Of Lifting Hook
Courtesy of FORD MOTOR CO.

61. Install the upper half of the Engine Lifting Bracket Set.

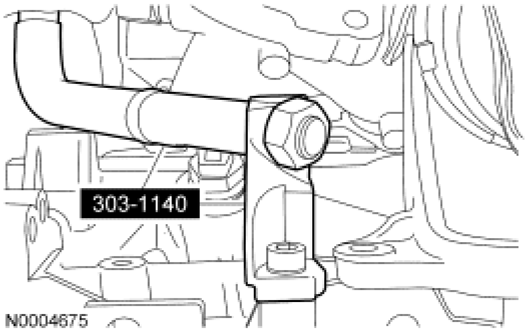


Fig. 201: Identifying Upper Half Of Lifting Hook
Courtesy of FORD MOTOR CO.

62. Install the Engine Lifting Bracket and Universal Adapter Bracket "L" hook on the LH side of the engine.

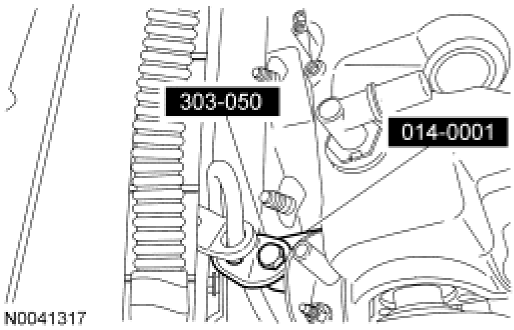


Fig. 202: Identifying Universal Lifting Brackets
Courtesy of FORD MOTOR CO.

63. Install the Engine Support Bar to support the engine.

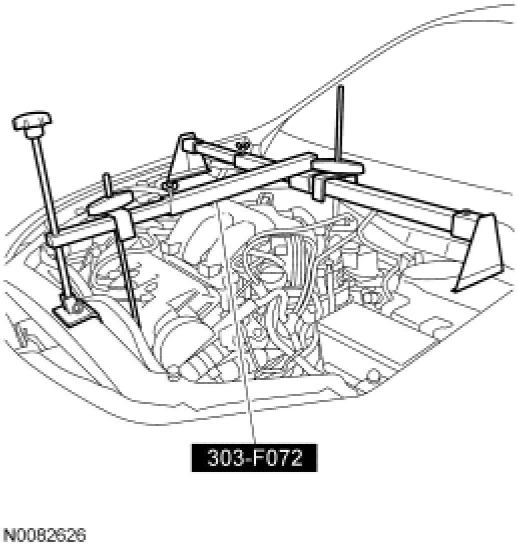


Fig. 203: Installing Engine Support Bar To Support Engine
Courtesy of FORD MOTOR CO.

64. Remove the 2 bolts from the transmission insulator.

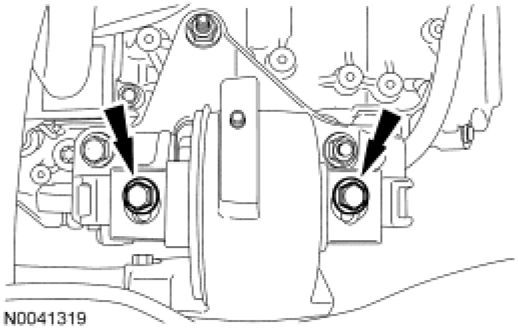


Fig. 204: Locating Transaxle Insulator Bolts
Courtesy of FORD MOTOR CO.

65. Lower the transaxle and remove the 2 nuts and the bolt and remove the transaxle support insulator bracket.

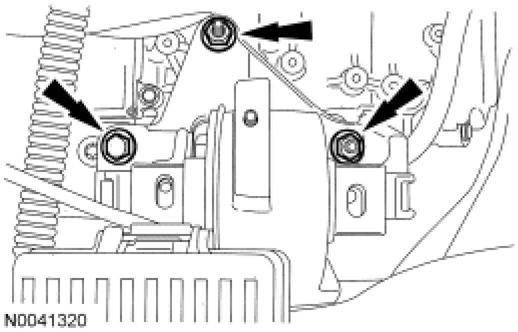


Fig. 205: Locating Transaxle Insulator Bracket Nuts And Bolt
Courtesy of FORD MOTOR CO.

66. Remove the HO2S bracket bolt and disconnect the wiring harness fastener.

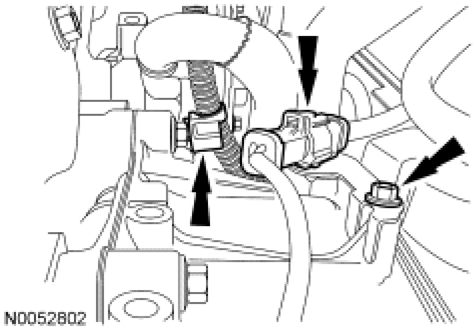


Fig. 206: Identifying Heated Oxygen Sensor (HO2S) Bracket & Stud Bolt
Courtesy of FORD MOTOR CO.

67. Remove the inspection cover.

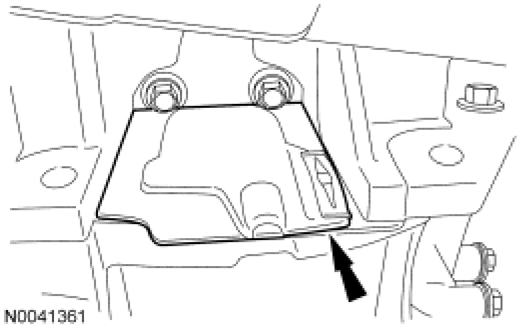


Fig. 207: Identifying Inspection Cover
Courtesy of FORD MOTOR CO.

68. Remove and discard the 3 torque converter nuts.

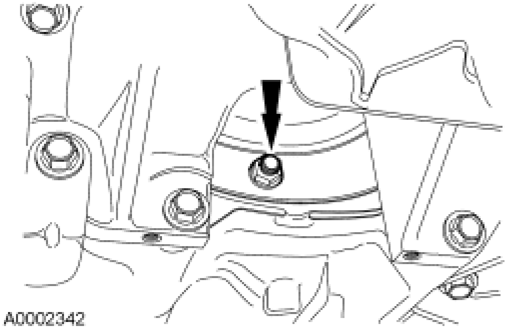


Fig. 208: Locating Torque Converter Nuts
Courtesy of FORD MOTOR CO.

69. Disconnect the transmission fluid cooler hoses.

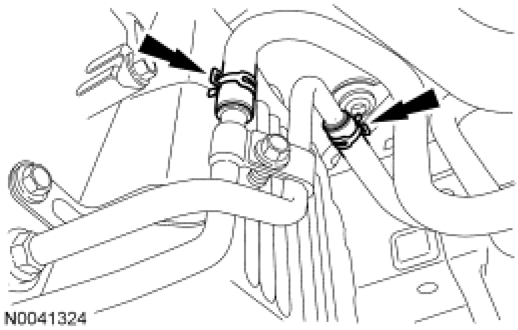


Fig. 209: Locating Transmission Fluid Cooler Hoses
Courtesy of FORD MOTOR CO.

70. Position a suitable high-lift transmission jack under the transaxle.
71. Remove the 5 torque converter housing bolts and remove the transmission.

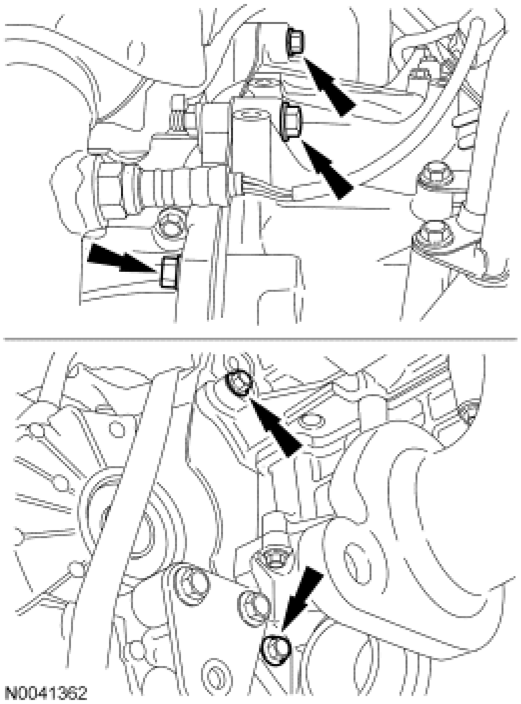
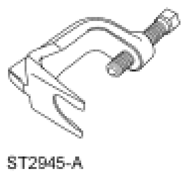
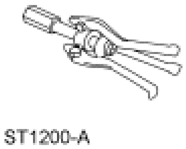


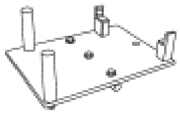
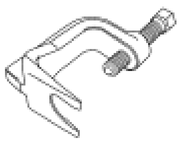
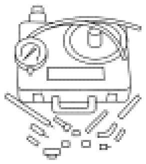
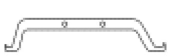
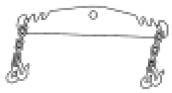
Fig. 210: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

72. If installing a new transaxle, the transmission fluid cooler will need to be backflushed and cleaned. Carry out transmission fluid cooler backflushing and cleaning. For additional information, refer to **Transmission Fluid Cooler - Backflushing and Cleaning**.

TRANSAXLE - 3.5L

Special Tools

Illustration	Tool Name	Tool Number
	Adapter for 204-592	204-592/1
	Bearing Cup Puller	308-047 (T77F-1102-A)
	Engine Lifting Bracket	303-1245

 ST3034-A		
 ST2272-A	Remover, Front Wheel Hub	205-D070 (D93P-1175-B) or equivalent
 ST2945-A	Separator, Ball Joint	204-592
 ST1298-A	Slide Hammer	100-001 (T50T-100-A)
 ST2977-A	Spreader Bar	303-1246
 ST1602-A	Support Bar, Engine	303-F072

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the battery and battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Remove the air cleaner and the outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.
4. Remove the upper intake manifold. For additional information, refer to **ENGINE - 3.5L** article.
5. Disconnect the selector lever cable end.

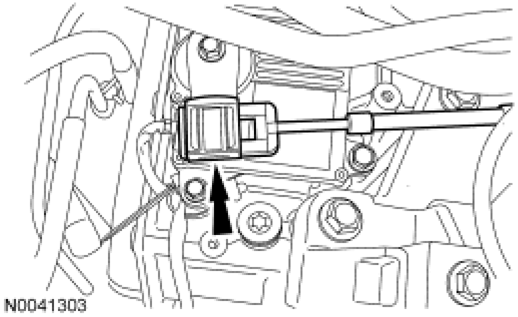


Fig. 211: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

6. Remove the 2 bolts and the nut for the selector lever cable bracket and position the cable and bracket aside.

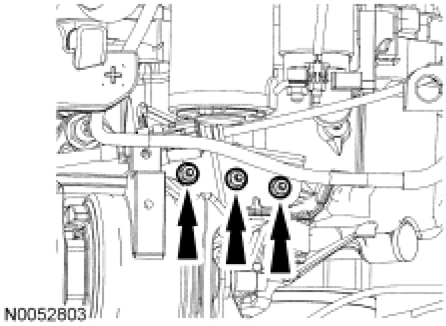


Fig. 212: Identifying Selector Lever Cable Bracket Bolts & Nuts
Courtesy of FORD MOTOR CO.

7. Disconnect the wire harness from the Transmission Control Module (TCM).

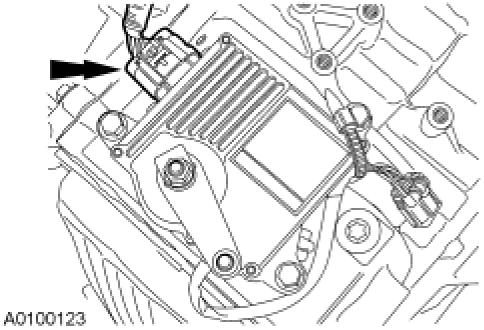


Fig. 213: Identifying Transmission Control Module Electrical Connector
Courtesy of FORD MOTOR CO.

8. Disconnect the wiring harness fasteners from the torque converter housing stud bolt and the starter motor.

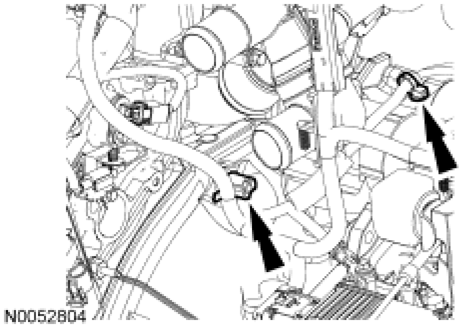


Fig. 214: Identifying Wiring Harness Fasteners & Torque Converter Housing Stud Bolt
Courtesy of FORD MOTOR CO.

9. Remove the 2 ground strap bolts and position aside the ground straps.

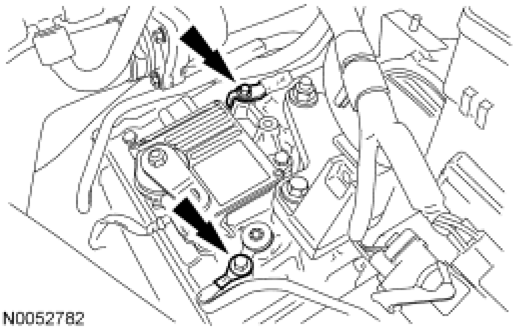


Fig. 215: Identifying Ground Straps & Ground Strap Bolts
Courtesy of FORD MOTOR CO.

10. Position the boot back and remove the starter terminals from the starter.

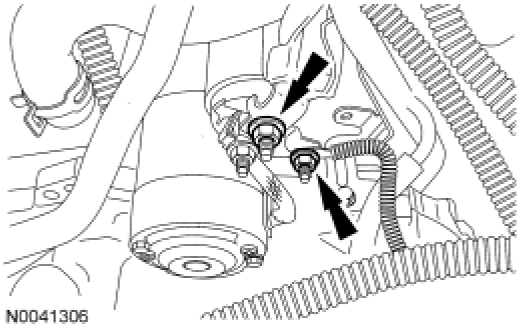


Fig. 216: Locating Bolts On Starter Terminals
Courtesy of FORD MOTOR CO.

11. Remove the 2 bolts and the starter.

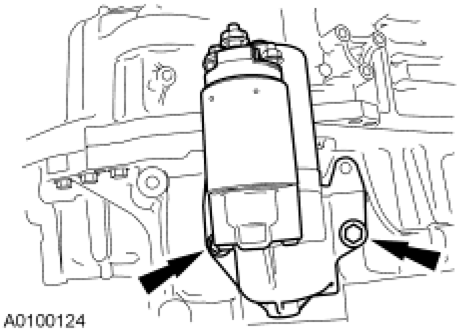


Fig. 217: Locating Starter Bolts
Courtesy of FORD MOTOR CO.

12. Remove the 4 upper torque converter housing bolts.

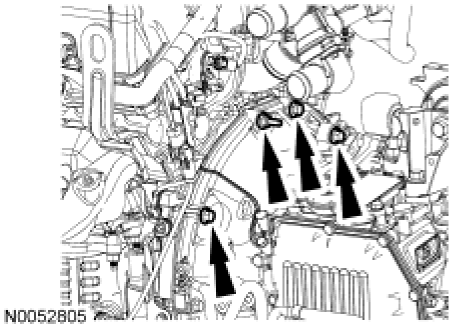


Fig. 218: Identifying Upper Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

13. Install the Engine Lifting Bracket on the LH cylinder head.

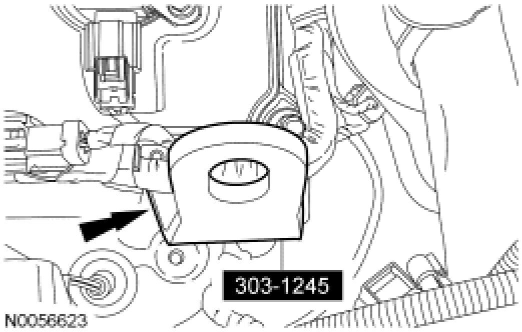


Fig. 219: Special Tool (303-1245) On LH Cylinder Head
Courtesy of FORD MOTOR CO.

14. Install the Engine Support Bar and Spreader Bar to support the engine.

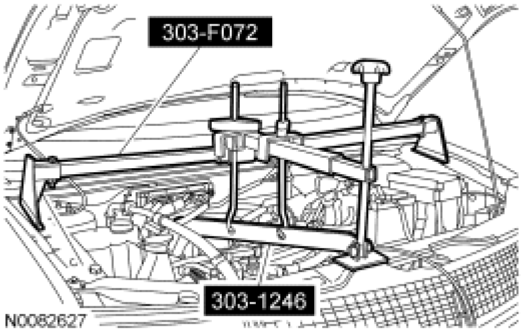


Fig. 220: Installing Engine Support Bar & Spreader Bar To Support Engine
Courtesy of FORD MOTOR CO.

15. Remove the transaxle support insulator through bolt.

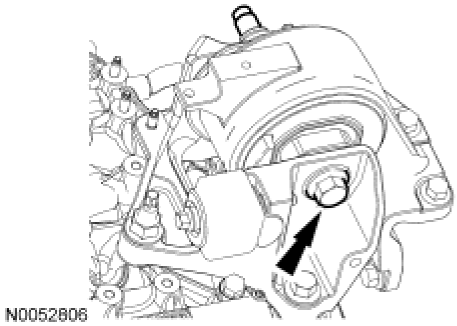


Fig. 221: Identifying Transaxle Support Insulator Through Bolt
Courtesy of FORD MOTOR CO.

16. Using the Engine Support Bar, lower the transaxle and remove the 2 transaxle support insulator bracket nuts, the bolt and the bracket.

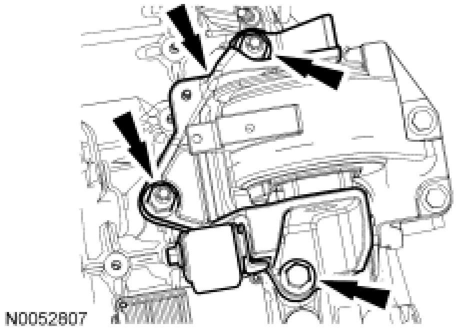


Fig. 222: Locating Transaxle Support Insulator Bracket Nuts & Bolt
Courtesy of FORD MOTOR CO.

17. Remove the 4 screws and position the RH fender splash shield aside.

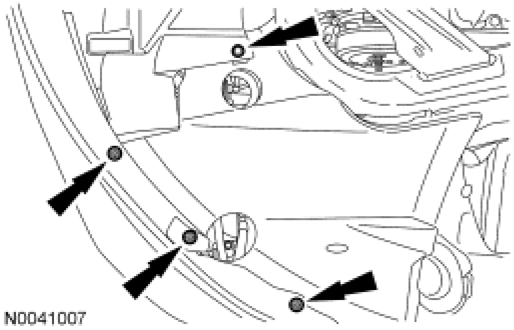


Fig. 223: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

18. Remove the 6 pin-type retainers and remove the RH front structure to subframe splash shield.

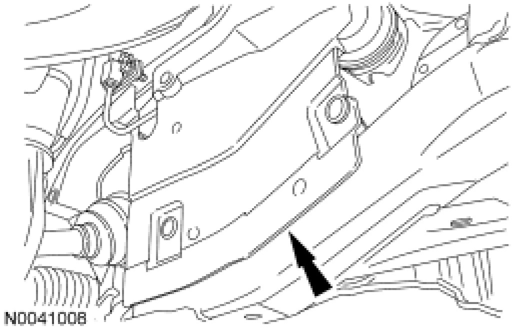


Fig. 224: Locating RH Front Structure-To-Subframe Splash Shield
Courtesy of FORD MOTOR CO.

19. Remove the 4 screws and position the LH fender splash shield aside.

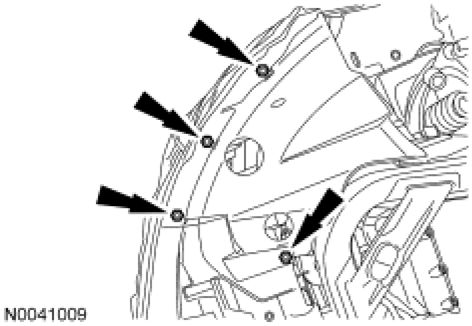


Fig. 225: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

20. Remove the pin-type retainers and remove the LH front structure-to-subframe splash shield.

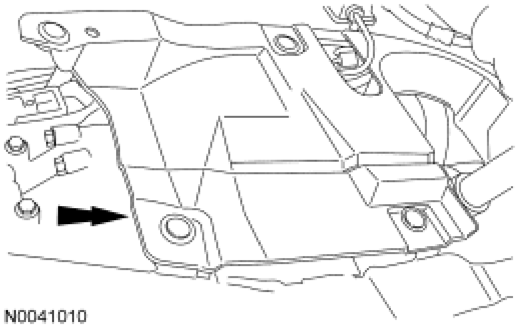


Fig. 226: Locating LH Front Structure-To-Subframe Splash Shield
Courtesy of FORD MOTOR CO.

21. Remove the 6 Y-pipe nuts and the Y-pipe assembly.

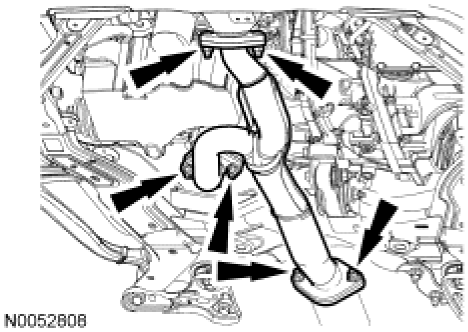


Fig. 227: Locating Y-Pipe Nuts & Y-Pipe Assembly
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

22. Remove the nuts and separate the sway bar links from the struts.

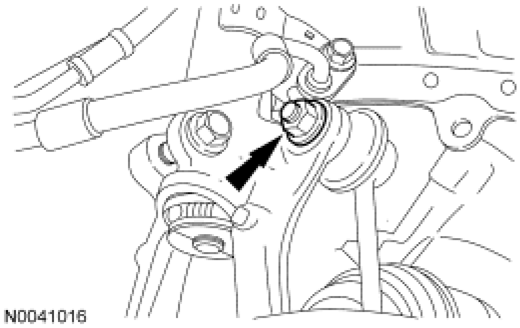


Fig. 228: Locating Sway Bar Links Nut
Courtesy of FORD MOTOR CO.

23. If a transaxle exchange or overhaul is required, the transmission fluid must be drained.
    - Remove the transmission drain plug and allow the transmission fluid to drain.

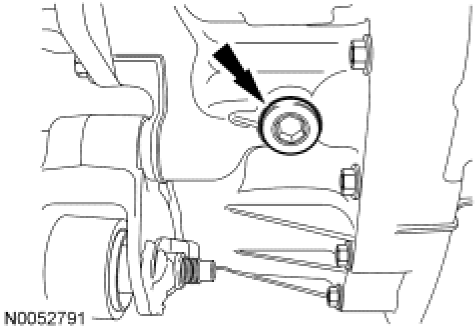


Fig. 229: Identifying Transmission Drain Plug
Courtesy of FORD MOTOR CO.

24. If removed, install the transmission fluid drain plug.
    - Tighten to 47 Nm (35 lb-ft).

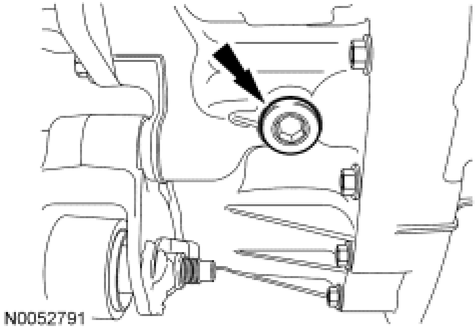


Fig. 230: Identifying Transmission Drain Plug
Courtesy of FORD MOTOR CO.

25. Remove the LH halfshaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.

    All-Wheel Drive (AWD) vehicles

26. Remove and discard the front wheel hub nut.

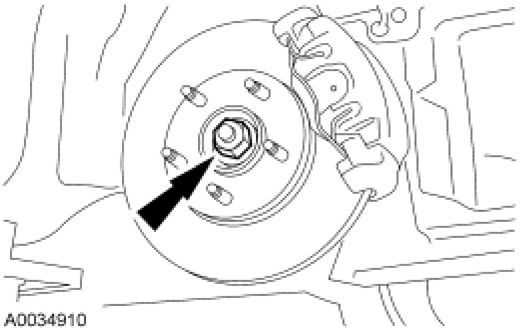


Fig. 231: Locating Front Wheel Hub Nut
Courtesy of FORD MOTOR CO.

All vehicles

27. Remove the RH lower control arm nuts.

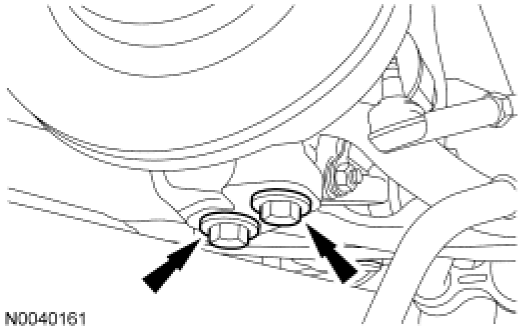


Fig. 232: Locating Front And Rear Lower Control Arm Nuts
Courtesy of FORD MOTOR CO.

NOTE: **When the lower ball joint is separated from the wheel knuckle, the lower arm may strike the outer constant velocity (CV) joint boot with enough force to damage the boot clamp. This will result in a loss of grease from the outer CV joint. Place a block of wood, or similar item, between the lower arm and the outer CV joint to prevent the lower arm from striking the outer CV joint.**

NOTE: **Once pressure is applied to the ball joint with the Ball Joint Separator and Adapter, it may be necessary to tap the wheel knuckle at the ball joint area to separate the ball joint from the wheel knuckle.**

28. Using the Ball Joint Separator and Adapter, separate the 2 lower ball joints from the wheel knuckle and remove the wheel knuckle.

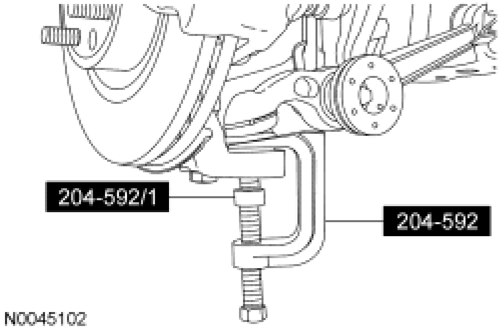


Fig. 233: Identifying Special Tool 204-592/1 And 204-592
Courtesy of FORD MOTOR CO.

29. Remove the bolt connecting the RH damper fork to the lower control arm.

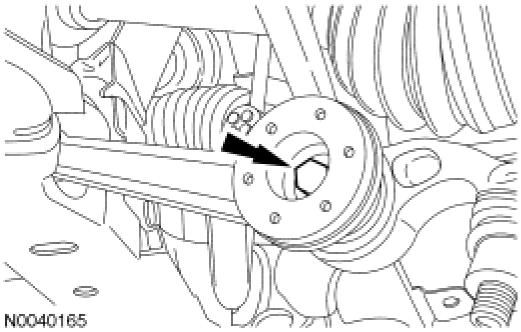


Fig. 234: Locating Damper Fork Bolt
Courtesy of FORD MOTOR CO.

30. Remove the 2 engine roll restrictor bracket bolts.

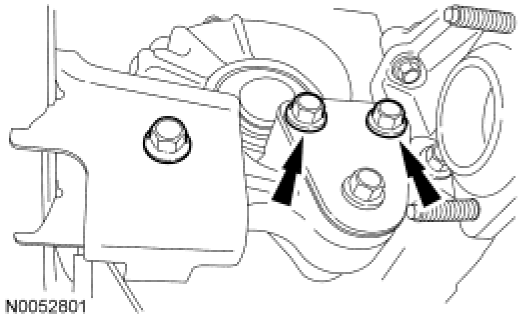


Fig. 235: Locating Engine Roll Restrictor Bracket Bolts
Courtesy of FORD MOTOR CO.

31. Remove the bolts and position the power steering cooler tube aside.

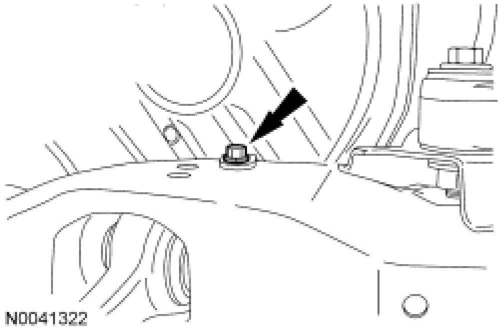


Fig. 236: Locating Power Steering Cooler Tube Bolts
Courtesy of FORD MOTOR CO.

32. Remove the 3 steering gear bolts and position the steering gear aside with mechanic's wire.

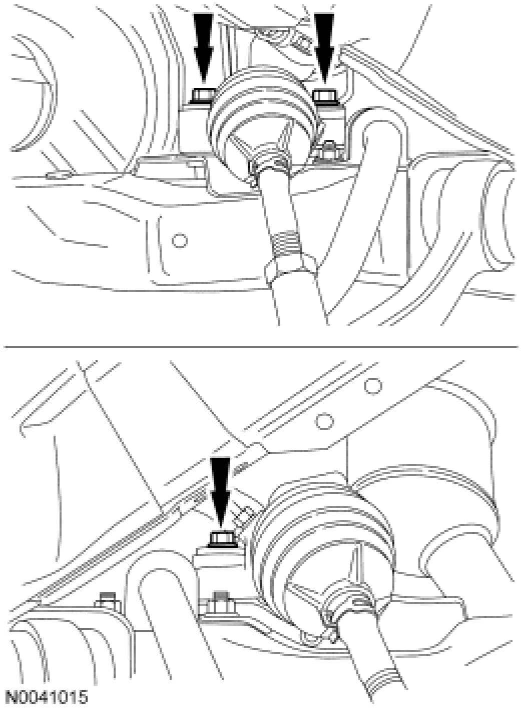


Fig. 237: Locating Steering Gear Bolts
Courtesy of FORD MOTOR CO.

33. Position a suitable powertrain lift table under the subframe.
34. Remove the 2 rear subframe nuts.

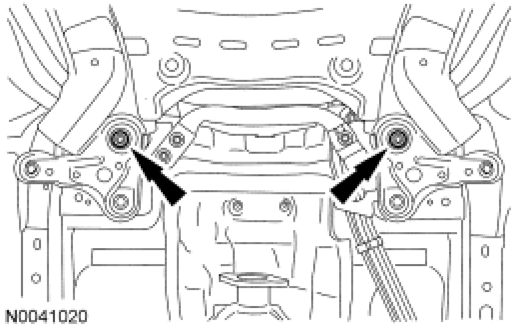


Fig. 238: Locating Rear Subframe Nuts
Courtesy of FORD MOTOR CO.

35. Remove the 4 bolts and the 2 subframe support brackets.

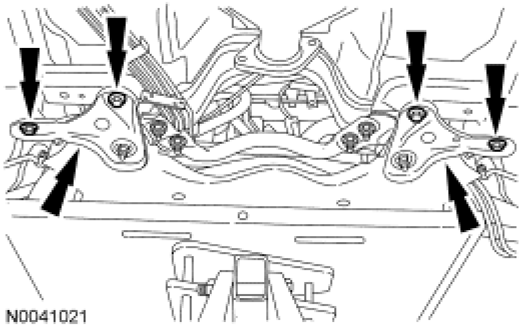


Fig. 239: Locating Subframe Support Brackets And Bolts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

36. Remove the 2 front subframe nuts and remove the subframe.

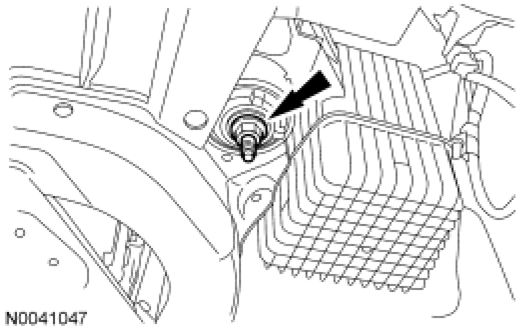


Fig. 240: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

37. Remove the 2 catalytic converter bracket bolts.

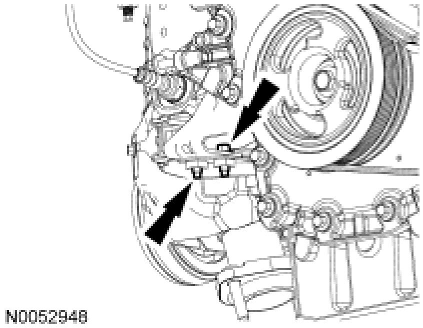


Fig. 241: Identifying Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

38. Remove the 2 nuts and remove the catalytic converter support bracket.

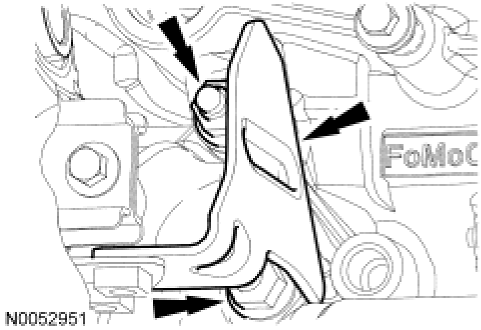


Fig. 242: Identifying Catalytic Converter Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

39. Remove the 3 bolts and position the RH halfshaft aside.

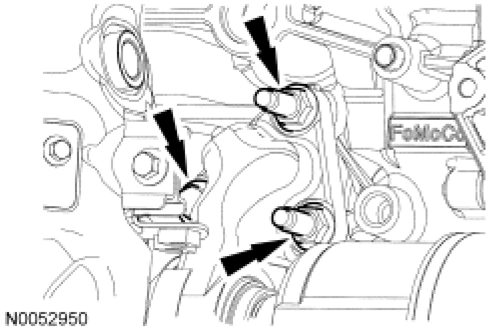


Fig. 243: Identifying Intermediate Shaft Bearing Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

AWD vehicles

40. Using the Front Wheel Hub Remover, press the halfshaft out of the wheel hub.

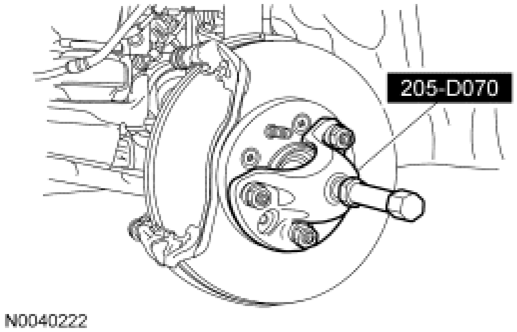


Fig. 244: Separating Halfshaft From Wheel Hub Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

41. Remove the 2 bolts and the RH halfshaft.

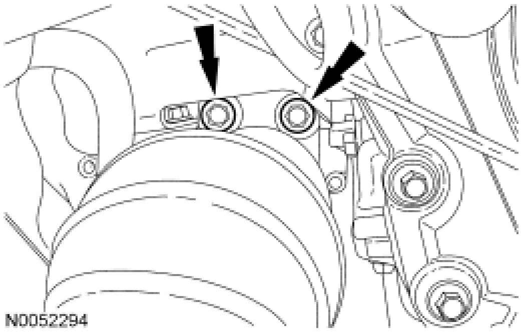


Fig. 245: Locating RH Halfshaft Bearing Support Bracket Bolts
Courtesy of FORD MOTOR CO.

42. Index the driveshaft, remove the 4 bolts and position the driveshaft aside.

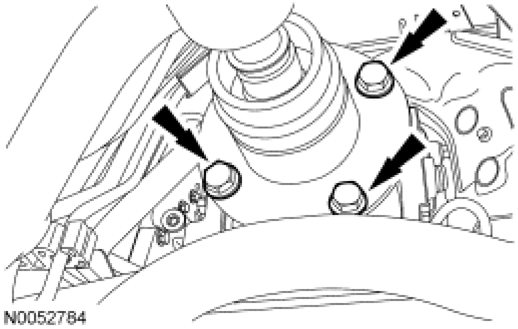


Fig. 246: Identifying Drive Shaft Bolts
Courtesy of FORD MOTOR CO.

43. Disconnect the RH catalyst monitor electrical connector.

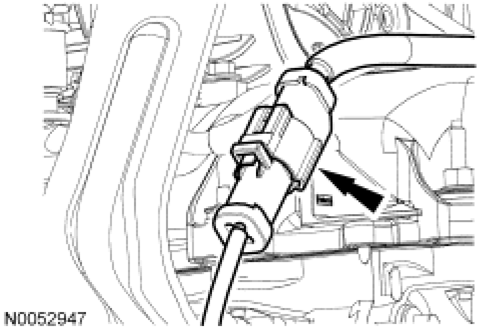


Fig. 247: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

44. Remove the 2 catalytic converter bracket bolts.

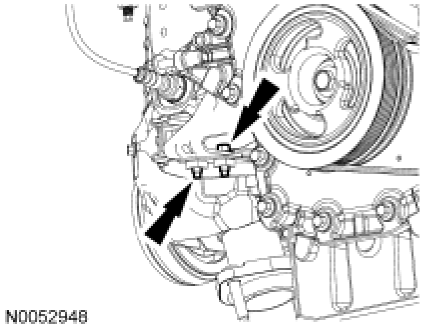


Fig. 248: Identifying Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

45. Remove the 4 nuts and the RH catalytic converter.

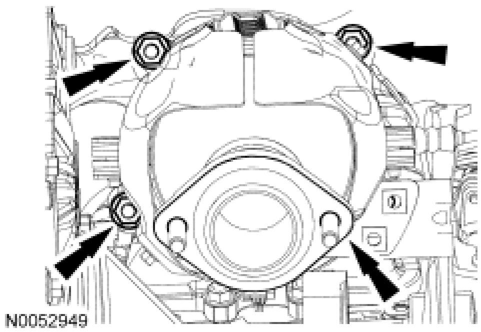


Fig. 249: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

46. Remove the 5 bolts and the power transfer unit PTU support bracket.

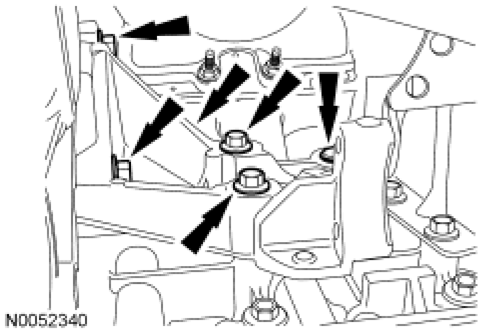


Fig. 250: Locating Power Transfer Unit (PTU) Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

NOTE:	**A new halfshaft seal must be installed anytime the RH halfshaft is removed.**

NOTE:	**The seal deflector will be damaged during removal. Be careful not to**

damage the cover seal directly behind the seal deflector.

47. Remove the seal deflector.

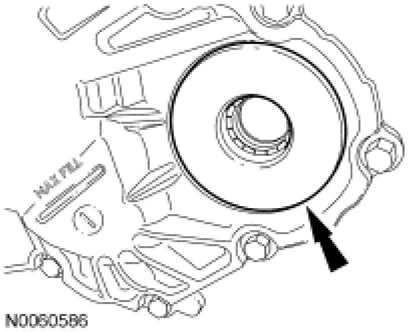


Fig. 251: Identifying Seal Deflector
Courtesy of FORD MOTOR CO.

48. Using the Bearing Cup Puller and Slide Hammer, remove the halfshaft seal from the PTU.

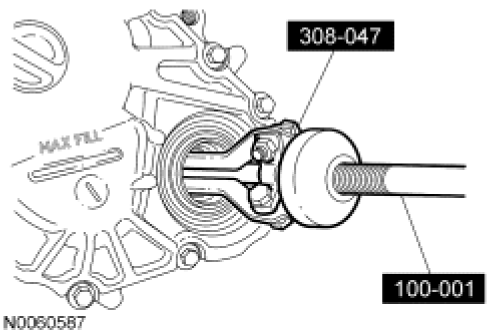


Fig. 252: Removing Intermediate Shaft Seal Using Special Tools (100-001) & (308-047)
Courtesy of FORD MOTOR CO.

49. Remove the 5 bolts and the PTU.

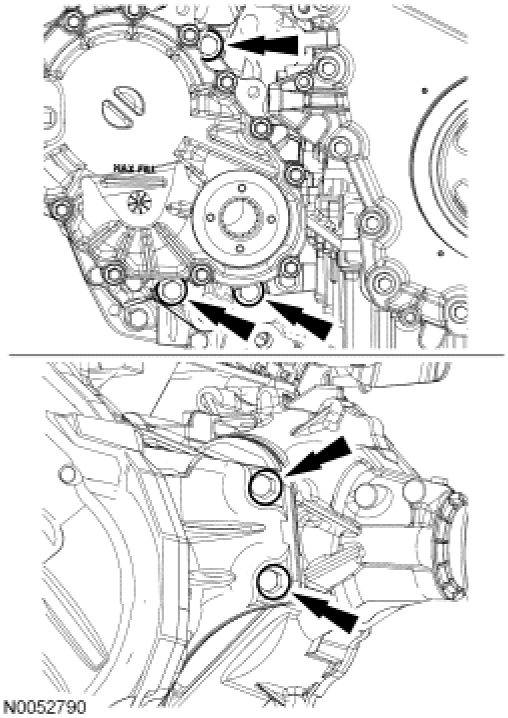


Fig. 253: Locating PTU Bolts
Courtesy of FORD MOTOR CO.

All vehicles

50. Remove the 2 fasteners and the inspection cover.

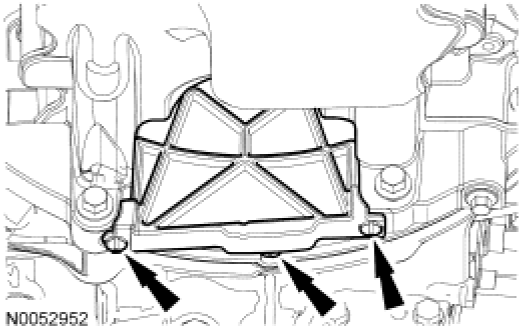


Fig. 254: Identifying Inspection Cover & Fasteners
Courtesy of FORD MOTOR CO.

51. Remove and discard the 4 torque converter nuts.

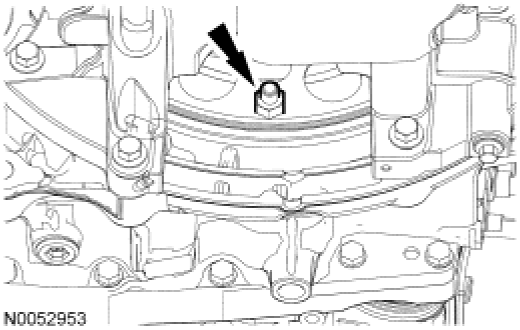


Fig. 255: Identifying Torque Converter Nuts
Courtesy of FORD MOTOR CO.

52. Disconnect the transmission fluid cooler hoses from the transmission fluid cooler tubes.

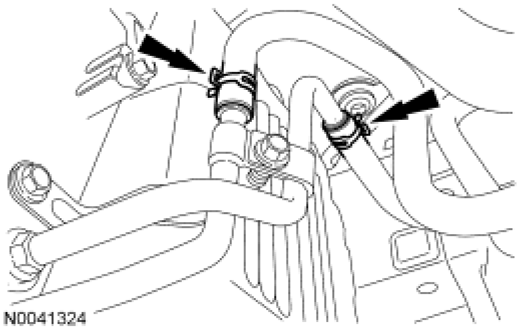


Fig. 256: Locating Transmission Fluid Cooler Hoses
Courtesy of FORD MOTOR CO.

53. Position a suitable high-lift transmission jack under the transaxle.
54. Remove the 7 torque converter housing bolts and remove the transaxle.

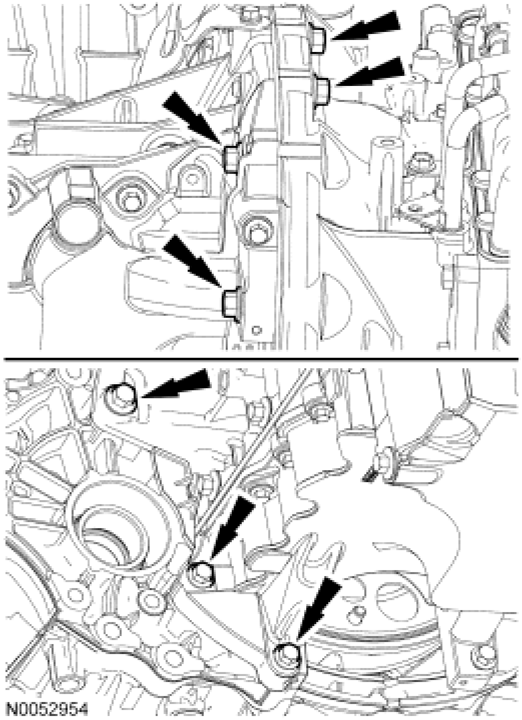


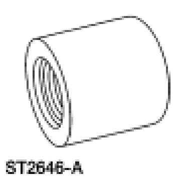
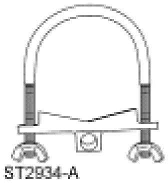
Fig. 257: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

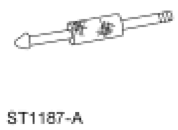
55. If installing a new transaxle, the transmission fluid cooler will need to be backflushed and cleaned. Carry out transmission fluid cooler tube backflushing and cleaning. For additional information, refer to **Transmission Fluid Cooler - Backflushing and Cleaning**.

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

TORQUE CONVERTER HUB SEAL

Special Tools

Illustration	Tool Name	Tool Number
	Converter Seal Installer	307-548
	Remover, Input Shaft Oil Seal	308-375

	Slide Hammer	307-005 (T59L100-B)

Material

Item	Specification
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A

DISASSEMBLY

1. Remove the transaxle. For additional information, refer to **Transaxle - 3.0L** or **Transaxle - 3.5L**.
2. Remove the torque converter.
3. Using the Input Shaft Oil Seal Remover and Slide Hammer, remove the torque converter hub seal.

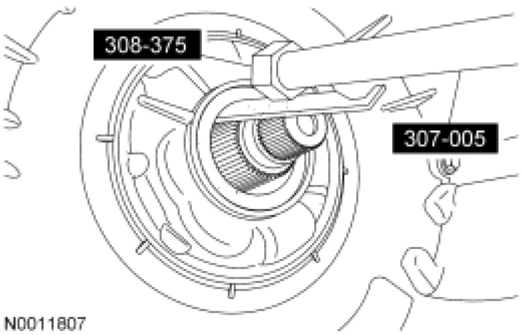


Fig. 258: Removing Torque Converter Hub Seal
Courtesy of FORD MOTOR CO.

ASSEMBLY

1. Position the torque converter hub seal in place.

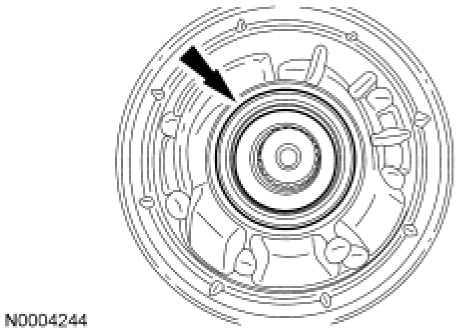


Fig. 259: Positioning Torque Converter Hub Seal In Place
Courtesy of FORD MOTOR CO.

2. Using the Converter Seal Installer, install the torque converter hub seal.

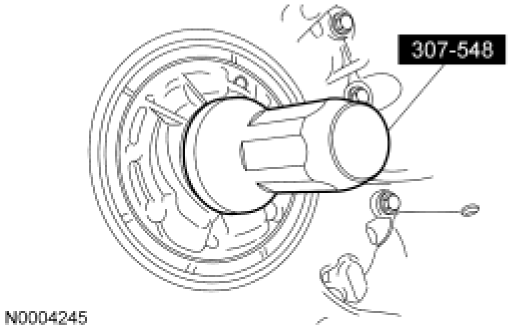


Fig. 260: Installing Torque Converter Hub Seal
Courtesy of FORD MOTOR CO.

3. Install the torque converter.
4. Install the transaxle. For additional information, refer to **Transaxle - 3.0L** or **Transaxle - 3.5L**.

TORQUE CONVERTER

Material

Item	Specification
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A

DISASSEMBLY

1. Remove the transaxle. For additional information, refer to **Transaxle - 3.0L** or **Transaxle - 3.5L**.
2. Remove the torque converter.

ASSEMBLY

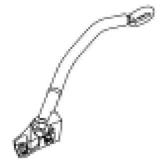
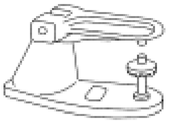
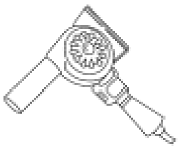
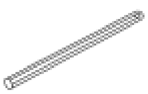
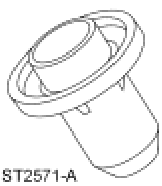
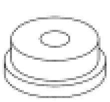
1. Install the torque converter.
2. Install the transaxle. For additional information, refer to **Transaxle - 3.0L** or **Transaxle - 3.5L**.

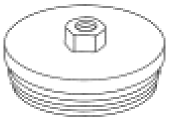
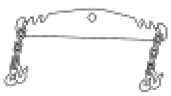
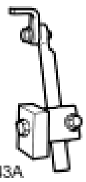
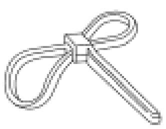
INSTALLATION

TRANSAXLE - 3.0L

Special Tools

Illustration	Tool Name	Tool Number
	Engine Lifting Bracket Set	303-1140

 ST2873-A		
 ST1278-A	Handle	205-153 (T80T-4000-W)
 ST1073-A	Heat Gun	107-R0300
 ST2138-A	Installer, Halfshaft	204-161 (T97P-1175-A)
 ST2939-A	Installer, Halfshaft Oil Seal	308-431
 ST2571-A	Installer, PTU Drive Gear Outer Oil Seal	308-430
 ST2981-A	Lifting Bracket, Engine	303-050 (T70P-6000)
 ST1568-A	Remover/Installer, Bearing Cup	204-038 (T77F-1217-A)

 ST1382-A	Socket, Exhaust Gas Oxygen Sensor	303-476 (T94P-9472-A)
 ST1602-A	Support Bar, Engine	303-F072
 ST2743A	Universal Adapter Bracket	014-0001
 ST1438-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) with appropriate hardware, or equivalent scan tool	

Material

Item	Specification
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B
Threadlock and Sealer TA-25	WSK-M2G351-A5

NOTE: **MERCON®, MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid and Motorcraft Continuously Variable Chain Type Transmission Fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage.**

NOTE: **If the transaxle was overhauled, or if installing a new transaxle and the transmission fluid cooler has not been flushed, flush the transmission fluid cooler at this time. For additional information, refer to Transmission Fluid Cooler - Backflushing and Cleaning.**

All vehicles

1. Prior to installing the transaxle, apply multi-purpose grease to the torque converter pilot hub.

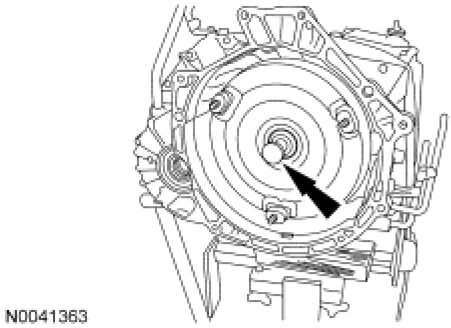


Fig. 261: Identifying Torque Converter Pilot Hub
Courtesy of FORD MOTOR CO.

2. Position the transaxle to the back of the engine.
3. Install the 5 transaxle-to-engine bolts.
   - Tighten to 40 Nm (30 lb-ft).

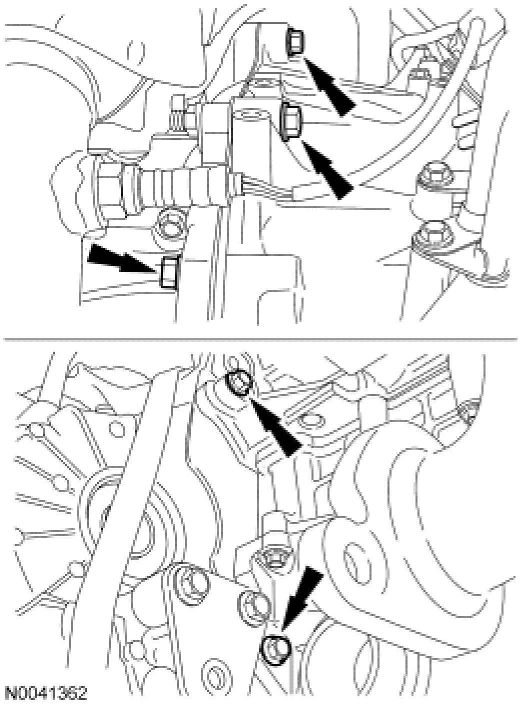


Fig. 262: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

4. Connect the transmission fluid cooler hoses to the transmission fluid cooler tubes.

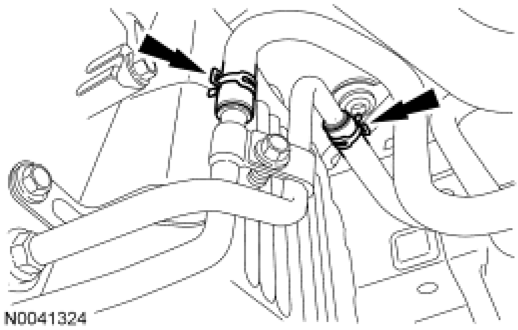


Fig. 263: Locating Transmission Fluid Cooler Hoses
Courtesy of FORD MOTOR CO.

5. Install 3 new torque converter nuts.
   - Tighten to 36 Nm (27 lb-ft).

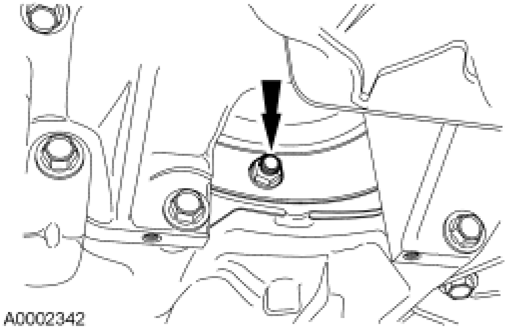


Fig. 264: Locating Torque Converter Nuts
Courtesy of FORD MOTOR CO.

6. Install the inspection cover.

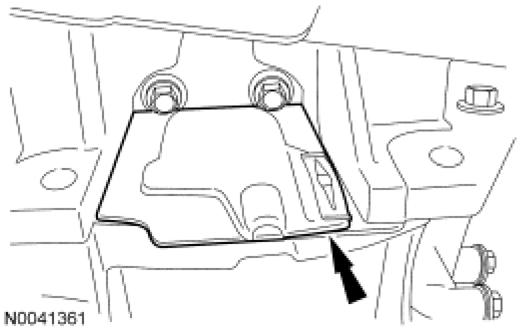


Fig. 265: Identifying Inspection Cover
Courtesy of FORD MOTOR CO.

7. Connect the wiring harness fastener to the stud bolt and position the Heated Oxygen Sensor (HO2S) bracket in place and install the bolt.
   - Tighten to 12 Nm (106 lb-in).

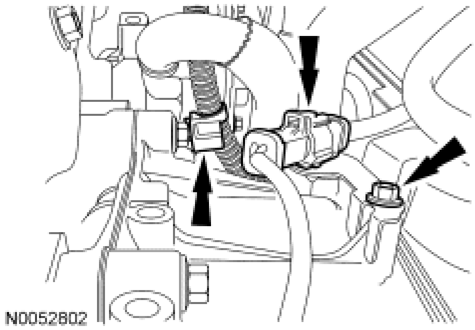


Fig. 266: Identifying Heated Oxygen Sensor (HO2S) Bracket & Stud Bolt
Courtesy of FORD MOTOR CO.

8. Position the transaxle insulator bracket in place. Apply threadlock and sealer to the threads and install the 2 nuts and the bolt.
   - Tighten to 80 Nm (59 lb-ft).

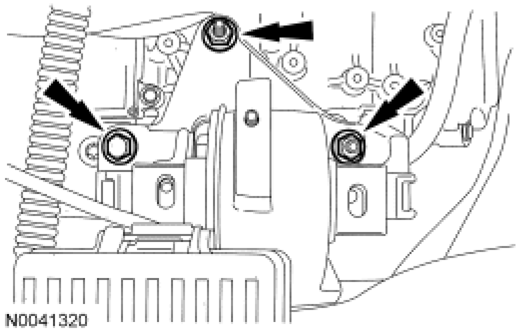


Fig. 267: Locating Transaxle Insulator Bracket Nuts And Bolt
Courtesy of FORD MOTOR CO.

9. Raise the transaxle. Apply threadlock and sealer to the threads and install the 2 transaxle insulator-to-frame bolts.
   - Tighten to 62 Nm (46 lb-ft).

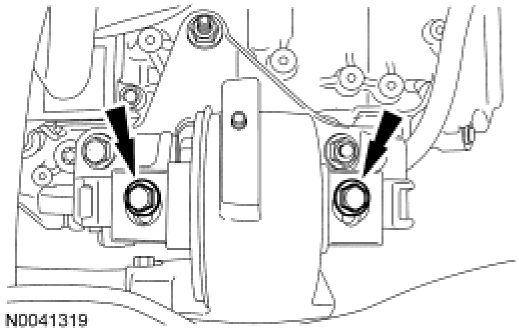


Fig. 268: Locating Transaxle Insulator Bolts
Courtesy of FORD MOTOR CO.

10. Remove the Engine Support Bar.

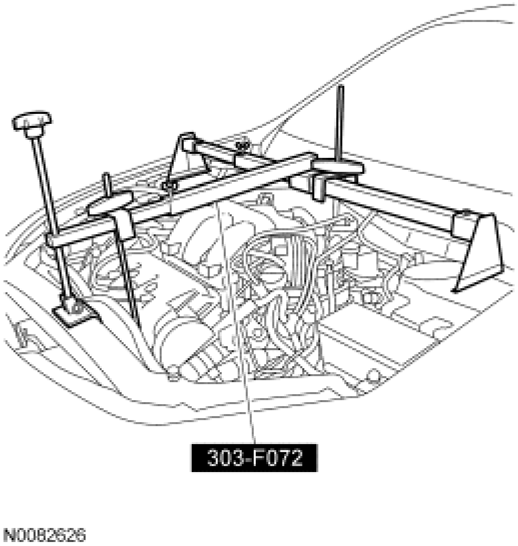


Fig. 269: Installing Engine Support Bar To Support Engine
Courtesy of FORD MOTOR CO.

11. Remove the Engine Lifting Bracket and the Universal Adapter Bracket "L" hook from the from the LH side of the engine.

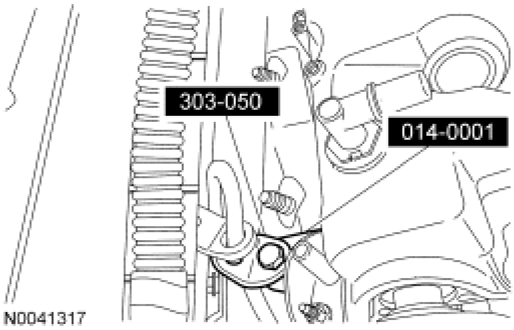


Fig. 270: Identifying Universal Lifting Brackets
Courtesy of FORD MOTOR CO.

12. Remove the upper half of the Engine Lifting Bracket Set.

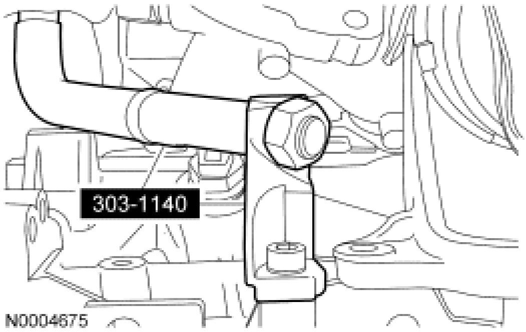


Fig. 271: Identifying Upper Half Of Lifting Hook
Courtesy of FORD MOTOR CO.

13. Remove the lower half of the Engine Lifting Bracket Set.

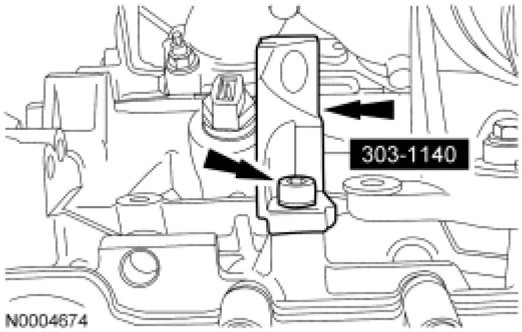


Fig. 272: Identifying Lower Half Of Lifting Hook
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

14. Position the Power Transfer Unit (PTU) in place and install the 5 bolts.
    - Tighten to 90 Nm (66 lb-ft).

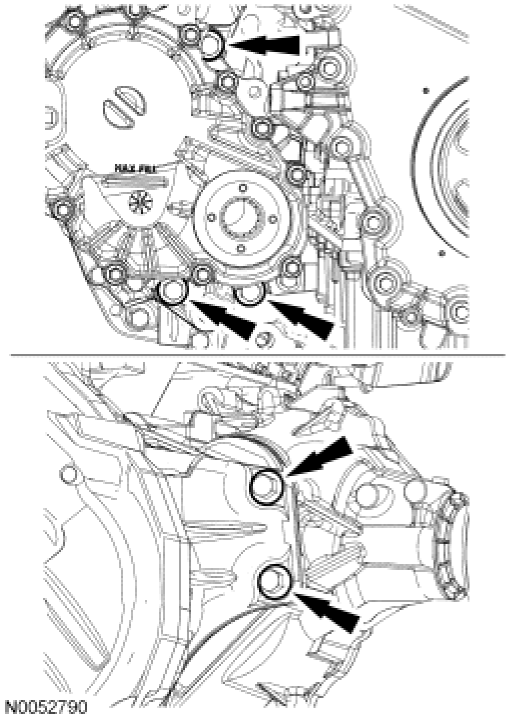


Fig. 273: Locating PTU Bolts
Courtesy of FORD MOTOR CO.

15. Using the Bearing Cup Remover/Installer and Handle, install a new intermediate shaft seal.

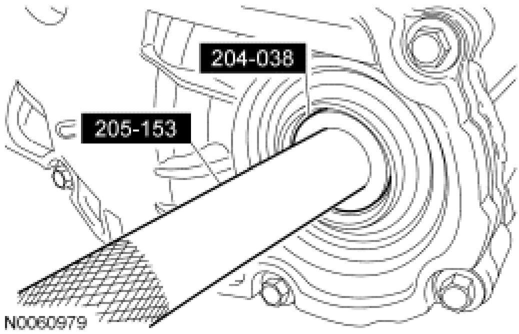


Fig. 274: Identifying Intermediate Shaft Seal & Special Tools (204-038, 205-153)
Courtesy of FORD MOTOR CO.

NOTE:	**Do not overheat (melt) the seal deflector. If the deflector is damaged, a new one must be used.**

16. Using the Heat Gun, heat the new seal deflector. Concentrate the heat across the back of the deflector near the white colored tabs. Install the seal deflector immediately after heating.
    - If necessary, use the PTU Drive Gear Outer Oil Seal Installer and Halfshaft Oil Seal Installer to seat the seal deflector. Make sure the deflector is fully seated and there are no cracks on the face or inner diameter white colored tab.

- For an alternate method to heat the seal deflector, place the deflector in boiling water for 3 to 5 minutes. Dry off deflector and install.
- Make sure the deflector is completely seated all the way around.

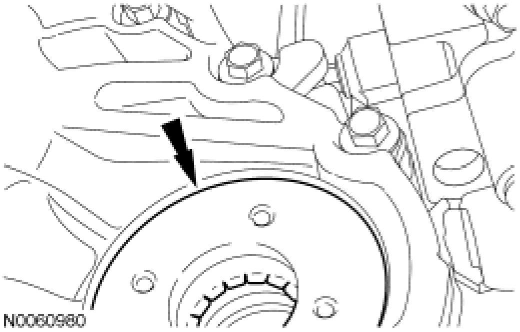


Fig. 275: Identifying Seal Deflector
Courtesy of FORD MOTOR CO.

17. Position the PTU support bracket in place and install the 5 bolts.
    - Tighten to 70 Nm (52 lb-ft).

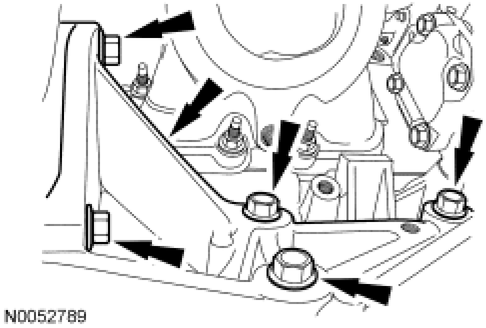


Fig. 276: Identifying PTU Support Bracket Bolts
Courtesy of FORD MOTOR CO.

18. Position the RH catalytic converter in place and install the catalytic converter-to-exhaust manifold nuts.
    - Tighten to 40 Nm (30 lb-ft).

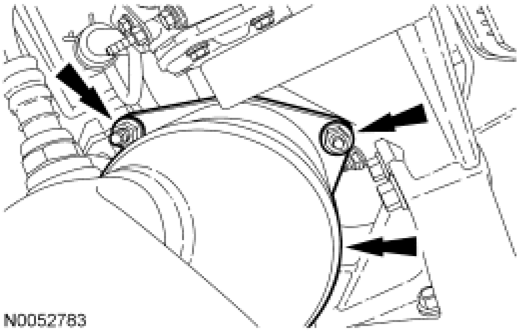


Fig. 277: Locating RH Catalytic Converter Nuts

Courtesy of FORD MOTOR CO.

19. Install the catalytic converter band clamp LH half and the 2 bolts.
    - Tighten to 40 Nm (30 lb-ft).

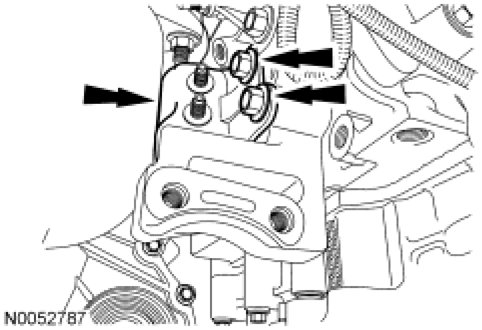


Fig. 278: Locating Catalytic Converter Band Clamp LH Half Nuts
Courtesy of FORD MOTOR CO.

20. Install the catalytic converter band clamp RH half and install the 3 nuts.
    - Tighten to 20 Nm (177 lb-in).

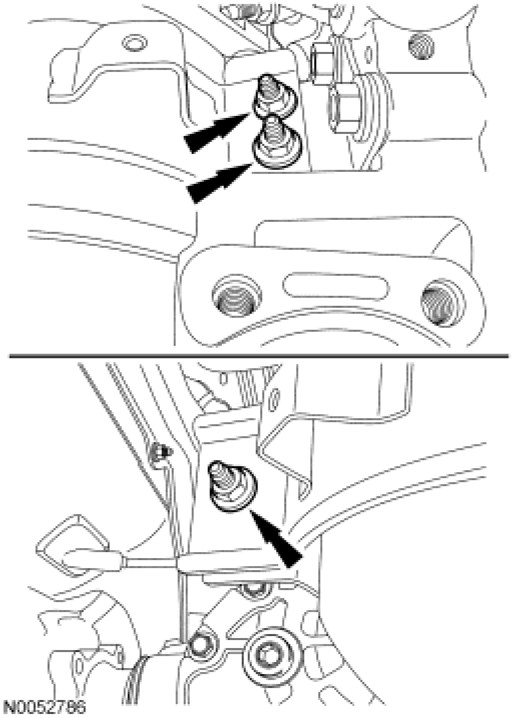


Fig. 279: Locating RH Exhaust Heat Shield Bracket Nuts - Inboard Half
Courtesy of FORD MOTOR CO.

21. Install the RH exhaust manifold heat shield and the 6 bolts.
    - Tighten to 11 Nm (97 lb-in).

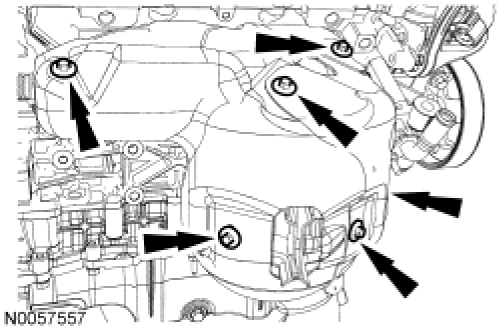


Fig. 280: Locating RH Exhaust Heat Shield Bolts
Courtesy of FORD MOTOR CO.

22. Using the Exhaust Gas Oxygen Sensor Socket, install the RH HO2S.
    - Tighten to 48 Nm (35 lb-ft).

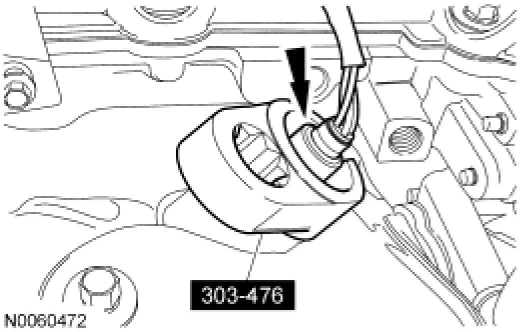


Fig. 281: Identifying RH HO2S & Special Tool (303-476)
Courtesy of FORD MOTOR CO.

23. Connect the RH HO2S electrical connector.

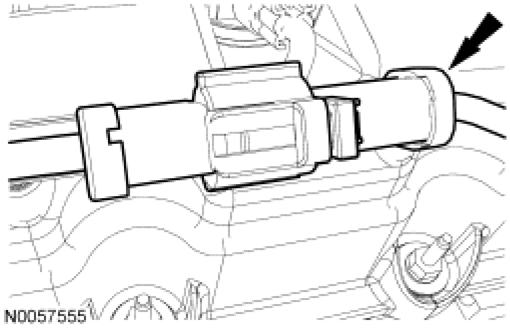


Fig. 282: Identifying RH HO2S Electrical Connector
Courtesy of FORD MOTOR CO.

24. Using the Exhaust Gas Oxygen Sensor Socket, install the RH catalyst monitor sensor.
    - Tighten to 48 Nm (35 lb-ft).

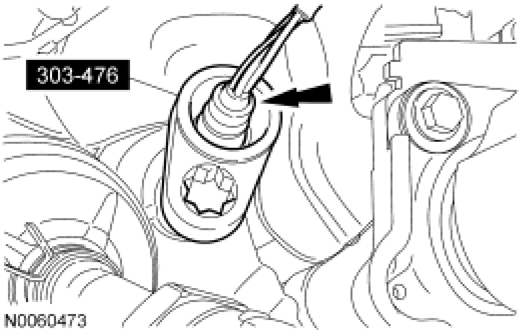


Fig. 283: Identifying RH Catalyst Monitor Sensor & Special Tool (303-476)
Courtesy of FORD MOTOR CO.

25. Connect the RH catalyst monitor sensor electrical connector and attach the wiring harness retainer.

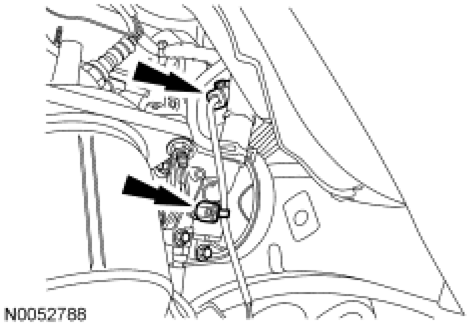


Fig. 284: Locating RH Catalyst Monitor Sensor Electrical Connector & Wiring Retainer
Courtesy of FORD MOTOR CO.

26. Position the driveshaft in place, align the index marks made during removal and install the 4 driveshaft bolts.
    - Tighten to 70 Nm (52 lb-ft).

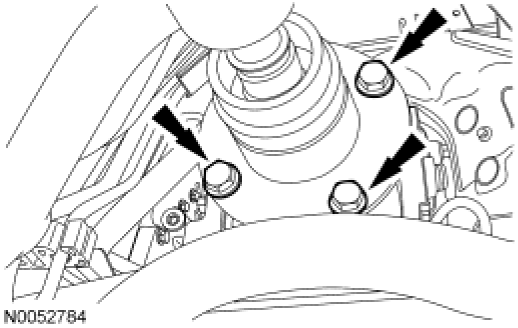


Fig. 285: Identifying Drive Shaft Bolts
Courtesy of FORD MOTOR CO.

27. Position the RH halfshaft in place and install the 2 RH halfshaft bearing support bracket bolts.
    - Tighten to 23 Nm (17 lb-ft).

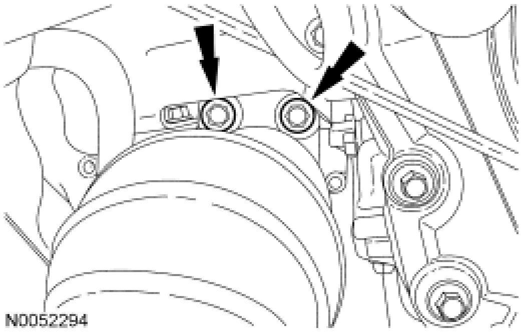


Fig. 286: Locating RH Halfshaft Bearing Support Bracket Bolts
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

28. Position the RH halfshaft in the transaxle and install the 2 RH halfshaft bearing support bracket bolts.
    - Tighten to 55 Nm (41 lb-ft).

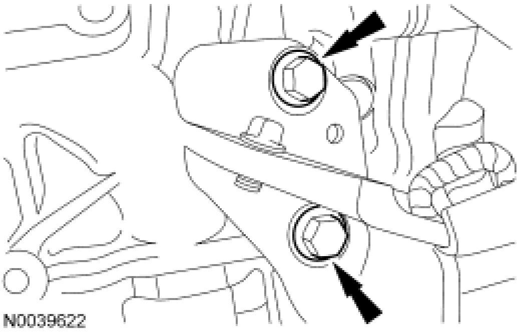


Fig. 287: Locating RH Halfshaft Carrier Bearing Bracket Bolts
Courtesy of FORD MOTOR CO.

29. Install the bolt retaining the brake caliper hose.
    - Tighten to 22 Nm (16 lb-ft).

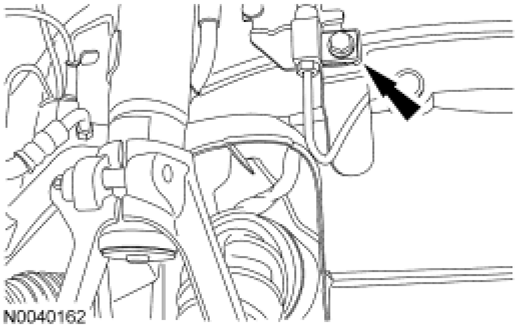


Fig. 288: Locating Brake Caliper Hose Bolt
Courtesy of FORD MOTOR CO.

30. Connect the HO2S to the RH halfshaft bearing support bracket.

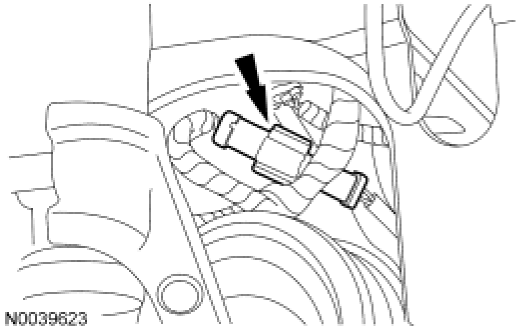


Fig. 289: Locating Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

31. Install the catalytic converter-to-engine block bracket and install the 2 bolts.
    - Tighten to 35 Nm (26 lb-ft).

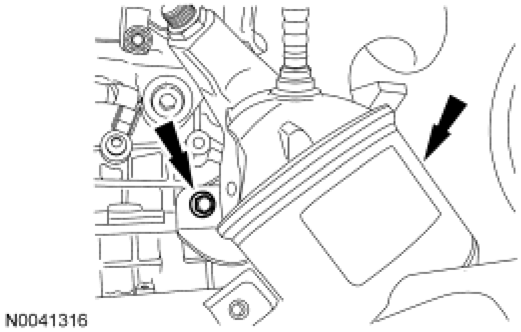


Fig. 290: Locating Catalytic Converter-To-Engine Block Bracket And Bolts
Courtesy of FORD MOTOR CO.

32. Install the catalytic converter band clamp and the 2 bolts.
    - Tighten to 20 Nm (177 lb-in).

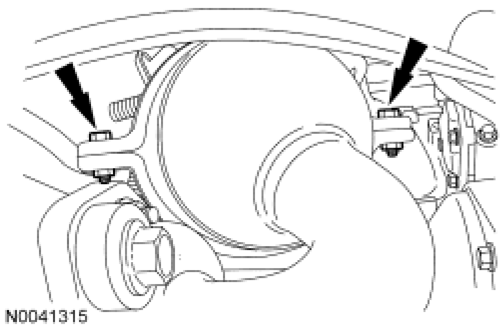


Fig. 291: Locating Catalytic Converter Band Clamp And Bolts
Courtesy of FORD MOTOR CO.

33. Install the RH exhaust manifold heat shield and the 2 bolts.
    - Tighten to 11 Nm (97 lb-in).

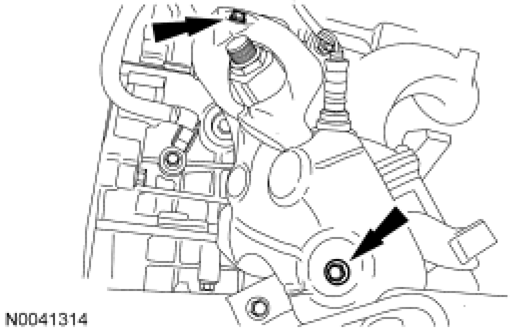


Fig. 292: Locating RH Exhaust Manifold Heat Shield And Bolts
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: FWD shown, AWD similar.

34. Loosely install the EGR tube nut on the RH exhaust manifold.

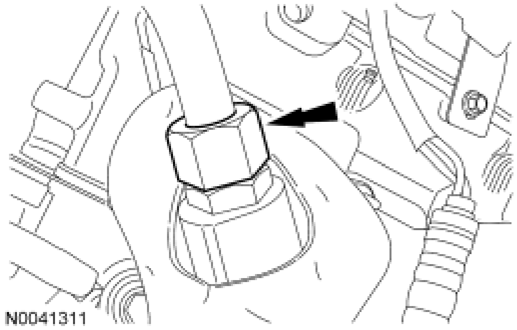


Fig. 293: Locating EGR Tube Nut At RH Exhaust Manifold
Courtesy of FORD MOTOR CO.

35. Position the subframe in place using a suitable powertrain lift.

NOTE: LH shown, RH similar.

36. Install the front subframe nuts.
    - Tighten to 150 Nm (111 lb-ft).

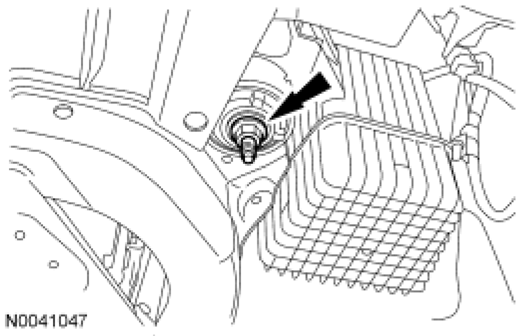


Fig. 294: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

37. Position the subframe support brackets in place and loosely install the bolts.

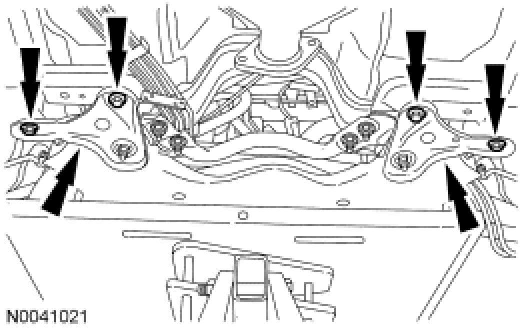


Fig. 295: Locating Subframe Support Brackets And Bolts
Courtesy of FORD MOTOR CO.

38. Install the rear subframe nuts.
    - Tighten to 150 Nm (111 lb-ft).

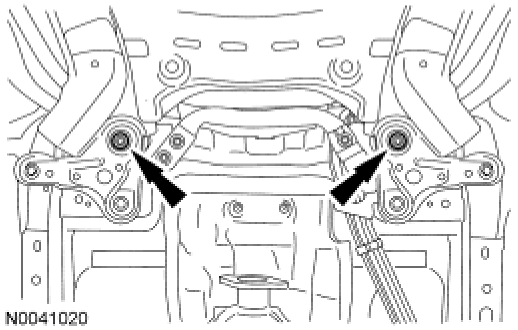


Fig. 296: Locating Rear Subframe Nuts
Courtesy of FORD MOTOR CO.

39. Tighten the subframe support bracket bolts.
    - Tighten to 103 Nm (76 lb-ft).

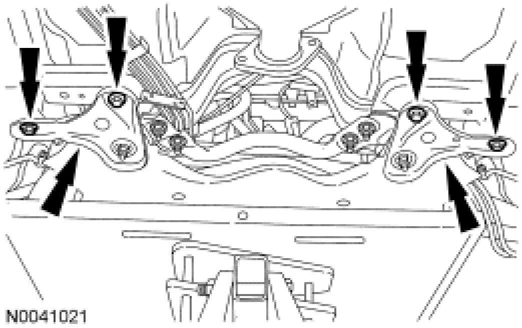


Fig. 297: Locating Subframe Support Brackets And Bolts
Courtesy of FORD MOTOR CO.

40. Position the power steering gear in place and install the 3 bolts.
    - Tighten to 107 Nm (79 lb-ft).

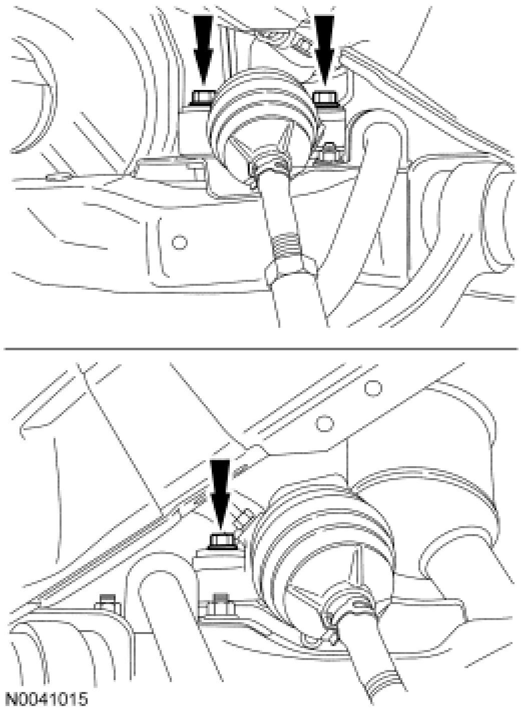


Fig. 298: Locating Steering Gear Bolts
Courtesy of FORD MOTOR CO.

41. Position the power steering line bracket in place and install the bolts.
    - Tighten to 9 Nm (80 lb-in).

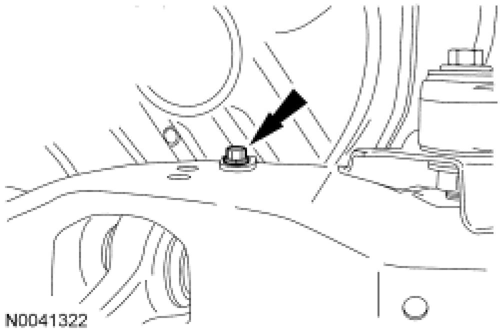


Fig. 299: Locating Power Steering Cooler Tube Bolts
Courtesy of FORD MOTOR CO.

NOTE: FWD shown, AWD similar.

42. Install the 2 transaxle roll restrictor bolts.
    - Tighten to 90 Nm (66 lb-ft).

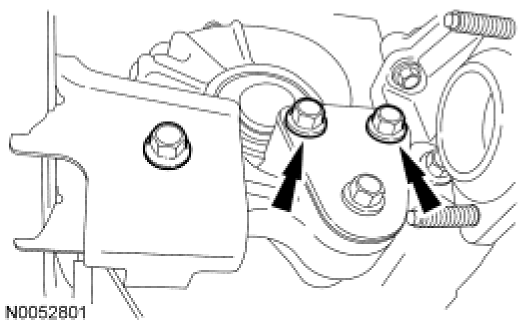


Fig. 300: Locating Engine Roll Restrictor Bracket Bolts
Courtesy of FORD MOTOR CO.

43. If equipped, install the roll restrictor heat shield and the bolts.

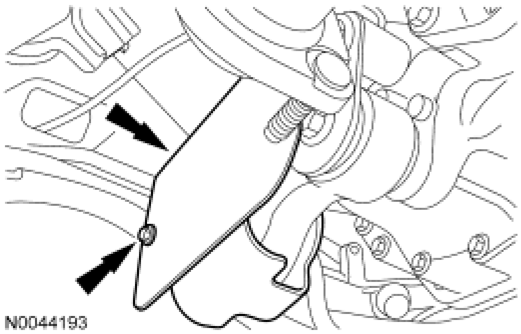


Fig. 301: Locating Heat Shield And Bolts
Courtesy of FORD MOTOR CO.

44. Position the Y-pipe assembly in place and install the 2 exhaust flexible pipe-to-catalytic converter nuts.

- Tighten to 40 Nm (30 lb-ft).

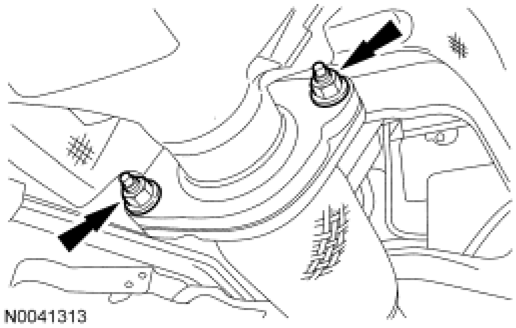


Fig. 302: Locating Flex Pipe Nuts
Courtesy of FORD MOTOR CO.

45. Install the Y-pipe bolts and the Y-pipe nuts.
    - Tighten to 40 Nm (30 lb-ft).

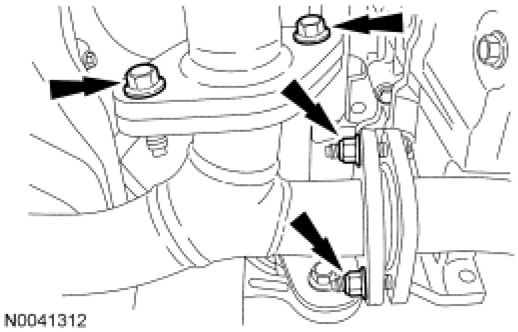


Fig. 303: Locating Y-Pipe Bolts And Nuts
Courtesy of FORD MOTOR CO.

46. Install the RH damper fork through bolt connecting the fork to the lower control arm.
    - Tighten to 103 Nm (76 lb-ft).

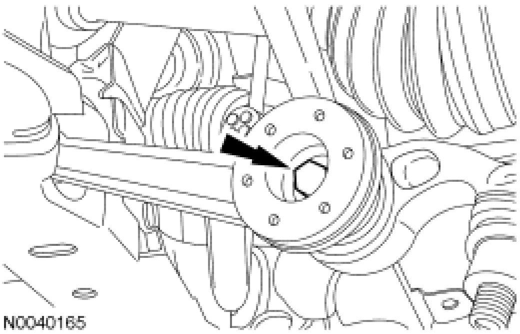


Fig. 304: Locating Damper Fork Bolt
Courtesy of FORD MOTOR CO.

47. Position the lower control arms in the knuckle and install the nuts.
    - Tighten to 200 Nm (148 lb-ft).

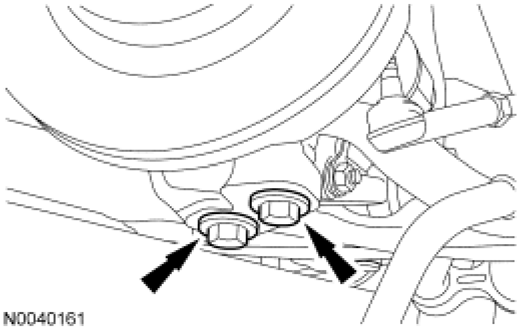


Fig. 305: Locating Front And Rear Lower Control Arm Nuts
Courtesy of FORD MOTOR CO.

AWD vehicles

48. Using the Halfshaft Installer, install the LH halfshaft in the wheel hub. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.

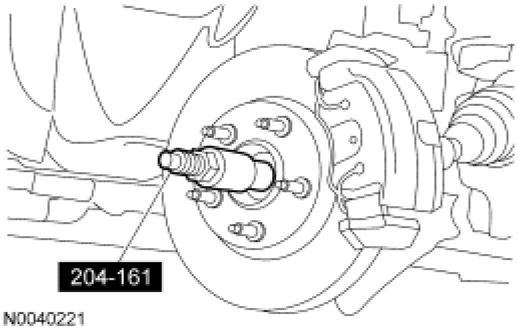


Fig. 306: Identifying Special Tool 204-161
Courtesy of FORD MOTOR CO.

49. Install the RH front wheel hub nut.
    - Tighten 225 Nm (185 lb-ft).

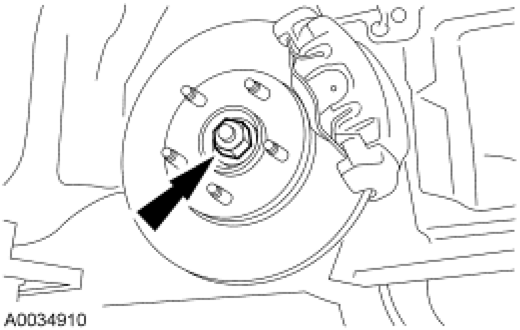


Fig. 307: Locating Front Wheel Hub Nut
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: LH shown, RH similar.

50. Using the Halfshaft Installer, install the RH halfshaft in the wheel hub. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.

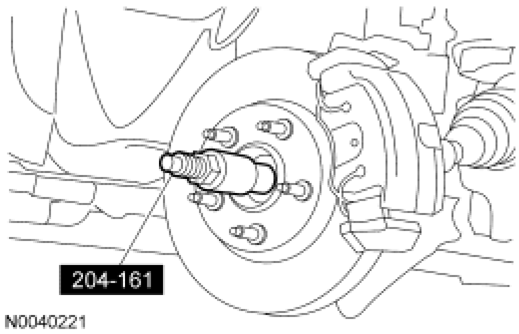


Fig. 308: Identifying Special Tool 204-161
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

51. Position the sway bar links in the struts and install the nuts.
    - Tighten to 40 Nm (30 lb-ft).

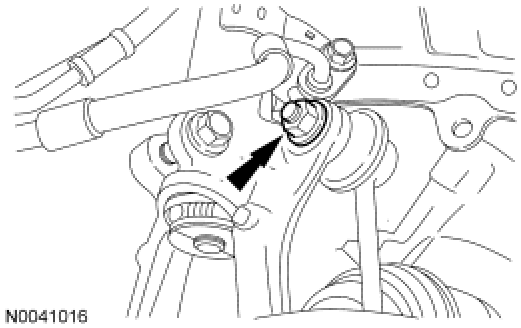


Fig. 309: Locating Sway Bar Links Nut
Courtesy of FORD MOTOR CO.

52. Install the LH front structure to subframe splash shield and install the pin-type retainers.

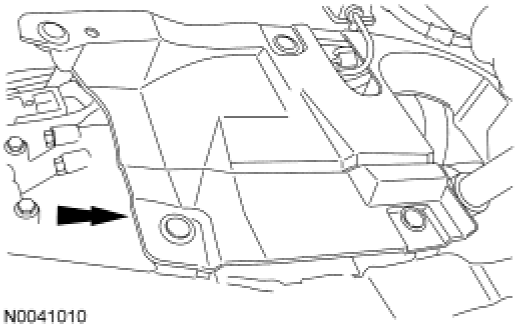


Fig. 310: Locating LH Front Structure-To-Subframe Splash Shield
Courtesy of FORD MOTOR CO.

53. Position the LH fender splash shield in place and install the 4 screws.

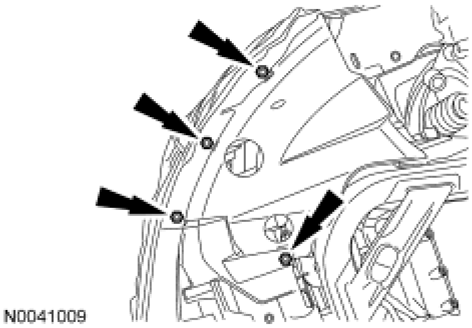


Fig. 311: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

54. Position the RH front structure-to-subframe splash shield in place and install the 6 pin-type retainers.

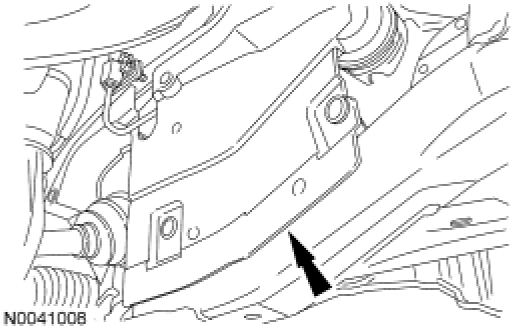


Fig. 312: Locating RH Front Structure-To-Subframe Splash Shield
Courtesy of FORD MOTOR CO.

55. Position the RH fender splash shield in place and install the 4 screws.

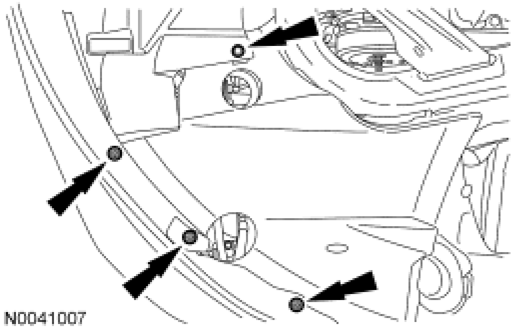


Fig. 313: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

56. Position the power steering line bracket on the right cylinder head and install the bolt.
    - Tighten to 7 Nm (62 lb-in).

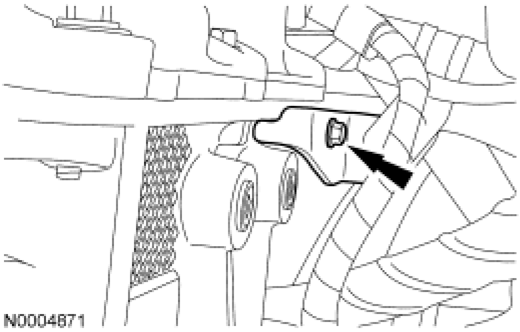


Fig. 314: Locating Bracket For Power Steering Hose
Courtesy of FORD MOTOR CO.

57. Install a new gasket and the EGR valve and install the 2 bolts.
    - Tighten to 25 Nm (18 lb-ft).

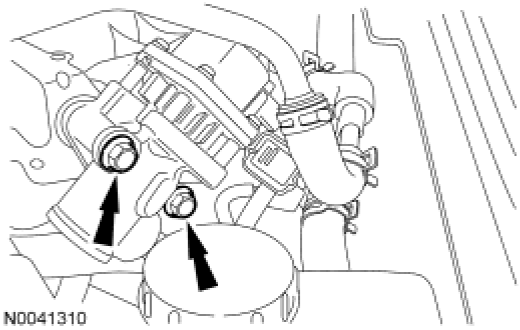


Fig. 315: Locating EGR Valve And Bolts
Courtesy of FORD MOTOR CO.

58. Install the EGR tube on the valve.
    - Tighten to 40 Nm (30 lb-ft).

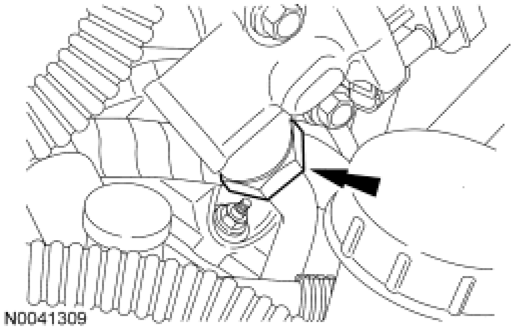


Fig. 316: Locating EGR Tube Nut
Courtesy of FORD MOTOR CO.

59. Connect the EGR valve electrical connector.

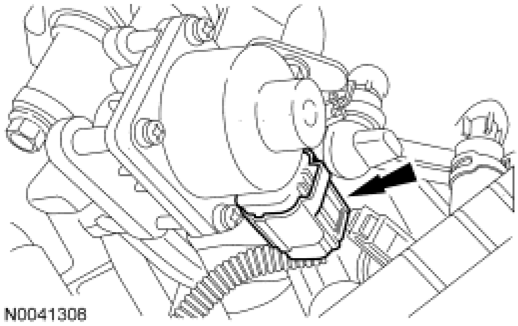


Fig. 317: Locating EGR Valve Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: FWD shown, AWD similar.

60. Tighten the EGR tube at the RH exhaust manifold.
    - Tighten to 40 Nm (30 lb-ft).

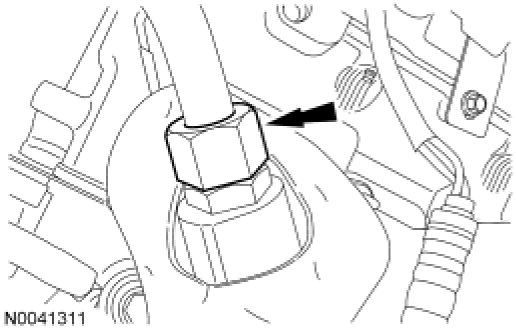


Fig. 318: Locating EGR Tube Nut At RH Exhaust Manifold
Courtesy of FORD MOTOR CO.

61. Install the 3 upper transaxle-to-engine retaining bolts.

- Tighten to 40 Nm (30 lb-ft).

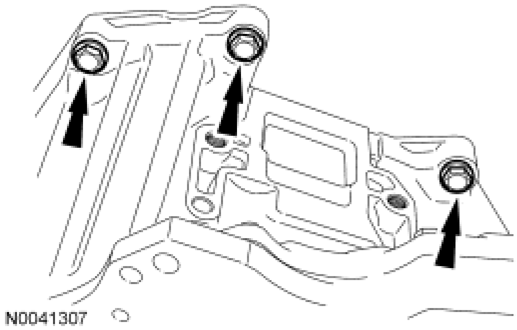


Fig. 319: Locating Upper Torque Converter Housing Bolts
Courtesy of FORD MOTOR CO.

62. Install the starter and the 2 bolts.
    - Tighten to 26 Nm (19 lb-ft).

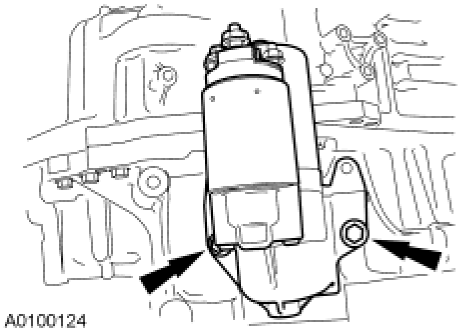


Fig. 320: Locating Starter Bolts
Courtesy of FORD MOTOR CO.

63. Connect the 2 starter motor electrical connectors.
    - Tighten the larger nut to 12 Nm (106 lb-in).
    - Tighten the smaller nut to 5 Nm (44 lb-in).

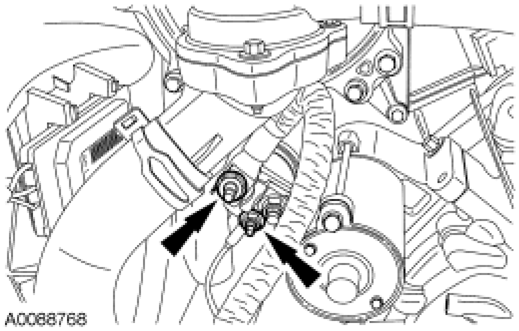


Fig. 321: Identifying Starter Motor Electrical Connectors
Courtesy of FORD MOTOR CO.

64. Install the electrical cover for the starter motor electrical connectors.

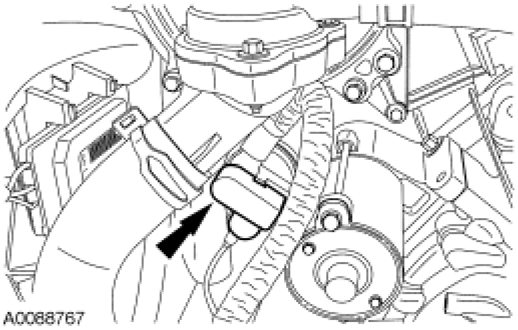


Fig. 322: Identifying Electrical Cover For Starter Motor Electrical Connectors
Courtesy of FORD MOTOR CO.

65. Install the 2 ground wires and ground wire bolts.
    - Tighten to 12 Nm (106 lb-in).

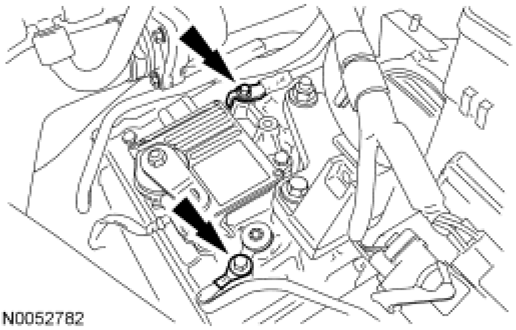


Fig. 323: Identifying Ground Straps & Ground Strap Bolts
Courtesy of FORD MOTOR CO.

66. Connect the Transmission Control Module (TCM) electrical connector.

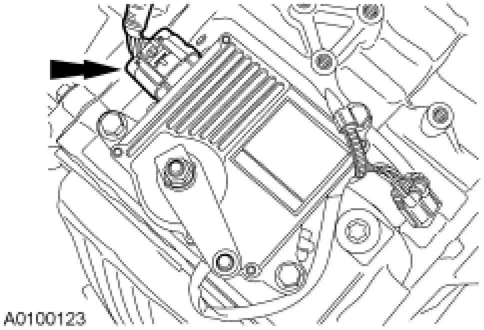


Fig. 324: Identifying Transmission Control Module Electrical Connector
Courtesy of FORD MOTOR CO.

67. Position the selector lever cable and bracket in place and install the selector lever cable nut and 2 selector

lever cable bolts.

- Tighten to 12 Nm (106 lb-in).

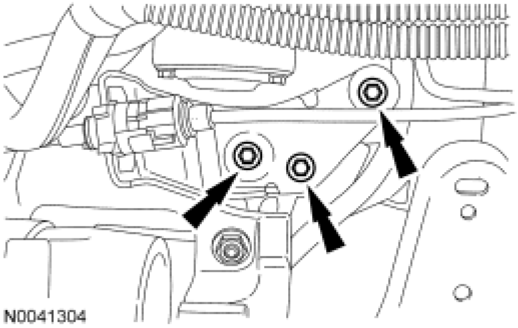


Fig. 325: Locating Transaxle Control Cable Bracket Bolts
Courtesy of FORD MOTOR CO.

68. Connect the selector lever cable end.

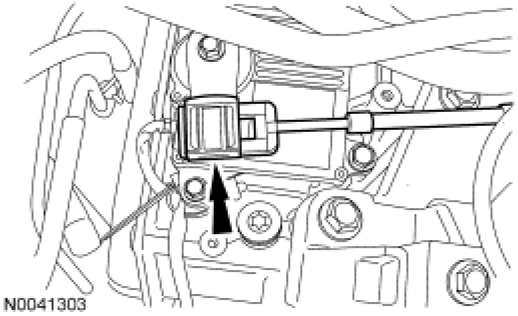


Fig. 326: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

69. Remove the transmission fluid fill plug.

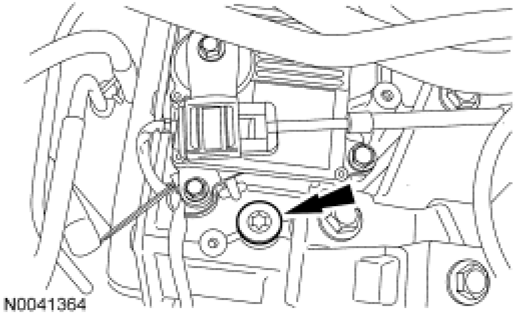


Fig. 327: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

70. Fill the transaxle with clean transmission fluid.

71. Install the transmission fluid fill plug.
    - Tighten to 39 Nm (29 lb-ft).

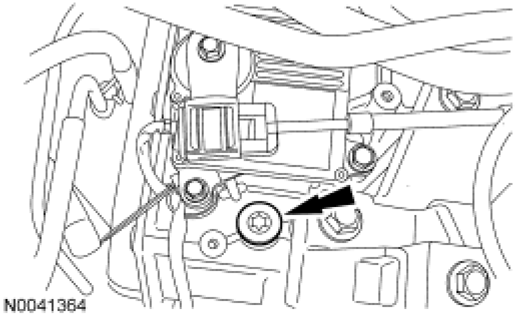


Fig. 328: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

72. Install the air cleaner and outlet tube. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 2.3L** article or **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article.
73. Install the battery tray and the battery. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
74. Remove the transmission fluid level indicator and make sure that the transaxle has transmission fluid in it.
75. With the transaxle in PARK, the vehicle on a level surface, the engine at idle (680-780 rpm) and foot pressed on the brake, move the selector lever through each gear and allow engagement of each gear. Place the selector lever back in the PARK position.
76. Wipe the transmission fluid level indicator cap and remove the transmission fluid level indicator.
77. Wipe the transmission fluid level indicator with a clean cloth.

NOTE: **In order to get an accurate transmission fluid level reading, the vehicle should be on a level surface. Idle the engine to reach the normal operating temperature. Using the scan tool, verify that the transaxle is at normal operating temperature 60°C-70°C (140°F-158°F), prior to adjusting the transmission fluid level.**

78. If transmission fluid needs to be added, add transmission fluid in 0.25L (1/2 pt) increments through the transmission fluid fill plug located on the top of the transaxle near the transmission fluid level indicator. Do not overfill the transmission fluid. Install the transmission fluid level indicator back in the transmission fluid filler tube until it is fully seated, then remove the transmission fluid level indicator. The transmission fluid level should be at the upper most mark on the transmission fluid level indicator. Only fill to the upper most mark on the transmission fluid level indicator. Do not overfill. Damage to the transaxle will occur.

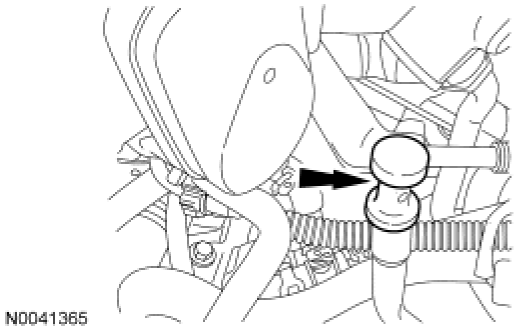


Fig. 329: Locating Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: **The correct transmission fluid level at normal operating temperature of 60°C-70°C (140°F-158°F) is between the top 2 marks on the fluid level indicator.**

79. Fill the transaxle to the correct fluid level.

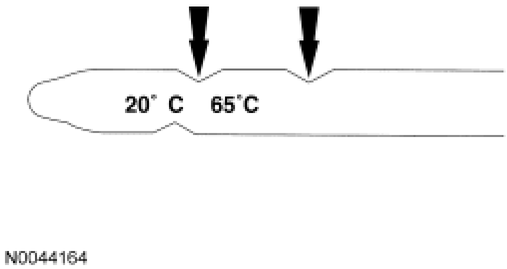


Fig. 330: Locating Temperature Marks On Fluid Level Indicator
Courtesy of FORD MOTOR CO.

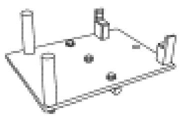
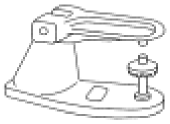
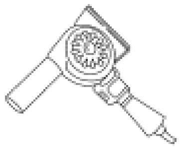
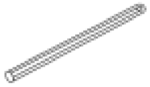
NOTE: **The correct transmission fluid level at cold operating temperature of 15°C-25°C (59°F-77°F) is at the bottom mark on the transmission fluid level indicator.**

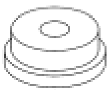
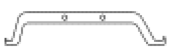
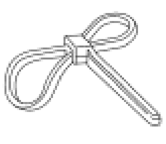
80. If the Transmission Fluid Temperature (TFT) is low, fill the transaxle with transmission fluid to the cold range on the transmission fluid level indicator. Recheck the transmission fluid level when the transaxle has reached the normal operating temperature.

Fig. 331: Locating Bottom Mark On Fluid Level Indicator
Courtesy of FORD MOTOR CO.

TRANSAXLE - 3.5L

Special Tools

Illustration	Tool Name	Tool Number
 ST3034-A	Engine Lifting Bracket	303-1245
 ST1278-A	Handle	205-153 (T80T-4000-W)
 ST1073-A	Heat Gun	107-R0300
 ST2138-A	Installer, Halfshaft	204-161 (T97P-1175-A)
 ST2939-A	Installer, Halfshaft Oil Seal	308-431

 ST2571-A	Installer, PTU Drive Gear Outer Oil Seal	308-430
 ST2981-A	Lifting Bracket, Engine	303-050 (T70P-6000)
 ST1568-A	Remover/Installer, Bearing Cup	204-038 (T77F-1217-A)
 ST2977-A	Spreader Bar	303-1246
 ST1602-A	Support Bar, Engine	303-F072
 ST1438-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Material

Item	Specification
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B
Threadlock and Sealer TA-25	WSK-M2G351-A5

NOTE: **MERCON®, MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid and Motorcraft Continuously Variable Chain Type**

Transmission Fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage.

NOTE: **If the transaxle was overhauled, or if installing a new transaxle and the transmission fluid cooler has not been flushed, flush the transmission fluid cooler at this time. For additional information, refer to Transmission Fluid Cooler - Backflushing and Cleaning.**

All vehicles

1. Prior to installing the transaxle, apply multi-purpose grease to the torque converter pilot hub.

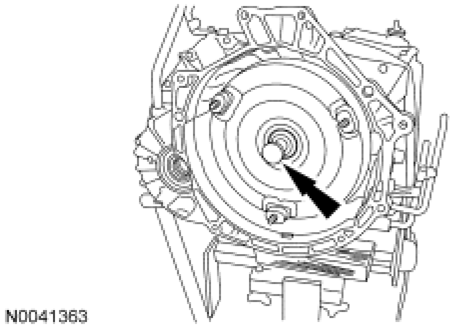


Fig. 332: Identifying Torque Converter Pilot Hub
Courtesy of FORD MOTOR CO.

2. Position the transaxle to the back of the engine.
3. Install the 7 transaxle-to-engine bolts.
   - Tighten to 48 Nm (35 lb-ft).

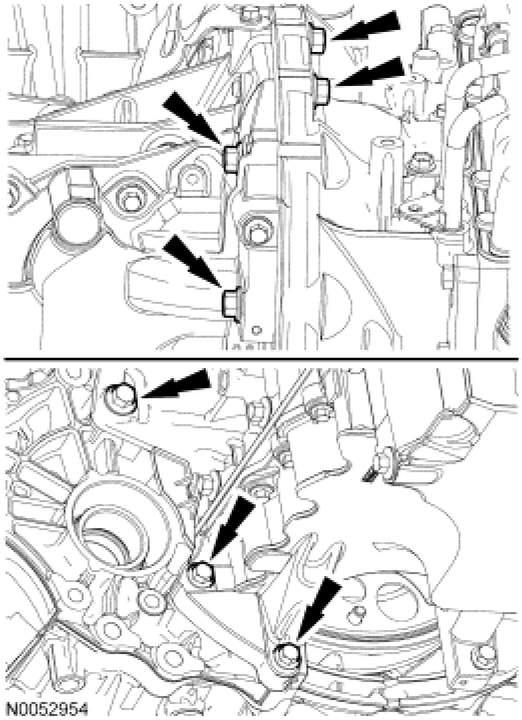


Fig. 333: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

4. Connect the transmission fluid cooler hoses to the transmission cooler tubes.

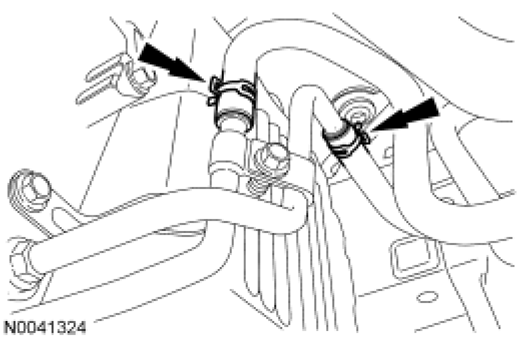


Fig. 334: Locating Transmission Fluid Cooler Hoses
Courtesy of FORD MOTOR CO.

5. Install 4 new torque converter nuts.
   - Tighten to 36 Nm (27 lb-ft).

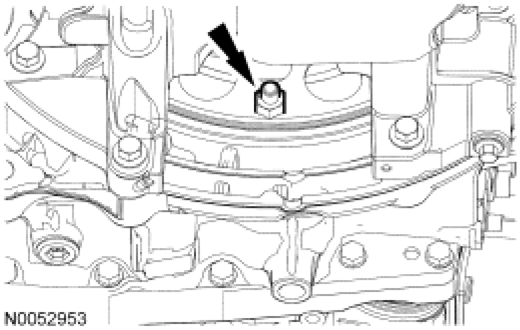


Fig. 335: Identifying Torque Converter Nuts
Courtesy of FORD MOTOR CO.

6. Position the inspection cover in place and install the 2 fasteners.

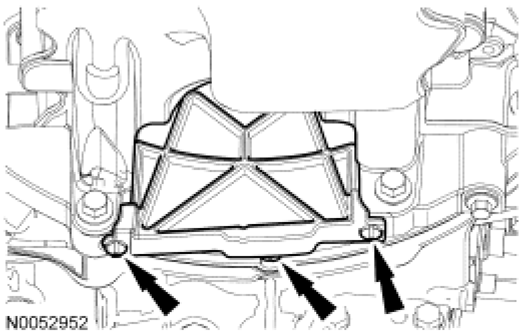


Fig. 336: Identifying Inspection Cover & Fasteners
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

7. Position the power transfer unit Power Transfer Unit (PTU) in place and install the 5 bolts.
   - Tighten to 90 Nm (66 lb-ft).

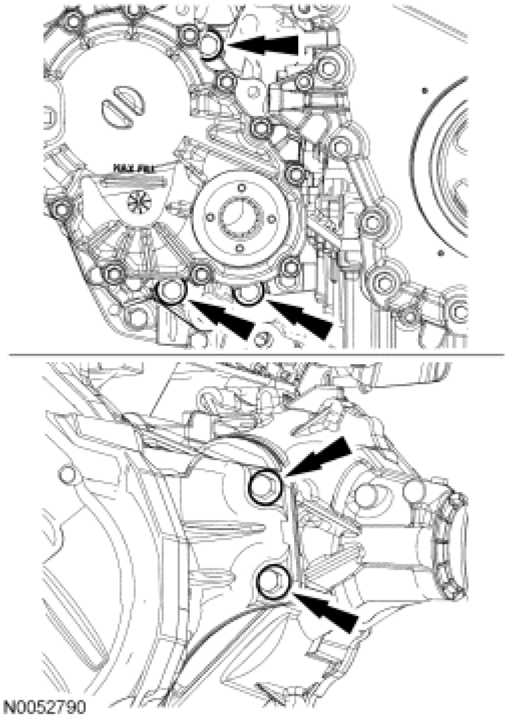


Fig. 337: Locating PTU Bolts
Courtesy of FORD MOTOR CO.

8. Using the Bearing Cup Remover/Installer and Handle, install a new intermediate shaft seal.

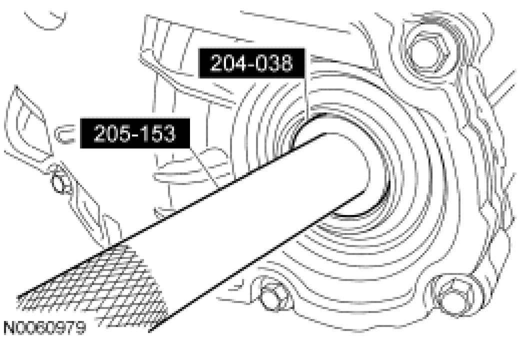


Fig. 338: Identifying Intermediate Shaft Seal & Special Tools (204-038, 205-153)
Courtesy of FORD MOTOR CO.

NOTE:	**Do not overheat (melt) the seal deflector. If the deflector is damaged, a new one must be used.**

9. Using the Heat Gun, heat the new seal deflector. Concentrate the heat across the back of the deflector near the white-colored tabs. Install the seal deflector immediately after heating.
   - If necessary, use the PTU Drive Gear Outer Oil Seal Installer and Halfshaft Oil Seal Installer to seat the seal deflector. Make sure the deflector is fully seated and there are no cracks on the face or inner diameter white-colored tab.

- For an alternate method to heat the seal deflector, place the deflector in boiling water for 3 to 5 minutes. Dry off deflector and install.
- Make sure the deflector is completely seated all the way around.

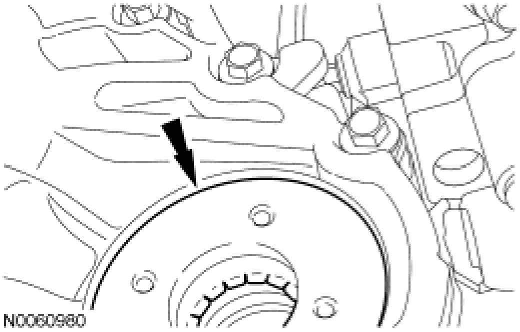


Fig. 339: Identifying Seal Deflector
Courtesy of FORD MOTOR CO.

10. Position the PTU support bracket in place and install the 5 bolts.
    - Tighten to 70 Nm (52 lb-ft).

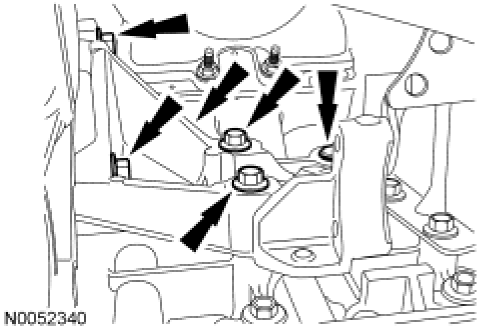


Fig. 340: Locating Power Transfer Unit (PTU) Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

11. Position the RH catalytic converter in place and install the 4 nuts.
    - Tighten to 40 Nm (30 lb-ft).

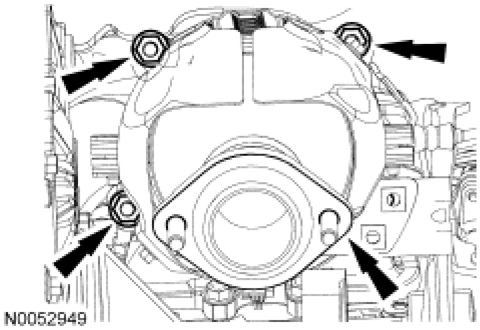


Fig. 341: Locating RH Catalytic Converter Nuts

Courtesy of FORD MOTOR CO.

12. Install the 2 catalytic converter bracket bolts.
    - Tighten to 20 Nm (177 lb-in).

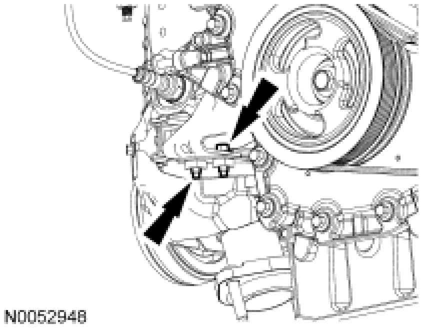


Fig. 342: Identifying Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

13. Connect the RH catalyst monitor sensor electrical connector.

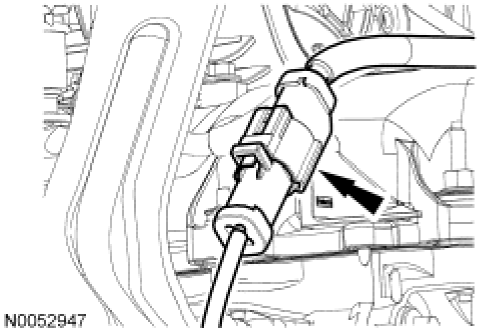


Fig. 343: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

14. Position the driveshaft in place, align the index marks made during removal and install the bolts.
    - Tighten to 70 Nm (52 lb-ft).

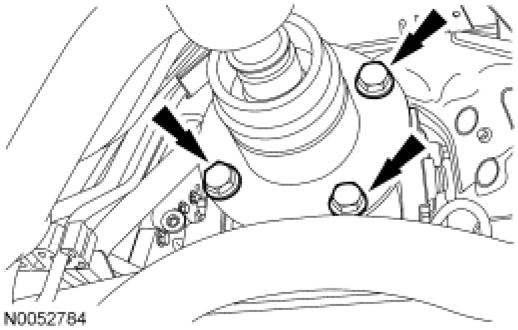


Fig. 344: Identifying Drive Shaft Bolts

Courtesy of FORD MOTOR CO.

15. Position the RH halfshaft in the transaxle and in the wheel hub and install the 2 bolts.
    - Tighten to 23 Nm (17 lb-ft).

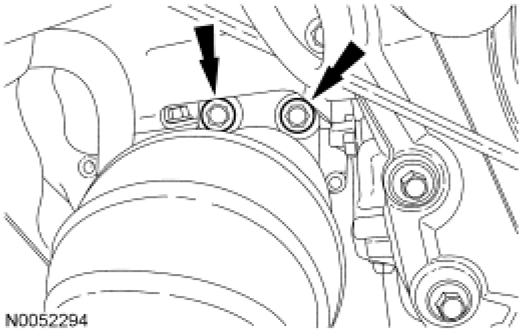


Fig. 345: Locating RH Halfshaft Bearing Support Bracket Bolts
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

16. Install the RH halfshaft in the transaxle and install the 3 bolts.
    - Tighten to 55 Nm (41 lb-ft).

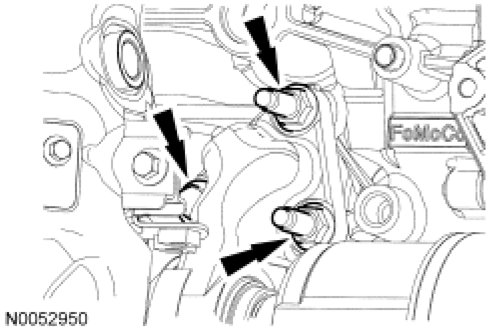


Fig. 346: Identifying Intermediate Shaft Bearing Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

17. Install the catalytic converter support bracket and install the 2 nuts.
    - Tighten to 23 Nm (17 lb-ft).

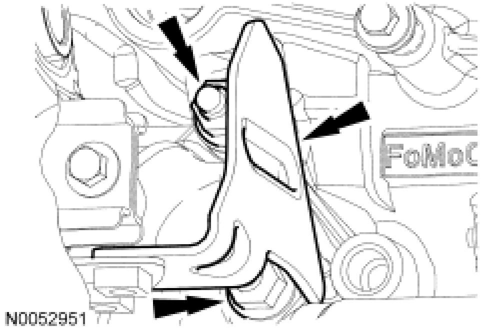


Fig. 347: Identifying Catalytic Converter Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

18. Install the 2 catalytic converter bracket bolts.
    - Tighten to 20 Nm (177 lb-in).

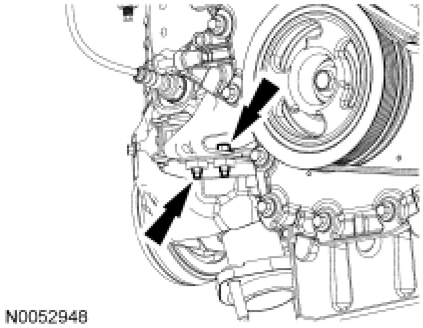


Fig. 348: Identifying Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: LH shown, RH similar.

19. Position the subframe in place and install the 2 front subframe nuts.
    - Tighten to 150 Nm (111 lb-ft).

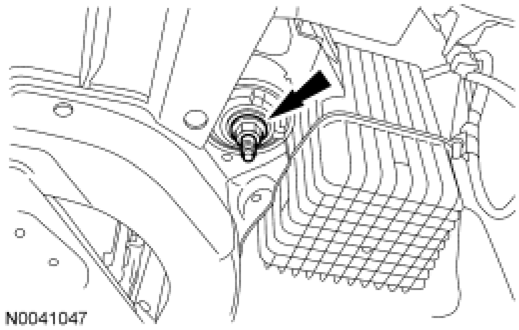


Fig. 349: Locating Front Subframe Nuts

Courtesy of FORD MOTOR CO.

20. Position the subframe support brackets in place and loosely install the bolts.

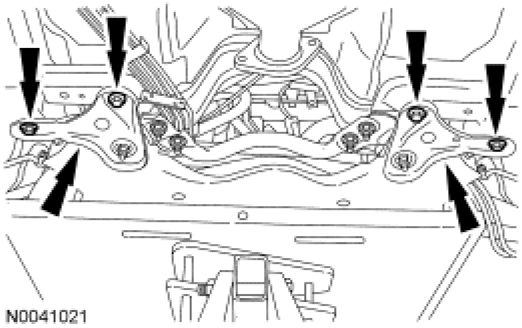


Fig. 350: Locating Subframe Support Brackets And Bolts
Courtesy of FORD MOTOR CO.

21. Install the rear subframe nuts.
    - Tighten to 150 Nm (111 lb-ft).

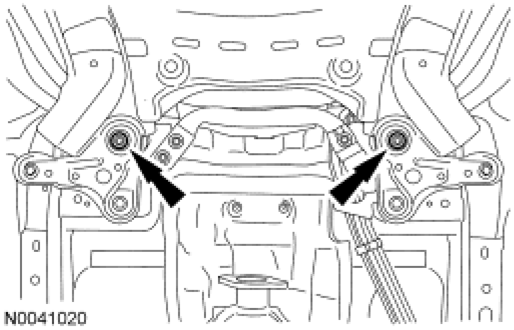


Fig. 351: Locating Rear Subframe Nuts
Courtesy of FORD MOTOR CO.

22. Tighten the subframe support bracket bolts.
    - Tighten to 103 Nm (76 lb-ft).

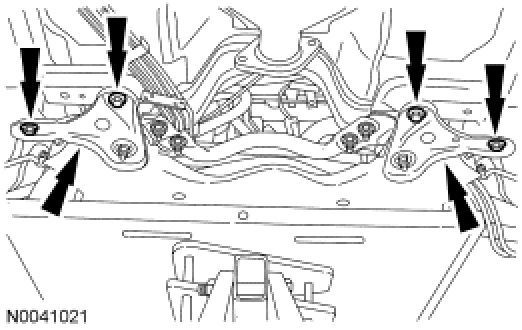


Fig. 352: Locating Subframe Support Brackets And Bolts

Courtesy of FORD MOTOR CO.

23. Position the steering gear in place and install the 3 bolts.
    - Tighten to 107 Nm (79 lb-ft).

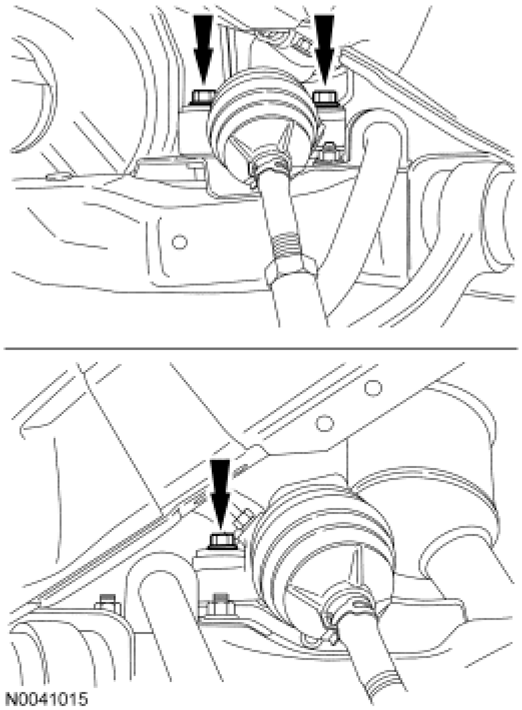


Fig. 353: Locating Steering Gear Bolts
Courtesy of FORD MOTOR CO.

24. Position the power steering cooler line bracket in place and install the bolts.
    - Tighten to 9 Nm (80 lb-in).

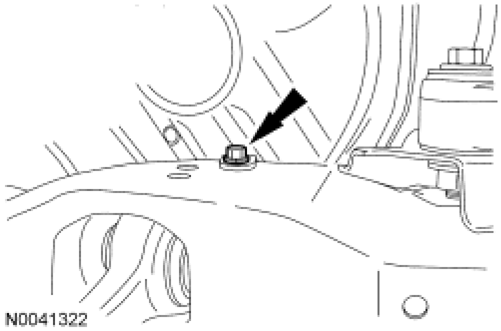


Fig. 354: Locating Power Steering Cooler Tube Bolts
Courtesy of FORD MOTOR CO.

25. Install the 2 roll restrictor bracket bolts.
    - Tighten to 90 Nm (66 lb-ft).

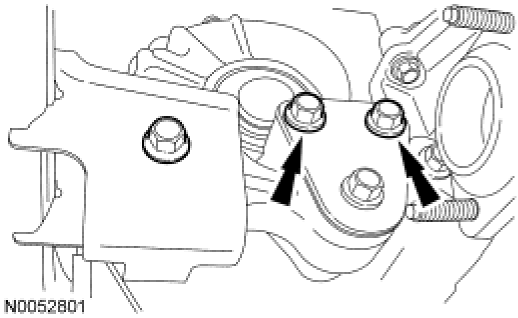


Fig. 355: Locating Engine Roll Restrictor Bracket Bolts
Courtesy of FORD MOTOR CO.

26. Install the RH damper fork through bolt connecting the fork to the lower control arm.
    - Tighten to 103 Nm (76 lb-ft).

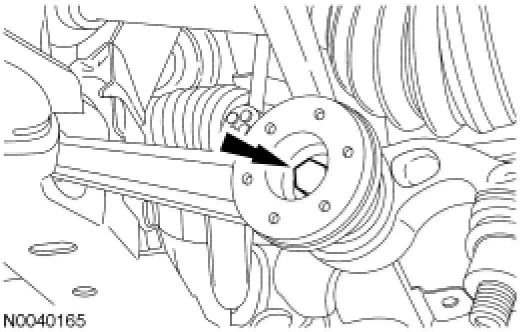


Fig. 356: Locating Damper Fork Bolt
Courtesy of FORD MOTOR CO.

27. Position the lower control arms in the knuckle and install the nuts.
    - Tighten to 200 Nm (148 lb-ft).

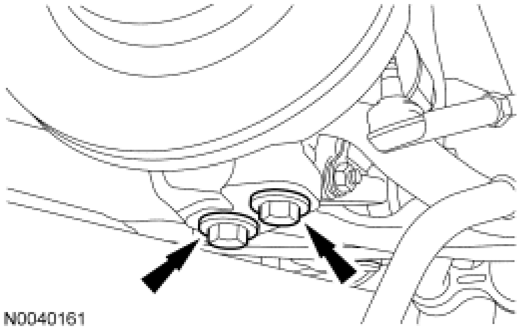


Fig. 357: Locating Front And Rear Lower Control Arm Nuts
Courtesy of FORD MOTOR CO.

AWD vehicles

28. Using the Halfshaft Installer, install the halfshaft in the wheel hub.

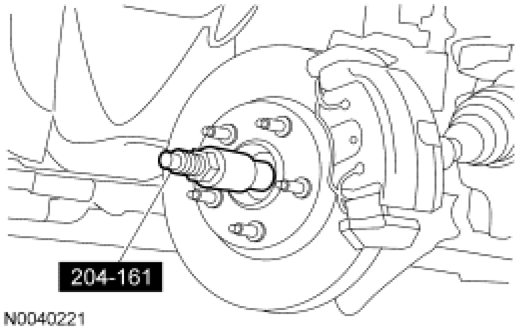


Fig. 358: Identifying Special Tool 204-161
Courtesy of FORD MOTOR CO.

29. Install a new front wheel hub nut.
    - Tighten to 255 Nm (185 lb-ft).

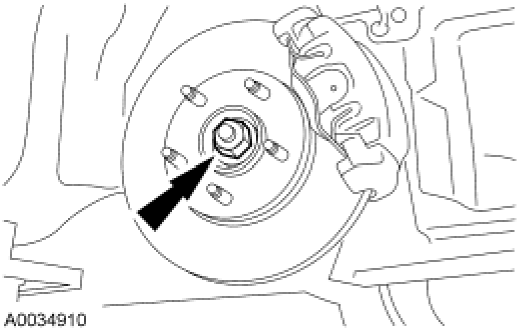


Fig. 359: Locating Front Wheel Hub Nut
Courtesy of FORD MOTOR CO.

All vehicles

30. Install the LH halfshaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.

NOTE: LH shown, RH similar.

31. Position the sway bar links in the struts and install the nuts.
    - Tighten to 40 Nm (30 lb-ft).

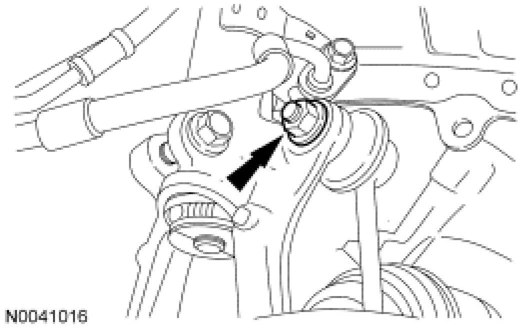


Fig. 360: Locating Sway Bar Links Nut
Courtesy of FORD MOTOR CO.

32. Position the Y-pipe in place and install the 6 Y-pipe nuts.
    - Tighten to 40 Nm (30 lb-ft).

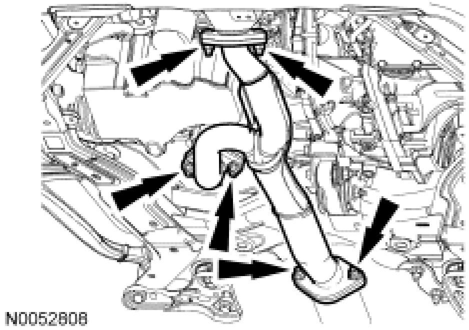


Fig. 361: Locating Y-Pipe Nuts & Y-Pipe Assembly
Courtesy of FORD MOTOR CO.

33. Install the LH front structure to subframe splash shield and install the pin-type retainers.

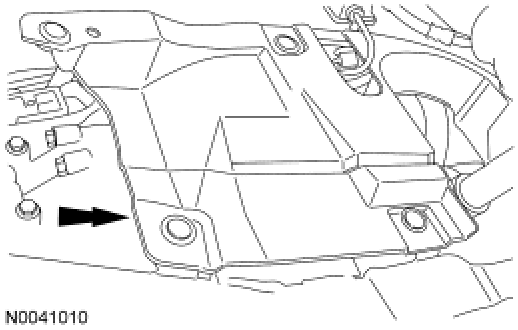


Fig. 362: Locating LH Front Structure-To-Subframe Splash Shield
Courtesy of FORD MOTOR CO.

34. Position the LH fender splash shield in place and install the 4 screws.

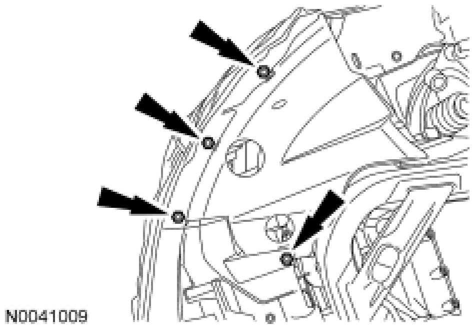


Fig. 363: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

35. Position the RH front structure-to-subframe splash shield in place and install the 6 pin-type retainers.

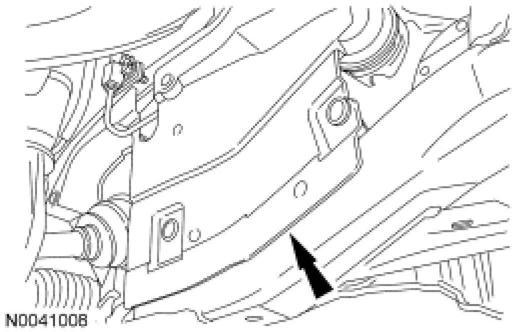


Fig. 364: Locating RH Front Structure-To-Subframe Splash Shield
Courtesy of FORD MOTOR CO.

36. Position the RH fender splash shield in place and install the 4 screws.

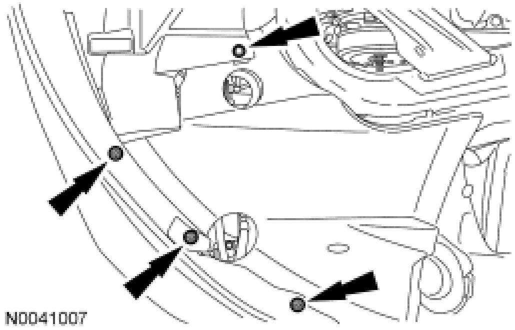


Fig. 365: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

37. Apply threadlock and sealer to the threads and install the transaxle support insulator bracket, the 2 nuts and the bolt.
    - Tighten to 80 Nm (59 lb-ft).

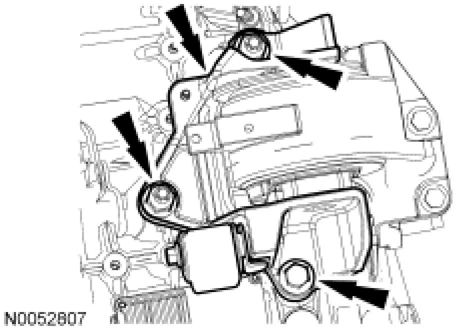


Fig. 366: Locating Transaxle Support Insulator Bracket Nuts & Bolt
Courtesy of FORD MOTOR CO.

38. Using the Engine Support Bar, raise the transaxle. Apply threadlock and sealant to the threads and install the transaxle support insulator through bolt.
    - Tighten to 130 Nm (96 lb-ft).

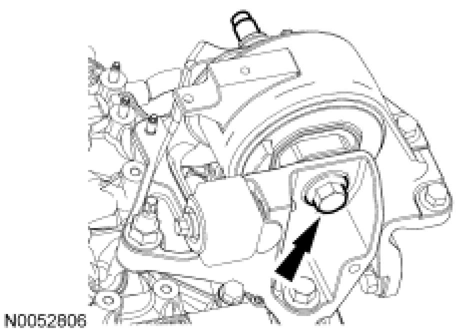


Fig. 367: Identifying Transaxle Support Insulator Through Bolt
Courtesy of FORD MOTOR CO.

39. Remove the Engine Support Bar and Spreader Bar.

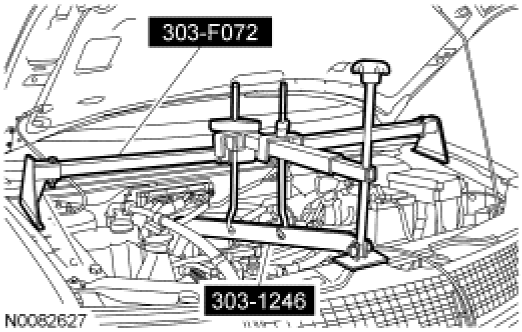


Fig. 368: Installing Engine Support Bar & Spreader Bar To Support Engine
Courtesy of FORD MOTOR CO.

40. Remove the Engine Lifting Bracket from the LH cylinder head.

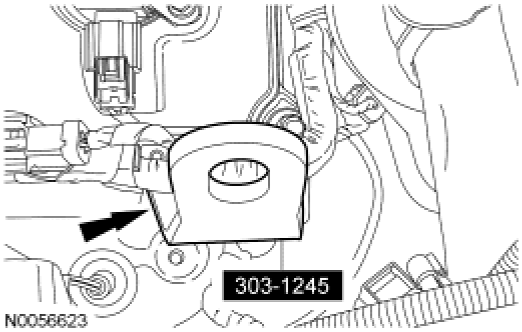


Fig. 369: Special Tool (303-1245) On LH Cylinder Head
Courtesy of FORD MOTOR CO.

41. Install the 4 upper transaxle-to-engine bolts.
    - Tighten to 48 Nm (35 lb-ft).

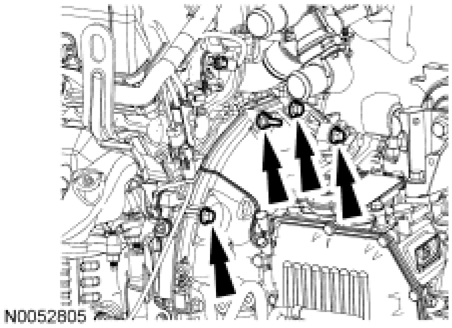


Fig. 370: Identifying Upper Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

42. Install the starter and the 2 bolts.
    - Tighten to 26 Nm (19 lb-ft).

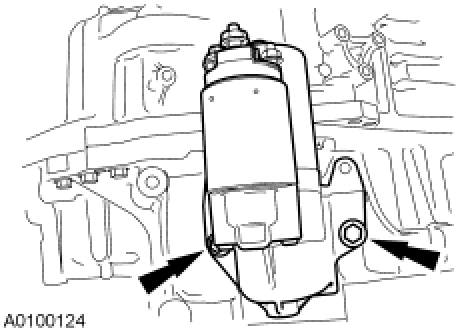


Fig. 371: Locating Starter Bolts
Courtesy of FORD MOTOR CO.

43. Connect the 2 starter motor electrical connectors and position back the electrical terminal cover.
    - Tighten the larger nut to 12 Nm (106 lb-in).

- Tighten the smaller nut to 5 Nm (44 lb-in).

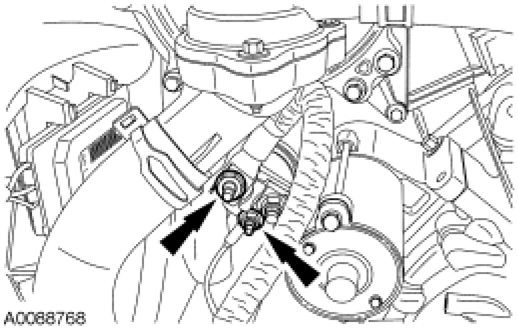


Fig. 372: Identifying Starter Motor Electrical Connectors
Courtesy of FORD MOTOR CO.

44. Position the 2 ground straps in place and install the 2 ground strap bolts.
    - Tighten to 12 Nm (106 lb-in).

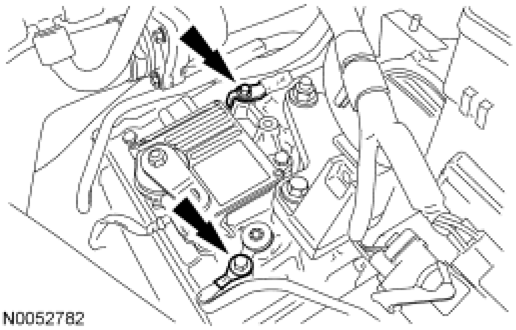


Fig. 373: Identifying Ground Straps & Ground Strap Bolts
Courtesy of FORD MOTOR CO.

45. Connect the wiring harness fasteners on the torque converter housing stud bolt and the starter motor.

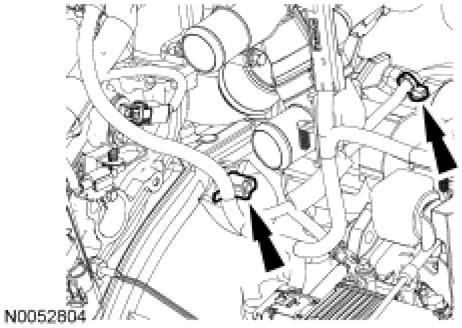


Fig. 374: Identifying Wiring Harness Fasteners & Torque Converter Housing Stud Bolt
Courtesy of FORD MOTOR CO.

46. Connect the Transmission Control Module (TCM) electrical connector.

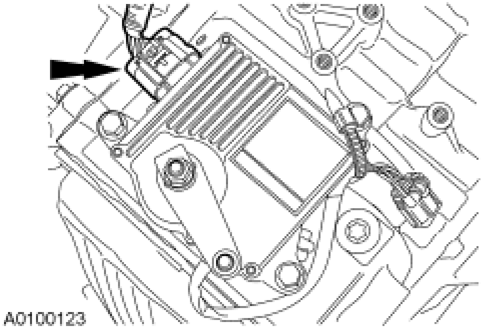


Fig. 375: Identifying Transmission Control Module Electrical Connector
Courtesy of FORD MOTOR CO.

47. Position the selector lever cable in place and install the 2 bolts and the nut.
    - Tighten to 12 Nm (106 lb-in).

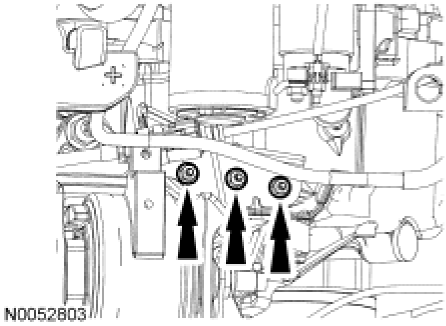


Fig. 376: Identifying Selector Lever Cable Bracket Bolts & Nuts
Courtesy of FORD MOTOR CO.

48. Connect the selector lever cable end.

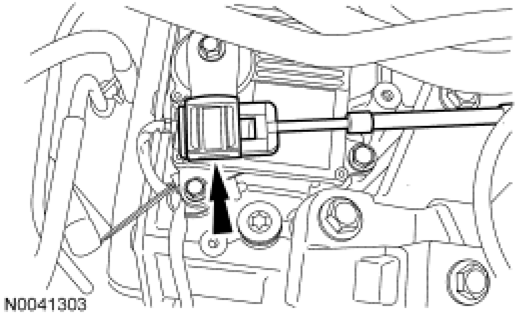


Fig. 377: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

49. Remove the transmission fluid fill plug.

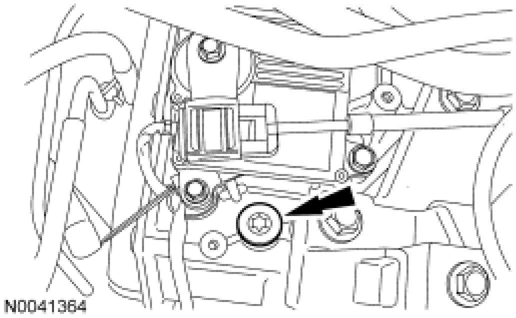


Fig. 378: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

50. Fill the transaxle with clean transmission fluid.
51. Install the transmission fluid fill plug.
    - Tighten to 39 Nm (29 lb-ft).

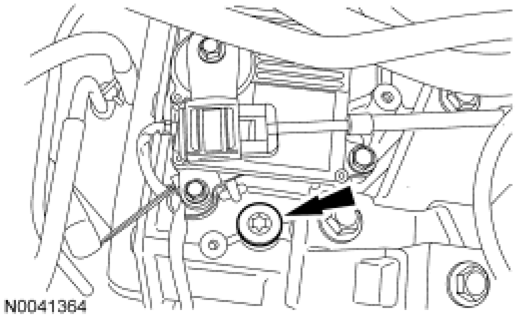


Fig. 379: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

52. Install the upper intake manifold. For additional information, refer to **ENGINE - 3.5L** article.
53. Install the air cleaner and outlet tube. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 2.3L** article or **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article.
54. Install the battery tray and the battery. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
55. Remove the transmission fluid level indicator and make sure that the transaxle has transmission fluid in it.
56. With the transaxle in PARK, the vehicle on a level surface, the engine at idle (680-780 rpm) and foot pressed on the brake, move the selector lever through each gear and allow engagement of each gear. Place the selector lever back in the PARK position.
57. Wipe the transmission fluid level indicator cap and remove the transmission fluid level indicator.
58. Wipe the transmission fluid level indicator with a clean cloth.

NOTE: **In order to get an accurate transmission fluid level reading the vehicle should be on a level surface. Idle the engine to reach the normal operating**

temperature. Using the scan tool, verify that the transaxle is at normal operating temperature 60°C-70°C (140°F-158°F), prior to adjusting the transmission fluid level.

59. If transmission fluid needs to be added, add transmission fluid in 0.25L (1/2 pt) increments through the transmission fluid fill plug located on the top of the transaxle near the transmission fluid level indicator. Do not overfill the transmission fluid. Install the transmission fluid level indicator back in the transmission fluid filler tube until it is fully seated, then remove the indicator. The transmission fluid level should be at the upper most mark on the transmission fluid level indicator. Only fill to the upper most mark on the transmission fluid level indicator. Do not overfill. Damage to the transaxle will occur.

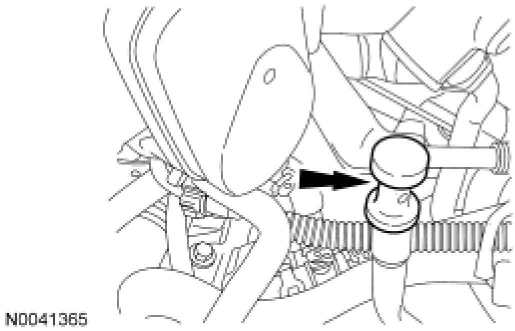


Fig. 380: Locating Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE:	**The correct transmission fluid level at normal operating temperature of 60°C-70°C (140°F-158°F) is between the top 2 marks on the transmission fluid level indicator.**

60. Fill the transaxle to the correct transmission fluid level.

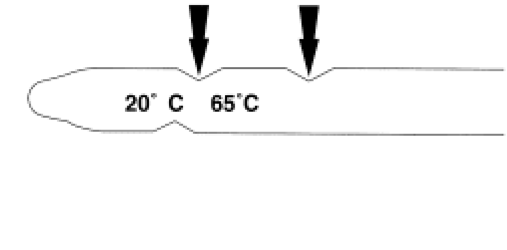


Fig. 381: Locating Temperature Marks On Fluid Level Indicator
Courtesy of FORD MOTOR CO.

NOTE:	**The correct transmission fluid level at cold operating temperature of 15°C-25°C (59°F-77°F) is at the bottom mark on the transmission fluid level indicator.**

61. If the Transmission Fluid Temperature (TFT) is low, fill the transaxle with transmission fluid to the cold range on the transmission fluid level indicator. Recheck the transmission fluid level when the transaxle has reached the normal operating temperature.

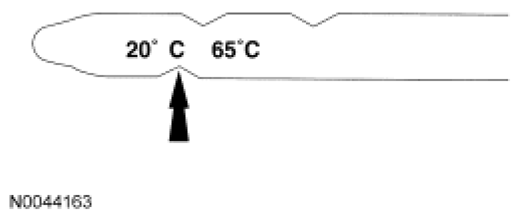


Fig. 382: Locating Bottom Mark On Fluid Level Indicator
Courtesy of FORD MOTOR CO.

2008 TRANSMISSIONS

Automatic Transaxle/Transmission External Controls - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Selector lever cable grommet nuts	8	71
Selector lever knob bolts	2	18
Selector lever nuts	12	106

DESCRIPTION AND OPERATION

EXTERNAL CONTROLS

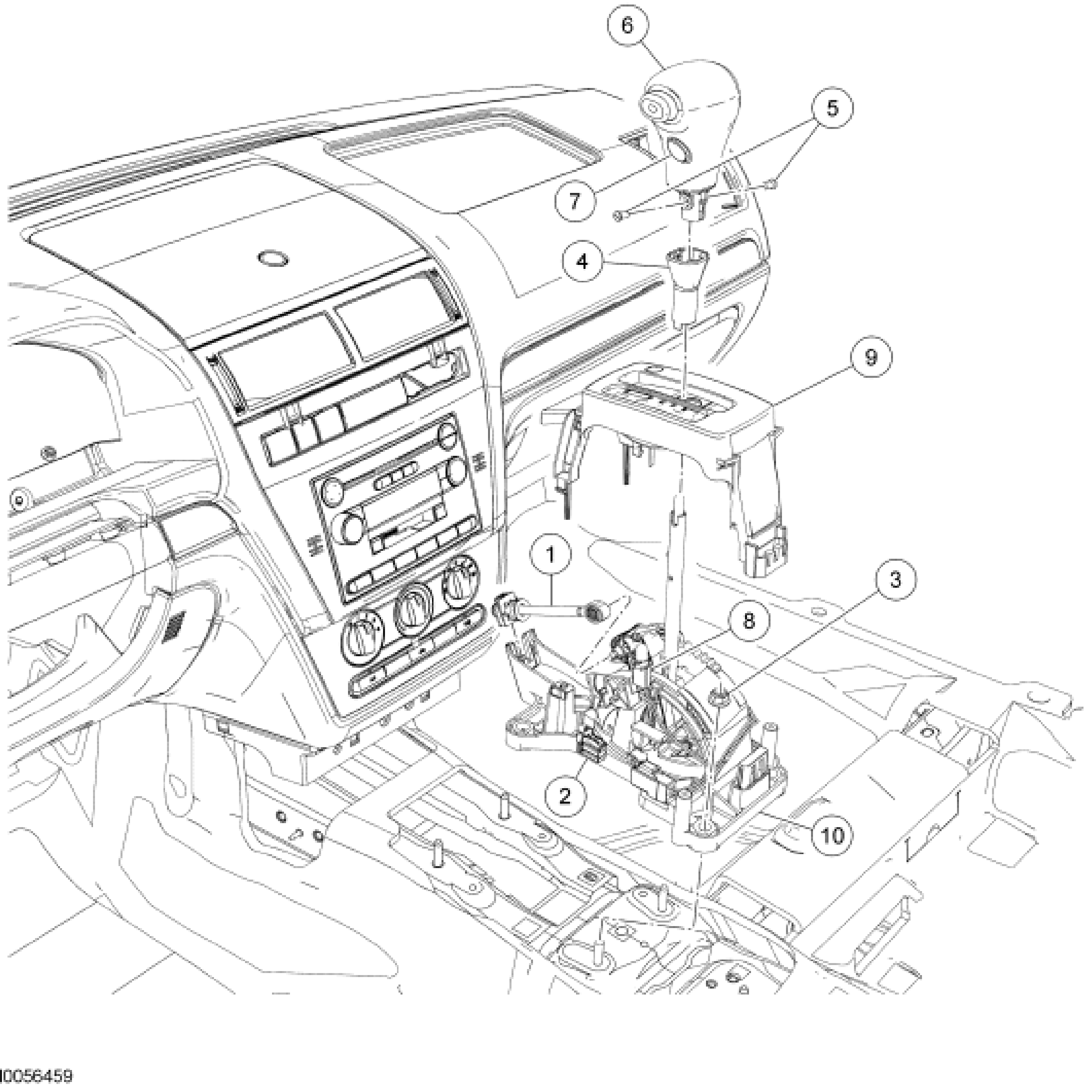


Fig. 1: Exploded View Of External Controls
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7E395	Selector lever cable
2	14489	Selector lever electrical connector
3	W520102	Selector lever nut (4 required)
4	-	Lower selector lever knob bezel
5	-	Selector lever knob bolts
6	7L010	Selector lever knob
7	-	Transmission Control Switch (TCS) (3.5L engine) (part of 7L010) (MKZ only)
8	-	PRNDL light

9	7E034	PRNDL bezel
10	7K004	Selector lever assembly (items 4-10)

The transaxle selector lever control linkage consists of:

- a selector lever cable that connects the transaxle range selector lever to the floor selector lever assembly.
- a Brake Shift Interlock Actuator (BSIA) that is integral to the floor selector lever assembly.

The floor selector lever assembly:

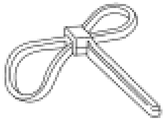
- locks the transaxle range selector lever in the PARK position when the ignition switch is in the lock position.
- requires the transaxle range selector lever to be in the PARK position to turn the ignition switch to the lock position.

The MKZ Transmission Control Switch (TCS) is a momentary contact switch located on the selector lever knob that allows the driver to cancel the operation of OVERDRIVE.

DIAGNOSTIC TESTS

EXTERNAL CONTROLS

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	73 III Digital Multimeter	105-R0057 or equivalent
 ST1438-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom. Go to **Symptom Chart - External Controls** or Go to **Symptom Chart - NVH**.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Selector lever cable • Manual control lever • Transmission Control Module (TCM) out of adjustment (6-speed transaxle) • Selector lever slider bunching or binding	• Battery Junction Box (BJB) fuse 14 (15A) • Connections • Wiring harness • Brake Pedal Position (BPP) switch • Brake Shift Interlock Actuator (BSIA) • Transmission Control Switch (TCS) (MKZ)

DTC Chart

DTC CHART

DTC	Component	Description	Condition	Symptom	Action
B2572	Brake Shift Interlock	Brake Shift Interlock Output Circuit Failure	The associated circuitry connected to the Smart Junction Box (SJB) or fuse, or the SJB itself may have an issue causing a brake shift interlock concern.	Brake shift interlock is inoperative or does not operate correctly.	Go to **Pinpoint Test A**.

Symptom Chart - External Controls

Symptom Chart - External Controls

Condition	Possible Sources	Action
• Brake shift interlock system does not release/lock correctly	• Circuitry open/shorted • Fuse 14 (15A) • Brake Pedal Position (BPP) switch	• Go to **Pinpoint Test A**.
• Brake shift interlock system does not release/lock correctly	• Brake Shift Interlock Actuator (BSIA) damaged or incorrectly installed after repair	• INSTALL a new selector lever assembly. REFER to **Selector Lever**.
• Transmission Control Switch (TCS) does not operate correctly (MKZ only)	• Instrument Cluster (IC) • Circuitry open/shorted • Transmission Control Module (TCM)	• Go to **Pinpoint Test B**.

	• TCS	
• Selector lever linkage is out of correct gear relationship	• Selector lever cable is out of adjustment • Loose selector lever cable bracket	• REFER to **Selector Lever Cable Adjustment**. • CHECK the selector cable bracket. TIGHTEN as necessary.
• Key stuck in the ignition cylinder or does not lock in the ignition cylinder when the selector lever is not in park	• Ignition cylinder damaged • Selector lever knob damaged • Selector lever park detent switch damaged • Selector lever pawl is not contacting park detent switch	• CHECK the ignition lock cylinder, REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article. • CHECK the selector lever knob button function by cycling the button. If the button is binding, INSTALL a new selector lever knob. REFER to **Selector Lever Knob - 2.3L, 3.0L** or **Selector Lever Knob - 3.5L**. • CHECK the park detent switch signal, go to **Pinpoint Test C**. • CHECK the selector lever for correct contact.
• Selector lever binding	• Selector lever bezel damaged • Selector lever damaged • Selector lever cable damaged • Internal transaxle components damaged	• CHECK the selector lever bezel for damage. If necessary, INSTALL a new selector lever bezel. REFER to **Selector Lever Bezel**. • CHECK the selector lever for damage. If necessary, INSTALL a new selector lever assembly. REFER to **Selector Lever**. • CHECK the selector lever cable for damage. If necessary, INSTALL a new selector lever cable. REFER to **Selector Lever Cable**. • CHECK the manual control lever and internal transaxle components for damage. REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article or **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
• Brake shift interlock override does not release the selector lever	• Brake shift interlock override damaged	• INSPECT the selector lever for damage. If necessary, INSTALL a new selector lever. REFER to **Selector Lever**.

Symptom Chart - NVH

NOTE: **NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be**

necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

Symptom Chart - NVH

Condition	Possible Sources	Action
• Vibration - a high frequency (20-80 Hz) that is felt through the seat or selector lever. Changes with engine speed	• Selector lever cable incorrectly routed, grounded out or loose	• CHECK the selector lever cable. REPAIR as necessary.

Electrical Connectors

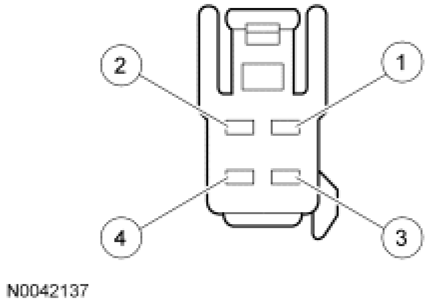


Fig. 2: Selector Lever Harness C3245 (3.0L Engine)
Courtesy of FORD MOTOR CO.

Pin Number	Circuit	Circuit Function
1	VET13 (GY/BU)	Brake Shift Interlock Actuator (BSIA) solenoid power circuit
2	CET22 (GY/BN)	Park position signal to ignition switch
3	CLN04 (BU/BN)	Power to PRNDL bulb
4	GD116 (BK/VT)	Ground

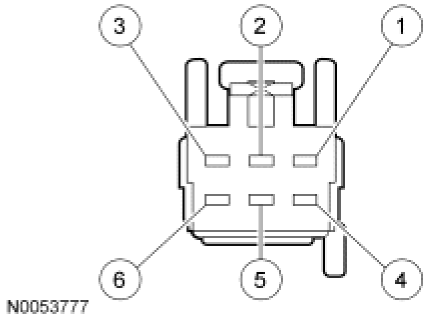


Fig. 3: Selector Lever Harness C3233 (3.5L Engine)

Courtesy of FORD MOTOR CO.

Pin Number	Circuit	Circuit Function
1	VET13 (GY/BU)	Brake Shift Interlock Actuator (BSIA) solenoid power circuit
2	CET22 (GY/BN)	Park position signal to ignition switch
3	-	Not used
4	VLN04 (VT/GY)	Power to PRNDL LED illumination
5	GD116 (BK/VT)	Ground
6	CET34 (BN/GN)	Transmission Control Switch (TCS)/ Overdrive (O/D) cancel (MKZ)

Pinpoint Tests

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Transmission Controls -6 Speed for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Transmission Controls-FNR5 for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Shift Interlock for schematic and connector information.

PINPOINT TEST A: THE BRAKE SHIFT INTERLOCK SYSTEM DOES NOT RELEASE/LOCK CORRECTLY

A1 TEST THE BRAKE LIGHTS

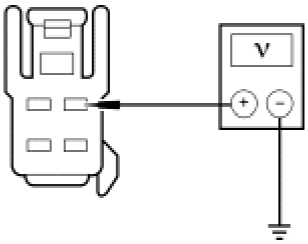
- Apply the brake pedal and view the brake lights.
- **Do the brake lights illuminate?**

  YES : Go to A2.

  NO : REFER to **EXTERIOR LIGHTING** article.

A2 TEST Brake Shift Interlock Actuator (BSIA) POWER CIRCUIT

- Disconnect: Selector Lever Electrical C3245 (2.3L/3.0L engine) or C3233 (3.5L engine)
- Key in ON position.



N0042138

Fig. 4: Testing Shift Interlock Actuator Power Circuit - 3.0L or a 2.3L
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.0L or a 2.3L engine, measure the voltage between selector lever harness C3245-1, circuit VET13 (GY/BU), vehicle harness side and ground, while applying the brake pedal.

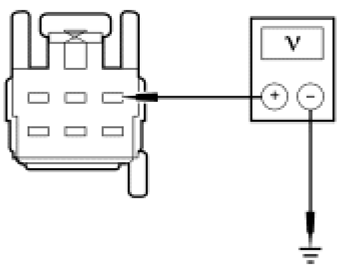


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Fig. 5: Measuring Voltage Between Selector Lever Harness C3245-1, Circuit VET13 (GY/BU)
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.5L engine, measure the voltage between selector lever harness C3233-1, circuit VET13 (GY/BU), vehicle harness side and ground, while applying the brake pedal.
- **Is the voltage greater than 10 volts?**

  YES : Go to A5.

  NO : Go to A3.

A3 TEST THE BSIA POWER CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: Smart Junction Box (SJB) C2280C

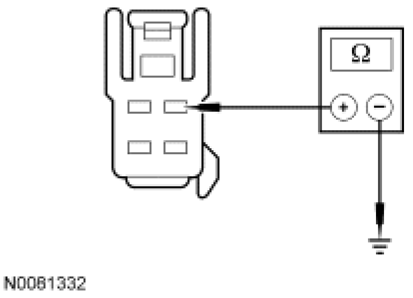


Fig. 6: Testing BSIA Power Circuit For A Short To Ground
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.0L or a 2.3L engine, measure the resistance between the selector lever harness C3245-1, circuit VET13 (GY/BU), vehicle harness side and ground.

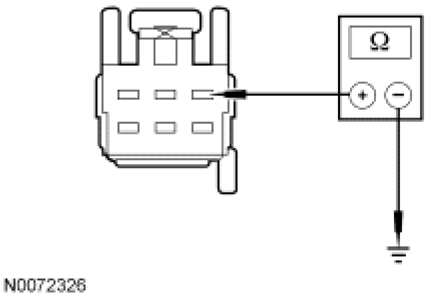


Fig. 7: Measuring Resistance Between Selector Lever Harness C3245-1, Circuit CET53 (BU/OG) & Ground
Courtesy of FORD MOTOR CO.

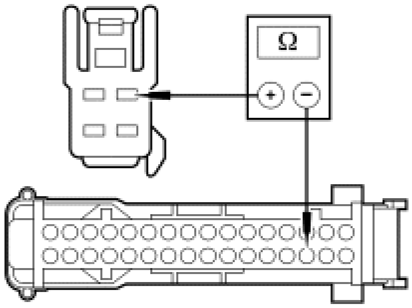
- Vehicles equipped with a 3.5L engine, measure the resistance between selector lever harness C3233-1, circuit VET13 (GY/BU), vehicle harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to A4.

  NO : REPAIR the circuit. TEST the system for normal operation.

A4 TEST THE BSIA POWER CIRCUIT FOR AN OPEN

- Key in OFF position.



N0081330

Fig. 8: Testing BSIA Power Circuit For An Open
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.0L or a 2.3L engine, measure the resistance between the selector lever harness C3245-1, circuit VET13 (GY/BU), vehicle harness side and SJB C2280C-14, circuit VET13 (GY/BU), vehicle harness side.

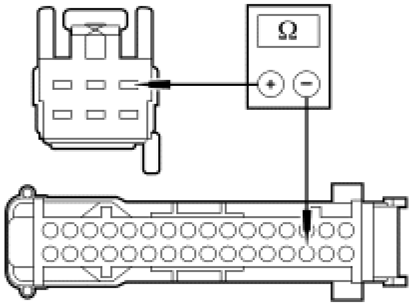


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Fig. 9: Measuring Resistance Between Selector Lever Harness C3245-1, Circuit VET13 (GY/BU)
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.5L engine, measure the resistance between the selector lever harness C3233-1, circuit VET13 (GY/BU), vehicle harness side and SJB C2280C-14, circuit VET13 (GY/BU), vehicle harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new SJB. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

A5 TEST THE BSIA GROUND CIRCUIT

- Key in OFF position.

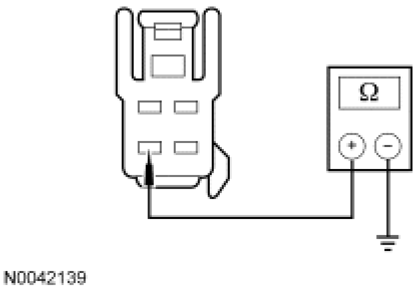

Fig. 10: Testing Shift Interlock Actuator Ground Circuit - 3.0L or a 2.3L
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.0L or a 2.3L engine, measure the resistance between the selector lever harness C3245-4, circuit GD116 (BK/VT), vehicle harness side and ground.

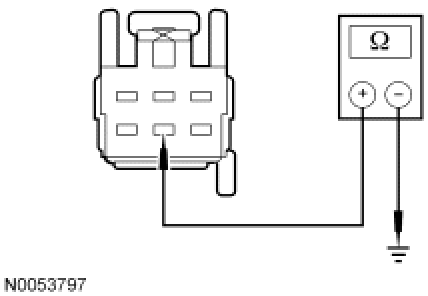

Fig. 11: Measuring Resistance Between Selector Lever Harness C3245-4, Circuit GD116 (BK/VT)
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.5L engine, measure the resistance between selector lever harness C3233-5, circuit GD116 (BK/VT), vehicle harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new selector lever. REFER to **Selector Lever**.

  NO : REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST B: Transmission Control Switch (TCS) DOES NOT OPERATE CORRECTLY (MKZ ONLY)

B1 TEST THE Instrument Cluster (IC)

- Connect the diagnostic tool.
- Using the scan tool, monitor the TCS PID while cycling the TCS.
- **Does the TCS PID cycle from depressed to not depressed?**

  YES : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

  NO : Go to B2.

B2 TEST THE SELECTOR LEVER GROUND CIRCUIT FOR AN OPEN

- Disconnect: Selector Lever Harness C3233

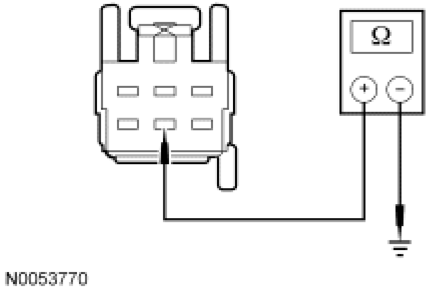

Fig. 12: Testing Selector Lever Ground Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between selector lever harness C3233-5, circuit GD116 (BK/VT), vehicle harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to B3.

  NO : REPAIR the selector lever ground circuit for an open. TEST the system for normal operation.

B3 TEST THE TCS CIRCUIT FOR AN OPEN

- Disconnect: Transmission Control Module (TCM) C1533

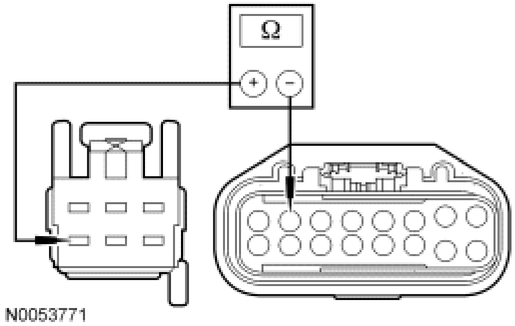

Fig. 13: Testing TC Switch Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between selector lever harness C3233-6, circuit CET34 (BN/GN), vehicle harness side and TCM C1533-7 circuit CET34 (BN/GN), vehicle harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to B4.

  NO : REPAIR the circuit for an open. TEST the system for normal operation.

B4 TEST THE TCS CIRCUIT FOR A SHORT TO GROUND

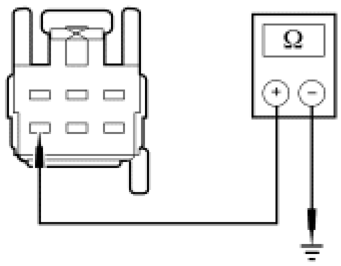

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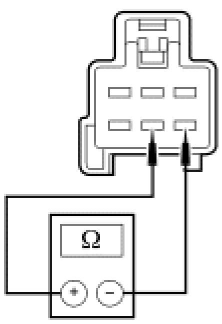
Fig. 14: Testing TCS Circuit For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between selector lever harness C3233-6, circuit CET34 (BN/GN), vehicle harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B5.

  NO : REPAIR the circuit for a short to ground. TEST the system for normal operation.

B5 TEST THE TCS



N0053773

Fig. 15: Testing TCS
Courtesy of FORD MOTOR CO.

- Measure the resistance between selector lever harness C3233-5 and C3233-6, component side, while cycling the TCS.
- **Is the resistance less than 5 ohms when pressed and greater than 10,000 ohms when released?**

  YES : INSTALL a new TCM. REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article. TEST the system for normal operation.

  NO : INSTALL a new selector lever knob. REFER to **Selector Lever Knob - 3.5L**. TEST the system for normal operation.

PINPOINT TEST C: KEY STUCK IN THE IGNITION CYLINDER OR DOES NOT LOCK THE IGNITION CYLINDER WHEN THE SELECTOR LEVER IS NOT IN PARK

C1 TEST Battery Junction Box (BJB) FUSE 14 (15A)

- Check fuse: BJB Fuse 14 (15A)

- **Is the resistance less than 5 ohms?**

  YES : Go to C2.

  NO : REPAIR the circuit. INSTALL a new fuse. TEST the system for normal operation.

C2 TEST THE INHIBIT SOLENOID POWER CIRCUIT FOR AN OPEN

- Disconnect: Ignition Switch Electrical C250

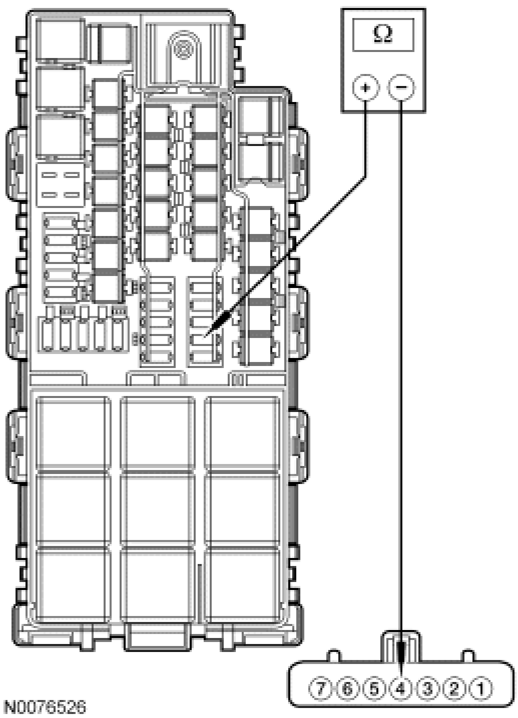


Fig. 16: Testing Inhibit Solenoid Power Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the output side of BJB fuse 14 (15A) and ignition switch electrical C250-4, circuit SBB14 (BN/RD), vehicle harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to C3.

  NO : REPAIR the circuit. TEST the system for normal operation.

C3 TEST FOR VOLTAGE AT THE SELECTOR LEVER CONNECTOR

- Select PARK.
- Key in OFF position.
- Disconnect: Selector Lever Electrical C3245 (2.3L/3.0L engine) or C3233 (3.5L engine)
- Visually inspect the connector and wires for damage.
- Key in ON position.

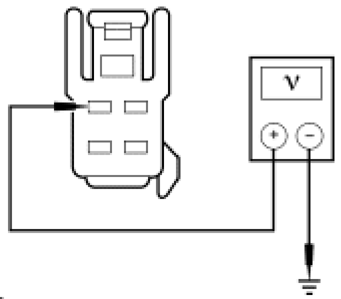


Fig. 17: Testing For Voltage At Selector Lever Connector - 3.0L Or 2.3L
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.0L or a 2.3L engine, measure the voltage between selector lever harness C3245-2, circuit CET22 (GY/BN), vehicle harness side and ground.

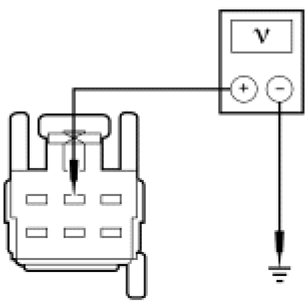


Fig. 18: Testing For Voltage At Selector Lever Connector - 3.5L
Courtesy of FORD MOTOR CO.

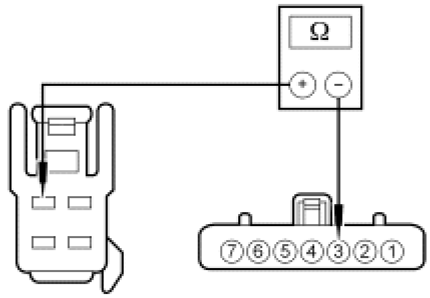
- Vehicles equipped with a 3.5L engine, measure the voltage between selector lever harness C3233-2, circuit CET22 (GY/BN), vehicle harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to C6.

  NO : Go to C4.

C4 TEST FOR AN OPEN CIRCUIT

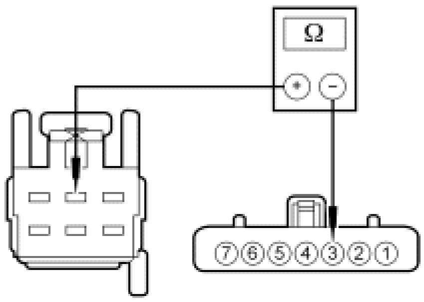
- Key in OFF position.
- Disconnect: Ignition Switch Electrical C250



N0071644

Fig. 19: Testing For An Open Circuit - 3.0L or 2.3L
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.0L or a 2.3L engine, measure the resistance between selector lever harness C3245-2, circuit CET22 (GY/BN), vehicle harness side and ignition switch electrical C250-3, circuit CET22 (GY/BN), vehicle harness side.



N0071645

Fig. 20: Testing For An Open Circuit - 3.5L
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.5L engine, measure the resistance between selector lever harness C3233-2, circuit CET22 (GY/BN), vehicle harness side and ignition switch electrical C250-3, circuit CET22 (GY/BN), vehicle harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to C5.

  NO : REPAIR the circuit. TEST the system for normal operation.

C5 TEST FOR A SHORT TO GROUND

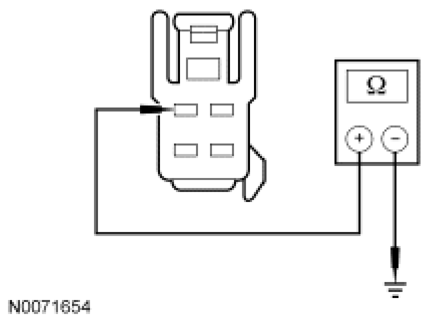


Fig. 21: Testing For A Short To Ground - 3.0L or 2.3L
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.0L or a 2.3L engine, measure the resistance between selector lever harness 3245-2, circuit CET22 (GY/BN), vehicle harness side and ground.

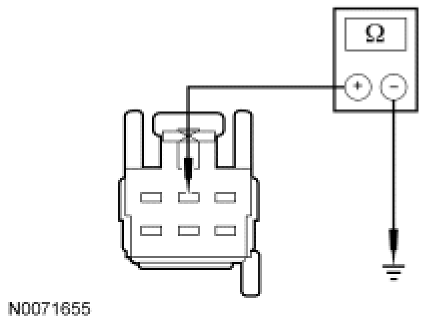


Fig. 22: Testing For A Short To Ground - 3.5L
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.5L engine, measure the resistance between selector lever harness 3233-2, circuit CET22 (GY/BN), vehicle harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new steering column lock module. REFER to **STEERING COLUMN SWITCHES** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

C6 TEST THE VEHICLE HARNESS GROUND CIRCUIT

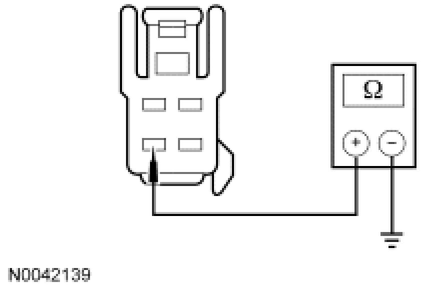
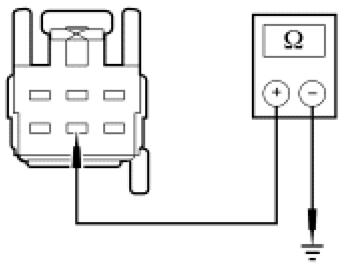


Fig. 23: Testing Shift Interlock Actuator Ground Circuit - 3.0L or a 2.3L
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.0L or a 2.3L engine, measure the resistance between selector lever harness C3245-4, circuit GD116 (BK/VT), vehicle harness side and ground.



N0053797

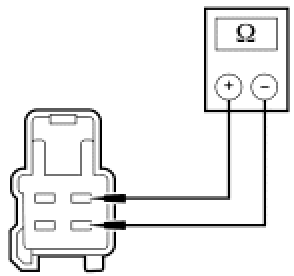
Fig. 24: Measuring Resistance Between Selector Lever Harness C3245-4, Circuit GD116 (BK/VT)
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.5L engine, measure the resistance between selector lever harness C3233-5, circuit GD116 (BK/VT), vehicle harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to C7.

  NO : REPAIR the circuit. TEST the system for normal operation.

C7 TEST THE PARK DETECT SWITCH



N0071657

Fig. 25: Testing Park Detect Switch - 3.0L or 2.3L
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.0L or a 2.3L engine, measure the resistance between selector lever harness C3245-2 and C3245-4, component side, with the selector lever in PARK and DRIVE.

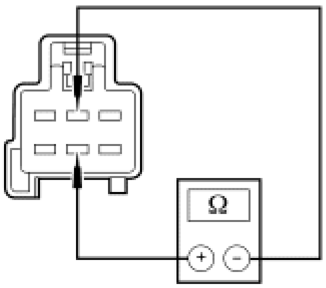


Fig. 26: Testing Park Detect Switch - 3.5L
Courtesy of FORD MOTOR CO.

- Vehicles equipped with a 3.5L engine, measure the resistance between selector lever harness C3233-2 and C3233-5, component side, with the selector lever in PARK and DRIVE.
- **Is the resistance greater than 10,000 ohms in PARK and less than 5 ohms in DRIVE?**

  YES : INSTALL a new steering column lock module. REFER to **STEERING COLUMN SWITCHES** article.

  NO : INSTALL a new selector lever assembly. REFER to **Selector Lever**.

GENERAL PROCEDURES

BRAKE SHIFT INTERLOCK OVERRIDE

NOTE: **If it is necessary to use the override procedure to move the selector lever out of the PARK position, it is possible that a fuse has blown and the brake lights are not operational. Before driving the vehicle, verify that the brake lights are working.**

This vehicle is equipped with a brake shift interlock feature that prevents the selector lever from being moved out of PARK when the ignition is in the ON position unless the brake pedal is depressed.

If the selector lever cannot be moved out of the PARK position when the ignition is in the ON position and the brake pedal is depressed carry out the following procedure:

1. Apply the parking brake.

   NOTE: **Relief located at the front of the access panel.**

2. Remove the access panel.

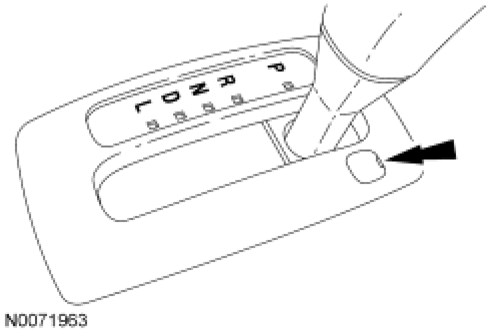


Fig. 27: Locating Access Panel
Courtesy of FORD MOTOR CO.

3. Using an suitable tool, depress the brake shift interlock override mechanism on the selector lever, apply the brake, depress the button on the selector lever and move the selector lever into NEUTRAL.

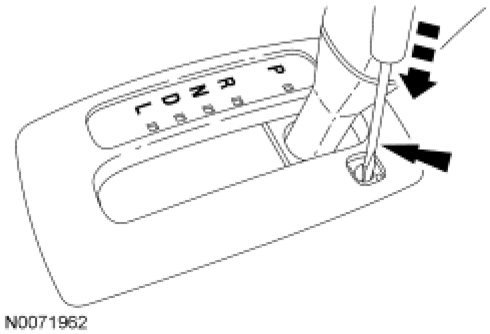


Fig. 28: Depressing Brake Shift Interlock Override Mechanism On Selector Lever Using An Suitable Tool
Courtesy of FORD MOTOR CO.

4. Start the vehicle.
5. Install the access panel.

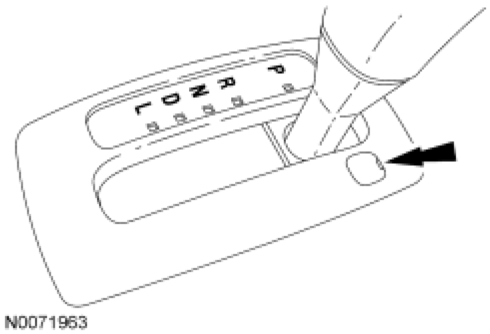


Fig. 29: Locating Access Panel
Courtesy of FORD MOTOR CO.

SELECTOR LEVER CABLE ADJUSTMENT

6-speed transaxle

1. Vehicles equipped with a 3.5L engine, remove the Air Cleaner (ACL) assembly. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.
2. Disconnect the selector lever cable end from the manual control lever.

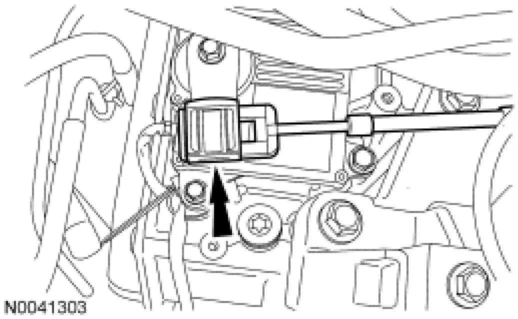


Fig. 30: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

3. Place the manual control lever in DRIVE.
    1. Place the manual control lever in PARK.
    2. Move the manual control lever counterclockwise 3 detents to the DRIVE position.

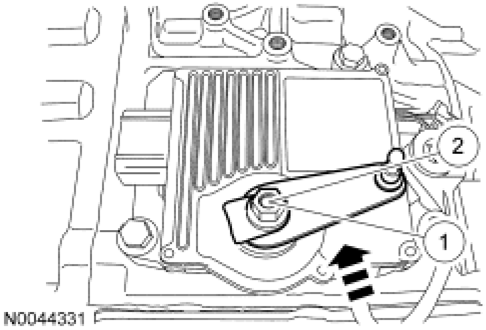


Fig. 31: Moving Manual Control Lever Counterclockwise
Courtesy of FORD MOTOR CO.

FNR5 transaxle

4. Disconnect the selector lever cable end from the manual control lever.

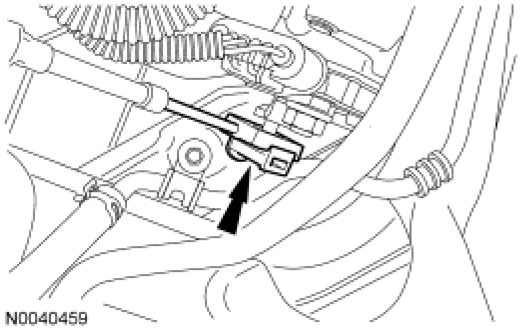


Fig. 32: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

NOTE: Transaxle removed from vehicle for clarity.

5. Place the manual control lever in NEUTRAL.
    1. Place the manual control lever in PARK.
    2. Move the manual control lever clockwise 3 detents to the DRIVE position.

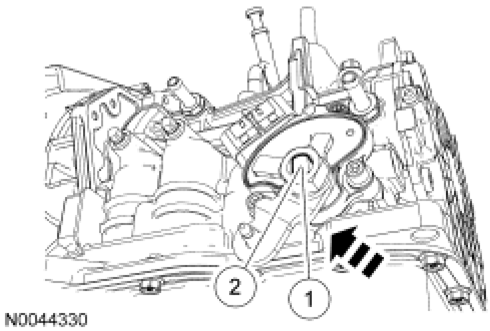


Fig. 33: Moving Manual Control Lever Clockwise
Courtesy of FORD MOTOR CO.

All vehicles

6. Place the selector lever in DRIVE.

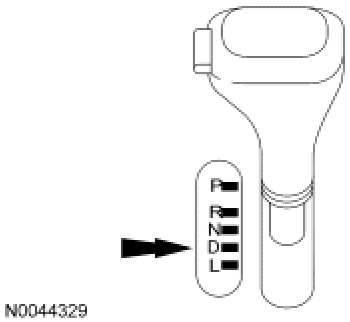


Fig. 34: Locating Gear Selector Lever

Courtesy of FORD MOTOR CO.

7. Unlock the adjuster by sliding the locking tab over.

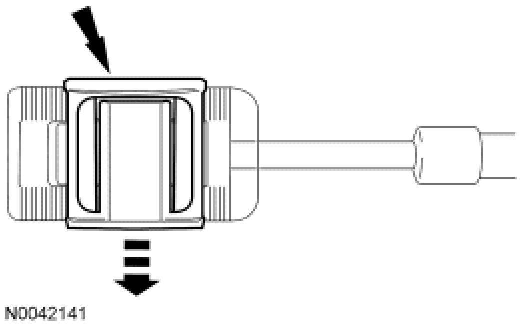


Fig. 35: Sliding Locking Tab Over
Courtesy of FORD MOTOR CO.

8. Slide the selector lever cable end forward or backward to align it with the manual control lever.

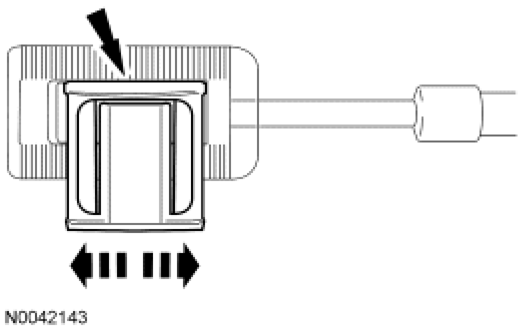


Fig. 36: Sliding Cable End
Courtesy of FORD MOTOR CO.

NOTE: FNR5 selector lever cable end shown, 6-speed transaxle similar.

9. With the adjuster locking tab released, connect the selector lever cable end to the manual control lever.

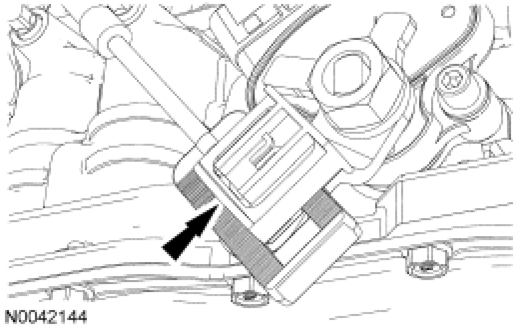


Fig. 37: Locating FNR5 Selector Lever Cable

Courtesy of FORD MOTOR CO.

NOTE: FNR5 selector lever cable end shown, 6-speed transaxle similar.

10. Slide the release tab back to lock the adjuster.

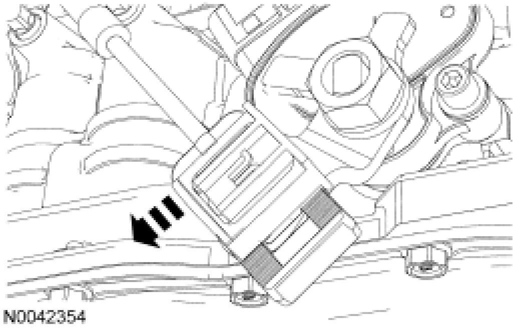


Fig. 38: Releasing Tab Back To Lock Adjuster
Courtesy of FORD MOTOR CO.

11. For vehicles equipped with a 3.5L engine, install the ACL assembly. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.
12. Verify that the vehicle starts in PARK and NEUTRAL only and that the reverse lamps illuminate in REVERSE.

REMOVAL AND INSTALLATION

SELECTOR LEVER CABLE

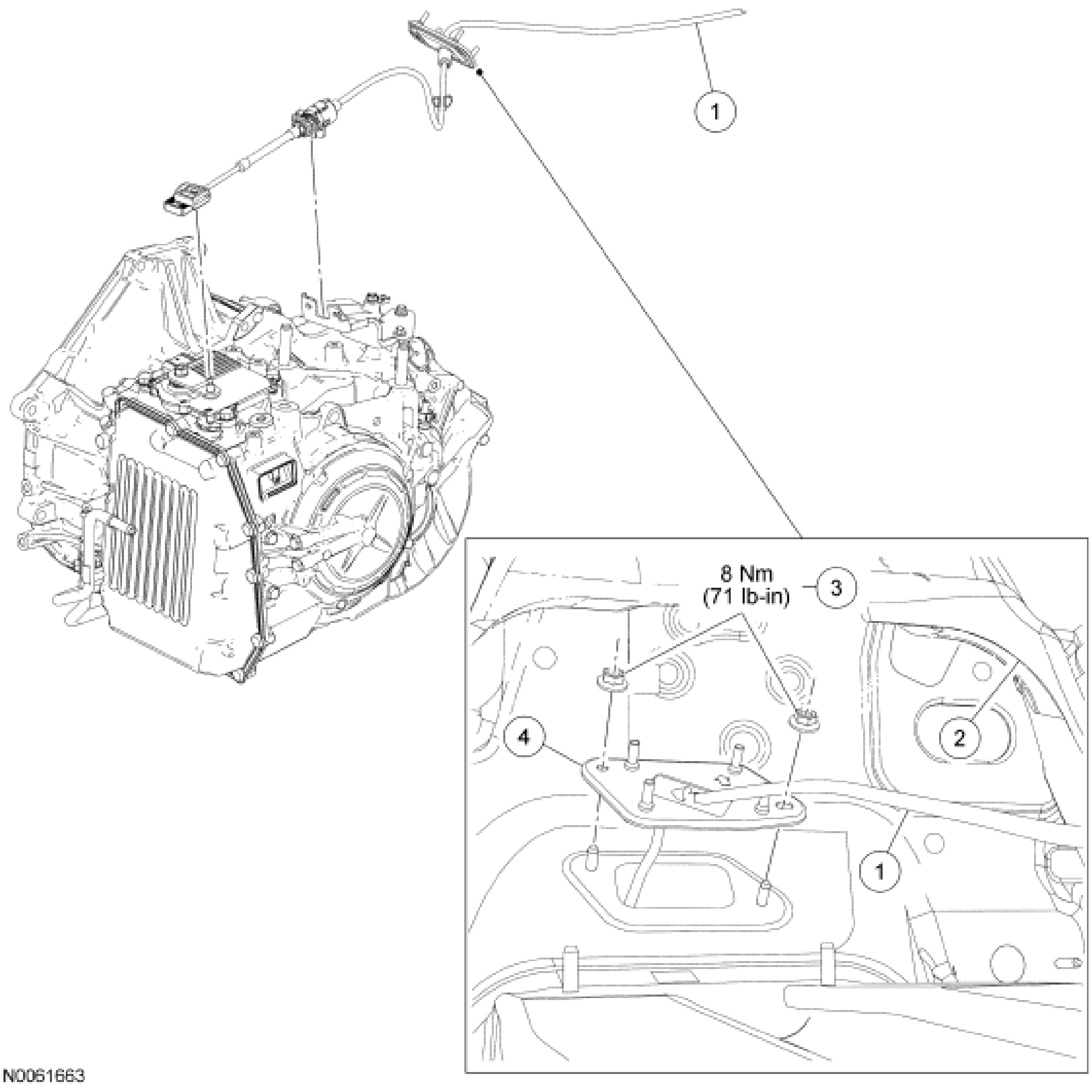


Fig. 39: Exploded View Of Selector Lever Cable With Torque Specification - 6-Speed Transaxle
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7E395	Selector lever cable
2	54017A40	Insulation blanket
3	W707142	Selector lever cable grommet retaining nuts
4	57809	Selector lever cable grommet

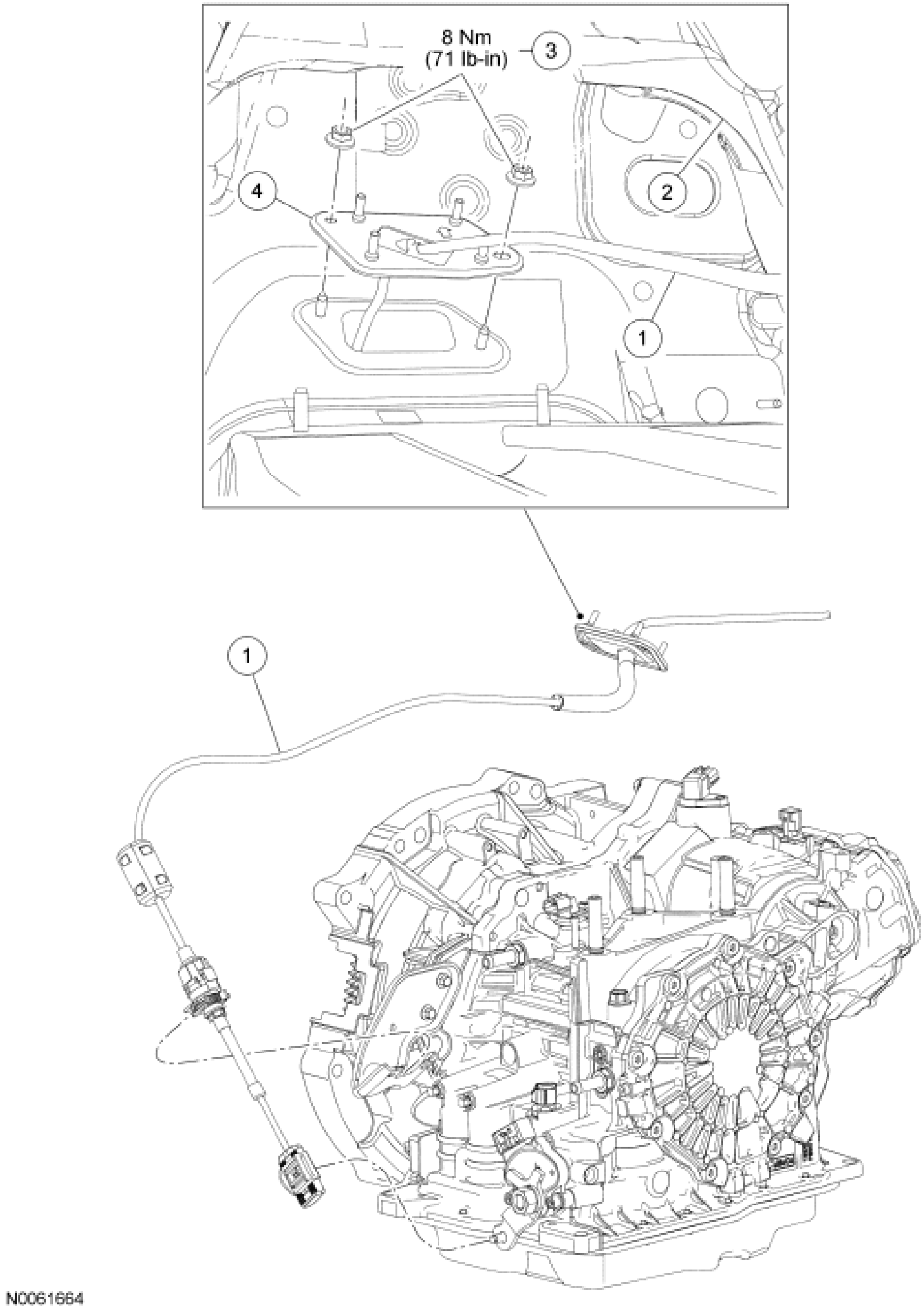


Fig. 40: Exploded View Of Selector Lever Cable With Torque Specification - FNR5 Transaxle
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7E395	Selector lever cable
2	54017A40	Insulation blanket
3	W707142	Selector lever cable grommet retaining

		nuts
4	57809	Selector lever cable grommet

REMOVAL

All vehicles

1. Remove the heater core and evaporator core housing. For additional information, refer to **CLIMATE CONTROL** article.
2. Remove the Restraints Control Module (RCM). For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

6 speed transaxle

3. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
4. Disconnect the selector lever cable end from the manual control lever.

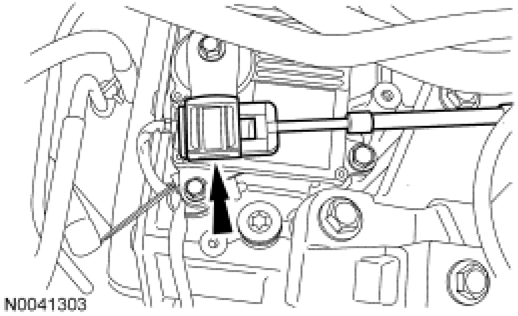


Fig. 41: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

5. Release the 2 tabs and remove the selector lever cable from the selector lever cable bracket.

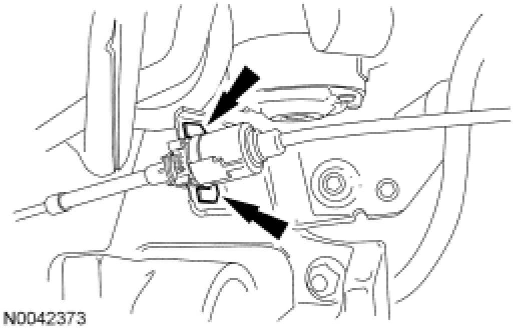


Fig. 42: Locating Tabs
Courtesy of FORD MOTOR CO.

FNR5 transaxle

6. Disconnect the selector lever cable end from the manual control lever.

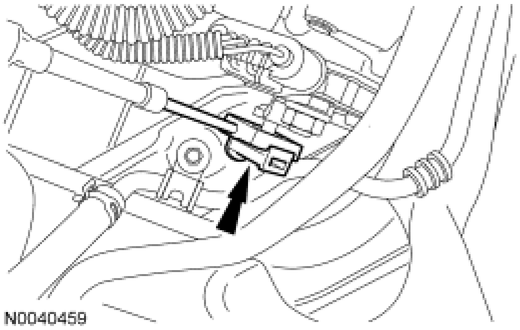


Fig. 43: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

7. Release the 2 tabs and remove the selector lever cable from the selector lever cable bracket.

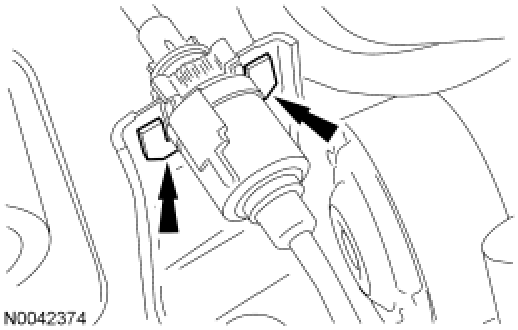


Fig. 44: Locating Selector Lever Cable Locking Tabs
Courtesy of FORD MOTOR CO.

All vehicles

8. Disconnect the 2 wiring harness fasteners and position the RCM wiring harness aside.

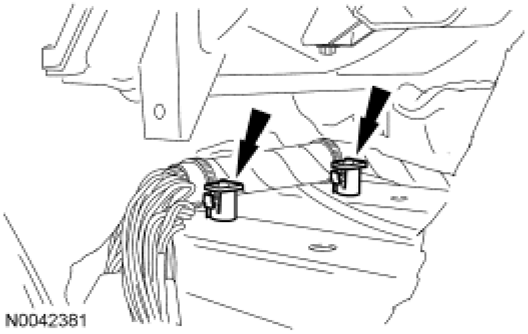


Fig. 45: Locating Wiring Harness Fasteners
Courtesy of FORD MOTOR CO.

9. Position the insulation blanket away from the bulkhead to gain access to the 2 selector lever cable bracket nuts.

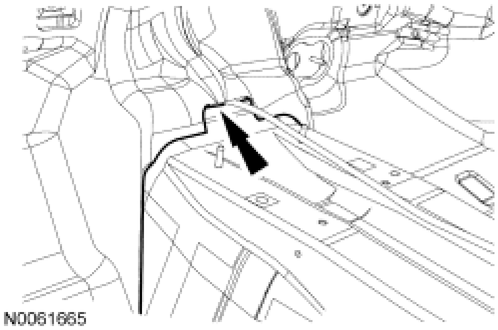


Fig. 46: Locating Insulation
Courtesy of FORD MOTOR CO.

10. Remove the 2 selector lever cable grommet nuts and remove the selector lever cable through the interior of the vehicle.

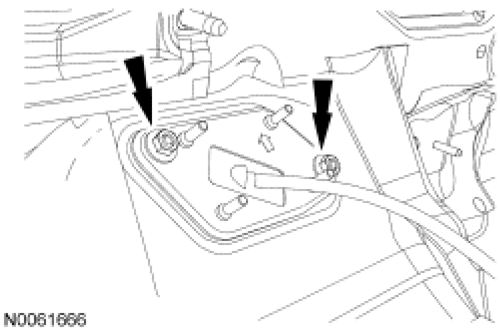


Fig. 47: Locating Selector Lever Cable Grommet Nuts
Courtesy of FORD MOTOR CO.

INSTALLATION

All vehicles

1. Position the selector lever cable in place and install the 2 nuts.
    - Tighten to 8 Nm (71 lb-in).

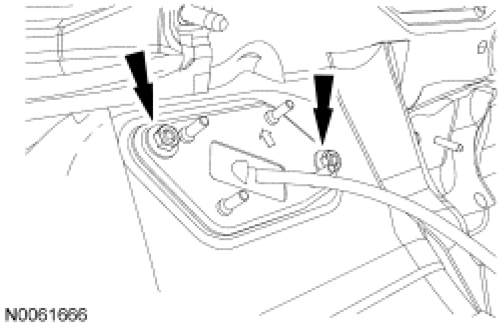


Fig. 48: Locating Selector Lever Cable Grommet Nuts
Courtesy of FORD MOTOR CO.

2. Position the insulation blanket in place over the selector lever cable grommet.

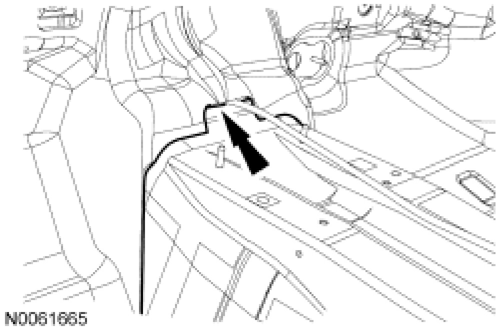


Fig. 49: Locating Insulation
Courtesy of FORD MOTOR CO.

3. Position back the RCM wiring harness and install the fasteners on the studs.

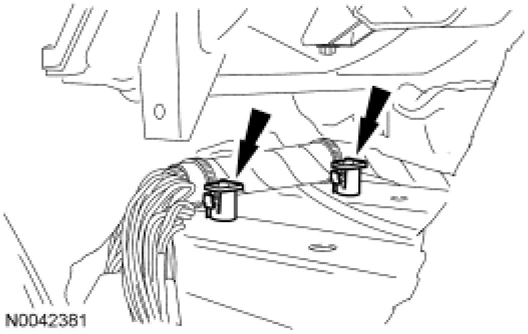


Fig. 50: Locating Wiring Harness Fasteners
Courtesy of FORD MOTOR CO.

FNR5 transaxle

NOTE: When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the selector lever cable end is

snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the selector lever cable to click in place. Pull back on the selector lever cable to make sure that it is locked into the selector lever cable bracket. Also make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable end to make sure that the selector lever cable end is correctly installed.

4. Position the selector lever cable in the bracket.

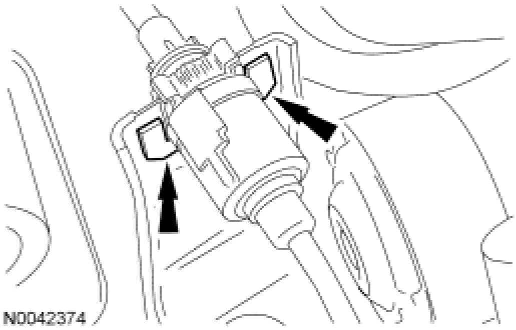


Fig. 51: Locating Selector Lever Cable Locking Tabs
Courtesy of FORD MOTOR CO.

5. Install the selector lever cable end on the manual lever.

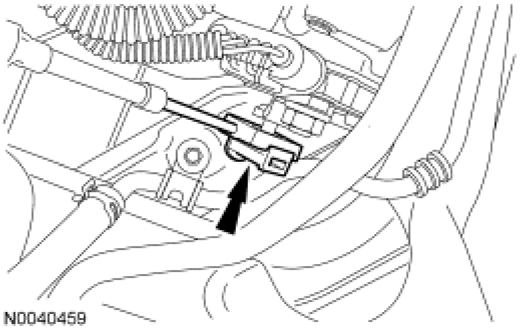


Fig. 52: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

6 speed transaxle

NOTE: **When installing the selector lever cable, make sure that the selector lever cable locking tabs are locked in place and the selector lever cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the selector lever cable to click in place. Pull back on the selector lever cable to make sure that it is locked into the selector lever cable bracket. Also make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable end to make sure that the selector lever cable end is correctly installed.**

6. Install the selector lever cable in the bracket. Be sure the tabs are locked in place.

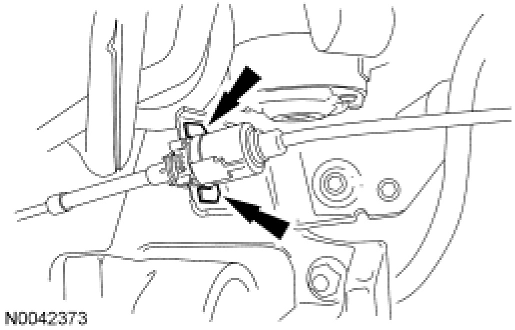


Fig. 53: Locating Tabs
Courtesy of FORD MOTOR CO.

7. Connect the selector lever cable end on the manual control lever.

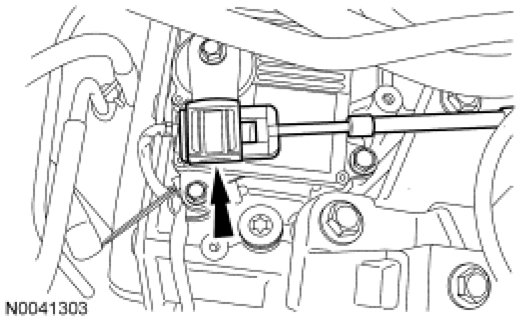


Fig. 54: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

8. Install the battery and battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

   All vehicles

9. Install the RCM. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
10. Install the heater core and evaporator core housing. For additional information, refer to **CLIMATE CONTROL** article.
11. Adjust the selector lever cable. For additional information, refer to **Selector Lever Cable Adjustment**.

SELECTOR LEVER

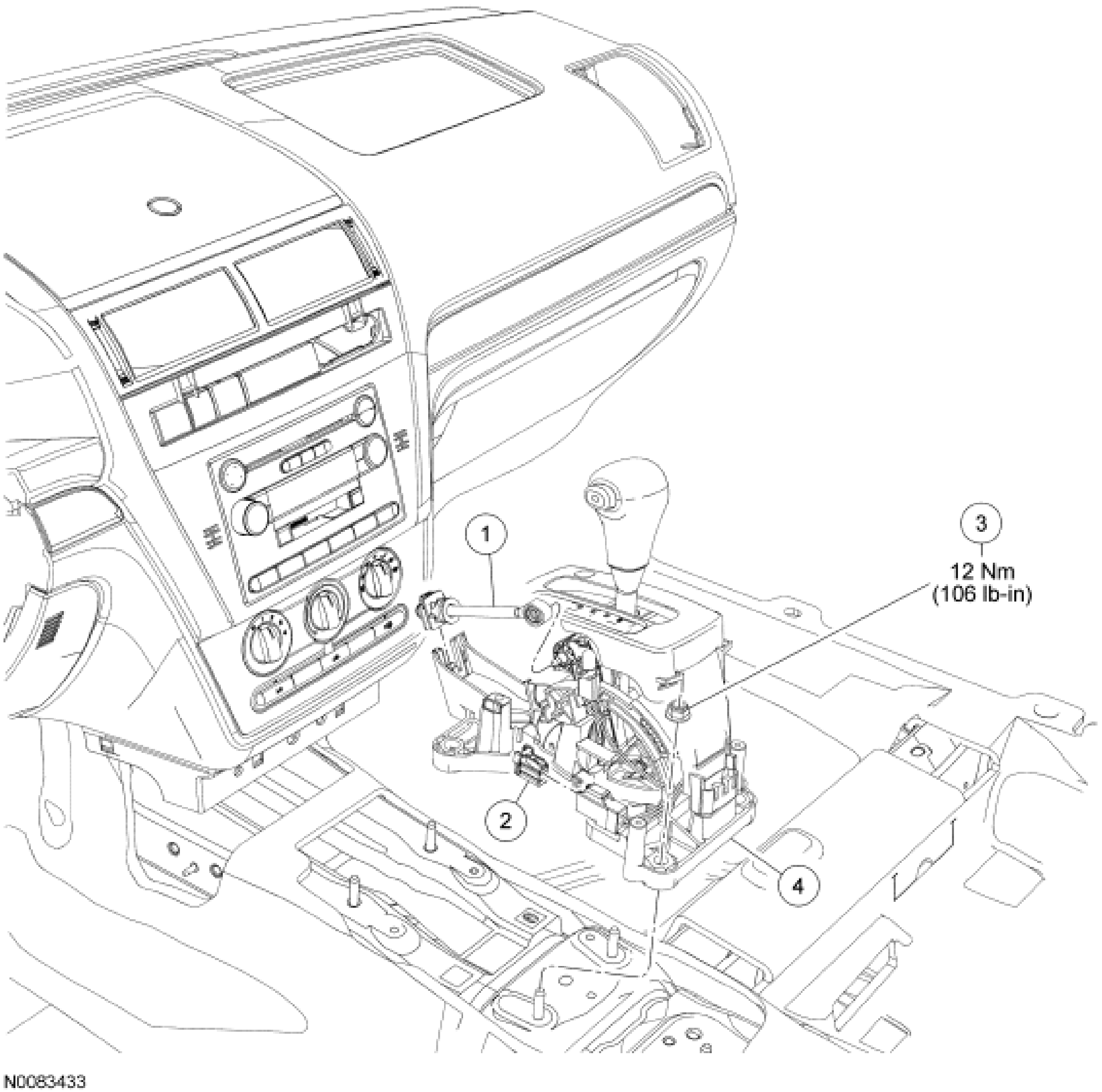


Fig. 55: Exploded View Of Selector Lever With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7E395	Selector lever cable
2	14489	Selector lever electrical connector
3	W520102	Selector lever nut (4 required)
4	7K004	Selector lever assembly

REMOVAL

1. Remove the center console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Disconnect the selector lever cable end from the selector lever.

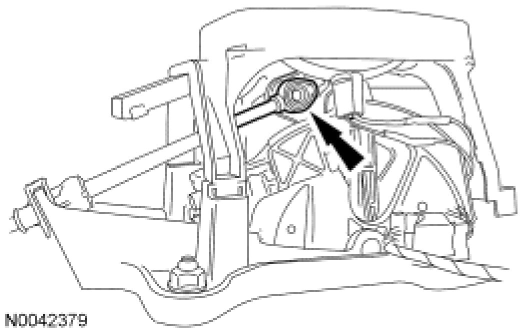


Fig. 56: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

3. Release the tab on the selector lever cable and remove it from the selector lever housing.

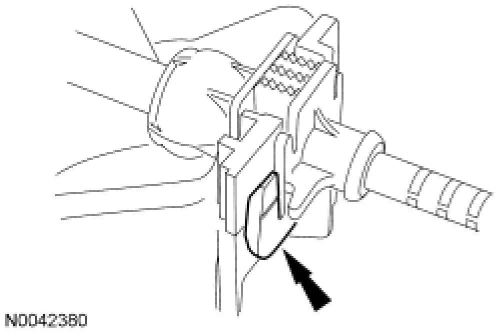


Fig. 57: Locating Selector Lever Cable Locking Tabs
Courtesy of FORD MOTOR CO.

4. Disconnect the electrical connector.

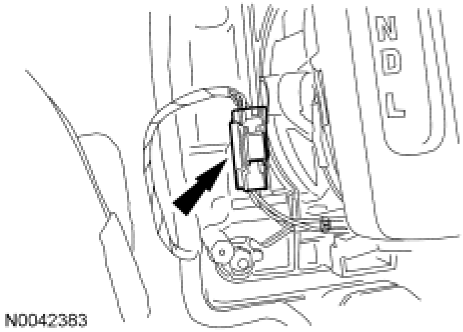


Fig. 58: Locating Electrical Connector
Courtesy of FORD MOTOR CO.

5. Remove the 4 nuts and remove the selector lever.

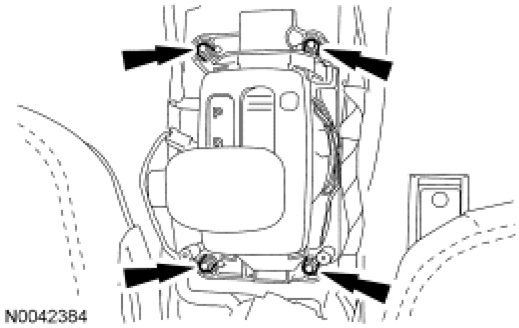


Fig. 59: Locating Nuts
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install the selector lever and the 4 nuts.
   - Tighten to 12 Nm (106 lb-in).

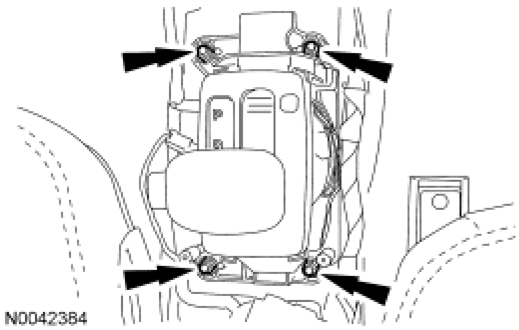


Fig. 60: Locating Nuts
Courtesy of FORD MOTOR CO.

2. Connect the electrical connector.

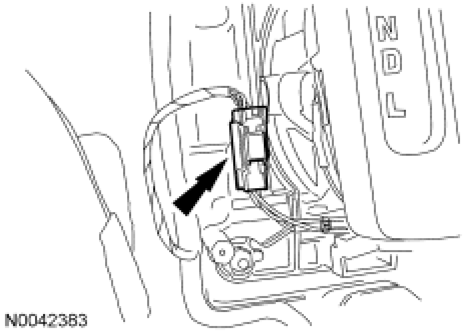


Fig. 61: Locating Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: **When installing the selector lever cable, make sure that the selector lever**

cable locking tabs are locked in place and the selector lever cable end is snapped onto the ball stud. Press the selector lever cable into the bracket and listen for the selector lever cable to click in place. Pull back on the selector lever cable to make sure that it is locked into the selector lever cable bracket. Also make sure that the selector lever cable end is correctly installed onto the ball stud. Pull back on the selector lever cable end to make sure that the selector lever cable end is correctly installed.

3. Install the selector lever cable in the selector lever housing.

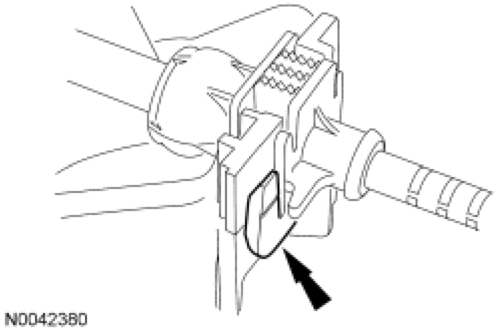


Fig. 62: Locating Selector Lever Cable Locking Tabs
Courtesy of FORD MOTOR CO.

4. Connect the selector lever cable end to the selector lever.

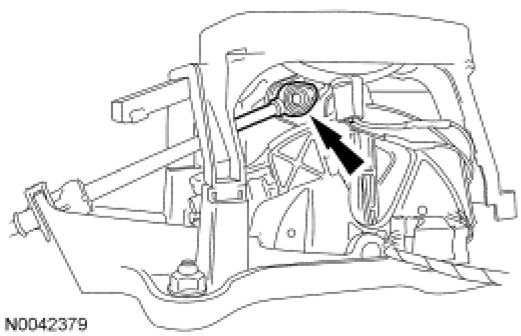


Fig. 63: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

5. Install the center console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
6. Adjust the selector lever cable, refer to **Selector Lever Cable Adjustment**.

SELECTOR LEVER BEZEL

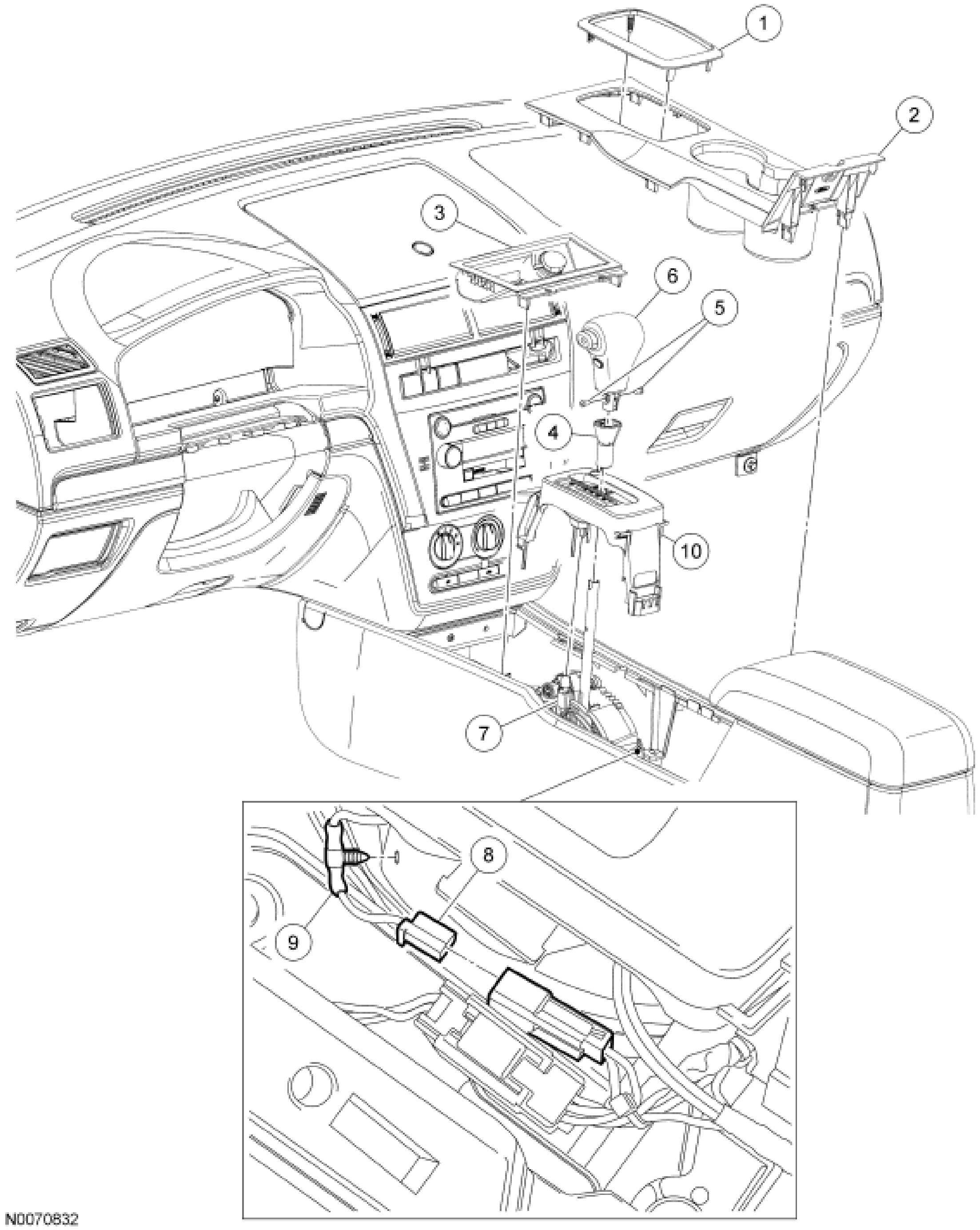


Fig. 64: Exploded View Of Selector Lever Bezel
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	54061A16	PRNDL indicator trim ring
2	54045A76	Center console trim cover
3	54045A07	Power outlet trim panel

4	-	Lower selector lever knob bezel
5	-	Selector lever knob screws
6	7L010	Selector lever knob
7	-	Selector lever indicator light
8	14A459	Transmission Control Switch (TCS) electrical connector (3.5L engine) (MKZ only)
9	-	TCS wiring harness retainer
10	7E034	Selector lever bezel

REMOVAL

All vehicles

1. Remove the PRNDL trim ring.

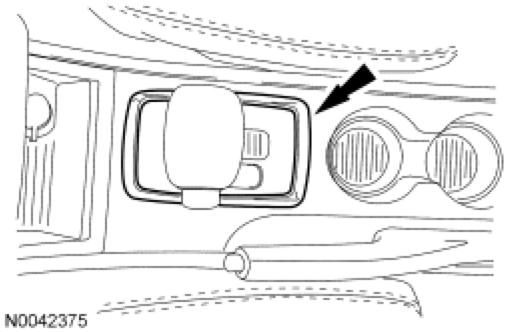


Fig. 65: Locating PRNDL Trim Ring
Courtesy of FORD MOTOR CO.

2. Remove the upper console panel.

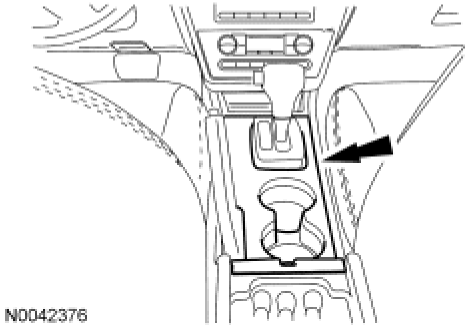


Fig. 66: Locating Upper Console Panel
Courtesy of FORD MOTOR CO.

Fusion/Milan

3. Remove the power outlet trim panel from the center console.

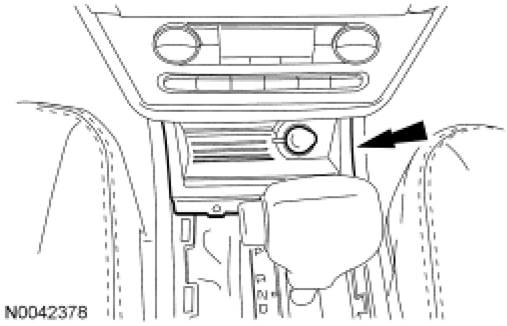


Fig. 67: Locating Power Outlet Trim Panel
Courtesy of FORD MOTOR CO.

4. Disconnect the electrical connector and remove the power outlet trim panel.

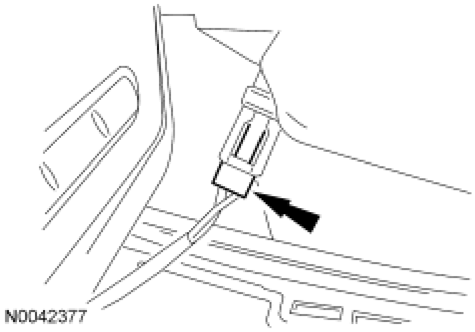


Fig. 68: Locating Power Outlet Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

5. Slide the lower selector lever knob bezel downward.

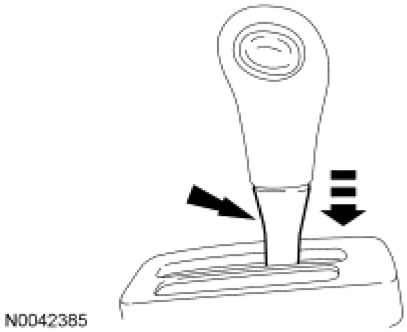


Fig. 69: Sliding Lower Shift Knob Bezel Downward
Courtesy of FORD MOTOR CO.

6. Remove and discard the 2 bolts from the selector lever knob.

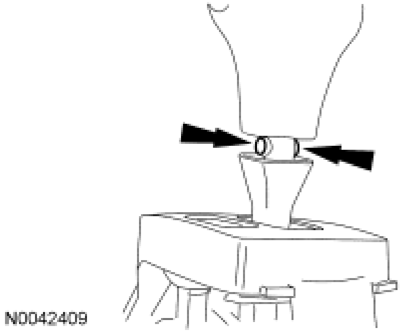


Fig. 70: Locating Bolts
Courtesy of FORD MOTOR CO.

Vehicles equipped with a light bulb

7. Disconnect the light from the PRNDL bezel.

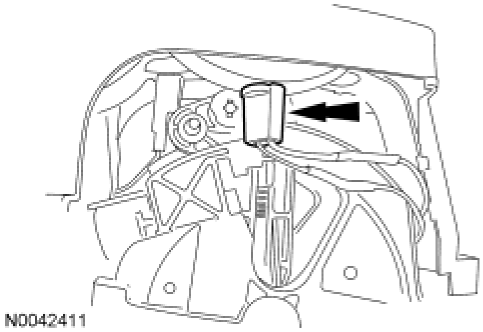


Fig. 71: Locating Light From PRNDL Bezel
Courtesy of FORD MOTOR CO.

Vehicles equipped with LED illumination

8. Disconnect the LED electrical connector.

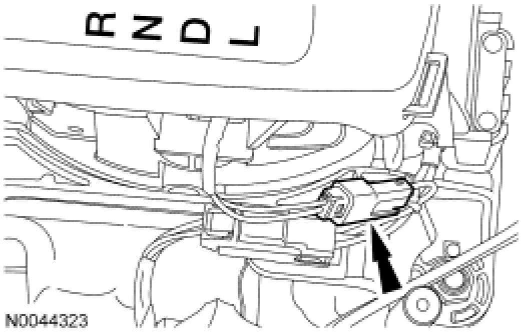


Fig. 72: Locating LED Electrical Connector
Courtesy of FORD MOTOR CO.

Vehicles equipped with a Transmission Control Switch (TCS)

9. Disconnect the Transmission Control Switch (TCS) electrical connector and remove the wiring harness fastener from the selector lever housing.

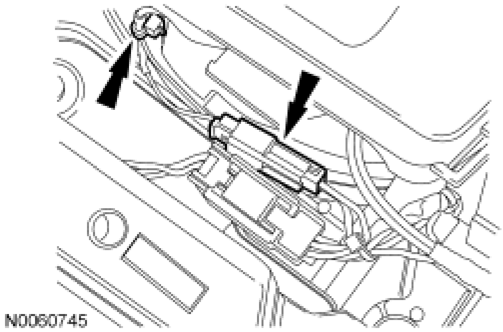


Fig. 73: Locating Transmission Control (TC) Switch Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

NOTE:	**Selector lever removed for clarity.**

10. Release the 3 tabs and remove the PRNDL bezel selector lever knob and knob bezel.

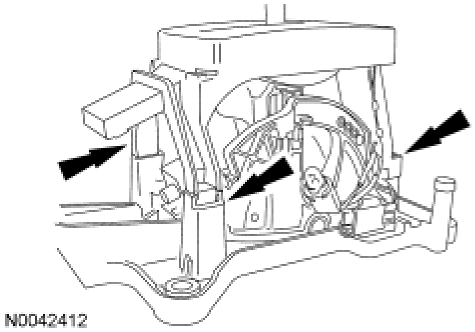


Fig. 74: Locating Tabs
Courtesy of FORD MOTOR CO.

INSTALLATION

Vehicles equipped with a Transmission Control Switch (TCS)

1. Route the TCS wiring harness through the selector lever knob bezel and the PRNDL bezel.

All vehicles

NOTE:	**Be sure that the override lever is inserted in the override lever guide or the shift interlock override button will not work correctly.**

NOTE: Selector lever removed for clarity.

2. Install the PRNDL bezel, selector lever knob and knob bezel on the selector lever.
   - Position the override lever in the override lever guide.
   - Make sure that the 3 locking tabs are locked in place.

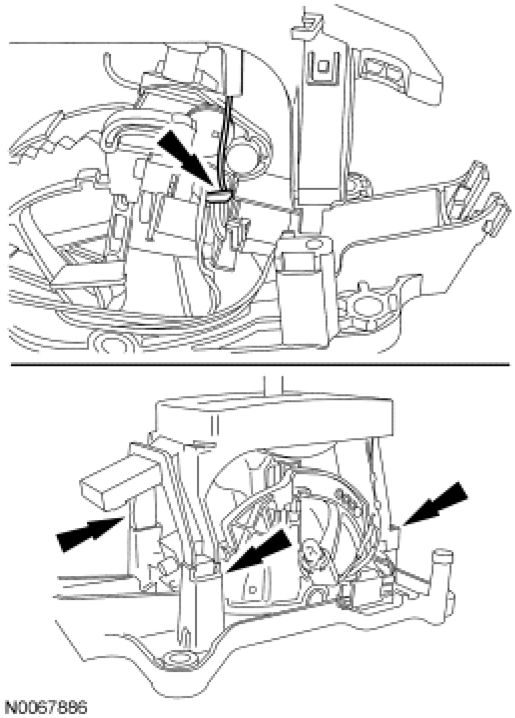


Fig. 75: Identifying PRNDL Bezel, Selector Lever Knob & Knob Bezel
Courtesy of FORD MOTOR CO.

Vehicles equipped with a Transmission Control Switch (TCS)

3. Connect the TCS electrical connector and install the wiring harness retainer on the selector lever housing.

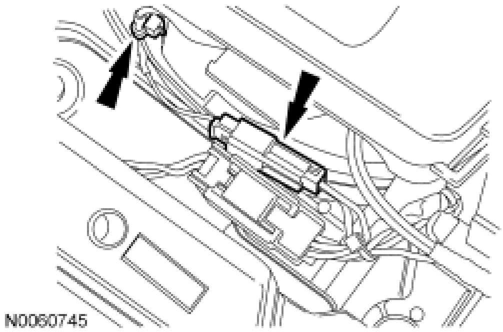


Fig. 76: Locating Transmission Control (TC) Switch Electrical Connector
Courtesy of FORD MOTOR CO.

Vehicles equipped with LED illumination

4. Connect the LED electrical connector.

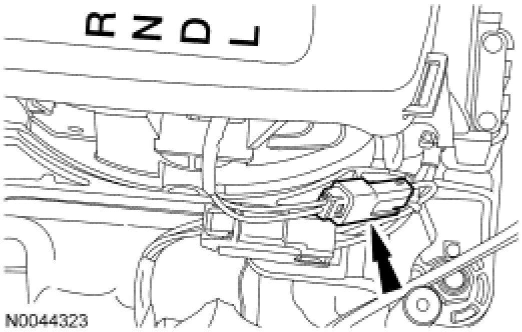


Fig. 77: Locating LED Electrical Connector
Courtesy of FORD MOTOR CO.

Vehicles equipped with a light bulb

5. Connect the light to the PRNDL bezel.

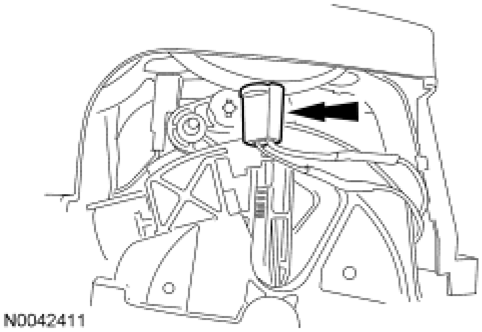


Fig. 78: Locating Light From PRNDL Bezel
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: **Do not overtighten the selector lever knob bolts or damage to the selector lever or knob may occur.**

6. Install the selector lever knob and 2 new bolts.
   - Tighten to 2 Nm (18 lb-in).

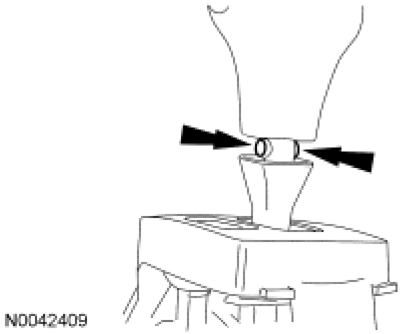


Fig. 79: Locating Bolts
Courtesy of FORD MOTOR CO.

7. Slide the lower selector lever knob bezel up and snap it into place.

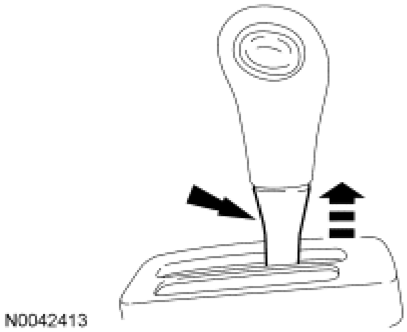


Fig. 80: Sliding Lower Shift Knob Bezel Up
Courtesy of FORD MOTOR CO.

Fusion/Milan

8. Connect the power outlet electrical connector.

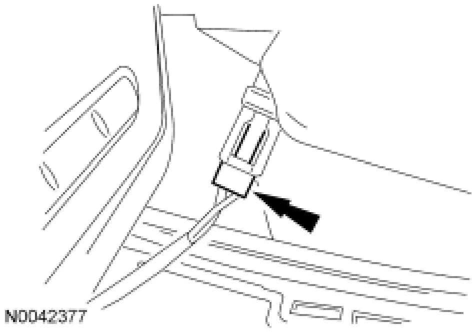


Fig. 81: Locating Power Outlet Electrical Connector
Courtesy of FORD MOTOR CO.

9. Install the power outlet trim panel in the center console.

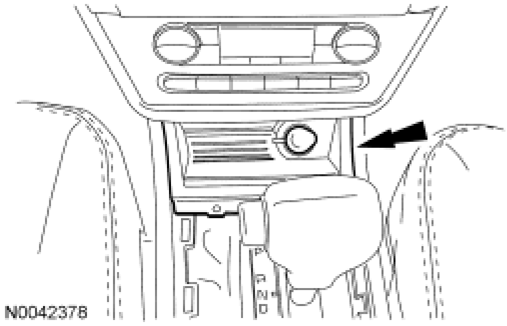


Fig. 82: Locating Power Outlet Trim Panel
Courtesy of FORD MOTOR CO.

All vehicles

10. Install the upper console panel.

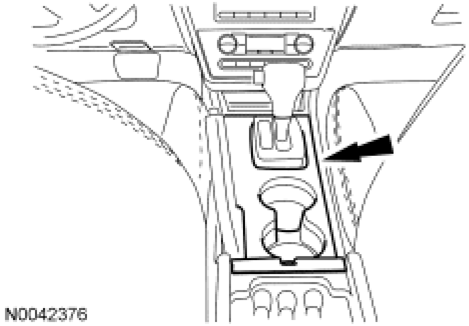


Fig. 83: Locating Upper Console Panel
Courtesy of FORD MOTOR CO.

11. Install the PRNDL trim ring.

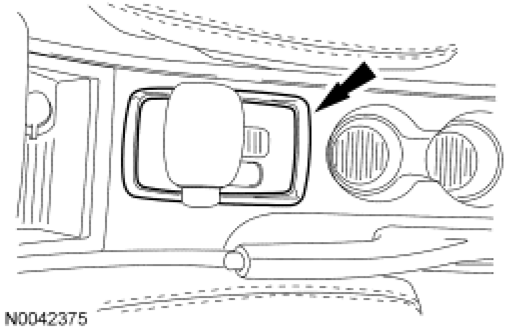


Fig. 84: Locating PRNDL Trim Ring
Courtesy of FORD MOTOR CO.

SELECTOR LEVER KNOB - 2.3L, 3.0L

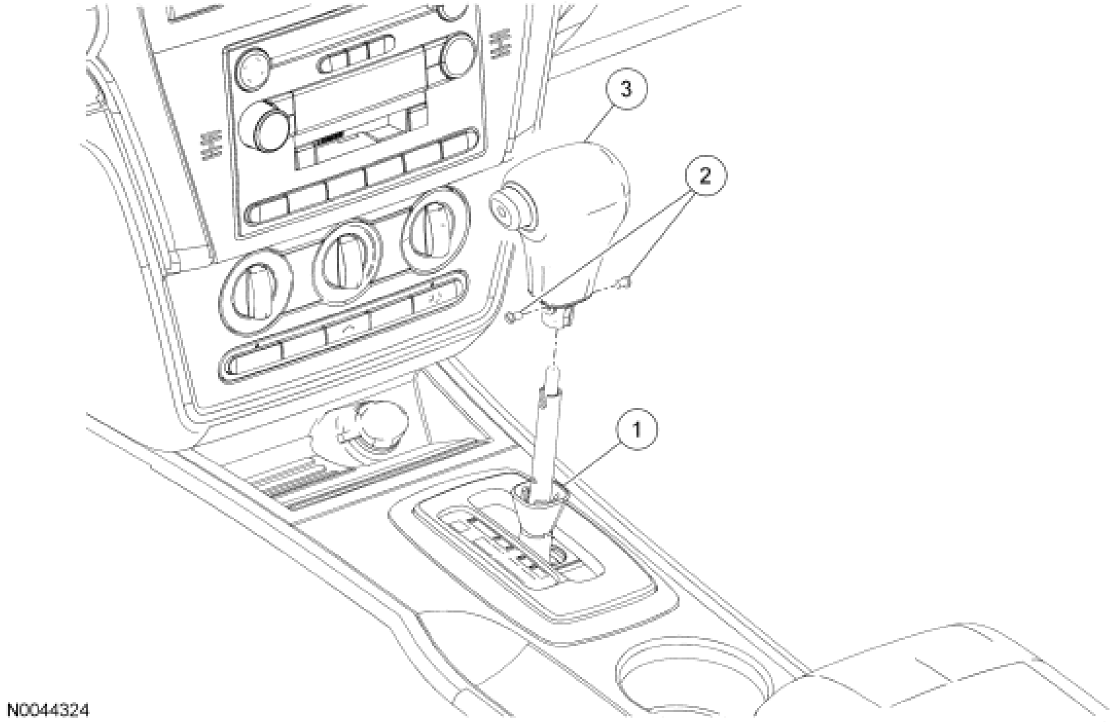


Fig. 85: Exploded View Of Selector Lever Knob - 2.3L, 3.0L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Lower selector lever knob bezel
2	-	Selector lever knob screws
3	7L010	Selector lever knob

REMOVAL

1. Slide the lower selector lever knob bezel downward.

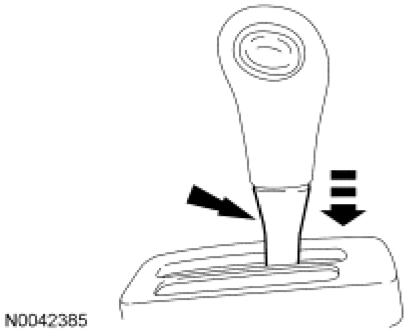


Fig. 86: Sliding Lower Shift Knob Bezel Downward
Courtesy of FORD MOTOR CO.

2. Remove and discard the 2 bolts and lift up on the selector lever knob to remove.

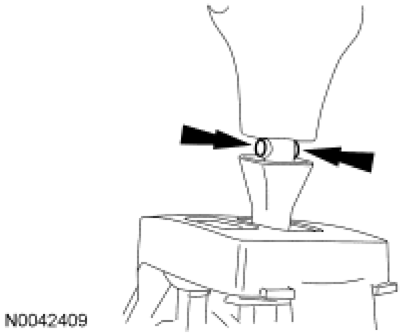


Fig. 87: Locating Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: Do not overtighten the selector lever knob bolts or damage to the selector lever or knob may occur.

1. Install the selector lever knob and 2 new bolts.
   - Tighten to 2 Nm (18 lb-in).

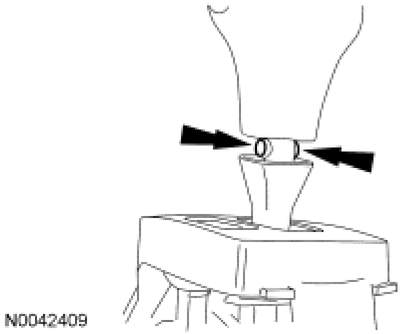


Fig. 88: Locating Bolts
Courtesy of FORD MOTOR CO.

2. Slide the lower selector lever knob bezel up and snap it into place.

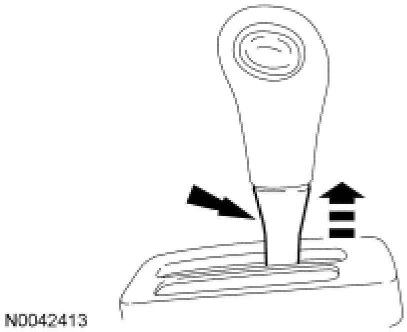


Fig. 89: Sliding Lower Shift Knob Bezel Up

Courtesy of FORD MOTOR CO.

SELECTOR LEVER KNOB - 3.5L

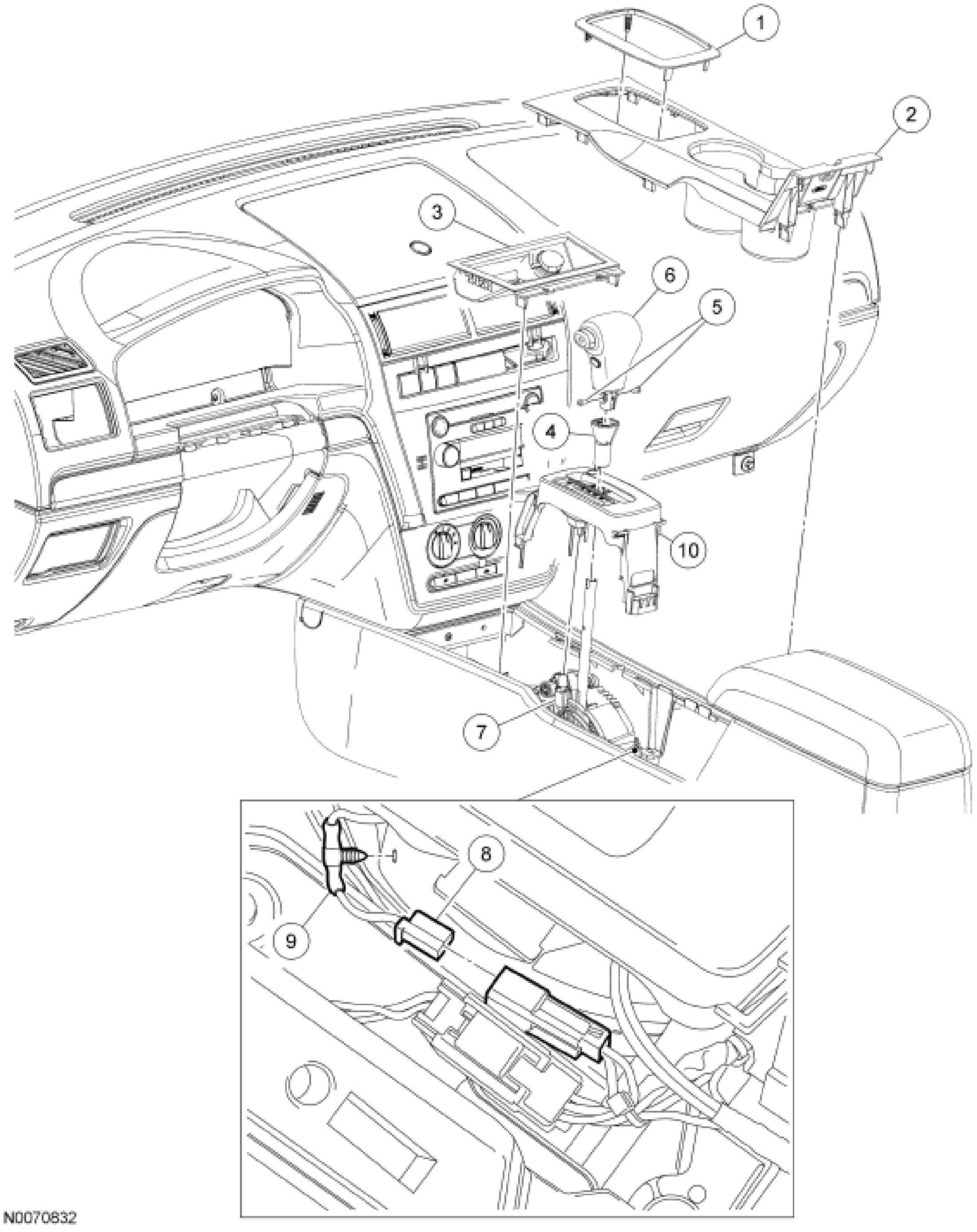


Fig. 90: Exploded View Of Selector Lever Bezel
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	54061A16	PRNDL indicator trim ring
2	54045A76	Center console trim cover
3	54045A07	Power outlet trim panel
4	-	Lower selector lever knob bezel
5	-	Selector lever knob screws
6	7L010	Selector lever knob
7	-	Selector lever indicator light
8	14A459	Transmission Control Switch (TCS) electrical connector (MKZ only)
9	-	TCS wiring harness retainer
10	7E034	Selector lever bezel

REMOVAL

All vehicles

1. Remove the PRNDL trim ring.

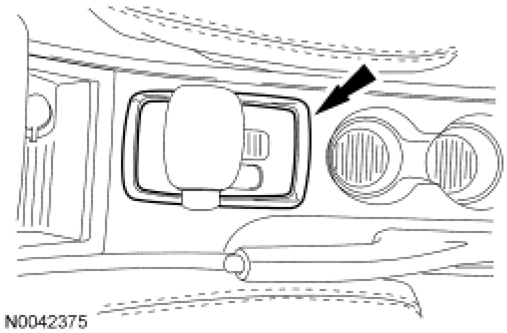


Fig. 91: Locating PRNDL Trim Ring
Courtesy of FORD MOTOR CO.

2. Remove the upper console panel.

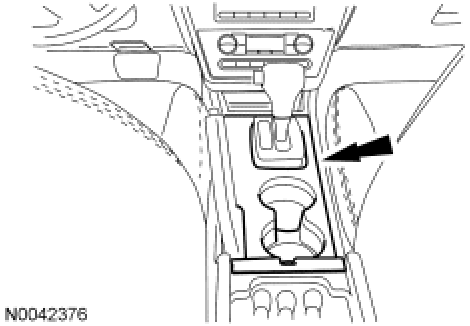


Fig. 92: Locating Upper Console Panel
Courtesy of FORD MOTOR CO.

3. Slide the lower shift knob bezel downward.

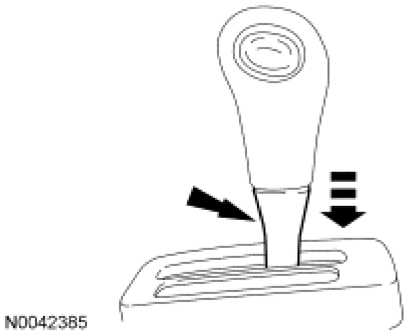


Fig. 93: Sliding Lower Shift Knob Bezel Downward
Courtesy of FORD MOTOR CO.

4. Remove and discard the 2 bolts from the selector lever knob.

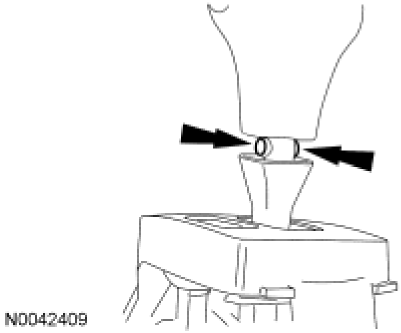


Fig. 94: Locating Bolts
Courtesy of FORD MOTOR CO.

Vehicles equipped with a light bulb

5. Disconnect the light from the PRNDL bezel.

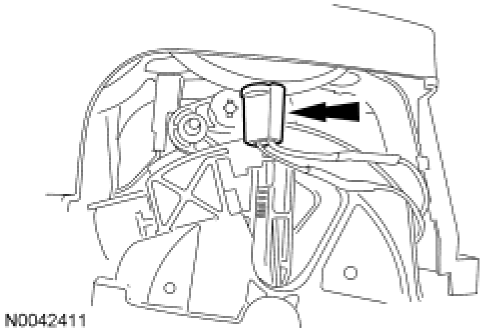


Fig. 95: Locating Light From PRNDL Bezel
Courtesy of FORD MOTOR CO.

Vehicles equipped with LED illumination

6. Disconnect the LED electrical connector.

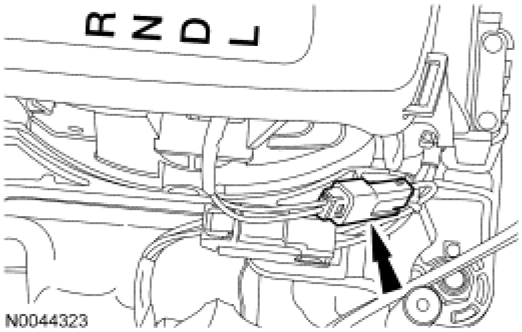


Fig. 96: Locating LED Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

7. Disconnect the Transmission Control Switch (TCS) electrical connector and remove the wiring harness retainer from the selector lever housing.

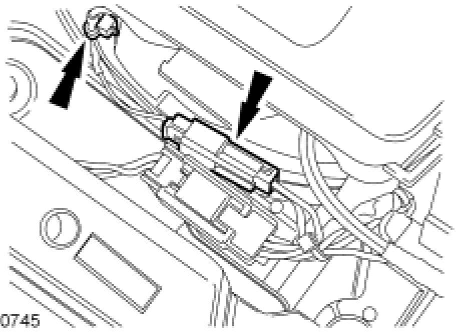


Fig. 97: Locating Transmission Control (TC) Switch Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: Selector lever removed for clarity.

8. Release the 3 tabs and remove the PRNDL bezel, selector lever knob and knob bezel.

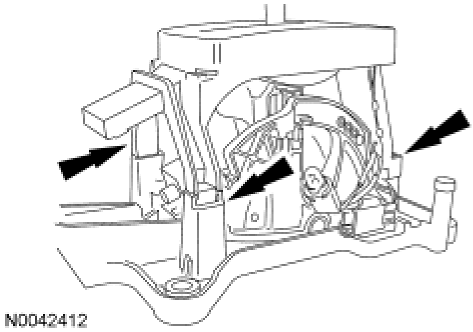


Fig. 98: Locating Tabs
Courtesy of FORD MOTOR CO.

INSTALLATION

All vehicles

NOTE: **Be sure that the override lever is inserted in the override lever guide or the shift interlock override button will not work correctly.**

NOTE: **Selector lever removed for clarity.**

1. Position the TCS wiring harness through the selector lever knob bezel and the PRNDL bezel and install the PRNDL bezel on the selector lever.
   - Position the override lever in the override lever guide.
   - Make sure that the 3 locking tabs are locked in place.

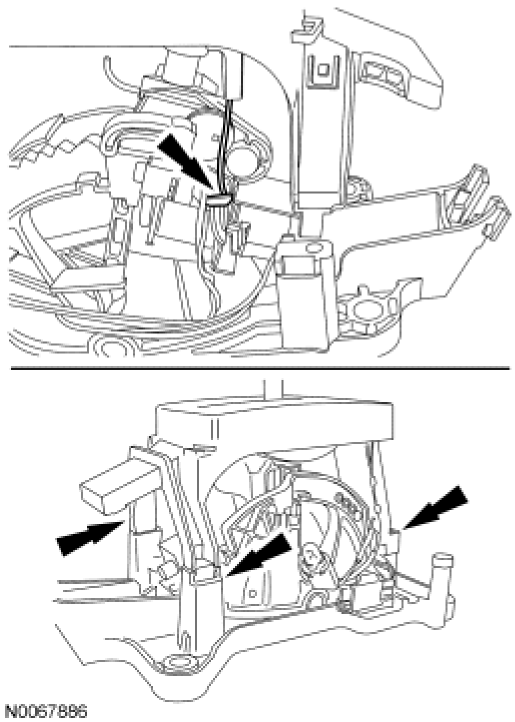


Fig. 99: Identifying PRNDL Bezel, Selector Lever Knob & Knob Bezel
Courtesy of FORD MOTOR CO.

2. Connect the TCS electrical connector and install the connector fastener on the selector lever housing.

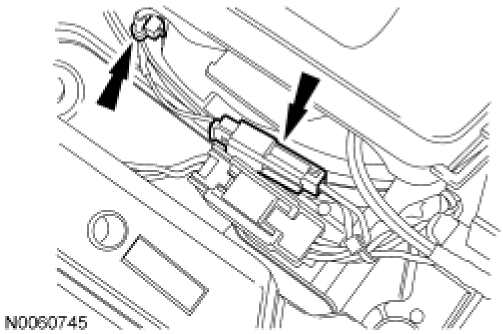


Fig. 100: Locating Transmission Control (TC) Switch Electrical Connector
Courtesy of FORD MOTOR CO.

Vehicles equipped with LED illumination

3. Connect the LED electrical connector.

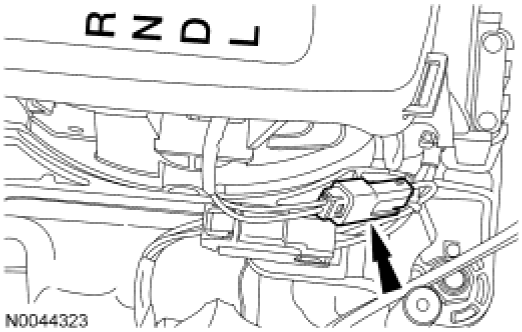


Fig. 101: Locating LED Electrical Connector
Courtesy of FORD MOTOR CO.

Vehicles equipped with a light bulb

4. Connect the light to the PRNDL bezel.

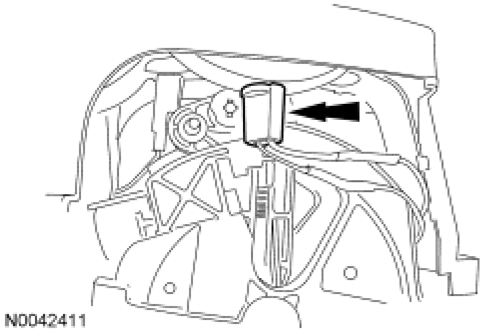


Fig. 102: Locating Light From PRNDL Bezel
Courtesy of FORD MOTOR CO.

All vehicles

5. Position the lower selector lever knob bezel in place.

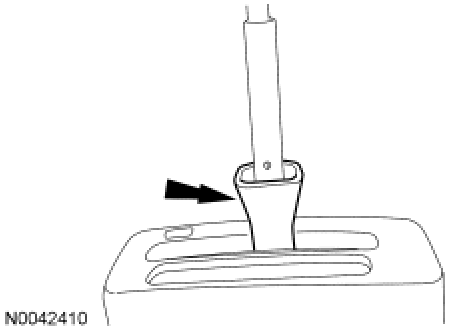


Fig. 103: Locating Lower Shift Knob Bezel
Courtesy of FORD MOTOR CO.

NOTE: **Do not overtighten the selector lever knob bolts or damage to the selector lever or knob may occur.**

6. Install the selector lever knob and 2 new bolts.
   - Tighten to 2 Nm (18 lb-in).

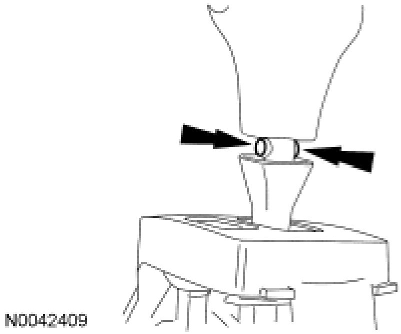


Fig. 104: Locating Bolts
Courtesy of FORD MOTOR CO.

7. Slide the lower selector lever knob bezel up and snap it into place.

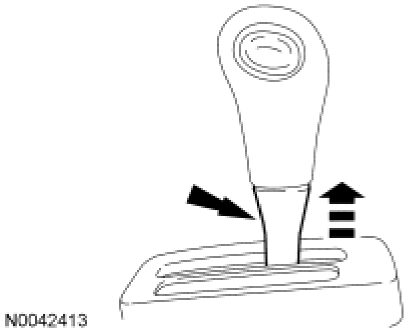


Fig. 105: Sliding Lower Shift Knob Bezel Up
Courtesy of FORD MOTOR CO.

8. Install the upper console panel.

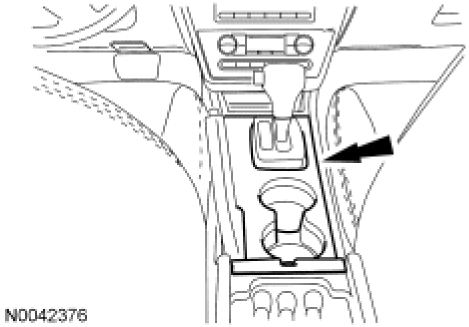


Fig. 106: Locating Upper Console Panel

Courtesy of FORD MOTOR CO.

9. Install the PRNDL trim ring.

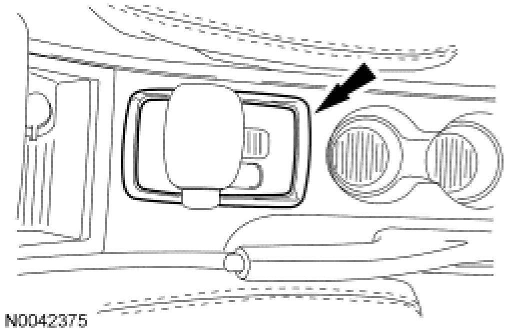


Fig. 107: Locating PRNDL Trim Ring
Courtesy of FORD MOTOR CO.

2008 ELECTRICAL

Battery, Mounting & Cables - Fusion, Milan & MKZ

SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Battery	
Cold Cranking Amps (CCA) measured at -18°C (0°F)	500 CCA - 2.3L and 3.5L 590 CCA - 3.0L
Voltage	12 volts

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Battery cable body ground terminal bolt	12	-	106
Battery cable starter solenoid terminal nut	12	-	106
Battery cable terminal nuts	5	-	44
Battery cable transaxle ground terminal bolt	10	-	89
Battery hold-down bracket bolt/nut	10	-	89
Battery Junction Box (BJB) cable terminal nut	8	-	71
Battery tray bolt/nut	9	-	80
Generator B+ terminal nut	12	-	106
Generator shield nuts (2.3L)	25	18	-
Starter motor solenoid wire terminal nut	5	-	44

DESCRIPTION AND OPERATION

BATTERY AND CABLES

Vehicles are equipped with a 12V, maintenance-free battery.

The battery and cable system consists of the following components:

- Battery
- Battery cable assembly
- Battery tray

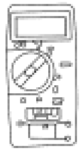
Ford Motor Company strongly recommends that lead-acid batteries be returned to an authorized recycling facility for disposal.

Fig. 1: Recycling Symbol
Courtesy of FORD MOTOR CO.

DIAGNOSTIC TESTS

BATTERY

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	Micro 490 Digital Battery Analyzer	162-00004 or equivalent

Principles of Operation

Battery Eye Operation

The purpose of the battery eye is to indicate the state of charge of the battery in the assembly plant and while on the dealership lot. The battery eye can also indicate the state-of-charge when the vehicle is delivered to the dealership and during the pre-delivery inspection process. The battery eye is made up of a viewing plate, 2 balls and a small passage. The balls indicate the specific gravity of the electrolyte by floating higher or lower in the passageway. It is important to note that the battery eye checks the specific gravity on only a single battery cell.

The color of the battery eye indicates the approximate state of charge.

- Red usually indicates the battery state-of-charge is at 40% or less.
- Yellow indicates the battery state-of-charge is between 40% and 57%.
- Green indicates the battery state-of-charge is above 57%.
- No color/black can occur after the battery has been in service for several years and some of the plate material has coated the balls.
- A clear battery eye can occur if the battery case becomes damaged and the electrolyte has fallen below the plates.

NOTE: The battery eye may remain red for a period of time (up to several days), even after the battery is fully charged, because the acid is not yet fully mixed.

Do not install a new battery based solely on the indication of the battery eye. The battery eye color simply indicates the battery state-of-charge, not its condition. For example, a red or yellow battery eye usually indicates the battery is discharged, not defective. If the battery eye indicates the battery may be discharged, it is necessary to recharge the battery before testing its condition.

Charging a Battery

Batteries discharge while the vehicle is on the dealer lot or parked by the customer for an extended period of time due to normal parasitic key-off loads. Also, vehicles still in dealer inventory or in long-term storage may be driven short distances with heavy electrical loads. Over a period of time (30 days or more), this could result in vehicles having shallow or deeply discharged batteries.

- Deeply discharged - A battery that is drained over a prolonged period of time, such as an unsold vehicle or a vehicle in storage, to the point the battery is dead.
- Shallow discharge - A battery that is drained by leaving an accessory on for several hours or a few days and has a very low charge.

The vehicle's charging system is designed to supply the electrical power needed to maintain the battery near full charge during normal vehicle use. The charging system is not capable of bringing a deeply discharged battery back near full charge in a short amount of time such as allowing the vehicle to idle for 15 minutes to "recharge the battery." Discharged batteries should be charged using an external charger.

NOTE: Battery chargers have improved greatly with the addition of the new generation pulse chargers. These chargers pulse current into the battery, breaking down the sulfation layer on the battery plates and generally reduce charging times to less than an hour.

NOTE: Cold batteries will not readily accept a charge. Therefore, batteries should be allowed to warm to approximately 5°C (41°F) before charging. This may require 4 to 8 hours at room temperature.

The following chart summarizes 2 recommended methods of charging.

Type of Battery Discharge	Pulse Charger	Standard Charger
Deeply discharged	Follow directions supplied with the pulse charger	2 to 8 hours and may take up to an hour to accept initial charge
Shallow discharge	45 minutes to an hour charge	2 hours (40A) on manual setting or medium automatic setting

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Battery • Battery mounting	• Battery cables • Battery posts

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the fault is not visually evident, go to **Pinpoint Test A**.

Pinpoint Tests

Pinpoint Test A: Battery Condition Test

Normal Operation

Battery condition is determined by measuring battery terminal voltage after a specific discharge current is applied for a specified time period.

This pinpoint test is intended to diagnose the following:

- Battery charge
- Battery

PINPOINT TEST A: BATTERY CONDITION TEST

A1 TEST THE BATTERY CONDITION

NOTE: A red test-eye indicates the battery is discharged, not necessarily defective.

NOTE: Failure to fully charge the battery before retesting may cause false readings.

- Verify the battery condition using the battery analyzer.
- **Is the battery OK?**

  YES : If the meter reads GOOD BATTERY, RETURN the battery to service.

  If the meter reads GOOD-RECHARGE, CHARGE the battery and RETURN it to service.

  If the meter reads CHARGE & RETEST, fully CHARGE and RETEST the battery.

  NO : If the meter reads REPLACE BATTERY, INSTALL a new battery.

  If the meter reads BAD CELL-REPLACE, INSTALL a new battery.

GENERAL PROCEDURES

BATTERY DISCONNECT

WARNING: **Batteries contain sulfuric acid and produce explosive gases. Work in a well-ventilated area. Do not allow the battery to come in contact with flames, sparks or burning substances. Avoid contact with skin, eyes or clothing. Shield eyes when working near the battery to protect against possible splashing of acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes, then get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.**

Refer to the Description and Operation portion of SUPPLEMENTAL RESTRAINT SYSTEM article for location of the RCM and impact sensor(s).

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

WARNING: **Always lift a plastic-cased battery with a battery carrier or with hands on opposite corners. Excessive pressure on the battery end walls may cause acid to flow through the vent caps, resulting in personal injury and/or damage to the vehicle or battery.**

WARNING: **Battery posts, terminals and related accessories contain lead and lead components. Wash hands after handling. Failure to follow these instructions may result in serious personal injury.**

NOTE: **When the battery (or PCM) is disconnected and connected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The charging system set point may also vary. The vehicle may need to be driven to relearn its strategy.**

NOTE: When disconnecting the battery ground cable to interrupt power to the vehicle electrical system, disconnect the battery ground cable only. It is not necessary to disconnect the positive battery cable.

1. Disconnect the battery ground terminal.
   - To connect, tighten to 5 Nm (44 lb-in).
2. Disconnect the positive battery terminal.
   - To connect, tighten to 5 Nm (44 lb-in).
3. To connect, reverse the disconnect procedure.

REMOVAL AND INSTALLATION

BATTERY AND BATTERY TRAY - EXPLODED VIEW

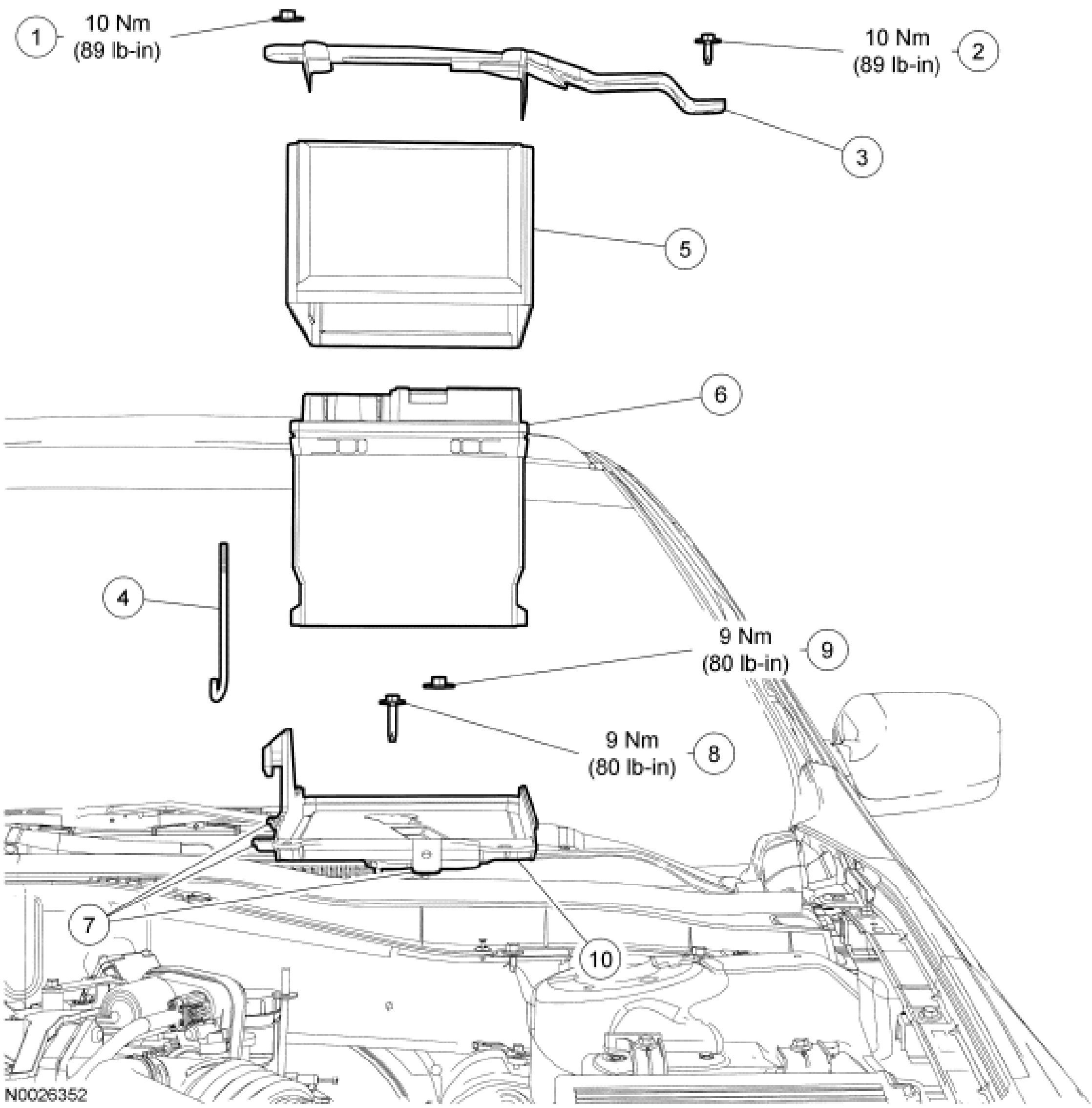


Fig. 2: Exploded View Of Battery & Battery Tray With Torque Specifications (2.3L & 3.0L)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W707142	Battery hold-down bracket nut
2	99726	Battery hold-down bracket bolt
3	10716	Battery hold-down bracket
4	10756	Battery hold-down bracket J-bolt
5	10A659	Battery heat shield
6	10655	Battery
7	-	Battery cable harness locators (3 required) (part of 14B060)
8	W710610	Battery tray bolt
9	W700430	Battery tray nut
10	10723	Battery tray

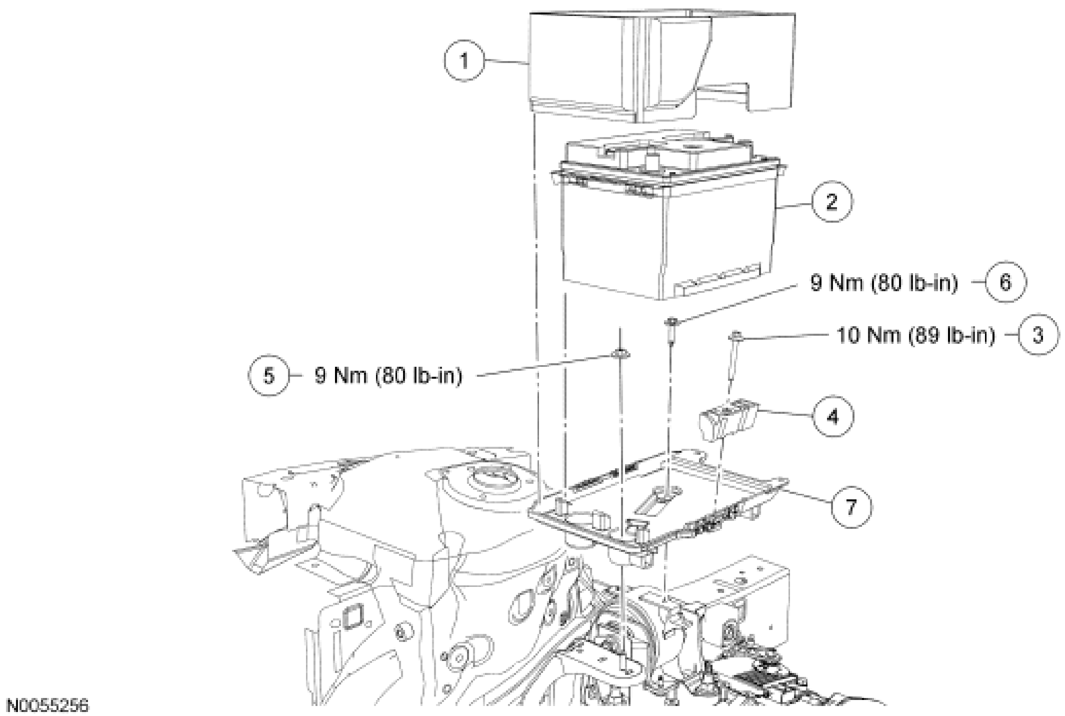


Fig. 3: Exploded View Of Battery & Battery Tray With Torque Specifications (3.5L)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	10A659	Battery heat shield
2	10655	Battery
3	N803471	Battery hold-down bracket bolt
4	-	Battery hold-down bracket

5	-	Battery tray nut
6	-	Battery tray bolt
7	10723	Battery tray

1. For additional information, refer to the procedures.

BATTERY

REMOVAL AND INSTALLATION

WARNING: **Batteries contain sulfuric acid and produce explosive gases. Work in a well-ventilated area. Do not allow the battery to come in contact with flames, sparks or burning substances. Avoid contact with skin, eyes or clothing. Shield eyes when working near the battery to protect against possible splashing of acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes, then get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.**

Refer to the Description and Operation portion of SUPPLEMENTAL RESTRAINT SYSTEM article for location of the RCM and impact sensor(s).

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

WARNING: **Always lift a plastic-cased battery with a battery carrier or with hands on opposite corners. Excessive pressure on the battery end walls may cause acid to flow through the vent caps, resulting in personal injury and/or damage to the vehicle or battery.**

NOTE: When the battery (or PCM) is disconnected and connected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The charging system set point may also vary. The vehicle may need to be driven to relearn its strategy.

All vehicles

1. Disconnect the battery. For additional information, refer to **Battery Disconnect**.

   2.3L and 3.0L vehicles

2. Remove the battery hold-down bracket bolt and nut.
   - To install, tighten to 10 Nm (89 lb-in).
3. Remove the battery hold-down bracket and J-bolt.

   3.5L vehicles

4. Remove the bolt and the battery hold-down bracket.

   All vehicles

5. Remove the battery heat shield.
6. Remove the battery.
7. To install, reverse the removal procedure.

BATTERY TRAY

REMOVAL AND INSTALLATION

1. Remove the battery. For additional information, refer to **Battery**.
2. Remove the 3 battery cable harness locators from the battery tray.
3. Remove the battery tray bolt and nut.
   - To install, tighten to 9 Nm (80 lb-in).
4. Remove the battery tray.
5. To install, reverse the removal procedure.

BATTERY CABLES - 2.3L

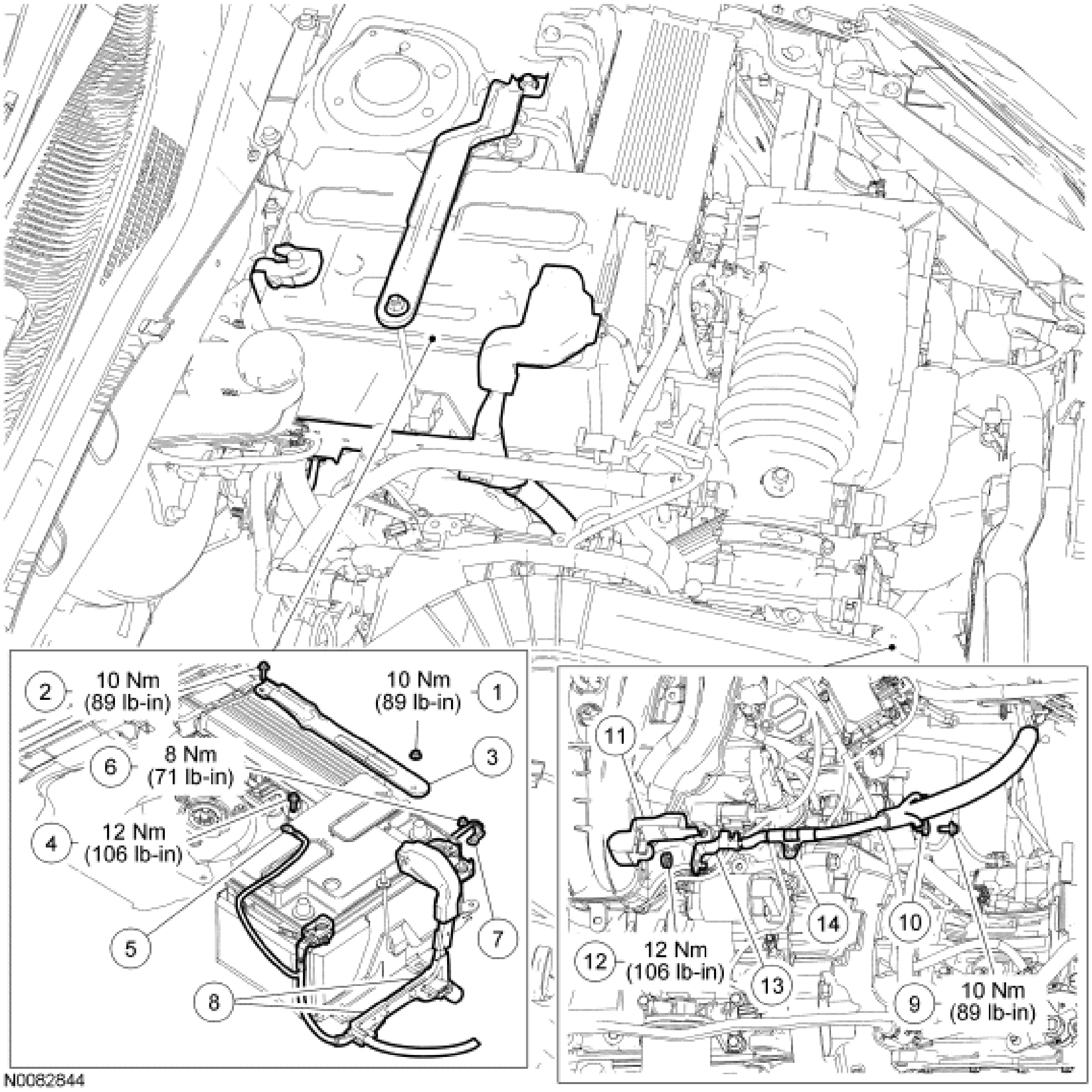


Fig. 4: Exploded View Of Battery Cables With Torque Specifications - 2.3L (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W707142	Battery hold-down bracket nut
2	99726	Battery hold-down bracket bolt
3	10716	Battery hold-down bracket
4	W705936	Battery cable body ground terminal bolt
5	-	Battery cable body ground terminal (part of 14B060)
6	W705790	Battery Junction Box (BJB) cable terminal nut
7	-	BJB cable terminal (part of 14290)
8	-	Battery cable locators (2 required) (part of 14B060)
9	W503271	Battery cable transaxle ground terminal bolt
10	-	Battery cable transaxle ground terminal (part of 14B060)

11	11N087	Starter solenoid terminal cover
12	W706414	Battery cable starter solenoid terminal nut
13	-	Battery cable starter solenoid terminal (part of 14B060)
14	-	Battery cable locator (part of 14B060)

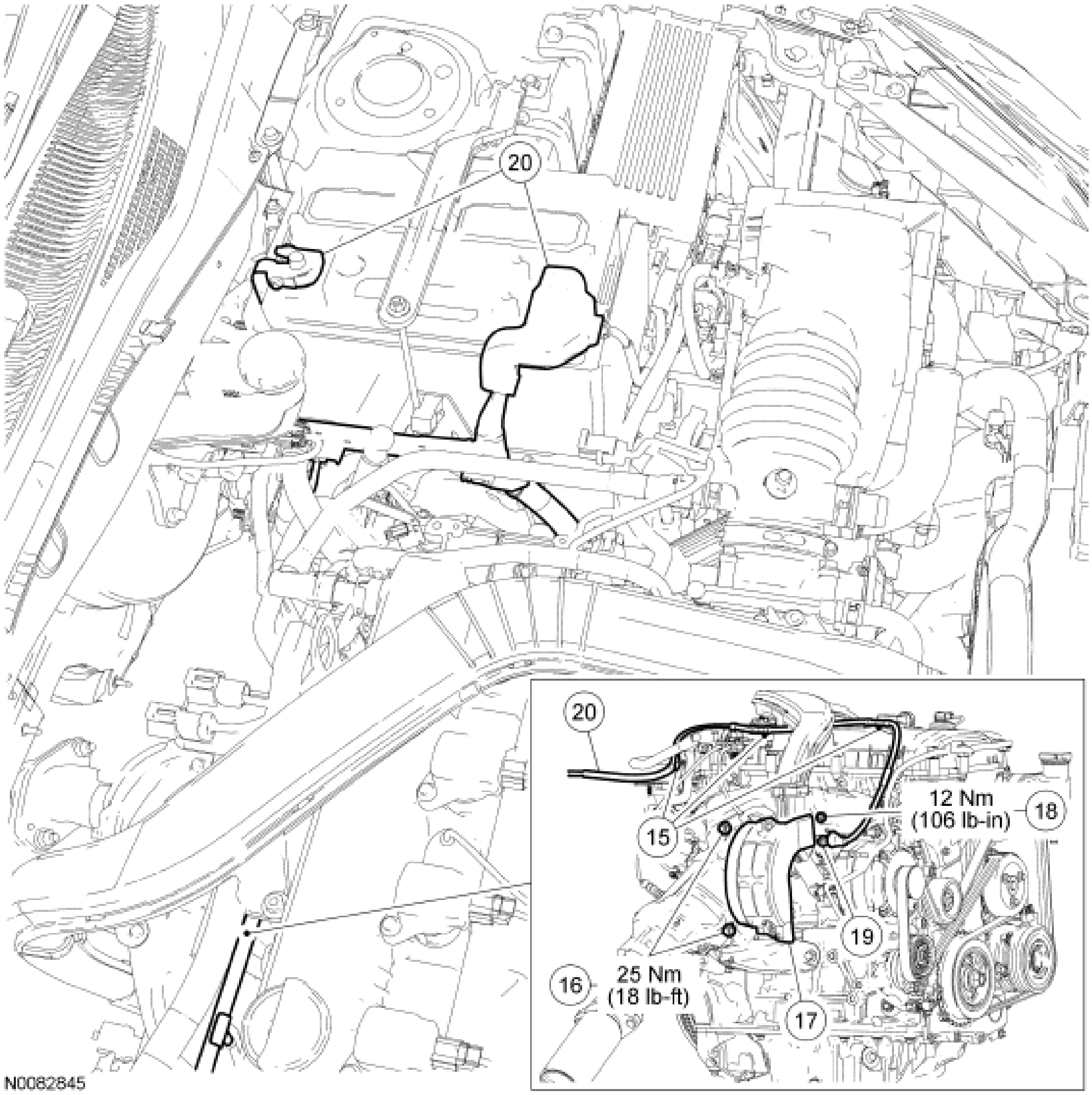


Fig. 5: Exploded View Of Battery Cables With Torque Specifications - 2.3L (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
15	-	Battery cable locators (3 required) (part of 14B060)
16	W520414	Generator shield nuts (2 required)
17	10A346	Generator shield
18	W706414	Generator B+ terminal nut

19	-	Generator B+ terminal (part of 14B060)
20	14B060	Battery cables

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery. For additional information, refer to **Battery Disconnect**.
3. Remove the bolt, nut and the battery hold-down bracket.
   - To install, tighten to 10 Nm (89 lb-in).
4. Remove the bolt and position the battery cable body ground terminal aside.
   - To install, tighten to 12 Nm (106 lb-in).
5. Remove the nut and position the Battery Junction Box (BJB) cable terminal aside.
   - To install, tighten to 8 Nm (71 lb-in).
6. Release the 2 battery cable locators from the battery tray.
7. Remove the bolt and position the battery cable transaxle ground terminal aside.
   - To install, tighten to 10 Nm (89 lb-in).
8. Remove the starter solenoid terminal cover.
9. Remove the nut and position the battery cable starter solenoid terminal aside.
   - To install, tighten to 12 Nm (106 lb-in).
10. Release the battery cable locator from the starter stud bolt.
11. Remove the 3 battery cable locators from the rear of the engine.
12. Remove the 2 nuts and the generator shield.
    - To install, tighten to 25 Nm (18 lb-ft).
13. Position the generator protective cover aside, remove the nut and position the generator B+ terminal aside.
    - To install, tighten to 12 Nm (106 lb-in).
14. Remove the battery cables.
15. To install, reverse the removal procedure.

BATTERY CABLES - 3.0L

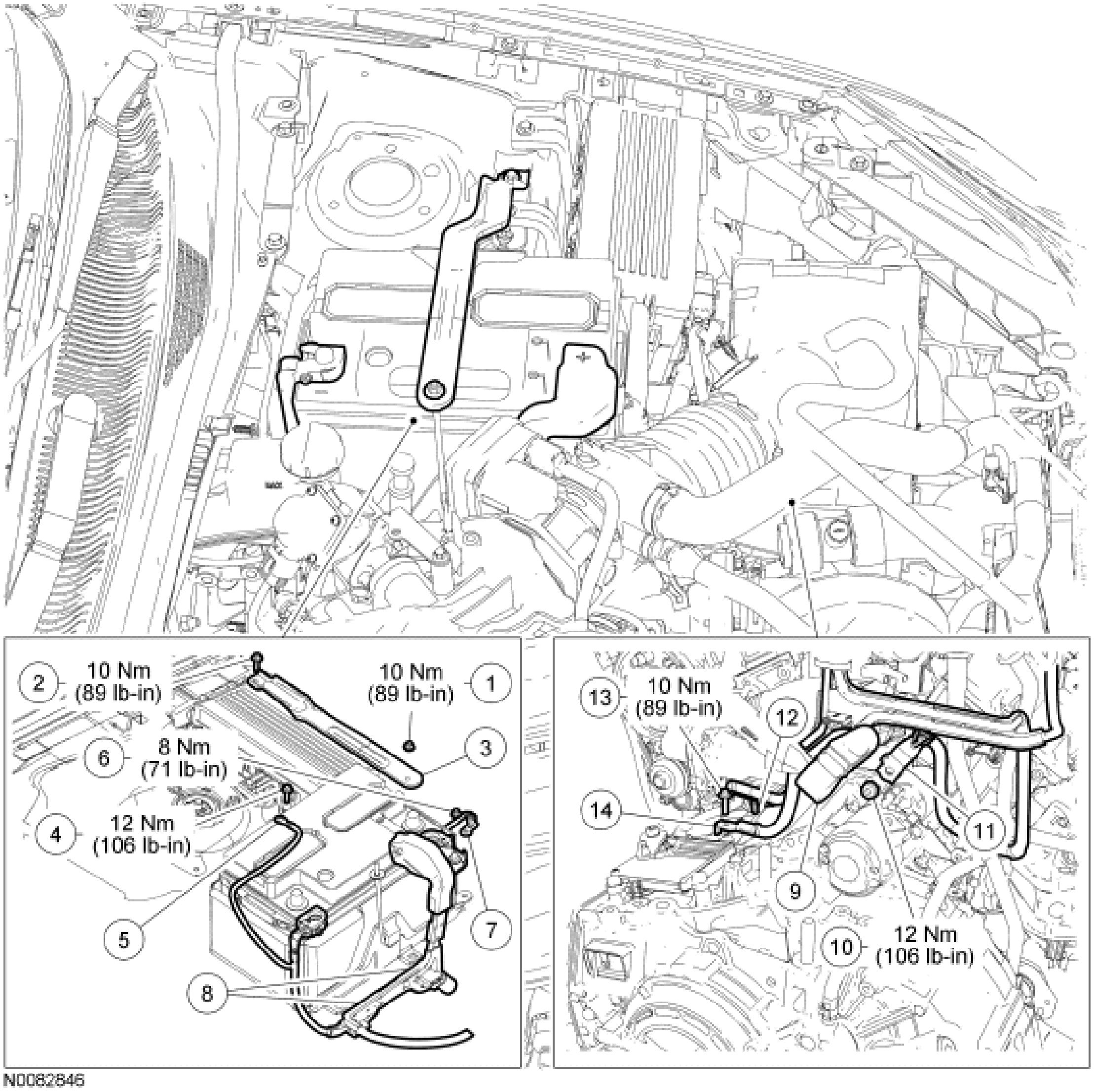


Fig. 6: Exploded View Of Battery Cables With Torque Specifications - 3.0L (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W707142	Battery hold-down bracket nut
2	99726	Battery hold-down bracket bolt
3	10716	Battery hold-down bracket
4	W705936	Battery cable body ground terminal bolt
5	-	Battery cable body ground terminal (part of 14B060)
6	W705790	Battery Junction Box (BJB) cable terminal nut
7	-	BJB cable terminal (part of 14290)
8	-	Battery cable locators (2 required) (part of 14B060)
9	11N087	Starter solenoid terminal cover
10	W706414	Battery cable starter solenoid terminal nut

11	-	Battery cable starter solenoid terminal (part of 14B060)
12	-	Battery cable harness locator (part of 14B060)
13	W503271	Battery cable transaxle ground terminal bolt
14	-	Battery cable transaxle ground terminal (part of 14B060)

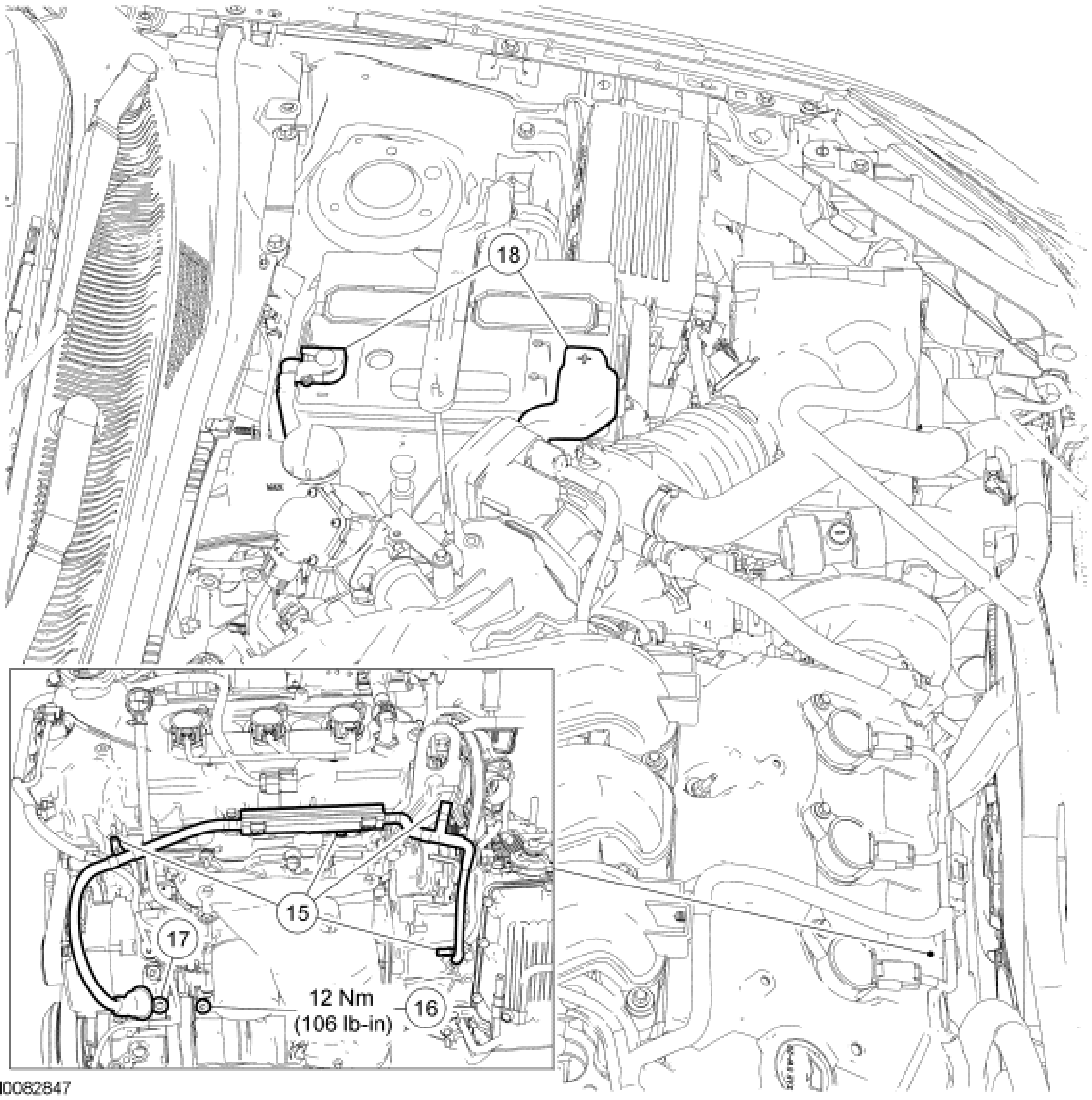


Fig. 7: Exploded View Of Battery Cables With Torque Specification - 3.0L (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
15	-	Battery cable locators (4 required) (part of 14B060)
16	W706414	Generator B+ terminal nut

17	-	Generator B+ cable terminal (part of 14B060)
18	14B060	Battery cables

REMOVAL AND INSTALLATION

1. Remove the battery tray. For additional information, refer to **Battery Tray**.
2. Remove the bolt, nut and the battery hold-down bracket.
   - To install, tighten to 10 Nm (89 lb-in).
3. Remove the bolt and position the battery cable body ground terminal aside.
   - To install, tighten to 12 Nm (106 lb-in).
4. Remove the nut and position the Battery Junction Box (BJB) cable terminal aside.
   - To install, tighten to 8 Nm (71 lb-in).
5. Remove the starter solenoid terminal cover.
6. Remove the nut and position the battery cable starter solenoid terminal aside.
   - To install, tighten to 12 Nm (106 lb-in).
7. Release the battery cable locator from the engine.
8. Remove the bolt and position the battery cable transaxle ground terminal aside.
   - To install, tighten to 10 Nm (89 lb-in).
9. Release the battery cable locator from the transaxle stud bolt.
10. Release the 3 battery cable locators from the LH valve cover.
11. Position the generator protective cover aside, remove the nut and position the generator B+ terminal aside.
    - To install, tighten to 12 Nm (106 lb-in).
12. Remove the battery cables.
13. To install, reverse the removal procedure.

BATTERY CABLES - 3.5L

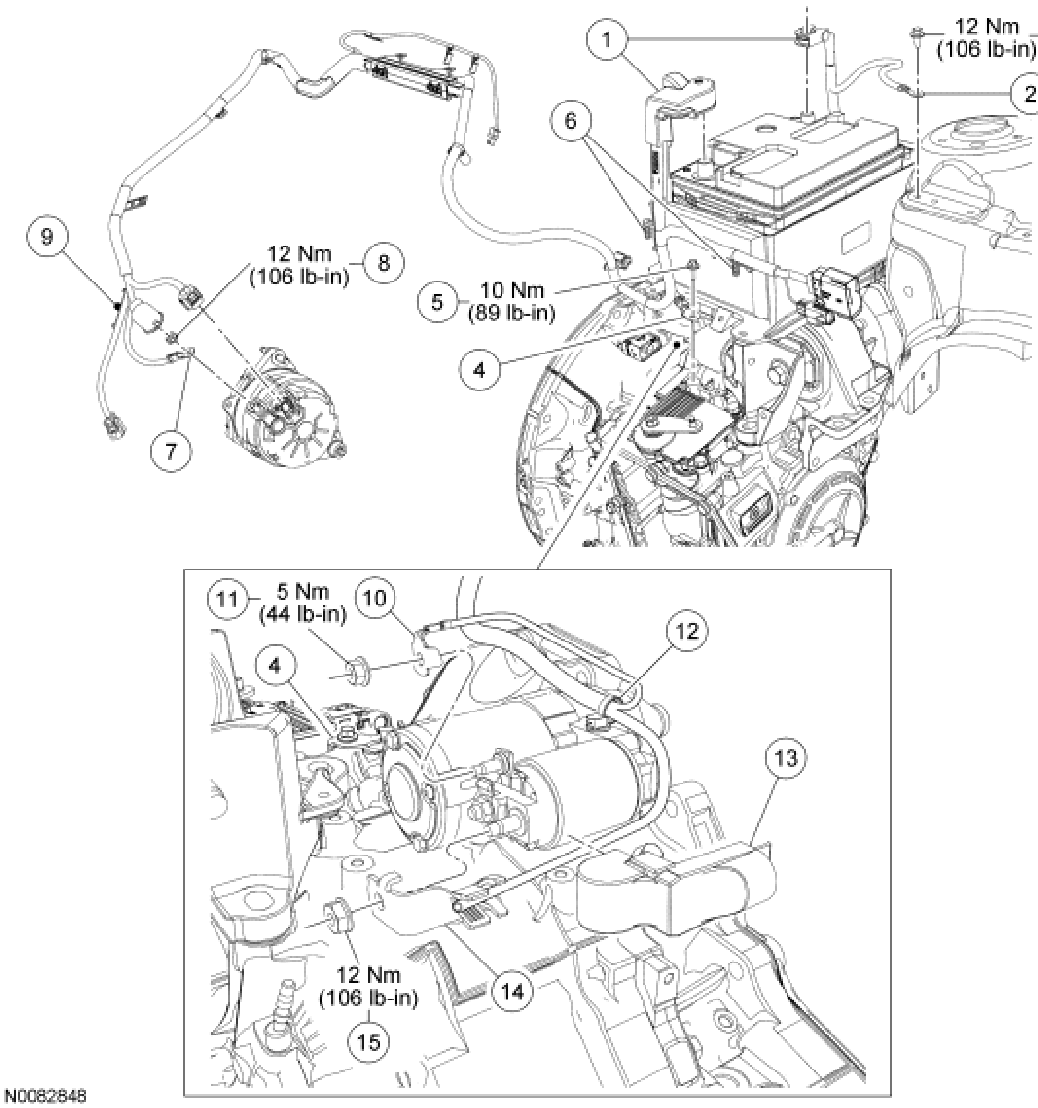


Fig. 8: Exploded View Of Battery Cables With Torque Specifications - 3.5L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Battery cables (part of 14B060)
2	-	Battery cable body ground terminal (part of 14B060)
3	W705936	Battery cable body ground terminal bolt
4	-	Battery cable transaxle ground terminal (part of 14B060)
5	W503271	Battery cable transaxle ground terminal bolt
6	-	Battery cable locators (2 required) (part of 14B060)
7	-	Generator B+ terminal (part of 14B060)
8	W706414	Generator B+ terminal nut
9	-	Pin-type retainer, wiring harness
10	-	Starter motor solenoid wire terminal (part of 14B060)

11	W705790	Starter motor solenoid wire terminal nut
12	-	Battery cable locator, starter
13	11N087	Starter solenoid terminal cover
14	-	Battery cable starter solenoid terminal (part of 14B060)
15	W706414	Battery cable starter solenoid terminal nut

REMOVAL AND INSTALLATION

1. Remove the battery tray. For additional information, refer to **Battery Tray**.
2. Remove the bolt and position the battery cable body ground terminal aside.
   - To install, tighten to 12 Nm (106 lb-in).
3. Remove the starter solenoid terminal cover.
4. Remove the nut and position the battery cable starter solenoid terminal aside.
   - To install, tighten to 12 Nm (106 lb-in).
5. Remove the nut and position the starter motor solenoid wire terminal aside.
   - To install, tighten to 5 Nm (44 lb-in).
6. Release the battery cable locator from the engine.
7. Remove the bolt and position the battery cable transaxle ground terminal aside.
   - To install, tighten to 10 Nm (89 lb-in).
8. Release the battery cable locator from the transaxle stud bolt.
9. Release the 3 battery cable locators from the LH valve cover.
10. Position the generator protective cover aside, remove the nut and position the generator B+ terminal aside.
    - To install, tighten to 12 Nm (106 lb-in).
11. Remove the battery cables.
12. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Body Closures - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Door check arm-to-body bolt	25	18
Door check arm-to-door nuts	15	11
Door hinge-to-body bolts	25	18
Door hinge-to-door bolts	30	22
Door striker plate bolts	22	16
Luggage compartment lid hinge-to-body bolts	25	18
Luggage compartment lid hinge-to-luggage compartment lid nuts	25	18
Luggage compartment lid striker plate bolts	22	16

GENERAL PROCEDURES

DOOR ALIGNMENT - FRONT

All alignments

1. Remove the door latch striker plate.

   Front door in and out, up and down alignment

2. Loosen, but do not remove, the front door hinge-to-front door fasteners enough to allow door alignment.

   Front door fore, aft and tilt alignment

3. Remove the front fender. For additional information, refer to **FRONT END BODY PANELS** article.
4. Loosen, but do not remove, the upper front door hinge-to-body fasteners enough to allow door alignment.
5. Loosen, but do not remove, the lower front door hinge-to-body fasteners enough to allow door alignment.

   All alignments

6. Adjust the door. For additional information, refer to **BODY REPAIRS** article.
7. Tighten the door fasteners.
   - Tighten the front door hinge-to-front door fasteners to 30 Nm (22 lb-ft).
   - Tighten the front door hinge-to-body fasteners to 25 Nm (18 lb-ft).

Front door fore, aft and tilt alignment

8. Install the front fender. For additional information, refer to **FRONT END BODY PANELS** article.

All alignments

9. Install and adjust the door striker as necessary. For additional information, refer to **BODY REPAIRS** article.
    - Tighten the door latch striker plate bolts to 22 Nm (16 lb-ft).

DOOR ALIGNMENT - REAR

All alignments

1. Remove the door latch striker plate.

Rear door in and out, up and down alignment

2. Loosen, but do not remove, the rear door hinge-to-rear door fasteners enough to allow door alignment.

Rear door fore, aft and tilt alignment

3. Position aside the B-pillar panel.
4. Loosen, but do not remove, the upper rear door hinge-to-body fasteners enough to allow door alignment.
5. Loosen, but do not remove, the lower rear door hinge-to-body fasteners enough to allow door alignment.

All alignments

6. Adjust the door. For additional information, refer to **BODY REPAIRS** article.
7. Tighten the door fasteners.
    - Tighten the rear door hinge-to-rear door fasteners to 30 Nm (22 lb-ft).
    - Tighten the rear door hinge-to-body fasteners to 25 Nm (18 lb-ft).

Rear door fore, aft and tilt alignment

8. Install the B-pillar trim panel.

All alignments

9. Install and adjust the door striker as necessary. For additional information, refer to **BODY REPAIRS** article.
    - Tighten the door latch striker plate bolts to 22 Nm (16 lb-ft).

LUGGAGE COMPARTMENT LID ALIGNMENT

1. Remove the luggage compartment lid struts.
2. Loosen the 4 luggage compartment lid bolts.
3. Adjust the luggage compartment lid as necessary.
   - For additional information, refer to **BODY REPAIRS** article.
4. Tighten the 4 luggage compartment lid hinge bolts.
   - Tighten to 25 Nm (18 lb-ft).
5. Install the luggage compartment lid struts.

STRIKER ADJUSTMENT

NOTE: Before adjusting the door latch striker plate, verify that the door can be closed easily and fits tightly.

1. Loosen the door latch striker bolts.

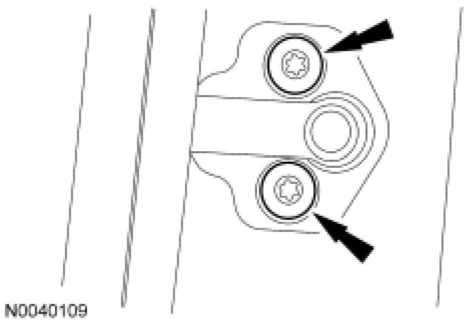


Fig. 1: Locating Door Latch Striker Plate Bolts
Courtesy of FORD MOTOR CO.

2. Reposition the door latch striker plate from side-to-side or up and down as necessary.
3. Tighten the door latch striker plate bolts.
   - Tighten to 22 N.m (16 lb-ft).

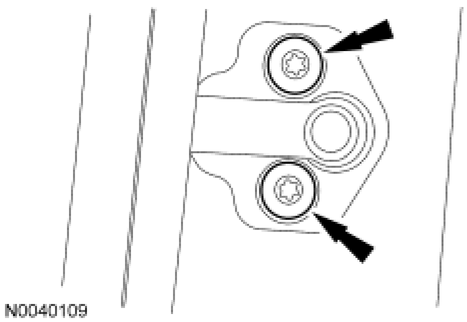


Fig. 2: Locating Door Latch Striker Plate Bolts
Courtesy of FORD MOTOR CO.

4. Check the adjustment of the door. For additional information, refer to **BODY REPAIRS** article.
   - Repeat the procedure as necessary.

REMOVAL AND INSTALLATION

DOOR

NOTE: Front door shown, rear door similar.

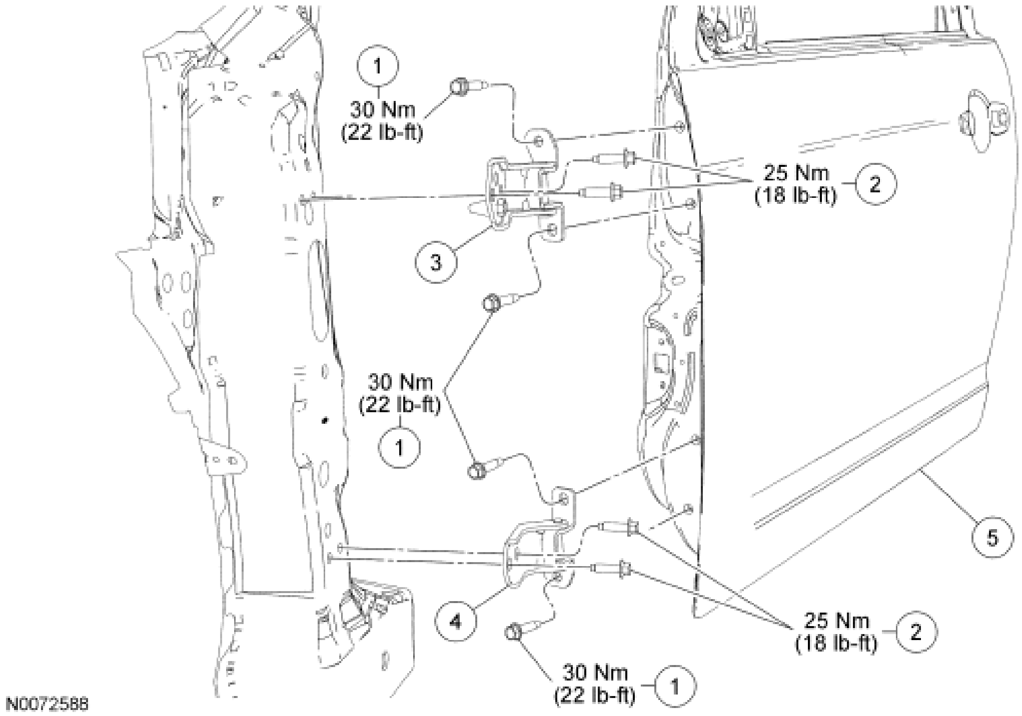


Fig. 3: Exploded View Of Door Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711119	Hinge-to-door bolts
2	W506023	Hinge-to-body bolts
3	5422800	Upper hinge
4	5422810	Lower hinge
5	5420124	Front door

REMOVAL AND INSTALLATION

1. Remove the door check arm-to-body bolt.
   - To install, tighten to 25 Nm (18 lb-ft).

CAUTION: To minimize the possibility of cross threading, hand start all fasteners during the installation.

CAUTION: To avoid damaging the door, this step requires an assistant.

2. Mark the position of each hinge and remove the hinge-to-door bolts.
   - To install, tighten to 30 Nm (22 lb-ft).
3. Remove the front door.
4. To install, reverse the removal procedure.
   - If necessary, align the door. For additional information, refer to **Door Alignment - Front** or **Door Alignment - Rear**.

DOOR CHECK ARM

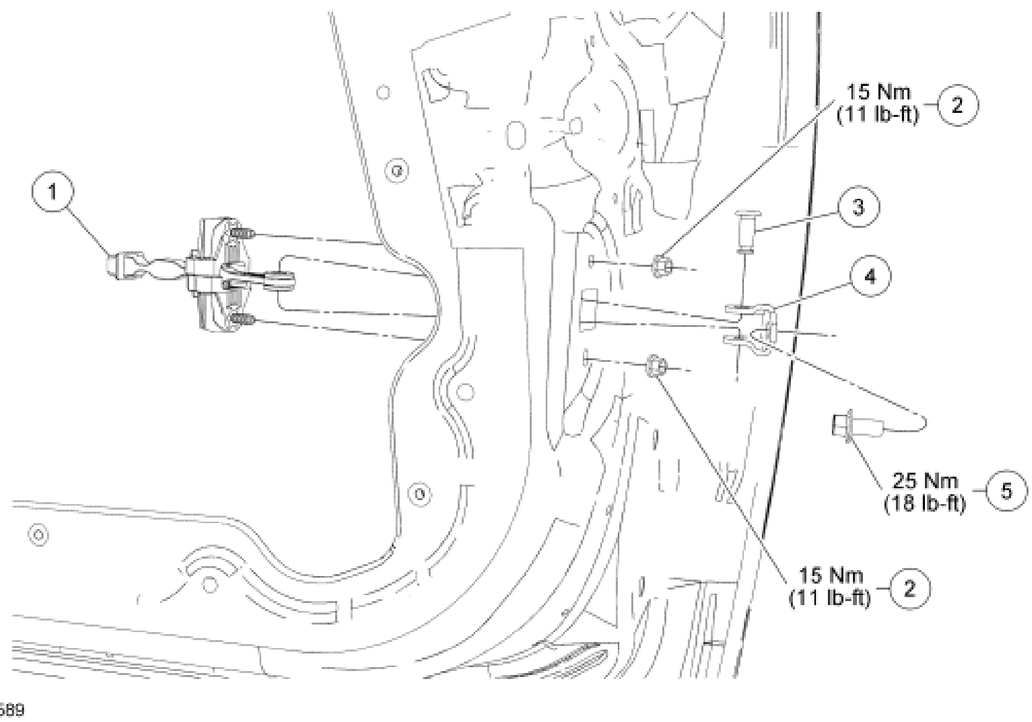


Fig. 4: Exploded View Of Door Check Arm With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5423552	Door check arm
2	W520111	Door check arm-to-door nuts
3	-	Door check arm-to-check arm bracket (part of 5423552)
4	-	Door check arm bracket (PIA-to-check arm)

5	W707375	Door check arm-to-door bolt

1. Remove the door trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the door check arm-to-body bolt.
   - To install, tighten to 25 Nm (18 lb-ft).
3. Remove the door check arm-to-door nuts.
   - To install, tighten to 15 Nm (11 lb-ft).
4. To install, reverse the removal procedure.

LUGGAGE COMPARTMENT LID

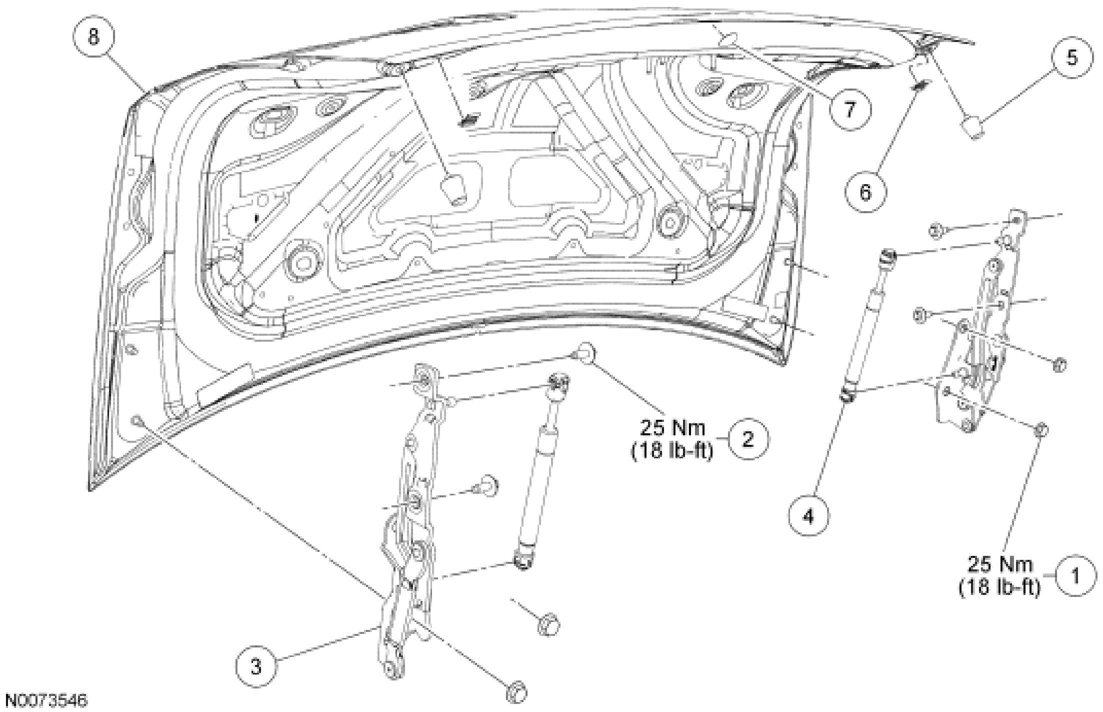


Fig. 5: Exploded View Of Luggage Compartment Lid With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N811478-S	Hinge-to-luggage compartment lid nut (4 required)
2	W503931	Hinge-to-rear quarter panel bolt (4 required)
3	5442700 RH/ 5442701 LH	Luggage compartment lid hinge
4	54406A10	Luggage compartment lid assist strut (RH/LH)
5	W712985	Luggage compartment bumper (2

		required)
6	58404D12	Flapper valve (2 required)
7	54401A22	Decklid patch
8	5440110	Luggage compartment lid

1. Open the luggage compartment lid.
2. Remove the luggage compartment lid trim panel and pushpins.
3. Disconnect the electrical connectors.
4. Remove the luggage compartment lid lift struts.
5. With the help of an assistant, remove the luggage compartment lid nuts.
    - To install, tighten to 25 N.m (18 lb-ft).
6. With the help of an assistant, remove the luggage compartment lid.
7. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Body Repairs - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Clear Silicone Rubber TA-32	ESB-M4G92-A	-
Flexible Foam Repair TA-4	-	-
Interior Spray Paint PM-19M547-xxxxH	-	-
Metal Bonding Adhesive TA-1	-	-
Metal Patch Panel Adhesive TA-3	-	-
Motorcraft Acid Neutralizer ZC-1-A	-	-
Motorcraft Adhesion Promoter PM-19A316-AA	-	-
Motorcraft Alkaline Neutralizer ZC-2-A	-	-
Motorcraft Custom Clear Coat Polish ZC-8-A	-	-
Motorcraft Detail Wash ZC-3-A	-	-
Motorcraft Metal Surface Prep ZC-31-A	-	-
Motorcraft Premium Undercoating PM-25-A	-	-
Motorcraft Premium Undercoating Quart PM-25-B	-	-
Motorcraft Rust Inhibitor Aerosol PM-24-A	-	-
Motorcraft Rust Inhibitor Quart PM-24-B	-	-
Plastic Bonding Adhesive TA-9	-	-
Roof Ditch Sealer		

TA-15	-	-
Seam Sealer TA-2	-	-
Trim and Weatherstrip Adhesive TA-14	-	-

General Equipment
3 Phase Inverter Spot Welder 254-00002
Compuspot 700F Welder 190-50080
I4 Inverter Spot Welder 254-00014
Inverter Welder with MIG Welder 254-00015

WELDING SPECIFICATIONS

WELDING SPECIFICATIONS

Item	Specification
Plug Weld Hole	8 mm (0.31 in)
Weld Wire ER70S-3 or equivalent	0.9-0.11 mm (0.035-0.045 in)

WELD NUGGET CHART

WELD NUGGET CHART

Test Thickness of Metal (mm)	Nugget Size
0.7 + 0.7	4.3 mm (0.16 in)
0.7 + 0.7 + 0.7	4.3 mm (0.16 in)
0.9 + 0.9	4.7 mm (0.18 in)
0.9 + 0.9 + 0.9	4.7 mm (0.18 in)
1.0 + 1.0	5.2 mm (0.2 in)
1.0 + 1.0 + 1.0	5.2 mm (0.2 in)
2.0 + 2.0	7.1 mm (0.27 in)
2.0 + 2.0 + 2.0	7.1 mm (0.27 in)
3.0 + 3.0	8.7 mm (0.34 in)
3.0 + 3.0 + 3.0	8.7 mm (0.34 in)
3.0 + 0.7	4.3 mm (0.16 in)
0.7 + 3.0 + 1.0	5.2 mm (0.2 in)
2.0 + 2.0 + 0.7	4.3 mm (0.16 in)
0.9 + 0.9 + 2.0	4.7 mm (0.18 in)
2.0 + 0.9 + 1.0	5.2 mm (0.2 in)
1.0 + 3.0 + 1.0	5.2 mm (0.2 in)
3.0 + 1.0 + 2.0	7.1 mm (0.27 in)
0.9 + 0.7 + 0.9	4.3 mm (0.16 in)

DESCRIPTION AND OPERATION

BODY

The body consists of the following:

- Unibody construction
- Radiator support bolster constructed of hybrid glass fiber polypropylene material
- High-strength low alloy (HSLA), high-strength and mild steels
- Dual-phase steel in select body structure components
- Bolted, removable front fenders, hinged doors and hood
- Underhood and body side door opening dimensions common between Ford Fusion, Mercury Milan and Lincoln MKZ
- Steel fenders
- Steel doors incorporating dent-resistant steel outer panels
- Steel luggage compartment lid
- Steel roof panel
- Steel hood incorporating dent-resistant steel outer panel
- Rear body openings unique for each model
- High-strength roll-formed bolt-on front and rear bumper beams
- Front and rear subframe assemblies housing suspension and steering components
- Underbody common between Ford Fusion, Mercury Milan and Lincoln MKZ
- Tailor welded blanks used in underbody (front floor rails and rear frame rails)
- Structural adhesive used in rear body side outer to inner
- Pumpable mastic sound deadening material contained in interior and exterior underbody floor pan(s)
- Optional rear decklid spoiler

For dimensional information, refer to the following illustrations:

NOTE: The following dimensional illustrations apply to the Ford Fusion, Mercury Milan and Lincoln MKZ unless otherwise indicated.

NOTE: Dimensions apply to right and left side.

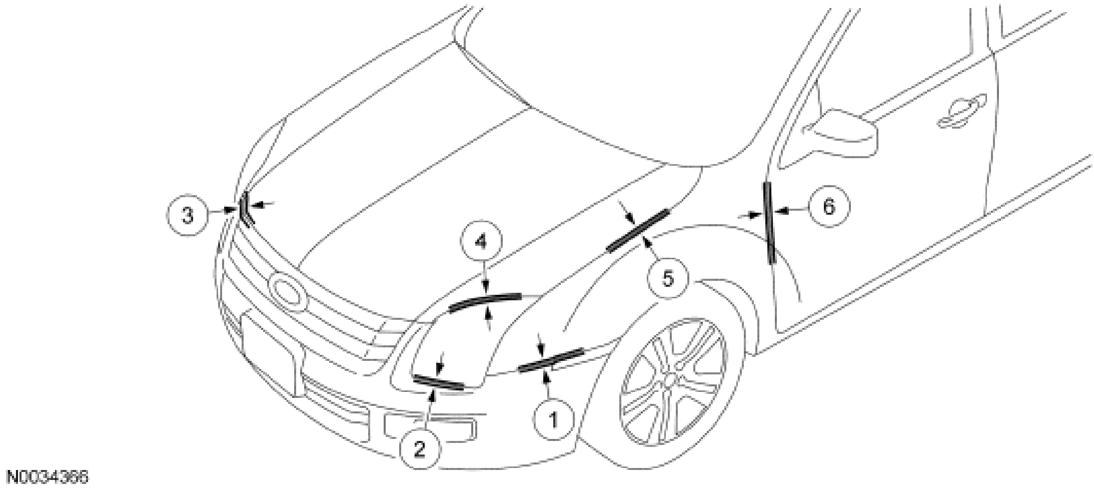


Fig. 1: Body Margins (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Description	Specification
1	Fender to side marker lamp	1.0 mm (0.03 in) ± 1.0 mm (0.03 in)
2	Headlamp assembly to fascia	2.0 mm (0.07 in) ± 2.0 mm (0.07 in)
3	Hood to fascia	5.0 mm (0.19 in) ± 3.0 mm (0.11 in)
4	Hood to headlamp	5.0 mm (0.19 in) ± 3.0 mm (0.11 in) (overslam clearance of 9.0 mm (0.35 in))
5	Hood to fender	4.0 mm (0.15 in) ± 2.0 mm (0.07 in)
6	Fender to door	4.0 mm (0.15 in) ± 2.0 mm (0.07 in)

NOTE: Dimensions apply to the right and left side.

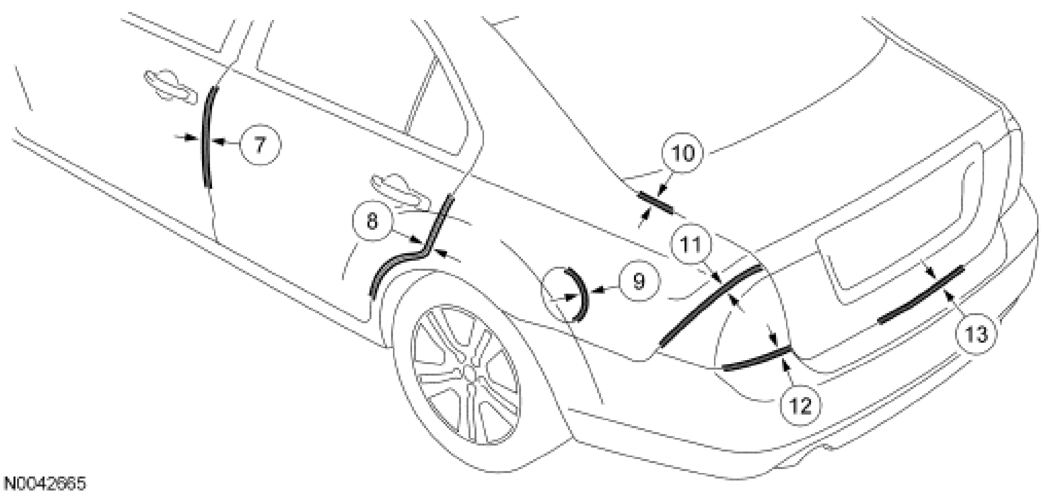


Fig. 2: Body Margins (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Description	Specification
7	Front door to rear door	4.0 mm (0.15 in) ± 2.0 mm (0.07 in)
8	Rear door to quarter panel	4.0 mm (0.15 in) ± 2.0 mm (0.07 in)
9	Fuel door to quarter panel	3.0 mm (0.11 in) ± 1.0 mm (0.03 in)
10	Quarter panel to luggage compartment lid	4.0 mm (0.15 in) ± 2.0 mm (0.07 in)
11	Lamp assembly to quarter panel	2.0 mm (0.07 in) ± 2.0 mm (0.07 in)
12	Lamp assembly to fascia	2.0 mm (0.07 in) ± 2.0 mm (0.07 in)
13	Luggage compartment lid to fascia	6.0 mm (0.23 in) ± 2.0 mm (0.07 in)

Underhood Dimensions

CAUTION: The radiator bolster is a hybrid component. If damage occurs to the radiator support component, it should not be repaired. A new component should be installed. Refer to ENGINE COOLING article. Failure to follow these instructions may result in incorrect operation of cooling system components.

NOTE: Measurements are obtained on center, unless otherwise indicated.

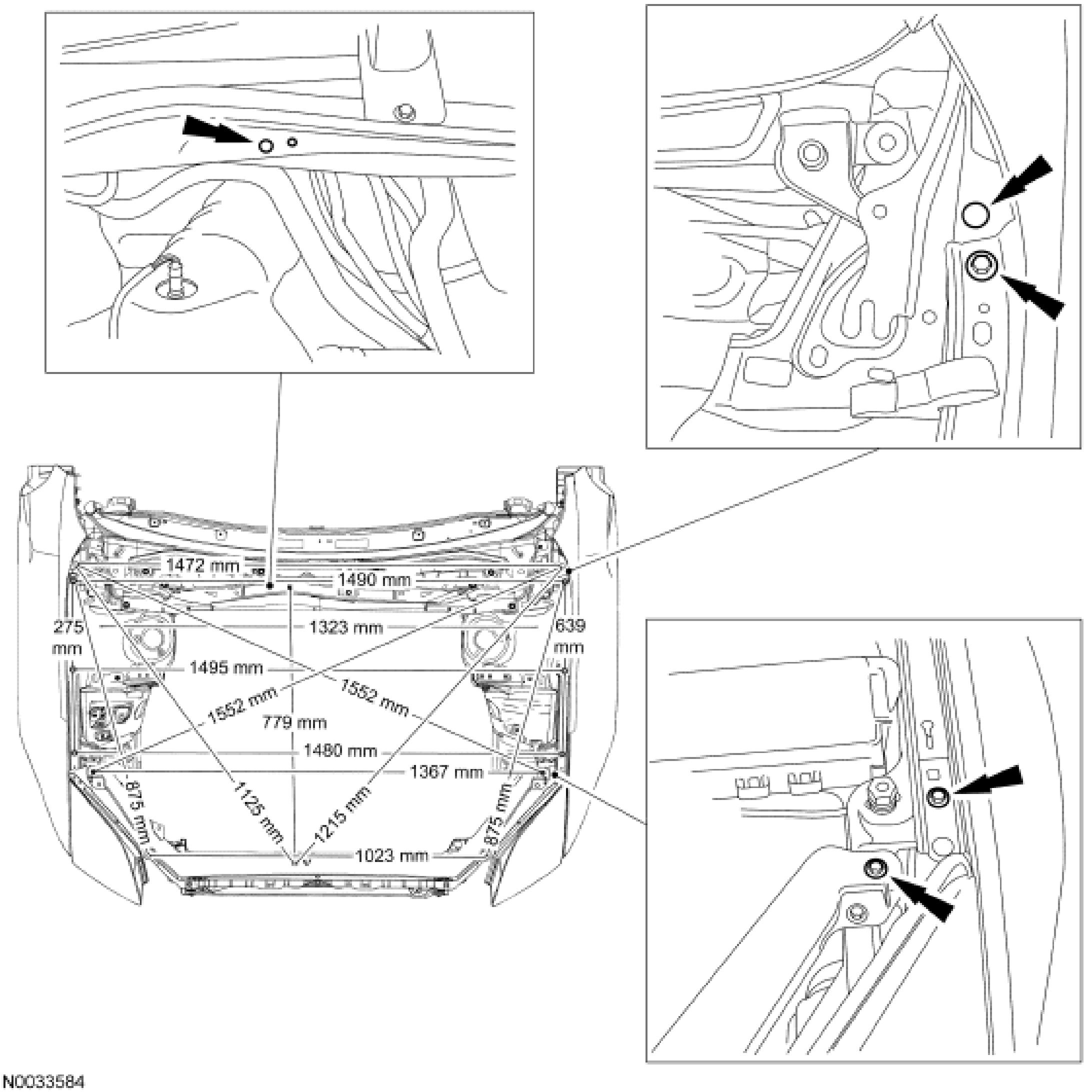


Fig. 3: Identifying Underhood Dimensions

Body Side Closure Dimensions

NOTE: **Measurements are obtained on center, unless otherwise indicated.**

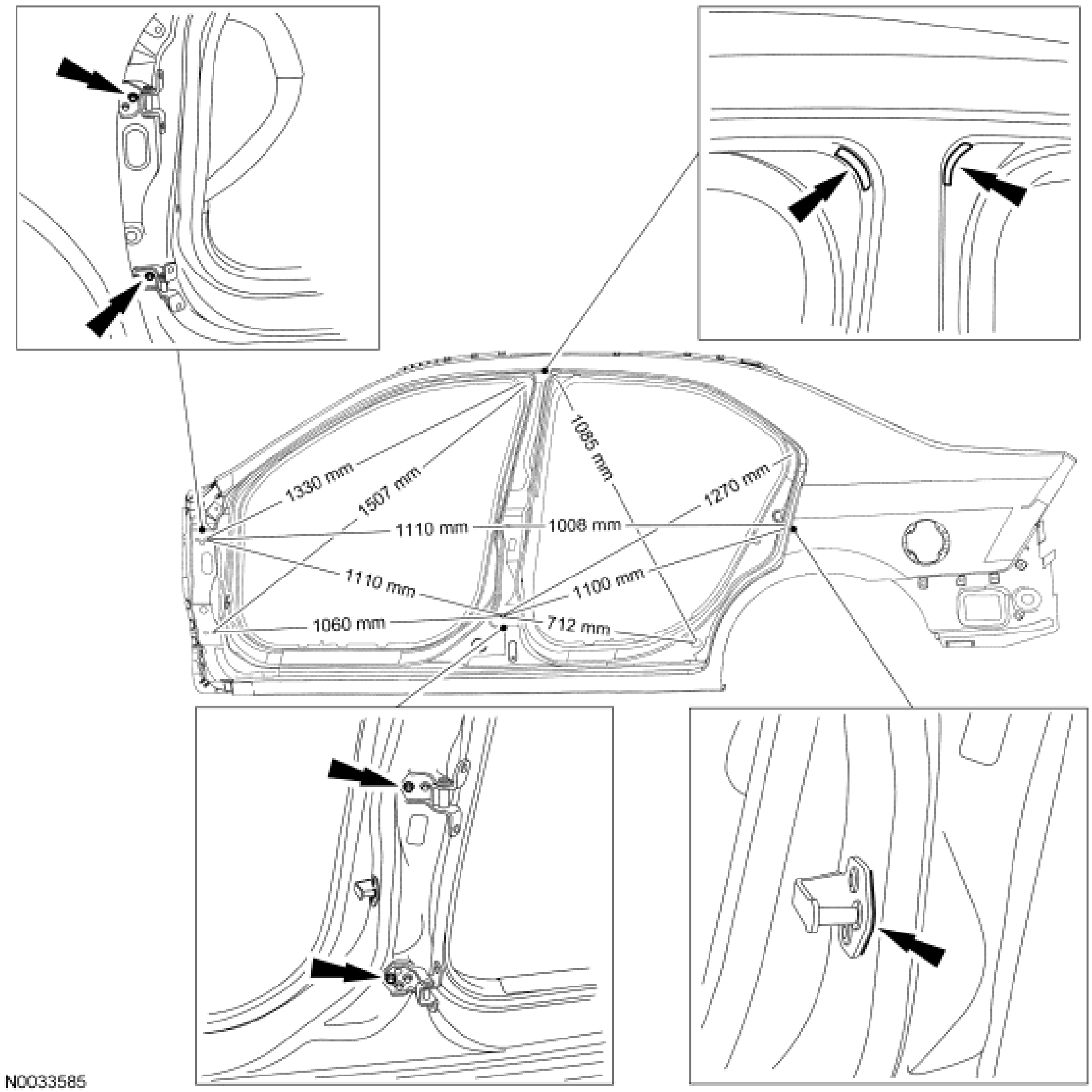


Fig. 4: Identifying Body Side Closure Dimensions
Courtesy of FORD MOTOR CO.

Rear Opening Dimensions

NOTE: Measurements are obtained on center, unless otherwise indicated.

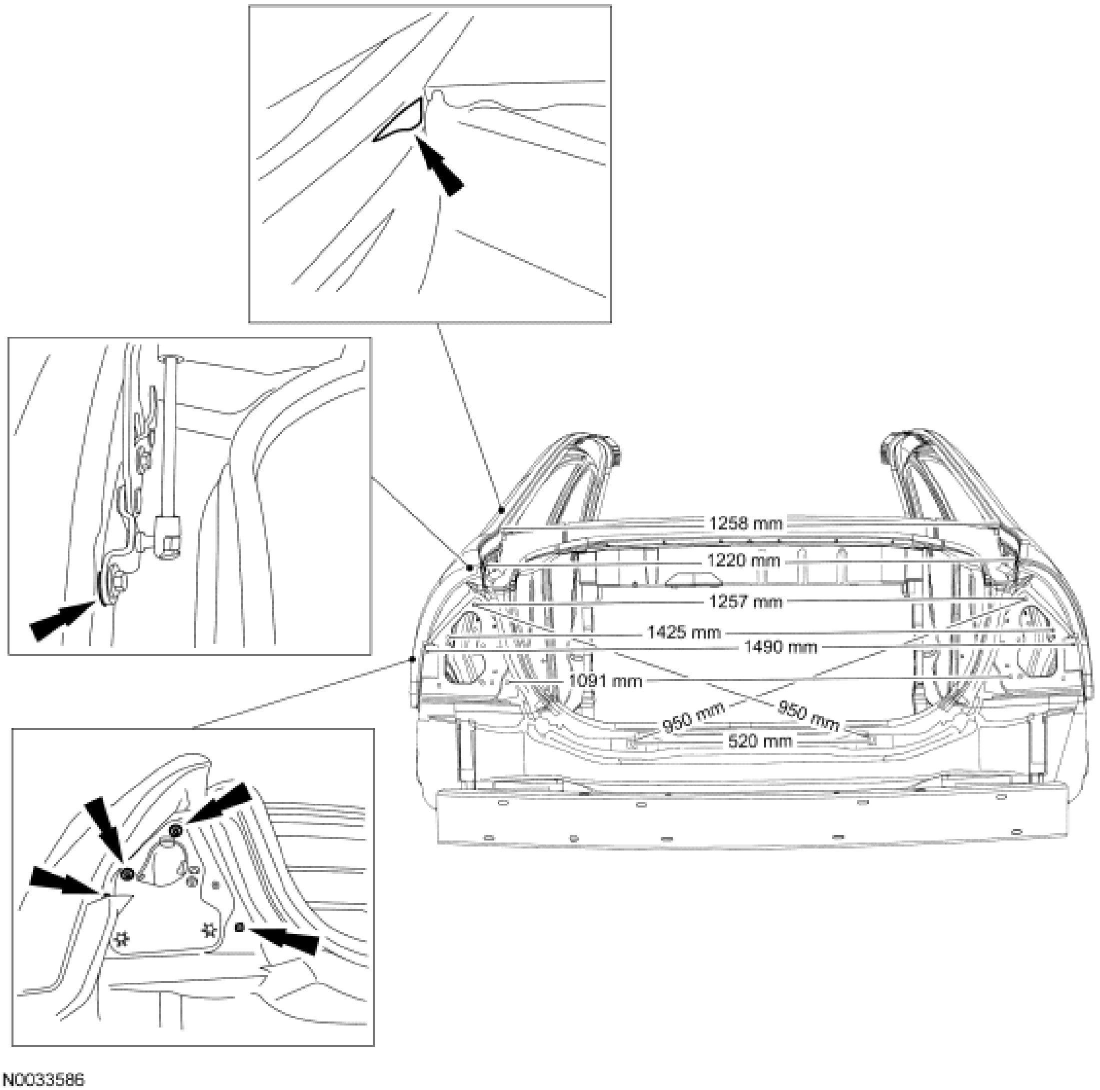


Fig. 5: Rear Opening Dimensions - Ford Fusion
Courtesy of FORD MOTOR CO.

NOTE: **Measurements are obtained on center, unless otherwise indicated.**

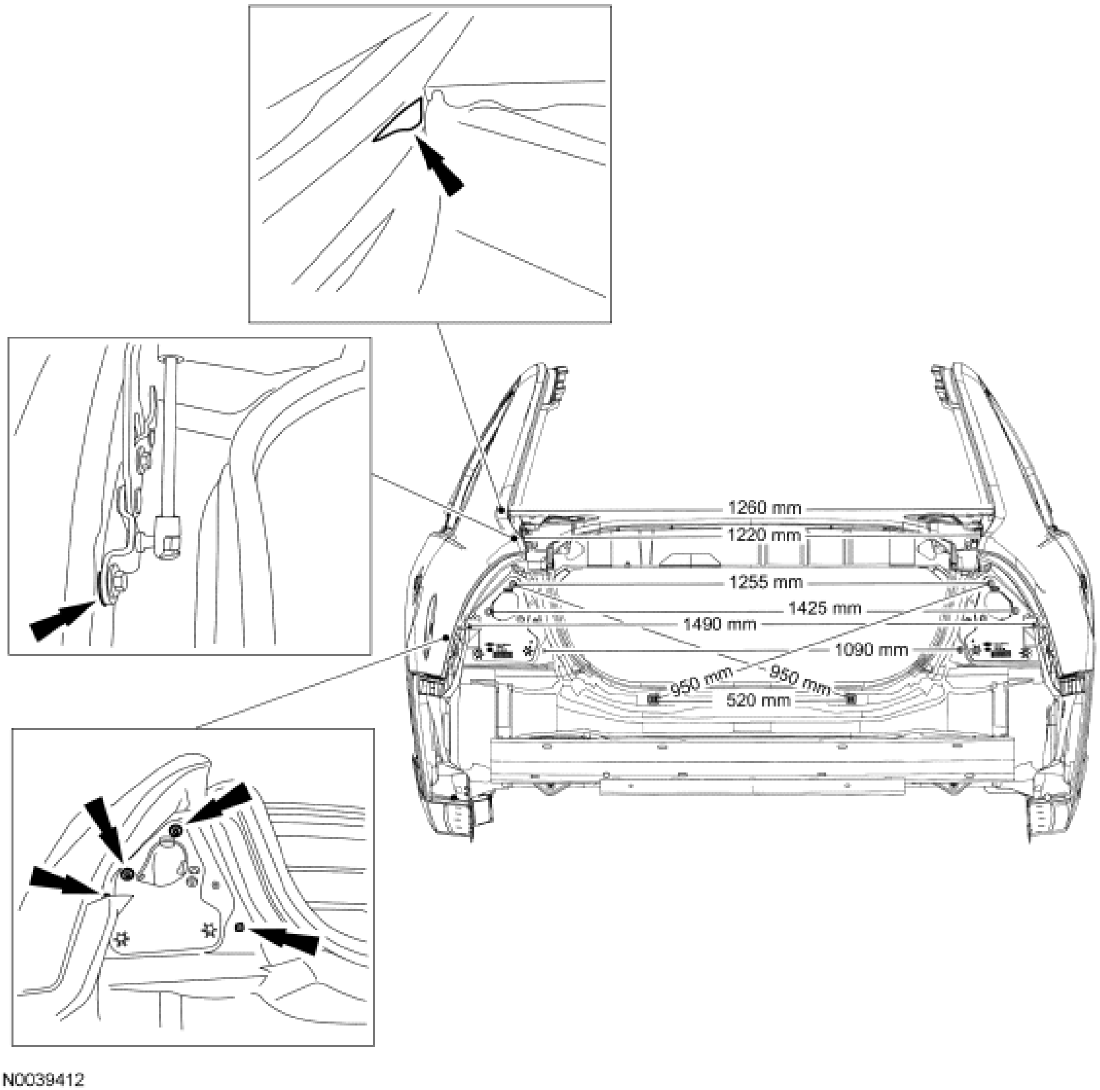


Fig. 6: Rear Opening Dimensions - Mercury Milan
Courtesy of FORD MOTOR CO.

NOTE: **Measurements are obtained on center, unless otherwise indicated.**

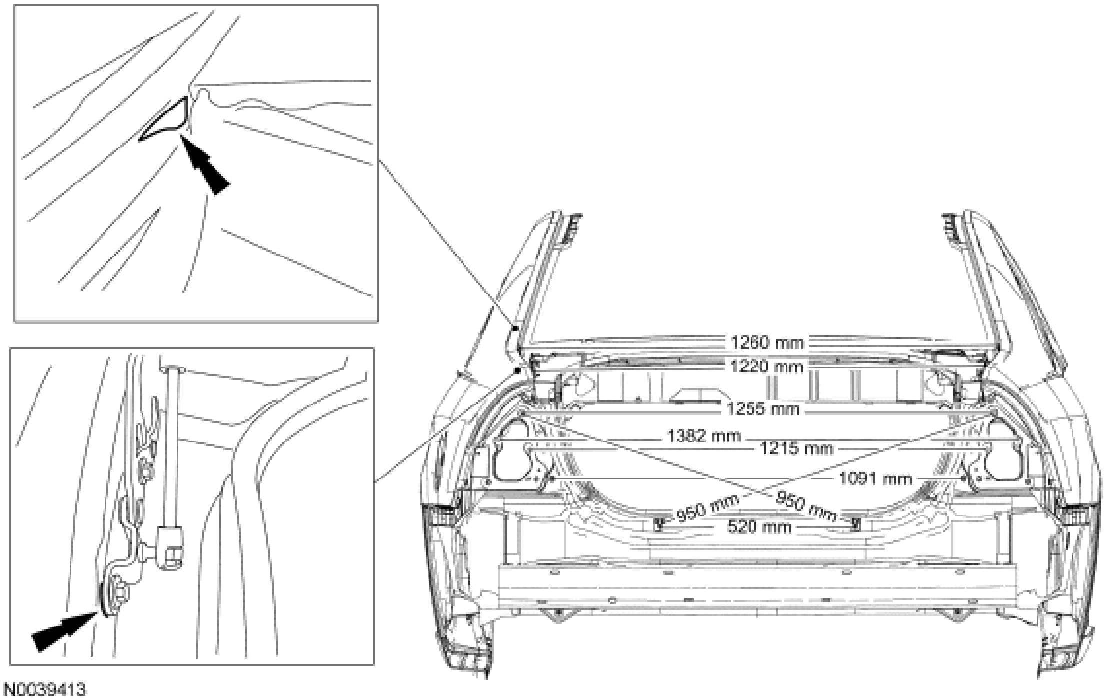


Fig. 7: Rear Opening Dimensions - Lincoln MKZ
Courtesy of FORD MOTOR CO.

Underbody Dimensions

WARNING: **Frame rail crush zones absorb crash energy during a collision and must be replaced if damaged. Straighten damaged frame rails to correct frame dimensions prior to frame member sectioning. Failure to follow these instructions may adversely affect frame rail performance and may result in serious personal injury to vehicle occupant(s).**

NOTE: **Datum height determined measuring from holes and slots on center, unless otherwise indicated.**

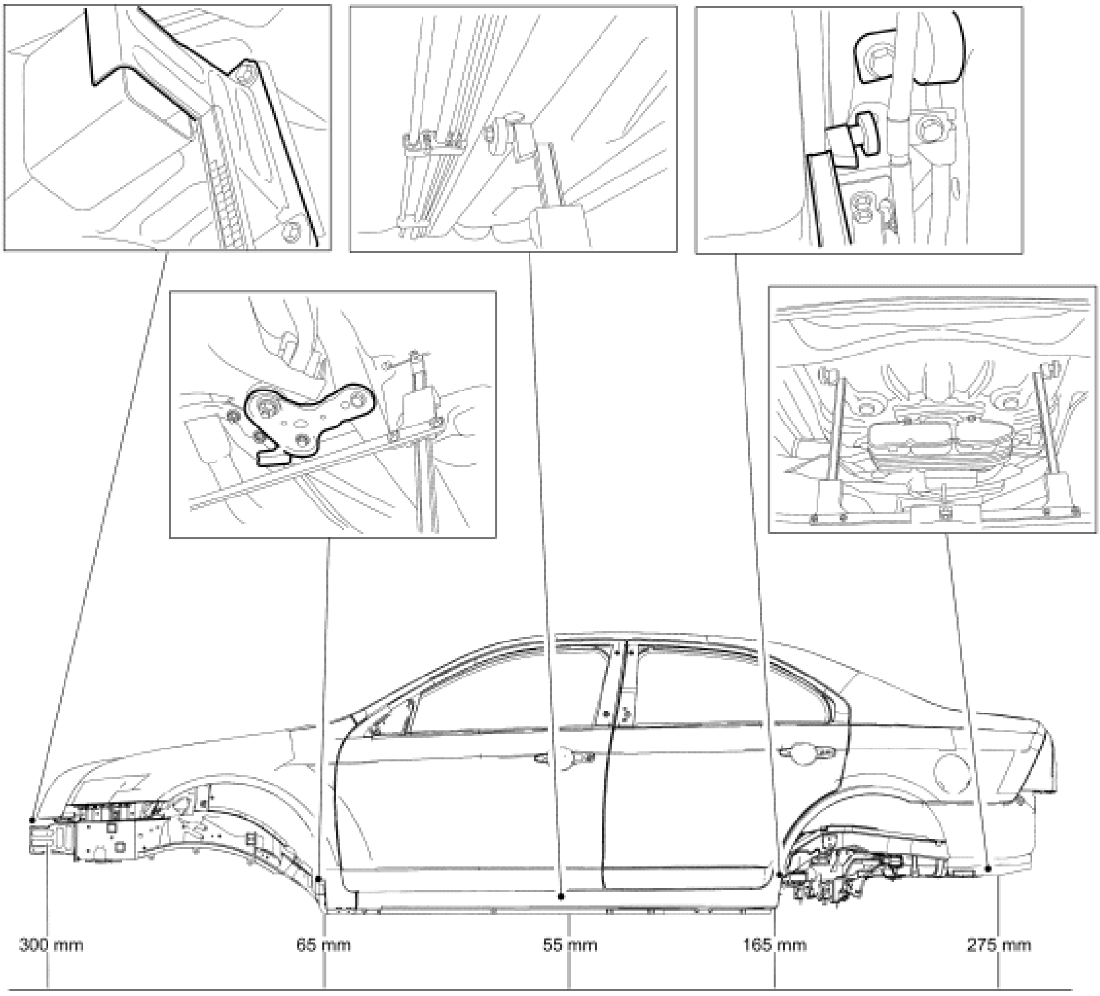
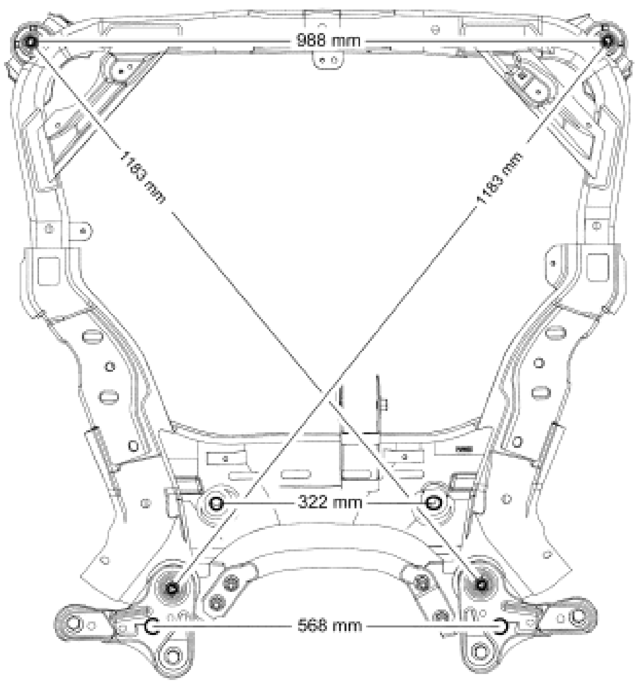


Fig. 8: Frame Datum Height
Courtesy of FORD MOTOR CO.

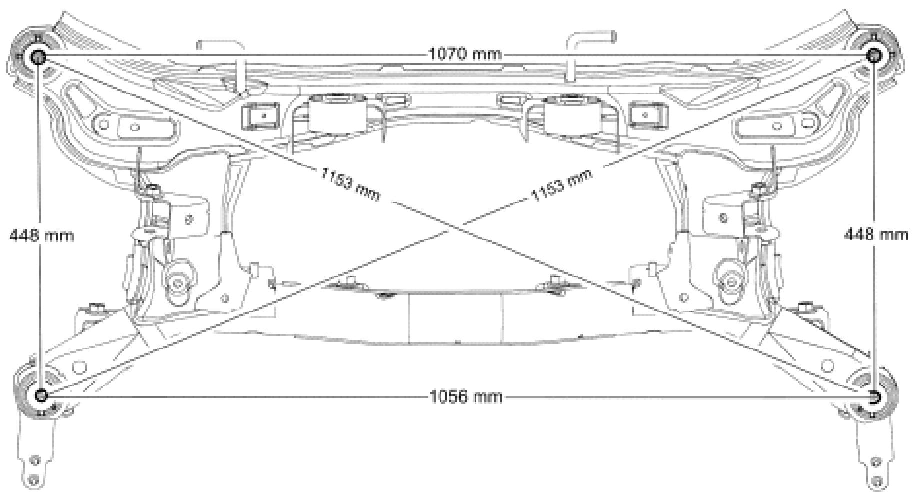
NOTE:	**Subframe dimensions shown are common between front wheel drive (FWD) and all wheel drive (AWD) configurations.**



N0072193

Fig. 9: Subframe - Front
Courtesy of FORD MOTOR CO.

NOTE: **Subframe dimensions shown are common between FWD and AWD configurations.**



N0072194

Fig. 10: Subframe - Rear
Courtesy of FORD MOTOR CO.

NOTE: **Measurements are obtained on center, unless otherwise indicated.**

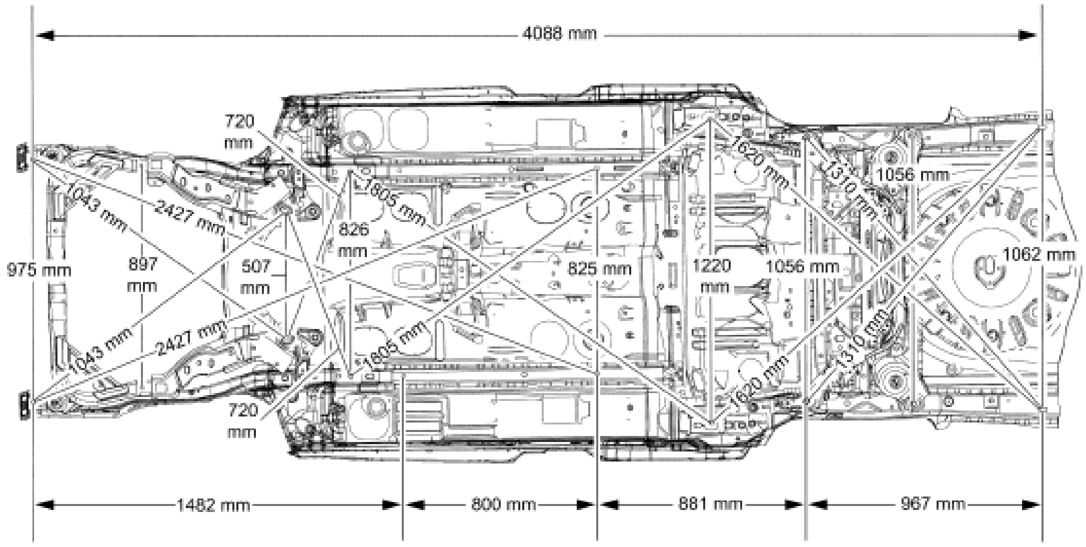


Fig. 11: Underbody Dimensions
Courtesy of FORD MOTOR CO.

WELDING PRECAUTIONS - STEEL

GENERAL SPECIFICATIONS

Item	Specification
Motorcraft Premium Undercoating PM-25-A	-
Motorcraft Rust Inhibitor Aerosol PM-24-A	-

WELDING SPECIFICATIONS

Item	Specification
Plug Weld Hole	8 mm (0.31 in)
Weld Wire ER70S-3 or equivalent	0.9-0.11 mm (0.035-0.045 in)

General Equipment
3 Phase Inverter Spot Welder 254-00002
Compuspot 700F Welder 190-50080
I4 Inverter Spot Welder 254-00014
Inverter Welder with MIG Welder 254-00015

WELD NUGGET CHART

Test Thickness of Metal (mm)	Nugget Size

0.7 + 0.7	4.3 mm (0.16 in)
0.7 + 0.7 + 0.7	4.3 mm (0.16 in)
0.9 + 0.9	4.7 mm (0.18 in)
0.9 + 0.9 + 0.9	4.7 mm (0.18 in)
1.0 + 1.0	5.2 mm (0.2 in)
1.0 + 1.0 + 1.0	5.2 mm (0.2 in)
2.0 + 2.0	7.1 mm (0.27 in)
2.0 + 2.0 + 2.0	7.1 mm (0.27 in)
3.0 + 3.0	8.7 mm (0.34 in)
3.0 + 3.0 + 3.0	8.7 mm (0.34 in)
3.0 + 0.7	4.3 mm (0.16 in)
0.7 + 3.0 + 1.0	5.2 mm (0.2 in)
2.0 + 2.0 + 0.7	4.3 mm (0.16 in)
0.9 + 0.9 + 2.0	4.7 mm (0.18 in)
2.0 + 0.9 + 1.0	5.2 mm (0.2 in)
1.0 + 3.0 + 1.0	5.2 mm (0.2 in)
3.0 + 1.0 + 2.0	7.1 mm (0.27 in)
0.9 + 0.7 + 0.9	4.3 mm (0.16 in)

WARNING: **Invisible ultraviolet and infrared rays emitted in welding can injure unprotected eyes and skin. Always use protection such as a welder's helmet with dark-colored filter lenses of the correct density. Electric welding will produce intense radiation, therefore, filter plate lenses of the deepest shade providing adequate visibility are recommended. It is strongly recommended that persons working in the weld area wear flash safety goggles. Also wear protective clothing. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always wear protective equipment including eye protection with side shields, and a dust mask when sanding or grinding. Failure to follow these instructions may result in serious personal injury.**

NOTE: Electronic modules and related wiring can be damaged when exposed to heat from welding procedures. Carefully disconnect and remove or position away from heat-affected areas. Failure to follow these instructions may result in incorrect operation of electronic module and related components.

NOTE: When it is necessary to carry out weld-bonding procedures, refer to Weld-Bonding.

The correct equipment and settings must be used when welding mild or high-strength steel. Metal Inert Gas (MIG) and Squeeze-Type Resistance Spot Welding (STRW) are the preferred methods. Surfaces must be clean and free of foreign materials.

- The correct protective clothing should always be worn.
- Adequate ventilation must be provided to avoid accumulation of poisonous gases.
- Place protective covers around components and wiring harnesses to protect from welding spatter.
- A test weld should always be carried out on a test sample.
- Follow equipment manufacturer's prescribed procedures and equipment settings for the type of weld being used.
- Use grinding discs and wire brushes dedicated to the type of material being welded.
- Follow equipment manufacturer's prescribed procedures and equipment settings for the type of weld being used. ER70S-2 or ER70S-6 wire are typically used for MIG welding steel.
- Disconnect the battery ground cable from the battery. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Components made of high-strength steel should not be heated to straighten or repair. Severely bent or kinked components should be replaced with new ones.
- Factory spot welds may be substituted with either STRW welds or MIG plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.
- Disconnect on-vehicle modules and protect them from possible heat damage and electrical currents when welding.
- Use of a weld-through primer is recommended where applicable.
- Corrosion protection needs to be restored whenever it is necessary to sand or grind through painted surfaces or E-coat, or when bare metal repairs are carried out. Refer to **Restoring Corrosion Protection Following Repair**.

Welding Precautions - Dual-Phase Steel

The correct equipment and settings must be used when welding Dual-Phase steel. MIG and STRW are the recommended methods. Surfaces must be clean and free of foreign materials.

ER70-S-6 is the recommended wire specification to use when welding Dual-Phase steel components.

Recommended gas mixtures are as follows: C02, 92Ar8C02, 84Ar16C02 and 77Ar23C02.

Components made of Dual-Phase steel should not be heated to straighten or repair. Severely bent or kinked components should be replaced with new ones.

Do not use Oxyacetylene equipment to weld Dual-Phase steel.

- The correct protective clothing should always be worn.
- Adequate ventilation must be provided to avoid the accumulation of poisonous gases.
- Place protective covers around components and wiring harnesses to protect from welding spatter.
- Use grinding discs and wire brushes dedicated to the type of material being welded.
- A test weld should always be carried out on a test sample.
- Follow equipment manufacturer's prescribed procedures and equipment settings for the type of weld

being used.

- Disconnect the battery ground cable from the battery. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Disconnect on-vehicle modules and protect them from possible heat damage and electrical currents when welding.
- Factory spot welds may be substituted with either STRW welds or MIG plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.
- Use of a weld-through primer is recommended where applicable.
- Corrosion protection needs to be restored whenever it is necessary to sand or grind through painted surfaces or E-coat, or when bare metal repairs are carried out. Refer to **Restoring Corrosion Protection Following Repair**.

PLASTIC COMPONENTS

WARNING: **Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.**

NOTE: **Ford Fusion shown, Mercury Milan and Lincoln MKZ similar.**

NOTE: **The following illustration(s) are not all-inclusive of trim levels available. The actual trim level of the vehicle will determine the viability of carrying out a plastic repair.**

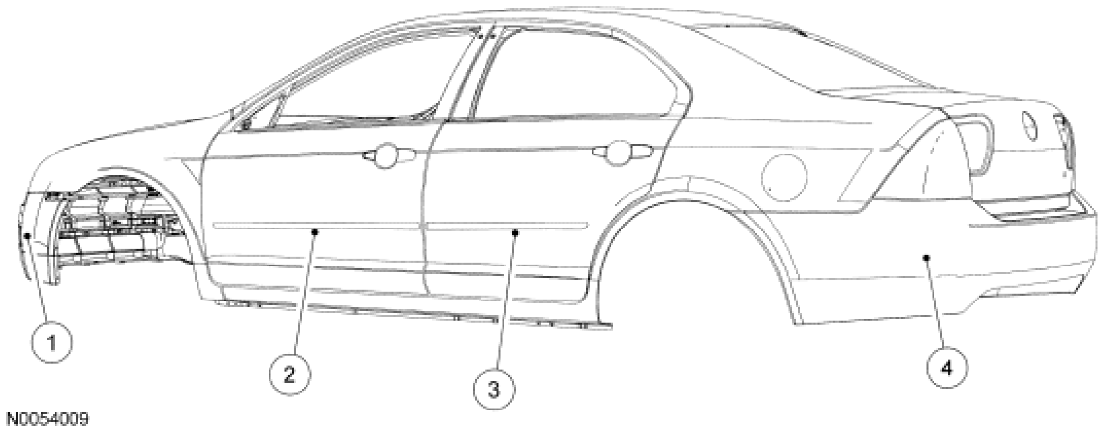


Fig. 12: Exterior Plastic Components - Painted
Courtesy of FORD MOTOR CO.

Item	Part Number	Description

1	17C831	Bumper cover (front) - Thermoplastic polyolefin (TPO)
2	25557 LH/ 25556 RH	Door molding (front) - TPO
3	20879 LH/ 20878 RH	Door molding (rear) - TPO
4	17K835	Bumper cover (rear) - TPO

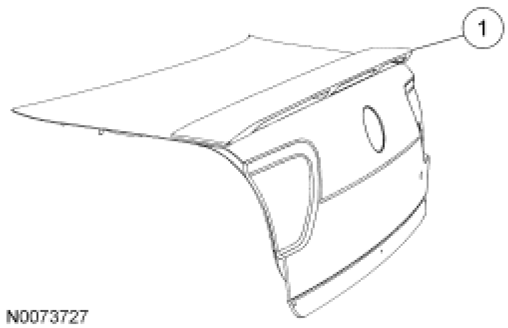


Fig. 13: Decklid Spoiler
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	44210	Spoiler - acrylonitrile butadiene styrene (ABS)

Several considerations will determine viability of plastic repair procedure(s):

- Is the damage cosmetic or structural?
- Can the repair be carried out on the vehicle?
- Is the part readily available?
- Is component repair the most cost effective method?
- Can the component be economically restored to original strength and appearance?
- Will the repair provide for the fastest, highest quality repair?

Several types of plastic are in use for automotive application. However, all plastics will fall into 2 primary categories of thermoplastic or thermosetting plastic.

Thermosetting Plastic - Generally, thermosetting plastics are made with 2-part thermosetting resins. When mixed together, heat is generated, producing a cure that is irreversible. Because of this thermosetting plastics will require the use of a 2-part adhesive for repair.

Sheet-Molded Compound - Sheet-molded compound (SMC) is a type of thermosetting plastic that uses glass fibers or nylon fibers in combination with thermosetting polyester resins. When fully cured SMC is strong and rigid.

SMC is similar to, but not identical to fiberglass. Ford Motor Company uses SMC in components such as fenders, hoods and liftgates.

Thermoplastic Compounds - Thermoplastic compounds are manufactured by a process that is reversible. Thermoplastics can be remolded repeatedly by reheating. This characteristic of thermoplastics makes plastic welding a possible repair alternative. A repair of thermoplastic compounds is still possible through the use of 2-part adhesive and filler repair materials and reinforcements as needed. Thermoplastics are widely used in interior trim components, wheel flares, body side cladding and bumper covers.

Polyolefin - Polyolefins fall into the family of thermoplastics with one unique characteristic: An oily or waxy feel to the material when sanded or ground. Polyolefin lends itself very well to remolding through the use of heat. Because of this, components made of this material lend themselves well to the possibility of plastic welding. Most adhesive repair materials and paint will not bond to surface of a polyolefin unless an adhesion promoter specially formulated for plastic is first applied to the exposed raw surface. Otherwise, polyolefins are repaired like most other thermoplastics. Some typical uses of polyolefins are:

- bumper covers.
- fan shrouds.
- wheel housings.

Proper identification of the various types of plastic is necessary to select the appropriate repair method(s) to carry out high quality plastic repairs. Refer to **Plastics Identification**.

SEALERS

MATERIAL

Item	Specification
Clear Silicone Rubber TA-32	ESB-M4G92-A
Roof Ditch Sealer TA-15	-
Seam Sealer TA-2	-

WARNING: **Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.**

The correct sealing of joints is essential to repairing the vehicle correctly. Sealers are used to prevent wind noise, water leaks, exhaust fumes and dust from entering the vehicle. They also provide anti-corrosion barriers. Sealers are applied to areas such as door and rear compartment hem flanges, wheelhouse, quarter outer, floor, cowl, roof and other panel-to-panel attaching points. The following joint sealers are recommended for use depending upon the application:

- Brushable Seam Sealer - A sealer intended to restore the original brushed seam appearance. It is used to seal lap joints in sheet metal that are spot welded (for example, floorpan and cowls).
- Roof Ditch Sealer - A self-leveling sealer used for drip rails, roof seams, quarter panels to rear deck and for water leaks.
- Seam Sealer - Heavy-bodied, non-sag adhesive/sealer for use on standing cosmetic seams, truck bed seams, tooled door skin seams and floor pans.

- Clear Silicone Rubber - Used for sealing water leaks, noise concerns, remounting trim and repairing torn weatherstripping.

Sealers should remain flexible after curing and must be paintable. Follow the manufacturer's directions for correct application of these materials.

Any damage to originally sealed joints should be repaired by resealing. Along with attaching points of new panels, open joints that require bridging of sealer to close a gap should be sealed using a heavy-bodied sealer.

SOUND DEADENERS AND INSULATORS

NOTE: **Mastic is made of a combustible material and should be removed prior to carrying out welding procedures to the area. Heat zones from welding near the mastic may cause the mastic material to burn.**

NOTE: **Corrosion protection must be restored to the area AFTER the mastic material is applied. Corrosion protection products contain wax and loss of adhesion may occur.**

NOTE: **To restore the vehicle to design intent, missing or damaged sound deadeners and insulators should be installed with the correct service replacement component.**

NOTE: **The following illustrations serve as a reference to indicate mastic sound deadener locations. Sound deadener material is applied from the factory in a pumpable form. Additional insulators and sound deadeners are used beyond those indicated in the illustration.**

NOTE: **Arrow indicates rear of vehicle.**

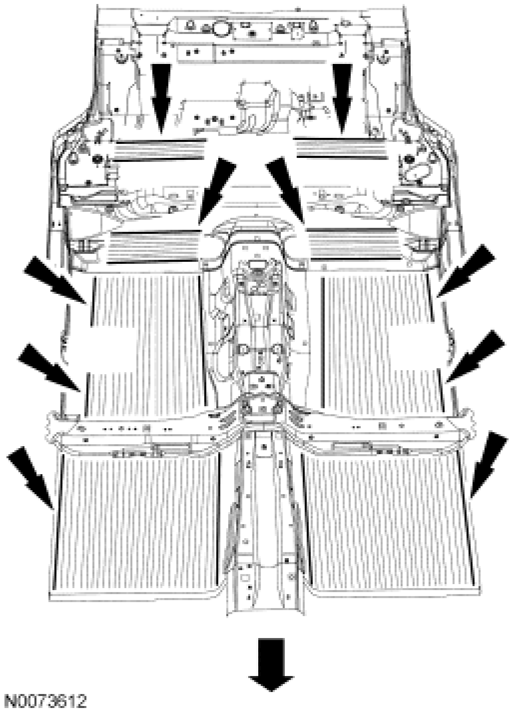


Fig. 14: Interior Floor Pan
Courtesy of FORD MOTOR CO.

NOTE: Arrow indicates rear of vehicle.

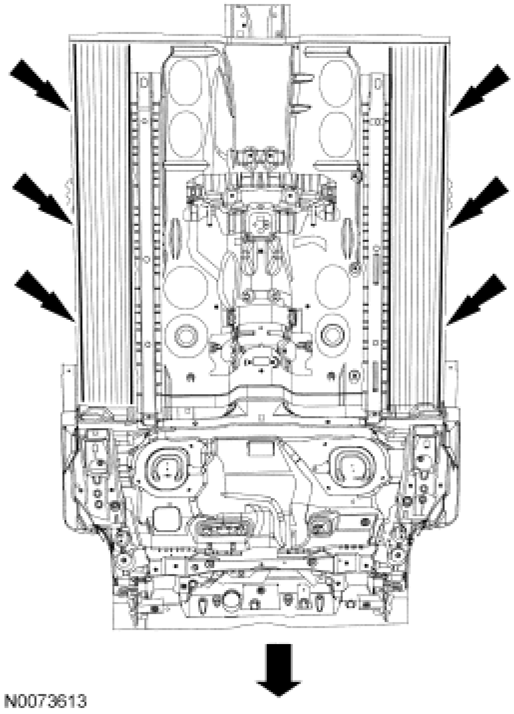


Fig. 15: Exterior Floor Pan

1. Whenever replacement of an existing mastic insulator is carried out, the surface must be thoroughly cleaned to make sure correct adhesion will occur. The surface should be 10°C (50°F) or greater before applying the mastic. The use of a heat gun to warm the metal surface will aid in adhesion.

ADHESIVES

MATERIAL

Item	Specification
Clear Silicone Rubber TA-32	ESB-M4G92-A
Metal Bonding Adhesive TA-1	-
Metal Patch Panel Adhesive TA-3	-
Motorcraft Metal Surface Prep ZC-31-A	-
Plastic Bonding Adhesive TA-9	-
Seam Sealer TA-2	-
Trim and Weatherstrip Adhesive TA-14	-

WARNING: **Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.**

NOTE: **When it is necessary to carry out weld-bonding procedures, refer to Weld-Bonding.**

Adhesives are used in a variety of applications. Typical uses for adhesives include roof panels, door skins and quarter panels. Trim applications include body side moldings, emblems, stationary glass and weatherstripping. Combination sealer/adhesives are also used. Surface preparation is critical to a high quality repair. Following the label instructions for the product is essential.

Work in a well-ventilated area and protect adjacent surfaces when working with adhesives. The use of eye protection and protective clothing is also recommended when working with adhesives. Carry out a trial fit, mark and align the surfaces before bonding the materials together.

Seam sealers and corrosion protection may be necessary once the adhesive(s) has cured, depending on the application. The following is a list of adhesives recommended for certain types of applications:

- Metal Bonding Adhesive - For bonding cold-rolled steel, galvanized steel, aluminum and correctly prepared E-coat. It is used for door skin and roof panel replacement and OEM structural adhesive replacement.
- Plastic Bonding Adhesive - For bonding a variety of plastics to plastics and plastics to primed, painted or E-coated metals. Also for general purpose bonding of trim components.
- Seam Sealer - Heavy-bodied, non-sag adhesive/sealer for use on: standing cosmetic seams, truck bed seams, tooled door skin seams and floor pans.

- Trim and Weatherstrip Adhesive - For use on body side molding, emblems, trim, bumper impact strips and carpeting.
- Clear Silicone Rubber - Used for sealing water leaks, noise concerns, remounting trim and repairing torn weatherstripping.

NOTE: The following illustration identifies structural adhesive location(s).

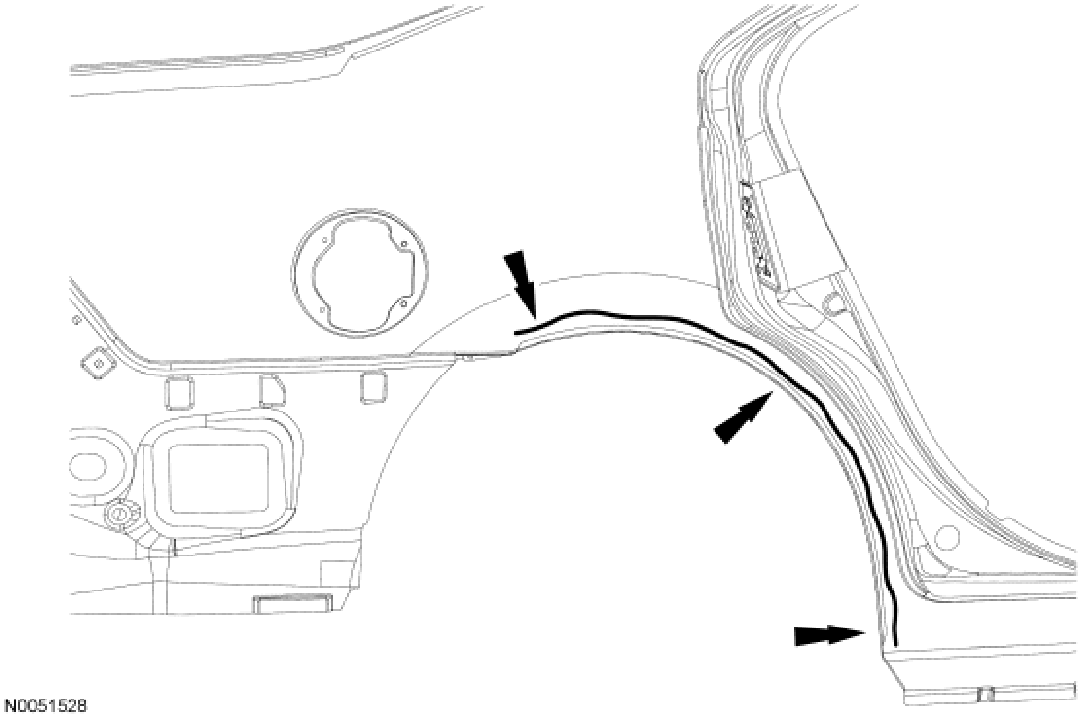


Fig. 16: Rear Body Side Outer to Inner
Courtesy of FORD MOTOR CO.

NOTE: Front door shown, rear door similar.

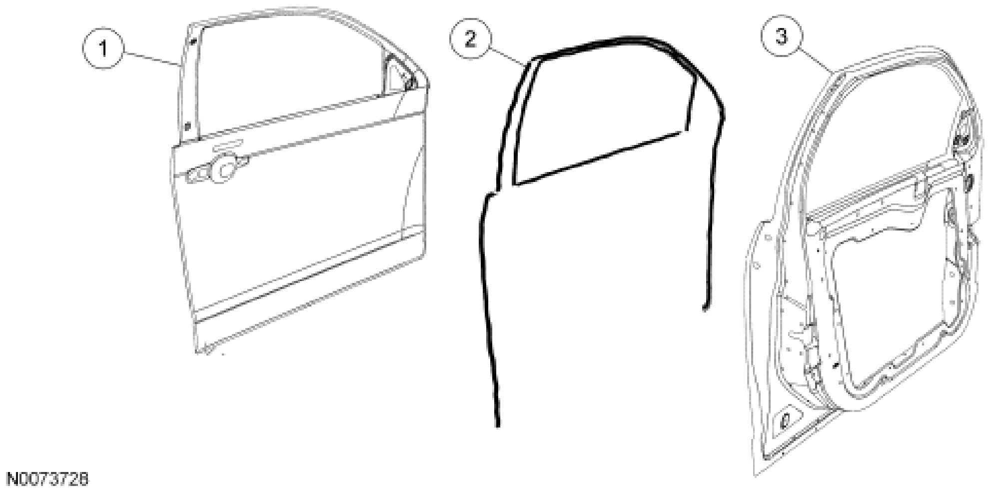


Fig. 17: Door Panel
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	20201 LH/ 20200 RH	Door panel outer
2	TA-1	Metal bonding adhesive
3	20125 LH/ 20124 RH	Door shell assembly

GENERAL PROCEDURES

SECTIONING GUIDELINES

General Equipment

3 Phase Inverter Spot Welder 254-00002
Compuspot 700F Welder 190-50080
I4 Inverter Spot Welder 254-00014
Inverter Welder with MIG Welder 254-00015

Material

Item	Specification
Metal Bonding Adhesive TA-1	-
Metal Patch Panel Adhesive TA-3	-
Motorcraft Metal Surface Prep ZC-31-A	-
Motorcraft Premium Undercoating PM-25-A	-
Motorcraft Rust Inhibitor Aerosol PM-24-A	-

Seam Sealer TA-2	-

WARNING: **Invisible ultraviolet and infrared rays emitted in welding can injure unprotected eyes and skin. Always use protection such as a welder's helmet with dark-colored filter lenses of the correct density. Electric welding will produce intense radiation, therefore, filter plate lenses of the deepest shade providing adequate visibility are recommended. It is strongly recommended that persons working in the weld area wear flash safety goggles. Also wear protective clothing. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always wear protective equipment including eye protection with side shields, and a dust mask when sanding or grinding. Failure to follow these instructions may result in serious personal injury.**

WARNING: **On vehicles equipped with safety canopy options, prior to carrying out any sectioning repairs near the roof line or sail panel areas of the vehicle, remove the safety canopy module and related components. Failure to comply may result in accidental deployment or damage to the safety canopy. Refer to SUPPLEMENTAL RESTRAINT SYSTEM article. Failure to follow these instructions may result in serious injury to technician or vehicle occupant(s).**

WARNING: **Do not cut or grind body side components within 50 mm (1.96 in) of restraint anchoring points. Welding within 50 mm (1.96 in) of restraint anchoring points may result in incorrect operation of restraint devices. For additional restraints anchoring location information, refer to SAFETY BELT SYSTEM article and SUPPLEMENTAL RESTRAINT SYSTEM article. Failure to follow these instructions may result in serious injury to vehicle occupant(s).**

WARNING: **Do not carry out body side sectioning repairs in areas of door hinge or striker anchoring points. Welding within 50 mm (1.96 in) of door hinge or striker locations may compromise structural integrity during a collision. Failure to follow these instructions may result in serious injury to vehicle occupant(s).**

NOTE: **Factory spot welds may be substituted with either squeeze-type resistance spot welds (STRSW) or metal inert gas (MIG) plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original location. Plug weld hole should equal 8 mm (0.31 in) diameter.**

NOTE: **Observe prescribed welding procedures when carrying out any body side**

section repair. For additional information, refer to Welding Precautions - Steel.

NOTE: The new design of the front and rear doors incorporates a new precision weatherstrip seal retainer flange above the belt line. Dimensions of this flange are critical to maintain correct sealing from water leaks, wind noise, etc. If these upper channels are damaged in a collision, the entire door shell should be replaced. The door assembly also incorporates:

- **an open bottom hem flange for improved corrosion protection.**
- **flat modified front and rear door hem flanges, below the belt lines. After hemming the production doors, a secondary operation adds a taper to the inside surface of the hem that reduces the variability of the door dimensions. This allows for smaller factory margins between the doors, fenders and quarter panels.**

NOTE: Illustration applicable to Ford Fusion, Mercury Milan and Lincoln MKZ. Cut lines shown in illustration are approximate.

NOTE: When it is necessary to carry out weld-bonding procedures, refer to Weld-Bonding.

1. Drill out the spot welds of the damaged panel to be sectioned. Using a cut-off wheel, reciprocating saw or plasma cutter, cut through the damaged area of the outer panel only and remove the section to be replaced.

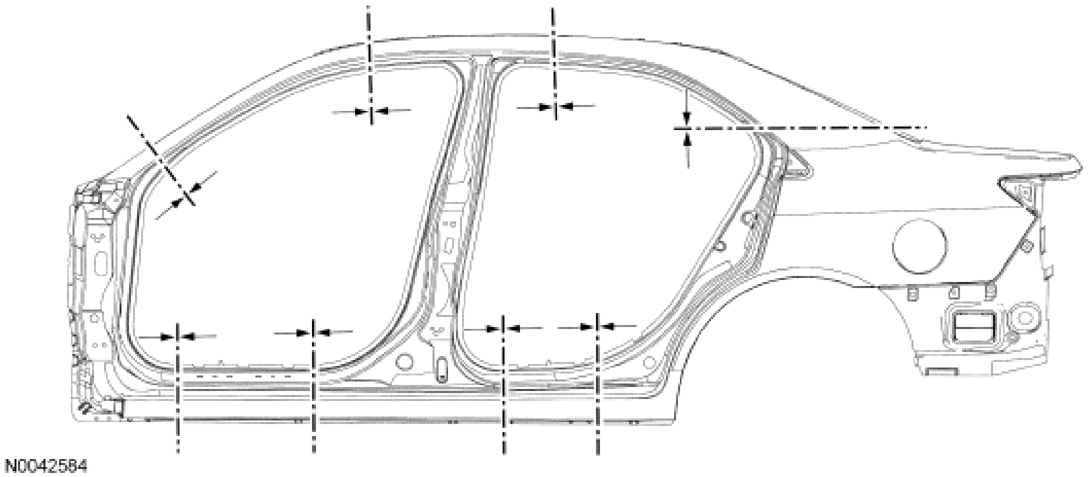


Fig. 18: Identifying Cut Lines
Courtesy of FORD MOTOR CO.

NOTE: Electronic modules and related wiring may be damaged when exposed to heat from welding procedures. Carefully disconnect and remove, or position away from heat affected areas. For additional information, refer to

Welding Precautions - Steel. Failure to follow these instructions may result in incorrect operation of modules and related components.

NOTE: **Ford Motor Company does not approve or recognize structural repair procedures using anything but genuine Ford parts.**

Structural repairs (frames, rails, aprons and body panels) carried out using other than Ford Motor Company parts have not been tested. In addition, structural equivalence and corrosion protection cannot be assured.

Returning a vehicle to pre-accident condition can only be assured if repair procedures are carried out by skilled technicians using genuine Ford Motor Company parts and approved methods.

Structural component repair procedures approved by Ford using genuine parts have been validated through testing by Ford Motor Company engineers. Should alternative structural component repair procedures and/or parts be used, repairers should be aware of the potential liability they incur.

NOTE: **When it is necessary to carry out weld-bonding procedures, refer to Weld-Bonding.**

2. Detrim the vehicle as necessary and drill out the spot welds from the damaged area. Using an air chisel or reciprocating saw, cut off the portion of the panel to be replaced.
3. Where possible, create a backer piece using a portion of the old panel. This will create a stronger joint.
4. When welding overlapping surfaces or substrates, apply corrosion protection material between the surfaces prior to welding. When the surfaces have been welded, apply corrosion protection material to the exterior surfaces or substrates. For additional information, refer to **Restoring Corrosion Protection Following Repair**.
    - Make sure horizontal joints and flanges are correctly sealed with seam sealer to prevent moisture intrusion. Water and moisture migrate to horizontal joints and corrosion tends to occur more rapidly in these areas. Metal surfaces must be clean and dry before applying seam sealer.
5. Proceed with refinish procedures following paint manufacturer's guidelines.

RESTORING CORROSION PROTECTION FOLLOWING REPAIR

Special Tools

Illustration	Tool Name	Tool Number
 ST3049-A	Rust Inhibitor Installation Kit	286-00002

	Undercoating Spray Gun	286-00001

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Motorcraft Premium Undercoating PM-25-A	-
Motorcraft Premium Undercoating Quart PM-25-B	-
Motorcraft Rust Inhibitor Aerosol PM-24-A	-
Motorcraft Rust Inhibitor Quart PM-24-B	-

WARNING: **Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always wear protective equipment including eye protection with side shields, and a dust mask when sanding or grinding. Failure to follow these instructions may result in serious personal injury.**

NOTE: Drilling access holes in body panels is not recommended. Drilling holes will break the original paint finish and promote corrosion.

NOTE: Corrosion protection needs to be restored whenever it is necessary to sand or grind through painted surfaces or E-coat, or when bare metal repairs are made.

NOTE: Rust inhibitor is a wax-based product and must be thoroughly stirred before applying to the vehicle. Store product at temperatures above 20°C (68°F) to avoid thickening of the material. If the product has been left in a cold environment, place the container in hot water for 5-10 minutes. Do not let water reach the cap of the container. Stir or shake vigorously before applying.

1. The surfaces must be free of oil, dirt and other foreign material. Carry out the process in the following sequence.
    1. Thoroughly clean and degrease metal surfaces using metal surface prep to remove wax and grease.

2. For best results, the vehicle should be at room temperature.
3. Rust inhibitor should be applied after the welding and refinishing process. Product cannot be welded through.
4. Air pressure setting for applicator gun is 448-517 kPa (65-75 psi).
   - Use the long wand when spraying enclosed areas. The spray nozzle provides a 360-degree spray pattern. Insert the wand as far as possible into the access hole, pull the trigger and wait 2-3 seconds and slowly pull the wand out of the access hole.
   - The short, hook-shaped wand sprays in one direction and must be rotated to provide complete coverage.
   - Apply the material in light mist coats.
   - Material displaces moisture.
5. Clean up any overspray with a mild solvent such as mineral spirits or bug and tar remover.

NOTE: The following illustrations provide typical applications of body seams and spot welded flanges and are not vehicle specific.

NOTE: Door assembly lower view.

2. Apply rust inhibitor as shown to the inside of the door shell on all the interior metal surfaces using the most suitable applicator wand. Apply material to the exposed edges after carrying out the welding process. Make sure horizontal surfaces are well protected as they are more susceptible to corrosion.

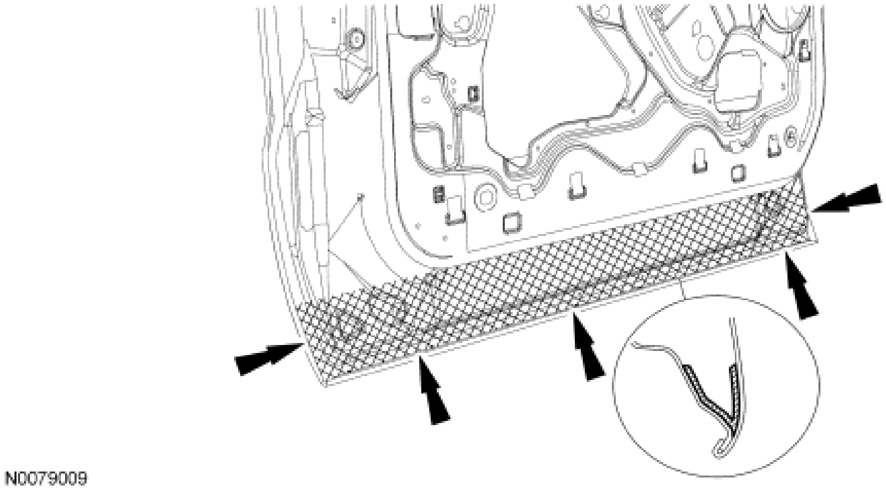


Fig. 19: Identifying Rust Inhibitor Application Locations
Courtesy of FORD MOTOR CO.

NOTE: Quarter panel inner view.

3. Apply rust inhibitor to the closed channel portion of the spot weld flange areas using the short, hook-shaped wand. Apply material to the exposed edges after carrying out the welding process. Make sure horizontal surfaces are well protected as they are more susceptible to corrosion.

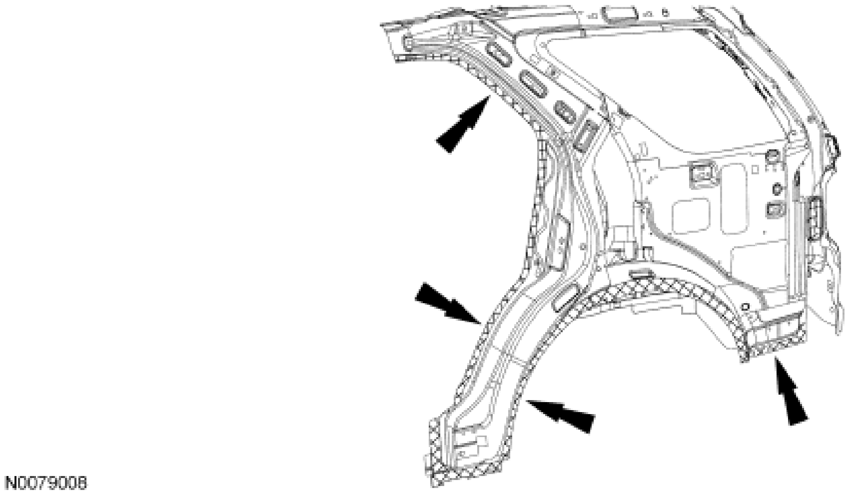


Fig. 20: Identifying Rust Inhibitor Application Locations
Courtesy of FORD MOTOR CO.

NOTE: Door frame opening view.

4. Apply rust inhibitor to the closed channel portion of the spot weld flange areas using the short, hook-shaped wand. Make sure horizontal surfaces are well protected as they are more susceptible to corrosion.

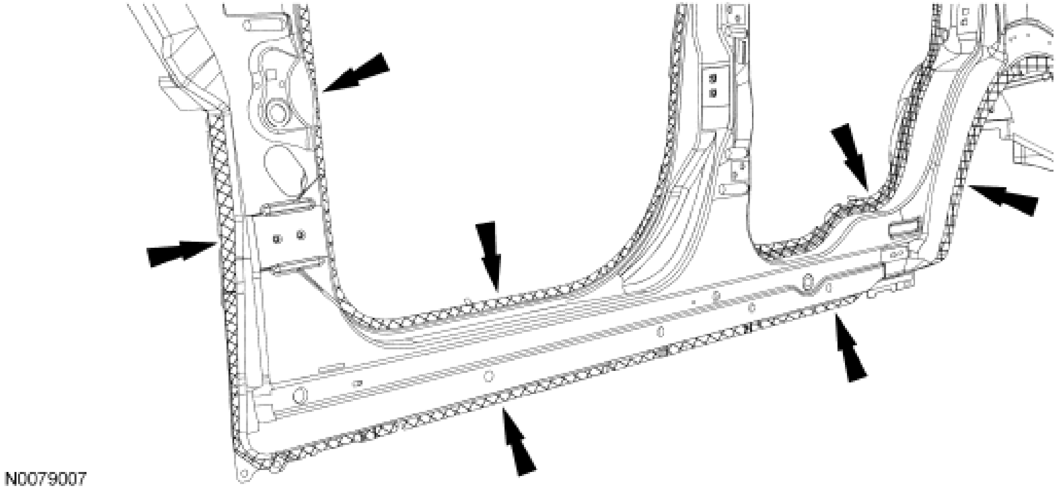


Fig. 21: Identifying Rust Inhibitor Application Locations
Courtesy of FORD MOTOR CO.

Body and Frame Undercoating

WARNING: Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.

WARNING: **Always wear protective equipment including eye protection with side shields, and a dust mask when sanding or grinding. Failure to follow these instructions may result in serious personal injury.**

NOTE: Do not allow undercoating on exhaust components, heat shields and driveshaft. Failure to follow these instructions may result in incorrect operation of these components.

NOTE: Undercoat is a wax-based product and must be thoroughly stirred before applying to the vehicle. Store product at temperatures above 20°C (68°F) to avoid thickening of the material. If the product has been left in a cold environment, place the container in hot water for 5-10 minutes. Do not let water reach the cap of the container. Stir or shake vigorously before applying.

NOTE: Avoid high-pressure water spray cleaning to treated underbody area for 24 hours.

1. Wire brush the area and make sure the surfaces are free of oil, dirt and other foreign material. Carry out the undercoating process in the following sequence.
    1. Thoroughly clean and degrease metal surfaces using metal surface prep to remove wax and grease.
    2. For best results, the vehicle should be at room temperature.
        - Bottle attaches directly to the dispensing gun.
    3. Undercoat should be applied after the welding and refinishing process. Product cannot be welded through.
    4. Air pressure setting for applicator gun is 552-621 kPa (80-90 psi).
        - Apply light mist coats, applicator sprays in fogging pattern.
        - Material displaces moisture.
    5. Clean up any overspray with a mild solvent such as mineral spirits or bug and tar remover.

NOTE: The following illustrations provide typical applications to frame rails and are not vehicle specific.

NOTE: Frame rail exterior spot-weld flange view.

2. Apply undercoat material to the exterior exposed edges after carrying out the welding and refinishing process.

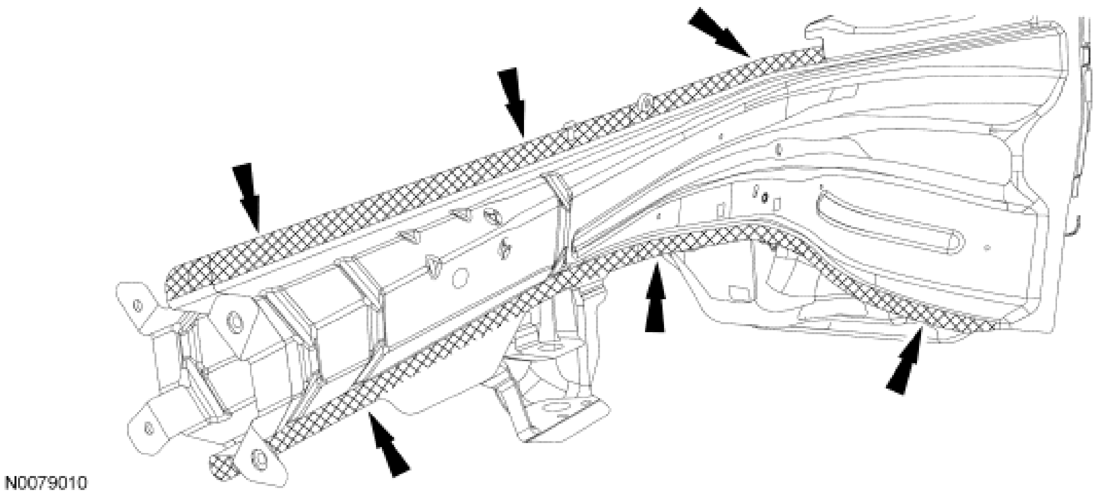


Fig. 22: Identifying Undercoat Material Application Locations
Courtesy of FORD MOTOR CO.

NOTE: Cross section view of typical unibody frame rail shown.

3. Apply rust inhibitor to the inner surfaces of the rail after carrying out welding process. Use the long wand and insert as far as possible, depress trigger and wait 2-3 seconds and slowly pull the wand to make sure the area is completely fogged.

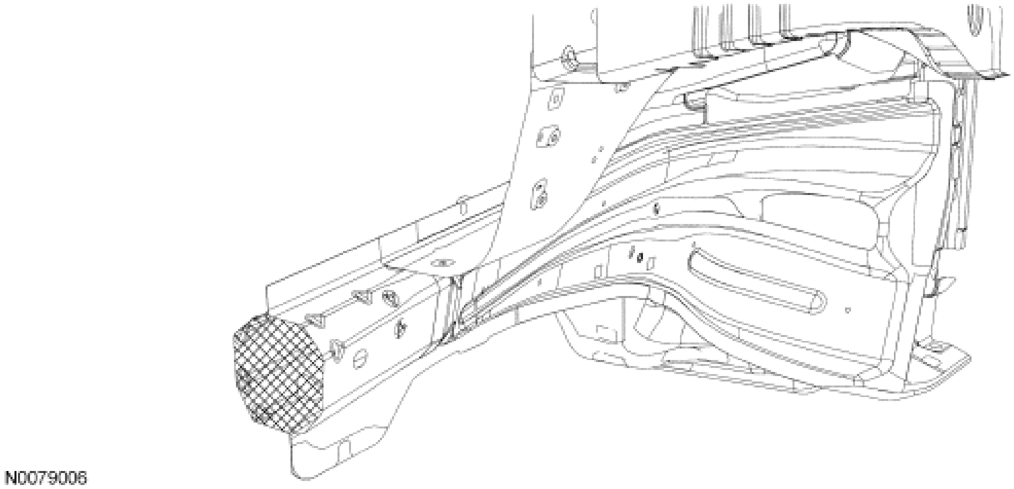


Fig. 23: Identifying Rust Inhibitor Application Locations
Courtesy of FORD MOTOR CO.

NOTE: Full frame vehicle, front rail-to-mid rail section repair shown.

4. Apply undercoat material to the exposed surfaces after carrying out the welding process. Make sure to completely cover any bare metal areas.

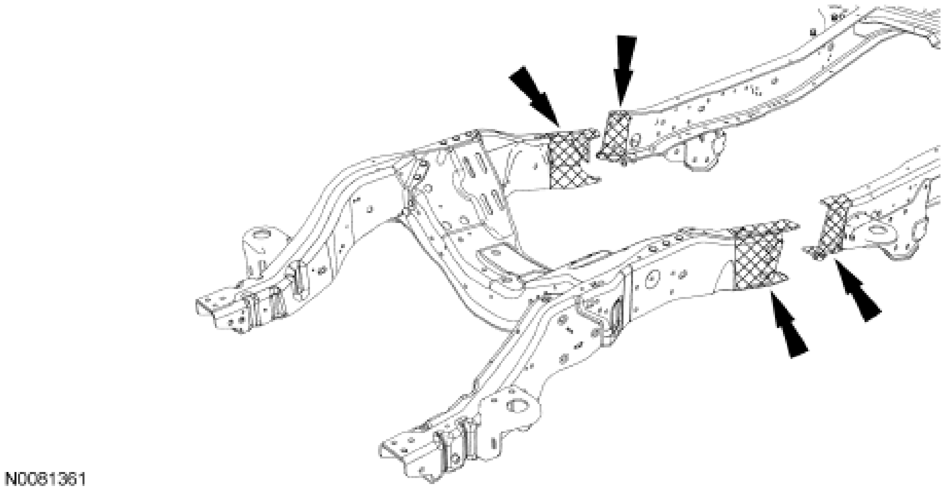


Fig. 24: Identifying Undercoat Material Application Locations
Courtesy of FORD MOTOR CO.

REFINISHING - ENVIRONMENTAL DAMAGE

Material

Item	Specification
Motorcraft Acid Neutralizer ZC-1-A	-
Motorcraft Alkaline Neutralizer ZC-2-A	-
Motorcraft Detail Wash ZC-3-A	-

Iron Oxide (Rail Dust) or Acid Rain Decontamination

WARNING: **Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always wear protective equipment including eye protection with side shields, and a dust mask when sanding or grinding. Failure to follow these instructions may result in serious personal injury.**

NOTE: **In extreme cases of contamination, the vehicle may require refinishing. To avoid paint failure, follow the appropriate decontamination procedure prior to carrying out any panel refinishing procedure.**

NOTE: **Iron oxide contamination appears as tiny rust spots on horizontal surfaces and in severe cases can be felt. This damage is typically caused from rail shipment,**

storage near railroad tracks or fallout from industrial manufacturing facilities.

NOTE: Acid rain contamination can be identified as water spotting and, in severe cases, staining within the water spots.

NOTE: Never paint over iron particles as rust spots will reoccur. Use only the recommended decontamination procedure detailed below.

1. Rinse any dust, dirt and foreign material from the vehicle body with cold water. Flush liberally.
2. Prepare the acid neutralizer by mixing 8 parts of water to 1 part neutralizer in a bucket.

NOTE: To avoid paint failure, do not allow the product to dry on the vehicle.

NOTE: Use a separate wash mitt for each product applied to the vehicle.

3. Working quickly and beginning at the top of the vehicle and working to the sides, apply the acid neutralizer mix to the entire vehicle. Keep the vehicle wet with the solution and lightly agitate for 5 to 7 minutes. Continue around the vehicle 4 to 5 times. For severe conditions, work the product for up to 8 minutes.
4. Rinse the vehicle completely with cold water to remove the product.
5. Dry only the horizontal surfaces of the vehicle, do not dry the glass at this time.

NOTE: To avoid damage to the paint surface, do not apply the alkaline neutralizer directly to the vehicle plastic trim.

NOTE: Use a separate wash mitt for each product applied to the vehicle.

NOTE: Alkaline neutralizer is a ready-to-use product. Do not mix with water.

6. Pour the alkaline neutralizer into a squirt bottle and apply the solution to a clean wash mitt.

NOTE: To avoid paint failure, do not allow the alkaline neutralizer to dry on the vehicle.

7. Apply the product to the vehicle keeping the solution wet and lightly agitate for 5 to 7 minutes. For severe conditions, work the product for up to 8 minutes.
8. Rinse the vehicle completely with cold water to remove the product.
9. Prepare the detail wash by mixing 29.5 ml (1 oz.) with 3.78L (1 gal) of water.
10. Using a clean wash mitt, shampoo the entire vehicle and rinse with cold water. Dry the vehicle completely.
11. Visually inspect the paint surface for any remaining evidence of ferrous metal particles. Repeat procedure as necessary.

Surface Finishing Following Decontamination

NOTE: **When attempting to affect a repair by buffing, polishing or color sanding, do not remove an excess of 0.3 mil of paint film or refinishing will be required.**

NOTE: **Acid rain discoloring or etching may require color sanding in addition to buffing and polishing. In extreme cases, refinishing may be required if the following procedure does not restore the vehicle finish.**

NOTE: **Do not intermix buffing products. Use only one manufacturer's product.**

NOTE: **Always follow the manufacturer's product usage sequence. Use the appropriate buffing or polishing pad at the recommended buffing speed as specified by the product manufacturer.**

1. Apply rubbing compound to the vehicle surface as recommended by the product manufacturer.
2. Apply machine glaze to the vehicle surface as recommended by the product manufacturer.
3. Use an alcohol and water mixture (1 to 1) to clean the buffed and polished areas. Verify removal of scratches and swirls before the application of the final polish.
4. Apply a final polish material by hand, with a dual-action sander and foam pad, or with an orbital polisher and appropriate polishing bonnet.
5. Wash and dry the vehicle.

REFINISHING - MANUFACTURING DAMAGE

Material

Item	Specification
Motorcraft Detail Wash ZC-3-A	-

WARNING: **Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always wear protective equipment including eye protection with side shields, and a dust mask when sanding or grinding. Failure to follow these instructions may result in serious personal injury.**

NOTE: **To avoid overspray damage to adjacent panels, protect adjacent areas/substrates when preparing for and during refinishing.**

NOTE: Peeling/delamination concerns can be described as lack of adhesion, either between the substrate and topcoats or between individual coats of paint.

1. Wash the repair area with detail wash or pH-neutral soap and water.
2. Remove any trim, emblems and hardware from the area to be repaired.

   NOTE: All delamination must be removed.

3. Sand or media blast the damaged surface, keeping the repair area as minimal as possible.
4. Treat any bare metal surface to prevent flash corrosion, and prime and block sand as necessary prior to refinishing.
5. Mask the adjacent panels to protect from overspray.
6. Spot repair the base coat as necessary, following the paint manufacturer's prescribed procedures.
7. Following the paint manufacturer's prescribed procedure, apply clear coat to the entire panel.

WELD-BONDING

General Equipment

3 Phase Inverter Spot Welder 254-00002
Compuspot 700F Welder 190-50080
I4 Inverter Spot Welder 254-00014
Inverter Welder with MIG Welder 254-00015

Material

Item	Specification
Metal Bonding Adhesive TA-1	-
Motorcraft Metal Surface Prep ZC-31-A	-
Motorcraft Premium Undercoating PM-25-A	-
Motorcraft Rust Inhibitor Quart PM-24-B	-
Seam Sealer TA-2	-

Weld-Bonding - Squeeze-Type Resistance Spot Welding (STRW) Method

WARNING: **Invisible ultraviolet and infrared rays emitted in welding can injure unprotected eyes and skin. Always use protection such as a welder's helmet with dark-colored filter lenses of the correct density. Electric welding will produce intense radiation, therefore, filter plate lenses of the deepest shade providing adequate visibility are recommended. It is**

strongly recommended that persons working in the weld area wear flash safety goggles. Also wear protective clothing. Failure to follow these instructions may result in serious personal injury.

WARNING: **Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always wear protective equipment including eye protection with side shields, and a dust mask when sanding or grinding. Failure to follow these instructions may result in serious personal injury.**

NOTE: **Ford Motor Company does not approve or recognize structural repair procedures using anything but genuine Ford parts.**

Structural repairs (frames, rails, aprons and body panels) carried out using other than Ford Motor Company parts have not been tested. In addition, structural equivalence and corrosion protection cannot be assured.

Returning a vehicle to pre-accident condition can only be assured if repair procedures are carried out by skilled technicians using genuine Ford Motor Company parts and approved methods.

Structural component repair procedures approved by Ford using genuine parts have been validated through testing by Ford Motor Company engineers. Should alternative structural component repair procedures and/or parts be used, repairers should be aware of the potential liability they incur.

NOTE: **Corrosion protection needs to be restored whenever it is necessary to grind through painted surfaces or E-coat, or when bare metal repairs are made. For additional information, refer to Restoring Corrosion Protection Following Repair.**

NOTE: **On door shells that are manufactured with structural adhesives only, weld bonding door skins is not recommended. Only metal bonding adhesive should be used.**

NOTE: **Weld-bonding is a method used to join metals using Squeeze-Type Resistance Spot Welding (STRW) or Metal Inert Gas (MIG) welding and structural adhesive. The steps listed in this procedure apply to both types of welding. STRW is the preferred method. MIG welding should only be used when areas to be welded cannot be accessed using STRW-type machinery.**

NOTE: **Factory spot welds should be substituted with either resistance spot welds or**

MIG plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.

1. Verify the vehicle is dimensionally correct on a frame machine. Straighten if necessary.
2. Remove damaged panels with an air saw or air chisel. Remove only large portions of the damaged panel. Avoid cutting into mating flanges or adjacent parts.
3. Drill out the spot welds using an appropriate spot-weld cutter and remove the remaining portions of the panel to be replaced.
4. Prepare any damaged flanges on the vehicle using hammer and dolly.
5. Grind the mating surface of the original flanges no greater than 25 mm (0.98 in) where the metal bonding adhesive will be applied.
   - Be sure to remove galvanizing on metal. Metal should have a shiny appearance.
   - Be careful not to damage the corners or thin the metal. The E-coat should also be removed on the opposite side of the flange only where the spot welds are to be placed.
6. Dry-fit and clamp the replacement service parts to verify a correct fit.
   - Remove the service part after verifying correct fit and alignment.

NOTE: **The ends of welding clamps should be insulated on the ends using tape or similar material when welding is carried out.**

7. Follow manufacturer's prescribed welding procedures and settings. For additional information, refer to **Welding Precautions - Steel**.
8. Prepare the adhesive. Dispense a small amount of metal bonding adhesive from the cartridge to make sure of an even flow of both components. Attach the mixing tip and dispense a mixing tip length of adhesive to make sure of a correct mix ratio.

NOTE: **Welding can be carried out anytime during the adhesive curing process, or after the adhesive is fully cured. Welder settings will vary when welding through wet adhesive versus welding through fully cured adhesive. Refer to welder manufacturer's recommended settings for welding through fully cured adhesive. It is recommended to place a shunt weld in an area with no adhesive to make sure of conductivity, particularly when welding through fully cured adhesive.**

NOTE: **Working time of the adhesive is 40-50 minutes at 21°C (70°F). For every -7°C (20°F) above 21°C (70°F), decrease the working time by one half. For every -7°C (20°F) below 21°C (70°F), double the working and cure time.**

9. Create a test sample.
   1. Prepare the metal and adhesive as described. Apply a 6-9 mm (0.23-0.35 in) bead of adhesive and weld the sample.
   2. Place the welded sample in a vice and carry out destructive weld tests by peeling the scrap metal

apart using large lock-type pliers. Measure the weld nugget to determine that the nugget meets Ford weld nugget requirements. If the weld nugget does not meet required size, adjust welder settings until the correct weld nugget size is achieved.

3. When the correct weld nugget size is achieved, the service part can be weld-bonded.

WELD NUGGET CHART

Test Thickness of Metal (mm)	Nugget Size
0.7 + 0.7	4.3 mm (0.16 in)
0.7 + 0.7 + 0.7	4.3 mm (0.16 in)
0.9 + 0.9	4.7 mm (0.18 in)
0.9 + 0.9 + 0.9	4.7 mm (0.18 in)
1.0 + 1.0	5.2 mm (0.2 in)
1.0 + 1.0 + 1.0	5.2 mm (0.2 in)
2.0 + 2.0	7.1 mm (0.27 in)
2.0 + 2.0 + 2.0	7.1 mm (0.27 in)
3.0 + 3.0	8.7 mm (0.34 in)
3.0 + 3.0 + 3.0	8.7 mm (0.34 in)
3.0 + 0.7	4.3 mm (0.16 in)
0.7 + 3.0 + 1.0	5.2 mm (0.2 in)
2.0 + 2.0 + 0.7	4.3 mm (0.16

	in)
0.9 + 0.9 + 2.0	4.7 mm (0.18 in)
2.0 + 0.9 + 1.0	5.2 mm (0.2 in)
1.0 + 3.0 + 1.0	5.2 mm (0.2 in)
3.0 + 1.0 + 2.0	7.1 mm (0.27 in)
0.9 + 0.7 + 0.9	4.3 mm (0.16 in)

10. Apply a 6-9 mm (0.23-0.35 in) bead of metal bonding adhesive to the vehicle prepared flange surface.
11. Place the service part(s) in the correct position on the vehicle.
    - When positioned, do not pull the component away from the vehicle. If repositioning is necessary, slide the service part(s). This will make sure of correct contact between the components and adhesive.
12. Clamp evenly and tightly. The adhesive contains glass beads which will prevent over-clamping the component.

NOTE: If welding will not be carried out immediately, allow a minimum of 1.5 to 2 hours of adhesive cure time at 21°C (70°F) before removing clamps. Cure time at lower temperatures should be increased. Clamps may be removed immediately after the component is welded.

13. Wipe excess adhesive from the panel before it cures.
14. Finish any cosmetic section seams with fiber-filled body filler. Rough sand the filler, apply conventional body filler after the adhesive cures and block-sand the area.
15. Use seam sealer wherever a cosmetic seam sealer is required.
16. Mix and apply primer surfacer per Ford-approved paint recommendations.
17. Mix and apply basecoat per Ford-approved paint recommendations.
18. Mix and apply clearcoat per Ford-approved paint recommendations. Refinishing materials may be force-dried following paint manufacturer's recommendations.
19. Apply anti-corrosion treatment to the repair area as required. For additional information, refer to **Restoring Corrosion Protection Following Repair**.

Weld-Bonding - Metal Inert Gas (MIG) Welding Method

WARNING: Invisible ultraviolet and infrared rays emitted in welding can injure unprotected eyes and skin. Always use protection such as a welder's helmet with dark-colored filter lenses of the correct density. Electric

welding will produce intense radiation, therefore, filter plate lenses of the deepest shade providing adequate visibility are recommended. It is strongly recommended that persons working in the weld area wear flash safety goggles. Also wear protective clothing. Failure to follow these instructions may result in serious personal injury.

WARNING: **Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always wear protective equipment including eye protection with side shields, and a dust mask when sanding or grinding. Failure to follow these instructions may result in serious personal injury.**

NOTE: Metal Inert Gas (MIG) weld-bonding can be substituted as an alternative to Squeeze-Type Resistance Spot Welding (STRW). It may only be used to weld areas that are inaccessible to STRW machinery. However, when accessible, STRW is the preferred method.

NOTE: Corrosion protection needs to be restored whenever it is necessary to grind through painted surfaces or E-coat, or when bare metal repairs are made. For additional information, refer to Restoring Corrosion Protection Following Repair.

NOTE: On door shells that are manufactured with structural adhesives only, weld-bonding door skins is not recommended. Only metal bonding adhesive should be used.

NOTE: Factory spot welds should be substituted with either resistance spot welds or MIG plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.

1. Remove damaged panels with an air saw or air chisel. Remove only large portions of the damaged panel. Avoid cutting into mating flanges or adjacent parts.
    - Drill out the spot welds using an appropriate spot-weld cutter and remove the remaining portions of the panel to be replaced.
2. After removing the damaged sheet metal panel(s), repair any damaged flanges on the vehicle using a hammer and dolly.
3. Using an appropriate grinder, carefully grind around the entire receiving flange area following the original welds. Be sure to remove all E-coat, paint or galvanized coating from the mating surfaces of the joint.
    - Be sure to remove galvanizing on metal. Metal should have a shiny appearance.

- Be careful not to damage the corners or thin the metal. The E-coat should also be removed on the opposite side of the flange only where the spot welds are to be placed.

4. Repeat the procedure from Step 3 on the mating surface of the replacement service part(s).
5. Prepare the new service panel for plug welds.
   - Using the original panel as a reference, drill or punch 8 mm (0.31 in) diameter holes in the exact number as the original spot welds. The holes should be positioned as close as possible to the original spot weld locations, without lining up exactly on top of an original spot weld site.
   - To make sure of correct weld performance, grind the immediate perimeter of the plug weld hole. Grind only in the area of the plug weld; this will keep corrosion to a minimum.
6. Dry-fit and clamp the replacement service parts to verify a correct fit and alignment.
   - Remove the service part after verifying correct fit and alignment.
7. The vehicle prepared flange areas where plug welds will be located must be kept free of adhesive. Apply 25 mm (0.98 in) tape to the plug weld areas to prevent contamination from the adhesive.
8. Prepare the adhesive. Dispense a small amount of metal bonding adhesive from the cartridge to make sure of an even flow of both components. Attach the mixing tip and dispense a mixing tip length of adhesive to make sure of correct mix ratio.

NOTE: **Work time of the adhesive is 40-50 minutes at 21°C (70°F). For every -7°C (20°F) above 21°C (70°F), decrease the working time by one half. For every -7°C (20°F) below 21°C (70°F), double the working and cure time.**

9. Apply a 6-9 mm (0.23-0.35 in) bead of adhesive to the vehicle prepared flange surface. Remove the tape from the plug weld areas.
10. Place the service part(s) in the correct position on the vehicle.
    - When positioned, do not pull the component away from the vehicle. If repositioning is necessary, slide the service part(s). This will make sure of correct contact between the components and adhesive.
11. Clamp evenly and tightly. The adhesive contains glass beads which will prevent over-clamping the component.

NOTE: **Welding can be carried out anytime during the adhesive curing process or after the adhesive is fully cured.**

NOTE: **If welding will not be carried out immediately, allow a minimum of 1.5 to 2 hours of adhesive cure time at 21°C (70°F) before removing clamps. Cure time at lower temperatures should be increased. Clamps may be removed immediately after the component is welded.**

12. Wipe excess adhesive from the panel before it cures.
13. Finish any cosmetic section seams with fiber-filled body filler. Rough sand the filler, apply conventional body filler after the adhesive cures and block-sand the area.
14. Use seam sealer wherever a cosmetic seam sealer is required.
15. Mix and apply primer surfacer per Ford-approved paint recommendations.

16. Mix and apply basecoat per Ford-approved paint recommendations.
17. Mix and apply clearcoat per Ford-approved paint recommendations. Refinishing materials may be force-dried following paint manufacturer's recommendations.
18. Apply anti-corrosion treatment to the repair area as required. For additional information, refer to **Restoring Corrosion Protection Following Repair**.

PLASTICS IDENTIFICATION

WARNING: **Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always wear protective equipment including eye protection with side shields, and a dust mask when sanding or grinding. Failure to follow these instructions may result in serious personal injury.**

NOTE: Identification of the various plastic types is necessary to select the appropriate repair methods to make high quality plastic repairs. Plastics can generally be broken down into 2 categories, thermoplastics and thermosetting plastics. Thermoplastics can be remolded by heating. This makes plastic welding a possible repair alternative.

NOTE: In some instances, a code or material designation is stamped indicating the plastic type.

1. Thermoplastics are solvent reactive. Types of thermoplastics include Thermoplastic Olefin (TPO), Polyvinyl Chloride (PVC) and Acrylonitrile Butadiene Styrene (ABS). Polyolefins have an oily or waxy appearance. Examples include some bumper covers, stone shields, fender aprons and fan shrouds. Polyolefins require an adhesion promoter prior to carrying out any refinish procedure.
    - To determine if the part is a polyolefin, grind the damaged area in an out-of-sight area. Grinding a polyolefin will melt and smear the plastic and leave a ragged edge. If the part is non-polyolefin, the area will grind or sand smoothly, producing a powdery dust.

RIGID PLASTIC PARTS

Code	Family Name	Common Trade Name	Typical Application
ABS	Acrylonitrile Butadiene Styrene	ABS, Cycolac, Lustran, Kralistic	A-Pillars, Consoles, Grilles
SMC	Sheet Molded Composite	SMC	Body Panels

FLEXIBLE PLASTIC PARTS

Code	Family Name	Common Trade Name	Typical Application
RRIM	Reinforced Reaction Injection-Mold Material PUR	RRIM	Fascias, Body Panels, Body Trims
TPO	Thermoplastic Polyolefin	Polytrope, Renflex, Santropren Telcar, Vistaflex, ETA, Apex, TPO	Bumpers, End Caps, Rubber Strips, Sight Shields, Claddings, Interior B-Post

2. Olefin plastic can also be identified by placing a small sliver in a container of water, if the sample floats, it is an olefin plastic. A non-olefin will sink when placed in a container of water.
3. Generally, thermosetting plastics are rigid or semi-rigid. Sheet-Molded Composite (SMC) is reinforced with glass and other fibers and are strong and rigid. SMC is used for large panels such as hoods, liftgates, fenders and quarter panels.
    - A burn test can be a reliable method to determine if a plastic is a thermosetting plastic. Extreme care must be exercised when using this method.
        - Apply an open flame to the corner of the damaged component. If the material crystallizes and becomes hard, it is a thermosetting plastic.

PLASTICS REFINISHING - EXTERIOR

Material

Item	Specification
Motorcraft Adhesion Promoter PM-19A316-AA	-

WARNING: **Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.**

NOTE: Care must be used if applying heat to parts. Thermoplastics soften and tend to lose their shape when heated.

1. The first step to any repair or refinish procedure is to identify the type of plastic. Is it thermosetting or thermoplastic, grained or smooth? This will determine how it should be cleaned and prepared for

refinishing. For additional information, refer to **Plastics Identification**.

- It is essential that the correct cleaner is used, depending on which painting system is employed, solvent-based or water-based.
- Clean part with warm water/mild detergent and gray scuff pad, then with plastic cleaner to remove wax, silicone and other contaminants. As a general rule, if water beads on the part, it requires additional cleaning as all the manufacturing release agent has not been removed.

2. New parts may require baking in a spray booth or heating with heat lamps to release trapped solvents or mold release agents used during manufacture.
3. After cleaning, lightly sand with 600-grit or finer sandpaper. Clean sanding residue with plastic cleaner and wipe clean.
4. A sealer may be required to prevent wrinkling and lifting of the topcoat prior to carrying out the refinish procedure.
5. Flexible and non-flexible components should be refinished separately as a flex additive is generally added to the paint material when refinishing flexible plastics.
6. It is recommended to carry out the refinish process with component installed on-vehicle to control color and blending of the adjacent panels.
7. Apply adhesion promoter. For best results, use only when product and surface temperatures are between 15°C (60°F) and 33°C (92°F). In cases of high humidity, apply the adhesion promoter in a spray booth or controlled climate. Hair dryers or fans may be used to create air movement to speed the adhesion promoter curing process.
   - Shake can vigorously for one full minute before use and repeat for 10 seconds after each full minute of use.
   - Test spray on a hidden area before proceeding.
8. Hold can 150 mm (5.9 in) to 254 mm (10 in) from the surface and spray a full wet coat with a steady back and forth motion. Be sure all areas of the surface are covered. Observe for a uniform gloss/coverage across the surface while the adhesion promoter is still wet.
9. Allow the adhesion promoter to dry 2-3 minutes and reapply a second wet coat. Allow to dry 2-3 minutes.
10. Proceed with the refinish process and follow the Ford-approved paint system procedures. Steps may vary between paint manufacturers.

PLASTICS REFINISHING - INTERIOR

Material

Item	Specification
Interior Spray Paint PM-19M547-xxxxH	-
Motorcraft Adhesion Promoter PM-19A316-AA	-

WARNING: **Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not repaint air bag modules with discolored or damaged trim covers or deployment doors; new air bag modules must be installed. Failure to follow this instruction may result in the air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

NOTE: The use of adhesion promoter is only required for polyolefin plastics. To avoid paint failure, do not use adhesion promoter or equivalent prior to color coating soft plastic.

NOTE: Care must be used if applying heat to parts. Thermoplastics soften and tend to lose their shape when heated.

1. The first step to any repair or refinish procedure is to identify the type of plastic. Is it thermosetting or thermoplastic, grained or smooth? This will determine how it should be cleaned and prepared for refinishing. For additional information, refer to **Plastics Identification**.
   - Clean part with warm water/mild detergent and gray scuff pad, then with plastic cleaner to remove wax, silicone and other contaminants.

NOTE: As with most refinishing procedures, surface preparation is critical to a correct repair. Surfaces must be clean, dry and free of contaminants that could cause loss of adhesion. A test sample should be painted prior to refinishing the repair or replacement part for correct color match.

2. Use interior trim spray paint only when the product and surface temperatures are 15°C to 33°C (60°F to 92°F). Blushing may occur in high humidity conditions. To alleviate this, apply paint in a spray booth or controlled climate. Hair dryers or fans may be used to create air movement to speed the paint curing process.
   - Shake can vigorously for 2 full minutes prior to use.
   - Apply to a small inconspicuous area to verify color match.

NOTE: If applying refinish materials to components on the vehicle, mask off adjacent areas to protect from overspray.

3. Hold can vertically 305 mm (12 in) from surface to be painted. Apply in light mist coats using even strokes from side to side. Stop spraying at the end of strokes.
4. Apply 2 to 3 mist coats, allowing approximately 10 minutes between coats. Heavy coats will result in patchiness and runs and may trap solvents, resulting in incorrect curing.

Adhesion Promoter

NOTE: Correct surface preparation must be carried out before any adhesion promoter or paint product is applied. Thoroughly clean surface to be coated. Remove any grease, dirt, polish, moisture or foreign material with a plastics wax and grease remover by wiping in one direction. To make sure of correct adhesion, it is

essential that all silicone, conditioners and existing paint be removed prior to application. If applying refinish materials to components on the vehicle, mask off adjacent areas to protect from overspray.

1. For best results, use only when the product and surface temperatures are between 15°C and 33°C (60°F to 92°F). In cases of high humidity, apply the adhesion promoter in a spray booth or controlled climate. Hair dryers or fans may be used to create air movement to speed the adhesion promoter curing process.
2. Shake can vigorously for one full minute before use and repeat for 10 seconds after each full minute of use.
    - Test spray on a hidden area before proceeding.
3. Hold can 150 mm (5.9 in) to 254 mm (10 in) from the surface and spray a full wet coat with a steady back and forth motion. Be sure all areas of the surface are covered. Observe for a uniform gloss/coverage across the surface while the adhesion promoter is still wet.
4. Allow the adhesion promoter to dry 2-3 minutes and reapply a second wet coat. Allow to dry 2-3 minutes.
5. Apply the color coat as soon as possible after second coat of adhesion promoter dries, within 10 minutes if possible.

PLASTICS REPAIR

Material

Item	Specification
Motorcraft Adhesion Promoter PM-19A316-AA	-
Plastic Bonding Adhesive TA-9	-

WARNING: **Always wear protective equipment including eye protection with side shields, and a dust mask when sanding or grinding. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always refer to Material Safety Data Sheet (MSDS) when handling chemicals and wear protective equipment as directed. Examples may include but are not limited to respirators and chemically resistant gloves. Failure to follow these instructions may result in serious personal injury.**

1. In deciding whether to repair or install a new component, follow these guidelines.
    - Is a part readily available?
    - Can the damaged part be economically returned to its original strength and appearance, or will the labor cost exceed the cost of a new component?
    - Will repair provide for the fastest, highest quality repair?

NOTE: **Never apply solvents such as lacquer thinner or reducer at any stage of plastic repair. Solvents, cleaners and water are absorbed by many types of**

plastics and by the glass fibers used for reinforcements. If this occurs, the plastic may swell in the area of repair and cause the repair to fail. Remove cleaners and water quickly and use air and heat to speed up drying.

NOTE: During the repair of polyolefin plastics, an adhesion promoter must be applied to the substrate to allow repair materials and paint to bond correctly. Reapplication is required when grinding or sanding through the sealer or primer layers.

NOTE: When possible, it is recommended to carry out as much of the plastic repair as possible on the vehicle. Parts mounted on the vehicle are held in correct alignment throughout the repair. Attempting to repair the part off the vehicle may cause misalignment. This could lead to failure of the repair.

2. Select the correct repair method by identifying the type of plastic being repaired. For additional information, refer to **Plastics Identification** to determine the type of plastic being repaired.

NOTE: Always refer to the manufacturer's label directions for the type of repair materials, fillers and bonding agents being used as they are material specific.

3. Determine whether a reinforcement piece is needed as a backer on large repairs.
   - Construct a reinforcement piece from a scrap piece of the type of plastic being repaired and follow manufacturer's label directions for the type of system being used.
   - When repairing Sheet-Molded Composite (SMC), a reinforcement piece can be constructed using several layers of glass cloth saturated with resin or structural adhesive. The weave of the cloth or screening should be loose enough to allow the resin to thoroughly penetrate. Reinforcement should cover the entire area of damage and extend outward beyond the damage or joint area.

Sheet-Molded Composite (SMC) Panel Repair

NOTE: The following procedure applies to repair of structural cracks and large gouges. If damage is cosmetic, use of reinforcing cloth may not be necessary.

1. Panels to be repaired should be dry and at room temperature 18°C (65°F) to 24°C (75°F) prior to carrying out any repairs. Both sides of the panel must be thoroughly cleaned before sanding or grinding.
2. Cover the break in the SMC (front and back) with masking tape. This protects the damaged area from absorbing the prep cleaner and eliminates wicking of the cleaner through the fibers into the SMC.
3. Remove all waxes, silicones, dirt and road oils from the area surrounding both sides of the damaged area with a plastics wax and grease remover.
   - Remove the tape and sand the back of the repair area with an angle grinder, Dual Action (D/A) sander or by hand using 80-grit sandpaper. Remove all dust with vacuum and tack cloth.
4. Create a reinforcing patch using a piece of scrap SMC that conforms well to the back of the damaged area

or form a patch from fiberglass cloth.

- Cut a section of cloth large enough to cover the repair, plus 25.4 mm (1 in) around the repair area.
- Cut a section of plastic film backing approximately 25.4 mm (1 in) larger than the cloth. Lay the plastic on a smooth, flat surface where it will be used to create a pyramid patch.

5. Follow manufacturer's directions and apply plastic repair adhesive to the plastic film backing and smooth with plastic spreader to recommended thickness. Place the pre-cut fiberglass cloth on the adhesive-coated plastic film. Cover the cloth with a coat of repair adhesive and spread to the recommended thickness.
6. Apply the prepared patch to the backside of the panel and compress. Follow manufacturer's instructions for adhesive cure. Remove plastic film after adhesive cures and sand as necessary to remove roughness.
7. Remove masking tape from the front side of damaged area and grind down to the backing patch. Use an angle grinder with a 30- to 40-grit wheel. Make a gradual taper in the area, this will prevent bull's-eyes or read-through in the finished repair. Sand prepared area with a D/A sander or hand-sand with 80-grit sandpaper.
8. Build a pyramid patch using fiberglass cloth or equivalent and plastic repair adhesive. Following manufacturer's directions, apply patch to damaged area.
9. Rough-grind area to remove excess adhesive. Sand repair area with 80-grit sandpaper, making sure to cut slightly below the SMC finished surface. This will allow for a finish coat of plastic body repair material.
10. Apply a finish coat of plastic repair filler material per manufacturer's directions.
11. Finish-sand, prime and topcoat using Ford-approved paint systems.

Thermoplastic Compounds

1. In deciding whether to repair or install a new component, follow these guidelines.
   - Is a part readily available?
   - Can the damaged part be economically returned to its original strength and appearance, or will the labor cost exceed the cost of a new component?
   - Will repair provide for the fastest, highest quality repair?

NOTE: The following steps are to be used as a guideline. Depending on what brand of adhesives or patch materials are used, procedures may vary slightly.

2. Thoroughly clean the damaged area with wax and grease remover formulated for use with plastics.
3. Hand sand the repair area with 80-grit sandpaper and remove any foreign material with compressed air.
4. Apply a plastics adhesion promoter per label directions to the repair area.
5. For small repairs, a plastic adhesive filler can be applied to damaged area. Follow manufacturer's directions and build layers to form a thickness above the damaged area. This will allow the area to be sanded smooth.
6. To repair large holes or cracks, measure and cut a piece of fiberglass cloth or equivalent 25.4 mm (1 in) larger than crack or hole.
   - Apply plastic repair adhesive to damaged area and immediately apply fiberglass cloth into plastic adhesive for reinforcement. Apply additional plastic repair adhesive for strength and shape as required.

7. Contour and shape the repair as necessary with D/A sander. Avoid sanding through the repair.
8. Finish-sand the area and carry out any required paint operations using Ford-approved paint systems.

Tab Repair - Bumper

NOTE:	**Inspect the bumper cover to determine if part can be repaired to an acceptable level of quality of appearance, fit and durability. Will labor and material cost of the repair meet or exceed the cost of a new replacement bumper cover? If the bumper cover is determined to be repairable, proceed to the following steps.**

NOTE:	**The following steps are to be used as a guideline. Depending on what brand of adhesives or patch materials are used, procedures may vary slightly.**

1. Remove the affected bumper. For additional information, refer to **BUMPERS** article.

NOTE:	**Illustration is not vehicle specific.**

2. Clean the broken tab(s) with a plastics wax and grease remover.

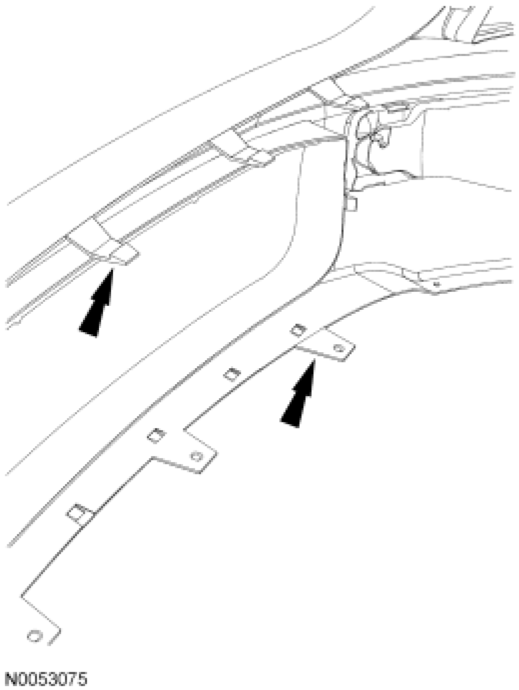


Fig. 25: Identifying Tab Repair - Bumper
Courtesy of FORD MOTOR CO.

3. Hand sand the repair area with 80-grit sandpaper and remove any foreign material with compressed air.

4. Apply a plastics adhesion promoter per label directions to the repair area.
5. Measure and cut a patch of fiberglass cloth or equivalent large enough to form the front of the tab, then slope back in a wedge shape approximately 51 mm (2 in) from original tab.
6. Prepare the repair adhesive cloth patch per manufacturer's instructions and apply to the affected area.
    - Immediately position the plastic repair material patch to form the tab shape.
7. Allow appropriate cure time and shape the repair tab using a small angle sander. Use extreme care to not sand through the exterior surface.
8. Carry out any required paint repair operations to the bumper cover using Ford-approved paint systems.
9. Reassemble and install the bumper cover. For additional information, refer to **BUMPERS** article.

REMOVAL AND INSTALLATION

INNER BODY REINFORCING PANELS

General Equipment

3 Phase Inverter Spot Welder 254-00002
Compuspot 700F Welder 190-50080
I4 Inverter Spot Welder 254-00014
Inverter Welder with MIG Welder 254-00015

Material

Item	Specification
Metal Bonding Adhesive TA-1	-
Metal Patch Panel Adhesive TA-3	-
Motorcraft Metal Surface Prep ZC-31-A	-
Motorcraft Premium Undercoating PM-25-A	-
Motorcraft Rust Inhibitor Aerosol PM-24-A	-
Seam Sealer TA-2	-

WARNING: **Invisible ultraviolet and infrared rays emitted in welding can injure unprotected eyes and skin. Always use protection such as a welder's helmet with dark-colored filter lenses of the correct density. Electric welding will produce intense radiation, therefore, filter plate lenses of the deepest shade providing adequate visibility are recommended. It is strongly recommended that persons working in the weld area wear flash safety goggles. Also wear protective clothing. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always wear protective equipment including eye protection with side shields, and a dust mask when sanding or grinding. Failure to follow these instructions may result in serious personal injury.**

WARNING: **On vehicles equipped with safety canopy options, prior to carrying out any sectioning repairs near the roof line or sail panel areas of the vehicle, remove the safety canopy module and related components. Failure to comply may result in accidental deployment or damage to the safety canopy. Refer to No Content . Failure to follow these instructions may result in serious injury to technician or vehicle occupant(s).**

WARNING: **Do not cut or grind body side components within 50 mm (1.96 in) of restraint anchoring points. Welding within 50 mm (1.96 in) of restraint anchoring points may result in incorrect operation of restraint devices. For additional restraints anchoring location information, refer to No Content and No Content . Failure to follow these instructions may result in serious injury to vehicle occupant(s).**

WARNING: **Do not carry out body side sectioning repairs in areas of laser welds. Factory laser welds cannot be duplicated with conventional welding equipment and structural integrity may be compromised. Failure to follow this instruction may result in serious injury to vehicle occupant(s).**

NOTE: **Left side shown, right side similar.**

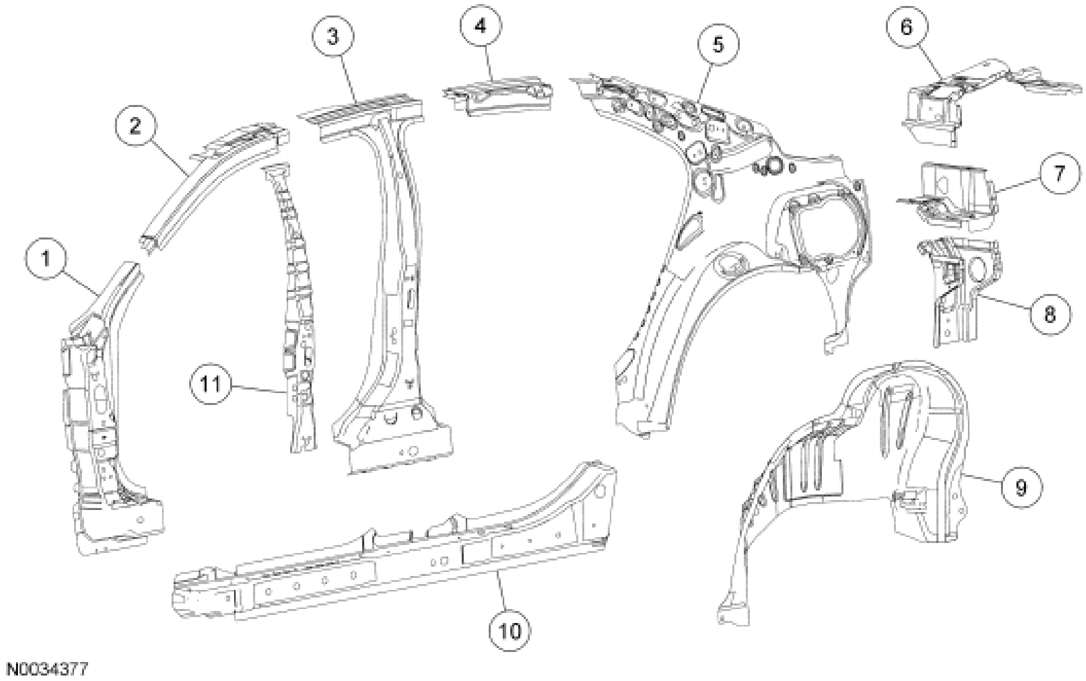


Fig. 26: Exploded View Of Inner Body Reinforcing Panels
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	02527 LH/ 02526 RH	Front body pillar reinforcement - high-strength steel
2	513A13 LH/ 513A12 RH	A-pillar reinforcement - high-strength steel
3	24321 LH/ 24320 RH	Center body pillar inner - high-strength steel
4	513A83 LH/ 513A82 RH	Roof side rail reinforcement - high-strength steel
5	27865 LH/ 27864 RH	Body Side inner panel - mild steel
6	46571 LH/ 46570 RH	Package tray support panel - mild steel
7	46775 LH/ 46774 RH	Package tray support on lower body - mild steel
8	46775 LH/ 46774 RH	Package tray to wheelhouse strainer - mild steel
9	27887 LH/ 27886 RH	Quarter panel inner wheelhouse - mild steel
10	10143 LH/ 10142 RH	Rocker panel reinforcement - dual-phase steel
11	244A29 LH/ 24428 RH	Center body pillar reinforcement - high-strength steel

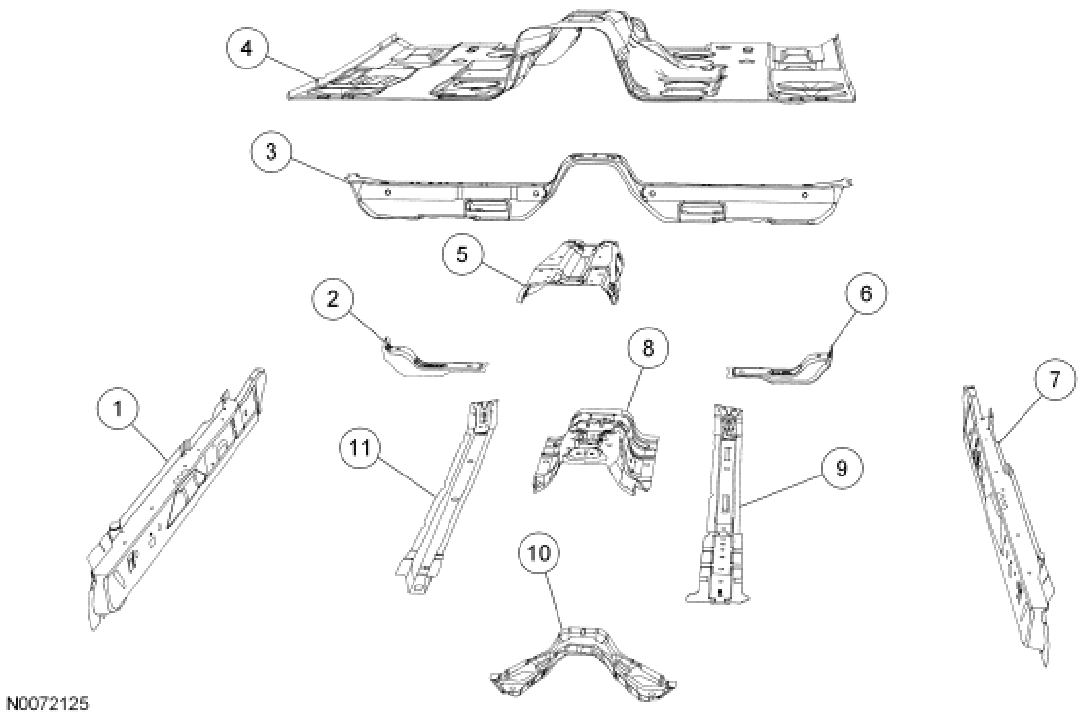


Fig. 27: Exploded View Of Underbody - Front
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	10136	Floor side member (RH) - high-strength steel
2	617C50	Seat track reinforcement (RH) - high-strength steel
3	10684	Crossmember No. 3 - mild steel
4	11135	Floor pan - mild steel
5	111K36	Floor tunnel reinforcement - mild steel
6	612K55	Seat track reinforcement (LH) - high-strength steel
7	10137	Floor side member (LH) - high-strength steel
8	54611	Floor tunnel reinforcement - mild steel
9	10063	Floor side member extension (LH) - high-strength steel
10	53656	Crossmember reinforcement - mild steel
11	10062	Floor side member extension (RH) - high-strength steel

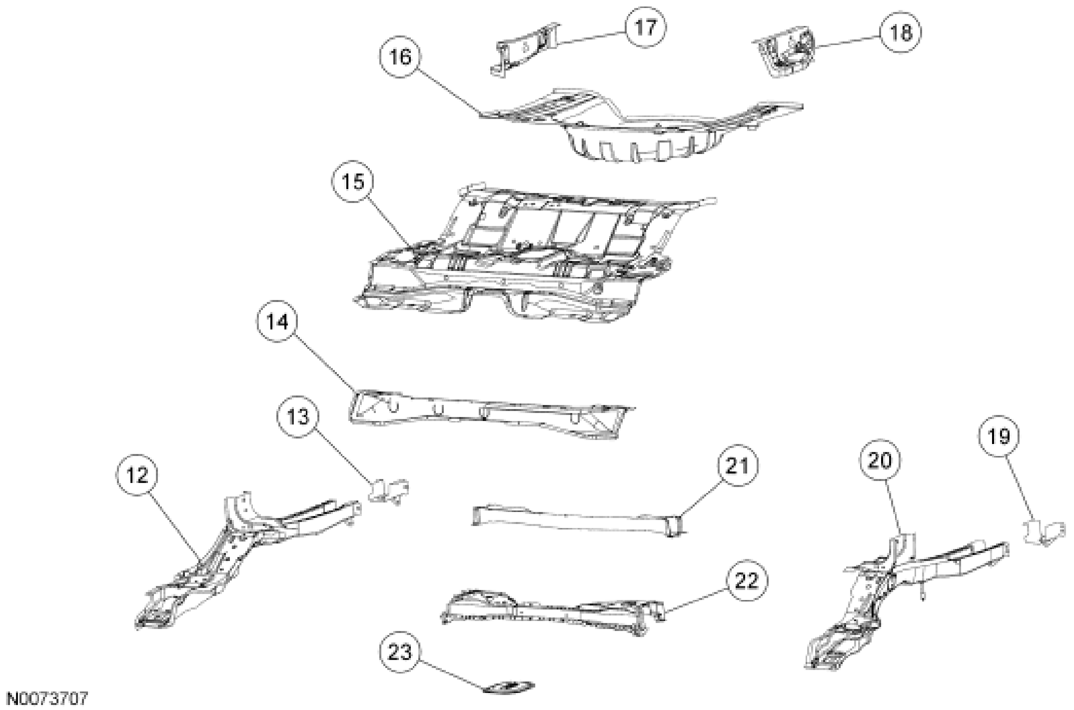


Fig. 28: Exploded View Of Underbody - Rear
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
12	101A14	Floor side member assembly (RH) - high-strength and mild steel
13	17A750	Bumper mount bracket - high-strength steel
14	10692A	Crossmember - mild steel
15	11160	Center floor pan - mild steel
16	11215	Rear floor pan - mild steel
17	11250B	Rear floor pan extension assembly (RH) - mild steel
18	11251B	Rear floor pan extension assembly (LH) - mild steel
19	17A750	Bumper mount bracket - high-strength steel
20	101A15	Floor side member assembly (LH) - high-strength and mild steel
21	10692B	Crossmember - mild steel
22	10716	Crossmember - mild steel
23	111B42	Floor panel - mild steel

NOTE: Factory spot welds may be substituted with either squeeze-type resistance spot welds (STRSW) or metal inert gas (MIG) plug welds. Spot/plug welds should equal factory welds in both location and quantity. Do not place a new spot weld directly over an original weld location. Plug weld hole should equal 8 mm (0.31 in) diameter.

NOTE: Ford Motor Company does not approve or recognize structural repair procedures using anything but genuine Ford parts.

Structural repairs (frames, rails, aprons and body panels) carried out using other than Ford Motor Company parts have not been tested. In addition, structural equivalence and corrosion protection cannot be assured.

Returning a vehicle to pre-accident condition can only be assured if repair procedures are carried out by skilled technicians using genuine Ford Motor Company parts and approved methods.

Structural component repair procedures approved by Ford using genuine parts have been validated through testing by Ford Motor Company engineers. Should alternative structural component repair procedures and/or parts be used, repairers should be aware of the potential liability they incur.

1. Remove the outer body sheet metal from the affected area prior to carrying out any reinforcing panel replacement. For additional information, refer to **Sectioning Guidelines**.

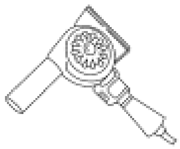
NOTE: Electronic modules and related wiring may be damaged when exposed to heat from welding procedures. Carefully disconnect and remove, or position away from heat affected areas. For additional information, refer to Welding Precautions - Steel.

NOTE: When it is necessary to carry out weld-bonding procedures, refer to Weld-Bonding.

2. Remove the outer body sheet metal from the affected area prior to carrying out any reinforcing panel replacement. For additional information, refer to **Sectioning Guidelines**.
3. When welding overlapping surfaces or substrates, apply corrosion protection material between the surfaces prior to welding. When the surfaces have been welded, apply corrosion protection material to the exterior surfaces or substrates. For additional information, refer to **Restoring Corrosion Protection Following Repair**.
   - Make sure horizontal joints and flanges are correctly sealed with seam sealer to prevent moisture intrusion. Water and moisture migrate to horizontal joints and corrosion tends to occur more rapidly in these areas. Metal surfaces must be clean and dry before applying seam sealer.
4. Proceed with refinish procedures following manufacturer's guidelines.

ROOF PANEL

Special Tools

Illustration	Tool Name	Tool Number
 ST1073-A	Heat Gun	107-R0300

General Equipment

3 Phase Inverter Spot Welder 254-00002
Compuspot 700F Welder 190-50080
I4 Inverter Spot Welder 254-00014
Inverter Welder with MIG Welder 254-00015

Material

Item	Specification
Flexible Foam Repair TA-4	-
Roof Ditch Sealer TA-15	-
Seam Sealer TA-2	-

REMOVAL

WARNING: **Invisible ultraviolet and infrared rays emitted in welding can injure unprotected eyes and skin. Always use protection such as a welder's helmet with dark-colored filter lenses of the correct density. Electric welding will produce intense radiation, therefore, filter plate lenses of the deepest shade providing adequate visibility are recommended. It is strongly recommended that persons working in the weld area wear flash safety goggles. Also wear protective clothing. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always wear protective equipment including eye protection with side shields, and a dust mask when sanding or grinding. Failure to follow these instructions may result in serious personal injury.**

NOTE: **Be sure to adequately protect all glass, exterior finish and interior trim to avoid damage during the repair procedure.**

NOTE: **Ford Motor Company does not approve or recognize structural repair procedures using anything but genuine Ford parts.**

Structural repairs (frames, rails, aprons and body panels) carried out using other than Ford Motor Company parts have not been tested. In addition, structural equivalence and corrosion protection cannot be assured.

Returning a vehicle to pre-accident condition can only be assured if repair procedures are carried out by skilled technicians using genuine Ford Motor Company parts and approved methods.

Structural component repair procedures approved by Ford using genuine parts have been validated through testing by Ford Motor Company engineers. Should alternative structural component repair procedures and/or parts be used, repairers should be aware of the potential liability they incur.

NOTE: **The roof panel on the Ford Fusion, Lincoln MKZ and Mercury Milan is affixed using a process not previously employed on a Ford Motor Company vehicle. The driver and passenger sides of the roof panel are laser skip-welded. Installation of a new roof panel will employ a weld-bonding technique. The use of mechanical welding and chemical bonding are both part of the installation technique.**

1. Remove the windshield and rear window glass. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

3. Remove the roof ditch moldings.

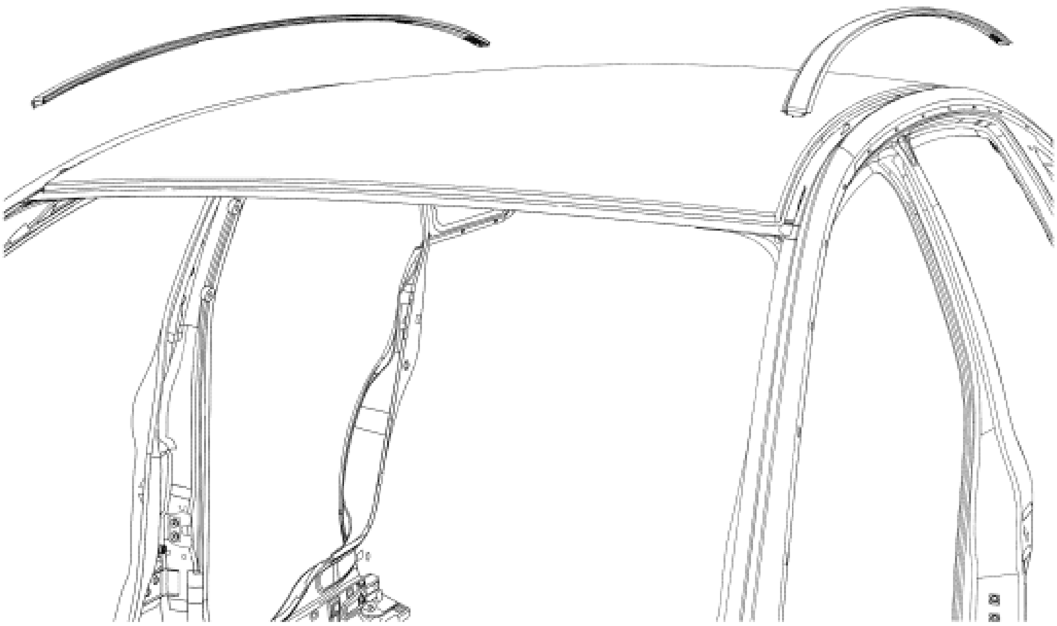


Fig. 29: Identifying Roof Ditch Moldings
Courtesy of FORD MOTOR CO.

NOTE: **For installation purpose, particular attention must be paid to the depth (thickness) of the sealer removed.**

4. Using a heat gun and a narrow scraper, remove the sealant along the entire length of the roof sides. Remove sealer as completely as possible.
5. From inside the vehicle, leaving as much of the foam as possible intact, separate the NVH foam along the roof bows from the roof panel using a flexible and sharp broad scraper or knife.

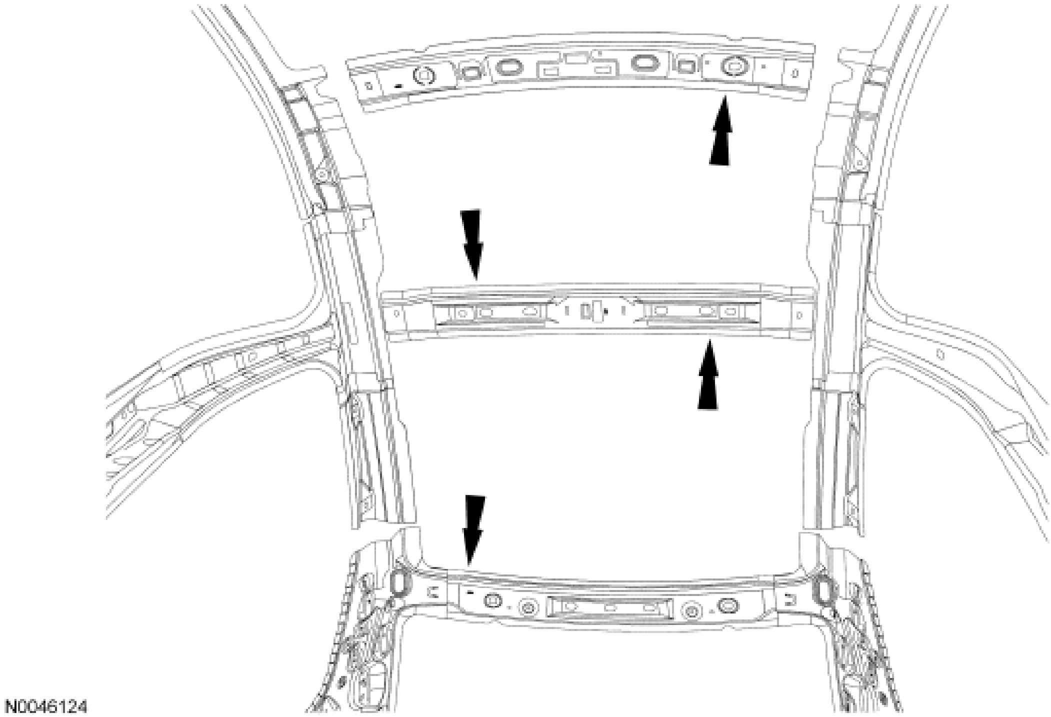


Fig. 30: Locating NVH Foam
Courtesy of FORD MOTOR CO.

6. Remove (drill out) all the roof panel spot welds from the windshield and rear window glass openings.
7. Using a cut-off wheel, plasma cutter or an air hammer equipped with a panel cutter bit, carefully separate the panel from the vehicle by cutting the entire length along the inner portion of the roof ditch seam on each side of the roof panel.

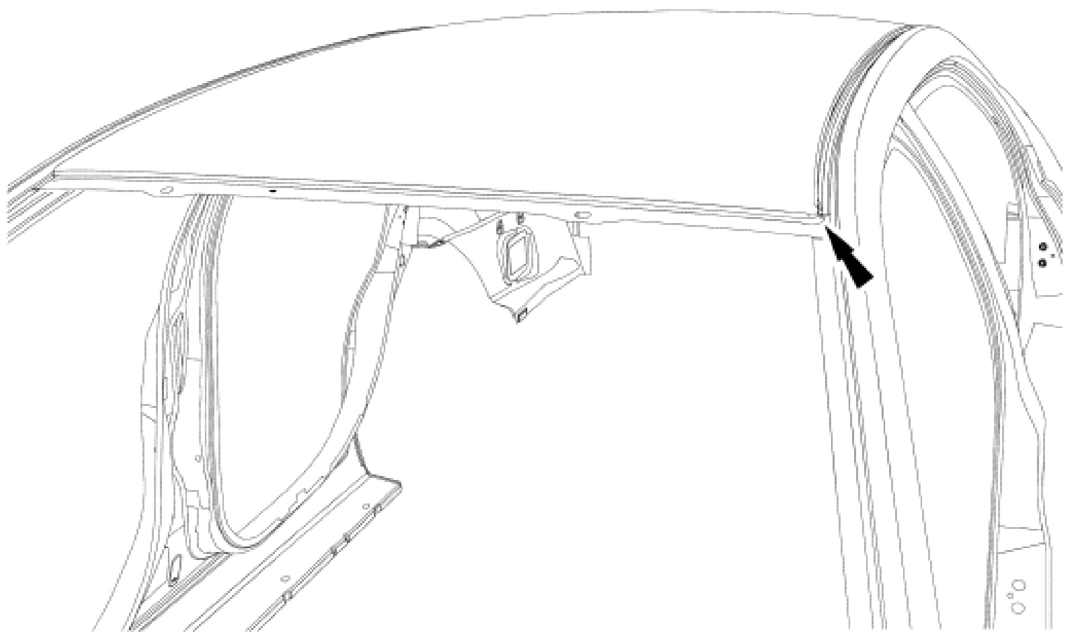


Fig. 31: Locating Roof Ditch Seam
Courtesy of FORD MOTOR CO.

8. With the help of an assistant, remove the roof panel from the vehicle.
9. Using an air hammer equipped with a flat chisel, remove the remaining portion of the roof panel from the roof ditch area.

INSTALLATION

NOTE: **Be sure to adequately protect all glass, exterior finish and interior trim to avoid damage during the repair procedure.**

1. Using a hammer and dolly, straighten any damage caused to flange areas during removal.
2. Using a grinder, carefully prepare the roof ditch area for the new roof panel.
3. With the help of an assistant, position the new roof panel on the vehicle.
4. Properly align and index-mark the positioning of the panel-to-vehicle and remove the panel.
5. Apply a 13 mm (0.51 in) tall bead of seam sealer TA-2 directly to the NVH foam remaining on the roof bows and immediately reinstall the roof panel aligning it to the index marks made during the test fitting.
   - If necessary, application of flexible foam repair may be used with the seam sealer.

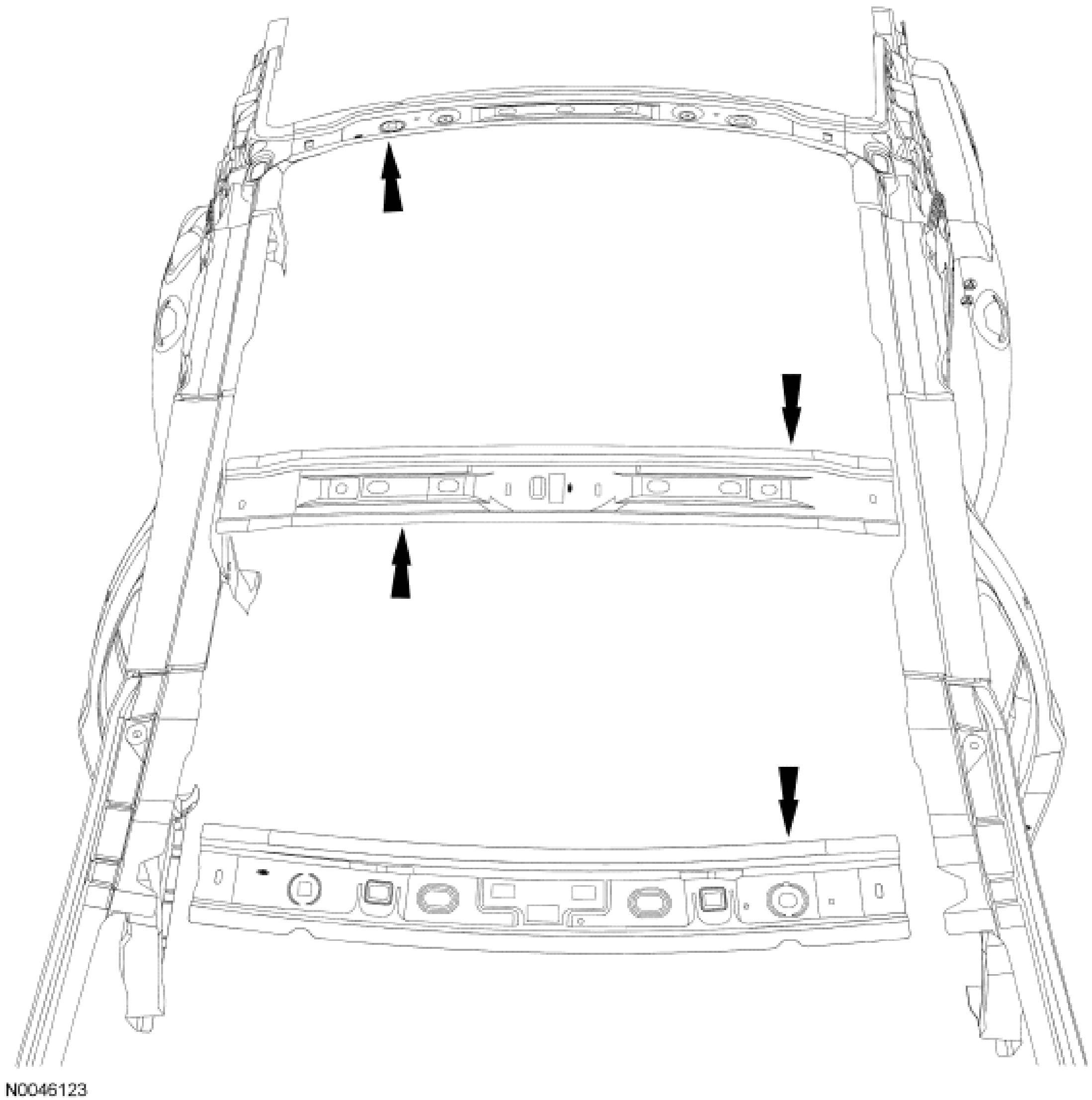


Fig. 32: Locating NVH Foam
Courtesy of FORD MOTOR CO.

6. Make sure good contact is made with the sealer and carefully clamp the roof panel on all sides.
7. Using the resistance spot welder, weld the roof panel to the vehicle in the windshield and rear window glass areas. Spot welds should match factory welds in both location and quantity.
8. Using the Metal Inert Gas (MIG) welder, seam-weld the roof panel sides with 10 mm (0.39 in) long weld beads spaced 40 mm (1.57 in) apart. Each corner must have a 10 mm (0.39 in) weld bead applied.
9. Prepare the repair area for refinish material application following the paint manufacturer's recommendations.
10. Apply a quality primer-sealer following the paint manufacturer's recommendation for both compatibility and application.

NOTE: **Always use refinishing materials from a single paint manufacturer. Combining products from more than one manufacturer may result in**

refinishing material incompatibility issues and potential void of warranty for each product applied.

11. If required, follow up with a quality primer-surfacer following the paint manufacturer's recommendations. Block sand to level using the recommended grit sandpaper.

NOTE: **Failure to purge air bubbles from the roof ditch sealer may result in air trapped in the roof ditch which may cause refinishing materials to pop.**

12. Stand the roof ditch sealer vertically (nose up) for a minimum of 30 minutes prior to application to permit trapped air to rise to the top so it may be purged.
13. Position the vehicle so it is level front-to-rear.
14. Using masking tape, form a dam at each end of the roof ditch (both sides) to prevent roof ditch sealer run-off.
15. Apply the roof ditch sealer following product directions to a depth equal to the sealer noted during removal.
16. Allow the material to cure 40-60 minutes at room temperature before refinishing. If roof ditch sealer has been allowed to cure in excess of 2 hours, scuff the surface using a red scuff pad.
17. Refinish the roof and repair area following Ford approved paint system recommendations.
18. Allow refinishing materials sufficient cure time to permit safe handling (refer to paint manufacturer's specification) and install the roof ditch molding.
19. Install the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
20. Install the windshield and rear window glass. For additional information, refer to **GLASS, FRAMES AND MECHANISMS** article.

2008 ACCESSORIES & BODY, CAB

Body System - General Information - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
3M Strip Caulk - Black 051135-08578	WSB-M4G32-C	-
Clear Silicone Rubber TA-32	ESB-M4G92-A	-
Flexible Foam Repair TA-4	-	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-
Silicone Spray Lubricant XL-6	ESR-M13P4-A	-
Trim and Weatherstrip Adhesive TA-14	-	-

DESCRIPTION AND OPERATION

INSULATION

Insulation is used as a sound-deadener to reduce exterior road and powertrain noises from the interior of the vehicle. Mastic insulators are also used as insulation. For information on the location of the mastic insulators, refer to **BODY REPAIRS** article. Insulation is installed:

- under the roof.
- above and below the instrument panel.
- at the cowl side panels.
- over the front and rear floor pans.
- inside the A-, B- and D-pillar sections.
- behind the rear quarter trim panel.

It has heat-bondable mastic deadeners for improved noise, vibration and harshness (NVH) characteristics.

BODY SEALER TYPES AND APPLICATIONS

Clear Silicone Rubber

Clear Silicone Rubber TA-32 or equivalent meeting Ford Specification ESB-M4G92-A:

- does not run.
- is fast drying.
- remains semi-elastic.
- can be used for sealing water leaks, noise concerns, remounting trim and repairing torn weatherstripping.

Caulking Cord

3M Strip Caulk-Black 051135-08578 or equivalent meeting Ford specification WSB-M4G32-C:

- is a heavy-bodied, plastic base with a filler.
- is commonly known as perma-gum.
- is used on spot-weld holes and between surfaces not sealed with a gasket.

Weatherstrip Adhesive

Trim and Weatherstrip Adhesive TA-14 or equivalent:

- is a quick drying, strong adhesive designed to hold weatherstripping onto all body panels and surrounding metal.

Silicone Lubricant

Silicone Spray Lubricant XL-6 or equivalent meeting Ford specification ESR-M13P4-A:

- is used to keep the door and the window weatherstrip pliable and soft.
- makes the door easier to close.
- retards weatherstrip squeaks.
- retards weatherstrip wear.
- helps retain door window alignment by reducing friction between the glass frame and the rubber weatherstrip.
- should not be used prior to painting.

Flexible Foam Repair

Flexible Foam Repair TA-4 or equivalent:

- deadens vibrations, fills voids and seals.
- stops wind noise and water leaks.
- expands to 10 times its size.
- typically used in replacement of mastic sealing and filling of door skins-to-impact bar, between hood inner and outer panels, between trunk inner and outer panels, pillar posts, roof rails and quarter panels.

DIAGNOSTIC TESTS

BODY SYSTEM

Material

Item	Specification
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

Inspection and Verification

Dust and Water Leaks

Most dust and water leaks occur due to missing or mis-installed body sealer or components. The source of the leak is detected by:

- inspecting for a dust pattern or water path near and above the area in question.
- removing any trim or carpet in the general area of the leak.
- road testing or water-hose testing the vehicle.
- placing a bright light under the vehicle, removing any necessary trim or carpet and inspecting the interior of the body at joints and weld lines.

Wind Noise

Most wind noise leaks occur at the corners of the windows or in the doors. Wind noise is detected by driving the vehicle at highway speeds or at speeds as specified by the customer. The vehicle should be driven in 4 different directions, with all the windows CLOSED, the radio OFF and the A/C blower motor OFF.

Squeak and Rattle

Squeak and rattle noises are generally caused by loose parts, contact or relative movement between 2 surfaces, or loose wires and connectors. The source of the noise can be detected by stopping movement of the suspect part by hand or by using dampening or low friction materials.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: **Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible that any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.**

Symptom Chart - Noise, Vibration and Harshness (NVH)

Condition	Possible Sources	Action
• Draft/wind noise and water leak around door perimeter	• Loose fit seal	• PINCH seal carrier to improve retention on seal flange.
	• Seal installed incorrectly	• REINSTALL the seal.
	• Door misaligned	• REALIGN the door. CHECK door gaps and fit in door opening and ADJUST as necessary. REFER to **BODY CLOSURES** article.
	• Scuff plate installed incorrectly	• REINSTALL the scuff plate.
	• Seal or seal pushpins damaged	• INSTALL a new seal/pushpins.
	• Sheet metal joints in door or door opening	• SEAL leaks with Silicone Gasket and Sealant.
• Draft/wind noise and water leak around glass run	• Door glass misaligned	• ADJUST door glass.
	• Glass run installed incorrectly	• REINSTALL glass run.
	• Leak path behind glass run	• INSTALL foam rope behind glass run.
	• Glass run channel spread wide	• PINCH glass run channel to reduce size of opening.
	• Glass run damaged	• INSTALL a new glass run.
• Draft/wind noise and water leak at inner belt line	• Belt line seal installed incorrectly on flange	• ADJUST seal. (Do not bend the flange.)
	• No contact with side glass	• ADJUST door glass.
	• No contact with glass runs at both ends of belt line seal	• ADJUST belt line seal or ADD foam at seal ends.
	• Belt line seal damaged	• INSTALL a new seal.
• Draft/wind noise and water leak at outer belt line	• Belt line seal installed incorrectly on flange (no glass contact)	• ADJUST seal.
	• Belt line seal does not contact the glass	• ADJUST door glass.
	• No contact with glass runs at both ends of belt line seal	• ADJUST belt line seal or ADD foam at seal ends.
	• Belt line seal damaged	• INSTALL a new seal.

• Draft/wind noise at inner door handle/speaker opening	• Hole in weathershield	• SEAL hole with suitable tape.
	• Weathershield misaligned	• REALIGN weathershield. INSTALL a new weathershield if pressure sensitive adhesive fails.
	• Exterior door handle seal misaligned/damaged	• REALIGN or INSTALL a new seal as necessary. REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
	• Speaker or speaker seal missing or damaged	• INSTALL a new door speaker.
• Draft/wind noise and water leaks at floor pan and grommets	• Missing or damaged plugs/grommets	• CHECK plugs/grommets for correct installation or damage. INSTALL new plugs/grommets if necessary.
• Road noise	• Missing mastic insulators	• CHECK for missing mastic insulators. REFER to **BODY REPAIRS** article.
	• Missing body insulators	• CHECK for missing body insulators.
• Rattles in body/doors and instrument panel	• Loose wires/cables	• CHECK that all wires/cables are correctly routed and inserted in correct retainers.
	• Loose objects/components in door wells, pillars quarter trim panels	• CHECK doors by carefully striking underside of doors with a rubber mallet while listening for rattles in doors and pillars. REMOVE or TIGHTEN loose objects/components.
	• Buzz from instrument panel components	• IDENTIFY which components of the instrument panel are buzzing. SECURE/FASTEN components as necessary, ADD foam or felt as needed if rattle persists.
• Door drain holes collecting water	• Holes clogged with mud or road tar	• CLEAN drain holes of foreign material with a punch or screwdriver. CHECK drain holes regularly.

• Wind noise from exterior rear view mirror	• Exterior mirror housing misaligned	• REALIGN with edges shingled to airflow, with no gaps.
	• Mirror sail gasket folded/misaligned	• REINSTALL with gasket unfolded and aligned correctly.
	• Mirror housing trim cap installed incorrectly	• REINSTALL with edges shingled to airflow.
	• Air leak through mirror housing hinge	• Fully ENGAGE mirror into its operating position. USE foam to block air path through hinge.
	• Inner sail trim installed incorrectly	• REINSTALL sail trim. ADJUST door trim.
	• Inner sail gasket/barrier installed incorrectly	• REINSTALL trim cover with gasket/barrier aligned correctly.
	• Air path through wiring bundle/fastener access holes	• BLOCK air path(s) with foam/tape.
	• Exposed fastener access hole on mirror housing/sail	• INSTALL a new cap if missing.
• Rattle/vibration from exterior rear view mirror	• Mirror glass adjustment screws loose	• REMOVE mirror glass and TIGHTEN mirror glass adjustment motor screws. REFER to **REAR VIEW MIRRORS** article.
	• Mirror mounting nuts loose	• TIGHTEN mirror mounting nuts. REFER to **REAR VIEW MIRRORS** article.
	• Aftermarket air deflector/stone shields	• If possible, REMOVE aftermarket air deflector/stone shield, then ROAD TEST vehicle. If concern is no longer present, ADVISE customer that aftermarket component was causing concern.
• Draft/wind noise and water leak around perimeter of all fixed glass	• Gaps in the sealant bead	• APPLY approved sealant.
	• Air traveling up windshield molding along A-pillar	• INSTALL foam rope full length of the A-pillar.

	• Gaps in sealant bead of windshield/rear glass	• RESEAL windshield/rear glass. REFER to **GLASS, FRAMES AND MECHANISMS** article.
	• Windshield/rear glass misaligned or not installed correctly	• REINSTALL windshield/rear glass. REFER to **GLASS, FRAMES AND MECHANISMS** article.
	• Rear hood seal at base of windshield misaligned/damaged	• REALIGN or INSTALL a new seal as necessary.
• Draft noise at cowl	• Cowl seal misaligned/damaged	• REALIGN or INSTALL a new seal as necessary.
• Draft/water leak or noise from roof opening panel	• Roof opening panel/components	• REFER to **ROOF OPENING PANEL** article for diagnosis.
• Wind noise created by airflow over or behind body panels	• Fender splash shield misaligned	• REALIGN fender splash shield.
	• Body panel misaligned (exposed edge)	• REALIGN appropriate body panel.
	• Hood misaligned (front margin)	• CHECK hood gaps and fit. ADJUST hood as necessary.
	• Front grille edge noise	• APPLY foam in hollow areas behind louvers.
• Wind noise created by grille opening panel	• Grille relationship to leading edge on hood	• If possible, ADJUST grille opening panel forward to eliminate wind noise.
	• Sharp edges due to material imperfections	• REMOVE sharp edges (no damage to visible surface).
• Wind noise from air extractor (body vent)	• Air extractor housing seated incorrectly	• REINSTALL air extractor housing.
	• Air extractor housing or flaps damaged	• INSTALL a new air extractor.
• Wind noise from bug shield/exterior windshield sun visor	• Turbulence created by location and shape	• DETERMINE if an OEM part or aftermarket. If aftermarket ADVISE customer accordingly. If OEM, VERIFY correctly installed. If noise is abnormal, REPAIR or INSTALL new as required.

2008 GENERAL INFORMATION

Brake System - General Information - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	227.5 ml (0.48 pt)
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-	-
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Front Disc Brake	
Brake disc minimum thickness	23.0 mm (0.905 in)
Brake pad maximum taper wear (in any direction)	3.0 mm (0.118 in)
Brake pad minimum thickness	3.0 mm (0.118 in)
Rear Disc Brake	
Brake disc minimum thickness	8.0 mm (0.314 in)
Brake pad maximum taper wear (in any direction)	3.0 mm (0.118 in)
Brake pad minimum thickness	3.0 mm (0.118 in)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Bleeder screw	8	-	71
Brake caliper guide pin bolts	26	19	-
Master cylinder brake tubes	17	-	150

DESCRIPTION AND OPERATION

BRAKE SYSTEM

The brake system consists of the following components:

- Front and rear disc brakes
- Cable/caliper actuated parking brake
- Brake master cylinder and fluid reservoir
- Vacuum-assisted power brake booster
- Four-wheel ABS
- Red brake light indicator

The brake pedal is connected to the power brake booster, which is connected to the brake master cylinder. When the brake pedal is pressed, brake fluid is pushed through the double-walled steel tubes and flexible hoses to the front and rear disc brake calipers. The brake fluid enters the disc brake calipers, forcing the caliper pistons and brake pads outward against the brake disc friction surface, slowing or stopping rotation. When the brake pedal is released, brake fluid pressure is relieved, returning the front and rear disc brake caliper pistons and brake pads to the unapplied position.

For additional information on the following:

- Front disc brakes, refer to **FRONT DISC BRAKE** article.
- Rear disc brakes, refer to **REAR DISC BRAKE** article.
- Parking brake actuation, refer to **PARKING BRAKE AND ACTUATION** article.
- Hydraulic brake actuation, refer to **HYDRAULIC BRAKE ACTUATION** article.
- Vacuum-assisted power brake booster, refer to **POWER BRAKE ACTUATION** article.
- ABS, refer to **VEHICLE DYNAMIC SYSTEMS** article.

DIAGNOSTIC TESTS

BRAKE SYSTEM

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

Principles of Operation

Brake System

Applying the brake pedal uses lever action to push a rod into the brake booster which, through the use of vacuum, boosts the force of the rod and then transmits this force into the master cylinder. This produces hydraulic pressure in the master cylinder. On vehicles not equipped with ABS, the hydraulic pressure is transmitted by brake fluid through the brake tubes to the individual brake calipers. On vehicles equipped with ABS, the hydraulic pressure is transmitted by brake fluid through the brake tubes to the ABS hydraulic control unit (HCU), which then distributes that pressure to the individual brake calipers. The brake calipers use hydraulic pressure to apply the pads. The application of the brake pads will cause the rotation of the wheels to slow or stop depending on how much brake pressure is applied. The parking brakes carry out the same function except that they are mechanically actuated by a cable that connects only to the rear brakes.

Red Brake Warning Indicator

The red brake warning indicator alerts the driver to certain conditions that exist in the brake system. The instrument cluster performs a bulb check when the ignition key is turned to the RUN position. The conditions that cause the indicator to illuminate are low brake fluid level, the parking brake is applied or there is a fault in the ABS (if the yellow ABS warning indicator is also illuminated). To diagnose a red brake warning indicator concern, refer to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

Inspection and Verification

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

CAUTION: Blistering or swelling of rubber brake components can indicate contamination of the brake fluid by a petroleum-based substance. Contaminated rubber components in the hydraulic brake system must be replaced and the entire hydraulic brake system must be flushed with clean, specified brake fluid to prevent recontamination.

CAUTION: Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled on a painted or plastic surface, immediately wash it with water.

NOTE: Always check the fluid level in the brake master cylinder reservoir before carrying out any test procedures. If the fluid level is not at the correct level, clean the reservoir cap before removing, then add clean, specified brake fluid.

NOTE: Prior to carrying out any diagnosis, make sure the red brake warning indicator is functional. Refer to INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES article.

The first indication that something may be wrong in the brake system is a change in the feeling through the brake pedal. The brake warning indicator in the instrument cluster and the brake fluid level in the brake master cylinder reservoir are also indicators of system concerns.

If a wheel is locked and the vehicle must be moved, open a bleeder screw at the locked wheel to let out enough fluid to relieve the pressure. Close the bleeder screw. This bleeding operation may release the brakes but will not correct the concern. If this does not relieve the locked wheel condition, repair the locked components before proceeding.

Inspect all hoses and connections. All unused vacuum connectors should be capped. Make sure hoses and their connections are correctly secured and in good condition with no holes, soft or collapsed areas.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Brake master cylinder • Brake master cylinder reservoir • Brake booster • Brake booster check valve • Brake booster vacuum hose • Brake hoses and tubes • Brake caliper • Brake caliper piston seals • Brake caliper guide pins • Brake disc • Brake pads • Brake pedal linkage • Wheel bearings • Tires	• Parking brake switch • Brake fluid level switch • Wiring, terminals and connectors

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, go to **Symptom Chart - Brake System** or Go to **Symptom Chart -**

Noise, Vibration and Harshness (NVH).

For low or spongy brake pedal concerns:

- check for fluid leaks. Repair as necessary.
- check and, if necessary, refill the brake master cylinder reservoir with clean, specified brake fluid.
- bleed the brake system and retest the brake pedal feel.
- if the brake pedal is still low or feels spongy, check the brake pedal mounting for looseness and correct installation. Check the power brake booster and the master cylinder for loose mounting. Correct as necessary and retest the system for normal operation.

For a slow or incomplete brake pedal return concern:

- inspect for binding, damage, correct installation or interference at the brake pedal.
- check the power brake booster for binding, damage and correct installation.

Road Test

The technician should have a thorough knowledge of the brake system operation and accepted general braking guidelines in order to detect any problems.

Select a road that is reasonably smooth and level. Gravel or bumpy roads are not suitable because the surface does not allow the tires to grip the road equally. Avoid crowned roads.

A key factor in evaluating brake concerns is the deceleration rate. This varies from vehicle to vehicle and with changes in operating conditions. It is evident how well the brakes are working after just a few applications.

Brake Pads

NOTE: It is not required to install new brake pads if the friction material thickness is within specifications. It is also not required to install new brake pads when the brake discs are machined.

- Remove the brake pads. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
- Inspect and measure the thickness of the brake pad friction material. Refer to **SPECIFICATIONS**.
  - If there are missing chunks or cracks in the lining through to the backing plate, install new brake pads. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
  - If the thickness of the friction material is less than the specified thickness, install new brake pads. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
  - If the friction material shows taper wear that is not within specifications, verify the caliper guide pins are functioning correctly. Refer to **Brake Caliper Guide Pins**.

Brake Discs

CAUTION: Using an impact tool without a torque socket will lead to unevenly tightened wheel nuts. This causes brake disc on-vehicle lateral runout and brake roughness.

NOTE: It is generally not required to install new brake discs to address noise issues.

- Remove the brake disc. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
- Inspect the brake discs and measure the brake disc thickness in a minimum of 4 places around the circumference of the brake disc. Record the measurements, refer to **SPECIFICATIONS**.
  - If the brake disc is cracked or otherwise damaged, install a new brake disc. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
  - If any thickness measurement is less than the minimum specification, install a new brake disc. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
  - If the diagnosis has revealed vibration in the steering wheel, seat or pedal while braking that varies with vehicle speed, machine the brake disc. Heavily scored brake discs, similar to that caused by pads worn down to the backing plate, should also be machined. In order to machine, discs must be above the minimum thickness specification. Refer to Specifications and **Brake Disc Machining**.

Brake Calipers

Inspect the brake calipers for the following:

- Brake fluid leaks
- Boots and seals for tears or cracks
- Caliper pistons for binding and corrosion
- Guide pins for correct operation. Refer to **Brake Caliper Guide Pins**

Brake Caliper Guide Pins

CAUTION: Do not use power tools for caliper guide pin bore cleaning. Damage to the bore may result.

NOTE: The guide pins are part of the anchor plate.

The guide pins should slide with a reasonable amount of hand force. If the brake pads show taper wear or the guide pins are difficult to move, install a new brake caliper anchor plate. Refer to **FRONT DISC BRAKE** article for the front brake caliper anchor plate or **REAR DISC BRAKE** article for the rear brake caliper anchor plate.

If the lining is not within specifications, install new brake pads. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.

Brake Hoses and Tubes

CAUTION: Never use copper tubing. It is subject to fatigue, cracking and corrosion, which may result in brake tube failure.

- Double-wall steel tubing is used throughout the brake hydraulic system. All brake tube fittings must be correctly double flared to provide strong, leakproof connections. When bending tubing to fit the underbody or rear axle contours, be careful not to kink or crack the tube.
- If a section of the brake tube is damaged, the entire section must be installed with a new tube of the same type, size, shape and length.
- When installing the hydraulic brake tubing, hoses or connectors, tighten all connections to specifications. After installation, bleed the brake system. Refer to **Brake System Bleeding**.

Install a new brake flexible hose if the hose shows signs of softening, cracking or other damage.

When installing a new brake hose, position the hose to avoid contact with other vehicle components.

Non-Pressure Leaks

Two parts of the brake system that may have a brake fluid loss that does not appear when the system is under pressure are the brake master cylinder reservoir and the brake caliper under the following conditions:

Reservoir

- Missing or poorly-fitted brake master cylinder filler cap
- Missing or damaged brake master cylinder filler cap gasket
- Punctured or otherwise damaged brake master cylinder reservoir
- Missing, damaged or poorly-fitted sealing grommets between the brake master cylinder and the brake master cylinder reservoir

The brake master cylinder reservoir grommets are not serviceable and must be installed new as part of a new brake master cylinder and reservoir assembly. Refer to brake master cylinder in **HYDRAULIC BRAKE ACTUATION** article.

Caliper

- Foreign material in the caliper piston seal groove
- Punctured or otherwise damaged caliper piston seal

The brake caliper piston seals are not serviceable and must be installed new as part of a new brake caliper. Refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.

Brake Master Cylinder - Normal Conditions

The following conditions are considered normal and are not indications that the brake master cylinder is in need

of service.

Condition 1: During normal operation of the brake master cylinder, the fluid level in the brake master cylinder reservoir will fall during brake application and rise during release. The net fluid level (such as after brake application and release) will remain unchanged.

Condition 2: A trace of brake fluid will exist on the booster shell below the master cylinder mounting flange. This results from the normal lubricating action of the master cylinder bore and seal.

Condition 3: Fluid level will decrease with pad wear.

Brake Master Cylinder - Abnormal Conditions

Changes in brake pedal feel or travel are indicators that something may be wrong in the brake system. Go to **Symptom Chart - Brake System** for abnormal condition diagnosis.

Brake Booster

Inspect the brake booster:

- for excessive corrosion or damage.
- vacuum connections for leakage.
- vacuum hoses for kinks or leakage.
- check valve for correct operation.

Parking Brake

Check the operation of the parking brake system with the vehicle on a hoist and the parking brake control fully released. Carry out the parking brake system diagnosis, refer to **PARKING BRAKE AND ACTUATION** article.

Symptom Chart - Brake System

Symptom Chart - Brake System

Condition	Possible Sources	Action
• The red brake warning indicator and the yellow ABS warning indicator are illuminated	• DTCs in the ABS module	• REFER to **VEHICLE DYNAMIC SYSTEMS** article to diagnose the ABS module.
• The red brake warning indicator is always/never on	• Brake fluid level switch • Parking brake switch • Wiring, terminals or connectors • Instrument cluster	• REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article to diagnose the red brake warning indicator.

	• Smart junction box (SJB)	
• The brakes pull or drift	• Tires	• INSPECT the tires for uneven or excessive wear, and correct inflation. REFER to **WHEELS AND TIRES** article.
	• Brake pads	• INSPECT the brake pads for contamination, uneven taper or excessive wear. REFER to **Brake Pads**.
	• Brake discs	• INSPECT the brake discs and the hubs for contamination or damage, INSTALL new as necessary.
	• Brake calipers and/or guide pins	• INSPECT the brake calipers and guide pins, REFER to **Brake Calipers** and **Brake Caliper Guide Pins**.
	• Suspension component and/or wheel alignment	• INSPECT the suspension and CHECK the wheel alignment. REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.
• Brake pedal goes down fast	• Brake fluid leaks and/or air in the system	• INSPECT the system for leaks. REPAIR as necessary. FILL the brake master cylinder reservoir. BLEED the system. REFER to **Brake System Bleeding**.
	• Brake master cylinder	• CARRY OUT the **Brake Master Cylinder - Bypass Condition**.
	• Hydraulic control unit (HCU)	• INSPECT the HCU. REFER to **VEHICLE DYNAMIC SYSTEMS** article.
• The brake pedal eases down slowly	• Air in the system	• BLEED the system. REFER to **Brake System Bleeding**.
	• Brake master cylinder	• CARRY OUT the **Brake Master Cylinder - Bypass Condition**.
	• HCU	• INSPECT the HCU. REFER to **VEHICLE DYNAMIC SYSTEMS** article.
		• INSPECT the brake pads for

• Brakes lock up under light brake pedal force	• Brake pads	uneven taper or excessive wear, REFER to **Brake Pads**.
	• Brake calipers and/or guide pins	• INSPECT the brake calipers and guide pins, REFER to **Brake Calipers** and **Brake Caliper Guide Pins**.
	• Anti-lock brake control system	• CHECK the anti-lock brake control system. REFER to **VEHICLE DYNAMIC SYSTEMS** article.
• Excessive/erratic brake pedal travel	• Brake fluid leaks and/or air in the system	• INSPECT the system for leaks. REPAIR as necessary. BLEED the system. REFER to **Brake System Bleeding**.
	• Brake calipers and/or guide pins	• INSPECT the brake calipers and guide pins, REFER to **Brake Calipers** and **Brake Caliper Guide Pins**.
	• Brake flexible hose	• INSPECT the brake flexible hoses for swelling and damage. INSTALL new as necessary. REFER to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
	• Brake master cylinder	• CARRY OUT the **Brake Master Cylinder - Bypass Condition**.
	• Brake pads	• INSPECT the brake pads for taper wear, REFER to **Brake Pads**.
	• Brake pedal	• INSPECT the brake pedal for binding, obstructions and correct installation. REPAIR as necessary. CHECK the brake pedal fasteners for correct torque. REFER to Specifications in **HYDRAULIC BRAKE ACTUATION** article.
	• Anti-lock brake control system	• CHECK the anti-lock brake control system. REFER to **VEHICLE DYNAMIC SYSTEMS** article.
		• REPAIR or INSTALL new

		components as necessary. REFER to **PARKING BRAKE AND ACTUATION** article.
• Brakes drag	• Parking brake component	
	• Brake caliper guide pins	• INSPECT the caliper guide pins for correct operation. INSTALL new components as necessary. REFER to **Brake Caliper Guide Pins**.
	• Disc brake caliper(s)	• REPAIR or INSTALL new brake calipers as necessary. REFER to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
	• Brake booster	• CARRY OUT the **Brake Master Cylinder - Bypass Condition**.
	• Brake master cylinder	• CARRY OUT the **Brake Master Cylinder - Bypass Condition**.
• Excessive brake pedal effort	• Insufficient engine vacuum for brake booster operation	• CHECK engine vacuum. REFER to the Intake Manifold Vacuum Test in **ENGINE SYSTEM - GENERAL INFORMATION** article.
	• Brake booster manifold vacuum hose	• VERIFY engine vacuum at the booster. REROUTE, REPAIR or INSTALL new components as necessary.
	• Brake booster	• VERIFY engine vacuum at the booster. CARRY OUT the **Brake Booster**.
	• Brake booster check valve	• VERIFY engine vacuum at the booster. CARRY OUT the **Brake Booster Check Valve**.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: **Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the**

causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

Symptom Chart - Noise, Vibration and Harshness (NVH)

Condition	Possible Sources	Action
• Vibration when the brakes are applied	• Tires	• CORRECT any wheel and tire concern before diagnosing the brake or suspension systems. REFER to **WHEELS AND TIRES** article to diagnose the tires.
	• Uneven brake pad wear • Brake disc pad transfer • Uneven brake disc wear • Suspension components	• COMPLETE the brake system inspection described in **Inspection and Verification**. If the condition still exists, go to **Pinpoint Test A**.
• Brake vibration/shudder - occurs when the brake pedal is released	• Brake caliper guide pins	• INSPECT the brake caliper guide pins for correct operation. REFER to **Brake Caliper Guide Pins**.
	• Brake drag	• Go to **Symptom Chart - Brake System**.
• Rattling noise	• Caliper mounting bolts loose	• CHECK the caliper bolts. TIGHTEN to specifications. REFER to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
	• Damaged or worn caliper guide pins or retainers	• CHECK the caliper guide pins and retainers for correct operation. REFER to **Brake Caliper Guide Pins**. INSTALL new components as necessary.
	• Missing or damaged anti-rattle clips or springs	• CHECK the brake pads for missing clips or broken springs. INSTALL new components as necessary. REFER to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.

	• Loose brake disc shield	• TIGHTEN the brake disc shield bolts to specification. REFER to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
• Clicking noise - with brakes applied on vehicles equipped with ABS brakes	• ABS hydraulic control unit (HCU)	• Acceptable condition during an ABS event.
• Squealing noise - occurs on first (morning) brake application	• Brake pads	• Acceptable condition. Caused by humidity and low brake pad temperature.
• Squealing noise - a continuous squeal	• Brake pads worn below minimum thickness	• INSPECT brake pads for excessive wear, taper wear or uneven wear. VERIFY brake pads are within minimum specifications. REFER to **Brake Pads**.
• Squealing noise - an intermittent squeal brought on by cold, heat, water, mud or snow	• Brake pads	• Acceptable condition.
• Groaning noise - occurs at low speeds with brake lightly applied (creeping)	• Brake pads	• Acceptable condition.
• Grinding noise - continuous	• Brake pads worn below minimum thickness	• INSPECT the brake pads, brake discs, and attaching hardware for damage. VERIFY brake components are within specifications. REFER to **SPECIFICATIONS**.
• Moaning noise	• Brake pads contaminated with grease or oil	• INSPECT the brake pads for contamination. REPAIR or INSTALL new components as necessary. REFER to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.

Pinpoint Tests

Pinpoint Test A: Vibration When the Brakes are Applied

Normal Operation

During moderate to heavy braking, noise from the hydraulic control unit (HCU) and pulsation in the brake pedal can be observed. Pedal pulsation coupled with noise during heavy braking or on loose gravel, bumps, wet or snowy surfaces is acceptable and indicates correct functioning of the ABS. Pedal pulsation or steering wheel nibble when the brakes are applied (frequency is proportioned to the vehicle speed) indicates a concern with a brake or suspension component.

PINPOINT TEST A: VIBRATION WHEN THE BRAKES ARE APPLIED

A1 ROAD TEST THE VEHICLE - LIGHT BRAKING

- Road test the vehicle. Warm the brakes by slowing the vehicle from 80 to 32 km/h (50 to 20 mph) using light brake force. At highway speeds of 89-97 km/h (55-60 mph), apply the brake using light pedal force.
- **Is there a vibration/shudder felt in the steering wheel, seat or brake pedal?**

  YES : Go to A4.

  NO : Go to A2.

A2 ROAD TEST THE VEHICLE - MODERATE TO HEAVY BRAKING

- Road test the vehicle. At highway speeds of 89-97 km/h (55-60 mph), apply the brake using a moderate to heavy pedal force.
- **Is there a vibration/shudder?**

  YES : Go to A3.

  NO : The concern is not present at this time.

A3 CHECK ABS OPERATION

- Road test the vehicle and apply the brakes on a dry, firm surface, then apply the brakes on a wet, snowy or loose surface (such as gravel).
- **Is the vibration/shudder only present on a wet, snowy or loose surface?**

  YES : This is a normal operating condition of the ABS.

  NO : Go to A5.

A4 CHECK THE PARKING BRAKE OPERATION

- Apply the parking brake to identify if the problem is in the front or rear brake. At highway speeds of 89-97 km/h (55-60 mph), lightly apply the parking brake until the vehicle slows down. Release the parking brake immediately after the test.
- **Is there a vibration/shudder?**

  YES : Go to A7.

  NO : Go to A5.

A5 CHECK THE FRONT SUSPENSION

- Check the front suspension. Refer to <u>**SUSPENSION SYSTEM - GENERAL INFORMATION**</u> article.
- **Are all the suspension components in satisfactory condition?**

  YES : Go to A6.

  NO : REPAIR or INSTALL new components as necessary. TEST the system for normal operation.

A6 RESURFACE THE FRONT BRAKE DISCS

CAUTION: Do not use a bench lathe to machine the brake discs. A bench lathe may cause brake disc on-vehicle lateral runout and brake roughness.

NOTE: Follow the brake lathe manufacturer's instructions to machine the brake discs. After machining, make sure the brake disc meets the thickness specification.

- Resurface the front brake discs. Refer to **Brake Disc Machining**.
- Road test the vehicle.
- **Is the vibration/shudder present?**

  YES : Go to A7.

  NO : The concern has been repaired.

A7 CHECK THE REAR SUSPENSION

- Check the rear suspension. Refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.
- **Are all the suspension components in satisfactory condition?**

  YES : RESURFACE the rear brake discs. REFER to **Brake Disc Machining**.

  NO : REPAIR or INSTALL new components as necessary. TEST the system for normal operation.

Component Tests

Brake Booster

1. Disconnect the check valve from the brake booster.
2. Apply the parking brake, start the engine and place the transmission in NEUTRAL.
3. Verify that manifold vacuum is available at the check valve with the engine at idle speed and the transmission in NEUTRAL.
   - If manifold vacuum is available, stop the engine, connect the check valve and continue with Step 5.
   - If manifold vacuum is not available, continue with Step 4.
4. Disconnect the check valve from the vacuum hose and verify that manifold vacuum is available at the hose with the engine at idle speed and the transmission in NEUTRAL.
   - If manifold vacuum is available, stop the engine, install a new check valve and continue with Step 5.
   - If manifold vacuum is not available, stop the engine, connect the vacuum hose to the check valve and refer to **ENGINE SYSTEM - GENERAL INFORMATION** article to diagnose the no vacuum condition.
5. Apply the brake pedal several times to exhaust all vacuum from the system.
6. Apply the brake pedal and hold it in the applied position. Start the engine and verify that the brake pedal moves downward after the engine starts.
   - If the brake pedal moves, the brake booster is operating correctly
   - If the brake pedal does not move, install a new brake booster. Refer to **POWER BRAKE**

ACTUATION article.

7. Operate the engine a minimum of 10 seconds at fast idle. Stop the engine, and let the vehicle stand for 10 minutes. Then apply the brake pedal with approximately 89 N (20 lb) of force. The brake pedal feel should be the same as that noted with the engine operating. If the brake pedal feels hard (no power assist), install a new brake booster check valve and retest. If the brake pedal feels spongy, bleed the hydraulic system to remove air. Refer to **Brake System Bleeding**.

Brake Booster Check Valve

The function of the brake booster check valve is to allow manifold vacuum to enter the brake booster and prevent the escape of vacuum in case manifold vacuum is lost during sustained full throttle operation.

1. Disconnect the vacuum booster hose from the check valve.
2. Apply the parking brake, start the engine and place the transmission in NEUTRAL.
3. Verify that manifold vacuum is available at the check valve end of the vacuum hose with the engine at idle speed and the transmission in NEUTRAL.
    - If manifold vacuum is available, stop the engine, connect the vacuum hose to the check valve and continue this test.
    - If manifold vacuum is not available, stop the engine, connect the vacuum hose to the check valve and refer to **ENGINE SYSTEM - GENERAL INFORMATION** article to diagnose the no vacuum condition.
4. Connect the vacuum hose to the check valve and run the engine for at least 10 seconds.
5. Operate the brake pedal to check for power assist.
    - If power assist is present, continue with this test.
    - If power assist is not present, refer to **Brake Booster**.

NOTE: Do not remove the brake booster check valve from the brake booster in this step.

6. Stop the engine and disconnect the vacuum booster hose from the brake booster check valve.
7. Apply the brake and verify that there is enough vacuum retained in the brake booster for at least one power-assisted brake application.
    - If there is enough vacuum for at least one power-asssisted brake application, the check valve is functioning correctly.
    - If there is not enough vacuum for at least one power-asssisted brake application, continue with this test.
8. Inspect the brake booster for any signs of damage that may cause a leak.
    - If any damage is found, install a new brake booster and repeat this test.
    - If no damage is found, install a new check valve.

Brake Master Cylinder - Bypass Condition

1. Disconnect the brake tubes from the master cylinder.

2. Plug the outlet ports of the master cylinder.
3. Apply the brakes. If brake pedal height cannot be maintained, the brake master cylinder has an internal leak and a new brake master cylinder must be installed.

Brake Master Cylinder - Compensator Port

The purpose of the compensator ports in the brake master cylinder is to:

- supply additional brake fluid from the brake master cylinder reservoir needed by the brake system due to brake lining wear.
- allow brake fluid to return to the brake master cylinder reservoir when the brakes are released. The returning brake fluid creates a slight turbulence in the brake master cylinder reservoir. This is a normal condition and indicates that the compensator ports are not clogged.

Clogged compensator ports may cause the brakes to hang up or not fully release. If clogged compensator ports are suspected, proceed as follows:

1. With the vehicle in NEUTRAL, position it on a hoist. Refer to **JACKING AND LIFTING** article.
2. With the brakes released, attempt to rotate each wheel and check for any brake drag.
   - If an excessive amount of brake drag exists at all 4 wheels, continue with the test.
   - If an excessive amount of brake drag exists at only one wheel, it indicates a possible seized brake caliper, brake wheel cylinder or parking brake component. Repair or install new components as necessary.
3. Check the brake stoplamp switch and the brake pedal free play to verify that the brake pedal is not partially applied.
4. Loosen the brake master cylinder nuts and position the brake master cylinder away from the brake booster.
5. With the brakes released, attempt to rotate each wheel and check for any brake drag.
   - If the brake drag is no longer present, install a new brake booster. Refer to **POWER BRAKE ACTUATION** article.
   - If the brake drag is still present, install a new master cylinder. Refer to **HYDRAULIC BRAKE ACTUATION** article.

GENERAL PROCEDURES

BRAKE DISC MACHINING

NOTE: **Do not use a bench lathe to machine the brake discs. Use an on-vehicle brake lathe only. Read the entire operating manual and/or view the video shipped with the lathe before installing, operating or repairing the lathe.**

NOTE: **An on-vehicle brake lathe with an automatic runout adjustment feature is preferred. However, if the lathe is not self adjusting, the lathe oscillation must be adjusted using a dial indicator. The total indicated runout target is 0.000 mm**

(0.000 in). The maximum indicated runout should be no more than 0.050 mm (0.002 in). If the runout adjustment (automatic or manual) is carried out correctly prior to machining, then the final brake disc runout will be within specification and a runout measurement is not necessary after machining.

NOTE: **Do not machine new brake discs.**

NOTE: **Lateral runout and disc thickness variation measurements are not required because correct adjustment of the on-vehicle brake lathe will make sure that these dimensions are within specification.**

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

   NOTE: **Do not allow the caliper to hang from the brake hose or damage to the hose may occur.**

   NOTE: **It is not necessary to disconnect the brake tube from the brake caliper.**

2. Remove the bolts and position the brake caliper or brake caliper and anchor plate assembly aside, as required.
   - Support the brake caliper using mechanic's wire.
3. Install the hub adapter using:
   - four wheel nuts on a 4-stud wheel hub.
   - five wheel nuts on a 5-stud wheel hub.
   - six wheel nuts on a 6-stud wheel hub.
   - four wheel nuts on a 7- or 8-stud wheel hub.
   - five wheel nuts on a 10-stud wheel hub.
4. Install the cutting lathe.
5. If the lathe is not self adjusting, adjust the lathe oscillation using a dial indicator. The total indicated runout target is 0.000 mm (0.000 in). The maximum indicated runout should be no more than 0.050 mm (0.002 in).
6. Center the cutting head, adjust the cutting bits and install the chip deflector/silencer.

   NOTE: **The depth of the cut should be between 0.10 and 0.40 mm (0.004 and 0.015 in). Lighter cuts will cause the bit to heat up and wear faster. Heavier cuts will cause poor brake disc surface finish.**

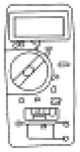
7. Machine the brake disc.
8. Remove the lathe and the silencer.
9. Remove the wheel nuts and hub adapter.
10. Remove the metal shavings.

NOTE: It is not required to install new brake pads if friction material is within specifications. For additional information, refer to SPECIFICATIONS.

11. Position the brake caliper or brake caliper and anchor plate assembly.
    - Install the bolts.
    - For fastener torque specifications, refer to **FRONT DISC BRAKE** article for front disc brakes or **REAR DISC BRAKE** article for rear disc brakes.
12. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

BRAKE SYSTEM BLEEDING

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

Pressure Bleeding

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.**

NOTE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

NOTE: **When any part of the hydraulic system has been disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.**

NOTE: **Due to the complexity of the fluid path within the rear integral parking brake calipers, it is necessary to press and release the parking brake during the bleed procedure.**

1. Clean all the dirt from around the brake fluid reservoir cap and remove the cap. Fill the brake master cylinder reservoir with clean, specified brake fluid.

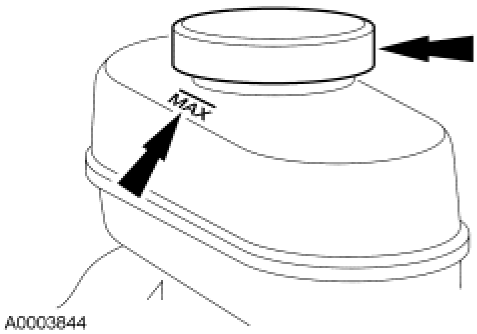


Fig. 1: Identifying Brake Master Cylinder Fluid Reservoir Cap And Max Fill Line
Courtesy of FORD MOTOR CO.

NOTE: **Master cylinder pressure bleeder adapter tools are available from various manufacturers of pressure bleeding equipment. Follow the instructions of the manufacturer when installing the adapter.**

2. Install the bleeder adapter to the brake master cylinder reservoir and attach the bleeder tank hose to the fitting on the adapter.
   - Pressure bleeding the brake system at 207-345 kPa (30-50 psi) is preferred to manual bleeding.
3. Open the valve on the bleeder tank.

NOTE: **Bleed the longest line first. Make sure the bleeder tank contains enough specified brake fluid to complete the bleeding operation.**

4. Remove the RH rear bleeder cap and place a box-end wrench on the bleeder screw. Attach a rubber drain tube to the RH rear bleeder screw and submerge the free end of the tube in a container partially filled with clean, specified brake fluid.

5. Loosen the RH rear bleeder screw. Leave open until clear, bubble-free brake fluid flows, then tighten the RH rear bleeder screw.
   - Press and release the parking brake 5 times.
   - Repeat until clear, bubble-free fluid comes out.
6. Tighten the RH rear bleeder screw to specifications, refer to **SPECIFICATIONS**. Remove the rubber hose and install the bleeder screw cap.
7. Repeat Steps 4 through 6 for the LH rear brake caliper.
8. Remove the RH front bleeder cap and place a box-end wrench on the bleeder screw. Attach a rubber drain tube to the RH front bleeder screw and submerge the free end of the tube in a container partially filled with clean, specified brake fluid.
9. Loosen the RH front bleeder screw. Leave open until clear, bubble-free brake fluid flows, then tighten the RH front bleeder screw.
10. Tighten the LH rear bleeder screw to specifications, refer to **SPECIFICATIONS**. Remove the rubber hose and install the bleeder screw cap.
11. Repeat Steps 8 through 10 for the LH front brake caliper.
12. Close the bleeder tank valve and release the pressure. Remove the tank hose from the adapter and remove the adapter. Fill the reservoir with clean, specified brake fluid and install the reservoir cap.

Manual Bleeding

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.**

NOTE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

NOTE: **When any part of the hydraulic system is disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal**

action. This requires bleeding of the hydraulic system after it is correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

NOTE: **Due to the complexity of the fluid path within the rear integral parking brake calipers, it is necessary to press and release the parking brake during the bleed procedure.**

NOTE: **Pressure bleeding the brake system is preferred to manual bleeding.**

1. Clean all dirt from and remove the brake master cylinder filler cap and fill the brake master cylinder reservoir with clean, specified brake fluid.

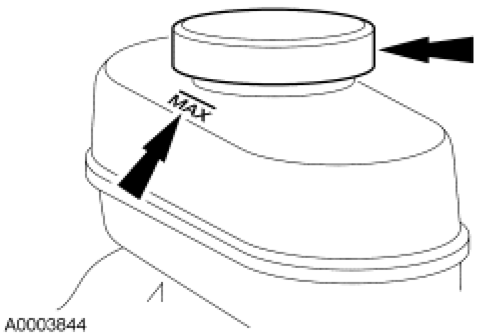


Fig. 2: Identifying Brake Master Cylinder Fluid Reservoir Cap And Max Fill Line
Courtesy of FORD MOTOR CO.

NOTE: **Bleed the brake system from the longest to the shortest brake line.**

2. Remove the RH rear brake caliper bleeder screw cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.
3. Have an assistant slowly pump the brake pedal and then hold firm pressure on the brake pedal.
4. Loosen the RH rear brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the bleeder screw.
   - Press and release the parking brake 5 times.
   - Repeat until clear, bubble-free fluid comes out.
   - Refill the brake master cylinder reservoir as necessary.
5. Tighten the RH rear brake caliper bleeder screw to specifications, refer to **SPECIFICATIONS**. Remove the rubber hose and install the bleeder screw cap.
6. Repeat Steps 2 through 5 for the LH rear brake caliper bleeder screw.
7. Remove the RH front brake caliper bleeder screw cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

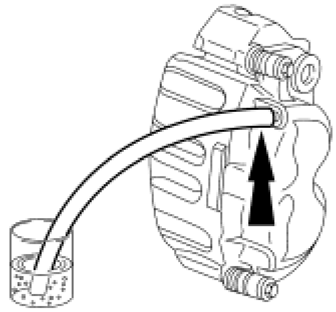


Fig. 3: Locating Rubber Drain Tube
Courtesy of FORD MOTOR CO.

8. Have an assistant slowly pump the brake pedal and then hold firm pressure on the brake pedal.
9. Loosen the RH front brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the bleeder screw.
   - Repeat until clear, bubble-free fluid comes out.
   - Refill the brake master cylinder reservoir as necessary.
10. Tighten the RH front brake caliper bleeder screw to specifications, refer to **SPECIFICATIONS**. Remove the rubber hose and install the bleeder screw cap.
11. Repeat Steps 7 through 10 for the LH front brake caliper bleeder screw.

ABS Hydraulic Control Unit (HCU) Bleeding

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.**

NOTE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

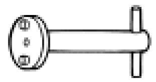
NOTE: This procedure is only required when a new Hydraulic Control Unit (HCU) is installed.

NOTE: When any part of the hydraulic system is disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it is correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

1. Connect the scan tool and follow the ABS HCU bleeding instructions.
2. Use the Pressure Bleeding or Manual Bleeding procedure to bleed the system. For additional information, refer to **Brake System Bleeding**.

COMPONENT BLEEDING

Special Tools

Illustration	Tool Name	Tool Number
 ST1112-A	Adapter for Adjuster, Rear Brake Caliper Piston	206-026 (T87P-2588-A)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

Master Cylinder

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding

operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

NOTE: Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.

NOTE: When any part of the hydraulic system is disconnected for repair or installation of new components, air can enter the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it is correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

NOTE: When a new brake master cylinder is installed, or the system is emptied or partially emptied, it should be primed to prevent air from entering the system.

1. Disconnect the brake tubes.

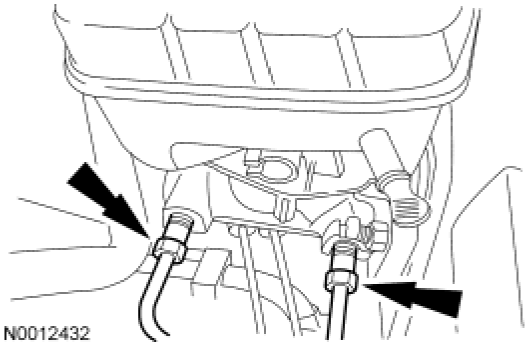


Fig. 4: Locating Brake Lines
Courtesy of FORD MOTOR CO.

2. Install short brake tubes onto the primary and secondary ports with the ends submerged in the brake master cylinder reservoir.

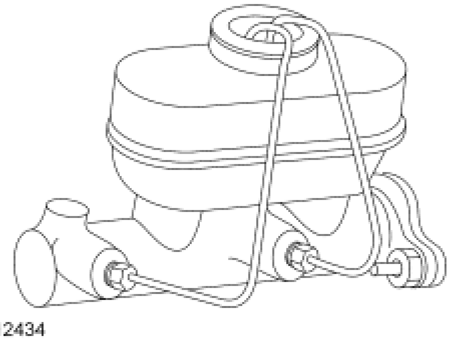


Fig. 5: Identifying Short Brake Tubes
Courtesy of FORD MOTOR CO.

3. Fill the brake master cylinder reservoir with clean, specified brake fluid.
4. Have an assistant slowly pump the brake pedal until clear fluid flows from the brake tubes, without air bubbles.
5. Remove the short brake tubes and install the master cylinder brake tubes.
    - Tighten to specifications, refer to **SPECIFICATIONS**.
6. Bleed each brake tube at the brake master cylinder as follows:
    1. Have an assistant slowly pump the brake pedal, and then hold firm pressure on the brake pedal.
    2. Loosen the rear-most brake tube fittings until brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the brake tube fitting.
    3. Repeat this operation until clear, bubble-free fluid comes out.
    4. Refill the brake master cylinder reservoir as necessary. Repeat the bleeding operation at the front brake tube.

Front Brake Caliper

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.**

NOTE: Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.

NOTE: It is not necessary to do a complete brake system bleed if only the brake caliper was disconnected or installed new.

1. Remove the brake caliper bleeder screw cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

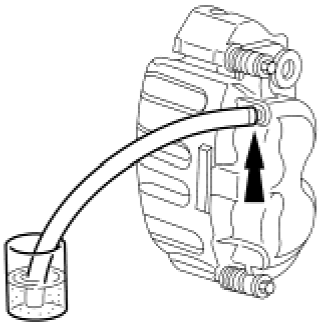


Fig. 6: Attaching Rubber Drain Hose To Disc Brake Caliper Bleeder Screw
Courtesy of FORD MOTOR CO.

2. Have an assistant pump the brake pedal at least 2 times and then hold firm pressure on the brake pedal.
3. Loosen the bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the bleeder screw.
   - Repeat until clear, bubble-free fluid comes out.
   - Refill the brake master cylinder reservoir as necessary.
4. Tighten the bleeder screw to specifications, refer to **SPECIFICATIONS**. Remove the rubber hose and install the bleeder screw cap.

Rear Brake Caliper

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.**

NOTE: Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.

NOTE: When any part of the hydraulic system is disconnected for repair or installation

of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it is correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

NOTE: Due to the complexity of the fluid path within the rear integral parking brake calipers, it may be necessary to follow this procedure when new calipers are installed.

NOTE: This procedure is necessary only when installing a new rear brake caliper. To bleed the brake system, refer to Brake System Bleeding.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. Remove the 2 brake caliper guide pin bolts and position the brake caliper aside.

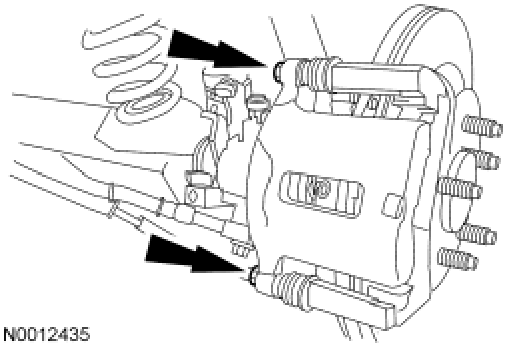


Fig. 7: Locating Brake Caliper Bolts
Courtesy of FORD MOTOR CO.

3. Remove the outer brake pad.

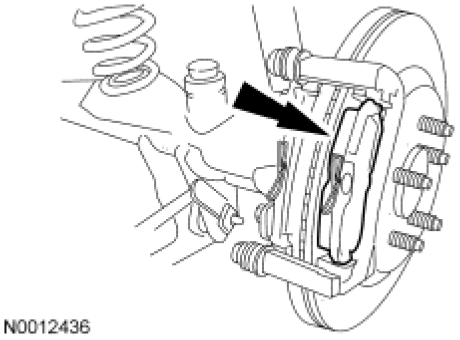


Fig. 8: Locating Outer Brake Pad
Courtesy of FORD MOTOR CO.

NOTE: Place a shop towel between the caliper and the brake disc.

4. Install the brake caliper using the 2 guide pin bolts.

- Tighten to specifications, refer to **SPECIFICATIONS**.

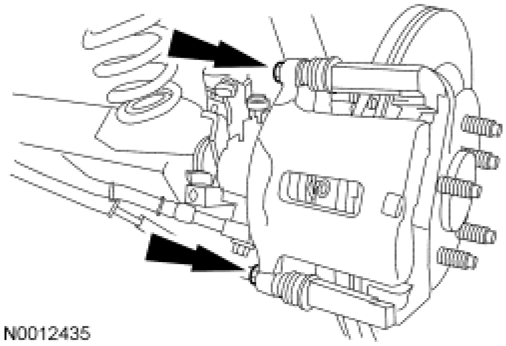


Fig. 9: Locating Brake Caliper Bolts
Courtesy of FORD MOTOR CO.

5. Slowly apply the brake pedal to extend the brake caliper piston outward.
6. Remove the 2 guide pin bolts and position the brake caliper aside.

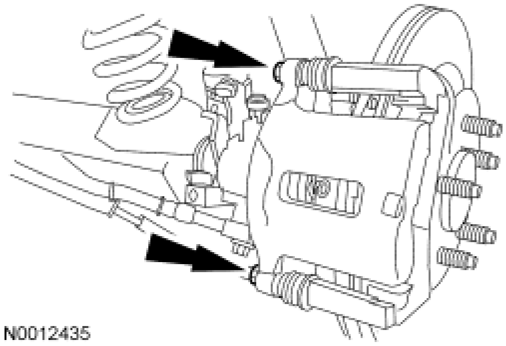


Fig. 10: Locating Brake Caliper Bolts
Courtesy of FORD MOTOR CO.

7. Remove the brake caliper bleeder screw cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

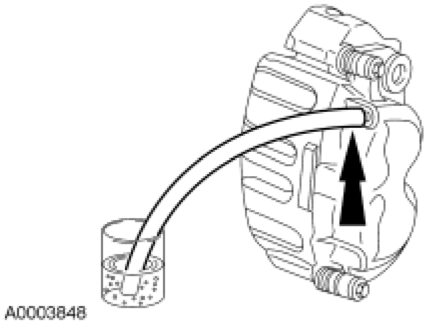


Fig. 11: Locating Rubber Drain Tube
Courtesy of FORD MOTOR CO.

8. Loosen the brake caliper bleeder screw.
9. Using the Rear Brake Caliper Piston Adjuster Adapter, fully retract the brake caliper piston and tighten the bleeder screw to specifications, refer to **SPECIFICATIONS**.

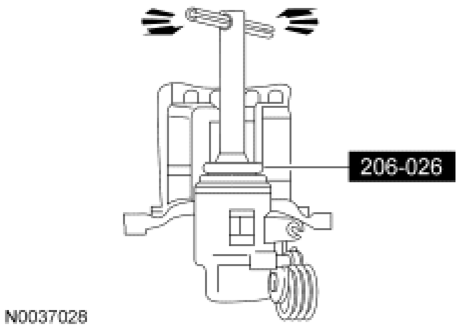


Fig. 12: Identifying Special Tools (206-026)
Courtesy of FORD MOTOR CO.

10. Repeat Steps 4 through 9 until clear, bubble free fluid comes out.
    - Refill the brake master cylinder reservoir as necessary.
    - Remove the rubber hose and install the bleeder screw cap.
11. Remove the 2 guide pin bolts and the shop towel.
12. Install the outer brake pad.

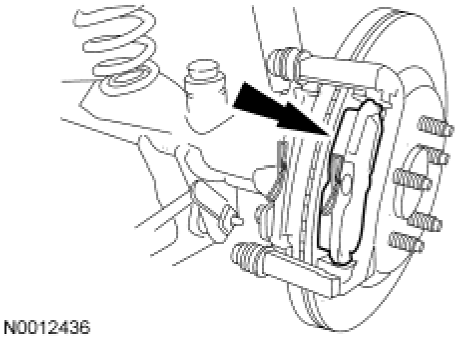


Fig. 13: Locating Outer Brake Pad
Courtesy of FORD MOTOR CO.

13. Position the brake caliper and install the 2 guide pin bolts.
    - Tighten to specifications, refer to **SPECIFICATIONS**.

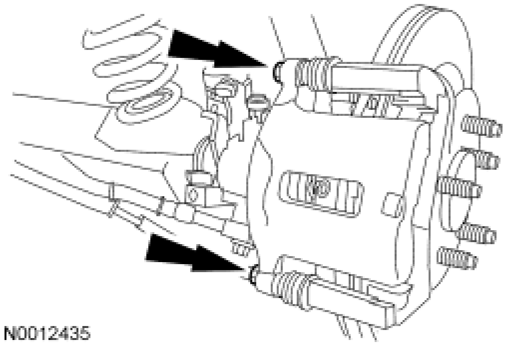


Fig. 14: Locating Brake Caliper Bolts
Courtesy of FORD MOTOR CO.

14. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

2008 ACCESSORIES & BODY, CAB

Bumpers - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Front bumper bolts	25	18	-
Front bumper nuts	25	18	-
Front bumper stud	15	-	133
Rear bumper bolts	25	18	-
Rear bumper nuts	25	18	-
Rear bumper stud	15	-	133

REMOVAL AND INSTALLATION

BUMPER - EXPLODED VIEW, FRONT

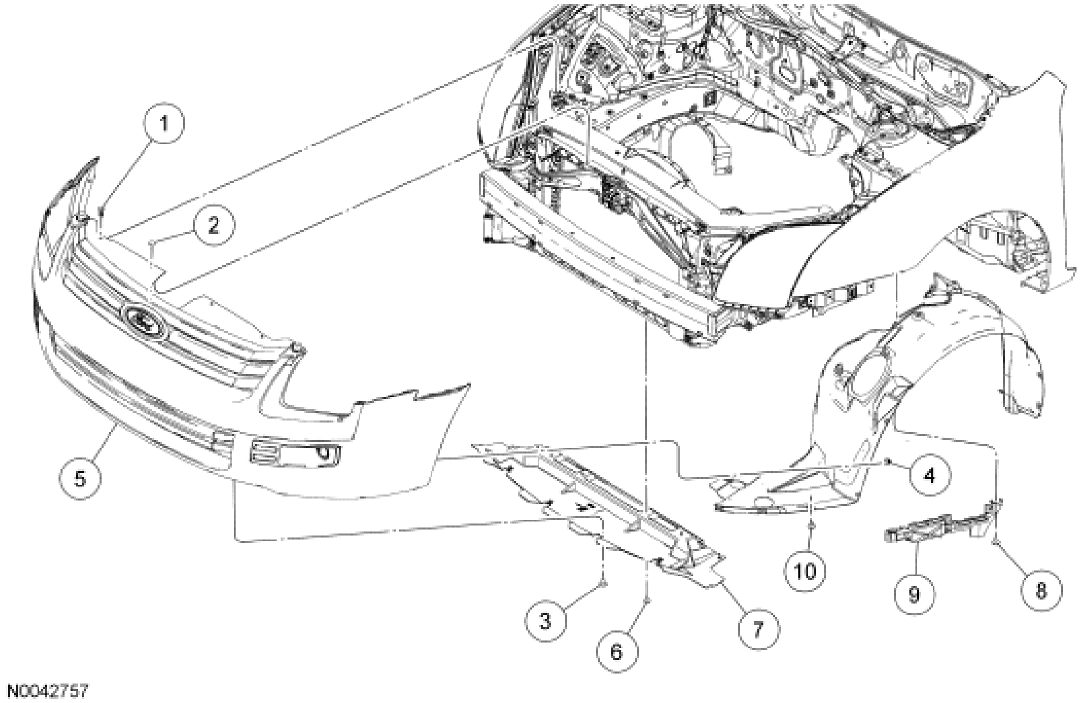


Fig. 1: Exploded View Of Front Bumper Components - Fusion
Courtesy of FORD MOTOR CO.

Item	Part Number	Description

1	W711685-S	Upper radiator grille bolt (2 required)
2	N807389-S	Upper radiator grille pin-type retainer (2 required)
3	W706805	Bumper cover air deflector bolt (4 required)
4	-	Splash shield pin-type retainer (6 required)
5	17D957	Front bumper cover
6	-	Air deflector screw (4 required)
7	8327	Lower air deflector
8	W706805	Bumper cover mounting bracket bolt
9	17C947	Bumper cover mounting bracket
10	-	Fender splash shield screw (8 required)

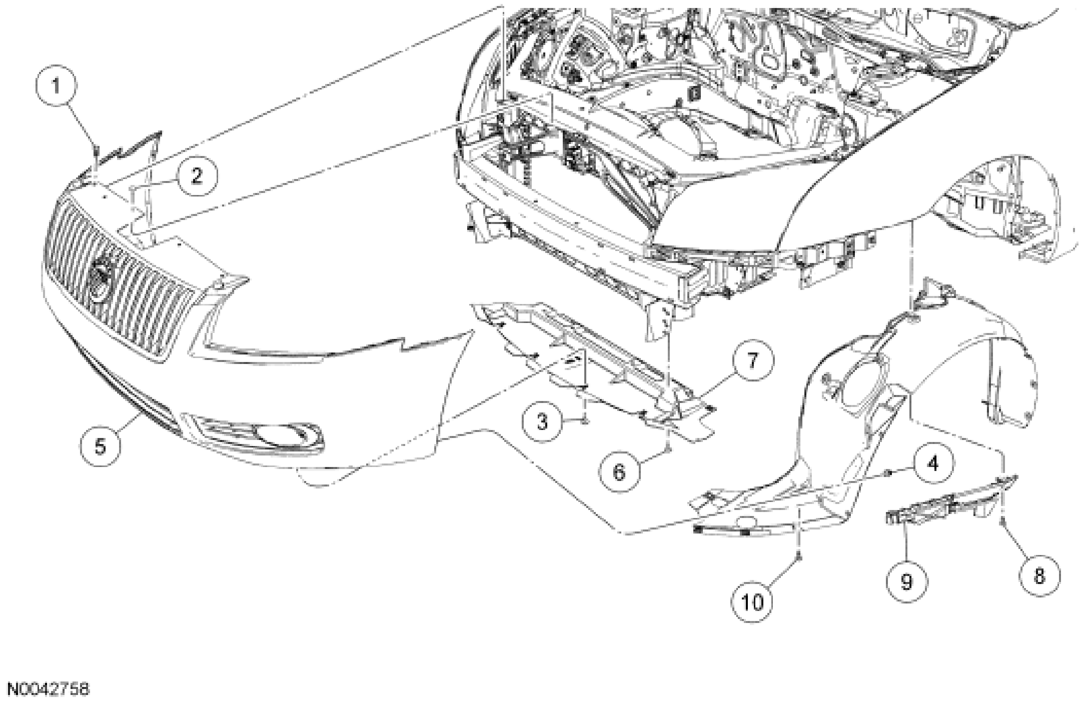


Fig. 2: Exploded View Of Front Bumper Components - Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711685-S	Upper radiator grille bolt (2 required)
2	N807389-S	Upper radiator grille pin-type retainer (2 required)
3	W706805	Bumper cover air deflector bolt (4 required)
4	-	Splash shield pin-type retainer (6

		required)
5	17D957	Front bumper cover
6	-	Air deflector screw (4 required)
7	8327	Lower air deflector
8	W706805	Bumper cover mounting bracket bolt
9	17C947	Bumper cover mounting bracket
10	-	Fender splash shield screw (8 required)

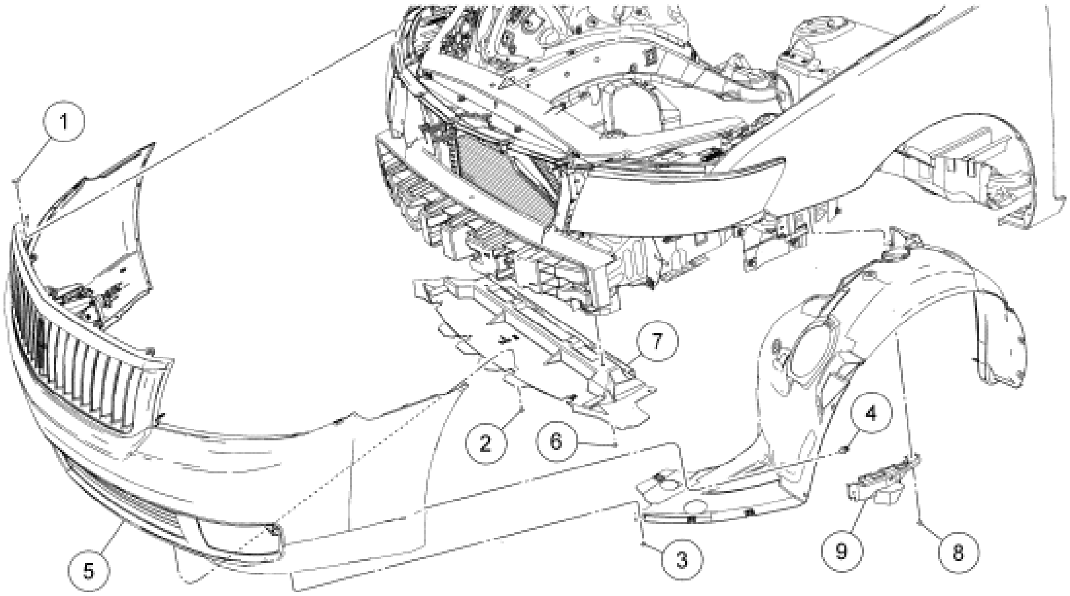


Fig. 3: Exploded View Of Front Bumper Components - MKZ
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711685-S	Upper radiator grille bolt (5 required)
2	W706805	Bumper cover air deflector bolt (4 required)
3	-	Fender splash shield screw (8 required)
4	-	Splash shield pin-type retainer (6 required)
5	17D957	Front bumper cover
6	-	Air deflector screw (4 required)
7	8327	Lower air deflector
8	-	Bumper cover mounting bracket bolt
9	17C947	Bumper cover mounting bracket

1. For additional information, refer to the procedures.

BUMPER COVER - FRONT

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the 6 pin-type retainers (3 each side).
3. Remove the 8 fender splash shield screws (4 each side).
4. Remove the 4 air deflector bolts.

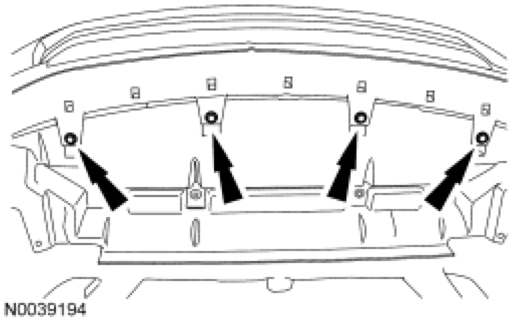


Fig. 4: Locating Air Deflector Bolts
Courtesy of FORD MOTOR CO.

5. If equipped, disconnect the fog lamp electrical connectors.

MKZ only

6. Remove the 5 bolts from the top of the radiator grille.

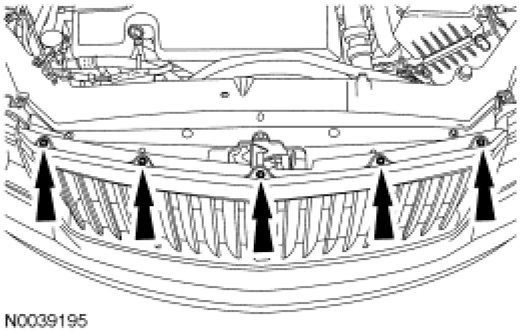


Fig. 5: Locating Radiator Grille Bolts
Courtesy of FORD MOTOR CO.

Fusion and Milan only

7. Remove the 2 bolts and the 2 pin-type retainers from the top of the radiator grille.

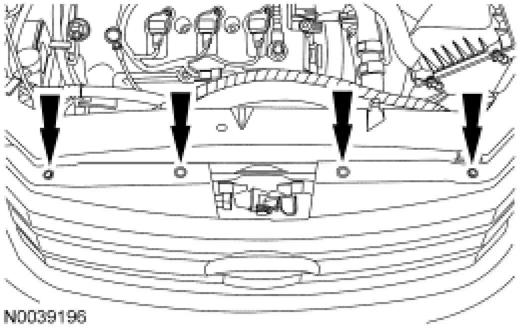


Fig. 6: Locating Pin-Type Retainers From Top Of Radiator Grille Bolts
Courtesy of FORD MOTOR CO.

8. Remove the side marker lamp. For additional information, refer to **EXTERIOR LIGHTING** article.
9. Release the tabs on the bumper cover mounting bracket.

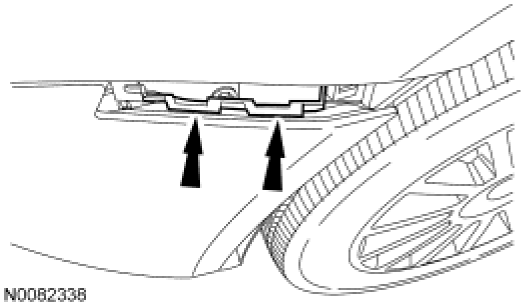


Fig. 7: Locating Tabs On Bumper Cover Mounting Bracket
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: The rearward upper portion of the bumper cover must be pulled outward to unclip it from the bumper cover mounting bracket.

10. Remove the front bumper cover.
11. To install, reverse the removal procedure.

BUMPER - FRONT

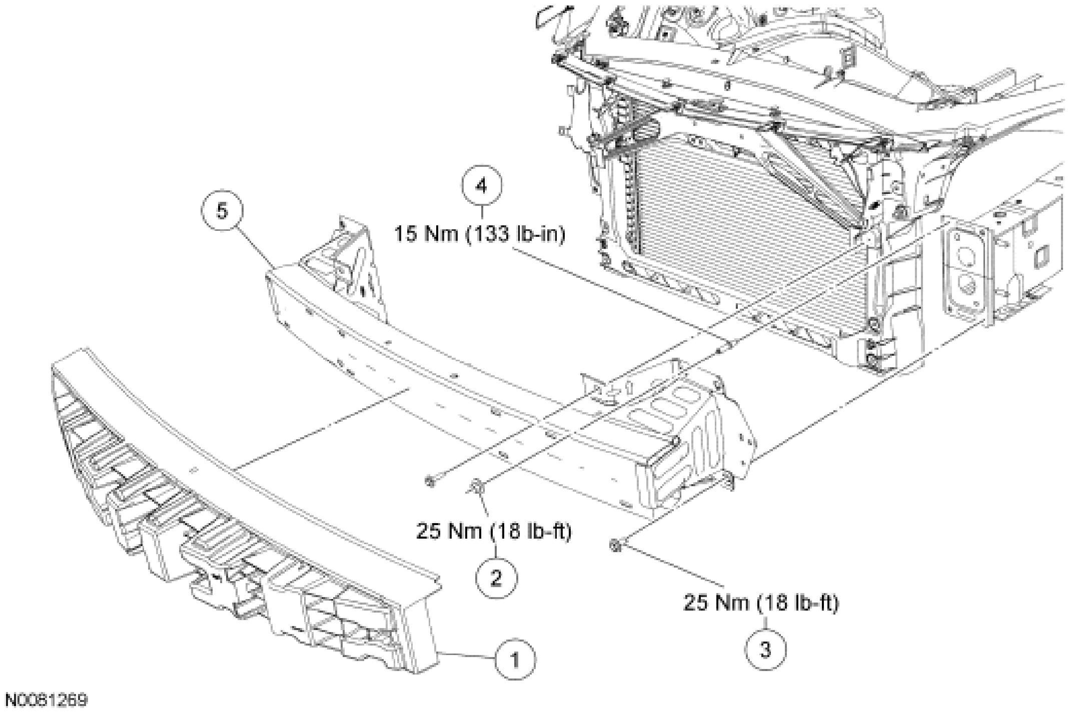


Fig. 8: Exploded View Of Front Bumper With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	17E898	Front bumper isolator
2	N621940-S	Front bumper stud nut (2 required
3	N811479-S	Front bumper mounting bolt (6 required)
4	N808889-S	Front bumper stud (2 required)
5	17757	Front bumper

REMOVAL AND INSTALLATION

1. Remove the front bumper cover. For additional information, refer to **Bumper Cover - Front**.
2. Remove the front bumper isolator from the front bumper.
   - Pull the isolator rearward while releasing the retainers.
3. Remove the 6 front bumper bolts (3 each side).
   - To install, tighten to 25 N.m (18 lb-ft).
4. Remove the 4 front bumper bolts (2 each side) from the radiator support.
5. Remove the 2 front bumper stud nuts.
   - To install, tighten to 25 N.m (18 lb-ft).
6. Remove the front bumper.
7. To install, reverse the removal procedure.

BUMPER - EXPLODED VIEW, REAR

NOTE: **Fusion shown, Milan and MKZ similar.**

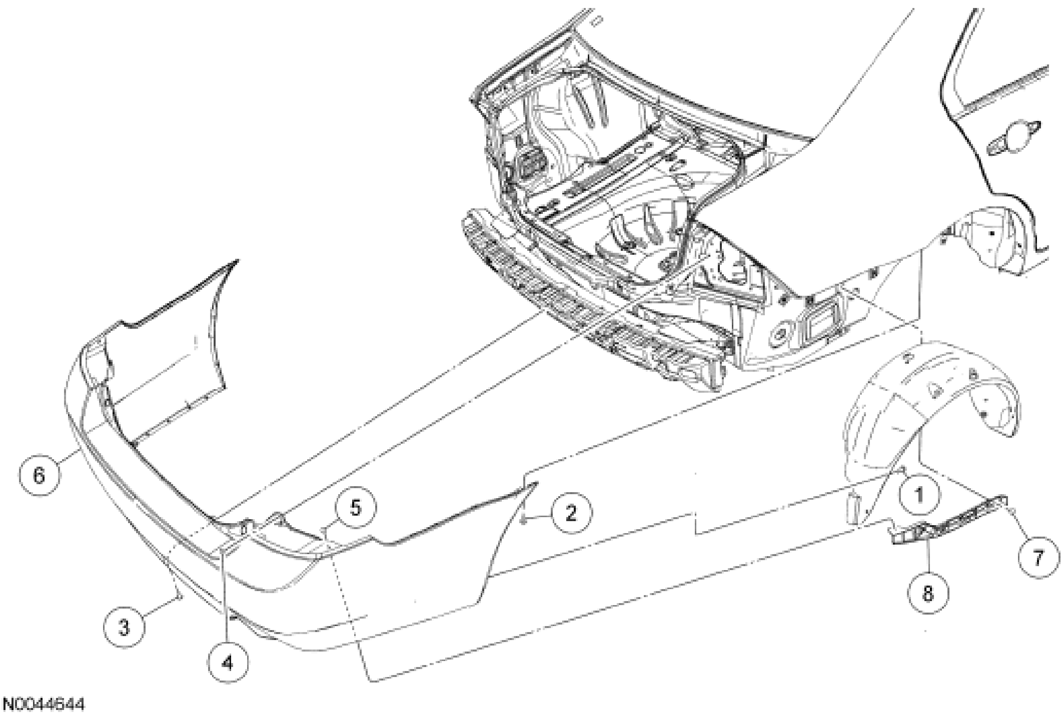


Fig. 9: Exploded View Of Rear Bumper
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Splash shield pin-type retainer (6 required)
2	W706805-S	Upper bumper cover screw (2 required)
3	N807389-S	Lower rear bumper cover pin-type retainer (2 required)
4	W505165-S	Bumper cover bolt (2 required)
5	N807389-S	Bumper cover pin-type retainer (2 required)
6	-	Rear bumper cover
7	W505154-S	Rear bumper cover mounting bracket bolt (2 required)
8	-	Rear bumper cover mounting bracket

1. For additional information, refer to the procedures.

BUMPER COVER - REAR

REMOVAL AND INSTALLATION

All vehicles

1. Remove the rear lamp assembly. For additional information, refer to **EXTERIOR LIGHTING** article.
2. Remove the 6 pin-type retainers (3 each side) from the rear splash shield.
3. Remove the 2 pin-type retainers from the lower rear bumper cover.

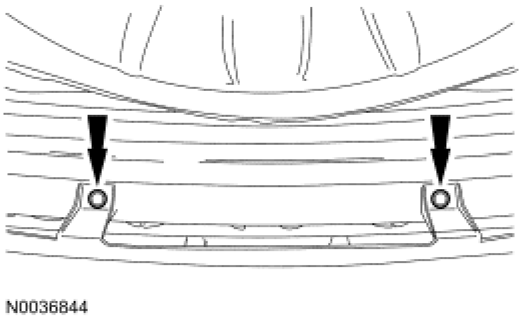


Fig. 10: Locating Pin-Type Retainers From Lower Rear Bumper Cover
Courtesy of FORD MOTOR CO.

4. Remove the 2 bolts and 2 pin-type retainers from the top of the rear bumper cover.
   1. Remove the 2 bolts (1 shown).
   2. Remove the 2 pin-type retainers (1 shown).

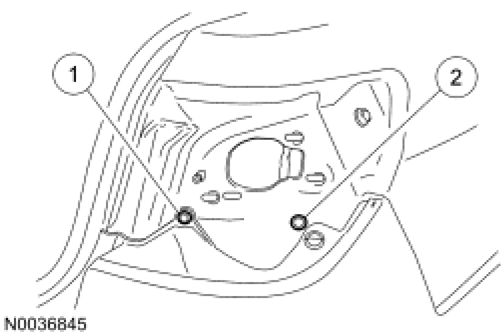


Fig. 11: Identifying Pin-Type Retainers And Bolts
Courtesy of FORD MOTOR CO.

5. Remove the 2 upper bumper cover screws (1 each side).
6. If equipped, disconnect the parking aid system electrical connector.

   Milan and MKZ only

7. Disconnect the license plate lamp electrical connector.

   All vehicles

8. Remove the rear bumper cover.

9. To install, reverse the removal procedure.

BUMPER - REAR

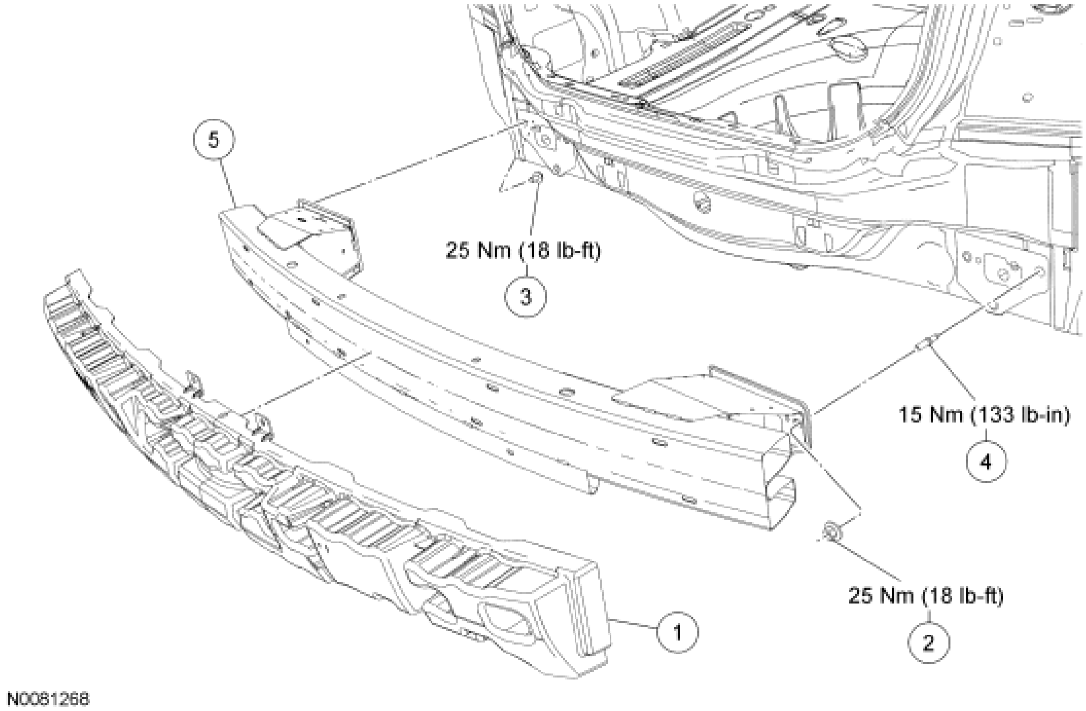


Fig. 12: Exploded View Of Rear Bumper With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	17E899	Isolator rear bumper
2	N621940-S	Rear bumper stud nut (4 required)
3	N811479-S	Rear bumper bolt (2 required)
4	N808889-S	Rear bumper stud (4 required)
5	17775	Rear bumper

REMOVAL AND INSTALLATION

1. Remove the rear bumper cover. For additional information, refer to **Bumper Cover - Rear**.
2. Remove the rear bumper isolator from the rear bumper.
   - Pull the isolator rearward to remove it from the retaining pins.
3. Remove the 4 rear bumper nuts.
   - To install, tighten to 25 N.m (18 lb-ft).
4. Remove the 2 rear bumper bolts.
   - To install, tighten to 25 N.m (18 lb-ft).
5. Remove the rear bumper.

6. To install, reverse the removal procedure.

CABIN AIR FILTER

Cabin Air Filter (Special Applications) - General Information

CABIN AIR FILTER APPLICATIONS

NOTE: This article is generic in nature and applies to many different makes and models. We do our best to determine which vehicles do and do not have a cabin air filter.

The vehicle you have selected may not be equipped with a factory-installed cabin air filter or the manufacturer does not provide a removal & installation procedure.

Some vehicles may be equipped with dealer add-on or aftermarket versions. If the vehicle you are working on is equipped with such a filter, check the availability of the replacement filter which may help with the location and replacement information as some include this information in the packaging.

Vehicle manufacturers have many names for these filters including:

- A/C Air Filter
- A/C Filter
- Activated Charcoal Filter
- Air Conditioner Filter
- Air Refiner Filter
- Cabin Air Filter
- Clean Air Filter
- Climate Control Air Filter
- Combination Filter
- Dust & Pollen Filter
- Dust Filter
- Evaporator Air Filter
- HVAC Air Filter
- HVAC Ventilation Filter
- In-Cabin Microfilter
- Microfilter
- Particle Filter
- Particle/Odor Filter
- Particulate Air Filter
- Passenger Compartment Air Cleaner
- Passenger Compartment Air Filter
- Pollen Filter

- Underhood Air Filter
- Ventilation Air Filter

2008 GENERAL INFORMATION

Charging System - General Information - Fusion, Milan & MKZ

SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Battery	
Voltage	12 volt
Generator, 2.3L	
Rating	90/150 amp (max) @ 1,800-6,000 generator RPM, approximately 700-2,500 engine RPM
Generator, 3.0L and 3.5L	
Rating	90/150 amp (max) @ 1,800-6,000 generator RPM, approximately 500-2,000 engine RPM

DESCRIPTION AND OPERATION

CHARGING SYSTEM

The charging system consists of the following:

- Generator
- Charging system warning indicator
- Necessary wiring and cables

The charging system is a negative ground system. The generator (including an internal voltage regulator) is belt-driven by the engine accessory drive system. When the engine is started, the generator begins to generate AC, which is internally converted to DC. This current is then supplied to the vehicle electrical system through the output (B+) terminal of the generator.

Battery

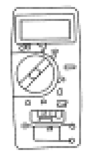
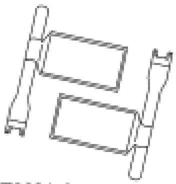
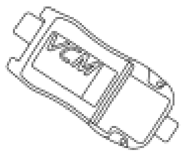
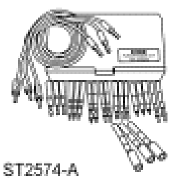
The battery is a 12V DC source connected in a negative ground system. The battery case is sealed with 2 vent holes to release gases. The battery has 3 major functions:

- Engine cranking power source
- Voltage stabilizer for the electrical system
- Temporary power source when electrical loads exceed the generator output current

DIAGNOSTIC TESTS

CHARGING SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2621-A	SABRE Premium Battery and Electrical System Tester	010-00736 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025B

Principles of Operation

The PCM controlled charging system determines the optimal voltage set point for the charging system and communicates this information to the voltage regulator. This system is unique in that it has 2 unidirectional communication circuits between the PCM and the generator/regulator. Both of these communication circuits are pulse-width modulated (PWM). The generator communication (GENCOM) circuit communicates the desired set point from the PCM to the voltage regulator. The generator monitor (GENMON) circuit communicates the generator load and error conditions to the PCM. The third circuit on the voltage regulator, the A circuit, is a dedicated battery voltage sense circuit.

The charging system voltage is controlled by the PCM. The generator charges the battery, and at the same time supplies voltage for all of the electrical loads that are required. The battery is more effectively charged with a higher voltage when the battery is cold and a lower voltage when the battery is warm. The PCM is able to adjust the charging voltage according to the battery temperature by using a signal from the intake air temperature (IAT) sensor. This means the voltage set point is calculated by the PCM and communicated to the regulator by the GENCOM circuit.

The PCM simultaneously controls and monitors the output of the generator. When the current consumption is high or the battery is discharged (the PCM recognizes this and increases the output of the generator to accommodate), the system is also able to increase the idle speed.

To minimize the engine drag when starting the engine, the PCM does not allow the generator to produce any output until the engine has started. The PCM then progressively increases the output of the generator.

The PCM is responsible for turning the charging system warning indicator off after the engine is started and illuminating it under fault conditions (when the generator is not generating the correct amount of current/voltage with the engine running). The charging system warning indicator is also illuminated by the PCM whenever the key is ON with the engine OFF.

This is a System 4 charging system, which uses the GENMON and GENCOM circuits to control and monitor the charging system through the PCM. System 4 charging systems are virtually identical in design and therefore, share the same diagnostics. The circuit numbers and colors may be different, but the functions are the same. System 4 charging systems may use any type of generator, as the generator type usually depends on the engine packaging and/or output requirements versus cost.

Inspection and Verification

WARNING: **Batteries contain sulfuric acid and produce explosive gases. Work in a well-ventilated area. Do not allow the battery to come in contact with flames, sparks or burning substances. Avoid contact with skin, eyes or clothing. Shield eyes when working near the battery to protect against possible splashing of acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes, then get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always lift a plastic-cased battery with a battery carrier or with hands on opposite corners. Excessive pressure on the battery end walls may cause acid to flow through the vent caps, resulting in personal injury and/or damage to the vehicle or battery.**

CAUTION: Do not make jumper connections except as directed. Incorrect connections may damage the voltage regulator test terminals, fuses or fusible links.

CAUTION: Do not allow any metal object to come in contact with the generator housing and internal diode cooling fins. A short circuit may result and burn out the diodes.

NOTE: While carrying out any pinpoint test, disregard any DTCs set while following a specific pinpoint test. After the completion of a test, be sure to clear all DTCs in the PCM.

NOTE: All voltage measurements are referenced to the negative (-) battery post unless otherwise specified.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Battery • Generator drive belt • Generator pulley	• Circuitry • Fusible links • Cables • Generator • PCM • Charging system warning indicator

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. Verify the battery condition. Refer to **BATTERY, MOUNTING AND CABLES** article.
5. Check the operation of the charging system warning indicator at the instrument cluster (IC). Normal operation is as follows:
   - With the key OFF, the charging system warning indicator should be off.
   - With the key ON and the engine OFF, the charging system warning indicator should be on.
   - With the engine running, the charging system warning indicator should be off.
6. Turn off the headlamps and the A/C system (if equipped). Turn the climate control blower to low/off. Check the battery voltage before and after starting the engine to determine if the battery voltage increases.

NOTE: Make sure to use the latest scan tool software release.

7. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

8. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
9. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.

10. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record continuous memory DTCs.
11. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM and the IC.
12. If the DTCs retrieved are related to the concern, go to the DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
13. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

NOTE: DTC P0622 can be set by the loss of the communication lines between the generator and the PCM. The charging system warning indicator then illuminates until the engine is operated at greater than 4,500 RPM (approximately wide open throttle [WOT]) for a minimum of 3 seconds. At this time, the generator self-excites. The charging system warning indicator remains illuminated, and the generator operates in a default mode (approximately 13.5 volts) until the engine is turned off.

DTC CHART

DTCs	Description	Source	Action
B1317	Battery Voltage High	Various Modules	Go to **Pinpoint Test B**.
B1318	Battery Voltage Low	Various Modules	Go to **Pinpoint Test F**.
B1676	Battery Voltage Out Of Range	Various Modules	Go to **Pinpoint Test F**.
P0563	System Voltage High	PCM	Go to **Pinpoint Test B**.
P0620	Generator Control Circuit	PCM	Go to **Pinpoint Test B**.
P0625	Generator Field Terminal Circuit - Low	PCM	Go to **Pinpoint Test B**.
P0626	Generator Field Terminal Circuit - High	PCM	Go to **Pinpoint Test B**.
P065B	Generator Control Circuit Range/Performance	PCM	Go to **Pinpoint Test B**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
	• High key-off current drain(s) • Engine, generator and battery grounds	

• The battery is discharged or battery voltage is low	• Positive battery cable • Circuitry • Battery • Generator	• Go to **Pinpoint Test A**.
• The charging system warning indicator is on with the engine running and no charging system DTCs present	• Circuitry • PCM • Generator • Instrument cluster (IC)	• Go to **Pinpoint Test C**.
• The generator is noisy	• Accessory drive belt • Loose bolts/brackets • Generator/pulley	• Go to **Pinpoint Test D**.
• Radio interference	• Generator • Circuitry • In-vehicle entertainment system	• Go to **Pinpoint Test E**.

Pinpoint Tests

CAUTION: Electronic modules are sensitive to electrostatic discharge. If exposed to these charges, damage can result.

Refer to Inspection and Verification, the PCM DTC Chart and the Symptom Chart for direction to the appropriate pinpoint test.

Pinpoint Test A: The Battery is Discharged or Battery Voltage is Low

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Charging System for schematic and connector information.

Normal Operation

The generator output voltage is supplied through the positive battery output (B+), circuit SDC14 (RD) terminal on the rear of the generator to the battery and electrical system. During normal operation the charging system warning indicator is off with the key in the ON position and the engine running. The charging system warning indicator is on with the key in the ON position and the engine off.

This pinpoint test is intended to diagnose the following:

- High key-off current drain(s)
- Engine, generator and battery grounds
- Positive battery cable
- Circuit SDC14 (RD) high resistance

- Battery
- Generator

PINPOINT TEST A: THE BATTERY IS DISCHARGED OR BATTERY VOLTAGE IS LOW

A1 CHECK THE BATTERY CONDITION

- Carry out the Battery - Condition Test to determine if the battery can hold a charge and is OK for use. Refer to **BATTERY, MOUNTING AND CABLES** article.
- **Does the battery pass the condition test?**

  YES : Go to A2.

  NO : INSTALL a new battery. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

A2 CHECK THE GENERATOR OUTPUT

- Carry out the Generator On-Vehicle Load Test and No Load Test. Refer to the Component Tests in this article.
- **Does the generator pass the component tests?**

  YES : Go to A3.

  NO : REFER to Pinpoint Test B.

A3 CHECK FOR CURRENT DRAINS

- Carry out the Battery - Drain Testing. Refer to the Component Tests in this article.
- **Are any circuits causing excessive current drains?**

  YES : REPAIR as necessary. TEST the system for normal operation.

  NO : Go to A4.

A4 CHECK THE VEHICLE GROUNDS

- Key in START position.

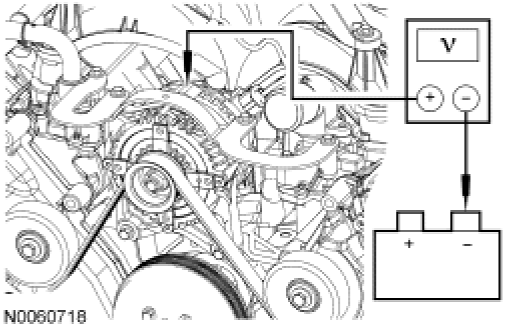


Fig. 1: Checking Vehicle Grounds
Courtesy of FORD MOTOR CO.

- With the engine running, measure the voltage drop between the generator housing and the negative battery terminal.
- **Is the voltage drop less than 0.1 volt?**

  YES : Go to A5.

NO : CHECK the engine ground, generator ground and the battery ground for corrosion. TEST the system for normal operation.

A5 CHECK THE VOLTAGE DROP IN THE B+ CIRCUIT SDC14 (RD)

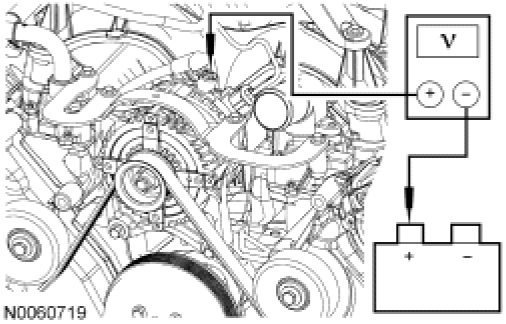


Fig. 2: Checking Voltage Drop In B+ Circuit SDC14 (RD)
Courtesy of FORD MOTOR CO.

- With the engine running, measure the voltage drop between generator B+ C102b, circuit SDC14 (RD) and the positive battery terminal.
- **Is the voltage drop less than 0.5 volt?**

  YES : CHECK if the customer left any electrical system(s) on or if there is an intermittent excessive battery draw. TEST the system for normal operation.

  NO : CHECK for any corrosion in the B+ SDC14 (RD), positive battery cable and/or connections. REPAIR as necessary. TEST the system for normal operation.

Pinpoint Test B: The Charging System Warning Indicator is On and Any Charging System DTC Stored

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Charging System for schematic and connector information.

Normal Operation

With the engine running, the charging system warning indicator is off. The sense A circuit SBB17 (RD) to the generator field coil is 13-15 volts. This voltage feedback is used by the regulator to maintain the battery voltage at the desired set point. The S (stator) circuit (internal to the generator) is used to monitor generator operation. This circuit and other regulator internal conditions are checked by the regulator to allow the PCM to turn off the charging system warning indicator by sending a message over the controller area network (CAN) bus to the instrument cluster (IC). The positive battery output (B+) circuit SDC14 (RD) is the generator output voltage supplied to the battery and electrical system.

This pinpoint test is intended to diagnose the following:

- Generator
- PCM

PINPOINT TEST B: THE CHARGING SYSTEM WARNING INDICATOR IS ON AND ANY CHARGING SYSTEM DTC

STORED

NOTE: **Make sure battery voltage is greater than 12.2 volts prior to carrying out this pinpoint test.**

NOTE: **Do not have a battery charger attached during vehicle testing.**

B1 CONFIRM THE BATTERY CONDITION

- Carry out the Battery Condition Test. Refer to **BATTERY, MOUNTING AND CABLES** article.
- **Is the battery OK?**

  YES : Go to B2.

  NO : CORRECT the battery condition and Go to B2.

B2 CHECK THE BATTERY JUNCTION BOX (BJB) FUSE F17 (10A)

- Check the fuse: BJB F17 (10A)
- **Is BJB fuse F17 (10A) OK?**

  YES : Go to B3.

  NO : REPAIR circuit SBB17 (RD) and INSTALL a new fuse. INSPECT PCM and engine ground circuits and make sure they are securely attached. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B3 CHECK THE GENERATOR B+ CONNECTION

- Key in OFF position.
- Inspect generator C102b, B+ circuit SDC14 (RD) connection. Connection should be tight.

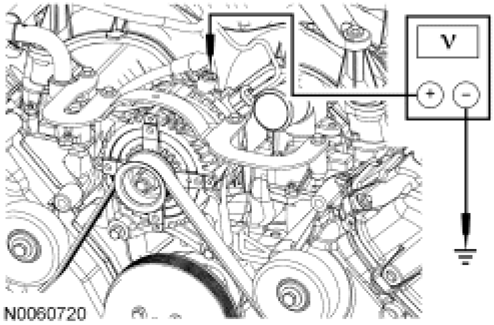


Fig. 3: Checking Generator B+ Connection
Courtesy of FORD MOTOR CO.

- Measure the voltage between generator C102b, B+ circuit SDC14 (RD) and ground.
- **Is generator C102b connection tight and does the generator B+ measure battery voltage?**

  YES : Go to B4.

  NO : TIGHTEN the generator B+ connection or REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B4 MONITOR THE PCM PID GENERATOR MONITOR WITH KEY ON/ENGINE OFF (KOEO)

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Clear the PCM DTCs
- Enter the following diagnostic mode on the diagnostic tool: Select PCM PIDs

  NOTE: Many of the PCM PIDs selected will be monitored later in this pinpoint test.

  Select and monitor the following PCM PIDs:

  - Generator Monitor (GENMON).
  - Generator Command Duty Cycle (GENCMD).
  - Generator Voltage Desired (GENVDSD).
  - Generator Fault Indicator Lamp (GENFIL).
  - Engine Revolutions Per Minute (RPM).
  - Module Supply Voltage (VPWR).
- Monitor the GENMON PID.
- **Does the GENMON PID read 0%?**

  YES : Go to B5.

  NO : Go to B8.

B5 MONITOR THE PCM PID GENERATOR MONITOR WITH KEY ON/ENGINE RUNNING (KOER)

- Key in START position.
- With the engine at idle, wait 15 seconds for the GENVDSD PID to increase to greater than 13 volts.
- Monitor PID GENMON at idle and 3,000 RPM.
- **Does the GENMON PID read between 3% and 98% at engine idle speed and at 3,000 RPM?**

  YES : Go to B6.

  NO : Go to B8.

B6 MONITOR THE PCM PIDs GENERATOR MONITOR, MODULE SUPPLY VOLTAGE AND GENERATOR DESIRED VOLTAGE WITH THE ENGINE AT 3,000 RPM

- Turn all electrical accessories (lights, blower motor, etc.) off.

  NOTE: If GENMON PID does not remain below 85%, make sure that the battery is at an acceptable state of charge and that all electrical accessories are off.

- Increase the engine speed to 3,000 RPM (or road test).
- **Does the VPWR PID remain within ± 0.5 volt of the GENVDSD PID when the GENMON PID is less than 85%?**

  YES : Go to B7.

  NO : Go to B17.

B7 MONITOR THE PCM PIDs GENERATOR MONITOR, MODULE SUPPLY VOLTAGE AND GENERATOR DESIRED VOLTAGE WITH THE ENGINE AT IDLE

- Return the engine speed to idle.

CAUTION: On vehicles with low electrical loads, it may be necessary to add external loads (devices connected to power points, etc.) to determine the maximum GENMON value. GENMON value will not read between 95%-98% on a vehicle with minimal electrical accessories. As long as there is a significant increase in the GENMON PID following the procedure below, answer YES to the question.

- Determine the maximum GENMON PID value by lowering engine idle RPM to 500 RPM or less using output state control and turn on all electrical accessories until the VPWR PID is less than the GENVDSD PID by at least 0.7 volt. Under this condition the GENMON PID should read between 95% and 98%.
- **Does the GENMON PID read between 95% and 98%?**

  YES : Go to B19.

  NO : Go to B17.

B8 CHECK THE VOLTAGE OUTPUTS FROM THE PCM

- Key in OFF position.
- Disconnect: Generator C102a
- Key in ON position.
- Measure the voltage of the following circuits:

EXPECTED VOLTAGES

Generator Connector	Circuit	Expected Voltage (Approximate)
C102a-1	CDC15 (VT)	8-11 volts (should be less than battery voltage)
C102a-2	CDC10 (BU/OG)	0 volts
C102a-3	SBB17 (RD)	Battery voltage

- **Are the voltages as indicated for each circuit?**

  YES : Go to B13.

  NO : If a fault is detected in the GENCOM circuit CDC10 (BU/OG) or GENMON circuit CDC15 (VT), go to B9.

If a fault is detected in the A sense SBB17 (RD) circuit, go to B12.

B9 CHECK CIRCUITS CDC10 (BU/OG) AND CDC15 (VT) FOR DAMAGE OR AN OPEN

- Key in OFF position.
- Disconnect: Generator C102a
- Disconnect: PCM C175e
- Inspect the following for damaged or pushed-out pins:

Component	Connector	Circuit
PCM	C175e-13	CDC10 (BU/OG)
PCM	C175e-26	CDC15 (VT)
Generator	C102a-2	CDC10 (BU/OG)
Generator	C102a-1	CDC15 (VT)

- Measure the resistance between circuit C175e-13 and C102a-2 and circuit C175e-26 and C102a-1.
- **Are the connectors and pins free of damage and are the resistances less than 5 ohms?**

  YES : Go to B10.

  NO : REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B10 CHECK CIRCUITS CDC10 (BU/OG) AND CDC15 (VT) FOR SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between circuits C102a-1, CDC15 (VT) and C102a-2, CDC10 (BU/OG).
- **Are the voltages approximately 0 volt?**

  YES : Go to B11.

  NO : REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B11 CHECK CIRCUITS CDC10 (BU/OG) AND CDC15 (VT) FOR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between circuit C102a-1, CDC15 (VT) harness side and ground and C102a-2, CDC10 (BU/OG) harness side and ground and also measure resistance. between each other:
- **Are the resistances less than 5 ohms?**

  YES : Go to B24.

  NO : REPAIR the affected circuits. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B12 CHECK CIRCUIT SBB17 (RD) FOR DAMAGE OR AN OPEN

- Key in OFF position.
- Disconnect: Generator C102a

- Inspect C102a-3 for damaged or pushed-out pins.
- Measure the resistance of the circuit A sense circuit SBB17 (RD) between the battery and C102a-3 generator connector.
- **Are the connectors and pins free of damage and are the resistances less than 5 ohms?**

  YES : Go to B24.

  NO : REPAIR the affected circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B13 CHECK FOR SHORTED CIRCUITS

- Key in OFF position.
- Disconnect: Generator C102a
- Verify that PID GENMON reads 100%.
- Carry out the Wiggle Test of wiring to determine if PID GENMON changes from 100%.
- **Does PID GENMON change from 100%?**

  YES : REPAIR short circuit on CDC15 (VT) C102a-1.

  NO : Go to B14.

B14 CHECK THE PCM PID GENERATOR MONITOR INPUT TO THE PCM

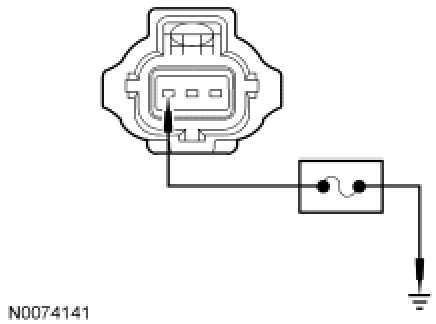


Fig. 4: Connecting PCM PID Generator Monitor Input To PCM
Courtesy of FORD MOTOR CO.

- Connect a fused (10A) jumper wire between generator C102a-1, circuit CDC15 (VT), harness side and ground.
- Key in ON position.
- Monitor the GENMON PID while performing a wiggle test on the wire harness.
- **Does the GENMON PID read 0%?**

  YES : Go to B15.

  NO : REPAIR open connection on circuit CDC15 (VT). INSPECT generator C102a-1 and PCM C175b-23 for damage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B15 COMPARE THE PCM PIDS GENERATOR MONITOR AND GENERATOR FIELD DUTY CYCLE

- Key in OFF position.

- Disconnect: Fused (10A) Jumper Wire

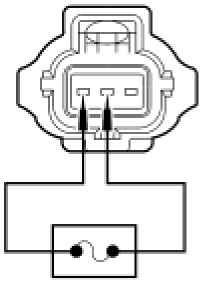


Fig. 5: Connecting PCM PIDS Generator Monitor & Generator Field Duty Cycle
Courtesy of FORD MOTOR CO.

- Connect a fused (10A) jumper wire between generator C102a-1, circuit CDC15 (VT), harness side and generator C102a-2, circuit CDC10 (BU/OG), harness side.
- Key in ON position.
- Monitor the GENMON and GENCMD PIDs while performing a wiggle test on the harness.
- **Does the GENMON PID read within 2% of the GENCMD PID?**

  YES : Go to B16.

  NO : INSPECT C175b-66, circuit 120 (BK/GN), PCM ground circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B16 A SENSE CIRCUIT LOAD TEST

NOTE:	**This step puts a load on the A sense circuit. If there are corroded or loose connections, loading the circuit may help show the fault.**

- Key in ON position.
- Using a 12-volt test lamp, check for voltage at C102a-3, circuit SBB17 (RD).
- **Does the test lamp illuminate?**

  YES : Go to B23.

  NO : REPAIR connection on circuit SBB17 (RD). INSPECT generator C102a-3 for damage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B17 CHECK THE PCM VPWR PID

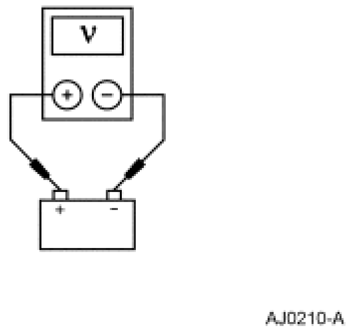


Fig. 6: Checking Charging System Voltage
Courtesy of FORD MOTOR CO.

- With the engine running, measure the battery voltage.
- Monitor the VPWR PID.
- **Are the battery voltage and VPWR PID within 0.5 volt of each other?**

  YES : Go to B19.

  NO : Go to B18.

B18 MEASURE THE PCM INPUT VOLTAGE

- Key in OFF position.
- Disconnect: PCM C175b
- Connect a fused (10A) jumper wire between PCM C175b-35, circuit CE302 (YE/BU) and ground.
- Key in ON position.

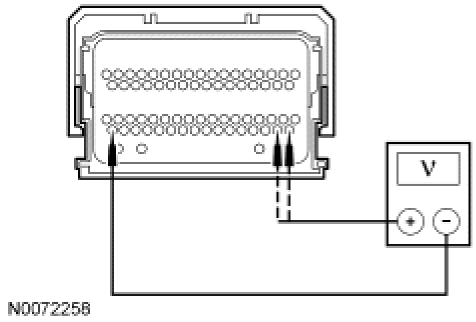


Fig. 7: Measuring PCM Input Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between PCM input voltage pins 51 and 52 to PCM ground pin 66.
- **Are voltages within 0.5 volt of PID VPWR?**

  YES : Go to B24.

  NO : REPAIR high resistance or loose connections between C175b-51 circuit CBP47 (GN/BU), C175b-52 circuit CBP47 (GN/BU) PCM power circuits or C175b-66, circuit GD120 (BK/GN), PCM ground circuit.

B19 CHECK THE GENERATOR B+ RESISTANCE

- Key in OFF position.
- Disconnect: Battery
- Disconnect: Generator C102b

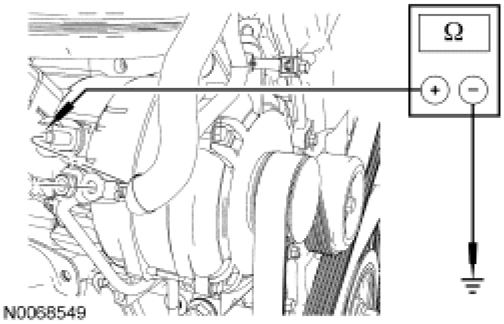


Fig. 8: Checking Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between generator C102b, component side and the generator housing.
- **Is the resistance greater than 125K ohms?**

  YES : Go to B20.

  NO : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B20 CHECK THE RESISTANCE OF THE VOLTAGE REGULATOR INTERNAL CIRCUITS TO GROUND

- Measure the resistance between generator C102a, component side and ground. Refer to the following table.

Pin	Expected Resistance
1	Greater than 1000K ohms
2	Greater than 125K ohms
3	Greater than 125K ohms

- **Are the resistance values as indicated?**

  YES : Go to B21.

  NO : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B21 ROAD TEST IN AN ATTEMPT TO VERIFY THE FAULT

- Connect: Generator C102b
- Connect: Generator C102a
- Connect: Battery
- Carry out a road test and monitor the following PIDs:
  - Generator monitor GENMON.
  - Generator voltage desired (GENVDSD).
  - Module supply voltage (VPWR).
- **Does the GENMON PID read either 0% or 100% during the road test?**

  YES : Go to B2.

  NO : If a road test did not cause the fault to occur, intermittent fault condition may be present. Go to B22.

B22 USE THE VEHICLE DATA RECORDER (VDR) TO CAPTURE INTERMITTENT FAULT CONDITION

- Connect a VDR to the vehicle and setup to capture the following PIDs:
  - Generator monitor (GENMON).
  - Generator command duty cycle (GENCMD).
  - Generator voltage desired (GENVDSD).
  - Generator fault indicator lamp (GENFIL).
  - Engine revolutions per minute (RPM).
  - Module supply voltage (VPWR).
- Set the VDR to trigger if any of the following events occur during vehicle operation (waiting 15 seconds after start):
  - VPWR PID reads greater than 15.2 volts.
  - GENMON PID reads 0% or 100%.
- Road test the vehicle.
- **Was a fault captured by the VDR?**

  YES : RECORD any values from the VDR that may have been captured. If no charging system DTCs are present, go to **Pinpoint Test C**. If any charging system DTCs are present, go to B3.

  NO : No problem found at this time. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B23 CHECK THE CHARGING SYSTEM CIRCUITS FOR INTERMITTENT FAULTS

- Key in OFF position.
- Connect: Generator C102b
- Connect: Generator C102a
- Connect: PCM C175b
- Connect the diagnostic tool.
- Key in START position.
- With the engine running, monitor the charging system warning indicator lamp and the scan tool for

DTCs.

- **Does the charging system warning indicator lamp illuminate and does any charging system DTC get stored into memory?**

  YES : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : The fault is not present and cannot be recreated at this time. This may indicate an intermittent fault. Go to B19.

B24 CHECK THE CHARGING SYSTEM CIRCUITS FOR INTERMITTENT FAULTS

- Key in OFF position.
- Connect: Generator C102b
- Connect: Generator C102a
- Connect: PCM C175b
- Connect the diagnostic tool.
- Key in START position.
- With the engine running, monitor the charging system warning indicator lamp and the scan tool for DTCs.
- **Does the charging system warning indicator lamp illuminate and does any charging system DTC get stored into memory?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article for 2.3L, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article for 3.0L or **ELECTRONIC ENGINE CONTROLS - 3.5L** article for 3.5L engines.

  NO : The fault is not present and cannot be recreated at this time. This may indicate an intermittent fault. Go to B19.

Pinpoint Test C: The Charging System Warning Indicator is On With the Engine Running and No Charging System DTCs Present

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Charging System for schematic and connector information.

Normal Operation

With the engine running, the charging system warning indicator is off. The A circuit SBB17 (RD) from the battery B+ to the generator regulator is 13-15 volts. This voltage feedback is used by the regulator to maintain the battery voltage at the desired set point. The S (stator) circuit (internal to the generator) is used to monitor generator operation. This circuit and other regulator internal conditions are checked by the regulator to allow the PCM to turn off the charging system warning indicator by sending a message over the controller area network (CAN) bus to the instrument cluster (IC). The positive battery output (B+) circuit SDC14 (RD) is the generator output supplied to the battery and electrical system.

This pinpoint test is intended to diagnose the following:

- Generator

- Circuitry
- IC
- PCM

PINPOINT TEST C: THE CHARGING SYSTEM WARNING INDICATOR IS ON WITH THE ENGINE RUNNING AND NO CHARGING SYSTEM DTCs PRESENT

NOTE: Make sure battery voltage is greater than 12.2 volts prior to carrying out this pinpoint test.

NOTE: Do not have a battery charger attached during vehicle testing.

C1 CHECK THE BATTERY CONDITION

- Carry out the Battery - Condition Test to determine if the battery can hold a charge and is OK for use. Refer to **BATTERY, MOUNTING AND CABLES** article.
- **Does the battery pass the condition test?**

  YES : Go to C2.

  NO : INSTALL a new battery. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

C2 CHECK THE GENERATOR B+ CONNECTION

- Key in OFF position.
- Inspect generator C102b connection. Connection should be tight.

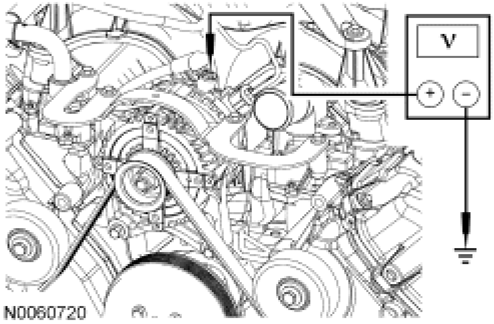


Fig. 9: Checking Generator B+ Connection
Courtesy of FORD MOTOR CO.

- Measure the voltage between generator C102b, circuit SDC14 (RD) and ground.
- **Is generator C102b connection tight and does the generator B+ measure battery voltage?**

  YES : Go to C3.

  NO : TIGHTEN the generator B+ connection or REPAIR the circuit. CLEAR the any DTCs. REPEAT the self-test. TEST the system for normal operation.

C3 CHECK THE VOLTAGE DROP IN THE B+ CIRCUIT SDC14 (RD)

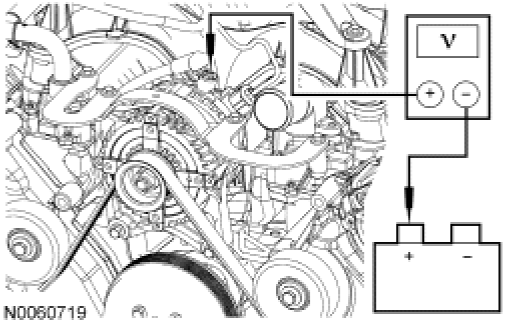


Fig. 10: Checking Voltage Drop In B+ Circuit SDC14 (RD)
Courtesy of FORD MOTOR CO.

- With the engine running, measure the voltage drop between generator B+ C102b, circuit SDC14 (RD) and the positive battery terminal.
- **Is the voltage drop less than 0.5 volt?**

  YES : Go to C4.

  NO : CHECK for any corrosion in the B+ C102b, circuit SDC14 (RD), positive battery cable and/or connections. REPAIR as necessary. TEST the system for normal operation.

C4 CHECK THE DTCs IN THE PCM

- Key in OFF position.
- Connect the diagnostic tool.
- Key in START position.
- Enter the following diagnostic mode on the diagnostic tool: Retrieve PCM DTCs
- Use the recorded PCM DTCs from the continuous and on-demand self tests.
- **Are any PCM DTCs recorded?**

  YES : For all DTCs EXCEPT charging system DTCs, REFER to the **Introduction - Gasoline Engines** article. If any charging system DTCs are present, go to **Pinpoint Test B**. If referred here by the **Introduction - Gasoline Engines** article, go to C5.

  NO : Go to C5.

C5 MONITOR PID GEN_FIL

- With the engine running, monitor PID GEN_FIL.
- **Does PID GENFIL show fault?**

  YES : Go to C6.

  NO : REPAIR/INSTALL a new IC, IC-to-PCM connection or the PCM. TEST the system for normal operation.

C6 MONITOR PID VPWR

- With the engine running, monitor PIDS VPWR, GENFIL, GENVDSD.
- **Is PID VPWR greater than 15.6 volts?**

  YES : Go to C7.

  NO : Go to C8.

C7 CHECK PCM VPWR PID

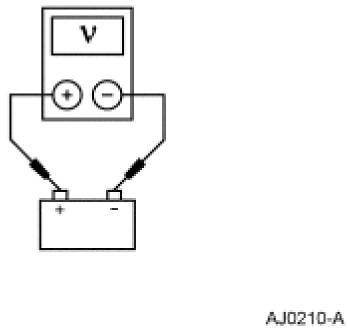


Fig. 11: Checking Charging System Voltage
Courtesy of FORD MOTOR CO.

- With the engine running, measure the battery voltage.
- Monitor the VPWR PID.
- **Are the battery voltage and VPWR PID within 0.6 volt of each other?**

  YES : Go to C8.

  NO : Go to C9.

C8 MEASURE PCM INPUT VOLTAGE

- Key in OFF position.
- Disconnect: PCM C175b
- Connect a fused (10A) jumper wire between C175b-35, circuit CE302 (YE/BU) and ground.
- Key in ON position.

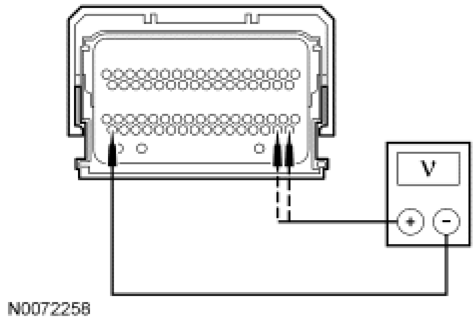


Fig. 12: Measuring PCM Input Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between PCM input voltage pins 51 and 52 to PCM ground pin 66.
- **Are voltages within 0.5 volt of PID VPWR?**

  YES : INSTALL a new PCM.

  NO : REPAIR high resistance or loose connections between C175b-51 circuit CBP47 (GN/BU), C175b-52 circuit CBP47 (GN/BU) PCM power circuits or C175b-66, circuit GD120 (BK/GN), PCM ground circuit.

C9 MONITOR THE PCM PID GENERATOR MONITOR WITH KEY ON/ENGINE RUNNING

(KOER)

- Connect: PCM C175b
- Key in START position.
- With the engine at idle, wait 15 seconds for the GENVDSD PID to increase to greater than 13 volts.
- Monitor PID GENMON at idle and 3000 RPM.
- **Does the GENMON PID read between 3% and 98% at engine idle speed and at 3,000 RPM?**

  YES : Go to C10.

  NO : Go to C11.

C10 MONITOR PID GENVDSD

- With the engine running, monitor PID GENVDSD.
- **Is PID GENVDSD greater than 15.2 volts?**

  YES : REPAIR connection on circuit SDC02 (RD). INSPECT generator C102a-3 for damage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If no problems are found, INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. TEST the system for normal operation.

  NO : REFLASH or INSTALL a new PCM.

C11 CHECK FOR SHORTED CIRCUITS

- Key in OFF position.
- Disconnect: Generator C102a
- Verify that PID GENMON reads 100%.
- Carry out the Wiggle Test of wiring to determine if PID GENMON changes from 100%.
- **Does PID GENMON change from 100%?**

  YES : REPAIR short circuit on C102a-1 CDC15 (VT).

  NO : Go to C12.

C12 CHECK THE PCM PID GENERATOR MONITOR INPUT TO THE PCM

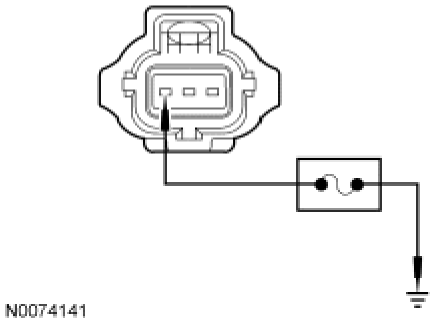


Fig. 13: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

- Connect a fused (10A) jumper wire between generator C102a-1, circuit CDC15 (VT), harness side and ground.

- Key in ON position.
- Monitor the GENMON PID while carrying out a Wiggle Test on the wire harness.
- **Does the GENMON PID read 0%?**

  YES : REPAIR open connection on circuit CDC15 (VT) C102a-1, and PCM C175e-26. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test D: The Generator is Noisy

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Charging System for schematic and connector information.

Normal Operation

The generator is belt-driven by the engine accessory drive system.

This pinpoint test is intended to diagnose the following:

- Accessory drive belt
- Loose bolts/brackets
- Generator/pulley

PINPOINT TEST D: THE GENERATOR IS NOISY

D1 CHECK FOR ACCESSORY DRIVE BELT NOISE AND LOOSE MOUNTING BRACKETS

- Key in OFF position.
- Check the accessory drive belt for damage and correct installation. Refer to **ACCESSORY DRIVE - 2.3L** article for 2.3L, **ACCESSORY DRIVE - 3.0L (4V)** article for 3.0L or **ACCESSORY DRIVE - 3.5L** article for 3.5L engines.
- Check the accessory mounting brackets and generator pulley for looseness or misalignment.
- **Is the accessory drive OK?**

  YES : Go to D2.

  NO : REPAIR as necessary. REFER to **ACCESSORY DRIVE - 2.3L** article for 2.3L, **ACCESSORY DRIVE - 3.0L (4V)** article for 3.0L or **ACCESSORY DRIVE - 3.5L** article for 3.5L engines for diagnosis and testing of the accessory drive system. TEST the system for normal operation.

D2 CHECK THE GENERATOR MOUNTING

- Check the generator mounting for loose bolts or misalignment.
- **Is the generator mounted correctly?**

  YES : Go to D3.

  NO : REPAIR as necessary. TEST the system for normal operation.

D3 CHECK THE GENERATOR FOR ELECTRICAL NOISE

- Disconnect: Generator C102b
- Key in START position.
- With the engine running, use a stethoscope or equivalent listening device to probe the generator.
- **Is the noise still present?**

  YES : Go to D4.

  NO : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. TEST the system for normal operation.

D4 CHECK THE GENERATOR FOR MECHANICAL NOISE

- With the engine running, use a stethoscope or equivalent listening device to probe the generator and the accessory drive area for unusual mechanical noise.
- **Is the generator the noise source?**

  YES : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. TEST the system for normal operation.

  NO : REFER to **ENGINE SYSTEM - GENERAL INFORMATION** article to diagnose the source of the engine noise.

Pinpoint Test E: Radio Interference

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Charging System for schematic and connector information.

Normal Operation

The generator radio suppression equipment reduces interference transmitted through the speakers by the vehicle electrical system.

This pinpoint test is intended to diagnose the following:

- Generator
- Circuitry
- In-vehicle entertainment system

PINPOINT TEST E: RADIO INTERFERENCE

E1 VERIFY THE GENERATOR IS THE SOURCE OF THE RADIO INTERFERENCE

NOTE: **If the OEM audio unit has been replaced with an aftermarket unit, the vehicle may not pass this test. Return the vehicle to OEM condition before following this pinpoint test.**

- Key in START position.
- Start and run the engine.

- Tune the audio unit to a station where the interference is present.
- Key in OFF position.
- Disconnect: Generator C102b
- Key in START position.
- With the engine running, determine if the interference is still present.
- **Is the interference present with the generator disconnected?**

  YES : REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article for diagnosis and testing of the in-vehicle entertainment system.

  NO : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. TEST the system for normal operation.

Pinpoint Test F: DTC B1318 or B1676 - Battery Voltage Low or Battery Voltage Out of Range

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Charging System for schematic and connector information.

Normal Operation

Various control modules within the vehicle operate at a voltage between 10-17 volts. Voltage to these modules is supplied through the vehicle harness to the module(s). Ground for the modules is provided by the modules ground circuit(s). If voltages to these modules rise above 17 volts, DTC B1317 or B1676 may set, or if voltage drops below 10 volts, DTC B1318 or B1676 may set.

This pinpoint test is intended to diagnose the following:

- Battery
- Charging System
- Module Voltage Supply
- Module Ground

NOTE: DTC B1317 or B1318 can be set if the vehicle has had a discharged battery, has recently been jump-started or has had the vehicle battery charged.

PINPOINT TEST F: DTC B1318 OR B1676 - BATTERY VOLTAGE LOW OR BATTERY VOLTAGE OUT OF RANGE

F1 CHECK FOR DTCs

- Key in OFF position.
- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: Retrieve all continuous DTCs
- **Is DTC B1318 or B1676 present in only one module?**

  YES : If DTC B1317 or B1676 are recorded in only ONE module, go to F2.

  NO : If DTC B1318 or B1676 are recorded in more than one module, go to **Pinpoint Test B**.

F2 CHECK THE BATTERY VOLTAGE

- Measure the battery voltage between the positive and negative battery posts with the key ON engine OFF (KOEO), and with the engine running, all accessory loads OFF.
- **Is the battery voltage between 10 and 13 volts with KOEO, and between 11 and 17 volts with the engine running?**

  YES : Go to F3.

  NO : CHECK and/or REPAIR the charging system as necessary. Go to **Pinpoint Test B**. TEST the system for normal operation. CLEAR the DTCs. REPEAT the self-test.

F3 CHECK THE VOLTAGE TO THE MODULE

- Key in OFF position.
- Disconnect: Affected module which recorded DTC B1317 or B1676
- Key in ON position.
- Measure all of the affected module's power circuits, harness side to ground. Refer to affected module Wiring Diagrams Cell for schematic and connector information.
- **Is the voltage greater than 10 volts?**

  YES : Go to F4.

  NO : REPAIR the module power circuit(s). CLEAR the DTCs. REPEAT the self-test.

F4 CHECK THE MODULE GROUNDS

- Key in OFF position.
- Measure the resistance between all of the affected module's ground circuits, harness side to ground. Refer to affected module Wiring Diagrams Cell for schematic and connector information.
- **Is the resistance less than 5 ohms?**

  YES : Go to F5.

  NO : REPAIR the module ground circuit(s). CLEAR the DTCs. REPEAT the self-test.

F5 CHECK THE MODULE FOR CORRECT OPERATION

- Key in OFF position.
- Disconnect: All of the affected module connectors
- Check the connector and module for:
  - corrosion.
  - pushed-out or damaged pins.
  - connector or module damage.
- Connect: All of the affected module connectors
- CLEAR all DTCs.
- OPERATE the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new module. REFER to the removal and installation procedure in the affected module's part. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been the result of a loose connection, may recently have had a discharged battery or may have been jump started.

CLEAR the DTCs. REPEAT the self-test.

Component Tests

Battery - Drain Testing

WARNING: Batteries contain sulfuric acid and produce explosive gases. Work in a well-ventilated area. Do not allow the battery to come in contact with flames, sparks or burning substances. Avoid contact with skin, eyes or clothing. Shield eyes when working near the battery to protect against possible splashing of acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes, then get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in serious personal injury.

CAUTION: To prevent damage to the meter, do not crank the engine or operate accessories that draw more than 10A.

NOTE: No factory-equipped vehicle should have more than a 50 mA (0.050 amp) draw.

NOTE: Many electronic modules draw 10 mA (0.010 amp) or more continuously.

NOTE: Use an inline ammeter between the negative battery post and its respective cable.

NOTE: Typically, a drain of approximately 1 amp can be attributed to a glove compartment lamp or interior lamp staying on continually. Other component failures or wiring shorts are located by selectively pulling fuses to pinpoint the location of the current drain. When the current drain is found, the meter reading falls to an acceptable level. If the drain is still not located after checking all the fuses, it is due to the generator.

NOTE: To accurately test the drain on a battery, an inline ammeter must be used. Use of a test lamp or voltmeter is not an accurate method due to the number of electronic modules.

Check for current drains on the battery in excess of 50 mA (0.050 amp) with all of the electrical accessories off and the vehicle at rest for at least 40 minutes. Current drains can be tested with the following procedure:

1. Make sure the battery junction box (BJB) and smart junction box (SJB) are accessible without turning on the interior lights or the underhood lights.
2. Drive the vehicle at least 5 minutes and over 48 km/h (30 mph) to turn on and activate the vehicle systems.

3. Allow the vehicle to sit with the key off for at least 40 minutes to allow modules to time out/power down.
4. Connect a fused jumper wire (30A) between the negative battery cable and the negative battery post to prevent the modules from resetting and to catch capacitive drains.
5. Disconnect the battery ground cable from the battery post without breaking the connection of the jumper wire.

NOTE: It is very important that continuity is not broken between the battery and the battery ground cable when connecting the meter. If this happens, the entire procedure must be repeated.

6. Connect the battery tester between the battery ground cable and the post. The meter must be capable of reading milliamps and should have a 10 amp capability.

NOTE: If the meter settings need to be switched or the test leads need to be moved to another jack, the jumper wire must be reinstalled to avoid breaking continuity.

7. Remove the jumper wire.

NOTE: Amperage draw varies from vehicle to vehicle depending on the equipment package. Compare to a similar vehicle for reference.

NOTE: No factory-equipped vehicle should have more than a 50 mA (0.050 amp) draw.

8. Note the amperage draw.
9. If the draw is found to be excessive, remove the fuses from the SJB one at a time and note the current reading. Do not reinstall the fuses until you have finished testing. To correctly isolate each of the circuits, all of the fuses may need to be removed and install one fuse, note the amperage draw, then remove the fuse and install the next fuse until each circuit is tested. When the current level drops to an acceptable level after removing a fuse, the circuit containing the excessive draw has been located.
10. If the current draw is still excessive, remove the fuses from the BJB one at a time and note the current drop. Do not reinstall the fuses until you have finished testing. To correctly isolate each of the circuits, all of the fuses may need to be removed and install one fuse, note the amperage draw, then remove the fuse and install the next fuse until each circuit is tested. When the current level drops to an acceptable level after removing a fuse, the circuit containing the excessive draw has been located.
11. Check the wiring diagrams for any circuits that run from the battery without passing through the BJB or the SJB. If the current draw is still excessive, disconnect these circuits until the draw is found. Also disconnect the generator electrical connections if the draw cannot be located. The generator may be internally shorted, causing the current drain.

Generator On-Vehicle Tests

CAUTION: To prevent damage to the generator, do not make the jumper wire

connections except as directed.

CAUTION: Do not allow any metal object to come in contact with the housing and the internal diode cooling fins with the key in the ON or OFF positions. A short circuit may result and burn out the diodes.

NOTE: Battery posts and cable clamps must be clean and tight for accurate meter indications.

NOTE: Refer to the battery tester article for complete directions for testing the charging system.

1. Turn off all lamps and electrical components.
2. Place the transmission in NEUTRAL and apply the parking brake.
3. Carry out the Load Test and No Load Test according to the following component tests:

Generator On-Vehicle Tests - Load Test

1. Switch the tester to the ammeter function.
2. Connect the positive and negative leads of the tester to the corresponding battery terminals.
3. Connect the current probe to the generator B+ output terminal, circuit SDC14 (RD).
4. With the engine running at approximately 2,500 RPM (2.3L), 2,000 RPM (3.0L and 3.5L), adjust the tester load bank to determine the output of the generator. Generator output should be greater than the graph shown below. If not, refer back to the pinpoint test or Go to **Symptom Chart**.

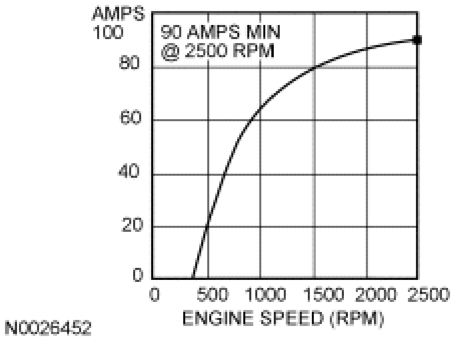


Fig. 14: Generator Output Graph - 2.3L
Courtesy of FORD MOTOR CO.

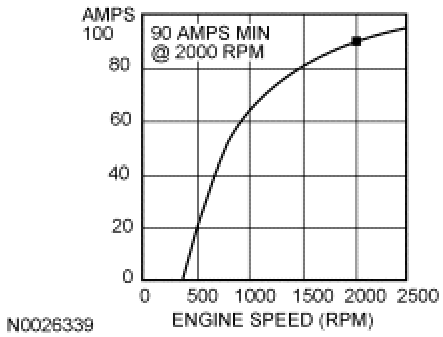


Fig. 15: Generator Output Graph - 3.0L & 3.5L
Courtesy of FORD MOTOR CO.

Generator On-Vehicle Tests - No Load Test

1. Switch the tester to the voltmeter function.
2. Connect the voltmeter positive lead to the generator B+ terminal, circuit SDC14 (RD) and the negative lead to ground.
3. Turn all of the electrical accessories off.
4. With the engine running at approximately 2,000 RPM, check the generator output voltage. The voltage should be between 13.2 and 15.5 volts. If not, refer back to the pinpoint test or Go to **Symptom Chart**.

2008 HVAC

Climate Control System - General Information & Diagnostics - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	**Specification**	**Fill Capacity**
A/C Cooling Coil Coating YN-29	-	-
A/C System Flushing Solvent YN-23	-	-
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B	177 ml (6 fl. oz.)
R-134a Refrigerant YN-19 (US); CYN-16-P or CYN-16-R (Canada)	WSH-M17B19-A	0.59 kg (21 oz.) (1.3 lb)

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	**Specification**
A/C Compressor	
Type	SP17
A/C Compressor Magnetic Clutch	
Air gap clearance	0.3-0.6 mm (0.012-0.024 in)
A/C Pressure Relief Valve[a]	
Close pressure	3103 kPa (450 psi)
Open pressure	3,792-4,137 kPa (550-600 psi)
Evaporator Discharge Air Temperature Sensor	
OFF temperature	2°C (36°F)
ON temperature	3°C (37°F)
Refrigerant System Dye	
R-134a Leak Detection Dye 164-R6060 or 164-R6081	-

[a] Manifold gauge set pressures may vary slightly depending on the distance between the service gauge port valve and the A/C pressure relief valve, the A/C cycling switch or the pressure cutoff switch location.

DESCRIPTION AND OPERATION

CLIMATE CONTROL SYSTEM

Climate Control System

WARNING: Take the following precautions when repairing an air conditioning system containing R-134a:

- **Always wear safety goggles.**
- **Avoid contact with liquid refrigerant R-134a. R-134a vaporizes at approximately -25°C (-13°F) under atmospheric pressure and will freeze skin tissue.**
- **Never allow refrigerant R-134a gas to escape in quantity in an occupied space. It will displace the oxygen needed to support life.**
- **Never use a torch in an atmosphere containing R-134a gas. R-134a is non-toxic at all normal conditions, but it decomposes when exposed to high temperatures such as a torch flame. During decomposition it releases irritating and toxic gasses (as described in the MSDS sheet from the manufacturer). Decomposition products are hydrofluoric acid, carbon dioxide and water.**

Failure to follow these instructions may result in serious personal injury.

NOTE: To avoid damaging the vehicle or air conditioning (A/C) components, the following precautions must be observed.

- **The A/C refrigerant of all vehicles must be identified and analyzed prior to refrigerant charging. Failure to do so may contaminate the shop bulk refrigerant and other vehicles.**
- **Do not add R-12 refrigerant to an A/C system that requires the use of R-134a refrigerant. These 2 types of refrigerant must never be mixed. Doing so may damage the A/C system.**
- **Charge the A/C system with R-134a refrigerant gas while the engine is running only at the low-pressure side, to prevent refrigerant slugging from damaging the A/C compressor.**
- **Use only R-134a refrigerant. Due to environmental concerns, when the A/C system is drained, the refrigerant must be collected using refrigerant recovery/recycling equipment. Federal, State/Provincial and/or local laws REQUIRE that R-134a be recovered into appropriate recovery equipment and the process be conducted by qualified technicians who have been certified by an approved organization, such as Automotive Service Excellence (ASE) or Mobile Air Conditioning Society (MACS). Use of a recovery machine dedicated to R-134a is necessary to reduce the possibility of oil and refrigerant incompatibility concerns. Refer to the**

instructions provided by the equipment manufacturer when removing refrigerant from or charging the A/C system.

- **Refrigerant R-134a must not be mixed with air for leak testing or used with air for any other purpose above atmospheric pressure. R-134a is combustible when mixed with high concentrations of air and higher pressures.**
- **A number of manufacturers are producing refrigerant products that are described as direct substitutes for refrigerant R-134a. The use of any unauthorized substitute refrigerant may severely damage the A/C components. If repair is required, use only new or recycled refrigerant R-134a.**

NOTE: **To avoid contamination of the air conditioning (A/C) system, the following precautions must be observed.**

- **Never open or loosen a connection before recovering the refrigerant.**
- **When loosening a connection, if any residual pressure is evident, allow it to leak out before opening the fitting.**
- **Evacuate a system that has been opened to install a new component or one that has discharged through leakage before charging.**
- **Seal open fittings with a cap or plug immediately after disconnecting a component from the system.**
- **Clean the outside of the fittings thoroughly before disconnecting a component from the system.**
- **Do not remove the sealing caps from a new component until ready to install.**
- **Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open an oil container until ready to use and install the cap immediately after using. Store the oil in a clean, moisture-free container.**
- **Install a new O-ring seal before connecting an open fitting. Coat the fitting and O-ring seal with mineral oil before connecting.**
- **When installing a refrigerant line, avoid sharp bends. Position the line away from the exhaust or any sharp edges that may chafe the line.**
- **Tighten threaded fittings only to specifications. The steel and aluminum fittings used in the refrigerant system will not tolerate overtightening.**
- **When disconnecting a fitting, use a wrench on both halves of the fitting to prevent twisting of the refrigerant lines or tubes.**
- **Do not open a refrigerant system or uncap a new component unless it is as close as possible to room temperature. This will prevent condensation from forming inside a component that is cooler than the surrounding air.**

The system components are the following:

- A/C compressor
- A/C compressor clutch assembly
- A/C condenser core with A/C receiver/drier
- A/C evaporator core
- Connecting refrigerant lines
- Thermostatic Expansion Valve (TXV)
- A/C pressure transducer
- Heater core and evaporator core housing
- HVAC module - Electronic Manual Temperature Control (EMTC)
- HVAC module - Electronic Automatic Temperature Control (EATC)
- HVAC module - Dual Automatic Temperature Control (DATC)
- Blower switch (EMTC systems)
- Temperature blend door actuators
- Floor/defrost/panel door actuator
- Air inlet door actuator
- Blower motor resistor or speed control module
- Blower motor
- Ambient temperature sensor
- In-vehicle temperature sensor
- Solar radiation sensor
- Evaporator discharge air temperature sensor

External Temperature Display

The external temperature is displayed when the EXT button is pressed. While the actual external temperature can vary continuously, the value that is displayed will update at a specific rate depending on whether or not the engine is "hot" and whether or not the vehicle is moving.

When the external temperature is rising, the display will update slowly. Updates (when the actual external temperature is higher than currently displayed value) will be limited to 0.6°C (1°F) every 20 seconds while the vehicle is moving at 40 km/h (25 mph) or greater for more than 90 seconds, or 0.6°C (1°F) every 20 minutes if the vehicle is not moving at this speed. This is to prevent the heat from the engine compartment from affecting the accuracy of the display.

When the external temperature is dropping, the display will update quickly.

Updates (when the actual external temperature is lower than currently displayed value) will only be limited to 0.6°C (1°F) every 2 seconds (regardless of vehicle speed). Consequently, the display will essentially follow the drop experienced by the external temperature thermistor.

Climate Control System Operation

Electronic Manual Temperature Control (EMTC) System

The EMTC system heats or cools the vehicle depending on the HVAC module - EMTC panel selection.

- The HVAC module - EMTC panel selections determine heating or cooling, air distribution and enables blower motor operation.
- The temperature control setting determines the air temperature.
- The blower motor switch varies the blower motor speed.
- During A/C operation the system also reduces the relative humidity of the air.

The EMTC system operation is determined by the settings on the climate control module. The EMTC system is composed of the HVAC module - EMTC, blower motor resistor, mode door actuator, air inlet door actuator and temperature blend door actuator to control the various functions.

The blower motor switch:

- sets the blower motor speed.
- directs the blower motor path to ground through the blower motor resistor to allow blower motor operation in LO, MED LO and MED HI.
- directs the blower motor path directly to ground, bypassing the blower motor resistor to allow blower motor operation in HI.

The A/C request button:

- can request the A/C compressor ON (when the function selector switch is in PANEL, FLOOR/PANEL and FLOOR) when the A/C request switch is pressed. Indicator illuminates when A/C request switch is toggled ON.
- indicator illuminates when the function selector switch is in MAX A/C and cannot be toggled.
- indicator does not illuminate in OFF and cannot be toggled.
- indicator can be toggled ON or OFF in FLOOR/DEFROST and DEFROST. The A/C compressor will operate regardless of indicator status if the outside air temperature is above 6°C (43°F).
- is serviced only with the climate control assembly.

The function selector:

- selects airflow direction.
- is serviced only with the HVAC module - EMTC.

The air recirculation button:

- selects either recirculated or outside air source.
- recirculates air in any mode except DEFROST, if requested.
- is disabled in MAX A/C or OFF mode where recirculated air only is used.
- is disabled in DEFROST mode where outside air only is used.

- is serviced only with the HVAC module - EMTC.
- may be a timed function in FLOOR/DEFROST and DEFROST.

The EMTC module also includes:

- a rear window DEFROST button, refer to **GLASS, FRAMES AND MECHANISMS** article.
- heated/cooled seat controls, refer to **SEATING** article.

Electronic Automatic Temperature Control (EATC) and Dual Automatic Temperature Control (DATC) System

The EATC and DATC system maintains the selected vehicle interior temperature by heating and/or cooling the air.

- During A/C operation, the system also reduces the relative humidity of the air.
- The driver may override the automatic mode of operation.
- The temperature control setting determines the air temperature.
- The blower motor control override buttons vary the blower motor speed.
- The driver side and passenger side temperature settings can be individually controlled (DATC only).

The EATC and DATC system operation is determined by the settings on the HVAC module - EATC or HVAC module - DATC. The DATC/EATC system automatically maintains a selected temperature for vehicle interior comfort. The DATC/EATC system is composed of the HVAC module - EATC or HVAC module - DATC, blower motor speed control, mode door actuator, air inlet door actuator, temperature blend door actuator, in-vehicle temperature sensor and solar radiation sensor to control the various functions.

When the HVAC module - EATC or HVAC module - DATC is set to AUTO:

- the air distribution direction, blower motor speed and A/C compressor operation are automatically controlled based on the temperature(s) selected.

The HVAC module - EATC or HVAC module - DATC manual override settings:

- allow the air distribution direction to be manually selected.
- allow the blower motor speed to be manually selected.
- allow RECIRCULATION mode to be manually selected in all modes except DEFROST. The A/C request can be cancelled by pressing the A/C request switch, turning the indicator OFF.
- allow A/C compressor operation to be manually selected except in FLOOR/DEFROST or DEFROST.

The DATC/EATC module also includes:

- a rear window DEFROST button, refer to **GLASS, FRAMES AND MECHANISMS** article.
- heated/cooled seat controls, refer to **SEATING** article.

External Temperature Display

The external temperature is displayed when the EXT button is pressed. While the actual external temperature can vary continuously, the value that is displayed will update at a specific rate depending on whether or not the engine is "hot" and whether or not the vehicle is moving.

When the external temperature is rising, the display will update slowly.

Updates (when the actual external temperature is higher than currently displayed value) will be limited to 0.6°C (1°F) every 20 seconds while the vehicle is moving at greater than 40 km/h (25 mph) for more than 90 seconds OR 0.6°C (1°F) every 20 minutes if the vehicle is not moving at this speed. This is to prevent the heat from the engine compartment from affecting the accuracy of the display.

When the external temperature is dropping, the display will update quickly.

Updates (when the actual external temperature is lower than currently displayed value) will only be limited to 0.6°C (1°F) every 2 seconds (regardless of vehicle speed). Consequently the display will essentially follow the drop experienced by the external temperature thermistor.

System Airflow Description - Electronic Manual Temperature Control (EMTC)

Max A/C

When MAX A/C is selected:

- the air inlet door actuator closes off outside air and admits only recirculated air.
- the recirc button is disabled and the indicator is illuminated.
- the floor/defrost/panel door directs airflow to the instrument panel A/C registers.
- blended air temperature is available.
- the A/C request button is illuminated and will be disabled.
- the A/C compressor will operate if the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

PANEL

When PANEL is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the instrument panel A/C registers.
- blended air temperature is available.
- the A/C request button is enabled. The A/C compressor can operate and the indicator will illuminate if the A/C request button is selected and the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

PANEL/FLOOR

When PANEL/FLOOR is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct and the instrument panel registers. A small amount of airflow from the side window demisters and defrost duct will be present.
- blended air temperature is available.
- the A/C request button is enabled. The A/C compressor can operate and the indicator will illuminate if the A/C request button is selected and the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

OFF

When OFF is selected:

- the recirc request button is disabled.
- the air inlet door actuator closes off outside air and admits only recirculated air.
- the A/C request button is disabled.
- the blower motor is OFF.

FLOOR

When FLOOR is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct. A small amount of airflow from the defroster duct and side window demisters will be present.
- blended air temperature is available.
- the A/C request button is enabled. The A/C compressor can operate and the indicator will illuminate if the A/C request button is selected and the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

FLOOR/DEFROST

When FLOOR/DEFROST is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button

is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.

- the floor/defrost/panel door directs airflow to the floor duct, the defroster duct and the side window demisters.
- blended air temperature is available.
- the A/C request button and the indicator can be toggled. To reduce fogging, the A/C compressor will operate automatically, regardless of indicator status, if the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

DEFROST

When DEFROST is selected:

- the air inlet door actuator opens, admitting only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the defroster duct and side window demisters. A small amount of airflow from the floor duct will be present.
- blended air temperature is available.
- the A/C request button and the indicator can be toggled. To reduce fogging, the A/C compressor will operate automatically, regardless of indicator status, if the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

System Airflow Description - Dual Automatic Temperature Control (DATC)/Electronic Automatic Temperature Control (EATC)

AUTO

When AUTO is selected:

- the temperature control setting is manually set to the desired setting.
- the air inlet door actuator is automatically controlled by the HVAC module - EATC or HVAC module - DATC, based on the temperature setting.
- the mode door actuators are automatically controlled by the HVAC module - EATC or HVAC module - DATC based on the temperature setting.
- the A/C compressor is automatically controlled by the HVAC module - EATC or HVAC module - DATC based on the temperature setting. The A/C compressor will not operate if the outside temperature is below approximately 6°C (43°F).
- the A/C request is controlled by the HVAC module - EATC or HVAC module - DATC based on the temperature settings. The A/C compressor will not operate if the outside air temperature is below 6°C (43°F). The A/C indicator automatically turns ON when the outside air temperature rises above 14°C (58°F) and automatically turns OFF when the outside air temperature falls below 11°C (51°F).
- the A/C request button and the RECIRC request button can be manually selected. When manually selected the A/C indicator will not change state with changing outside air temperature.
- the blower motor is ON. The blower motor speed is automatically controlled by the HVAC module -

EATC or HVAC module - DATC based on the temperature setting, but can be manually overridden.

OFF

When OFF is selected:

- the recirc request button is disabled.
- the air inlet door actuator closes off outside air and admits only recirculated air.
- the floor/defrost/panel door actuator is in the DEFROST position.
- the A/C request button is disabled.
- the blower motor is OFF.

PANEL

When PANEL is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the instrument panel A/C registers.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C request button (indicator ON), can the airflow temperature be cooled below the outside air temperature.
- the A/C request button is enabled. The A/C compressor may operate and the indicator will illuminate if the A/C request button is selected and the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

PANEL/FLOOR

When PANEL/FLOOR is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the floor duct and the instrument panel A/C registers. A small amount of airflow from the side window demisters and defrost duct will be present.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C request button (indicator ON), can the airflow temperature be cooled below the outside air temperature.
- the A/C request button is enabled. The A/C compressor may operate and the indicator will illuminate if the A/C request button is selected and the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

FLOOR

When FLOOR is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment. The recirc function may time out and the air inlet door will change to the outside air position.
- the floor/defrost/panel door directs airflow to the floor duct. A small amount of airflow from the defroster duct and side window demisters will be present.
- blended air temperature is available. Only when A/C compressor operation has been selected by pressing the A/C request button (indicator ON), can the airflow temperature be cooled below the outside air temperature.
- the A/C request button is enabled. The A/C compressor may operate and the indicator will illuminate if the A/C request button is selected and the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

FLOOR/DEFROST

When FLOOR/DEFROST is selected:

- the recirc request button is enabled. If the recirc request button is selected (indicator ON), the air inlet door actuator closes off outside air from entering the passenger compartment. If the recirc request button is not selected (indicator OFF), the air inlet door actuator admits only outside air into the passenger compartment. The recirc function may time out and the air inlet door will change to the outside air position.
- the floor/defrost/panel door directs airflow to the floor duct, the defroster duct and the side window demisters.
- blended air temperature is available.
- the A/C request button is enabled. The A/C compressor will operate automatically and the indicator will illuminate if the A/C request button is selected and the outside temperature is above approximately 6°C (43°F).
- the blower motor is ON.

DEFROST

When DEFROST is selected:

- the recirc request button and indicator is disabled. Regardless of button and indicator status, the air inlet door actuator admits only outside air into the passenger compartment.
- the floor/defrost/panel door directs airflow to the defroster duct and side window demisters. A small amount of airflow from the floor duct will be present.
- blended air temperature is available.
- the A/C request button will indicate the last status and the indicator can be toggled. To reduce fogging,

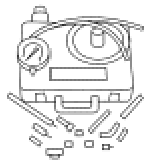
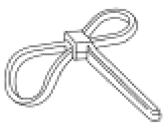
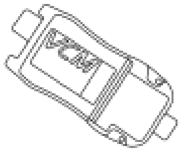
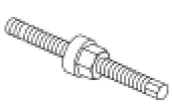
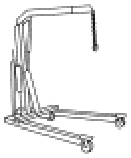
the A/C compressor will operate automatically, regardless of indicator status, if the outside temperature is above approximately 6°C (43°F).

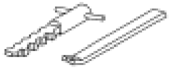
- the blower motor is ON.

DIAGNOSTIC TESTS

CLIMATE CONTROL SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
 ST1298-A	A/C Flush Adapter Kit	219-00074 or equivalent
 ST1438-A	Flex Probe Kit	105-R025B or equivalent
 ST1185-A	Fluke 77 III Automotive Meter	105-R0056 or equivalent
 ST2834-A	Pressure Test Kit	014-R1072 or equivalent
 ST1287-A	R-134a Manifold Gauge Set	176-R032A or equivalent
 ST1341-A	Refrigerant Leak Detector	216-00001 or equivalent

	Set, A/C Fittings	412-DS028 (014-00333, D93L-19703B) or equivalent
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operation

There are 4 main principles involved with the basic theory of operation:

- Heat transfer
- Latent heat of vaporization
- Relative humidity
- Effects of pressure

Heat Transfer

If 2 substances of different temperature are placed near each other, the heat in the warmer substance will transfer to the colder substance.

Latent Heat of Vaporization

When a liquid boils (converts to gas) it absorbs heat without raising the temperature of the resulting gas. When the gas condenses (converts back to a liquid), it gives off heat without lowering the temperature of the resulting liquid.

Relative Humidity

The amount of moisture (water vapor content) that the air can hold is directly related to the air temperature. The more heat there is in the air, the more moisture the air can hold. The lower the moisture content in the air, the more comfortable occupants feel. Removing the moisture from the air lowers its relative humidity and improves personal comfort.

Effects of Pressure on Boiling or Condensation

As the pressure is increased on a liquid, the temperature at which the liquid boils (converts to gas) also increases. Conversely, when the pressure on a liquid is reduced, its boiling point is also reduced. When in the gas state, an increase in pressure causes an increase in temperature, while a decrease in pressure will decrease the temperature of the gas.

Compressor Anti-Slugging Strategy (CASS)

Liquid refrigerant may accumulate in the A/C compressor under certain conditions. To alleviate damage to the A/C compressor, the Compressor Anti-Slugging Strategy (CASS) is utilized.

CASS is initiated only under specific conditions:

- Ignition is OFF for more than 8 hours
- Ambient temperature is above -4°C (25°F)
- Battery voltage is above 8.5 volts during engine cranking

When these conditions are present, the PCM will activate the A/C control relay prior to cranking of the engine. The A/C control relay engages the A/C compressor for approximately 4-15 A/C compressor revolutions or a maximum of 2 seconds (depending upon vehicle application), allowing the liquid refrigerant to be pushed from the A/C compressor. CASS is initiated by the PCM regardless of the HVAC system settings.

The Refrigerant Cycle

During stabilized conditions (A/C system shutdown), the refrigerant pressures are equal throughout the system. When the A/C compressor is in operation, it increases pressure on the refrigerant vapor, raising its temperature. The high-pressure and high-temperature vapor is then released into the top of the A/C condenser core.

The A/C condenser, being close to ambient temperature, causes the refrigerant vapor to condense into a liquid when heat is removed from the refrigerant by ambient air passing over the fins and tubing. The now liquid refrigerant, still at high pressure, exits from the bottom of the A/C condenser and enters the inlet side of the A/C receiver/drier. The receiver/drier is designed to remove moisture from the refrigerant.

The outlet of the receiver/drier is connected to the Thermostatic Expansion Valve (TXV). The TXV provides the orifice which is the restriction in the refrigerant system and separates the high- and low-pressure sides of the A/C system. As the liquid refrigerant passes across this restriction, its pressure and boiling point are reduced.

The liquid refrigerant is now at its lowest pressure and temperature. As it passes through the A/C evaporator, it absorbs heat from the airflow passing over the plate/fin sections of the A/C evaporator. This addition of heat causes the refrigerant to boil (convert to gas). The now cooler air can no longer support the same humidity level of the warmer air and this excess moisture condenses on the exterior of the evaporator coils and fins and drains outside the vehicle.

The refrigerant cycle is now repeated with the A/C compressor again increasing the pressure and temperature of the refrigerant.

A thermistor which monitors the temperature of the air that has passed through the evaporator core controls A/C clutch cycling. If the temperature of the evaporator core discharge air is low enough to cause the condensed water vapor to freeze, the A/C clutch is disengaged by the vehicle PCM.

The high-side line pressure is also monitored so that A/C compressor operation will be interrupted if the system pressure becomes too high or is determined to be too low (low charge condition).

The A/C compressor thermal protection switch will interrupt compressor operation if the compressor housing exceeds temperature limits.

The A/C compressor relief valve will open and vent refrigerant to relieve unusually high system pressure.

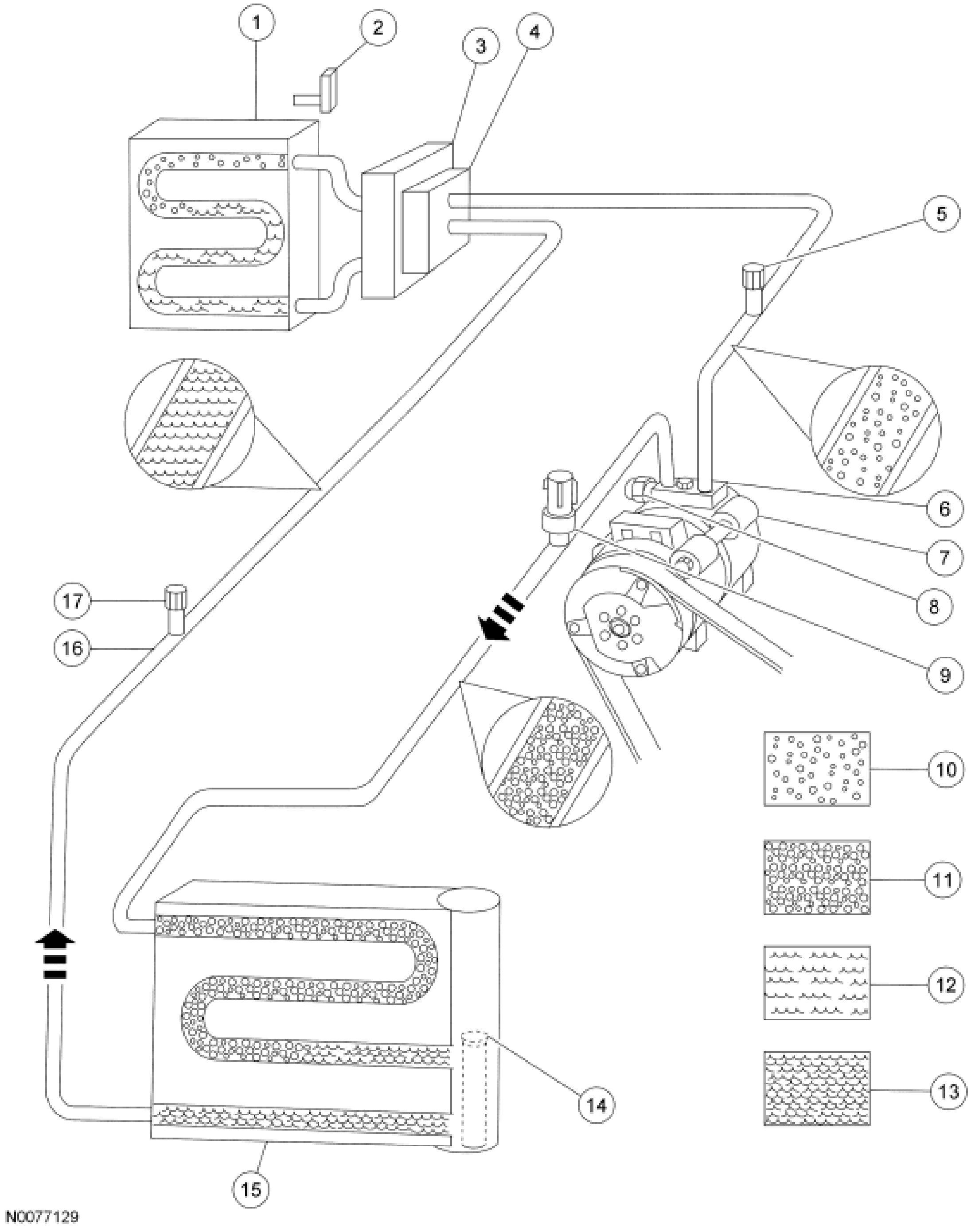


Fig. 1: Thermostatic Expansion Valve (TXV) Type Refrigerant System
Courtesy of FORD MOTOR CO.

Item	Description
1	A/C evaporator core

2	A/C evaporator core outlet temperature thermistor
3	Thermostatic Expansion Valve (TXV)
4	Manifold and tube assembly - TXV
5	A/C charge valve port (low side)
6	Manifold and tube assembly - A/C compressor
7	A/C compressor
8	A/C pressure relief valve
9	A/C pressure transducer
10	Low-pressure vapor
11	High-pressure vapor
12	Low-pressure liquid
13	High-pressure liquid
14	A/C desiccant cartridge
15	A/C condenser core with A/C receiver/drier
16	Evaporator-to-condenser line
17	A/C charge valve port (high side)

Inspection and Verification

1. Verify the customer's concern by operating the climate control system to duplicate the condition.
2. Inspect to determine if one of the following mechanical or electrical concerns apply:

VISUAL INSPECTION CHART

Mechanical	Electrical

• Loose, missing or damaged A/C compressor drive belt
• Loose or disconnected A/C clutch
• Broken or binding door/actuator
• Broken or leaking refrigerant lines
• Obstructed in-vehicle temperature sensor
• Disconnected in-vehicle temperature aspirator hose
	• Smart Junction Box (SJB) fuse(s):
	  ○ 13 (7.5A)
	  ○ 23 (7.5A)
	  ○ 27 (7.5A)
	• Battery Junction Box (BJB) fuse(s):
	  ○ 4 (40A)
	  ○ 25 (10A)
	• Blower motor inoperative
	• A/C compressor inoperative
	• Circuitry open/shorted
	• Disconnected electrical connectors
	• Cooling fan inoperative

3. As pinpoint tests and measurements are being carried out, be sure to inspect for any disconnected, loose-fitting or incorrectly installed component, module and inline electrical connectors and pins.
4. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.

NOTE: Make sure to use the latest scan tool software release.

5. If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

NOTE: The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

6. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
7. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM, HVAC module - Electronic Automatic Temperature Control (EATC) or HVAC module - Dual Automatic Temperature Control (DATC).
8. Carry out the network test.
   - If the scan tool responds with no communication from one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
9. Carry out the self-test diagnostics for the PCM, HVAC module - EATC or HVAC module - DATC.

NOTE: Some PCM DTCs may inhibit A/C operation. If any PCM DTCs are retrieved, diagnose those first. Refer to the PCM DTC Chart.

10. If any of the HVAC module - EATC or HVAC module - DATC DTCs retrieved are related to the concern, refer to the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) DTC Chart. If the PCM DTCs retrieved are related to the concern, refer to the PCM DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
11. If no DTCs related to the concern are retrieved, go to **Symptom Chart - Climate Control Systems** or Go to **Symptom Chart - NVH**

Alternate Diagnostic Methods - HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC)

The EATC and DATC system must be diagnosed by first retrieving any DTCs, if present.

- An on-demand (hard fault) DTC indicates that the fault is currently present. An on-demand DTC suggests a wiring fault, disconnected connector or component failure.
- A continuous (intermittent) DTC alone (corresponding on-demand DTC is not present) indicates that the fault is an intermittent condition and may not be currently present. A continuous only DTC suggests a poor wiring connection, loose pin or terminal or intermittent component failure.

On-demand (hard fault) or continuous (intermittent fault) DTCs can be retrieved using a scan tool. If using a scan tool, refer to the scan tool operating manual.

On-demand DTCs can also be retrieved by carrying out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test. To retrieve and/or clear continuous DTCs, carry out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) - Retrieve Continuous DTCs procedure. Always retrieve both on-demand and continuous DTCs before proceeding with diagnosis and/or repair.

If no on-demand or continuous DTCs are present, go to **Symptom Chart - Climate Control Systems** for the appropriate diagnostic action.

HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test

The HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test will retrieve on-demand (hard fault) DTCs only, it will not retrieve continuous DTCs. Continuous DTCs can be cleared when exiting the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test. Make sure to retrieve continuous DTCs by carrying out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) - Retrieve Continuous DTCs procedure before clearing any continuous DTCs.

- The HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test will not detect concerns associated with data link messages like engine coolant temperature or vehicle speed signals. A scan tool must be used to retrieve these concerns.
- The HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test will detect concerns in the system control functions and will display on-demand (hard fault) DTCs for concerns that are present during the self-test. The vehicle interior temperature should be between 4°C-38°C (40°F-100°F) when carrying out the self-test. If the temperatures are not within the specified ranges, false DTCs may be displayed.
- The self-test can be initiated after cycling the ignition switch from OFF to ON. Normal operation of the climate control system stops when the self-test is activated.
- To enter the self-test, press the OFF and DEFROST buttons simultaneously and release, then press the AUTO button within 2 seconds. The display will show a flashing blower icon for 20 seconds, after which all vacuum fluorescent segments will be displayed if there are no on-demand DTCs present. If DTCs are present, the HVAC module -EATC or HVAC module -DATC will display "00 00" and then on-demand DTCs. Record all DTCs displayed.
- If any DTCs appear during the self-test, carry out the diagnostic procedure. Refer to the HVAC Module -

Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) DTC Chart and follow the ACTION for each DTC given.

- To exit the self-test and **retain** all DTCs, press any button **except** DEFROST. The HVAC module - EATC or HVAC module - DATC will exit the self-test and retain all DTCs.
- Always exit the self-test before powering the system down (system turned OFF). Once the self-test is exited, the ignition switch must remain ON for at least 30 seconds to allow the door actuators to automatically recalibrate.
- If a condition exists, but no on-demand DTCs appear during the self-test, carry out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) - Retrieve Continuous DTCs procedure.

HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) - Retrieve Continuous DTCs

The HVAC module -EATC or HVAC module - DATC will retrieve only continuous (intermittent) DTCs when carrying out this procedure.

- Retrieval of continuous DTCs can be initiated after cycling the ignition switch from OFF to ON. Normal operation of the climate control system stops when retrieving continuous DTCs.
- To retrieve continuous DTCs, press the OFF and DEFROST buttons simultaneously and release, then press the RECIRC button within 2 seconds. All vacuum fluorescent segments will be displayed if there are no continuous DTCs present. Continuous DTCs are indicated by the presence of the Celsius symbol (° C) on the HVAC module - EATC or HVAC module - DATC display. Record all DTCs displayed.
- If any DTCs appear, carry out the diagnostic procedure. Refer to the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) DTC Chart and follow the ACTION for each DTC given.
- If a condition exists but no DTCs appear, go to **Symptom Chart - Climate Control Systems** condition: The DATC/EATC System is Inoperative, Intermittent or Incorrect Operation.
- To exit and **retain** all continuous DTCs, press any button **except** DEFROST. The HVAC module - EATC or HVAC module -DATC will exit the retrieved continuous DTCs mode and retain all continuous DTCs.
- To exit and **clear** all continuous DTCs, press the DEFROST button. The HVAC module -EATC or HVAC module - DATC will exit the retrieve continuous DTCs mode and all continuous DTCs will be cleared.
- Always exit the procedure before powering the system down (system turned OFF). Once the procedure is exited, the ignition switch must remain ON for at least 30 seconds to allow the door actuators to automatically recalibrate.
- Continuous DTCs will be deleted after 80 ignition switch ON cycles after the intermittent fault occurs.

HVAC Module Cold Boot Process

The purpose of the cold boot process is to allow the HVAC module to reinitializes and calibrate the actuators. To carry out the cold boot process, follow the steps below.

1. Turn the ignition switch to the OFF position.
2. Disconnect the HVAC module electrical connectors.

3. Wait one minute.
4. Connect the HVAC module electrical connectors.
5. Turn the ignition switch to the ON position.
6. Select any position except OFF on the HVAC module.

   The HVAC will now initialize and calibrate the actuators. Calibration of the actuators will take approximately 30 seconds.

PCM DTC Chart

PCM DTC CHART

DTC	Description	Action to Take
P0532	A/C Refrigerant Pressure Sensor A Circuit Low	Go to **Pinpoint Test A**.
P0533	A/C Refrigerant Pressure Sensor A Circuit High	Go to **Pinpoint Test A**.
P0537	A/C Evaporator Temperature Sensor Low	Go to **Pinpoint Test B**.
P0538	A/C Evaporator Temperature Sensor High	Go to **Pinpoint Test B**.
P0645	Air Conditioning Clutch Relay (A/CCR) Control Circuit	Go to **Pinpoint Test C**.
P1464	A/C Demand Out Of Self Test Range	If the HVAC selector was not in the OFF position, PLACE it in the OFF position, CLEAR the DTCs and REPEAT the self-test. If the DTC does not return, IGNORE the DTC and continue diagnostics. If the DTC returns, go to **Pinpoint Test O**. [a]
All Other DTCs	-	REFER to the **Introduction - Gasoline Engines** article.

[a] PCM DTC P1464 will set if the function selector is in PANEL with A/C button pressed, DEFROST or MAX A/C mode when the on-demand self-test is being run.

HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) DTC Chart

NOTE: **Some PCM DTCs may inhibit A/C operation. If any PCM DTCs are retrieved, diagnose those first. Refer to the PCM DTC Chart.**

HVAC MODULE - ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) AND HVAC MODULE - DUAL AUTOMATIC TEMPERATURE CONTROL (DATC) DTC CHART

DTC	Description	Action to Take
B1003	Mode Door Circuit Failure	Go to **Pinpoint Test F**.

B1200	Stuck Button	Button held too long may set DTC. ATTEMPT to clean buttons. If code returns, INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article.
B1251	Air Temperature Internal Sensor Circuit Open	Go to **Pinpoint Test D**.
B1253	Air Temperature Internal Sensor Circuit Short To Ground	Go to **Pinpoint Test D**.
B1255	Air Temperature External Sensor Circuit Open	Go to **Pinpoint Test E**.
B1257	Air Temperature External Sensor Circuit Short To Ground	Go to **Pinpoint Test E**.
B1342	Module Faulted	INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article.
B1676	Battery Voltage Out of Range	Go to **Pinpoint Test J**.
B2266	Left Side Blend Door Circuit Failure	Go to **Pinpoint Test Q**.
B2267	Right Side Blend Door Circuit Failure	Go to **Pinpoint Test Q**.
B2426	Passenger Solar Radiation Sensor Circuit Open	Go to **Pinpoint Test F**.
B2427	Passenger Solar Radiation Sensor Circuit Short to Ground	Go to **Pinpoint Test F**.
B2795	Driver Solar Radiation Sensor Circuit Short to Ground	Go to **Pinpoint Test F**.
B2796	Driver Solar Radiation Sensor Circuit Open	Go to **Pinpoint Test F**.
B2826	Front Evaporator Temp Sensor Circuit Failure	Go to **Pinpoint Test G**.
B2827	Front Evaporator Temp Sensor Short to Ground	Go to **Pinpoint Test G**.

Symptom Chart - Climate Control System

Symptom Chart - Climate Control System

Condition	Possible Sources	Action
• No communication with the HVAC module - Dual Automatic Temperature Control (DATC) or HVAC module - Electronic Automatic Temperature Control (EATC)	• Fuse(s) • Circuitry open • HVAC module - DATC communication network • HVAC module - EATC communication network	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• HVAC functions verification	• HVAC system and/or related components	• Go to **Pinpoint Test K**.
• Air inlet door is inoperative	• Circuitry open/shorted • HVAC module - EATC • HVAC module - DATC • HVAC module - Electronic Manual	• Go to **Pinpoint Test H**.

	Temperature Control (EMTC) • Air inlet door actuator/linkage	
• Incorrect/erratic direction of airflow from outlets	• Circuitry short/open • Door actuator • Mode door binding or stuck • HVAC module - EATC • HVAC module - DATC • HVAC module - EMTC • Door actuator arm not connected to the door crank	• Go to **Pinpoint Test I**.
• Reduced outlet airflow	• Circuitry short • A/C compressor clutch air gap • A/C cycling switch • A/C clutch relay • Blower motor • Blower motor control • Blower motor resistor • Blower motor switch • PCM	• If the A/C compressor does not cycle, go to **Pinpoint Test N**. • EMTC systems, if the A/C compressor cycles normally, go to **Pinpoint Test S**. • EATC/DATC systems, if the A/C compressor cycles normally, Go to **Pinpoint Test U**.
• Insufficient, erratic or no heat	• Low engine coolant level • Engine overheating • Plugged or partially plugged heater core • Temperature blend door is binding or stuck • Temperature blend door actuator • Heater hose is kinked or binding	• Go to **Pinpoint Test L**.
	• Open fuse • Circuitry short/open • A/C system discharged/low charge • PCM	

• The air conditioning (A/C) is inoperative	• HVAC module - EATC • HVAC module - DATC • HVAC module - EMTC • A/C compressor clutch air gap • A/C clutch relay	• Go to **Pinpoint Test M**.
• The air conditioning (A/C) is always on - A/C compressor does not cycle	• Circuitry short/open • PCM • A/C compressor clutch air gap • A/C clutch relay	• Go to **Pinpoint Test N**.
• The air conditioning (A/C) is always on - A/C mode always commanded ON	• Circuitry short/open • HVAC module - EATC • HVAC module - DATC • HVAC module - EMTC • PCM	• Go to **Pinpoint Test O**.
• Temperature control is inoperative/does not operate correctly - EMTC	• Circuitry open/shorted • HVAC module - EMTC • Temperature blend door • Temperature blend door actuator • Door actuator arm not connected to the door crank	• Go to **Pinpoint Test P**.
• Temperature control is inoperative/does not operate correctly - EATC/DATC	• Circuitry open/shorted • HVAC module - EATC • HVAC module - DATC • Temperature blend door • Temperature blend door actuator • Door actuator arm not connected to the door crank	• Go to **Pinpoint Test Q**.
• The blower motor is inoperative - EMTC	• Fuse(s) • Circuitry open/shorted • A/C blower motor switch • Blower motor relay • A/C blower motor	• Go to **Pinpoint Test R**.

	• HVAC module - EMTC	
• The blower motor does not operate correctly - EMTC	• Circuitry shorted • A/C blower motor resistor • A/C blower motor switch	• Go to **Pinpoint Test S**.
• The blower motor is inoperative - DATC/EATC	• Fuse(s) • Circuitry short/open • Blower motor relay • A/C blower motor • HVAC module - EATC • HVAC module - DATC • A/C blower motor speed control	• Go to **Pinpoint Test T**.
• The blower motor does not operate correctly - DATC/EATC	• Circuitry short • A/C blower motor speed control • HVAC module - EATC • HVAC module - DATC • A/C blower motor speed control	• Go to **Pinpoint Test U**.
• The dual temperature control is inoperative/does not operate correctly	• Temperature blend door/actuator broken/binding • HVAC module - DATC • Low A/C refrigerant charge	• CHECK that the A/C system pressure is above 290 kPa (42 psi). If the pressure is below 290 kPa (42 psi), REFER to **Fluorescent Dye Leak Detection**. CHECK the temperature blend doors/actuators for a binding or broken condition. If no condition is found, INSTALL a new DATC module.
• The temperature set point does not repeat after turning the ignition switch OFF	• Open fuse • Circuitry short/open • HVAC module - EATC • HVAC module - DATC	• CHECK circuit SBP07 (WH/RD) for a short or open and repair as necessary. If OK, INSTALL a new HVAC module.
• The temperature display will not switch between Celsius and Fahrenheit	• HVAC module - EATC • HVAC module - DATC • Instrument Cluster (IC) module	• If the IC does not switch between English and Metric, REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article. • If only the HVAC module does not switch between English and Metric,

		INSTALL a new HVAC module.
• Inaccurate external temperature display	• HVAC module - EATC • HVAC module - DATC	• REFER to Description and Operation of the External Temperature Display. If the external temperature display is not operating as described and no DTC is present, CARRY OUT the **Ambient Temperature Sensor**. If the sensor tests OK, CARRY OUT the HVAC Module Cold Boot Process. If the condition returns, INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.
• A/C pressure relief valve discharging	• High system pressure • A/C pressure relief valve	• CHECK the high-side system pressure. If the pressure is below the A/C pressure relief valve open pressure, REPLACE the A/C pressure relief valve. If the system pressure is above the A/C pressure relief valve open pressure, REPAIR the system for a restriction.

Symptom Chart - NVH

NOTE: **NVH symptoms will be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.**

Symptom Chart - NVH

Condition	Possible Sources	Action
• Noisy A/C compressor clutch	• A/C compressor clutch air gap out of specification	• CHECK and ADJUST the A/C compressor clutch gap if necessary. REFER to **Air Conditioning (A/C) Clutch Air Gap Adjustment**. TEST the system for normal operation. • If the A/C compressor clutch gap is OK, INSTALL an A/C

		compressor clutch. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

Pinpoint Tests

Pinpoint Test A: DTC P0532 or P0533

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Electronic Engine Controls - 2.3L for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Electronic Engine Controls - 3.0L for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Electronic Engine Controls - 3.5L for schematic and connector information.

Normal Operation

Under normal operation, the A/C pressure transducer receives a ground from the PCM through circuit RE407 (YE/VT). A 5-volt reference voltage is supplied to the A/C pressure transducer from the PCM through circuit LE424 (YE/GN). The A/C pressure transducer sends a voltage to the PCM through circuit VH433 (VT/OG) to indicate the A/C pressure.

- DTC P0532 A/C Pressure Refrigerant Sensor A Circuit Low - The A/C pressure transducer inputs a voltage to the PCM. If the voltage is below the calibrated level, this DTC sets.
- DTC P0533 A/C Pressure Refrigerant Sensor A Circuit High - The A/C pressure transducer inputs a voltage to the PCM. If the voltage is above the calibrated level, this DTC sets.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- A/C pressure transducer
- PCM

PINPOINT TEST A: DTC P0532 OR DTC P0533

NOTE: **When disconnecting and reconnecting the pressure transducer electrical connector, make sure that the connector-locking device is in place and that the locking device and connector are correctly and fully seated.**

A1 CHECK THE PCM OUTPUT VOLTAGE

- Key in OFF position.
- Disconnect: A/C Pressure Transducer C1260
- Key in ON position.

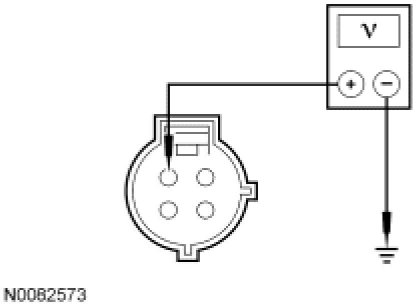


Fig. 2: Checking PCM Output Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and A/C pressure transducer C2160-2, circuit LE424 (YE/GN), harness side.
- **Is the voltage between 4.7 and 5.1 volts?**

  YES : Go to A2.

  NO : REPAIR circuit LE424 (YE/GN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

A2 CHECK THE PCM SENSOR GROUND

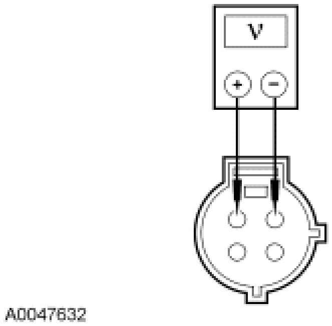


Fig. 3: Checking PCM Sensor Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between A/C pressure transducer C2160-1, circuit RE407 (YE/VT), harness side and A/C pressure transducer C2160-2, circuit LE424 (YE/GN), harness side.
- **Is the voltage between 4.7 and 5.1 volts?**

  YES : If diagnosing DTC P0532, go to A3. If diagnosing DTC P0533, go to A5.

  NO : REPAIR circuit RE407 (YE/VT) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

A3 CHECK THE A/C PRESSURE TRANSDUCER HIGH

- Enter the following diagnostic mode on the diagnostic tool: A/C Pressure (ACP_PRESS) PCM PID

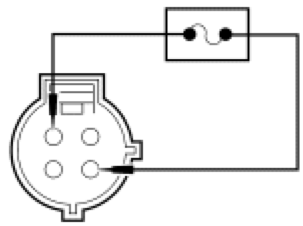


Fig. 4: Checking A/C Pressure Transducer High
Courtesy of FORD MOTOR CO.

- While observing the ACP_PRESS PCM PID, connect a fused jumper between A/C pressure transducer C2160-3, circuit VH433 (VT/OG), harness side and A/C pressure transducer C2160-2, circuit LE424 (YE/GN), harness side.
- **Does the ACP_PRESS PCM PID voltage read greater than 4 volts?**

  YES : INSTALL a new A/C pressure transducer. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : Go to A4.

A4 CHECK CIRCUIT VH433 (VT/OG) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: PCM C175b

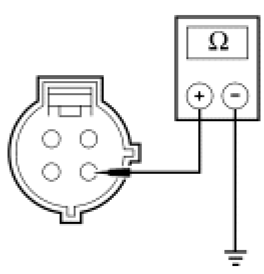


Fig. 5: Checking Circuit VH433 (VT/OG) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and A/C pressure transducer C2160-3, circuit VH433 (VT/OG), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to A7.

  NO : REPAIR circuit VH433 (VT/OG) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

A5 CHECK THE A/C PRESSURE TRANSDUCER HIGH

- Enter the following diagnostic mode on the diagnostic tool: A/C Pressure (ACP_PRESS) PCM PID

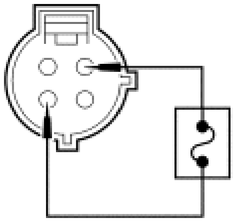


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Fig. 6: Connecting A Fused Jumper Between A/C Cycling Switch C130-4 And C130-1
Courtesy of FORD MOTOR CO.

- While observing the ACP_PRESS PCM PID, connect a fused jumper between A/C pressure transducer C2160-3, circuit VH433 (VT/OG), harness side and A/C pressure transducer C2160-1, circuit RE407 (YE/VT), harness side.
- **Does the ACP_PRESS PCM PID voltage read less than 4.9 volts?**

  YES : INSTALL a new A/C pressure transducer. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : Go to A6.

A6 CHECK CIRCUIT VH433 (VT/OG) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: PCM C175b
- Key in ON position.

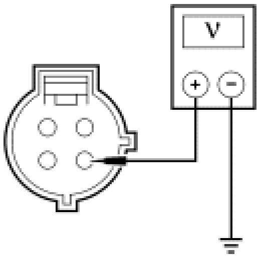

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Fig. 7: Checking Circuit VH433 (VT/OG) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and A/C pressure transducer C2160-3, circuit VH433 (VT/OG), harness side.
- **Is any voltage present?**

  YES : REPAIR circuit VH433 (VT/OG) for a short to voltage. CLEAR the DTCs. REPEAT the

self-test. TEST the system for normal operation.

NO : Go to A7.

A7 CHECK CIRCUIT VH433 (VT/OG) FOR A SHORT TO CIRCUIT LE424 (YE/GN) OR RE407 (YE/VT)

- Key in OFF position.

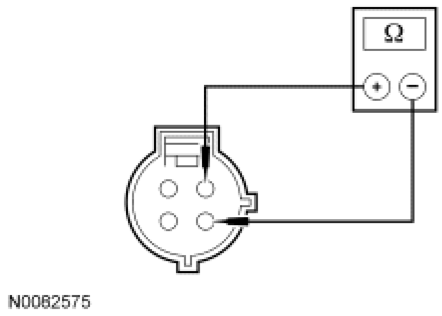


Fig. 8: Checking Circuit VH433 (VT/OG) For A Short To Circuit LE424 (YE/GN) Or RE407 (YE/VT)
Courtesy of FORD MOTOR CO.

NOTE: **For DTC P0532 only.**

- Measure the resistance between A/C pressure transducer C2160-3, circuit VH433 (VT/OG), harness side and A/C pressure transducer C2160-1, circuit RE407 (YE/VT), harness side.

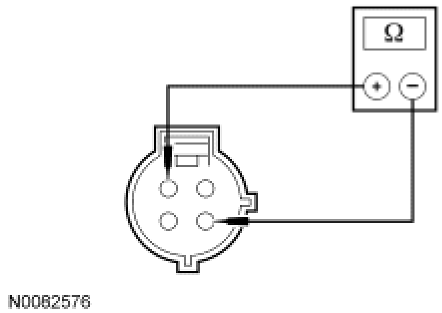


Fig. 9: Measuring Resistance Between A/C Pressure Transducer C2160-3 & C2160-1, Circuit VH433 (VT/OG) & RE407 (YE/VT)
Courtesy of FORD MOTOR CO.

NOTE: **For DTC P0533 only.**

- Measure the resistance between A/C pressure transducer C2160-3, circuit VH433 (VT/OG), harness side and A/C pressure transducer C2160-2, circuit LE424 (YE/GN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to A8.

NO : REPAIR circuit VH433 (VT/OG) for a short to circuit LE424 (YE/GN) or RE407 (YE/VT). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

A8 CHECK CIRCUIT VH433 (VT/OG) FOR AN OPEN

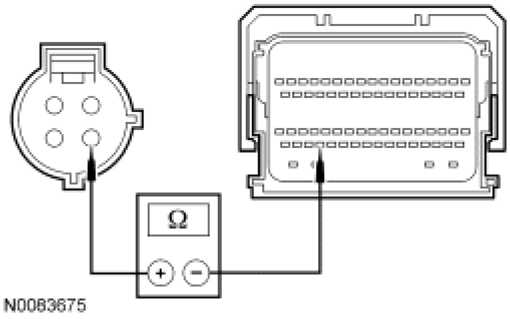


Fig. 10: Checking Circuit VH433 (VT/OG) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between A/C pressure transducer C2160-3, circuit VH433 (VT/OG), harness side and PCM C175b-63, circuit VH433 (VT/OG), harness side
- **Is the resistance less than 5 ohms?**

  YES : Go to A9.

  NO : REPAIR circuit VH433 (VT/OG) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

A9 CHECK THE PCM CONNECTION

- Clear the DTCs.
- Disconnect all the PCM connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
  - incorrectly seated connector.
- Connect and correctly seat all the PCM connectors.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new PCM. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: DTC P0537 or P0538

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Electronic Engine Controls - 2.3L for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Manual Climate Control System for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the evaporator discharge air temperature sensor receives a ground from the PCM through circuit RE407 (YE/VT). A 5-volt reference voltage is supplied to the evaporator discharge air temperature sensor from the PCM through circuit VH406 (VT/BN).

- DTC P0537 A/C Evaporator Temperature Sensor Low - The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground.
- DTC P0538 A/C Evaporator Temperature Sensor High - The module senses no voltage drop on the sensor reference voltage circuit, indicating an open circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Evaporator discharge air temperature sensor
- PCM

PINPOINT TEST B: DTC P0537 OR DTC P0538

B1 CHECK THE SENSOR RESISTANCE

- Key in OFF position.
- Disconnect: Evaporator Discharge Temperature Sensor C2295
- Carry out the **Temperature Sensor - Evaporator Discharge**.
- **Is the resistance within the specified values for the temperatures?**

  YES : Go to B2.

  NO : INSTALL a new in-vehicle temperature sensor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B2 CHECK THE HVAC MODULE OUTPUT VOLTAGE

- Key in ON position.
- Press the AUTO button.

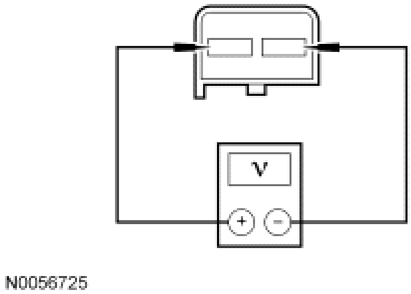


Fig. 11: Checking EATC Sensor Output Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between evaporator discharge temperature sensor C2295-2, circuit VH406 (VT/BN), harness side and C2295-1, circuit RE407 (YE/VT), harness side.
- **Is the voltage between 4.7 and 5.1 volts?**

  YES : INSTALL a new evaporator discharge sensor. If code returns, go to B7.

  NO : If diagnosing DTC P0538, go to B3.

  If diagnosing DTC P0537, go to B5.

B3 CHECK CIRCUIT VH406 (VT/BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: PCM C175b

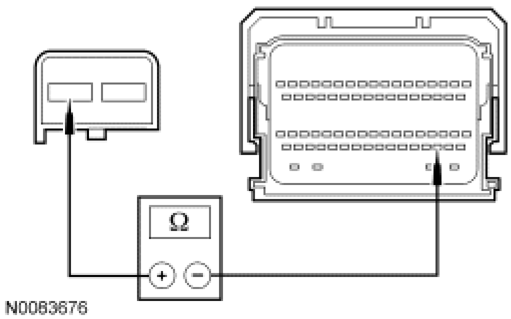


Fig. 12: Checking Circuit VH406 (VT/BN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between PCM C175b-53, circuit VH406 (VT/BN), harness side and evaporator discharge temperature sensor C2295-2, circuit VH406 (VT/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to B4.

  NO : REPAIR circuit VH406 (VT/BN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B4 CHECK CIRCUIT RE407 (YE/VT) FOR AN OPEN

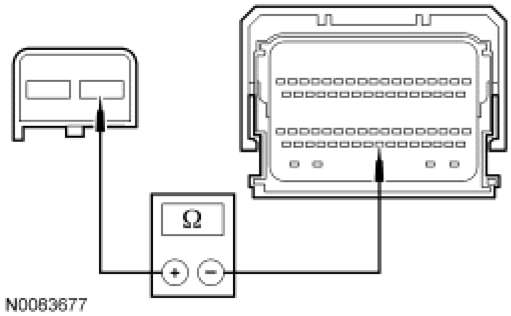


Fig. 13: Checking Circuit RE407 (YE/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between PCM C175b-58, circuit RE407 (YE/VT), harness side and evaporator discharge temperature sensor C2295-1, circuit RE407 (YE/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to B7.

  NO : REPAIR circuit RE407 (YE/VT) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B5 CHECK CIRCUITS VH406 (VT/BN) AND RE407 (YE/VT) FOR A SHORT TOGETHER

- Key in OFF position.
- Disconnect: PCM C175b

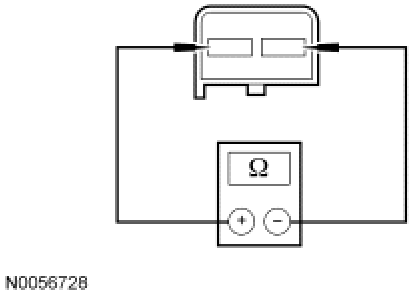


Fig. 14: Checking Circuit VH406 (VT/BN) For A Short To Circuit RH104 (BU/BN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between evaporator discharge temperature sensor C2295-2, circuit VH406 (VT/BN), harness side and C2295-1, circuit RE407 (YE/VT), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B6.

  NO : REPAIR circuits VH406 (VT/BN) and RE407 (YE/VT) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B6 CHECK CIRCUIT VH406 (VT/BN) FOR A SHORT TO GROUND

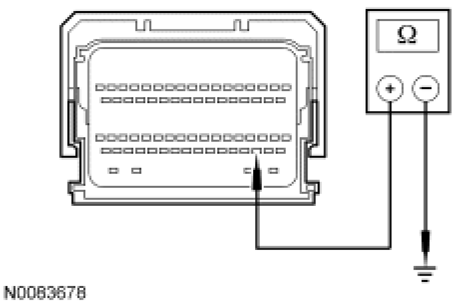


Fig. 15: Checking Circuit VH406 (VT/BN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between PCM C175b-53, circuit VH406 (VT/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B7.

  NO : REPAIR circuit VH406 (VT/BN) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

B7 CHECK THE PCM CONNECTION

- Clear the DTCs.
- Disconnect all the PCM connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
  - incorrectly seated connector.
- Connect and correctly seat all the PCM connectors.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new PCM. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: DTC P0645

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Manual Climate Control System for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, voltage is provided to the A/C clutch relay coil through circuit CBP47 (GN/BU). When A/C is requested, and A/C line pressures allow, a ground is provided to the A/C clutch relay coil from the PCM through circuit CH302 (WH/BN), energizing the A/C clutch relay.

- DTC P0645 - A/C Clutch Relay Control Circuit - The DTC sets when the PCM grounds the relay circuit, excessive current draw is detected on the relay circuit or, with the relay circuit not grounded by the PCM, voltage is not detected on the relay circuit the PCM expects to detect voltage coming through the relay coil to the relay circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- A/C clutch relay
- PCM

PINPOINT TEST C: DTC P0645

C1 CHECK THE VOLTAGE TO THE A/C CLUTCH RELAY

- Key in OFF position.
- Disconnect: A/C Clutch Relay
- Key in ON position.

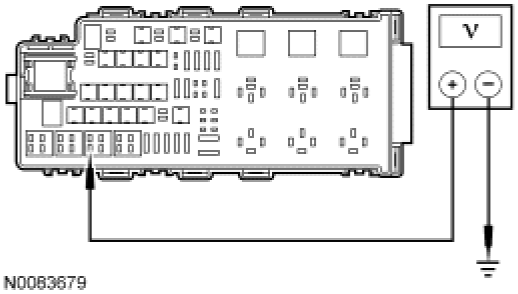


Fig. 16: Checking Voltage To A/C Clutch Relay
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and the A/C clutch relay socket, circuit CBP47 (GN/BU).
- **Is the voltage greater than 10 volts?**

  YES : CARRY OUT the A/C clutch relay component test. Refer to COMPONENT TESTING. If the relay tests OK, go to C2.

  NO : REPAIR circuit CBP47 (GN/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

C2 CHECK CIRCUIT CH302 (WH/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: PCM C175b
- Key in ON position.

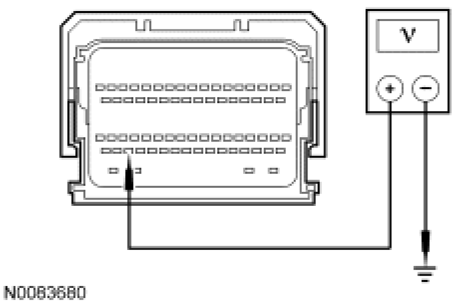


Fig. 17: Checking Circuit CH302 (WH/BN) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and PCM C175b-64, circuit CH302 (WH/BN), harness side.
- **Is any voltage present?**

  YES : REPAIR circuit CH302 (WH/BN) for a short to voltage. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : Go to C3.

C3 CHECK CIRCUIT CH302 (WH/BN) FOR A SHORT TO GROUND

- Key in OFF position.

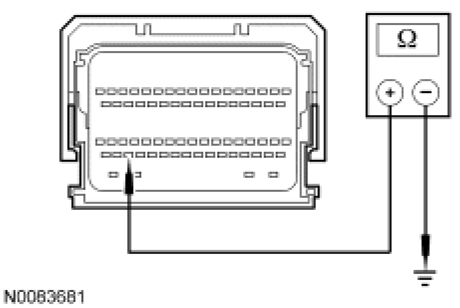


Fig. 18: Checking Circuit CH302 (WH/BN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and PCM C175b-64, circuit CH302 (WH/BN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to C4.

  NO : REPAIR circuit CH302 (WH/BN) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

C4 CHECK CIRCUIT CH302 (WH/BN) FOR AN OPEN

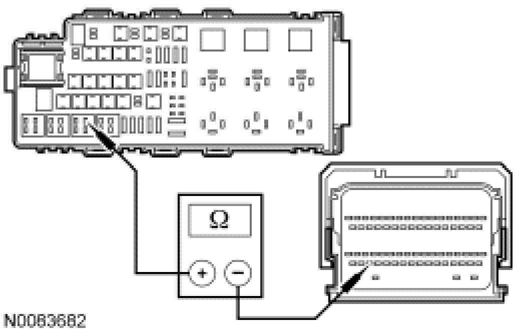


Fig. 19: Checking Circuit CH302 (WH/BN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between A/C clutch relay socket, circuit CH302 (WH/BN) and PCM C175b-64, circuit CH302 (WH/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to C5.

  NO : REPAIR circuit 321 (GY/WH) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

C5 CHECK THE PCM CONNECTION

- Clear the DTCs.
- Disconnect all the PCM connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
  - incorrectly seated connector.
- Connect and correctly seat all the PCM connectors.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new PCM. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test D: DTC B1251 or B1253

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the in-vehicle air temperature sensor receives a ground from the HVAC module - Electronic Automatic Temperature Control (EATC) or HVAC module - Dual Automatic Temperature Control (DATC) through circuit RH104 (BU/BN). A 5-volt reference voltage is supplied to the in-vehicle air

temperature sensor from the HVAC module - DATC or HVAC module - EATC through circuit VH414 (GN/BU).

- DTC B1251 Air Temperature Internal Sensor Circuit Open - The module senses no voltage drop on the sensor reference voltage circuit, indicating an open circuit.
- DTC B1253 Air Temperature Internal Sensor Circuit Short to Ground - The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- In-vehicle air temperature sensor
- HVAC module - EATC
- HVAC module - DATC

PINPOINT TEST D: DTC B1251 OR DTC B1253

D1 CHECK THE SENSOR RESISTANCE

- Key in OFF position.
- Disconnect: In-Vehicle Temperature Sensor C233
- Carry out the **In-Vehicle Temperature Sensor**.
- **Does the in-vehicle temperature sensor test OK?**

  YES : Go to D2.

  NO : INSTALL a new in-car temperature sensor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

D2 CHECK THE HVAC MODULE OUTPUT VOLTAGE

- Key in ON position.
- Press the AUTO button.

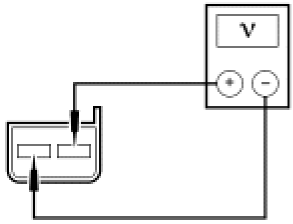


Fig. 20: Checking EATC Sensor Output Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between in-vehicle temperature sensor C233-2, circuit VH414 (GN/BU), harness side and C233-1, circuit RH104 (BU/BN), harness side.

- **Is the voltage between 4.7 and 5.1 volts?**

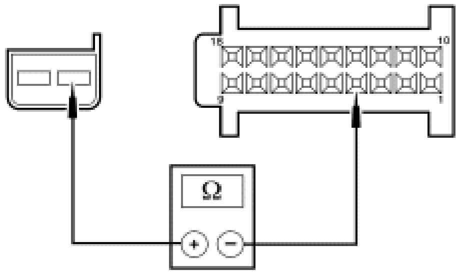
  YES : INSTALL a new in-vehicle sensor. CLEAR the DTCs. REPEAT the self-test. If code returns, go to D7.

  NO : If diagnosing **DTC B1251** , go to D3.

  If diagnosing **DTC B1253** , go to D5.

D3 CHECK CIRCUIT VH414 (GN/BU) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module - DATC C2356b or HVAC Module - EATC C228b

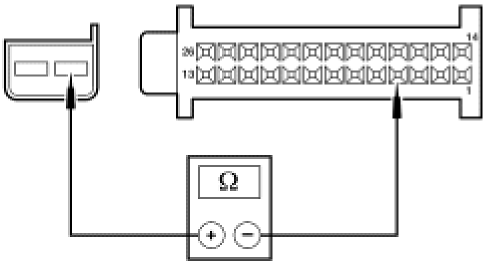


N0083683

Fig. 21: Checking Circuit VH414 (GN/BU) For An Open (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the resistance between HVAC module - EATC C228b-4, circuit VH414 (GN/BU), harness side and in-vehicle temperature sensor C233-2, circuit VH414 (GN/BU), harness side.



N0083684

Fig. 22: Checking Circuit VH414 (GN/BU) For An Open (DATC)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

- Measure the resistance between HVAC module - DATC C2356b-4, circuit VH414 (GN/BU), harness side and in-vehicle temperature sensor C233-2, circuit VH414 (GN/BU), harness side.

- **Is the resistance less than 5 ohms?**

  YES : Go to D4.

  NO : REPAIR circuit VH414 (GN/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

D4 CHECK CIRCUIT RH104 (BU/BN) FOR AN OPEN

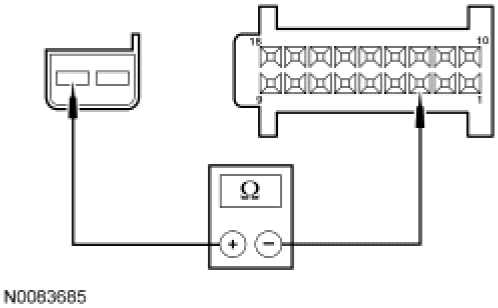


Fig. 23: Checking Circuit RH104 (BU/BN) For An Open (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the resistance between HVAC module - EATC C228b-3, circuit RH104 (BU/BN), harness side and in-vehicle temperature sensor C233-1, circuit RH104 (BU/BN), harness side.

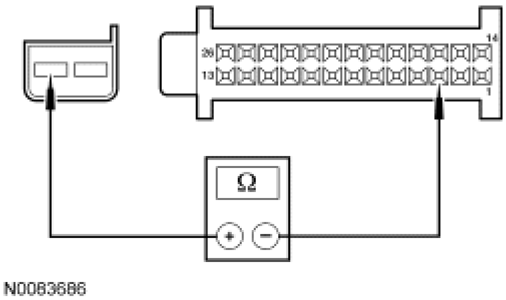


Fig. 24: Checking Circuit RH104 (BU/BN) For An Open (DATC)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

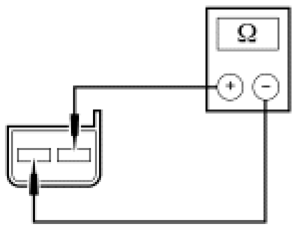
- Measure the resistance between HVAC module - DATC C2356b-3, circuit RH104 (BU/BN), harness side and in-vehicle temperature sensor C233-1, circuit RH104 (BU/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to D7.

  NO : REPAIR circuit RH104 (BU/BN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

D5 CHECK CIRCUITS VH414 (GN/BU) AND RH104 (BU/BN) FOR A SHORT TOGETHER

- Key in OFF position.
- Disconnect: HVAC Module - DATC C2356b or HVAC Module - EATC C228b



N0041872

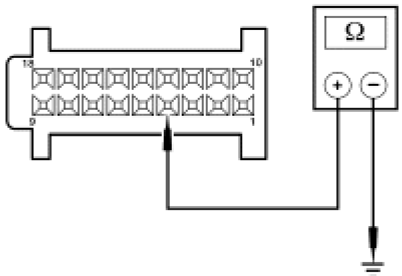
Fig. 25: Checking Circuit VH414 (GN/BU) For Short To Circuit RH104 (BU/BN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between in-vehicle temperature sensor C233-2, circuit VH414 (GN/BU), harness side and C233-1, circuit RH104 (BU/BN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to D6.

  NO : REPAIR circuits VH414 (GN/BU) and RH104 (BU/BN) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

D6 CHECK CIRCUIT VH414 (GN/BU) FOR A SHORT TO GROUND



N0063667

Fig. 26: Checking Circuit VH414 (GN/BU) For A Short To Ground (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the resistance between HVAC module - EATC C228b-4, circuit VH414 (GN/BU), harness side and ground.

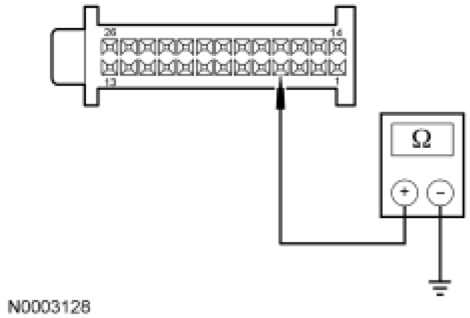


Fig. 27: Checking Circuit VH414 (GN/BU) For A Short To Ground (DATC)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

- Measure the resistance between HVAC module - DATC C2356b-4, circuit VH414 (GN/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to D7.

  NO : REPAIR circuit VH414 (GN/BU) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

D7 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test E: DTC B1255 or B1257

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the ambient air temperature sensor receives a ground from the HVAC module - Electronic Automatic Temperature Control (EATC) or HVAC module - Dual Automatic Temperature Control (DATC) through circuit RH104 (BU/BN). A 5-volt reference voltage is supplied to the ambient air temperature sensor from the DATC/EATC module through circuit VH407 (YE/GN).

- DTC B1255 Air Temperature External Sensor Circuit Open - The module senses no voltage drop on the sensor reference voltage circuit, indicating an open circuit.
- DTC B1257 Air Temperature External Sensor Circuit Short To Ground - The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Ambient air temperature sensor
- HVAC module - EATC
- HVAC module - DATC

PINPOINT TEST E: DTC B1255 OR DTC B1257

E1 CHECK THE SENSOR RESISTANCE

- Key in OFF position.
- Disconnect: Ambient Temperature Sensor C132
- Carry out the **Ambient Temperature Sensor**.
- **Does the ambient temperature sensor test OK?**

  YES : Go to E2.

  NO : INSTALL a new ambient temperature sensor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

E2 CHECK THE HVAC MODULE OUTPUT VOLTAGE

- Key in ON position.
- Press the AUTO button.

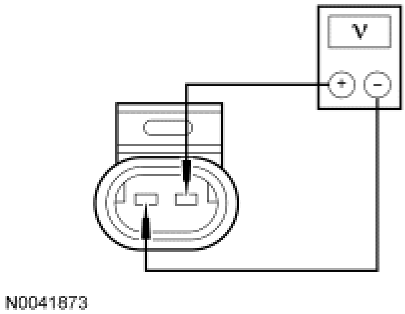


Fig. 28: Checking EATC Sensor Output Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ambient temperature sensor C132-A, circuit VH407 (YE/GN), harness side and C132-B, circuit RH104 (BU/BN), harness side.
- **Is the voltage between 4.7 and 5.1 volts?**

  YES : INSTALL a new ambient sensor. CLEAR the DTCs. REPEAT the self-test. If code returns, go to E7.

NO : If diagnosing **DTC B1255** , go to E3.

If diagnosing **DTC B1257** , go to E5.

E3 CHECK CIRCUIT VH407 (YE/GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module - DATC C2356b or HVAC Module - EATC C228b

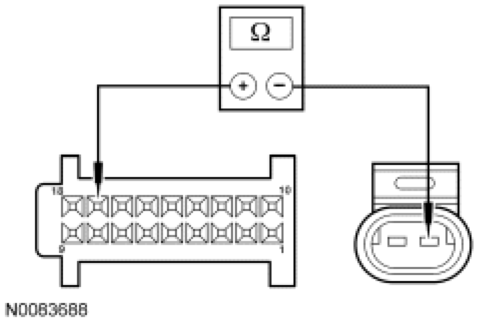


Fig. 29: Checking Circuit VH407 (YE/GN) For An Open (EATC)
Courtesy of FORD MOTOR CO.

NOTE: **EATC systems only.**

- Measure the resistance between HVAC module - EATC C228b-17, circuit VH407 (YE/GN), harness side and ambient temperature sensor C132-A, circuit VH407 (YE/GN), harness side.

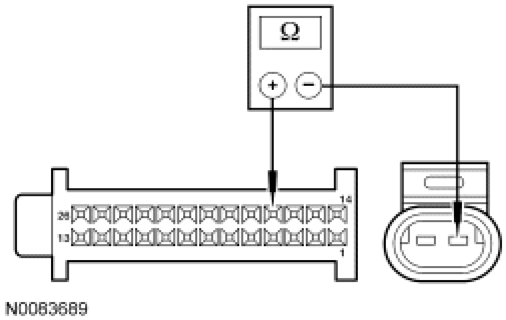


Fig. 30: Checking Circuit VH407 (YE/GN) For An Open (DATC)
Courtesy of FORD MOTOR CO.

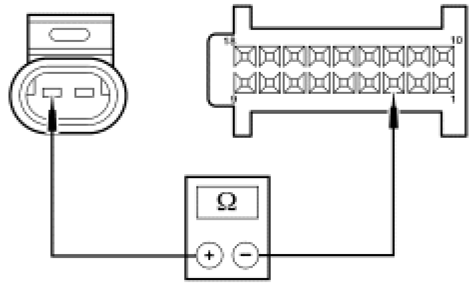
NOTE: **DATC systems only.**

- Measure the resistance between HVAC module - DATC C2356b-17, circuit VH407 (YE/GN), harness side and ambient temperature sensor C132-A, circuit VH407 (YE/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to E4.

NO : REPAIR circuit VH407 (YE/GN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

E4 CHECK CIRCUIT RH104 (BU/BN) FOR AN OPEN

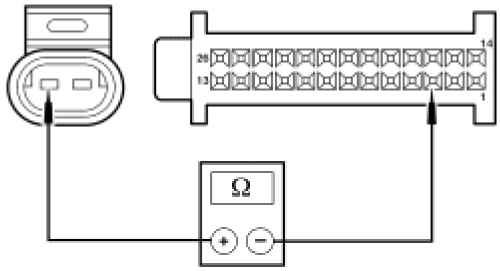


N0083690

Fig. 31: Checking Circuit RH104 (BU/BN) For An Open (EATC)
Courtesy of FORD MOTOR CO.

NOTE: **EATC systems only.**

- Measure the resistance between HVAC module - EATC C228b-3, circuit RH104 (BU/BN), harness side and ambient temperature sensor C132-B, circuit RH104 (BU/BN), harness side.



N0083691

Fig. 32: Checking Circuit RH104 (BU/BN) For An Open (DATC)
Courtesy of FORD MOTOR CO.

NOTE: **DATC systems only.**

- Measure the resistance between HVAC module - DATC C2356b-3, circuit RH104 (BU/BN), harness side and ambient temperature sensor C132-B, circuit RH104 (BU/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to E7.

  NO : REPAIR circuit RH104 (BU/BN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

E5 CHECK CIRCUITS VH407 (YE/GN) AND RH104 (BU/BN) FOR A SHORT TOGETHER

- Key in OFF position.

- Disconnect: HVAC Module - DATC C2356b or HVAC Module - EATC C228b

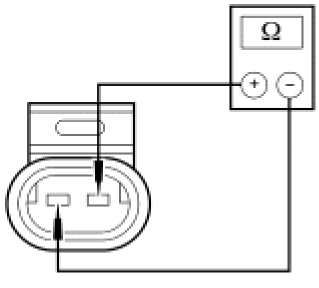


Fig. 33: Checking Circuit VH407 (YE/GN) For Short To Circuit RH104 (BU/BN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between ambient temperature sensor C132-A, circuit VH407 (YE/GN), harness side and C132-B, circuit RH104 (BU/BN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to E6.

  NO : REPAIR circuits VH407 (YE/GN) and RH104 (BU/BN) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

E6 CHECK CIRCUIT VH407 (YE/GN) FOR A SHORT TO GROUND

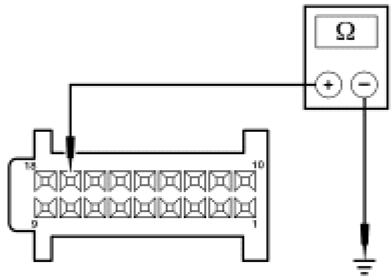


Fig. 34: Checking Circuit VH407 (YE/GN) For A Short To Ground (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the resistance between HVAC module - EATC C228b-17, circuit VH407 (YE/GN), harness side and ground.

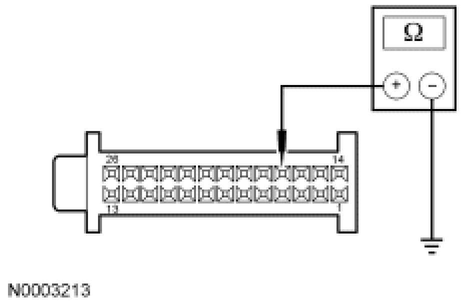


Fig. 35: Checking Circuit VH407 (YE/GN) For A Short To Ground (DATC)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

- Measure the resistance between HVAC module - DATC C2356b-17, circuit VH407 (YE/GN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to E7.

  NO : REPAIR circuit VH407 (YE/GN) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

E7 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test F: DTC B2426, B2427, B2795 or B2796

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the solar radiation sensor receives a ground through circuit GD116 (BK/VT). A 5-volt reference voltage is supplied to the solar radiation sensor from the HVAC module - Electronic Automatic Temperature Control (EATC) or HVAC module - Dual Automatic Temperature Control (DATC) through circuits (LH) VH416 (VT/GY) and (RH) VH417 (YE/OG).

DTC	Description	Fault Trigger Conditions
B2795	Driver Solar Radiation Sensor Circuit Short to Ground	The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground.
B2796	Driver Solar Radiation Sensor Circuit Open	The module senses no voltage drop on the sensor reference voltage circuit, indicating an open circuit.
B2426	Passenger Solar Radiation Sensor Circuit Open	The module senses no voltage drop on the sensor reference voltage circuit, indicating an open circuit.
B2427	Passenger Solar Radiation Sensor Circuit Short to Ground	The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Solar radiation sensor
- HVAC module - EATC
- HVAC module - DATC

PINPOINT TEST F: DTC B2426, B2427, B2795 or DTC B2796

F1 CHECK THE SOLAR RADIATION SENSOR REFERENCE VOLTAGE

- Key in OFF position.
- Disconnect: Solar Radiation Sensor C286
- Key in ON position.
- Press the AUTO button.

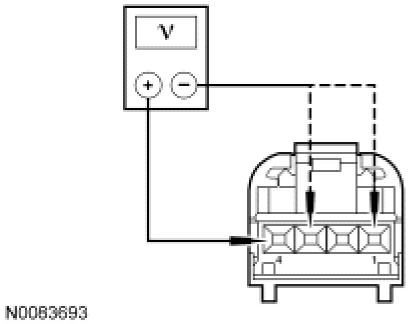


Fig. 36: Checking Solar Radiation Sensor Reference Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between solar radiation sensor C286-4, circuit GD116 (BK/VT), harness side

and:

- **For DTC B2426 or B2427** , C286-1, circuit VH417 (YE/OG), harness side.
- **For DTC B2795 or B2796** , C286-3, circuit VH416 (VT/GY), harness side.

- **Are the voltages between 4.7 and 5.1 volts?**

  YES : INSTALL a new solar radiation sensor. CLEAR the DTCs. REPEAT the self-test. If the DTC returns, go to F5.

  NO : If diagnosing DTC B2426 or B2796, go to F2.

  If diagnosing DTC B2427 or B2795, go to F4.

F2 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

- Key in OFF position.

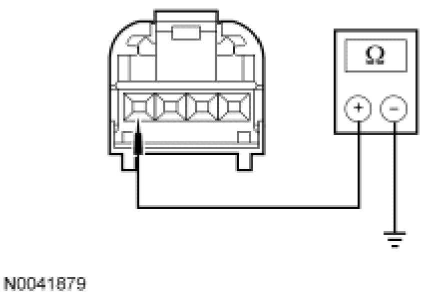


Fig. 37: Checking Circuit GD116 (BK/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between solar radiation sensor C286-4, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to F3.

  NO : REPAIR circuit GD116 (BK/VT) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

F3 CHECK CIRCUIT VH416 (VT/GY) OR VH417 (YE/OG) FOR AN OPEN

- Disconnect: HVAC Module - DATC C2356b or HVAC Module - EATC C228b

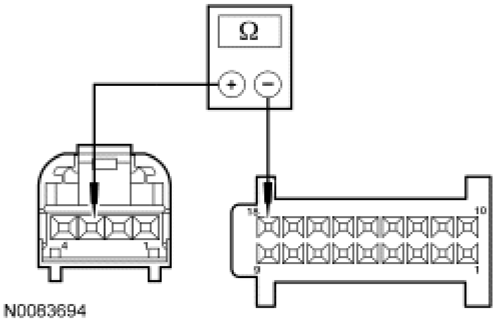


Fig. 38: Checking Circuit VH416 (VT/GY) OR VH417 (YE/OG) For An Open (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the resistance between HVAC module - EATC C228b-18, circuit VH416 (VT/GY), harness side and solar radiation sensor C286-3, circuit VH416 (VT/GY), harness side.

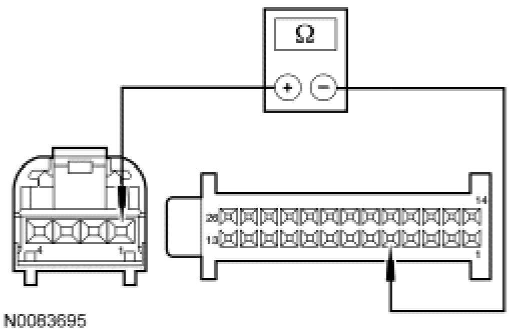


Fig. 39: Checking Circuit VH416 (VT/GY) OR VH417 (YE/OG) For An Open (DATC, DTC B2426)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

- Measure the resistance between HVAC module - DATC C2356b-5, circuit VH417 (YE/OG), harness side and solar radiation sensor C286-1, circuit VH417 (YE/OG), harness side.

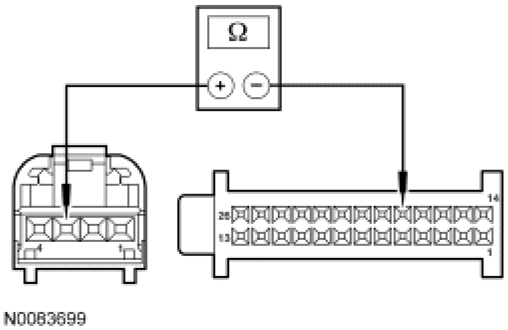


Fig. 40: Checking Circuit VH416 (VT/GY) OR VH417 (YE/OG) For An Open (DATC, DTC B2796)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

- Measure the resistance between HVAC module - DATC C2356b-18, circuit VH416 (VT/GY), harness side and solar radiation sensor C286-3, circuit VH416 (VT/GY), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to F5.

NO : REPAIR circuit VH416 (VT/GY) or VH417 (YE/OG) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

F4 CHECK CIRCUIT VH416 (VT/GY) OR VH417 (YE/OG) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: HVAC Module - DATC C2356b or HVAC Module - EATC C228b

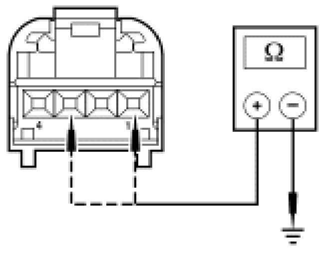


Fig. 41: Checking Circuit VH416 (VT/GY) OR VH417 (YE/OG) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and:
  - **For DTC B2427** , solar radiation sensor C286-1, circuit VH417 (YE/OG), harness side.
  - **For DTC B2795** , solar radiation sensor C286-3, circuit VH416 (VT/GY), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to F5.

  NO : REPAIR circuit VH416 (VT/GY) or VH417 (YE/OG) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

F5 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test G: DTC B2826 or B2827

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic

and connector information.

Normal Operation

Under normal operation, the evaporator discharge air temperature sensor receives a ground from the HVAC module - Dual Automatic Temperature Control (DATC) through circuit RH104 (BU/BN). A 5-volt reference voltage is supplied to the evaporator discharge air temperature sensor from the HVAC module - DATC through circuit VH406 (VT/BN).

- DTC B2826 Front Evaporator Temp Sensor Circuit Failure - The module senses no voltage drop on the sensor reference voltage circuit, indicating an open circuit.
- DTC B2827 Front Evaporator Temp Sensor Short to Ground - The module senses excessive voltage drop on the sensor reference voltage circuit, indicating a short directly to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Evaporator discharge air temperature sensor
- HVAC module - DATC

PINPOINT TEST G: DTC B2826 OR DTC B2827

G1 CHECK THE SENSOR RESISTANCE

- Key in OFF position.
- Disconnect: Evaporator Discharge Temperature Sensor C2295
- Carry out the **Temperature Sensor - Evaporator Discharge**.
- **Is the resistance within the specified values for the temperatures?**

  YES : Go to G2.

  NO : INSTALL a new in-vehicle temperature sensor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

G2 CHECK THE HVAC MODULE OUTPUT VOLTAGE

- Key in ON position.
- Press the AUTO button.

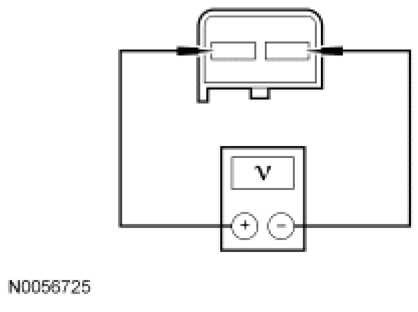


Fig. 42: Checking EATC Sensor Output Voltage

Courtesy of FORD MOTOR CO.

- Measure the voltage between evaporator discharge temperature sensor C2295-2, circuit VH406 (VT/BN), harness side and C2295-1, circuit RH104 (BU/BN), harness side.
- **Is the voltage between 4.7 and 5.1 volts?**

  YES : INSTALL a new evaporator discharge sensor. If code returns, go to G7.

  NO : If diagnosing DTC B2826, go to G3.

  If diagnosing DTC B2827, go to G5.

G3 CHECK CIRCUIT VH406 (VT/BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module - DATC 2356b

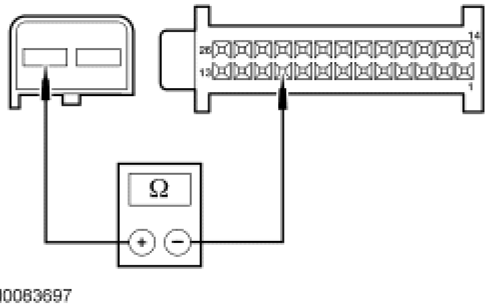


Fig. 43: Checking Circuit VH406 (VT/BN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C2356b-10, circuit VH406 (VT/BN), harness side and evaporator discharge temperature sensor C2295-2, circuit VH406 (VT/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to G4.

  NO : REPAIR circuit VH406 (VT/BN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

G4 CHECK CIRCUIT RH104 (BU/BN) FOR AN OPEN

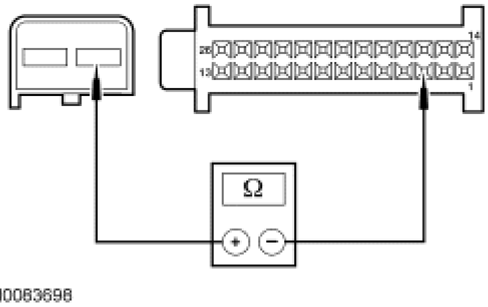


Fig. 44: Checking Circuit RH104 (BU/BN) For An Open
Courtesy of FORD MOTOR CO.

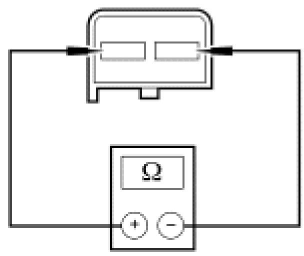
- Measure the resistance between HVAC module - DATC C2356b-3, circuit RH104 (BU/BN), harness side and evaporator discharge temperature sensor C2295-1, circuit RH104 (BU/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to G7.

  NO : REPAIR circuit RH104 (BU/BN) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

G5 CHECK CIRCUITS VH406 (VT/BN) AND RH104 (BU/BN) FOR A SHORT TOGETHER

- Key in OFF position.
- Disconnect: HVAC Module - DATC 2356b



N0056728

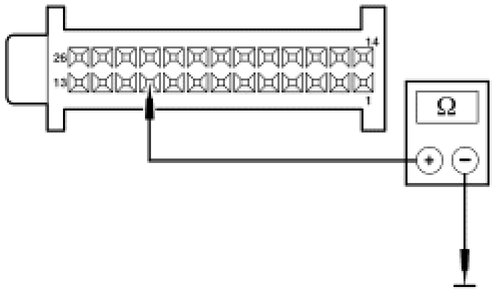
Fig. 45: Checking Circuit VH406 (VT/BN) For A Short To Circuit RH104 (BU/BN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between evaporator discharge temperature sensor C2295-2, circuit VH406 (VT/BN), harness side and C2295-1, circuit RH104 (BU/BN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to G6.

  NO : REPAIR circuits VH406 (VT/BN) and RH104 (BU/BN) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

G6 CHECK CIRCUIT VH406 (VT/BN) FOR A SHORT TO GROUND



N0083700

Fig. 46: Checking Circuit VH406 (VT/BN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C2356b-10, circuit VH406 (VT/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to G7.

  NO : REPAIR circuit VH406 (VT/BN) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

G7 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test H: Air Inlet Door is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Manual Climate Control System for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, to rotate the air inlet door actuator, the HVAC module supplies voltage to the air inlet door actuator motor through circuit CH208 (GN/OG), and supplies ground through circuit CH207 (BU/GY). To reverse the air inlet door actuator rotation, the HVAC module reverses the voltage and ground circuits.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Air inlet door actuator motor
- HVAC module - Electronic Automatic Temperature Control (EATC)
- HVAC module - Dual Automatic Temperature Control (DATC)
- HVAC module - Electronic Manual Temperature Control (EMTC)

- Stuck or bound linkage or door

PINPOINT TEST H: AIR INLET DOOR IS INOPERATIVE

H1 CHECK DOOR ACTUATOR OPERATION

NOTE: If a jumper fuse opens while carrying out this test step, repair the circuit(s) for a short.

- Disconnect: HVAC Module - DATC C2356a, HVAC Module - EATC C228a or HVAC Module - EMTC C2357a

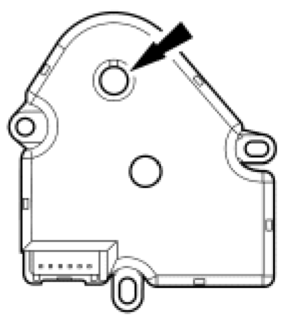


Fig. 47: Checking Door Actuator Operation
Courtesy of FORD MOTOR CO.

- Observe the air inlet door actuator drive shaft.
- Key in ON position.

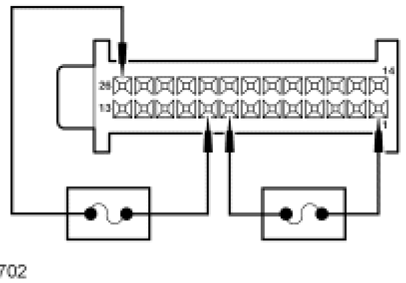
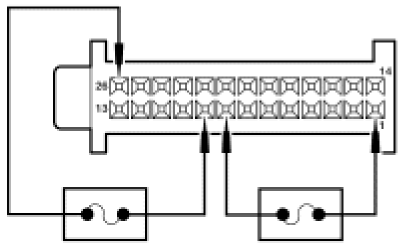


Fig. 48: Checking Door Actuator Operation (EMTC)
Courtesy of FORD MOTOR CO.

NOTE: EMTC systems only.

- Connect a fused jumper wire between:
  - HVAC module - EMTC C2357a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EMTC C2357a-9, circuit CH208 (GN/OG), harness side.

- HVAC module - EMTC C2357a-1, circuit GD116 (BK/VT), harness side and HVAC module - EMTC C2357a-8, circuit CH207 (BU/GY), harness side.

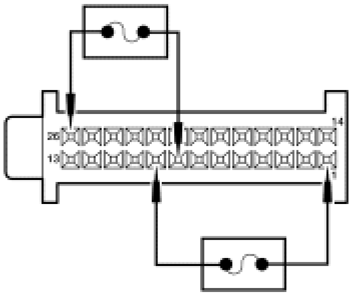


N0063702

Fig. 49: Checking Door Actuator Operation (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Connect a fused jumper wire between:
  - HVAC module - EATC C228a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EATC C228a-9, circuit CH208 (GN/OG), harness side.
  - HVAC module - EATC C228a-1, circuit GD116 (BK/VT), harness side and HVAC module - EATC C228a-8, circuit CH207 (BU/GY), harness side.



N0063703

Fig. 50: Checking Door Actuator Operation (DATC)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

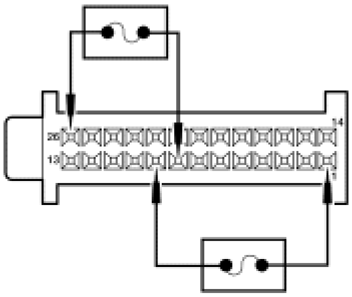
- Connect a fused jumper wire between:
  - HVAC module - DATC C2356a-26, circuit SBP07 (WH/RD), harness side and HVAC module - DATC C2356a-8, circuit CH208 (GN/OG), harness side.
  - HVAC module - DATC C2356a-1, circuit GD116 (BK/VT), harness side and HVAC module - DATC C2356a-9, circuit CH207 (BU/GY), harness side.
- **Does the actuator motor rotate?**

YES : Go to H2.

NO : Go to H3.

H2 CHECK DOOR ACTUATOR OPERATION

NOTE: If a jumper fuse opens while carrying out this test step, repair the circuit(s) for a short.

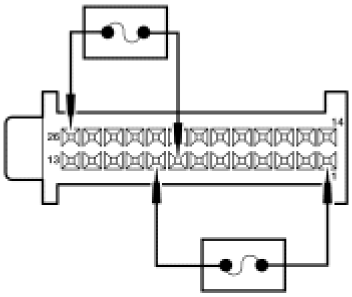


N0083703

Fig. 51: Checking Door Actuator Operation (EMTC)
Courtesy of FORD MOTOR CO.

NOTE: EMTC systems only.

- Connect a fused jumper wire between:
  - HVAC module - EMTC C2357a-1, circuit GD116 (BK/VT), harness side and HVAC module - EMTC C2357a-9, circuit CH208 (GN/OG), harness side.
  - HVAC module - EMTC C2357a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EMTC C2357a-8, circuit CH207 (BU/GY), harness side.



N0083703

Fig. 52: Checking Door Actuator Operation (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Connect a fused jumper wire between:
  - HVAC module - EATC C228a-1, circuit GD116 (BK/VT), harness side and HVAC module -

EATC C228a-9, circuit CH208 (GN/OG), harness side.

- HVAC module - EATC C228a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EATC C228a-8, circuit CH207 (BU/GY), harness side.

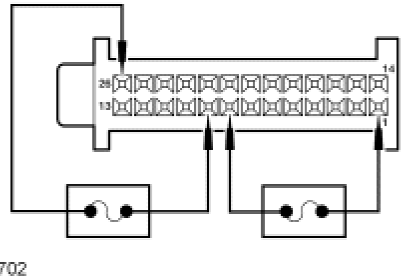


Fig. 53: Checking Door Actuator Operation (DATC)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

- Connect a fused jumper wire between:
  - HVAC module - DATC C2356a-1, circuit GD116 (BK/VT), harness side and HVAC module - DATC C2356a-8, circuit CH208 (GN/OG), harness side.
  - HVAC module - DATC C2356a-26, circuit SBP07 (WH/RD), harness side and HVAC module - DATC C2356a-9, circuit CH207 (BU/GY), harness side.
- **Does the actuator motor reverse rotation?**

  YES : INSPECT for binding or broken door and linkage. If no condition is found, go to H4.

  NO : Go to H3.

H3 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR AN OPEN

- Disconnect: Air Inlet Door Actuator C289

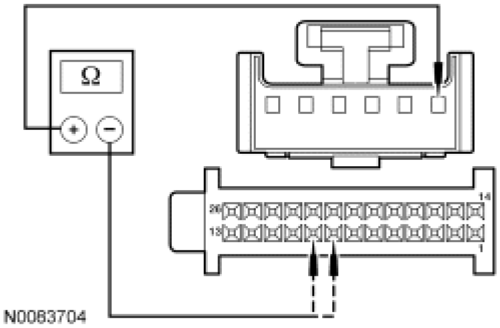


Fig. 54: Checking Actuator Motor Drive Circuits For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between air inlet door actuator C289-5, circuit CH207 (BU/GY), harness side and:

NOTE: EMTC systems only.

- HVAC module - EMTC C2357a-8, circuit CH207 (BU/GY), harness side.

NOTE: EATC systems only.

- HVAC module - EATC C228a-8, circuit CH207 (BU/GY), harness side.

NOTE: DATC systems only.

- HVAC module - DATC C2356a-9, circuit CH207 (BU/GY), harness side.

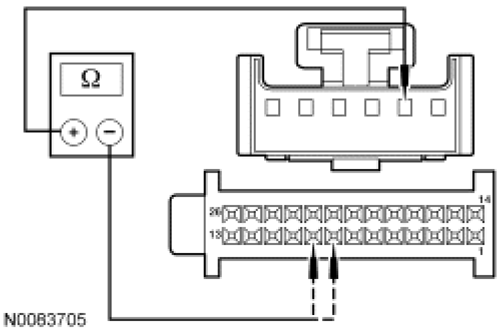


Fig. 55: Checking Actuator Motor Drive Circuits For An Open (DATC)
Courtesy of FORD MOTOR CO.

- Measure the resistance between air inlet door actuator C289-6, circuit CH208 (GN/OG), harness side and:

NOTE: EMTC systems only.

- HVAC module - EMTC C2357a-9, circuit CH208 (GN/OG), harness side.

NOTE: EATC systems only.

- HVAC module - EATC C228a-9, circuit CH208 (GN/OG), harness side.

NOTE: DATC systems only.

- HVAC module - DATC C2356a-8, circuit CH208 (GN/OG), harness side.

- **Are the resistances less than 5 ohms?**

  YES : INSPECT for binding or broken linkage. If no condition is found, INSTALL a new door actuator. TEST the system for normal operation.

  NO : REPAIR the circuit(s) for an open. TEST the system for normal operation.

H4 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.

NOTE: DATC/EATC systems only.

- Carry out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test I: Incorrect/Erratic Direction of Airflow From Outlet(s)

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Manual Climate Control System for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, to rotate the mode door actuator, the HVAC module supplies voltage to the floor/defrost/panel mode door actuator motor through the circuit CH229 (WH/BU), and supplies ground through circuit CH228 (YE/GY). To reverse the mode door actuator rotation, the HVAC module reverses the voltage and ground circuits.

The mode door actuator feedback resistor is supplied a ground from the HVAC module through circuit RH111 (GY/BU) and a 5-volt reference voltage on circuit LH111 (BN/WH). The HVAC module reads the voltage on the mode door actuator feedback circuit VH436 (YE/VT) to determine the mode door actuator position, by the position of the actuator feedback resistor wiper arm.

- DTC B1003 Mode Door Failure - The module senses no change in actuator feedback voltage when the actuator motor has been energized.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Floor/defrost/panel mode door actuator motor
- HVAC module - Electronic Manual Temperature Control (EMTC)
- HVAC module - Electronic Automatic Temperature Control (EATC)

- HVAC module - Dual Automatic Temperature Control (DATC)
- Stuck or bound linkage or door

PINPOINT TEST I: INCORRECT/ERRATIC DIRECTION OF AIRFLOW FROM OUTLET(S)

I1 CHECK THE FEEDBACK POTENTIOMETER TOTAL RESISTANCE

- Disconnect: HVAC Module - DATC C2356a, HVAC Module - EATC C228a, or HVAC Module - EMTC C2357a

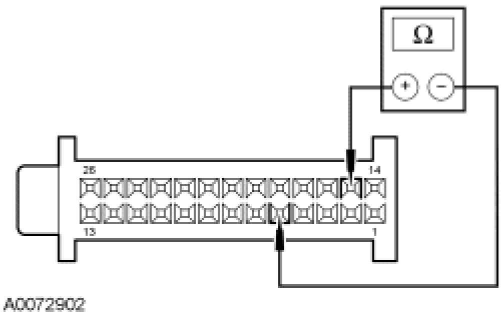


Fig. 56: Checking Feedback Potentiometer Total Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between:

  NOTE: EMTC systems only.

  - HVAC module - EMTC C2357a-5, circuit LH111 (BN/WH), harness side and HVAC module - EMTC C2357a-15, circuit RH111 (GY/BU), harness side.

  NOTE: EATC systems only.

  - HVAC module - EATC C228a-5, circuit LH111 (BN/WH), harness side and HVAC module - EATC C228a-15, circuit RH111 (GY/BU), harness side.

  NOTE: DATC systems only.

  - HVAC module - DATC C2356a-5, circuit LH111 (BN/WH), harness side and HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side.
- **Is the resistance between 4,000 and 6,000 ohms for EMTC/EATC systems or between 2,667 and 4,000 ohms for DATC systems?**

  YES : Go to I2.

  NO : If resistance is greater than 4,000 ohms for EMTC/EATC systems or 6,000 ohms for DATC systems, go to I4.

  If resistance is less than 4,000 ohms for EMTC/EATC systems or 2,667 ohms for DATC systems,

go to I6.

I2 CHECK THE POTENTIOMETER LOW-SIDE RESISTANCE

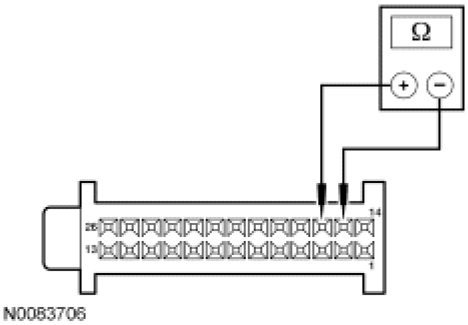


Fig. 57: Checking Potentiometer Low-Side Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between:

  NOTE: EMTC systems only.

  - HVAC module - EMTC C2357a-15, circuit RH111 (GY/BU), harness side and HVAC module - EMTC C2357a-16, circuit VH436 (YE/VT), harness side.

  NOTE: EATC systems only.

  - HVAC module - EATC C228a-15, circuit RH111 (GY/BU), harness side and HVAC module - EATC C228a-16, circuit VH436 (YE/VT), harness side.

  NOTE: DATC systems only.

  - HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side and HVAC module - DATC C2356a-16, circuit VH436 (YE/VT), harness side.
- **Is the resistance between 1 and 10,000 ohms?**

  YES : Go to I3.

  NO : If the resistance is greater than 10,000 ohms, go to I7.

  If the resistance is less than 1 ohm, go to I8.

I3 CHECK THE POTENTIOMETER HIGH-SIDE RESISTANCE

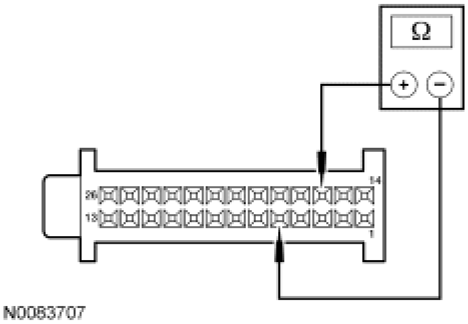


Fig. 58: Checking Potentiometer High-Side Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between:

  NOTE: EMTC systems only.

  - HVAC module - EMTC C2357a-5, circuit LH111 (BN/WH), harness side and HVAC module - EMTC C2357a-16, circuit VH436 (YE/VT), harness side.

  NOTE: EATC systems only.

  - HVAC module - EATC C228a-5, circuit LH111 (BN/WH), harness side and HVAC module - EATC C228a-16, circuit VH436 (YE/VT), harness side.

  NOTE: DATC systems only.

  - HVAC module - DATC C2356a-5, circuit LH111 (BN/WH), harness side and HVAC module - DATC C2356a-16, circuit VH436 (YE/VT), harness side.
- **Is the resistance between 1 and 10,000 ohms?**

  YES : Go to I10.

  NO : If the resistance is greater than 10,000 ohms, INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  If the resistance is less than 1 ohm, go to I9.

I4 CHECK CIRCUIT LH111 (BN/WH) FOR AN OPEN

NOTE: Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.

- Disconnect: Floor/Defrost/Panel Door Actuator C2278

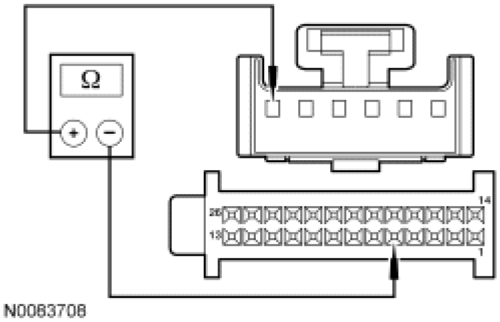


Fig. 59: Checking Circuit LH111 (BN/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between floor/defrost/panel door actuator C2278-10, circuit LH111 (BN/WH), harness side and:

  NOTE: EMTC systems only.

  - HVAC module - EMTC C2357a-5, circuit LH111 (BN/WH), harness side.

  NOTE: EATC systems only.

  - HVAC module - EATC C228a-5, circuit LH111 (BN/WH), harness side.

  NOTE: DATC systems only.

  - HVAC module - DATC C2356a-5, circuit LH111 (BN/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to I5.

  NO : REPAIR circuit LH111 (BN/WH) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

I5 CHECK THE ACTUATOR RETURN CIRCUIT RH111 (GY/BU) FOR AN OPEN

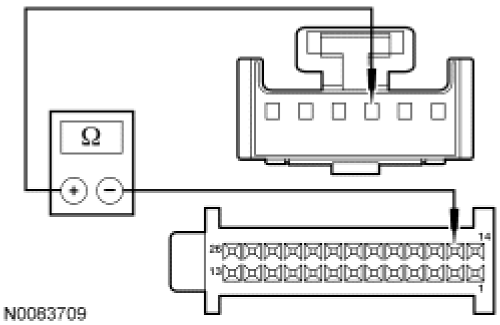


Fig. 60: Checking Actuator Return Circuit RH111 (GY/BU) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between floor/defrost/panel door actuator C2278-7, circuit RH111 (GY/BU), harness side and:

  NOTE: EMTC systems only.

  - HVAC module - EMTC C2357a-15, circuit RH111 (GY/BU), harness side.

  NOTE: EATC systems only.

  - HVAC module - EATC C228a-15, circuit RH111 (GY/BU), harness side.

  NOTE: DATC systems only.

  - HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR circuit RH111 (GY/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

I6 CHECK CIRCUITS RH111 (GY/BU) AND LH111 (BN/WH) FOR A SHORT TOGETHER

NOTE: Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.

- Disconnect: Floor/Defrost/Panel Door Actuator C2278

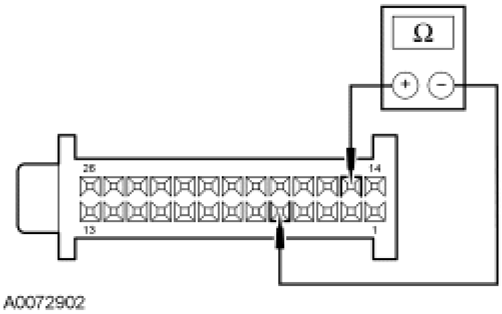


Fig. 61: Checking Circuits RH111 (GY/BU) & LH111 (BN/WH) For A Short Together
Courtesy of FORD MOTOR CO.

- Measure the resistance between:

  NOTE: EMTC systems only.

- HVAC module - EMTC C2357a-5, circuit LH111 (BN/WH), harness side and HVAC module - EMTC C2357a-15, circuit RH111 (GY/BU), harness side.

NOTE: EATC systems only.

- HVAC module - EATC C228a-5, circuit LH111 (BN/WH), harness side and HVAC module - EATC C228a-15, circuit RH111 (GY/BU), harness side.

NOTE: DATC systems only.

- HVAC module - DATC C2356a-5, circuit LH111 (BN/WH), harness side and HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side.

- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR circuits RH111 (GY/BU) and LH111 (BN/WH) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

I7 CHECK CIRCUIT VH436 (YE/VT) FOR AN OPEN

NOTE: Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.

- Disconnect: Floor/Defrost/Panel Door Actuator C2278

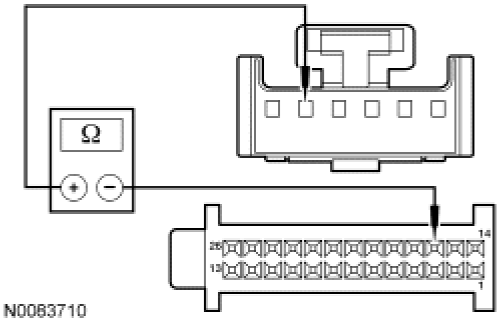


Fig. 62: Checking Circuit VH436 (YE/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between floor/defrost/panel door actuator C2278-9, circuit VH436 (YE/VT), harness side and:

NOTE: EMTC systems only.

- HVAC module - EMTC C2357a-16, circuit VH436 (YE/VT), harness side.

NOTE: EATC systems only.

- HVAC module - EATC C228a-16, circuit VH436 (YE/VT), harness side.

NOTE: DATC systems only.

- HVAC module - DATC C2356a-16, circuit VH436 (YE/VT), harness side.

- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR circuit VH436 (YE/VT) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

I8 CHECK CIRCUITS RH111 (GY/BU) AND VH436 (YE/VT) FOR A SHORT TOGETHER

NOTE: Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.

- Disconnect: Floor/Defrost/Panel Door Actuator C2278

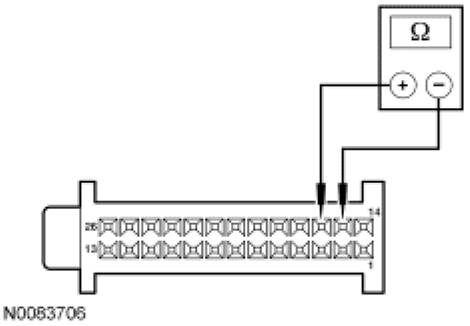


Fig. 63: Checking Circuits RH111 (GY/BU) & VH436 (YE/VT) For A Short Together
Courtesy of FORD MOTOR CO.

- Measure the resistance between:

NOTE: EMTC systems only.

- HVAC module - EMTC C2357a-15, circuit RH111 (GY/BU), harness side and HVAC module - EMTC C2357a-16, circuit VH436 (YE/VT), harness side.

NOTE: EATC systems only.

- HVAC module - EATC C228a-15, circuit RH111 (GY/BU), harness side and HVAC module - EATC C228a-16, circuit VH436 (YE/VT), harness side.

NOTE: DATC systems only.

- HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side and HVAC module - DATC C2356a-16, circuit VH436 (YE/VT), harness side.

- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR circuits RH111 (GY/BU) and VH436 (YE/VT) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

I9 CHECK CIRCUITS LH111 (BN/WH) AND VH436 (YE/VT) FOR A SHORT TOGETHER

NOTE: Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.

- Disconnect: Floor/Defrost/Panel Door Actuator C2278

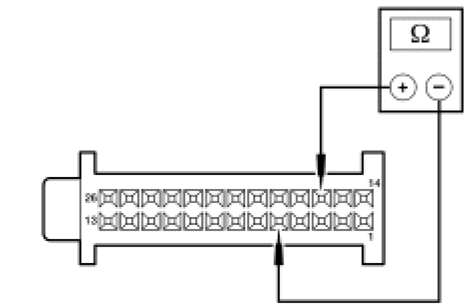


Fig. 64: Checking Circuits LH111 (BN/WH) & VH436 (YE/VT) For A Short Together
Courtesy of FORD MOTOR CO.

- Measure the resistance between:

NOTE: EMTC systems only.

- HVAC module - EMTC C2357a-5, circuit LH111 (BN/WH), harness side and HVAC module - EMTC C2357a-16, circuit VH436 (YE/VT), harness side.

NOTE: EATC systems only.

- HVAC module - EATC C228a-5, circuit LH111 (BN/WH), harness side and HVAC module - EATC C228a-16, circuit VH436 (YE/VT), harness side.

NOTE: DATC systems only.

- HVAC module - DATC C2356a-5, circuit LH111 (BN/WH), harness side and HVAC

module - DATC C2356a-16, circuit VH436 (YE/VT), harness side.

- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR circuits LH111 (BN/WH) and VH436 (YE/VT) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

I10 CHECK CIRCUITS LH111 (BN/WH) AND VH436 (YE/VT) FOR A SHORT TO GROUND

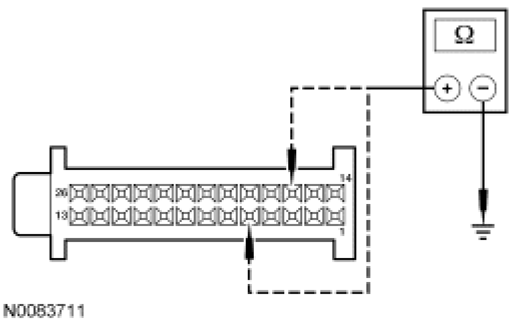


Fig. 65: Checking Circuits LH111 (BN/WH) & VH436 (YE/VT) For A Short To Ground (EMTC)
Courtesy of FORD MOTOR CO.

NOTE: **EMTC systems only.**

- Measure the resistance between ground and the following:
  - HVAC module - EMTC C2357a-5, circuit LH111 (BN/WH), harness side.
  - HVAC module - EMTC C2357a-16, circuit VH436 (YE/VT), harness side.

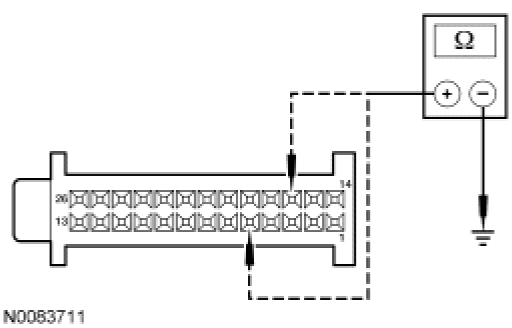


Fig. 66: Checking Circuits LH111 (BN/WH) & VH436 (YE/VT) For A Short To Ground (EATC)
Courtesy of FORD MOTOR CO.

NOTE: **EATC systems only.**

- Measure the resistance between ground and the following:

- HVAC module - EATC C228a-5, circuit LH111 (BN/WH), harness side.
- HVAC module - EATC C228a-16, circuit VH436 (YE/VT), harness side.

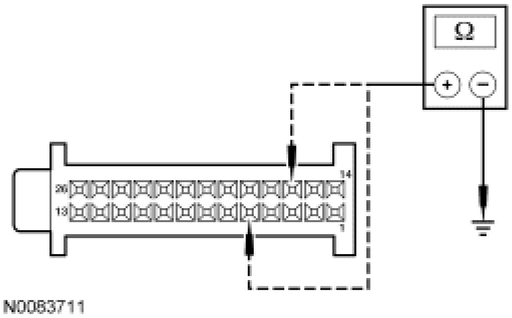


Fig. 67: Checking Circuits LH111 (BN/WH) & VH436 (YE/VT) For A Short To Ground (DATC)
Courtesy of FORD MOTOR CO.

NOTE: **DATC systems only.**

- Measure the resistance between ground and the following:
  - HVAC module - DATC C2356a-5, circuit LH111 (BN/WH), harness side.
  - HVAC module - DATC C2356a-16, circuit VH436 (YE/VT), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to I11.

  NO : REPAIR circuit(s) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

I11 CHECK CIRCUITS RH111 (GY/BU) AND VH436 (YE/VT) FOR A SHORT TO POWER

- Key in ON position.

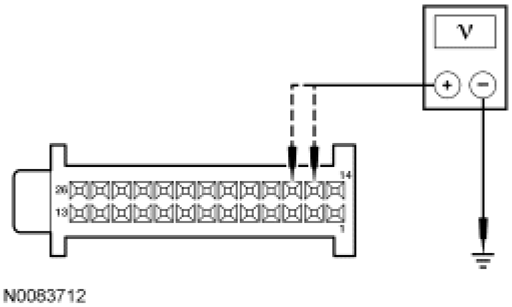


Fig. 68: Checking Circuits RH111 (GY/BU) & VH436 (YE/VT) For A Short To Power (EMTC)
Courtesy of FORD MOTOR CO.

NOTE: **EMTC systems only.**

- Measure the voltage between ground and the following:
  - HVAC module - EMTC C2357a-15, circuit RH111 (GY/BU), harness side.
  - HVAC module - EMTC C2357a-16, circuit VH436 (YE/VT), harness side.

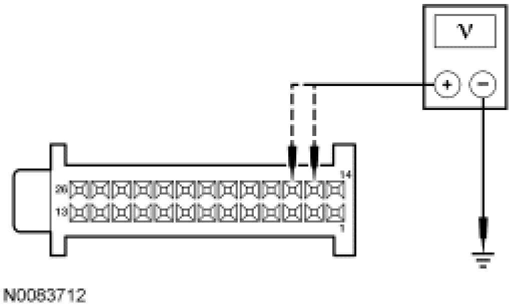


Fig. 69: Checking Circuits RH111 (GY/BU) & VH436 (YE/VT) For A Short To Power (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the voltage between ground and the following:
  - HVAC module - EATC C228a-15, circuit RH111 (GY/BU), harness side.
  - HVAC module - EATC C228a-16, circuit VH436 (YE/VT), harness side.

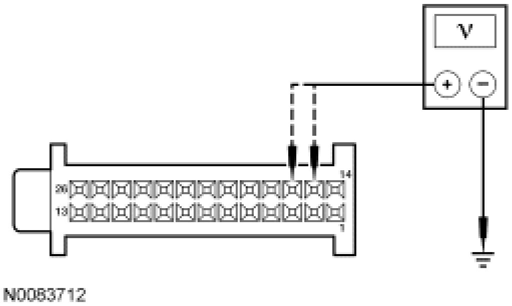


Fig. 70: Checking Circuits RH111 (GY/BU) & VH436 (YE/VT) For A Short To Power (DATC)
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and the following:

NOTE: DATC systems only.

  - HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side.
  - HVAC module - DATC C2356a-16, circuit VH436 (YE/VT), harness side.
- **Is any voltage present?**

YES : REPAIR circuit(s) for a short to power. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

NO : For EMTC systems, go to I12.

For EATC systems, go to I13.

For DATC systems, go to I14.

I12 CHECK THE DOOR ACTUATOR OPERATION

NOTE: **If a jumper fuse opens while carrying out this test step, repair the circuit(s) for a short.**

- Key in ON position.

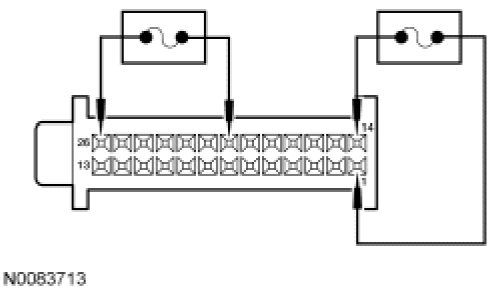


Fig. 71: Checking Door Actuator Operation
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - EMTC C2357a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EMTC C2357a-20, circuit CH228 (YE/GY), harness side.
  - HVAC module - EMTC C2357a-1, circuit GD116 (BK/VT), harness side and HVAC module - EMTC C2357a-14, circuit CH229 (WH/BU), harness side.

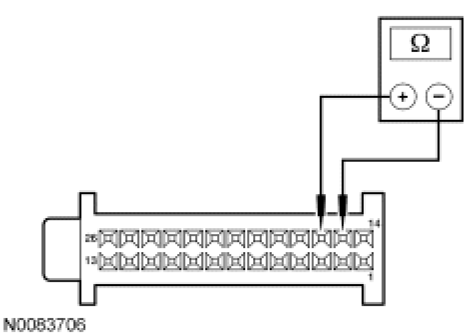


Fig. 72: Measuring Resistance Between C2357A-1 & C2357A-14, Circuit GD116 (BK/VT) & CH229 (WH/BU)

Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - EMTC C2357a-15, circuit RH111 (GY/BU), harness side and HVAC module - EMTC C2357a-16, circuit VH436 (YE/VT), harness side.

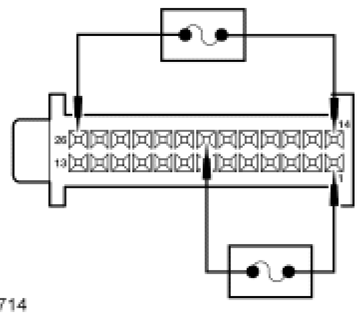


Fig. 73: Measuring Resistance Between C2357A-15 & C2357A-16, Circuit RH111 (GY/BU) & VH436 (YE/VT)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - EMTC C2357a-1, circuit GD116 (BK/VT), harness side and HVAC module - EMTC C2357a-20, circuit CH228 (YE/GY), harness side.
  - HVAC module - EMTC C2357a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EMTC C2357a-14, circuit CH229 (WH/BU), harness side.

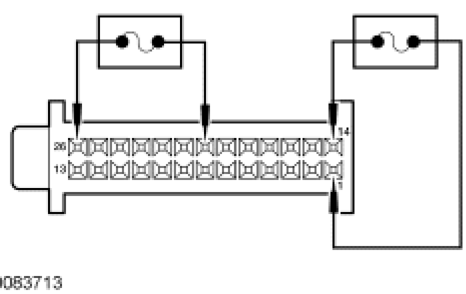


Fig. 74: Measuring Resistance Between C2357A-26 & C2357A-14, Circuit SBP07 (WH/RD) & CH229 (WH/BU)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - EMTC C2357a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EMTC C2357a-20, circuit CH228 (YE/GY), harness side.
  - HVAC module - EMTC C2357a-1, circuit GD116 (BK/VT), harness side and HVAC module - EMTC C2357a-14, circuit CH229 (WH/BU), harness side.
- **Does the resistance increase and decrease when the jumpers are connected?**

  YES : INSPECT for binding or broken door and linkage. If no condition is found, go to I17.

NO : Go to I15.

I13 CHECK THE DOOR ACTUATOR OPERATION

NOTE: If a jumper fuse opens while carrying out this test step, repair the circuit(s) for a short.

- Key in ON position.

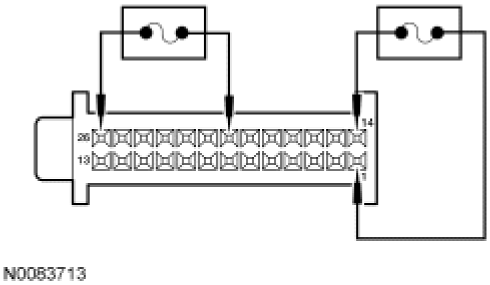


Fig. 75: Checking Door Actuator Operation
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - EATC C228a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EATC C228a-20, circuit CH228 (YE/GY), harness side.
  - HVAC module - EATC C228a-1, circuit GD116 (BK/VT), harness side and HVAC module - EATC C228a-14, circuit CH229 (WH/BU), harness side.

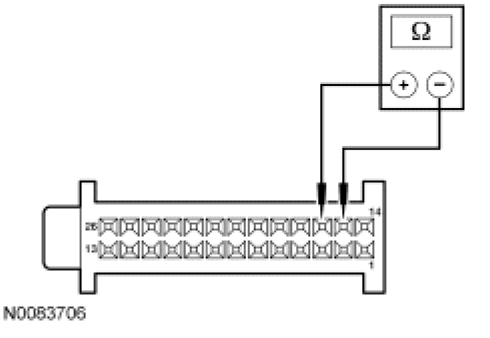


Fig. 76: Measuring Resistance Between C228A-1 & C228A-14, Circuit GD116 (BK/VT) & CH229 (WH/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between:
  - HVAC module - EATC C228a-15, circuit RH111 (GY/BU), harness side and HVAC module - EATC C228a-16, circuit VH436 (YE/VT), harness side.

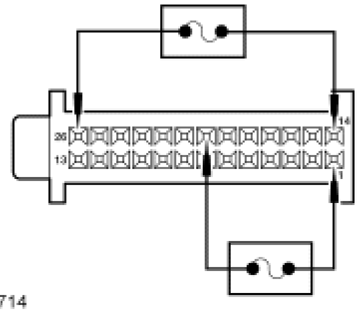


Fig. 77: Measuring Resistance Between C228A-15 & C228A-16, Circuit RH111 (GY/BU) & VH436 (YE/VT)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - EATC C228a-1, circuit GD116 (BK/VT), harness side and HVAC module - EATC C228a-20, circuit CH228 (YE/GY), harness side.
  - HVAC module - EATC C228a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EATC C228a-14, circuit CH229 (WH/BU), harness side.

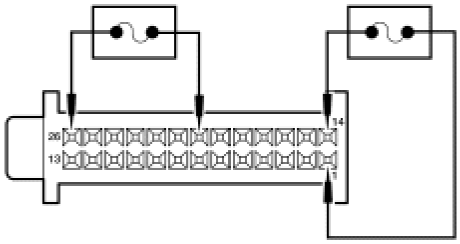


Fig. 78: Measuring Resistance Between C228A-26 & C228A-14, Circuit SBP07 (WH/RD) & CH229 (WH/BU)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - EATC C228a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EATC C228a-20, circuit CH228 (YE/GY), harness side.
  - HVAC module - EATC C228a-1, circuit GD116 (BK/VT), harness side and HVAC module - EATC C228a-14, circuit CH229 (WH/BU), harness side.
- **Does the resistance increase and decrease when the jumpers are connected?**

  YES : INSPECT for binding or broken door and linkage. If no condition is found, go to I17.

  NO : Go to I15.

I14 CHECK THE DOOR ACTUATOR OPERATION

NOTE: If a jumper fuse opens while carrying out this test step, repair the circuit(s)

for a short.

- Key in ON position.

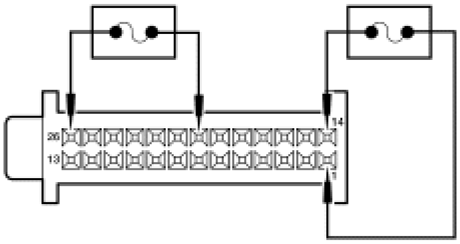


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Fig. 79: Checking Door Actuator Operation
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - DATC C2356a-26, circuit SBP07 (WH/RD), harness side and HVAC module - DATC C2356a-20, circuit CH228 (YE/GY), harness side.
  - HVAC module - DATC C2356a-1, circuit GD116 (BK/VT), harness side and HVAC module - DATC C2356a-14, circuit CH229 (WH/BU), harness side.

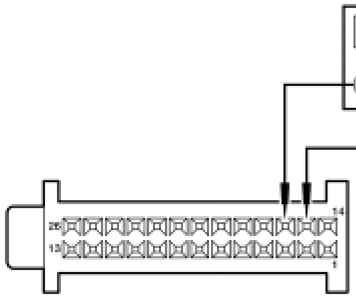

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Fig. 80: Measuring Resistance Between C2356A-1 & C2356A-14, Circuit GD116 (BK/VT) & CH229 (WH/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between:
  - HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side and HVAC module - DATC C2356a-16, circuit VH436 (YE/VT), harness side.

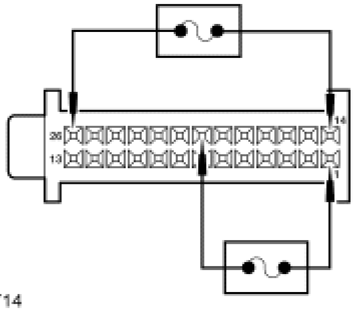

Fig. 81: Measuring Resistance Between C2356A-15 & C2356A-16, Circuit RH111 (GY/BU) & VH436 (YE/VT)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - DATC C2356a-1, circuit GD116 (BK/VT), harness side and HVAC module - DATC C2356a-20, circuit CH228 (YE/GY), harness side.
  - HVAC module - DATC C2356a-26, circuit SBP07 (WH/RD), harness side and HVAC module - DATC C2356a-14, circuit CH229 (WH/BU), harness side.

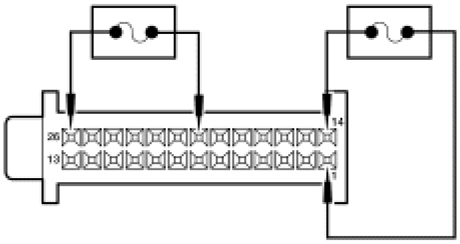

Fig. 82: Measuring Resistance Between C2356A-26 & C2356A-14, Circuit SBP07 (WH/RD) & CH229 (WH/BU)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - DATC C2356a-26, circuit SBP07 (WH/RD), harness side and HVAC module - DATC C2356a-20, circuit CH228 (YE/GY), harness side.
  - HVAC module - DATC C2356a-1, circuit GD116 (BK/VT), harness side and HVAC module - DATC C2356a-14, circuit CH229 (WH/BU), harness side.
- **Does the resistance increase and decrease when the jumpers are connected?**

  YES : INSPECT for binding or broken door and linkage. If no condition is found, go to I17.

  NO : Go to I15.

I15 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS

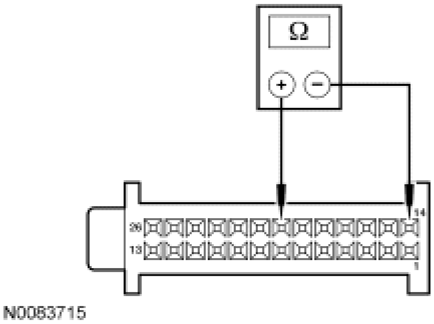

Fig. 83: Checking Actuator Motor Drive Circuits
Courtesy of FORD MOTOR CO.

- Measure the resistance between:

  NOTE: EMTC systems only.

  - HVAC module - EMTC C2357a-20, circuit CH228 (YE/GY), harness side and HVAC module - EMTC C2357a-14, circuit CH229 (WH/BU), harness side.

  NOTE: EATC systems only.

  - HVAC module - EATC C228a-20, circuit CH228 (YE/GY), harness side and HVAC module - EATC C228a-14, circuit CH229 (WH/BU), harness side.

  NOTE: DATC systems only.

  - HVAC module - DATC C2356a-20, circuit CH228 (YE/GY), harness side and HVAC module - DATC C2356a-14, circuit CH229 (WH/BU), harness side.
- **Is the resistance between approximately 38-48 ohms?**

  YES : INSPECT for binding or broken door and linkage. If no condition is found, INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : Go to I16.

I16 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR AN OPEN

NOTE: Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.

- Disconnect: Floor/Defrost/Panel Door Actuator C2278

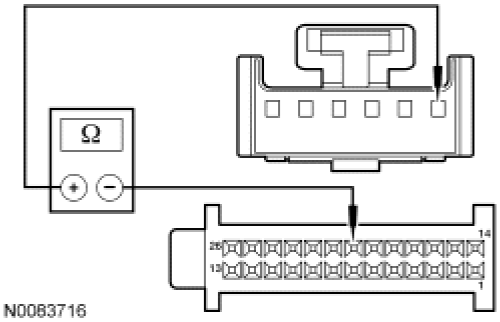

Fig. 84: Checking Actuator Motor Drive Circuits For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between floor/defrost/panel door actuator C2278-5, circuit CH228 (YE/GY), harness side and:

  NOTE: EMTC systems only.

  - HVAC module - EMTC C2357a-20, circuit CH228 (YE/GY), harness side.

  NOTE: EATC systems only.

  - HVAC module - EATC C228a-20, circuit CH228 (YE/GY), harness side.

  NOTE: DATC systems only.

  - HVAC module - DATC C2356a-20, circuit CH228 (YE/GY), harness side.

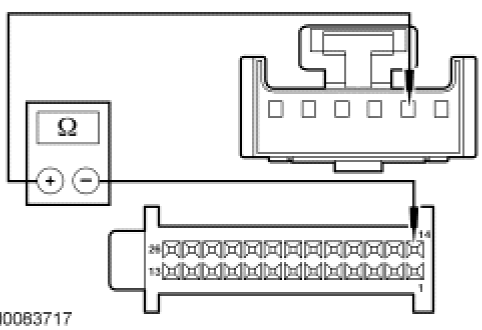

Fig. 85: Measuring Resistance Between Floor/Defrost/Panel Door Actuator C2278-5, Circuit CH228 (YE/GY)
Courtesy of FORD MOTOR CO.

- Measure the resistance between floor/defrost/panel door actuator C2278-6, circuit CH229 (WH/BU), harness side and:

  NOTE: EMTC systems only.

- HVAC module - EMTC C2357a-14, circuit CH229 (WH/BU), harness side.

  NOTE: EATC systems only.

- HVAC module - EATC C228a-14, circuit CH229 (WH/BU), harness side.

  NOTE: DATC systems only.

- HVAC module - DATC C2356a-14, circuit CH229 (WH/BU), harness side.

- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR the circuit(s) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

I17 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.

  NOTE: DATC/EATC systems only.

- Carry out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test J: DTC: B1676 - Battery Voltage Out of Range

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

NOTE: DTC B1676 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged due to excessive load on the charging system from aftermarket accessories.

Normal Operation

Under normal operation, the HVAC module - Electronic Automatic Temperature Control (EATC) or HVAC module - Dual Automatic Temperature Control (DATC) module receives a ground through circuit GD116 (BK/VT). The HVAC module - EATC or HVAC module - DATC is supplied constant battery voltage through

circuit SBP07 (WH/RD) and ignition switched voltage through circuit CBP20 (YE/VT).

- DTC B1676 Battery Voltage Out of Range- The module senses when battery voltage is less than 9 volts or greater than 16 volts.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- HVAC module - EATC module
- HVAC module - DATC module

PINPOINT TEST J: DTC: B1676 - BATTERY VOLTAGE OUT OF RANGE

J1 RETRIEVE ALL Continuous Memory Diagnostic Trouble Codes (CMDTCs) IN ALL MODULES

- Enter the following diagnostic mode on the diagnostic tool: Self Test - All CMDTCs
- **Is B1317, B1318 or B1676 present in more than one module AND P0563, P0620, P0625, P0626 or P065B present in the PCM?**

  YES : REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article for diagnosis of the battery and charging system. CLEAR all CMDTCs. TEST the system for normal operation.

  NO : Go to J2.

J2 CHECK BATTERY CONDITION

- Refer to **BATTERY, MOUNTING AND CABLES** article and carry out the Battery - Condition Test
- **Does the battery pass the condition test?**

  YES : If the battery passed the condition test but required a recharge, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnose the charging system. CLEAR all CMDTCs. TEST the system for normal operation.

  If the battery passed the condition test and did not require a recharge, go to J3.

  NO : INSTALL a new battery. CLEAR all continuous memory DTCs. TEST the system for normal operation.

J3 CHECK CHARGING SYSTEM VOLTAGE

NOTE: Do not allow the engine speed to increase above 2,000 RPM while performing this step or the generator may self excite and result in default charging system output voltage. If engine speed goes above 2,000 RPM, shut the vehicle OFF and restart the engine before performing this step.

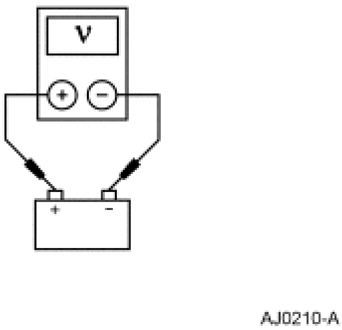

Fig. 86: Checking Charging System Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage of the battery with and without a load on the charging system as follows:
  - Turn off all accessories and run the engine at 1,500 RPM for a minimum of 2 minutes while measuring battery voltage.
  - Turn on headlights and HVAC fan on high and run engine at 1,500 RPM for a minimum of 2 minutes while measuring battery voltage.
- **Are the voltages between 13 and 15.2 volts?**

  YES : Go to J4.

  NO : REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnose the charging system. CLEAR all CMDTCs. TEST the system for normal operation.

J4 CHECK FOR VOLTAGE MONITORING THE MODULE SUPPLY VOLTAGE (VBAT_CC) HVAC PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: VBAT_CC HVAC PID
- Monitor the battery voltage VBAT_CC HVAC PID.
- **Is the battery voltage less than 9 or greater than 15.5 volts?**

  YES : If voltage is less than 9 volts, go to J5.

  If voltage is greater than 15.5 volts, INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. CLEAR all CMDTCs. REPEAT the self-test.

  NO : Go to J7.

J5 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module - DATC C2356a or HVAC Module - EATC C228a
- Measure the resistance between HVAC module - DATC C2356a-1 or HVAC module - EATC C228a-1, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to J6.

  NO : REPAIR circuit GD116 (BK/VT). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

J6 CHECK CIRCUITS SBP07 (WH/RD) AND CBP20 (YE/VT) FOR AN OPEN

- Key in ON position.

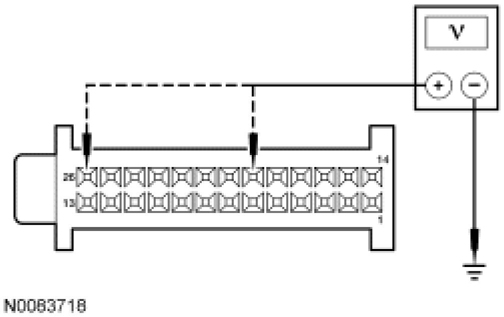

Fig. 87: Checking Circuits SBP07 (WH/RD) & CBP20 (YE/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between HVAC module - DATC C2356a-26 or HVAC module - EATC C228a-26, circuit SBP07 (WH/RD), harness side, HVAC module - DATC C2356a-19 or HVAC module - EATC C228a-19, circuit CBP20 (YE/VT), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to J7.

  NO : VERIFY Smart Junction Box (SJB) fuses 13 (7.5A) and 27 (7.5A) are OK. If OK, REPAIR circuit SBP07 (WH/RD) or CBP20 (YE/VT) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.

J7 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test K: HVAC Functions Verification

This pinpoint test is intended to diagnose the following:

- HVAC system

PINPOINT TEST K: HVAC FUNCTIONS VERIFICATION

NOTE: Diagnose any HVAC module DTCs before carrying out the following pinpoint test.

NOTE: Some PCM DTCs may inhibit A/C operation. If any PCM DTCs are retrieved, diagnose those first. Refer to PCM DTC Chart.

K1 CHECK THE BLOWER MOTOR OPERATION

- Key in ON position.
- Select PANEL mode.
- Observe blower motor operation and select each blower motor speed.
- **Does the blower motor operate in all selections and change speed in each?**

  YES : Go to K2.

  NO : Electronic Manual Temperature Control (EMTC) systems, If the blower motor does not operate in any setting, go to **Pinpoint Test R**.

  Electronic Automatic Temperature Control (EATC) /Dual Automatic Temperature Control (DATC) systems, If the blower motor does not operate in any setting, go to **Pinpoint Test T**.

  EMTC systems, If the blower motor does not properly change speeds or shut OFF, go to **Pinpoint Test S**.

  EATC /DATC systems, If the blower motor does not properly change speeds or shut OFF, go to **Pinpoint Test U**.

K2 CHECK AIRFLOW OPERATION

- Select the highest blower motor setting.

  NOTE: Refer to DESCRIPTION AND OPERATION for proper airflow descriptions.

- While observing the airflow, select each of the airflow positions (PANEL, PANEL/FLOOR, FLOOR, FLOOR/DEFROST, DEFROST).
- **Is the airflow directed to the proper outlets?**

  YES : Go to K3.

  NO : Go to **Pinpoint Test I**.

K3 VERIFY TEMPERATURE CONTROL OPERATION

- Start the vehicle and allow it to reach normal operating temperature.
- With the A/C OFF, select PANEL mode.
- Change the temperature setting from the coldest to the warmest and back to the coldest
- **Does the temperature change between very warm to cool?**

  YES : Go to K4.

  NO : If the temperature does not get very warm, go to **Pinpoint Test L**.

EMTC systems, If the temperature does not change at all, go to **Pinpoint Test P**.

EATC /DATC systems, If the temperature does not change at all, Go to **Pinpoint Test Q**.

K4 VERIFY THE A/C CLUTCH DOES NOT ENGAGE WITH A/C OFF

- With the A/C OFF, select PANEL mode.
- Select the coldest temperature setting.
- **Is the outlet temperature close to ambient temperature?**

  YES : Go to K5.

  NO : EMTC systems, If the temperature is warmer than ambient temperature, go to **Pinpoint Test P** and diagnose for inoperative blend door.

  EATC /DATC systems, If the temperature is warmer than ambient temperature, go to **Pinpoint Test Q** and diagnose for inoperative blend door.

  If the outlet temperature is significantly colder than ambient temperature and the A/C compressor clutch cycles normally, go to **Pinpoint Test O**.

  If the outlet temperature is significantly colder than ambient temperature and the A/C compressor clutch does not cycle, go to **Pinpoint Test N**.

K5 VERIFY A/C CLUTCH ENGAGEMENT IN THE A/C MODE

- Make sure the ambient air temperature is above 2°C (35°F).
- Select PANEL mode.
- Press the A/C button (indicator ON).
- **Does the A/C clutch engage when the PANEL and A/C button (indicator ON) is pressed?**

  YES : Go to K6.

  NO : Go to **Pinpoint Test M**.

K6 CHECK THE RECIRC OPERATION

- Press the RECIRC button (indicator OFF).
- Select PANEL mode.
- Select the highest blower motor setting.
- Observe airflow noise.
- Press the RECIRC button (indicator ON).
- **Does the airflow noise increase when the RECIRC mode is selected (indicator ON)?**

  YES : The system is operating normally.

  NO : Go to **Pinpoint Test H**.

Pinpoint Test L: Insufficient, Erratic or No Heat

Normal Operation

Under normal operation, warm coolant flows from the engine through the heater core and back to the engine.

This pinpoint test is intended to diagnose the following:

- Plugged heater core
- Coolant level
- Temperature blend door

PINPOINT TEST L: INSUFFICIENT, ERRATIC OR NO HEAT

L1 CHECK FOR CORRECT ENGINE COOLANT LEVEL

- Key in OFF position.
- Check the engine coolant level when hot and cold.
- **Is the engine coolant at the correct level (hot/cold) as indicated on the engine coolant recovery reservoir?**

  YES : Go to L3.

  NO : Go to L2.

L2 CHECK THE ENGINE COOLING SYSTEM FOR LEAKS

- Pressure test the cooling system for leaks. Refer to **ENGINE COOLING** article.
- **Does the engine cooling system leak?**

  YES : REPAIR the engine coolant leak. TEST the system for normal operation.

  NO : Go to L3.

L3 CHECK FOR COOLANT FLOW TO THE HEATER CORE

- Key in ON position.
- Run the engine until it reaches normal operation temperature. Select the FLOOR position on the control assembly. Set the temperature control to full warm and the blower to the lowest setting.

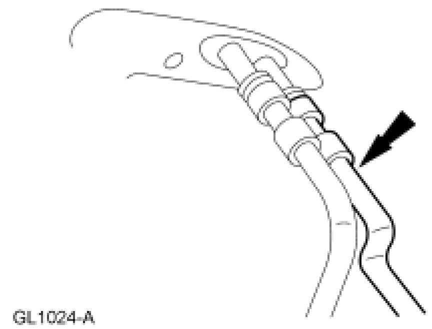

Fig. 88: Checking Coolant Flow To Heater Core
Courtesy of FORD MOTOR CO.

- Using a suitable thermo-couple temperature measuring device, check the heater core inlet hose to see if it is hot.
- **Is the heater core inlet hose hot?**

  YES : Go to L4.

  NO : REFER to **ENGINE COOLING** article to check cooling system function.

L4 CHECK FOR A PLUGGED OR RESTRICTED HEATER CORE

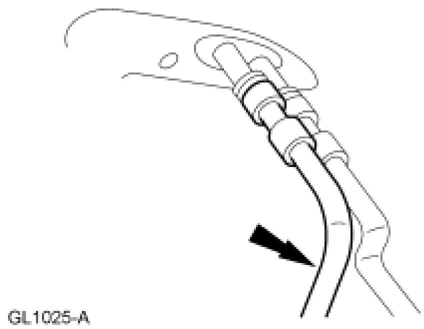

Fig. 89: Check Plugged Or Restricted Heater Core
Courtesy of FORD MOTOR CO.

- Using a suitable thermo-couple temperature measuring device, measure the heater core outlet hose temperature.
- **Is the heater core outlet hose temperature similar to the inlet hose temperature (within approximately 6-17°C [10-30°F])?**

  YES : Go to **Pinpoint Test L** and diagnose for a blend door actuator.

  NO : INSTALL a new heater core. TEST the system for normal operation.

Pinpoint Test M: The Air Conditioning (A/C) is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Manual Climate Control System for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, when A/C is requested, in Electronic Automatic Temperature Control (EATC) or Dual Automatic Temperature Control (DATC) system, a message is sent over the Medium Speed Controller Area Network (MS-CAN) bus to the Instrument Cluster (IC), then from the IC through the High Speed Controller Area Network (HS-CAN) bus to the PCM; or a voltage is sent to the IC through circuit CH434 (GY/YE), then a message is sent from the IC through the HS-CAN bus to the PCM in Electronic Manual Temperature Control (EMTC) systems.

Ignition voltage for the A/C clutch relay switch is provided through circuit SBB25 (RD). When the PCM energizes the relay, ignition voltage is supplied to the A/C clutch through circuit CH401 (VT/WH). Ground is supplied for the A/C clutch through circuit GD121 (BK/YE).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- PCM
- HVAC module - EATC
- HVAC module - DATC
- HVAC module - EMTC
- A/C evaporator discharge temperature sensor
- A/C pressure transducer
- A/C compressor clutch field coil
- A/C control relay
- A/C clutch air gap

PINPOINT TEST M: THE AIR CONDITIONING (A/C) IS INOPERATIVE

NOTE: **It is important to install relays in their correct position in the Battery Junction Box (BJB). Installing a relay incorrectly may cause wiring shorts or damage to modules. While carrying out diagnostics on BJB relays, have only one BJB relay removed at a time. Failure to follow these instructions may result in damage to the vehicle circuitry or to control modules.**

NOTE: **Some PCM DTCs may inhibit A/C operation. If any PCM DTCs are retrieved, diagnose those first. Refer to Introduction - Gasoline Engines article.**

NOTE: **When disconnecting and reconnecting the pressure transducer electrical connector, make sure that the connector-locking device is in place and that the locking device and connector are correctly and fully seated.**

NOTE: **Before carrying out the following test, check that the A/C system pressure is above 290 kPa (42 psi). If the pressure is below 290 kPa (42 psi), refer to Fluorescent Dye Leak Detection.**

M1 CHECK THE A/C PRESSURE SENSOR (ACP_PRESS) PCM PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: ACP_PRESS PCM PID
- With the R-134a Manifold Gauge Set connected, compare the pressure readings of the R-134a Manifold Gauge Set and the ACP_PRESS PCM PID.
- **Are the pressure values of the R-134a Manifold Gauge Set and the ACP_PRESS PCM PID similar?**

  YES : Go to M2.

  NO : INSTALL a new A/C pressure transducer. TEST the system for normal operation.

M2 CHECK THE A/C EVAPORATOR TEMPERATURE (EVAP_TEMP) HVAC PID (3.5L ONLY) OR EVAPORATOR TEMPERATURE (A/CT) PCM PID

- Allow the vehicle exterior and interior to stabilize to an ambient temperature above 16°C (60°F).
- Enter the following diagnostic mode on the diagnostic tool: EVAP_TEMP HVAC PID (3.5L only) or A/CT PCM PID
- **Does the EVAP_TEMP HVAC PID (3.5L ONLY) or A/CT PCM PID read similar to the ambient temperature?**

  YES : DATC/EATC, go to M3.

  EMTC, go to M4.

  NO : INSTALL a new A/C evaporator discharge temperature sensor. TEST the system for normal operation.

M3 CHECK THE AIR CONDITIONING SWITCH STATUS (CC_AC) HVAC PID WITH THE A/C ON

- Enter the following diagnostic mode on the diagnostic tool: CC_AC HVAC PID
- Press and hold the A/C manual override button on the HVAC module - DATC or HVAC module - EATC module.
- **Does the CC_AC HVAC PID read DEPRESSED?**

  YES : Go to M5.

  NO : Go to M14.

M4 CHECK THE EMTC A/C SIGNAL WITH THE A/C ON

- Key in OFF position.
- Disconnect: IC C220
- Key in ON position.
- Select panel mode and press the A/C button on the HVAC module - EMTC.

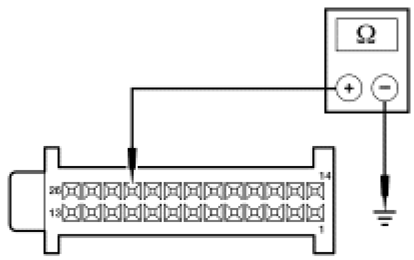

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Fig. 90: Checking EMTC A/C Signal With A/C ON
Courtesy of FORD MOTOR CO.

- Measure the resistance between IC C220-23, circuit CH434 (GY/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to M5.

  NO : Go to M7.

M5 CHECK THE AIR CONDITIONING COMPRESSOR CYCLING SWITCH (ACCS) PCM

PID WITH THE A/C ON

- Key in OFF position.

NOTE: For EMTC systems only.

- Disconnect: For EMTC systems only, IC C220
- Key in ON position.

NOTE: For EMTC systems only.

- Enter the following diagnostic mode on the diagnostic tool: ACCS PCM PID
- Press the PANEL and A/C manual override buttons on the HVAC module - DATC and HVAC module - EATC or select MAX A/C on the HVAC module - EMTC.
- **Does the ACCS PCM PID read ON?**

  YES : Go to M6.

  NO : Go to M15.

M6 CHECK THE AIR CONDITIONING CLUTCH (WAC/ACCR) PCM PID WITH THE A/C ON

- Enter the following diagnostic mode on the diagnostic tool: WAC/ACCR PCM PID
- **Does the WAC/ACCR PCM PID read ON?**

  YES : Go to M9.

  NO : Go to M15.

M7 CHECK CIRCUIT CH434 (GY/YE) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module - EMTC C2357a

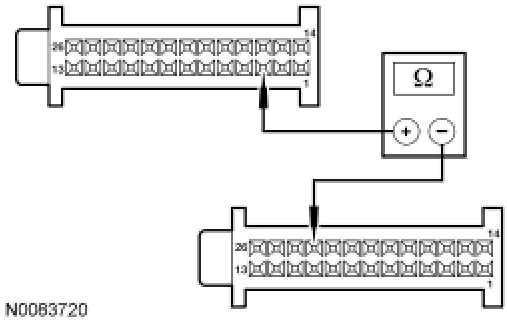

Fig. 91: Checking Circuit CH434 (GY/YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - EMTC C2357a-3, circuit CH434 (GY/YE), harness side and IC C220-23, circuit CH434 (GY/YE), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to M8.

NO : REPAIR circuit CH434 (GY/YE) for an open. TEST the system for normal operation.

M8 CHECK CIRCUIT CH434 (GY/YE) FOR A SHORT TO VOLTAGE

- Key in ON position.

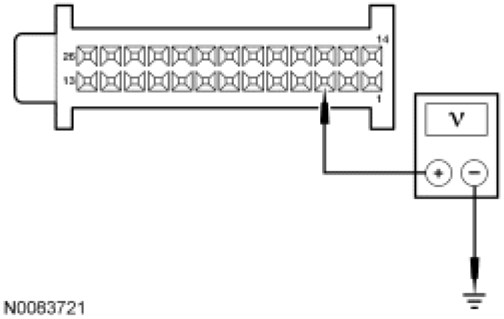

Fig. 92: Checking Circuit CH434 (GY/YE) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between HVAC module - EMTC C2357a-3, circuit CH434 (GY/YE), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to M15.

  NO : REPAIR circuit CH434 (GY/YE) for a short to voltage. TEST the system for normal operation.

M9 CHECK THE VOLTAGE AT THE A/C COMPRESSOR CLUTCH FIELD COIL

- Key in OFF position.
- Disconnect: A/C Compressor Clutch Field Coil C100
- Key in ON position.
- Press the PANEL and A/C manual override buttons on the HVAC module - EATC and HVAC module - DATC or select MAX A/C on the HVAC module - EMTC.

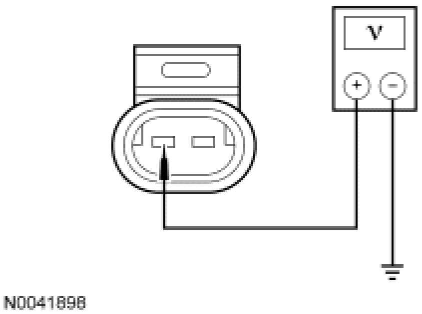

Fig. 93: Checking Circuit CH401 (VT/WH) For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between A/C compressor clutch field coil C100-B, circuit CH401 (VT/WH), harness side and ground.

- **Is the voltage greater than 10 volts?**

  YES : Go to M10.

  NO : Go to M12.

M10 CHECK THE GROUND AT THE A/C COMPRESSOR CLUTCH FIELD COIL

- Key in OFF position.

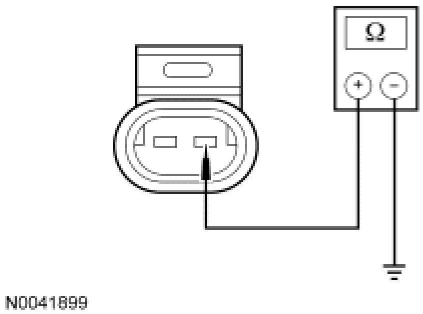

Fig. 94: Checking Ground At A/C Compressor Clutch Field Coil
Courtesy of FORD MOTOR CO.

- Measure the resistance between A/C compressor clutch field coil C100-A, circuit GD121 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to M11.

  NO : REPAIR circuit GD121 (BK/YE) for an open. TEST the system for normal operation.

M11 CHECK THE A/C COMPRESSOR CLUTCH AIR GAP

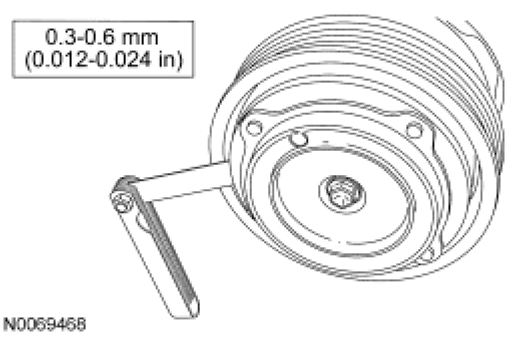

Fig. 95: Checking A/C Compressor Clutch Air Gap
Courtesy of FORD MOTOR CO.

- Measure the A/C compressor clutch air gap at 3 equally spaced locations between the clutch hub and the A/C compressor clutch pulley.
- **Is the A/C compressor clutch air gap greater than 0.6 mm (0.024 in)?**

  YES : ADJUST the A/C compressor clutch gap. REFER to **Air Conditioning (A/C) Clutch Air Gap Adjustment**. TEST the system for normal operation.

  NO : INSTALL a new A/C compressor clutch field coil. TEST the system for normal operation.

M12 CHECK CIRCUIT SBB25 (RD) FOR VOLTAGE

- Key in OFF position.
- Disconnect: A/C Clutch Relay
- Key in ON position.

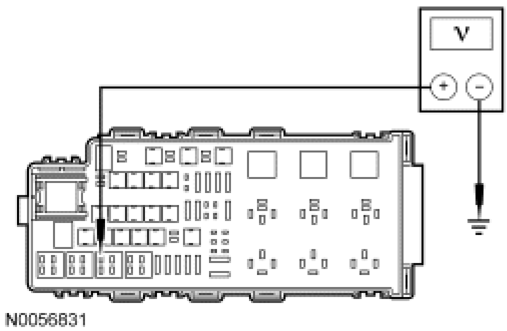

Fig. 96: Checking Circuit SBB25 (RD) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between A/C clutch relay socket, circuit SBB25 (RD) and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to M13.

  NO : VERIFY Battery Junction Box (BJB) fuse 25 (10A) is OK. If OK, REPAIR circuit SBB25 (RD) for an open. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams article to identify the possible causes of the circuit short.

M13 CHECK CIRCUIT CH401 (VT/WH) FOR AN OPEN

- Key in OFF position.

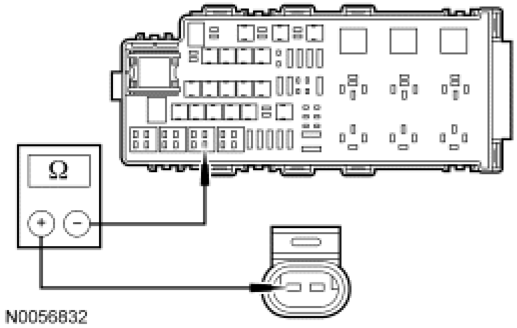

Fig. 97: Checking Circuit CH401 (VT/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between A/C clutch relay socket pin 5, circuit CH401 (VT/WH) and A/C compressor clutch field coil C100-B, circuit CH401 (VT/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to M15.

  NO : REPAIR circuit CH401 (VT/WH) for an open. TEST the system for normal operation.

M14 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.

NOTE: DATC/EATC systems only.

- Carry out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

M15 CHECK THE PCM CONNECTION

- Check the DTCs.
- Disconnect all the PCM connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
  - incorrectly seated connector.
- Connect and correctly seat all the PCM connectors.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new PCM. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been cause by a loose or corroded connector.

Pinpoint Test N: The Air Conditioning (A/C) is Always On - A/C Compressor Does Not Cycle

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Manual Climate Control System for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, when A/C is requested in Electronic Automatic Temperature Control (EATC) or Dual Automatic Temperature Control (DATC) systems, a message is sent over the Medium Speed Controller Area Network (MS-CAN) bus to the Instrument Cluster (IC), then from the IC through the High Speed Controller

Area Network (HS-CAN) bus to the PCM; or a voltage is sent to the IC through circuit CH434 (GY/YE), then a message is sent from the IC through the HS-CAN bus to the PCM Electronic Manual Temperature Control (EMTC) systems.

Ignition voltage for the A/C clutch relay switch is provided through circuit SBB25 (RD). When the PCM energizes the relay, ignition voltage is supplied to the A/C clutch through circuit CH401 (VT/WH). Ground is supplied for the A/C clutch through circuit GD121 (BK/YE).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PCM
- A/C evaporator discharge temperature sensor
- A/C pressure transducer
- A/C control relay
- A/C clutch air gap

PINPOINT TEST N: THE AIR CONDITIONING (A/C) IS ALWAYS ON - A/C COMPRESSOR DOES NOT CYCLE

NOTE: **When disconnecting and reconnecting the pressure transducer electrical connector, make sure that the connector-locking device is in place and that the locking device and connector are correctly and fully seated.**

N1 CHECK THE A/C PRESSURE SENSOR (ACP_PRESS) PCM PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: ACP_PRESS PCM PID
- With the R-134a Manifold Gauge Set connected, compare the pressure readings of the R-134a Manifold Gauge Set and the ACP_PRESS PCM PID.
- **Are the pressure values of the R-134a Manifold Gauge Set and the ACP_PRESS PCM PID similar?**

  YES : Go to N2.

  NO : INSTALL a new A/C pressure transducer. TEST the system for normal operation.

N2 CHECK THE A/C EVAPORATOR TEMPERATURE (EVAP_TEMP) HVAC PID (3.5L ONLY) OR EVAPORATOR TEMPERATURE (A/CT) PCM PID

- Allow the vehicle exterior and interior to stabilize to an ambient temperature above 16°C (60°F).
- Enter the following diagnostic mode on the diagnostic tool: EVAP_TEMP HVAC PID (3.5L only) or A/CT PCM PID
- **Does the EVAP_TEMP HVAC PID (3.5L ONLY) or A/CT PCM PID read similar to the ambient temperature?**

  YES : Go to N3.

  NO : INSTALL a new A/C evaporator discharge temperature sensor. TEST the system for normal operation.

N3 CHECK AIR CONDITIONING CLUTCH (WAC/ACCR) PCM PID WITH THE A/C OFF

- Enter the following diagnostic mode on the diagnostic tool: WAC/ACCR PCM PID
- Select the OFF position on the HVAC module.
- **Does the WAC/ACCR PCM PID read ON?**

  YES : Go to N6.

  NO : Go to N4.

N4 CHECK FOR VOLTAGE TO THE A/C COMPRESSOR CLUTCH FIELD COIL

- Key in OFF position.
- Disconnect: A/C Compressor Clutch Field Coil C100
- Key in ON position.

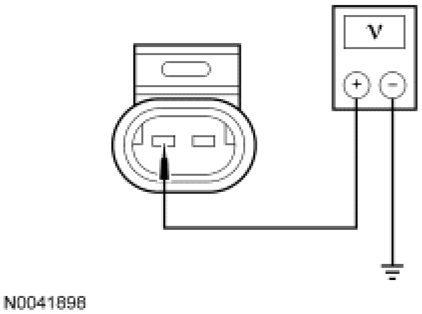

Fig. 98: Checking Circuit CH401 (VT/WH) For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between A/C compressor clutch field coil C100-B, circuit CH401 (VT/WH), harness side and ground.
- **Is any voltage present?**

  YES : Go to N5.

  NO : ADJUST the A/C compressor clutch gap. REFER to **Air Conditioning (A/C) Clutch Air Gap Adjustment**. TEST the system for normal operation.

N5 CHECK CIRCUIT CH401 (VT/WH) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: A/C Clutch Relay
- Key in ON position.

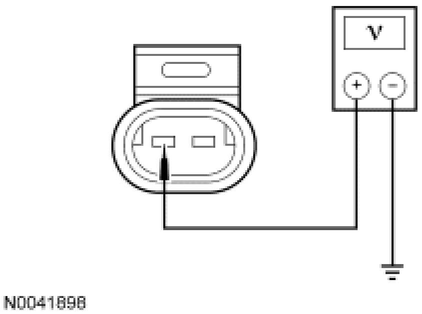

Fig. 99: Checking Circuit CH401 (VT/WH) For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between A/C compressor clutch field coil C100-B, circuit CH401 (VT/WH), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR circuit CH401 (VT/WH) for a short to voltage. TEST the system for normal operation.

  NO : INSTALL a new A/C clutch relay. CHECK the A/C clutch diode. INSTALL a new diode if necessary. TEST the system for normal operation.

N6 CHECK THE PCM CONNECTION

- Clear the DTCs.
- Disconnect all the PCM connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
  - incorrectly seated connector.
- Connect and correctly seat all the PCM connectors.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new PCM. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test O: The Air Conditioning (A/C) is Always On - A/C Mode Always Commanded ON

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Manual Climate Control System for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, when A/C is requested in Electronic Automatic Temperature Control (EATC) or Dual Automatic Temperature Control (DATC) systems, a message is sent over the Medium Speed Controller Area Network (MS-CAN) bus to the Instrument Cluster (IC), then from the IC through the High Speed Controller Area Network (HS-CAN) bus to the PCM; or a voltage is sent to the IC through circuit CH434 (GY/YE), then a message is sent from the IC through the HS-CAN bus to the PCM Electronic Manual Temperature Control (EMTC) systems.

Ignition voltage for the A/C clutch relay switch is provided through circuit SBB25 (RD). When the PCM

energizes the relay, ignition voltage is supplied to the A/C clutch through circuit CH401 (VT/WH). Ground is supplied for the A/C clutch through circuit GD121 (BK/YE).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PCM
- HVAC module - EATC
- HVAC module - DATC
- HVAC module - EMTC

PINPOINT TEST O: THE AIR CONDITIONING (A/C) IS ALWAYS ON - A/C MODE ALWAYS COMMANDED ON

NOTE: When disconnecting and reconnecting the pressure transducer electrical connector, make sure that the connector-locking device is in place and that the locking device and connector are correctly and fully seated.

O1 CHECK THE AIR CONDITIONING COMPRESSOR CYCLING SWITCH (ACCS) PCM PID WITH THE A/C OFF

- Enter the following diagnostic mode on the diagnostic tool: ACCS PCM PID
- Press the OFF manual override buttons on the HVAC module - DATC and HVAC module - EATC or select OFF on the HVAC module - EMTC.
- **Does the ACCS PCM PID read ON?**

  YES : DATC/EATC, go to O2.

  EMTC, go to O3.

  NO : Go to O6.

O2 CHECK THE AIR CONDITIONING SWITCH STATUS (CC_AC) HVAC PID WITH THE A/C OFF

- Enter the following diagnostic mode on the diagnostic tool: CC_AC HVAC PID
- **Does the CC_AC HVAC PID read DEPRESSED?**

  YES : Go to O5.

  NO : Go to O6.

O3 CHECK EMTC A/C REQUEST OUTPUT

- Key in OFF position.
- Disconnect: IC C220
- Key in ON position.
- Select the OFF position on the HVAC module - EMTC.

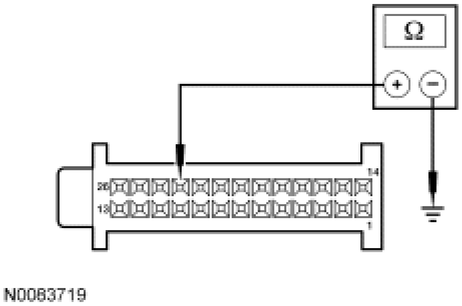

Fig. 100: Checking EMTC A/C Request Output
Courtesy of FORD MOTOR CO.

- Measure the resistance between IC C220-23, circuit CH434 (GY/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to O4.

  NO : Go to O6.

O4 CHECK CIRCUIT CH434 (GY/YE) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: HVAC module - EMTC C2357a
- Key in ON position.

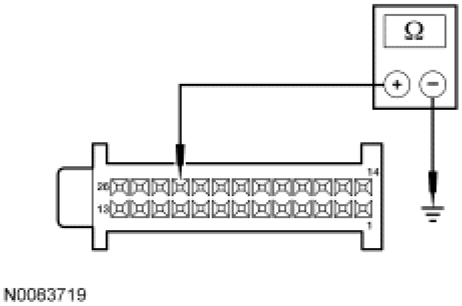

Fig. 101: Checking Circuit CH434 (GY/YE) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between IC C220-23, circuit CH434 (GY/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to O5.

  NO : REPAIR circuit CH434 (GY/YE) for a short to ground. TEST the system for normal operation.

O5 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.

NOTE: **DATC/EATC systems only.**

- Carry out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

O6 CHECK THE PCM CONNECTION

- Clear the DTCs.
- Disconnect all the PCM connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
  - incorrectly seated connector.
- Connect and correctly seat all the PCM connectors.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new PCM. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test P: Temperature Control is Inoperative/Does Not Operate Correctly - EMTC

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Manual Climate Control System for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, to rotate the blend door actuator, the HVAC module supplies voltage to the blend door actuator motor through circuit CH233 (VT/BN), and supplies ground through circuit CH234 (YE/GN). To reverse the blend door actuator rotation, the HVAC module reverses the voltage and ground circuits.

The blend door actuator feedback resistors are supplied a ground from the HVAC module by circuit RH111 (GY/BU) and a 5-volt reference voltage circuit LH111 (BN/WH). The HVAC module reads the voltage on circuit VH439 (GY/VT) to determine the blend door actuator position, by the position of the actuator feedback resistor wiper arm.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Blend door actuator motor
- HVAC module - Electronic Manual Temperature Control (EMTC)
- Stuck or bound linkage or door

PINPOINT TEST P: TEMPERATURE CONTROL IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - EMTC

P1 CHECK THE FEEDBACK POTENTIOMETER TOTAL RESISTANCE

- Key in OFF position.
- Disconnect: HVAC Module - EMTC C2357a

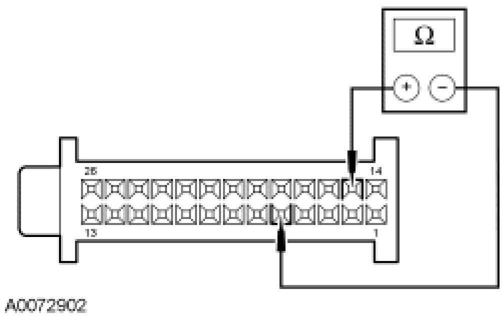

Fig. 102: Checking Feedback Potentiometer Total Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - EMTC C2357a-5, circuit LH111 (BN/WH), harness side and HVAC module - EMTC C2357a-15, circuit RH111 (GY/BU), harness side.
- **Is the resistance between 4,000 and 6,000 ohms?**

  YES : Go to P2.

  NO : If resistance is greater than 6,000 ohms, go to P4.

  If resistance is less than 4,000 ohms, go to P5.

P2 CHECK THE POTENTIOMETER LOW-SIDE RESISTANCE

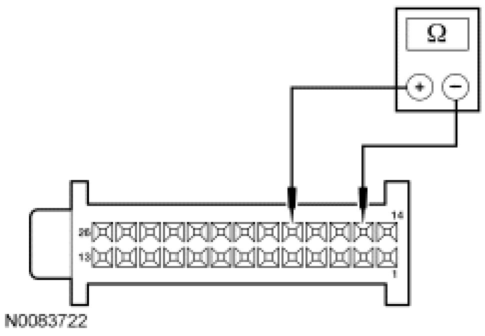

Fig. 103: Checking Potentiometer Low-Side Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - EMTC C2357a-15, circuit RH111 (GY/BU), harness side and HVAC module - EMTC C2357a-18, circuit VH439 (GY/VT), harness side.
- **Is the resistance between 1 and 10,000 ohms?**

  YES : Go to P3.

  NO : If resistance is greater than 10,000 ohms, go to P6.

  If resistance is less than 1 ohm, go to P7.

P3 CHECK THE POTENTIOMETER HIGH-SIDE RESISTANCE

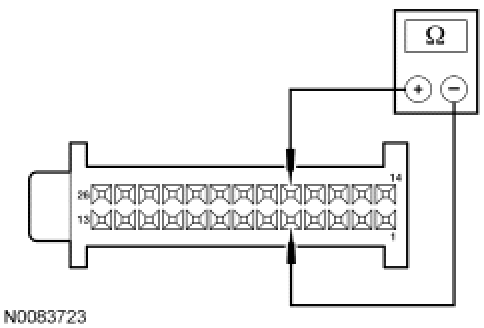

Fig. 104: Checking Potentiometer High-Side Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - EMTC C2357a-5, circuit LH111 (BN/WH), harness side and HVAC module - EMTC C2357a-18, circuit VH439 (GY/VT), harness side.
- **Is the resistance between 1 and 10,000 ohms?**

  YES : Go to P9.

  NO : If resistance is greater than 10,000 ohms, INSTALL a new door actuator. TEST the system for normal operation.

  If resistance is less than 1 ohm, go to P8.

P4 CHECK CIRCUITS LH111 (BN/WH) AND RH111 (GY/BU) FOR AN OPEN

NOTE:	**Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.**

- Disconnect: LH Blend Door Actuator C2091

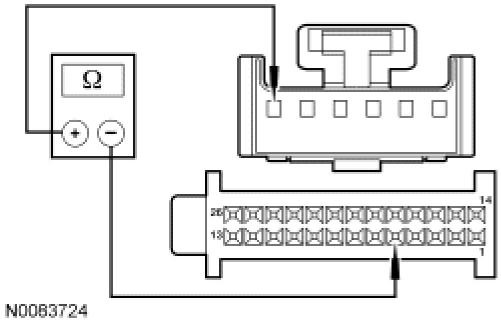

Fig. 105: Checking Circuits LH111 (BN/WH) & RH111 (GY/BU) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - EMTC C2357a-5, circuit LH111 (BN/WH), harness side and LH blend door actuator C2091-10, circuit LH111 (BN/WH), harness side.

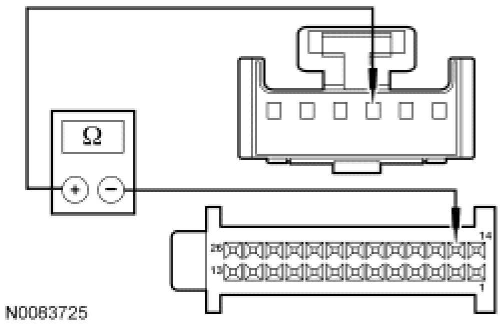

Fig. 106: Measuring Resistance Between C2357A-5 & C2091-10, Circuit LH111 (BN/WH) & LH111 (BN/WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - EMTC C2357a-15, circuit RH111 (GY/BU), harness side and LH blend door actuator C2091-7, circuit RH111 (GY/BU), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR circuit LH111 (BN/WH) or RH111 (GY/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

P5 CHECK CIRCUITS RH111 (GY/BU) AND LH111 (BN/WH) FOR A SHORT TOGETHER

NOTE:	**Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.**

- Disconnect: LH Blend Door Actuator C2091

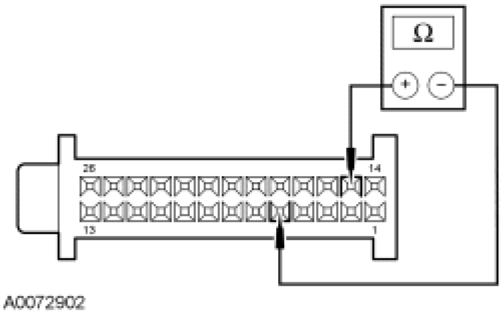

Fig. 107: Checking Circuits RH111 (GY/BU) & LH111 (BN/WH) For A Short Together
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - EMTC C2357a-5, circuit LH111 (BN/WH), harness side and HVAC module - EMTC C2357a-15, circuit RH111 (GY/BU), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR circuits RH111 (GY/BU) and LH111 (BN/WH) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

P6 CHECK CIRCUIT VH439 (GY/VT) FOR AN OPEN

NOTE:	Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.

- Disconnect: LH Blend Door Actuator C2091

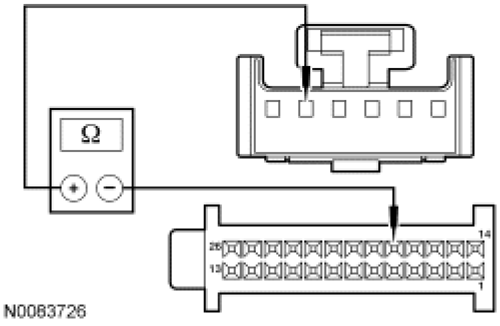

Fig. 108: Checking Circuit VH439 (GY/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - EMTC C2357a-18, circuit VH439 (GY/VT), harness side and LH blend door actuator C2091-9, circuit VH439 (GY/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

NO : REPAIR circuit VH439 (GY/VT) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

P7 CHECK CIRCUIT RH111 (GY/BU) FOR A SHORT TO CIRCUIT VH439 (GY/VT)

NOTE:	**Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.**

- Disconnect: LH Blend Door Actuator C2091

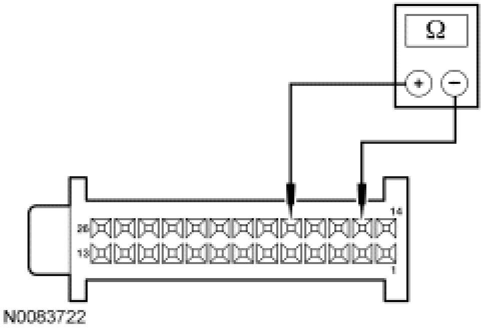

Fig. 109: Checking Circuit RH111 (GY/BU) For A Short To Circuit VH439 (GY/VT)
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - EMTC C2357a-15, circuit RH111 (GY/BU), harness side and HVAC module - EMTC C2357a-18, circuit VH439 (GY/VT), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR circuits RH111 (GY/BU) and VH439 (GY/VT) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

P8 CHECK CIRCUIT LH111 (BN/WH) FOR A SHORT TO CIRCUIT VH439 (GY/VT)

NOTE:	**Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.**

- Disconnect: LH Blend Door Actuator C2091

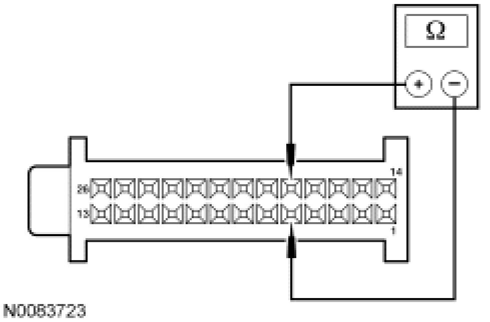

Fig. 110: Checking Circuit LH111 (BN/WH) For A Short To Circuit VH439 (GY/VT)
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - EMTC C2357a-5, circuit LH111 (BN/WH), harness side and HVAC module - EMTC C2357a-18, circuit VH439 (GY/VT), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR circuits LH111 (BN/WH) and VH439 (GY/VT) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

P9 CHECK CIRCUITS LH111 (BN/WH) AND VH439 (GY/VT) FOR A SHORT TO GROUND

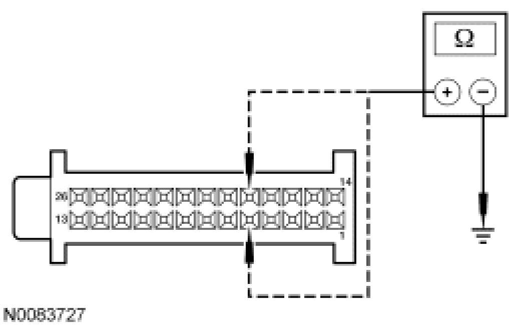

Fig. 111: Checking Circuits LH111 (BN/WH) & VH439 (GY/VT) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and the following:
  - HVAC module - EMTC C2357a-5, circuit LH111 (BN/WH), harness side.
  - HVAC module - EMTC C2357a-18, circuit VH439 (GY/VT), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to P10.

  NO : REPAIR circuit(s) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

P10 CHECK CIRCUITS RH111 (GY/BU) AND VH439 (GY/VT) FOR A SHORT TO POWER

- Key in ON position.

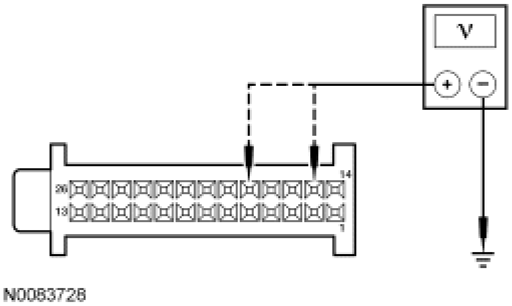

Fig. 112: Checking Circuits RH111 (GY/BU) & VH439 (GY/VT) For A Short To Power
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and the following:
  - HVAC module - EMTC C2357a-15, circuit RH111 (GY/BU), harness side.
  - HVAC module - EMTC C2357a-18, circuit VH439 (GY/VT), harness side.
- **Is any voltage present?**

  YES : REPAIR circuit(s) for a short to power. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : Go to P11.

P11 CHECK THE DOOR ACTUATOR OPERATION

NOTE: **If a jumper fuse opens while carrying out this test step, repair the circuit(s) for a short.**

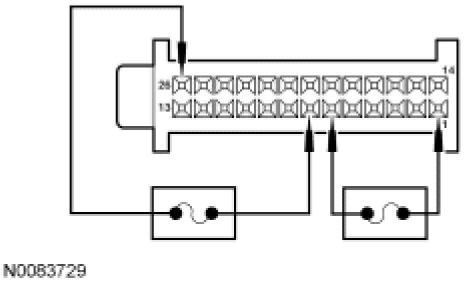

Fig. 113: Checking Door Actuator Operation
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - EMTC C2357a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EMTC C2357a-7, circuit CH233 (VT/BN), harness side.
  - HVAC module - EMTC C2357a-1, circuit GD116 (BK/VT), harness side and HVAC module - EMTC C2357a-6, circuit CH234 (YE/GN), harness side.

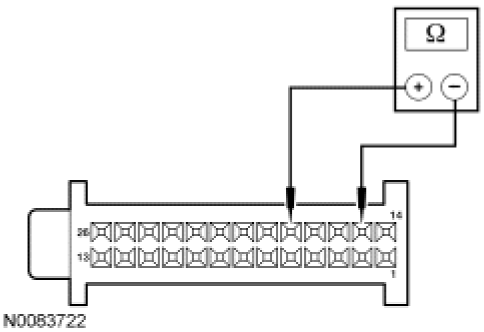

Fig. 114: Measuring Resistance Between C2357A-1 & C2357A-6, Circuit GD116 (BK/VT) & CH234 (YE/GN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - EMTC C2357a-15, circuit RH111 (GY/BU), harness side and HVAC module - EMTC C2357a-18, circuit VH439 (GY/VT), harness side.

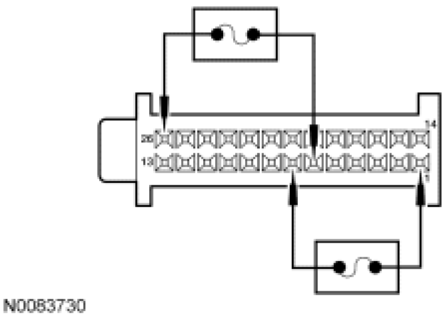

Fig. 115: Measuring Resistance Between C2357A-15 & C2357A-18, Circuit RH111 (GY/BU) & VH439 (GY/VT)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - EMTC C2357a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EMTC C2357a-6, circuit CH234 (YE/GN), harness side.
  - HVAC module - EMTC C2357a-1, circuit GD116 (BK/VT), harness side and HVAC module - EMTC C2357a-7, circuit CH233 (VT/BN), harness side.

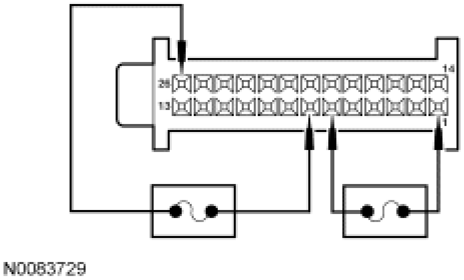

Fig. 116: Measuring Resistance Between C2357A-1 & C2357A-7, Circuit GD116 (BK/VT) & CH233 (VT/BN)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - EMTC C2357a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EMTC C2357a-7, circuit CH233 (VT/BN), harness side.
  - HVAC module - EMTC C2357a-1, circuit GD116 (BK/VT), harness side and HVAC module - EMTC C2357a-6, circuit CH234 (YE/GN), harness side.
- **Does the resistance increase and decrease when the jumpers are connected?**

  YES : INSPECT for binding or broken door and linkage. If no condition is found, go to P14.

  NO : Go to P12.

P12 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS

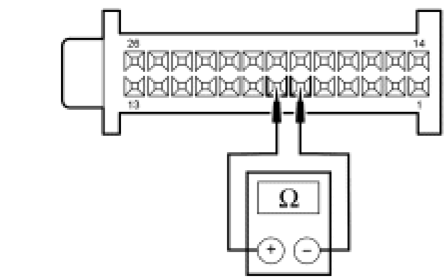

Fig. 117: Checking Actuator Motor Drive Circuits
Courtesy of FORD MOTOR CO.

- Measure the resistance between the HVAC module - EMTC C2357a-7, circuit CH233 (VT/BN), harness side and HVAC module - EMTC C2357a-6, circuit CH234 (YE/GN), harness side.
- **Is the resistance between approximately 59-73 ohms?**

  YES : INSPECT for binding or broken door and linkage. If no condition is found, INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : Go to P13.

P13 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR AN OPEN

NOTE:	Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.

- Disconnect: LH Blend Door Actuator C2091

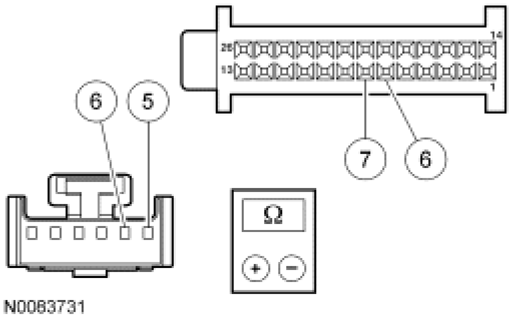

Fig. 118: Checking Actuator Motor Drive Circuits For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the HVAC module - EMTC connector, harness side and LH blend door actuator, harness side using the following chart.

HVAC Module Connector	Circuit	LH Blend Door Actuator Connector
C2357a-7	CH233 (VT/BN)	C2091-5
C2357a-6	CH234 (YE/GN)	C2091-6

- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR the circuit(s) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

P14 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test Q: Temperature Control is Inoperative/Does Not Operate Correctly - EATC/DATC

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Manual Climate Control System for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, to rotate the blend door actuator, the HVAC module supplies voltage to the blend door actuator motors through the door actuator feed A circuits, and supplies ground through the door actuator feed B circuits. To reverse the blend door actuator rotation, the HVAC module reverses the voltage and ground circuits.

The blend door actuator feedback resistors are supplied a ground from the HVAC module by the blend door actuator return circuits and a 5-volt reference voltage on the blend door actuator reference circuits. The HVAC module reads the voltage on the blend door actuator feedback circuits to determine the blend door actuator position, by the position of the actuator feedback resistor wiper arm.

Door actuator feed A circuits

- (Dual Automatic Temperature Control (DATC)/Electronic Automatic Temperature Control (EATC)) LH Blend - CH238 (YE/OG)
- RH Blend - CH212 (BU/OG)

Door actuator feed B circuits

- (DATC/EATC) LH Blend - CH239 (BU/WH)
- RH Blend - CH213 (BN/GN)

Door actuator return circuits

- LH Blend - RH111 (GY/BU)
- RH Blend - RH111 (GY/BU)

Door actuator reference circuits

- LH Blend - LH111 (BN/WH)
- RH Blend - LH111 (BN/WH)

Door actuator feedback circuits

- (DATC/EATC) LH Blend - VH440 (BN/BU)
- RH Blend - VH441 (WH/BN)

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Blend door actuator motor

- HVAC module - EATC
- HVAC module - DATC
- Stuck or bound linkage or door

PINPOINT TEST Q: TEMPERATURE CONTROL IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - EATC/DATC

Q1 CHECK THE FEEDBACK POTENTIOMETER TOTAL RESISTANCE

- Disconnect: HVAC Module - DATC C2356a or HVAC Module - EATC C228a

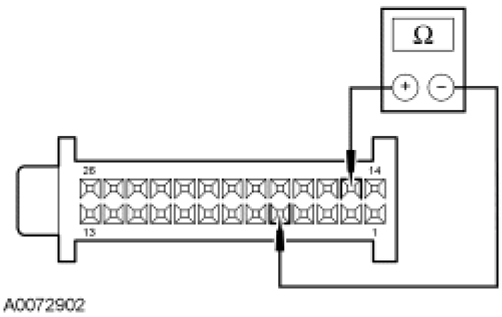

Fig. 119: Checking Feedback Potentiometer Total Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between:

  NOTE: EATC systems only.

  - HVAC module - EATC C228a-5, circuit LH111 (BN/WH), harness side and HVAC module - EATC C228a-15, circuit RH111 (GY/BU), harness side.

  NOTE: DATC systems only.

  - HVAC module - DATC C2356a-5, circuit LH111 (BN/WH), harness side and HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side.
- **Is the resistance between 4,000 and 6,000 ohms for EATC systems or between 2,667 and 4,000 ohms for DATC systems?**

  YES : Go to Q2.

  NO : For EATC systems, if resistance is greater than 4,000 ohms, go to Q4.

  For EATC systems, if resistance is less than 4,000 ohms, go to Q6.

  For DATC systems, if resistance is greater than 6,000 ohms, go to Q4.

  For DATC systems, If resistance is less than 2,667 ohms, go to Q6.

Q2 CHECK THE POTENTIOMETER LOW-SIDE RESISTANCE

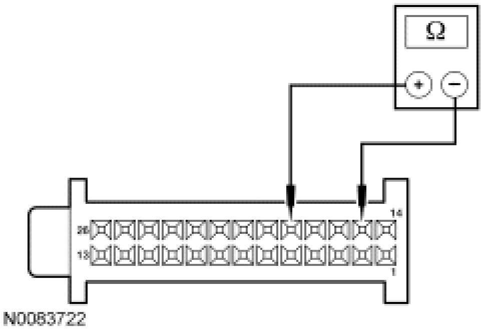

Fig. 120: Checking Potentiometer Low-Side Resistance (EATC)
Courtesy of FORD MOTOR CO.

NOTE: **EATC systems only.**

- Measure the resistance between HVAC module - EATC C228a-15, circuit RH111 (GY/BU), harness side and HVAC module - EATC C228a-18, circuit VH439 (GY/VT), harness side.

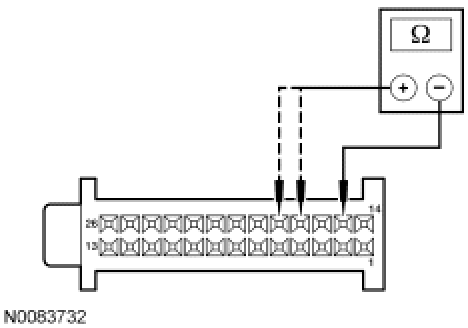

Fig. 121: Checking Potentiometer Low-Side Resistance (DATC)
Courtesy of FORD MOTOR CO.

NOTE: **DATC systems only.**

- Measure the resistance between HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side and the following:
  - **For DTC B2266** , HVAC module - DATC C2356a-18, circuit VH440 (BN/BU), harness side.
  - **For DTC B2267** , HVAC module - DATC C2356a-17, circuit VH441 (WH/BN), harness side.
- **Is the resistance between 1 and 10,000 ohms?**

  YES : Go to Q3.

  NO : If resistance is greater than 10,000 ohms, go to Q7.

  If resistance is less than 1 ohm, go to Q8.

Q3 CHECK THE POTENTIOMETER HIGH-SIDE RESISTANCE

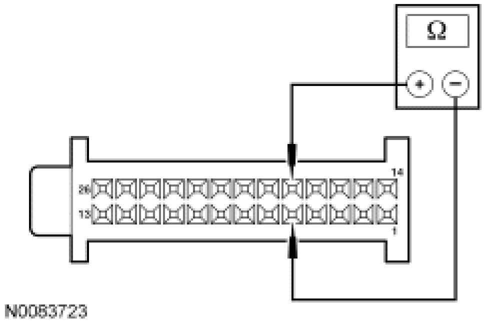

Fig. 122: Checking Potentiometer High-Side Resistance (EATC)
Courtesy of FORD MOTOR CO.

NOTE: **EATC systems only.**

- Measure the resistance between HVAC module - EATC C228a-5, circuit LH111 (BN/WH), harness side and HVAC module - EATC C228a-18, circuit VH439 (GY/VT), harness side.

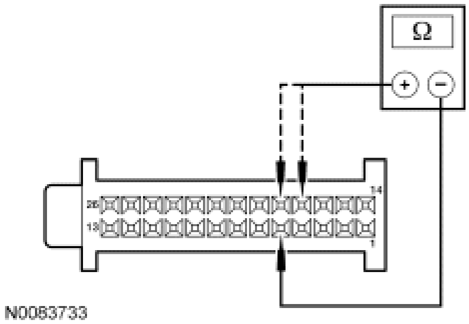

Fig. 123: Checking Potentiometer High-Side Resistance (DATC)
Courtesy of FORD MOTOR CO.

NOTE: **DATC systems only.**

- Measure the resistance between HVAC module - DATC C2356a-5, circuit LH111 (BN/WH), harness side and the following:
  - **For DTC B2266** , HVAC module - DATC C2356a-18, circuit VH440 (BN/BU), harness side.
  - **For DTC B2267** , HVAC module - DATC C2356a-17, circuit VH441 (WH/BN), harness side.
- **Is the resistance between 1 and 10,000 ohms?**

  YES : Go to Q10.

  NO : If resistance is greater than 10,000 ohms, INSTALL a new door actuator. TEST the system for normal operation.

  If resistance is less than 1 ohm, go to Q9.

Q4 CHECK CIRCUIT LH111 (BN/WH) FOR AN OPEN

NOTE: Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.

- Disconnect: **For DTC B2266** , LH Blend Door Actuator C2091
- Disconnect: **For DTC B2267** , RH Blend Door Actuator C2092

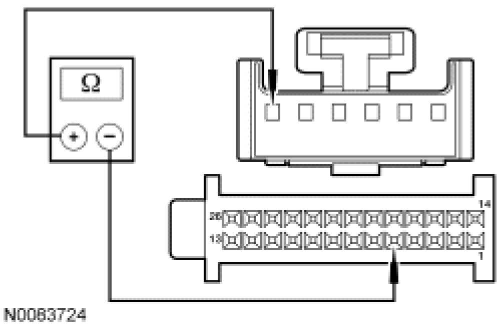

Fig. 124: Checking Circuit LH111 (BN/WH) For An Open (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the resistance between HVAC module - EATC C228a-5, circuit LH111 (BN/WH), harness side and LH blend door actuator C2091-10, circuit LH111 (BN/WH), harness side.

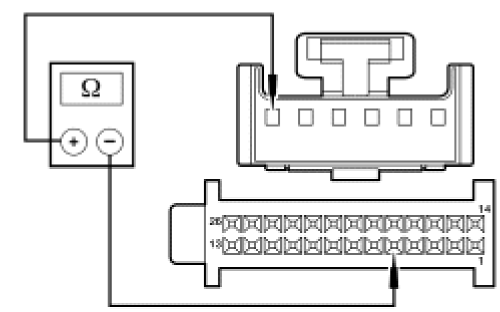

Fig. 125: Checking Circuit LH111 (BN/WH) For An Open (DATC)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

- Measure the resistance between HVAC module - DATC C2356a-5, circuit LH111 (BN/WH), harness side and the following:
    - **For DTC B2266** , LH blend door actuator C2091-10, circuit LH111 (BN/WH), harness side.
    - **For DTC B2267** , RH blend door actuator C2092-10, circuit LH111 (BN/WH), harness side.

- **Is the resistance less than 5 ohms?**

  YES : Go to Q5.

  NO : REPAIR circuit LH111 (BN/WH) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Q5 CHECK THE ACTUATOR RETURN CIRCUIT RH111 (GY/BU) FOR AN OPEN

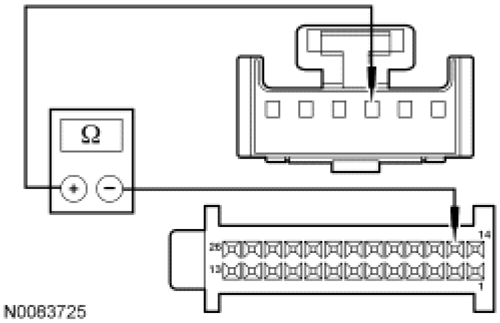

Fig. 126: Checking Actuator Return Circuit RH111 (GY/BU) For An Open (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the resistance between HVAC module - EATC C228a-15, circuit RH111 (GY/BU), harness side and LH blend door actuator C2091-7, circuit RH111 (GY/BU), harness side.

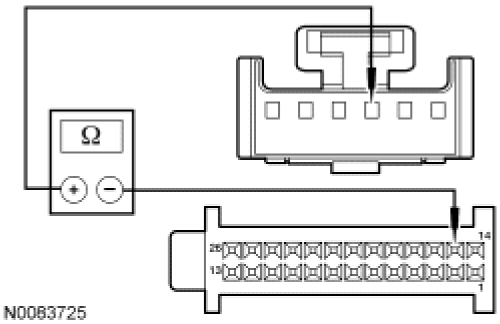

Fig. 127: Checking Actuator Return Circuit RH111 (GY/BU) For An Open (DATC)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

- Measure the resistance between HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side and the following:
  - **For DTC B2266** , LH blend door actuator C2091-7, circuit RH111 (GY/BU), harness side.
  - **For DTC B2267** , RH blend door actuator C2092-7, circuit RH111 (GY/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system

for normal operation.

NO : REPAIR circuit RH111 (GY/BU) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Q6 CHECK CIRCUITS RH111 (GY/BU) AND LH111 (BN/WH) FOR A SHORT TOGETHER

NOTE: Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.

- Disconnect: **For DTC B2266** , LH Blend Door Actuator C2091
- Disconnect: **For DTC B2267** , RH Blend Door Actuator C2092

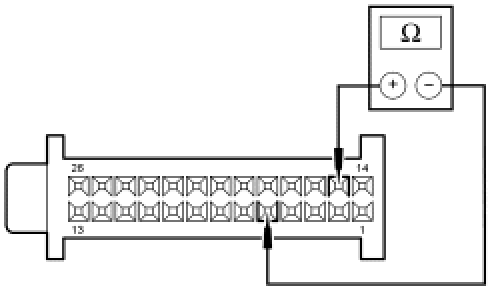

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Fig. 128: Checking Circuits RH111 (GY/BU) & LH111 (BN/WH) For A Short Together (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the resistance between HVAC module - EATC C228a-5, circuit LH111 (BN/WH), harness side and HVAC module - EATC C228a-15, circuit RH111 (GY/BU), harness side.

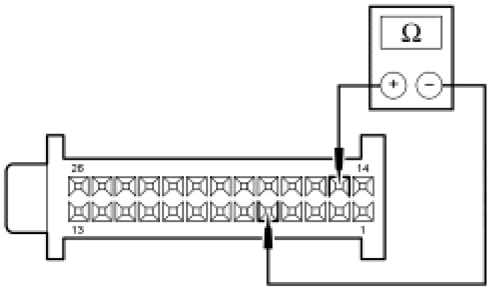

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Fig. 129: Checking Circuits RH111 (GY/BU) & LH111 (BN/WH) For A Short Together (DATC)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

- Measure the resistance between HVAC module - DATC C2356a-5, circuit LH111 (BN/WH), harness side and HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR circuits RH111 (GY/BU) and LH111 (BN/WH) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Q7 CHECK CIRCUIT VH440 (BU/BN), VH441 (WH/BN) OR VH439 (GY/VT) FOR AN OPEN

NOTE: Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.

- Disconnect: **For DTC B2266** , LH Blend Door Actuator C2091
- Disconnect: **For DTC B2267** , RH Blend Door Actuator C2092

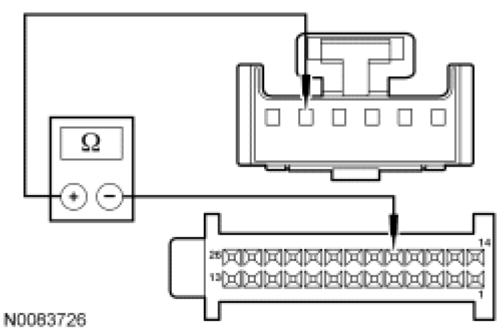


Fig. 130: Checking Circuit VH440 (BU/BN), VH441 (WH/BN) Or VH439 (GY/VT) For An Open (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the resistance between HVAC module - EATC C228a-18, circuit VH439 (GY/VT), harness side and LH blend door actuator C2091-9, circuit VH439 (GY/VT), harness side.

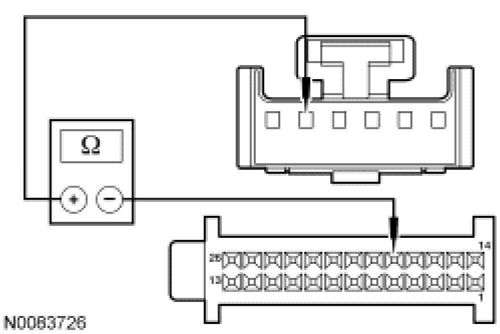


Fig. 131: Checking Circuit VH440 (BU/BN), VH441 (WH/BN) Or VH439 (GY/VT) For An Open (DATC, DTC B2266)
Courtesy of FORD MOTOR CO.

NOTE:	**DATC systems only.**

NOTE:	**For DTC B2266**

- Measure the resistance between HVAC module - DATC C2356a-18 , circuit VH440 (BU/BN), harness side and LH blend door actuator C2091-9, circuit VH440 (BU/BN), harness side.

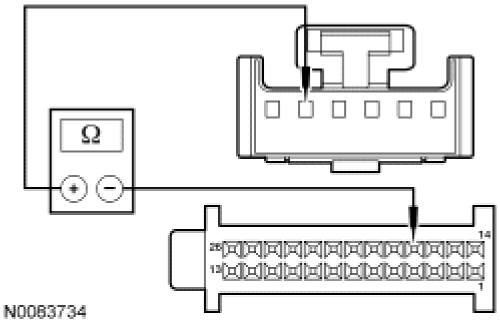


Fig. 132: Checking Circuit VH440 (BU/BN), VH441 (WH/BN) Or VH439 (GY/VT) For An Open (DATC, DTC B2267)
Courtesy of FORD MOTOR CO.

NOTE:	**DATC systems only.**

NOTE:	**For DTC B2267**

- Measure the resistance between HVAC module - DATC C2356a-17, circuit VH441 (WH/BN), harness side and RH blend door actuator C2092-9, circuit VH441 (WH/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR circuit VH440 (BU/BN), VH441 (WH/BN) or VH439 (GY/VT) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Q8 CHECK CIRCUIT RH111 (GY/BU) FOR A SHORT TO CIRCUIT VH440 (BU/BN), VH441 (WH/BN) OR VH439 (GY/VT)

NOTE:	**Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.**

- Disconnect: **For DTC B2266** , LH Blend Door Actuator C2091
- Disconnect: **For DTC B2267** , RH Blend Door Actuator C2092

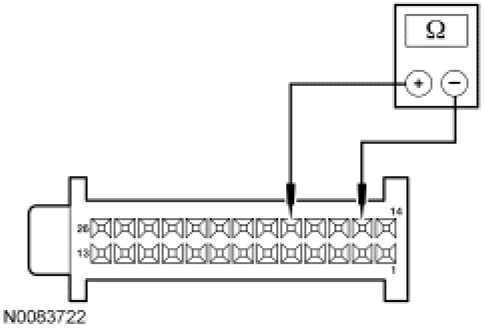


Fig. 133: Checking Circuit RH111 (GY/BU) For A Short To Circuit VH440 (BU/BN), VH441 (WH/BN) Or VH439 (GY/VT) (EATC)
Courtesy of FORD MOTOR CO.

NOTE: **EATC systems only.**

- Measure the resistance between HVAC module - EATC C228a-15, circuit RH111 (GY/BU), harness side and HVAC module - EATC C228a-18, circuit VH439 (GY/VT), harness side.

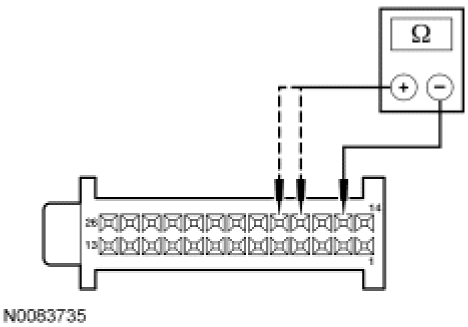


Fig. 134: Checking Circuit RH111 (GY/BU) For A Short To Circuit VH440 (BU/BN), VH441 (WH/BN) Or VH439 (GY/VT) (DATC)
Courtesy of FORD MOTOR CO.

NOTE: **DATC systems only.**

- Measure the resistance between HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side and the following:
  - **For DTC B2266** , HVAC module - DATC C2356a-18, circuit VH440 (BU/BN), harness side.
  - **For DTC B2267** , HVAC module - DATC C2356a-17, circuit VH441 (WH/BN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR circuits RH111 (GY/BU) and circuit VH440 (BU/BN), VH441 (WH/BN) or VH439 (GY/VT) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for

normal operation.

Q9 CHECK CIRCUIT LH111 (BN/WH) FOR A SHORT TO CIRCUIT VH440 (BU/BN), VH441 (WH/BN) OR VH439 (GY/VT)

NOTE:	Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.

- Disconnect: **For DTC B2266** , LH Blend Door Actuator C2091
- Disconnect: **For DTC B2267** , RH Blend Door Actuator C2092

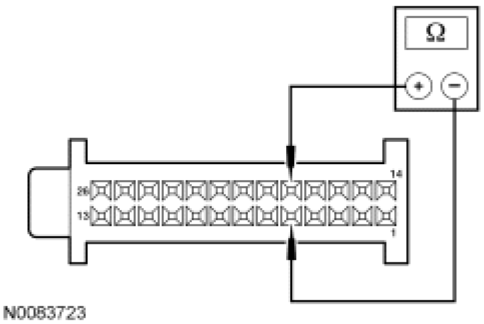


Fig. 135: Checking Circuit LH111 (BN/WH) For A Short To Circuit VH440 (BU/BN), VH441 (WH/BN) Or VH439 (GY/VT) (EATC)
Courtesy of FORD MOTOR CO.

NOTE:	EATC systems only.

- Measure the resistance between HVAC module - EATC C228a-5, circuit LH111 (BN/WH), harness side and HVAC module - EATC C228a-18, circuit VH439 (GY/VT), harness side.

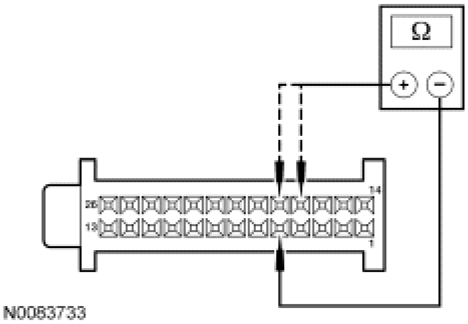


Fig. 136: Checking Circuit LH111 (BN/WH) For A Short To Circuit VH440 (BU/BN), VH441 (WH/BN) Or VH439 (GY/VT) (DATC)
Courtesy of FORD MOTOR CO.

NOTE:	DATC systems only.

- Measure the resistance between HVAC module - DATC C2356a-5, circuit LH111 (BN/WH), harness side and the following:
  - **For DTC B2266** , HVAC module - DATC C2356a-18, circuit VH440 (BU/BN), harness side.
  - **For DTC B2267** , HVAC module - DATC C2356a-17, circuit VH441 (WH/BN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR circuits LH111 (BN/WH) and VH440 (BU/BN), VH441 (WH/BN) or VH439 (GY/VT) for a short together. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Q10 CHECK CIRCUIT LH111 (BN/WH), VH439 (GY/VT), VH440 (BU/BN) OR VH441 (WH/BN) FOR A SHORT TO GROUND

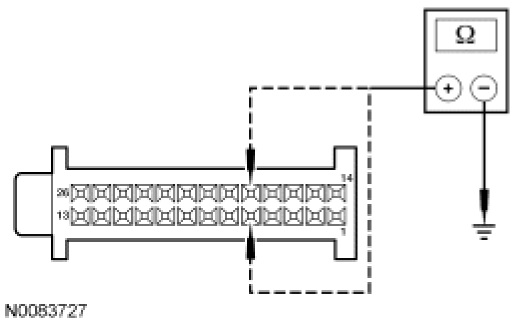


Fig. 137: Checking Circuit LH111 (BN/WH), VH439 (GY/VT), VH440 (BU/BN) Or VH441 (WH/BN) For A Short To Ground (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the resistance between ground and the following:
  - HVAC module - EATC C228a-5, circuit LH111 (BN/WH), harness side.
  - HVAC module - EATC C228a-18, circuit VH439 (GY/VT), harness side.

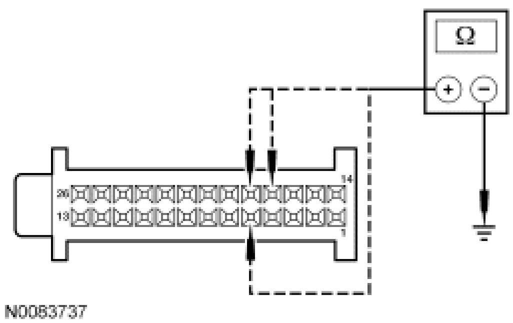


Fig. 138: Checking Circuit LH111 (BN/WH), VH439 (GY/VT), VH440 (BU/BN) Or VH441 (WH/BN) For A Short To Ground (DATC)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

- Measure the resistance between ground and the following:
  - HVAC module - DATC C2356a-5, circuit LH111 (BN/WH), harness side.
  - **For DTC B2266** , HVAC module - DATC C2356a-18, circuit VH440 (BU/BN), harness side.
  - **For DTC B2267** , HVAC module - DATC C2356a-17, circuit VH441 (WH/BN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to Q11.

  NO : REPAIR circuit(s) for a short to ground. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Q11 CHECK CIRCUIT RH111 (GY/BU), VH439 (GY/VT), VH440 (BU/BN) OR VH441 (WH/BN) FOR A SHORT TO POWER

- Key in ON position.

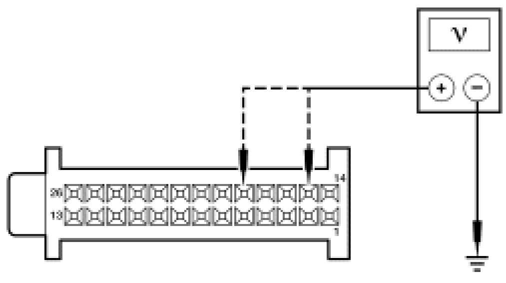


Fig. 139: Checking Circuit RH111 (GY/BU), VH439 (GY/VT), VH440 (BU/BN) Or VH441 (WH/BN) For A Short To Power (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the voltage between ground and the following:
  - HVAC module - EATC C228a-15, circuit RH111 (GY/BU), harness side.
  - HVAC module - EATC C228a-18, circuit VH439 (GY/VT), harness side.

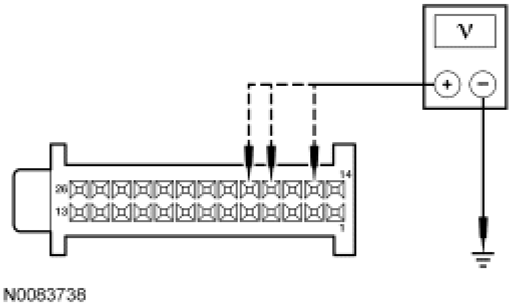


Fig. 140: Checking Circuit RH111 (GY/BU), VH439 (GY/VT), VH440 (BU/BN) Or VH441 (WH/BN) For A Short To Power (DATC)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

- Measure the voltage between ground and the following:
  - HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side.
  - **For DTC B2266** , HVAC module - DATC C2356a-18, circuit VH440 (BU/BN), harness side.
  - **For DTC B2267** , HVAC module - DATC C2356a-17, circuit VH441 (WH/BN), harness side.
- **Is any voltage present?**

  YES : REPAIR circuit(s) for a short to power. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : For EATC systems, go to Q12.

  For DATC systems, **DTC B2266** , go to Q13.

  For DATC systems, **DTC B2267** , go to Q14.

Q12 CHECK THE DOOR ACTUATOR OPERATION

NOTE: If a jumper fuse opens while carrying out this test step, repair the circuit(s) for a short.

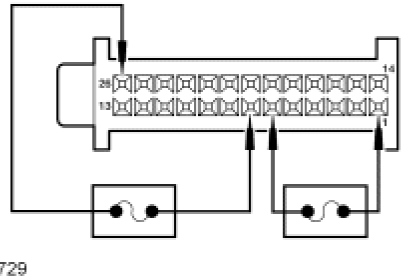


Fig. 141: Checking Door Actuator Operation
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - EATC C228a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EATC C228a-7, circuit CH233 (VT/BN), harness side.
  - HVAC module - EATC C228a-1, circuit GD116 (BK/VT), harness side and HVAC module - EATC C228a-6, circuit CH234 (YE/GN), harness side.

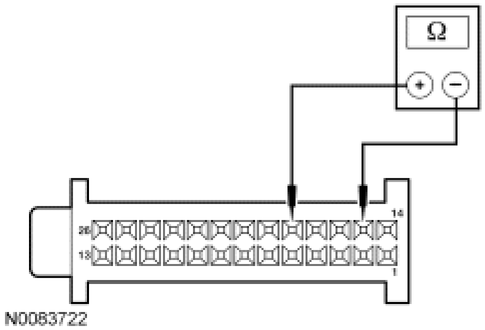


Fig. 142: Measuring Resistance Between C228A-1 & C228A-6, Circuit GD116 (BK/VT) & CH234 (YE/GN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - EATC C228a-15, circuit RH111 (GY/BU), harness side and HVAC module - EATC C228a-18, circuit VH439 (GY/VT), harness side.

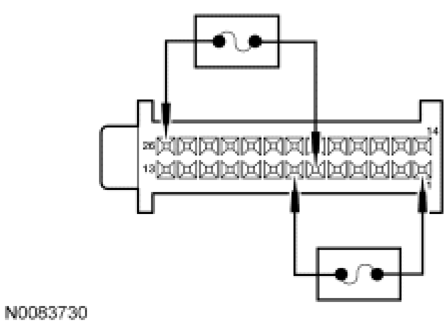


Fig. 143: Measuring Resistance Between C228A-15 & C228A-18, Circuit RH111 (GY/BU) & VH439 (GY/VT)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - EATC C228a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EATC C228a-6, circuit CH234 (YE/GN), harness side.
  - HVAC module - EATC C228a-1, circuit GD116 (BK/VT), harness side and HVAC module - EATC C228a-7, circuit CH233 (VT/BN), harness side.

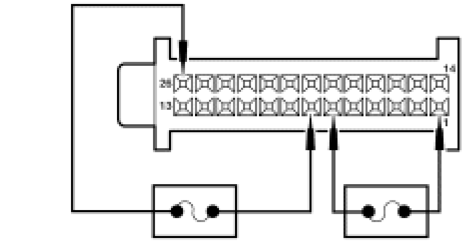


Fig. 144: Measuring Resistance Between C228A-1 & C228A-7, Circuit GD116 (BK/VT) & CH233 (VT/BN)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - EATC C228a-26, circuit SBP07 (WH/RD), harness side and HVAC module - EATC C228a-7, circuit CH233 (VT/BN), harness side.
  - HVAC module - EATC C228a-1, circuit GD116 (BK/VT), harness side and HVAC module - EATC C228a-6, circuit CH234 (YE/GN), harness side.
- **Does the resistance increase and decrease when the jumpers are connected?**

  YES : INSPECT for binding or broken door and linkage. If no condition is found, go to Q17.

  NO : Go to Q15.

Q13 CHECK THE DOOR ACTUATOR OPERATION

NOTE:	**If a jumper fuse opens while carrying out this test step, repair the circuit(s) for a short.**

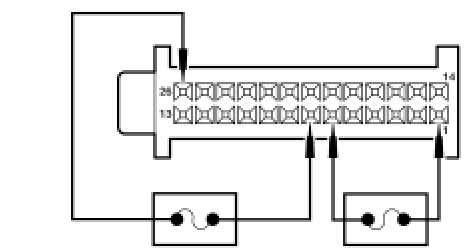


Fig. 145: Checking Door Actuator Operation
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - DATC C2356a-26, circuit SBP07 (WH/RD), harness side and HVAC module - DATC C2356a-7, circuit CH238 (YE/OG), harness side.
  - HVAC module - DATC C2356a-1, circuit GD116 (BK/VT), harness side and HVAC module - DATC C2356a-6, circuit CH239 (BU/WH), harness side.

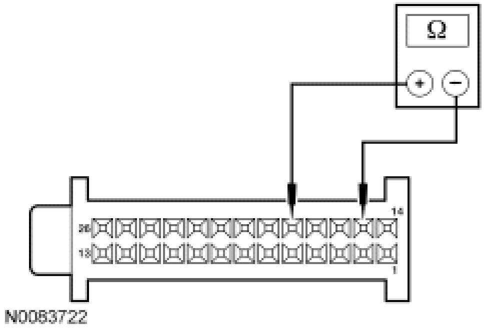


Fig. 146: Measuring Resistance Between C2356A-1 & C2356A-6, Circuit GD116 (BK/VT) & CH239 (BU/WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side and HVAC module - DATC C2356a-18, circuit VH440 (BN/BU), harness side.

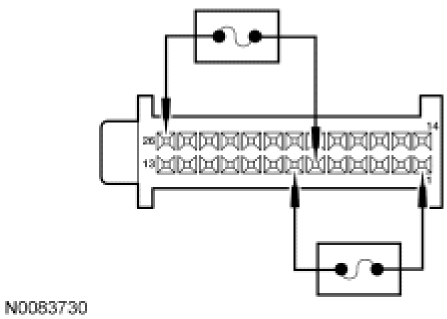


Fig. 147: Measuring Resistance Between C2356A-15 & C2356A-18, Circuit RH111 (GY/BU) & VH440 (BN/BU)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - DATC C2356a-26, circuit SBP07 (WH/RD), harness side and HVAC module - DATC C2356a-6, circuit CH239 (BU/WH), harness side.
  - HVAC module - DATC C2356a-1, circuit GD116 (BK/VT), harness side and HVAC module - DATC C2356a-7, circuit CH238 (YE/OG), harness side.

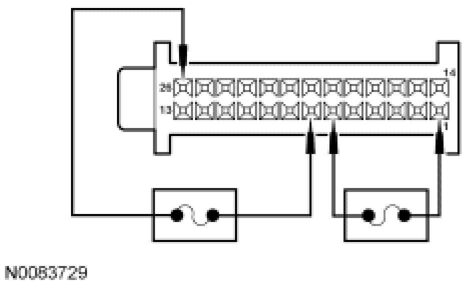


Fig. 148: Measuring Resistance Between C2356A-1 & C2356A-7, Circuit GD116 (BK/VT) & CH238 (YE/OG)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - DATC C2356a-26, circuit SBP07 (WH/RD), harness side and HVAC module - DATC C2356a-7, circuit CH238 (YE/OG), harness side.
  - HVAC module - DATC C2356a-1, circuit GD116 (BK/VT), harness side and HVAC module - DATC C2356a-6, circuit CH239 (BU/WH), harness side.
- **Does the resistance increase and decrease when the jumpers are connected?**

  YES : INSPECT for binding or broken door and linkage. If no condition is found, go to Q17.

  NO : Go to Q15.

Q14 CHECK THE DOOR ACTUATOR OPERATION

NOTE: **If a jumper fuse opens while carrying out this test step, repair the circuit(s) for a short.**

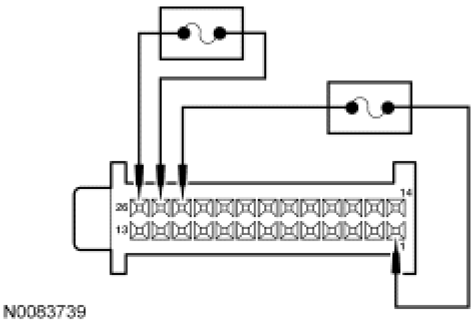


Fig. 149: Checking Door Actuator Operation
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - DATC C2356a-26, circuit SBP07 (WH/RD), harness side and HVAC module - DATC C2356a-25, circuit CH212 (BU/OG), harness side.
  - HVAC module - DATC C2356a-1, circuit GD116 (BK/VT), harness side and HVAC module - DATC C2356a-24, circuit CH213 (BN/GN), harness side.

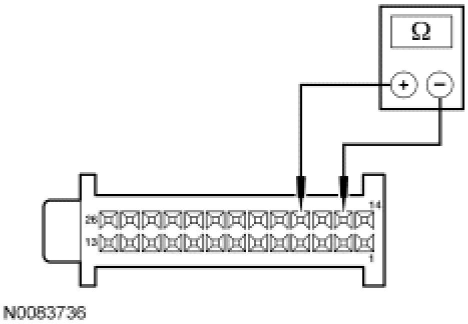


Fig. 150: Measuring Resistance Between C2356A-1 & C2356A-24, Circuit GD116 (BK/VT) & CH213 (BN/GN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module - DATC C2356a-15, circuit RH111 (GY/BU), harness side and HVAC module - DATC C2356a-17, circuit VH441 (WH/BN), harness side.

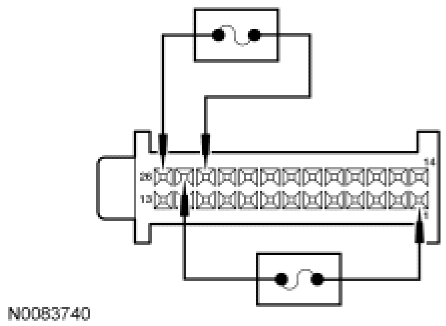


Fig. 151: Measuring Resistance Between C2356A-15 & C2356A-17, Circuit RH111 (GY/BU) & VH441 (WH/BN)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - DATC C2356a-26, circuit SBP07 (WH/RD), harness side and HVAC module - DATC C2356a-24, circuit CH213 (BN/GN), harness side.
  - HVAC module - DATC C2356a-1, circuit GD116 (BK/VT), harness side and HVAC module - DATC C2356a-25, circuit CH212 (BU/OG), harness side.

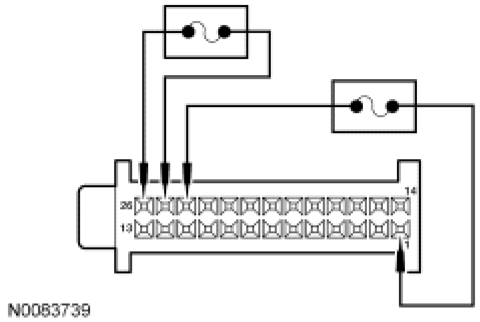


Fig. 152: Measuring Resistance Between C2356A-1 & C2356A-25, Circuit GD116 (BK/VT) & CH212 (BU/OG)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between:
  - HVAC module - DATC C2356a-26, circuit SBP07 (WH/RD), harness side and HVAC module - DATC C2356a-25, circuit CH212 (BU/OG), harness side.
  - HVAC module - DATC C2356a-1, circuit GD116 (BK/VT), harness side and HVAC module - DATC C2356a-24, circuit CH213 (BN/GN), harness side.

- **Does the resistance increase and decrease when the jumpers are connected?**

  YES : INSPECT for binding or broken door and linkage. If no condition is found, go to Q17.

  NO : Go to Q15.

Q15 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS

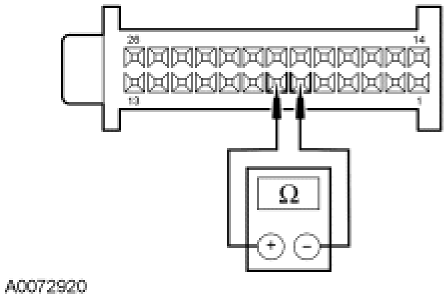


Fig. 153: Checking Actuator Motor Drive Circuits (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the resistance between HVAC module - EATC C228a-6, circuit CH234 (YE/GN), harness side and HVAC module - EATC C228a-7, circuit CH233 (VT/BN), harness side.

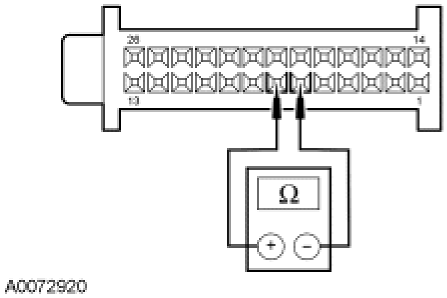


Fig. 154: Checking Actuator Motor Drive Circuits (DATC)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

NOTE: For DTC B2266

- Measure the resistance between HVAC module - DATC C2356a-7, circuit CH238 (YE/OG), harness side and HVAC module - DATC C2356a-6, circuit CH239 (BU/WH), harness side.

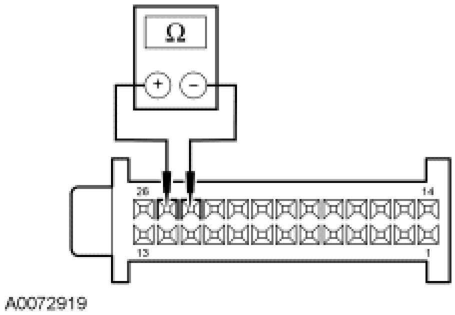


Fig. 155: Checking Actuator Motor Drive Circuits (DATC, DTC B2267)
Courtesy of FORD MOTOR CO.

NOTE:	**DATC systems only.**

NOTE:	**For DTC B2267**

- Measure the resistance between HVAC module - DATC C2356a-25, circuit CH212 (BU/OG), harness side and HVAC module - DATC C2356a-24, circuit CH213 (BN/GN), harness side.
- **Is the resistance between approximately 59-73 ohms?**

  YES : INSPECT for binding or broken door and linkage. If no condition is found, INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : Go to Q16.

Q16 CHECK THE ACTUATOR MOTOR DRIVE CIRCUITS FOR AN OPEN

NOTE:	**Due to limited connector accessibility, before carrying out this test step, visually inspect the wiring between the HVAC module and actuator for opens or shorts. If no damage is visually evident, proceed with the test.**

- Disconnect: **For DTC B2266** , LH Blend Door Actuator C2091
- Disconnect: **For DTC B2267** , RH Blend Door Actuator C2092

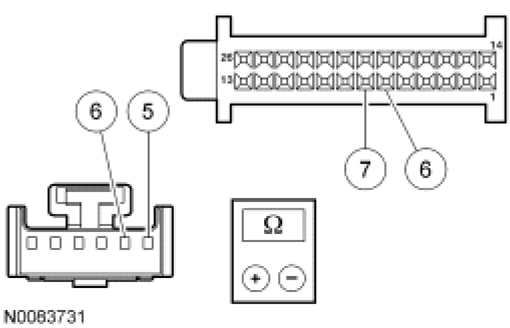


Fig. 156: Checking Actuator Motor Drive Circuits For An Open (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the resistance between the HVAC module - EATC connector, harness side and LH blend door actuator, harness side using the following chart.

HVAC Module Connector	Circuit	LH Blend Door Actuator Connector
C228a-7	CH233 (VT/BN)	C2091-5
C228a-6	CH234 (YE/GN)	C2091-6

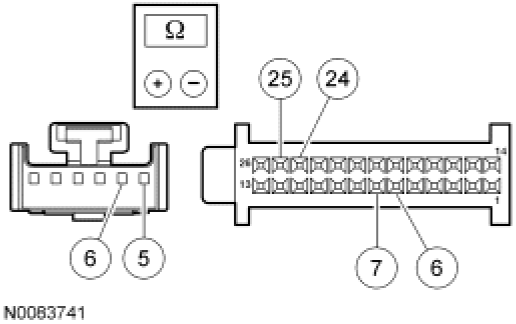


Fig. 157: Checking Actuator Motor Drive Circuits For An Open (DATC)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

- Measure the resistance between the HVAC module - DATC connector, harness side and LH blend door actuator, harness side or RH blend door actuator, harness side using the following chart.

DTC	HVAC Module Connector	Circuit	LH/RH Blend Door Actuator Connector
B2266	C2356a-7	CH238 (YE/OG)	LH, C2091-5
B2266	C2356a-6	CH239 (BU/WH)	LH, C2091-6
B2267	C2356a-25	CH212 (BU/OG)	RH, C2092-5
B2267	C2356a-24	CH213 (BN/GN)	RH, C2092-6

- **Are the resistances less than 5 ohms?**

  YES : INSPECT for binding or broken linkage. If no condition is found, INSTALL a new door actuator. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR the circuit(s) for an open. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Q17 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test R: The Blower Motor is Inoperative - EMTC

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Manual Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the blower motor relay coil receives ignition voltage through circuit CBP23 (BN/YE). The coil receives ground from the HVAC module - Electronic Manual Temperature Control (EMTC) through circuit CH123 (VT/GN) if any function selector position but OFF is selected. Voltage is supplied to the relay switch contact through circuit SBB04 (GN/RD). When the relay coil is energized, voltage is delivered to the blower motor through circuit CH402 (YE/GN). Ground for the blower motor is provided through circuit CH430 (VT/OG) from the blower resistor or the blower switch (HI). The blower resistor and blower switch are grounded through circuit GD115 (BK/GY).

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Blower motor
- HVAC module - EMTC
- Blower motor relay
- Blower motor switch

PINPOINT TEST R: THE BLOWER MOTOR IS INOPERATIVE - EMTC

NOTE: It is important to install relays in their correct position in the Battery Junction Box (BJB). Installing a relay incorrectly may cause wiring shorts or damage to modules. While carrying out diagnostics on BJB relays, have only one BJB relay removed at a time. Failure to follow these instructions may result in damage to the vehicle circuitry or to control modules.

R1 CHECK CIRCUIT CH430 (VT/OG) FOR GROUND

- Disconnect: Blower Motor C288
- Turn the function selector switch to the VENT position.
- Turn the blower motor switch to the HI position.

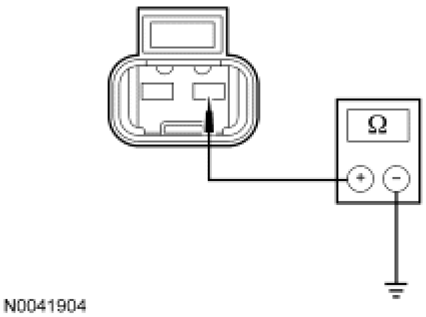


Fig. 158: Checking Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between A/C blower motor C288-B, circuit CH430 (VT/OG), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to R4.

  NO : Go to R2.

R2 CHECK CIRCUIT CH430 (VT/OG) FOR AN OPEN

- Disconnect: Blower Motor Switch C2357b

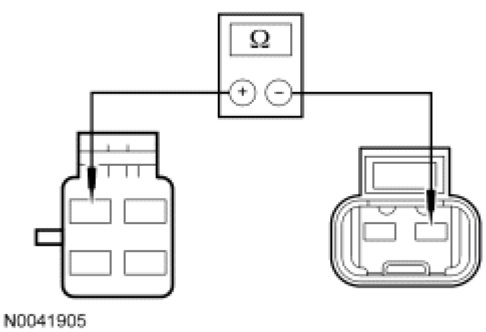


Fig. 159: Checking Circuit CH430 (VT/OG) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor switch C2357b-2, circuit CH430 (VT/OG), harness side and blower motor C288-B, circuit CH430 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to R3.

  NO : REPAIR circuit CH430 (VT/OG) for an open. TEST the system for normal operation.

R3 CHECK CIRCUIT GD115 (BK/GY) FOR AN OPEN

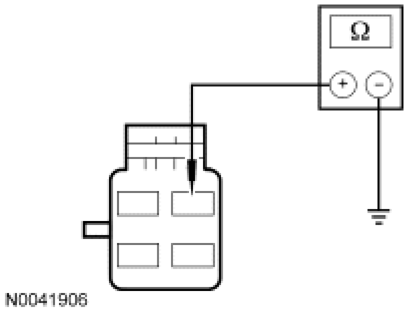


Fig. 160: Checking Circuit GD115 (BK/GY) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor switch C2357b-1, circuit GD115 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new blower motor switch. TEST the system for normal operation.

  NO : REPAIR circuit GD115 (BK/GY) for an open. TEST the system for normal operation.

R4 CHECK A/C BLOWER MOTOR CIRCUIT CH402 (YE/GN) FOR VOLTAGE

- Key in ON position.

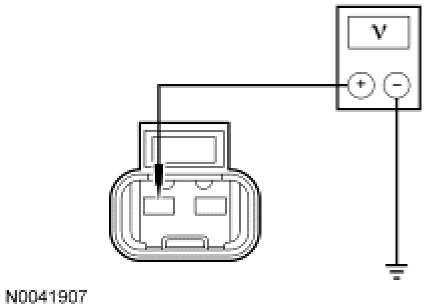


Fig. 161: Checking A/C Blower Motor Circuit CH402 (YE/GN) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between A/C blower motor connector C288-A, circuit CH402 (YE/GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new blower motor. TEST the system for normal operation.

NO : Go to R5.

R5 CHECK CIRCUIT CH402 (YE/GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Blower Motor Relay

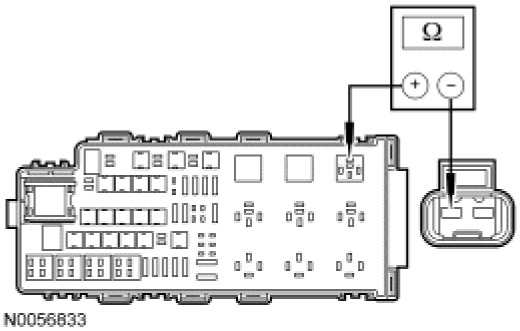


Fig. 162: Checking Circuit CH402 (YE/GN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor relay connector pin 87, circuit CH402 (YE/GN) and blower motor C288-A, circuit CH402 (YE/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to R6.

  NO : REPAIR circuit CH402 (YE/GN) for an open. TEST the system for normal operation.

R6 CHECK THE BLOWER MOTOR RELAY

- Connect: Blower Motor C288
- Key in ON position.

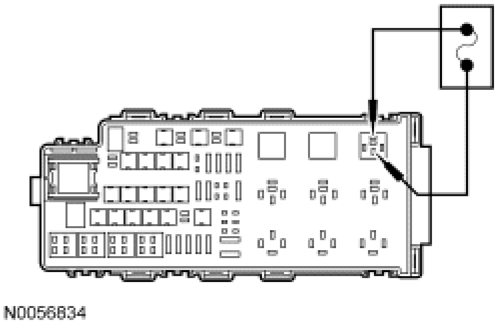


Fig. 163: Checking Blower Motor Relay
Courtesy of FORD MOTOR CO.

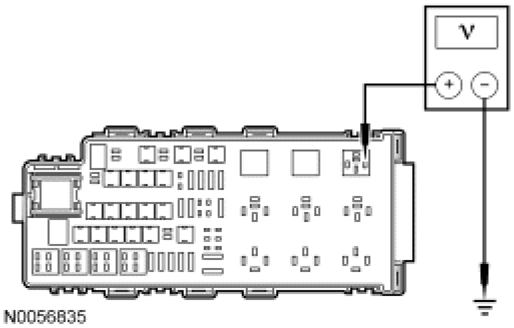
- Connect a fused jumper lead between blower motor relay socket pin 30, circuit SBB04 (GN/RD) and pin 87, circuit CH402 (YE/GN).
- **Does the blower motor operate?**

  YES : Go to R7.

NO : VERIFY BJB fuse 4 (40A) is OK. If OK, REPAIR circuit SBB04 (GN/RD) for an open. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams Manual to identify the possible causes of the circuit short.

R7 CHECK THE RELAY COIL SUPPLY VOLTAGE

- Key in OFF position.



N0056835

Fig. 164: Checking Relay Coil Supply Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between blower motor relay socket pin 86, circuit CBP23 (BN/YE) and ground.
- **Is the voltage greater than 10 volts?**

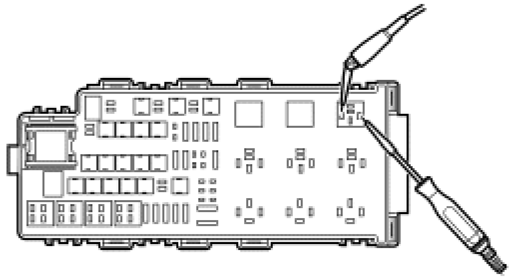
YES : Go to R8.

NO : VERIFY Smart Junction Box (SJB) fuse 23 (7.5A) is OK. If OK, REPAIR circuit CBP23 (BN/YE) for an open. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams article to identify the possible causes of the circuit short.

R8 CHECK THE BLOWER MOTOR RELAY

NOTE: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use the test lamp probe.

- Key in ON position.



N0063742

Fig. 165: Checking Blower Motor Relay
Courtesy of FORD MOTOR CO.

- With the engine running, connect a 12-volt test lamp between blower motor relay socket pin 85, circuit CH123 (VT/GN) and socket pin 86, circuit CBP23 (BN/YE).
- **Does the test lamp illuminate?**

  YES : INSTALL a new blower motor relay. TEST the system for normal operation.

  NO : Go to R9.

R9 CHECK CIRCUIT CH123 (VT/GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module - EMTC C2357a

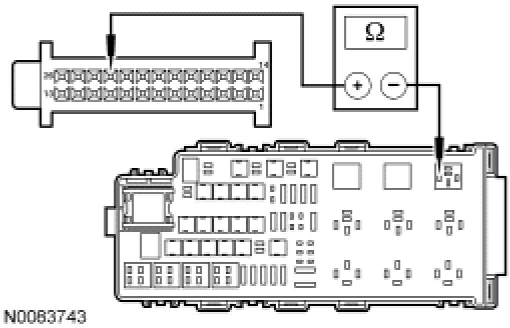


Fig. 166: Checking Circuit CH123 (VT/GN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor relay connector pin 85, circuit CH123 (VT/GN) and HVAC Module - EMTC C2357a-23, circuit CH123 (VT/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to R10.

  NO : REPAIR circuit CH123 (VT/GN) for an open. TEST the system for normal operation.

R10 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test S: The Blower Motor Does Not Operate Correctly - EMTC

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Manual Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the blower motor is provided a ground from the blower resistor through circuit CH430 (VT/OG). The resistor gets a ground from circuit GD115 (BK/GY) in the lowest blower setting. In MED-LO and MED-HI the resistor gets a ground from the blower motor switch through circuit CH428 (GN/WH) or CH429 (GY/BN), depending on selected speed. In HI, the blower motor is grounded directly through the blower motor switch from circuit CH430 (VT/OG) to circuit GD115 (BK/GY). The blower switch receives its ground from circuit GD115 (BK/GY).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Blower motor resistor
- Blower motor switch

PINPOINT TEST S: THE BLOWER MOTOR DOES NOT OPERATE CORRECTLY - EMTC

S1 CHECK THE BLOWER MOTOR OPERATION

- Key in ON position.
- Turn the function selector switch to the floor position.
- Select all blower speed positions.
- **Does the blower motor operate in any position?**

YES : If the blower motor does not operate in HI, go to S2.

If the blower motor does not operate in MED-HI, go to S3.

If the blower motor does not operate in MED-LO, go to S4.

If the blower motor does not operate in LO, go to S5.

For all other symptoms, go to S9.

NO : Go to **Pinpoint Test R**.

S2 CHECK CIRCUIT CH430 (VT/OG) FOR AN OPEN

- Key in OFF position.
- Disconnect: Blower Motor Switch C2357b
- Disconnect: Blower Motor C288

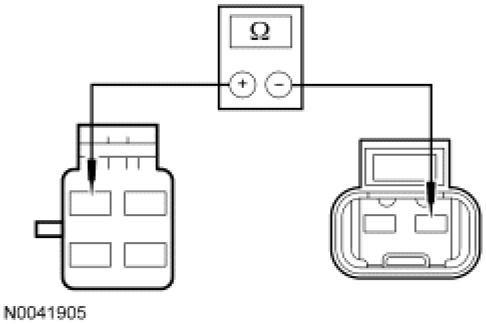


Fig. 167: Checking Circuit CH430 (VT/OG) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor switch C2357b-2, circuit CH430 (VT/OG), harness side and blower motor C288-B, circuit CH430 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to S6.

  NO : REPAIR circuit CH430 (VT/OG) for an open. TEST the system for normal operation.

S3 CHECK CIRCUIT CH429 (GY/BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Blower Motor Switch C2357b
- Disconnect: Blower Motor Resistor C293

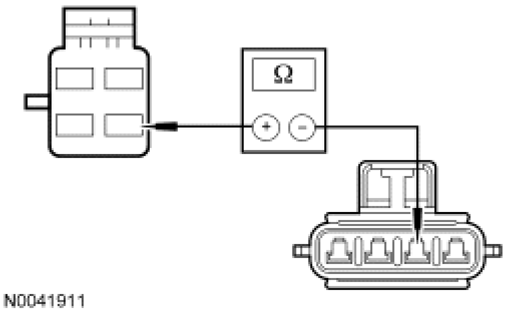


Fig. 168: Checking Circuit CH429 (GY/BN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor switch C2357b-3, circuit CH429 (GY/BN), harness side and blower motor resistor C293-B, circuit CH429 (GY/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to S6.

  NO : REPAIR circuit CH429 (GY/BN) for an open. TEST the system for normal operation.

S4 CHECK CIRCUIT CH428 (GN/WH) FOR AN OPEN

- Key in OFF position.
- Disconnect: Blower Motor Switch C2357b

- Disconnect: Blower Motor Resistor C293

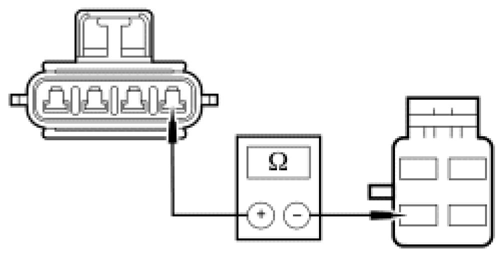


Fig. 169: Checking Circuit CH428 (GN/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor switch C2357b-4, circuit CH428 (GN/WH), harness side and blower motor resistor C293-A, circuit CH428 (GN/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to S6.

  NO : REPAIR circuit CH428 (GN/WH) for an open. TEST the system for normal operation.

S5 CHECK BLOWER MOTOR RESISTOR GROUND CIRCUIT GD115 (BK/GY) FOR AN OPEN

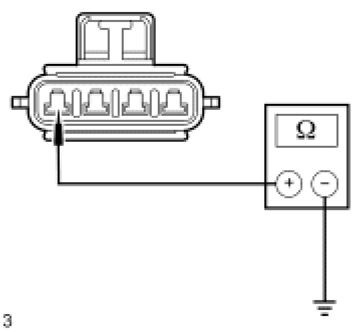


Fig. 170: Checking Blower Motor Resistor Ground Circuit GD115 (BK/GY) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor resistor C293-D, circuit GD115 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to S6.

  NO : REPAIR circuit GD115 (BK/GY) for an open. TEST the system for normal operation.

S6 CHECK THE BLOWER MOTOR RESISTOR CIRCUIT CH430 (VT/OG) FOR AN OPEN

- Connect: Blower Motor C288

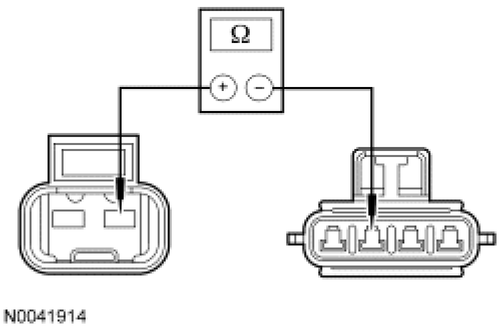


Fig. 171: Checking Blower Motor Resistor Circuit CH430 (VT/OG) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor resistor C293-C, circuit CH430 (VT/OG), harness side and blower motor C288-B, circuit CH430 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to S7.

  NO : REPAIR circuit CH430 (VT/OG) for an open. TEST the system for normal operation.

S7 CHECK THE BLOWER MOTOR RESISTOR

- Carry out the **Blower Motor Resistor**.
- **Does the blower motor resistor test good?**

  YES : Go to S8.

  NO : INSTALL a new blower motor resistor. TEST the system for normal operation.

S8 CHECK THE BLOWER MOTOR SWITCH CIRCUIT GD115 (BK/GY) FOR AN OPEN

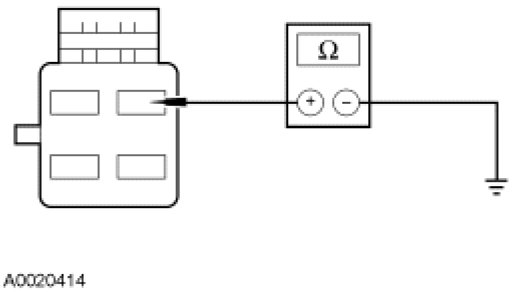


Fig. 172: Checking Blower Motor Switch Circuit 57 (BK) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor switch C2357b-1, circuit GD115 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new blower motor switch. TEST the system for normal operation.

  NO : REPAIR circuit GD115 (BK/GY) for an open. TEST the system for normal operation.

S9 CHECK CIRCUITS CH430 (VT/OG), CH428 (GN/WH) AND CH429 (GY/BN) FOR A SHORT

TO GROUND

- Key in OFF position.
- Disconnect: Blower Motor C288
- Disconnect: Blower Motor Resistor C293
- Place the blower switch in the lowest setting.

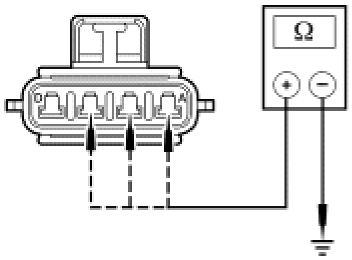


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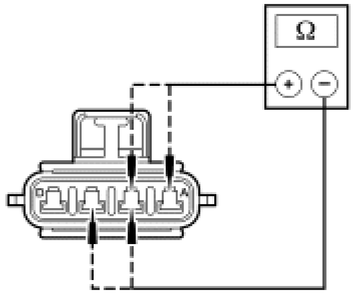
Fig. 173: Checking Circuits CH430 (VT/OG), CH428 (GN/WH) & CH429 (GY/BN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and blower motor resistor:
  - C293-A, circuit CH428 (GN/WH), harness side.
  - C293-B, circuit CH429 (GY/BN), harness side.
  - C293-C, circuit CH430 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to S10.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

S10 CHECK THE BLOWER MOTOR CIRCUITS FOR SHORTS TOGETHER



N0083745

Fig. 174: Checking Blower Motor Circuits For Shorts Together
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor resistor:
  - C293-A, circuit CH428 (GN/WH), harness side and C293-B, circuit CH429 (GY/BN), harness side.

- C293-A, circuit CH428 (GN/WH), harness side and C293-C, circuit CH430 (VT/OG), harness side.
- C293-B, circuit CH429 (GY/BN), harness side and C293-C, circuit CH430 (VT/OG), harness side.

- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new blower motor switch. TEST the system for normal operation.

  NO : REPAIR the affected circuits. TEST the system for normal operation.

Pinpoint Test T: The Blower Motor is Inoperative - DATC/EATC

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the blower motor relay coil receives a ground from the HVAC module - Electronic Automatic Temperature Control (EATC) or HVAC module - Dual Automatic Temperature Control (DATC) module through circuit CH123 (VT/GN). The coil receives ignition voltage through circuit CBP23 (BN/YE). Voltage is supplied to the relay switch contact through circuit SBB04 (GN/RD). When the relay coil is energized, voltage is delivered to the blower motor control module through circuit CH402 (YE/GN). Ground for the blower control module is provided by circuit GD115 (BK/GY). The HVAC module - DATC or HVAC module - EATC module provides a pulsed ground to the blower control module through circuit VH101 (WH/VT) to control the blower speed. Voltage for the motor is provided through circuit CH218 (GN/VT) from the blower control module. Ground for the motor is provided through circuit VH301 (YE/BU) from the blower control module.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Blower motor relay
- Blower motor control
- HVAC module - EATC
- HVAC module - DATC
- Blower motor

PINPOINT TEST T: THE BLOWER MOTOR IS INOPERATIVE - DATC/EATC

NOTE:	**It is important to install relays in their correct position in the Battery Junction Box (BJB). Installing a relay incorrectly may cause wiring shorts or damage to modules. While carrying out diagnostics on BJB relays, have only one BJB relay removed at a time. Failure to follow these instructions may result in damage to the vehicle circuitry or to control modules.**

T1 VERIFY THE BLOWER MOTOR OPERATION

- Key in ON position.
- Press the PANEL button on the HVAC module. Adjust the blower motor setting to LO and then to HI.
- **Is the blower motor inoperative in all settings?**

  YES : Go to T2.

  NO : Go to **Pinpoint Test U**.

T2 CHECK FOR VOLTAGE TO THE BLOWER MOTOR

- Key in OFF position.
- Disconnect: Blower Motor C288
- Key in ON position.

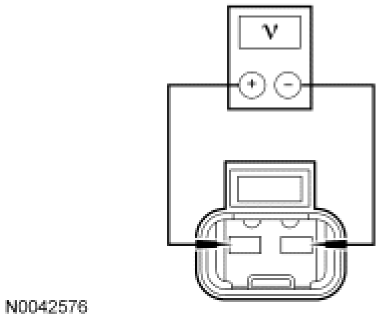


Fig. 175: Checking For Voltage To Blower Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between blower motor C288-A, circuit CH123 (VT/GN), harness side and blower motor C288-B, circuit VH301 (YE/BU), harness side.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new blower motor. TEST the system for normal operation.

  NO : Go to T3.

T3 CHECK FOR VOLTAGE TO THE BLOWER MOTOR CONTROLLER

- Key in OFF position.
- Disconnect: Blower Motor Speed Control C271
- Key in ON position.
- Press the PANEL button on the HVAC module.

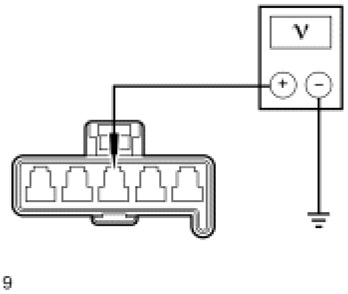


Fig. 176: Checking For Voltage To Blower Motor Controller
Courtesy of FORD MOTOR CO.

- Measure the voltage between blower motor speed control C271-C, circuit CH402 (YE/GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to T4.

  NO : Go to T12.

T4 CHECK CIRCUIT GD115 (BK/GY) FOR AN OPEN

- Key in OFF position.

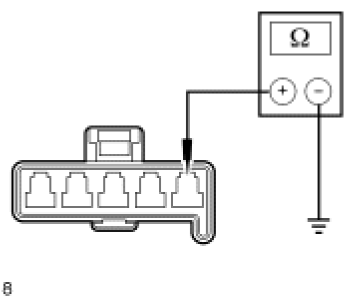


Fig. 177: Checking Circuit GD115 (BK/GY) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor speed control C271-A, circuit GD115 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to T5.

  NO : REPAIR circuit GD115 (BK/GY) for an open. TEST the system for normal operation.

T5 CHECK CIRCUIT VH101 (WH/VT) FOR GROUND SIGNAL

- Key in ON position.
- Press the PANEL button on the HVAC module. Adjust the blower motor setting to HI.

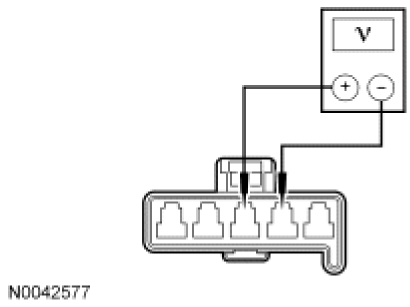


Fig. 178: Checking Circuit VH101 (WH/VT) For Ground Signal
Courtesy of FORD MOTOR CO.

- Measure the voltage between blower motor speed control C271-B, circuit VH101 (WH/VT), harness side and blower motor speed control C271-C, circuit CH402 (YE/GN), harness side.
- **Is the voltage greater than 10 volts?**

  YES : Go to T8.

  NO : Go to T6.

T6 CHECK CIRCUIT VH101 (WH/VT) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: HVAC Module - EATC C228b or HVAC Module - DATC C2356b
- Key in ON position.

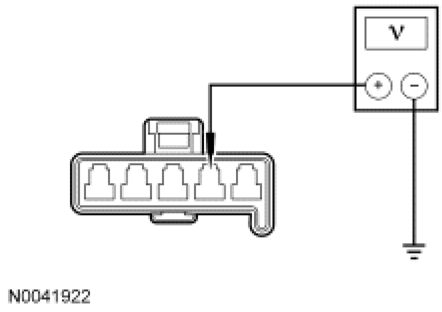


Fig. 179: Checking Circuit VH101 (WH/VT) For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and blower motor speed control C271-B, circuit VH101 (WH/VT), harness side.
- **Is any voltage present?**

  YES : REPAIR circuit VH101 (WH/VT) for a short to voltage. TEST the system for normal operation.

  NO : Go to T7.

T7 CHECK CIRCUIT VH101 (WH/VT) FOR AN OPEN

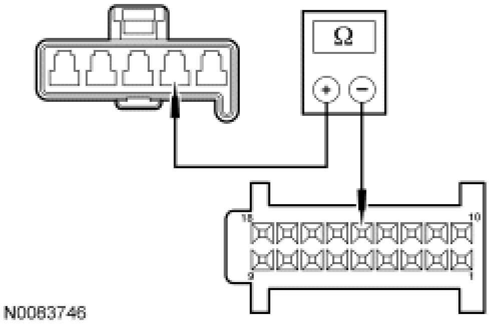


Fig. 180: Checking Circuit VH101 (WH/VT) For An Open (EATC)
Courtesy of FORD MOTOR CO.

NOTE: EATC systems only.

- Measure the resistance between blower motor control C271-B, circuit VH101 (WH/VT), harness side and HVAC module - EATC C228b-14, circuit VH101 (WH/VT), harness side.

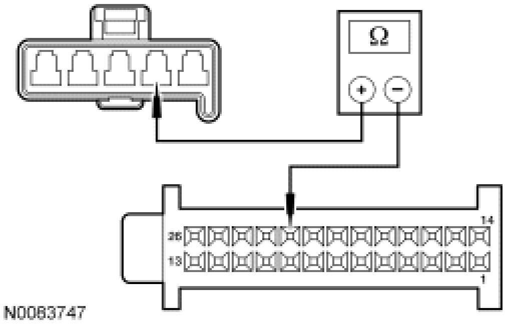


Fig. 181: Checking Circuit VH101 (WH/VT) For An Open (DATC)
Courtesy of FORD MOTOR CO.

NOTE: DATC systems only.

- Measure the resistance between blower motor control C271-B, circuit VH101 (WH/VT), harness side and HVAC module - DATC C2356b-22, circuit VH101 (WH/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to T18.

  NO : REPAIR circuit VH101 (WH/VT) for an open. TEST the system for normal operation.

T8 CHECK CIRCUITS CH218 (GN/VT) AND VH301 (YE/BU) FOR AN OPEN

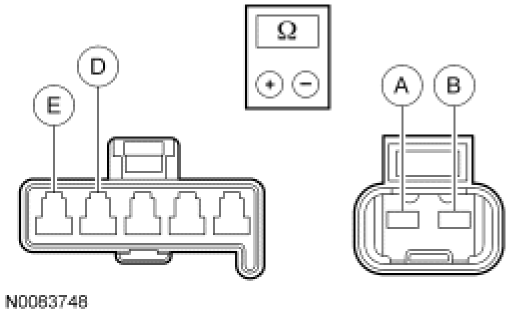


Fig. 182: Checking Circuits CH218 (GN/VT) & VH301 (YE/BU) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the blower motor connector, harness side and blower motor speed control, harness side using the following chart.

Blower Motor Connector	Circuit	Blower Motor Speed Control Connector
C288-A	CH218 (GN/VT)	C271-E
C288-B	VH301 (YE/BU)	C271-D

- **Are the resistances less than 5 ohms?**

  YES : Go to T9.

  NO : REPAIR circuit CH218 (GN/VT) or VH301 (YE/BU) for an open. TEST the system for normal operation.

T9 CHECK CIRCUITS CH218 (GN/VT) AND VH301 (YE/BU) FOR A SHORT TOGETHER

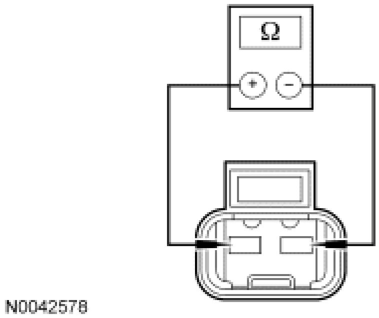


Fig. 183: Checking Circuits CH218 (GN/VT) And VH301 (YE/BU) For Short Together
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor C288-A, circuit CH218 (GN/VT), harness side and

blower motor C288-B, circuit VH301 (YE/BU), harness side.

- **Is the resistance greater than 10,000 ohms?**

  YES : Go to T10.

  NO : REPAIR circuits CH218 (GN/VT) and VH301 (YE/BU) for a short together. TEST the system for normal operation.

T10 CHECK CIRCUIT CH218 (GN/VT) FOR A SHORT TO GROUND

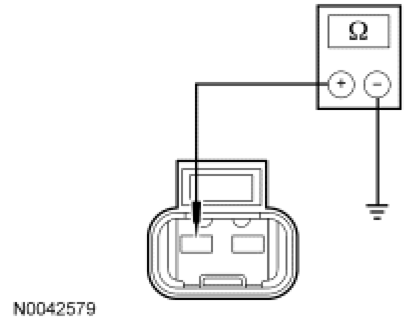


Fig. 184: Checking Circuit CH218 (GN/VT) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and blower motor C288-A, circuit CH218 (GN/VT), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to T11.

  NO : REPAIR circuit CH218 (GN/VT) for a short to ground. TEST the system for normal operation.

T11 CHECK CIRCUIT VH301 (YE/BU) FOR A SHORT TO VOLTAGE

- Key in ON position.

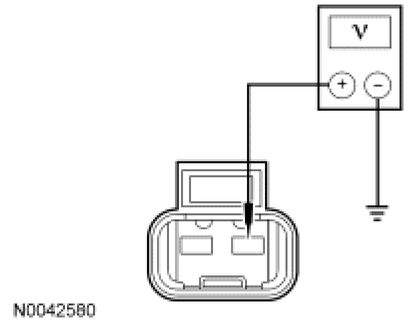


Fig. 185: Checking Circuit VH301 (YE/BU) For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and blower motor C288-B, circuit VH301 (YE/BU), harness side.
- **Is any voltage present?**

YES : REPAIR circuit VH301 (YE/BU) for a short to voltage. TEST the system for normal operation.

NO : INSTALL a new blower motor speed control. TEST the system for normal operation.

T12 CHECK CIRCUIT CH402 (YE/GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Blower Motor Relay

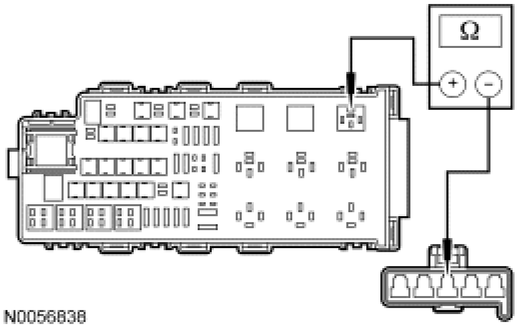


Fig. 186: Checking Circuit CH402 (YE/GN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor relay socket pin 87, circuit CH402 (YE/GN) and blower motor control C271-C, circuit CH402 (YE/GN), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to T13.

NO : REPAIR circuit CH402 (YE/GN) for an open. TEST the system for normal operation.

T13 CHECK THE RELAY COIL SUPPLY VOLTAGE

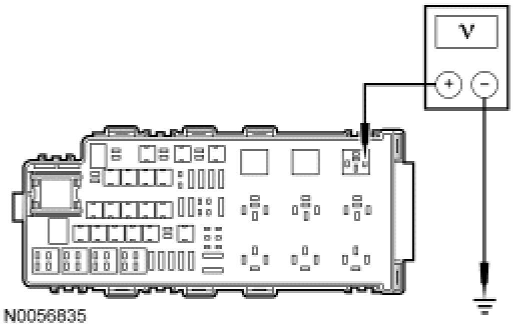


Fig. 187: Checking Relay Coil Supply Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between blower motor relay socket pin 86, circuit CBP23 (BN/YE) and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to T14.

NO : VERIFY Smart Junction Box (SJB) fuse 23 (7.5A) is OK. If OK, REPAIR circuit CBP23

(BN/YE) for an open. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams article to identify the possible causes of the circuit short.

T14 CHECK THE RELAY SWITCH POWER CIRCUIT FOR AN OPEN

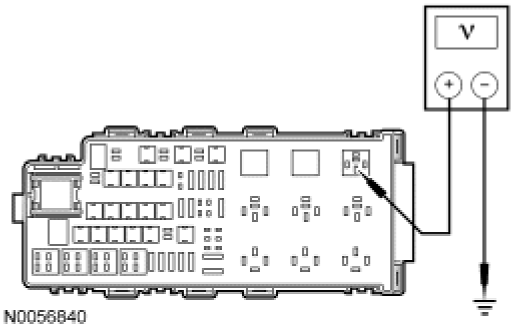


Fig. 188: Checking Relay Switch Power Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between blower motor relay socket pin 30, circuit SBB04 (GN/RD) and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to T15.

  NO : VERIFY Battery Junction Box (BJB) fuse 4 (40A) is OK. If OK, REPAIR circuit SBB04 (GN/RD) for an open. TEST the system for normal operation. If not OK, REFER to the Wiring Diagrams article to identify the possible causes of the circuit short.

T15 CHECK THE MODULE OUTPUT

NOTE:	**Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use the test lamp probe.**

- Key in ON position.

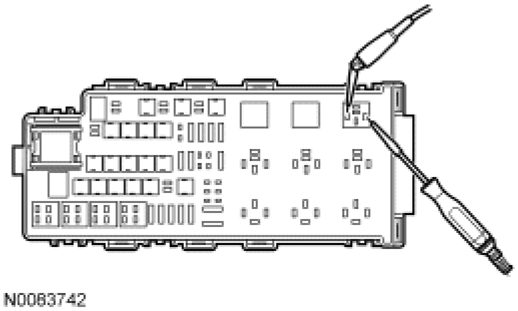


Fig. 189: Checking Module Output
Courtesy of FORD MOTOR CO.

- With the engine running, connect a 12-volt test lamp between blower motor relay socket pin 85, circuit CH123 (VT/GN) and socket pin 86, circuit CBP23 (BN/YE).

- **Does the test lamp illuminate?**

  YES : INSTALL a new blower motor relay. TEST the system for normal operation.

  NO : Go to T16.

T16 CHECK CIRCUIT CH123 (VT/GN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: HVAC Module - DATC C2356a or HVAC Module - EATC C228a
- Key in ON position.

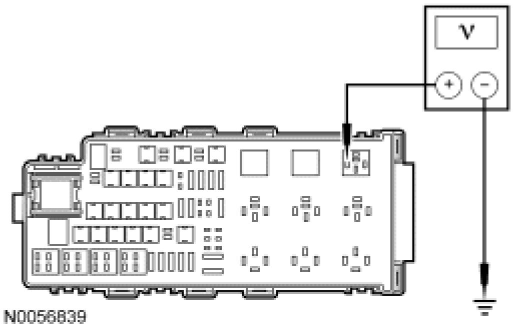


Fig. 190: Checking Circuit CH123 (VT/GN) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between blower motor relay socket pin 85, circuit CH123 (VT/GN) and ground.
- **Is any voltage present?**

  YES : REPAIR circuit CH123 (VT/GN) for a short to voltage. TEST the system for normal operation.

  NO : Go to T17.

T17 CHECK CIRCUIT CH123 (VT/GN) FOR AN OPEN

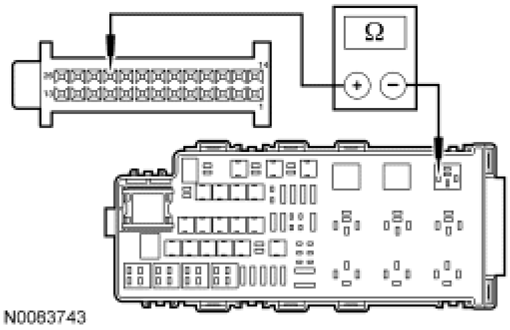


Fig. 191: Checking Circuit CH123 (VT/GN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor relay socket pin 85, circuit CH123 (VT/GN) and: or and .

NOTE: EATC systems only.

- HVAC module - EATC C228a-23, circuit CH123 (VT/GN), harness side.

NOTE: DATC systems only.

- HVAC module - DATC C2356a-23, circuit CH123 (VT/GN), harness side.

- **Is the resistance less than 5 ohms?**

  YES : Go to T18.

  NO : REPAIR circuit CH123 (VT/GN) for an open. TEST the system for normal operation.

T18 CHECK THE MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test U: The Blower Motor Does Not Operate Correctly - DATC/EATC

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

Under normal operation, the blower motor relay coil receives a ground from the HVAC module -Electronic Automatic Temperature Control (EATC) or HVAC module - Dual Automatic Temperature Control (DATC) module through circuit CH123 (VT/GN). The coil receives ignition voltage through circuit A_CBP23 (BN/YE). Voltage is supplied to the relay switch contact through circuit SBB04 (GN/RD). When the relay coil is energized, voltage is delivered to the blower motor control module through circuit CH402 (YE/GN). Ground for the blower control module is provided by circuit GD115 (BK/GY). The HVAC module - DATC or HVAC module - EATC module provides a pulsed ground to the blower control module through circuit VH101 (WH/VT) to control the blower speed. Voltage for the motor is provided through circuit CH218 (GN/VT) from the blower control module. Ground for the motor is provided through circuit VH301 (YE/BU) from the blower control module.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

- Blower motor control module
- Blower motor relay
- HVAC module - EATC
- HVAC module - DATC

PINPOINT TEST U: THE BLOWER MOTOR DOES NOT OPERATE CORRECTLY - DATC/EATC

NOTE: It is important to install relays in their correct position in the Battery Junction Box (BJB). Installing a relay incorrectly may cause wiring shorts or damage to modules. While carrying out diagnostics on BJB relays, have only one BJB relay removed at a time. Failure to follow these instructions may result in damage to the vehicle circuitry or to control modules.

U1 VERIFY THE BLOWER MOTOR OPERATION

- Key in ON position.
- Press the panel button on the HVAC module. Adjust the blower motor setting to LO and then to HI.
- **Does the blower motor operate at any setting?**

  YES : If the blower motor operates always in HI, go to U2.

  If the blower motor is always ON, go to U5.

  NO : Go to **Pinpoint Test T**.

U2 CHECK CIRCUIT VH101 (WH/VT) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: Blower Motor Speed Control C271
- Disconnect: HVAC Module - DATC Module C2356b or HVAC Module - EATC C228b

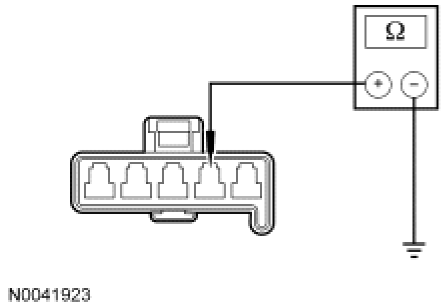


Fig. 192: Checking Circuit VH101 (WH/VT) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and blower motor speed control C271-B, circuit VH101 (WH/VT), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to U3.

NO : REPAIR circuit VH101 (WH/VT) for a short to ground. TEST the system for normal operation.

U3 CHECK CIRCUIT CH218 (GN/VT) FOR A SHORT TO VOLTAGE

- Disconnect: Blower Motor C288
- Key in ON position.

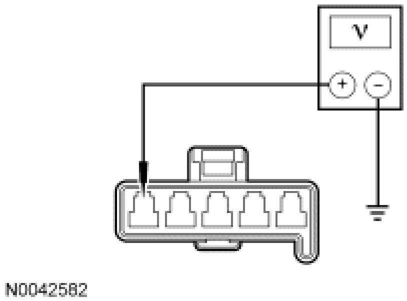


Fig. 193: Checking Circuit CH218 (GN/VT) For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and blower motor speed control C271-E, circuit CH218 (GN/VT), harness side.
- **Is any voltage present?**

  YES : REPAIR circuit CH218 (GN/VT) for a short to voltage. TEST the system for normal operation.

  NO : Go to U4.

U4 CHECK CIRCUIT VH301 (YE/BU) FOR A SHORT TO GROUND

- Key in OFF position.

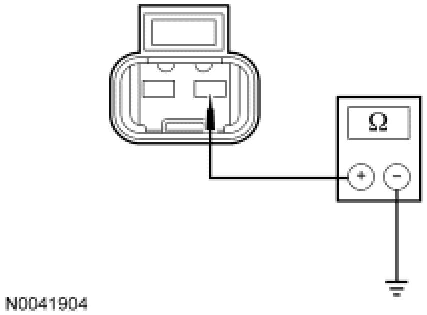


Fig. 194: Checking Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and blower motor C288-B, circuit VH301 (YE/BU), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new blower control. TEST the system for normal operation. If the condition

returns, go to U6.

NO : REPAIR circuit VH301 (YE/BU) for a short to voltage. TEST the system for normal operation.

U5 CHECK CIRCUIT CH123 (VT/GN) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: Blower Motor Relay
- Disconnect: HVAC Module - DATC Module C2356a or HVAC module - EATC C228a

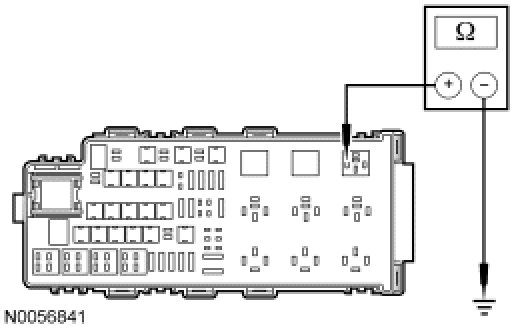


Fig. 195: Checking Circuit CH123 (VT/GN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between blower motor relay socket pin 85, circuit CH123 (VT/GN) and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : CARRY OUT the blower motor relay component test. Refer to COMPONENT TESTING. If the relay tests OK, go to U6.

  NO : REPAIR circuit CH123 (VT/GN) for a short to ground. TEST the system for normal operation.

U6 CHECK MODULE CONNECTION

- Carry out the HVAC Module Cold Boot Process.
- Carry out the HVAC Module - Electronic Automatic Temperature Control (EATC) and HVAC Module - Dual Automatic Temperature Control (DATC) On-Demand Self Test.
- Operate the system.
- **Does the concern return?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Component Tests

Temperature Sensor - Evaporator Discharge

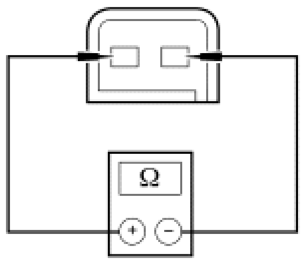


Fig. 196: Temperature Sensor - Evaporator Discharge
Courtesy of FORD MOTOR CO.

Ambient Temperature	Approximate Resistance
-40°C (-40°F)	925,021 ohms
-35°C (-31°F)	673,787 ohms
-30°C (-22°F)	496,051 ohms
-25°C (-13°F)	368,896 ohms
-20°C (-4°F)	276,959 ohms
-15°C (5°F)	209,816 ohms
-10°C (14°F)	160,313 ohms
-5°C (23°F)	123,485 ohms
0°C (32°F)	95,851 ohms
5°C (41°F)	74,940 ohms
10°C (50°F)	59,016 ohms
15°C (59°F)	46,797 ohms
20°C (68°F)	37,352 ohms
25°C (77°F)	30,000 ohms
30°C (86°F)	24,239 ohms
35°C (95°F)	19,696 ohms
40°C (104°F)	16,092 ohms
45°C (113°F)	13,216 ohms
50°C (122°F)	10,908 ohms
55°C (131°F)	9,056 ohms
60°C (140°F)	7,556 ohms
65°C (149°F)	6,335 ohms
70°C (158°F)	5,337 ohms
75°C (167°F)	4,515 ohms
80°C (176°F)	3,837 ohms
85°C (185°F)	3,273 ohms
90°C (194°F)	2,804 ohms
95°C (203°F)	2,411 ohms
100°C (212°F)	2,080 ohms

105°C (221°F)	1,801 ohms
110°C (231°F)	1,564 ohms
115°C (239°F)	1,363 ohms
120°C (248°F)	1,191 ohms

Blower Motor Resistor

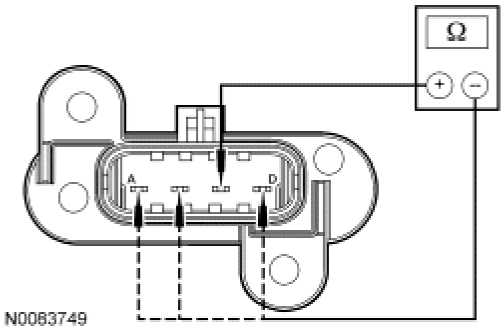


Fig. 197: Blower Motor Resistor
Courtesy of FORD MOTOR CO.

Blower Motor Resistor Pins	Approx. Resistance
C and B	1.27 ohms
C and A	2.45 ohms
C and D	4.5 ohms

In-Vehicle Temperature Sensor

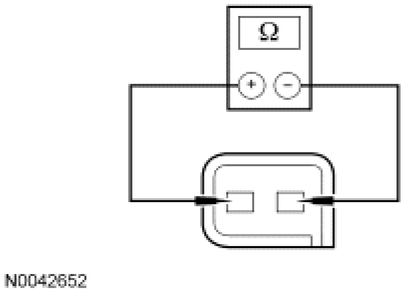


Fig. 198: In-Vehicle Temperature Sensor
Courtesy of FORD MOTOR CO.

Temperature	Resistance
-40°C (-40°F)	100,865 ohms
-20°C (-4°F)	28,582 ohms
0°C (32°F)	9,399 ohms
25°C (77°F)	2,795 ohms

40°C (104°F)	1,465 ohms
60°C (140°F)	671 ohms
85°C (185°F)	283 ohms

Ambient Temperature Sensor

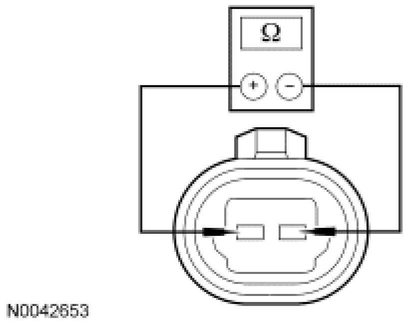


Fig. 199: Ambient Temperature Sensor
Courtesy of FORD MOTOR CO.

Ambient Temperature	Resistance
-40°C (-40°F)	100,865 ohms
-20°C (-4°F)	28,582 ohms
0°C (32°F)	9,399 ohms
25°C (77°F)	2,795 ohms
40°C (104°F)	1,465 ohms
60°C (140°F)	671 ohms
85°C (185°F)	283 ohms

Heater Core

NOTE: Testing of returned heater cores reveals that a large percentage of heater cores are good and did not require the installation of a new heater core. If a heater core leak is suspected, the heater core must be tested by following the plugged heater core component test before the heater core pressure test. Carry out a system inspection by checking the heater system thoroughly as follows:

1. Inspect for evidence of coolant leakage at the heater hose to heater core attachments. A coolant leak in the heater hose could follow the heater core tube to the heater core and appear as a leak in the heater core.

NOTE: Spring-type clamps are installed as original equipment. Installation and overtightening of non-specified clamps can cause leakage at the heater hose connection and damage the heater core.

2. Check the integrity of the heater hose clamps.

Heater Core - Plugged

1. Check to see that the engine coolant is at the correct level.
2. Start the engine and turn on the heater.
3. When the engine coolant reaches operating temperature, feel the heater core inlet and outlet hoses to see if they are hot.
4. If the outlet only is not hot:
   - the heater core may have an air pocket.
   - the heater core may be plugged.
5. If the inlet only is not hot:
   - the thermostat may not be working correctly.

Heater Core - Pressure Test

Use the Pressure Test Kit to carry out the pressure test.

NOTE: Due to space limitations, a bench test may be necessary for pressure testing.

1. Drain the coolant from the cooling system.
2. Disconnect the heater hoses from the heater core.
3. Install a short piece of heater hose, approximately 101 mm (4 in) long on each heater core tube.
4. Fill the heater core and heater hoses with water and install plug BT-7422-B and the adapter BT-7422-A from the Pressure Test Kit. Secure the heater hoses, plug and adapter with hose clamps.

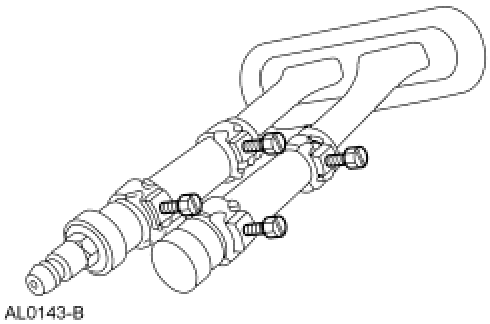


Fig. 200: Heater Core With Adapter & Plug
Courtesy of FORD MOTOR CO.

5. Attach the pump and gauge assembly from the Pressure Test Kit to the adapter.
6. Close the bleed valve at the base of the gauge. Pump 138 kPa (20 psi) of air pressure into the heater core.
7. Observe the pressure gauge for a minimum of 3 minutes.
8. If the pressure drops, check the heater hose connections to the core tubes for leaks. If the heater hoses do not leak, remove the heater core from the vehicle and carry out the bench test.

Heater Core - Bench Test

1. Remove the heater core from the vehicle.
2. Drain all of the coolant from the heater core.
3. Connect the 101 mm (4 in) test heater hoses with plug and adapter to the core tubes. Then connect the Pressure Test Kit to the adapter.
4. Apply 138 kPa (20 psi) of air pressure to the heater core. Submerge the heater core in water.
5. If a leak is observed, install a new heater core.

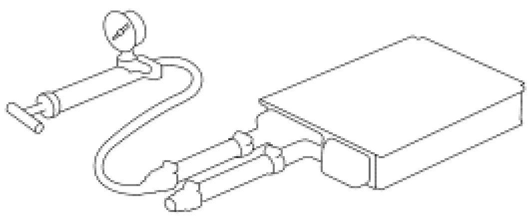


Fig. 201: Bench Testing Heater Core
Courtesy of FORD MOTOR CO.

Evaporator/Condenser Core - On-Vehicle Leak Test

1. Discharge and recover the refrigerant. Refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.
2. Disconnect the suspect evaporator core or condenser core from the A/C system.
3. Clean the manifold fittings.
4. Connect the appropriate test fittings from the A/C Fittings Set to the condenser or evaporator core tube connections.

NOTE: **The automatic shut-off valves on some gauge set hoses do not open when connected to the test fittings. If available, use hoses without shut-off valves. If hoses with shut-off valves are used, make sure the valve opens when attached to the test fittings or install an adapter that will activate the valve. The test is not valid if the shut-off valve does not open.**

5. Connect the red and blue hoses from the R-134a Manifold Gauge Set to the test fittings on the evaporator core or condenser core. Connect the yellow hose to a known good vacuum pump.
6. Open both gauge set valves and start the vacuum pump. Allow the vacuum pump to operate for a minimum of 45 minutes after the gauge set low pressure gauge indicates 101 kPa (30 in-Hg). The 45-minute evacuation is necessary to remove any refrigerant from oil left in the evaporator core or condenser core. If the refrigerant is not completely removed from the oil, out gassing will degrade the vacuum and appear as a refrigerant leak.
7. If the low pressure gauge reading will not drop to 101 kPa (30 in-Hg) when the valves on the gauge and manifold set are open and the vacuum pump is operating, close the gauge set valves and observe the low

pressure gauge. If the pressure rises rapidly to zero, a large leak is indicated. Recheck the test fitting connections and gauge set connections before installing a new evaporator core or condenser core.

8. After evacuating for 45 minutes, close the gauge set valves and stop the vacuum pump. Observe the low pressure gauge; it should remain at the 101 kPa (30 in-Hg) mark.
    - If the low pressure gauge reading rises 34 or more kPa (10 or more in-Hg) of vacuum from the 101 kPa (30 in-Hg) position in 10 minutes, a leak is indicated.
    - If a very small leak is suspected, wait 30 minutes and observe the vacuum gauge.
    - If a small amount of vacuum is lost, operate the vacuum pump with gauge valves open for an additional 30 minutes to remove any remaining refrigerant from the oil in the evaporator core or condenser core. Then recheck for loss of vacuum.
    - If a very small leak is suspected, allow the system to sit overnight with vacuum applied and check for vacuum loss.
9. If the evaporator core or condenser core does leak, as verified by the above procedure, install a new evaporator core or condenser core.

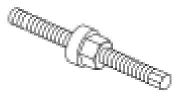
A/C Compressor - External Leak Test

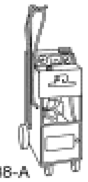
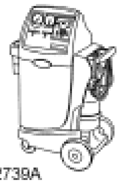
1. Install the A/C Pressure Test Adapter on the port of the A/C compressor, using the existing manifold retaining bolt.
2. Connect the high and low pressure lines of a R-134a Manifold Gauge Set or a refrigerant recovery/recycling station such as the R-134a A/C service center to the corresponding fittings on the A/C Pressure Test Adapter.
3. Attach the center hose of a R-134a Manifold Gauge Set to a refrigerant container standing in an upright position.
4. Hand-rotate the compressor shaft 10 complete revolutions to distribute the oil inside the A/C compressor.
5. Open the low pressure gauge valve, the high pressure gauge valve and the valve on the refrigerant container to allow the refrigerant vapor to flow into the A/C compressor.
6. Using the Refrigerant Leak Detector, check for leaks at the compressor shaft.
7. If a shaft seal leak is found, replace the compressor shaft seal. If an external leak is found, install a new A/C compressor.
8. When the leak test is complete, recover the refrigerant from the compressor.

GENERAL PROCEDURES

REFRIGERANT SYSTEM TESTS

Special Tools

Illustration	Tool Name	Tool Number
 ST1287-A	R-134a Manifold Gauge Set	023-00047 or equivalent

 ST2738-A	R-134a Refrigerant Management Center	176-00002 or equivalent
 ST2739A	R-134a Refrigerant Management Center	023-00174 or equivalent

Procedure 1 - Ambient Temperature at or Below 38°C (100°F)

NOTE: The system performance can be evaluated and diagnosed by analysis of the compressor suction and discharge pressures. The following procedure is used to determine if the system is operating at normal pressures.

NOTE: The procedure varies depending on the ambient (shop) temperature. If the ambient temperature is 38°C (100°F) or lower, follow Procedure 1. If the ambient temperature is over 38°C (100°F), follow Procedure 2.

NOTE: If the A/C compressor cycles at any time during this test, refer to the diagnostic table.

1. Drive the vehicle or run the engine until it reaches normal operating temperature.
2. Connect an R-134a Manifold Gauge Set or R-134a Refrigerant Management Service Center with high-pressure and low-pressure gauges to the refrigerant system.
3. Set the climate controls.
    - If equipped with manual climate control, set the A/C controls for normal A/C-PANEL mode, full COOL temperature, FRESH air, HI blower. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.
    - If equipped with Electronic Automatic Temperature Control (EATC) or Dual Automatic Temperature Control (DATC), set temperature to 15°C (60°F) (lowest possible temp setting) with the dual function disabled (if equipped). Manually set blower on HI. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.
4. Open all vehicle windows and leave the hood open for the test. Open the rear doors.
5. Confirm the compressor clutch is engaged and the engine cooling fan(s) are operating or engaged. Allow the vehicle to idle until the suction (low-side) and discharge (high-side) pressures are stable or fluctuate in a range that repeats.
6. Record the ambient (shop) temperature.
7. Record the discharge pressure. If the pressure is fluctuating, record the average value.
8. Determine if the discharge pressure falls within the normal operating limits using the Normal Refrigerant

Discharge Pressures chart.

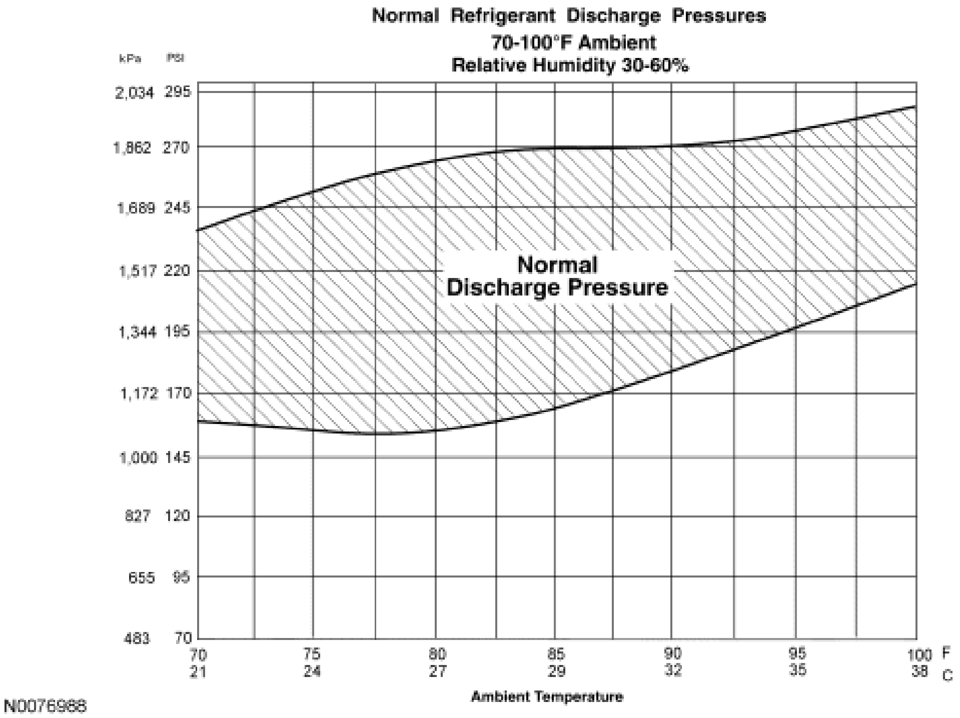


Fig. 202: Normal Refrigerant Discharge Pressures Chart [Ambient Temperature At Or Below 38°C (100°F)]
Courtesy of FORD MOTOR CO.

9. Record the suction pressure. If the pressure is fluctuating, record the average value.
10. Determine if the suction pressure falls between normal operating limits using the Normal Refrigerant Suction Pressures chart.

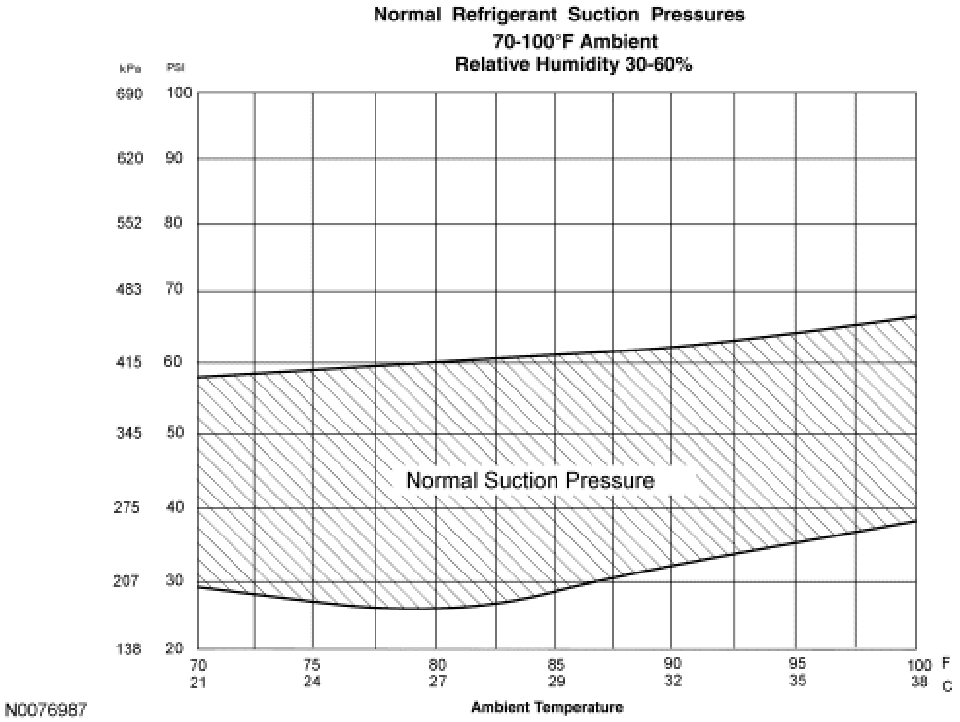


Fig. 203: Normal Refrigerant Suction Pressures Chart [Ambient Temperature At Or Below 38°C (100°F)]
Courtesy of FORD MOTOR CO.

11. Proceed to the Diagnostic Table.

Procedure 2 - Ambient Temperature Above 38°C (100°F)

NOTE: **The system performance can be evaluated and diagnosed by analysis of the compressor suction and discharge pressures. The following procedure is used to determine if the system is operating at normal pressures.**

NOTE: **The procedure varies depending on the ambient (shop) temperature. If the ambient temperature is 38°C (100°F) or lower, follow Procedure 1. If the ambient temperature is over 38°C (100°F), follow Procedure 2.**

1. Drive the vehicle or run the engine until it reaches normal operating temperature.
2. Connect an R-134a Manifold Gauge Set or R-134a Refrigerant Management Center with high-pressure and low-pressure gauges to the refrigerant system.
3. Set the climate controls.
   - If equipped with manual climate control, set the A/C controls for normal A/C-PANEL mode, full COOL temperature, FRESH air, MED LO blower. If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.
   - If equipped with Electronic Automatic Temperature Control (EATC) or Dual Automatic Temperature Control (DATC), set temperature to 15°C (60°F) (lowest possible temp setting).

Manually set blower to MED LO (3 to 4 bars). If the vehicle has a fresh air/recirc button, set it to FRESH. If the vehicle has an A/C switch or compressor on switch, set it to A/C ON.

4. Open all vehicle windows and leave the hood open for the test. Open the rear hatch and/or rear doors (if equipped).
5. Confirm the compressor clutch is engaged and the engine cooling fan(s) are operating or engaged. Allow the vehicle to idle until the suction (low-side) and discharge (high-side) pressures are stable or fluctuate in a range that repeats.
6. Record the ambient (shop) temperature.
7. Record the discharge pressure. If the pressure is fluctuating, record the average value.
8. Determine if the discharge pressure falls within the normal operating limits using the Normal Refrigerant Discharge Pressures chart.

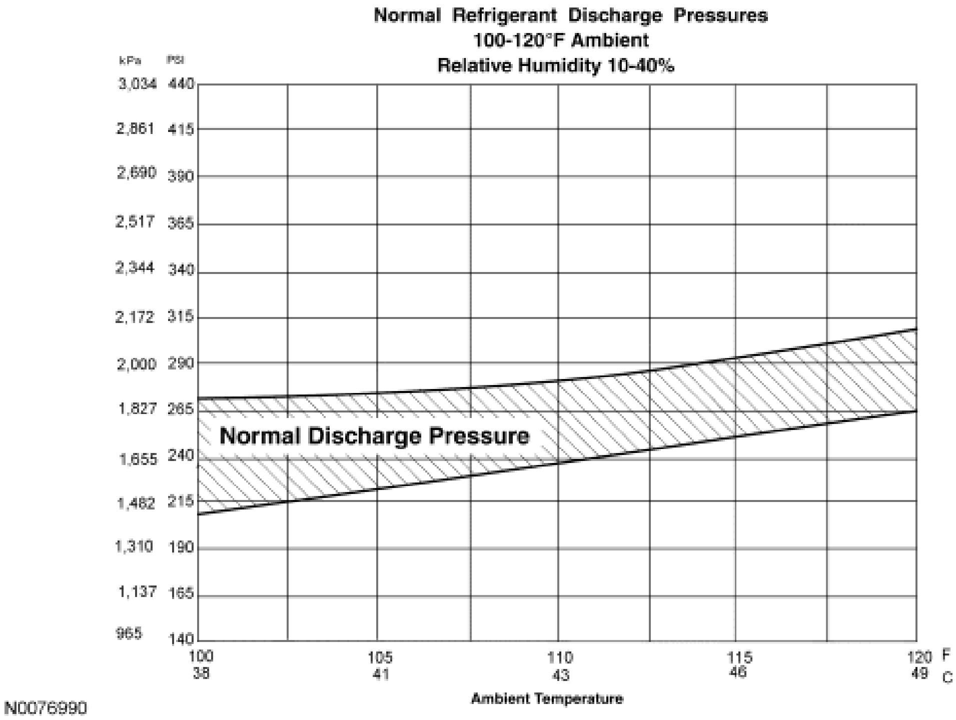


Fig. 204: Normal Refrigerant Discharge Pressures Chart [Ambient Temperature Above 38°C (100°F)]
Courtesy of FORD MOTOR CO.

9. Record the suction pressure. If the pressure is fluctuating, record the average value.
10. Determine if the suction pressure falls between normal operating limits using the Normal Refrigerant Suction Pressures chart.

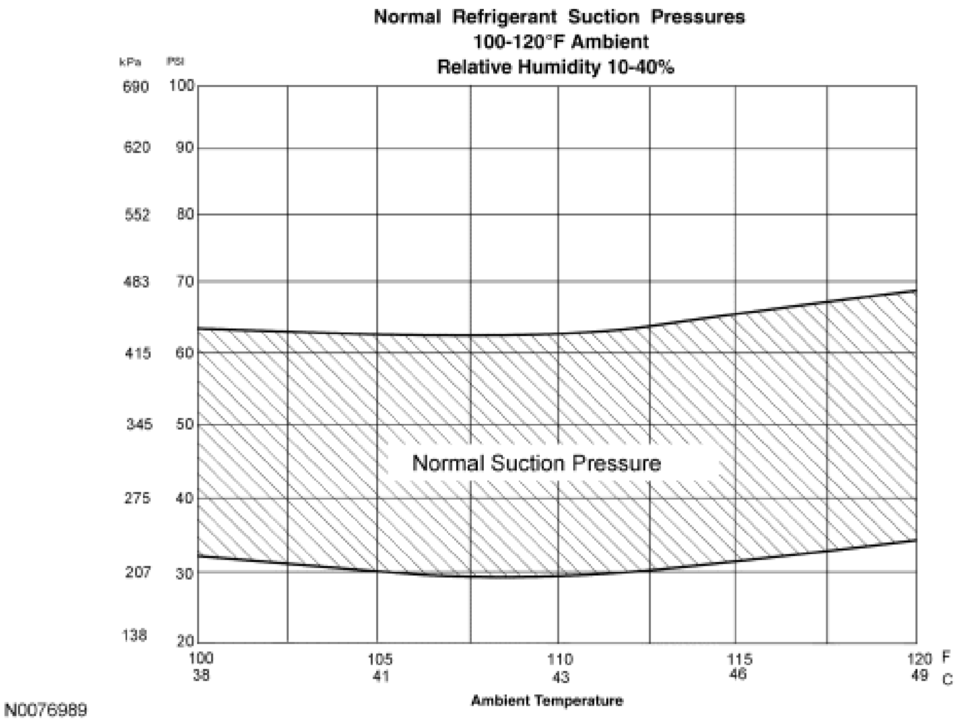


Fig. 205: Normal Refrigerant Suction Pressures Chart [Ambient Temperature Above 38°C (100°F)]
Courtesy of FORD MOTOR CO.

11. Proceed to the Diagnostic Table.

Diagnostic Table

NOTE: The following table is used to guide diagnosis of the refrigerant system if operating pressures are outside normal limits.

1. Refer to the chart below.

High (Discharge) Pressure	Low (Suction) Pressure	Component - Causes
High or Clutch Cycling	High	Condenser - inadequate airflow.
High	Normal to High	Engine - overheating.
Normal to High	Normal	Refrigerant overcharge - air in refrigerant.
		A/C suction line -

Normal to Low	Normal to High	partially restricted or plugged[a] .
Normal to Low	Low or Clutch Cycling	Low refrigerant charge, A/C suction line - partially restricted or plugged[b] A/C cycling switch - sticking closed (if equipped).
Erratic Operation or Compressor Not Running		A/C cycling switch - poor connection at A/C clutch connector or clutch cycling switch connector. A/C electrical circuit erratic - see A/C Electrical Circuit Wiring Diagram.
Normal to Low	High	Compressor - low performance.
Additional Possible Cause Components Associated With Inadequate Compressor Operation		
• Compressor Drive Belt - loose • Compressor Clutch - slipping • Clutch Coil Open - shorted, or loose mounting		

• Control Assembly Switch - dirty contacts or sticking open • Clutch Wiring Circuit - high resistance, open or blown fuse • Compressor Operation Interrupted by Engine Computer
Additional Possible Cause Components Associated With a Damaged Compressor
• Incorrect Clutch Air-gap • Suction Accumulator - refrigerant oil bleed hose plugged • Refrigerant Leaks

[a] Low pressure reading will be normal to high if pressure is taken at accumulator and if restriction is downstream of service access valve.

[b] Low pressure reading will be low if pressure is taken near the compressor and restriction is upstream of service access valve.

AIR CONDITIONING (A/C) CLUTCH AIR GAP ADJUSTMENT

1. Check the A/C clutch air gap at 3 equally spaced places between the clutch plate and the A/C clutch pulley.

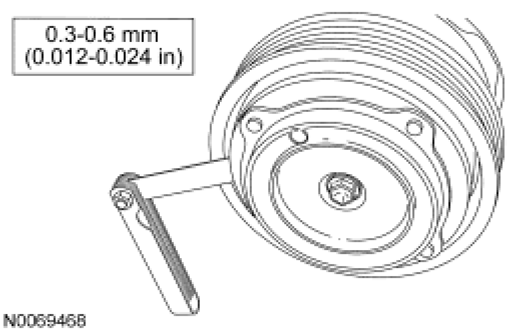
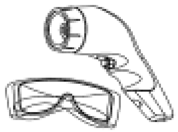
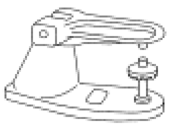
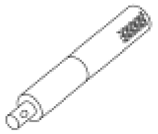
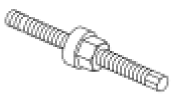
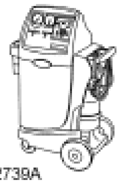
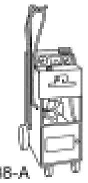


Fig. 206: Checking A/C Compressor Clutch Air Gap
Courtesy of FORD MOTOR CO.

2. If the A/C clutch air gap is out of range, remove the clutch plate. Add or remove spacers between the clutch plate hub and the compressor shaft until the clearance is within specification.

FLUORESCENT DYE LEAK DETECTION

Special Tools

Illustration	Tool Name	Tool Number
 ST3073-A	Cordless/Rechargable True UV LED Light ES	023-00182 or equivalent
 ST1278-A	R-134a Leak Detection Dye	164-R6060
 ST1326-A	R-134a Loop/Add On Injector Kit-Set	219-00069 or equivalent
 ST1287-A	R-134a Manifold Gauge Set	023-00047 or equivalent
 ST2739A	R-134a Refrigerant Center	023-00174 or equivalent
 ST2738-A	R-134a Refrigerant Center	176-00002 or equivalent

Fluorescent Dye Detection

NOTE: Ford Motor Company vehicles are produced with R-134a fluorescent dye installed in the refrigerant system from the factory. The location of leaks can be pinpointed by the bright yellow-green glow of the fluorescent dye under a UV lamp. Since more than one leak can exist, make sure to inspect each component, line and fitting in the refrigerant system for a leak.

1. Check for leaks using a Rotunda-approved UV lamp.
   - Inspect all components, lines and fittings of the refrigerant system.
2. If a leak is found, recover the refrigerant. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.
3. Repair the refrigerant system leak(s).
4. Evacuate and charge the refrigerant system. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.
5. After the leak(s) is/are repaired, remove any traces of fluorescent dye with a general purpose oil solvent.
6. Verify the repair by running the vehicle for a short period of time and rechecking the area of the leak with a Rotunda-approved UV lamp.

Fluorescent Dye Injection - Using an R-134a Refrigerant Management Center and Dye/Lubricant Injector

NOTE: Fluorescent refrigerant system dye is added to the refrigerant system at the factory to assist in refrigerant system leak diagnosis using a Rotunda-approved ultraviolet black light. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant capacity has been lost due to a fitting separation, hose rupture or other damage.

NOTE: Before using the dye/lubricant injector from the R-134a Loop/Add On Injector Kit-Set for the first time, refer to the manufacturer's instructions on evacuation of any non-condensable gases from the hoses.

NOTE: Only connect the dye/lubricant injector when fluorescent dye is to be injected. The injector has a one-way check valve that will prevent refrigerant system recovery and evacuation.

NOTE: Refrigerant system pressure should be between 413-551 kPa (60-80 psi) at 24°C (75°F) with the engine off.

1. Connect an R-134a Refrigerant Center or a R-134a Manifold Gauge Set to the refrigerant system service port valves.

   NOTE: The dye/lubricant injector is included as part of the 219-00069 R-134a Loop/Add On Injector Kit-Set.

2. Verify that the valves on the dye/lubricant injector are closed.

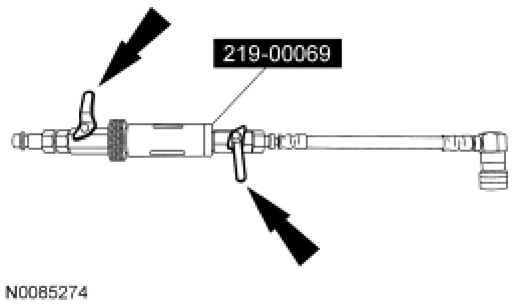


Fig. 207: Verifying Valves On Dye/Lubricant Injector Are Closed
Courtesy of FORD MOTOR CO.

3. Fill the fluorescent dye injector reservoir with 7 ml (0.25 oz.) of fluorescent dye.

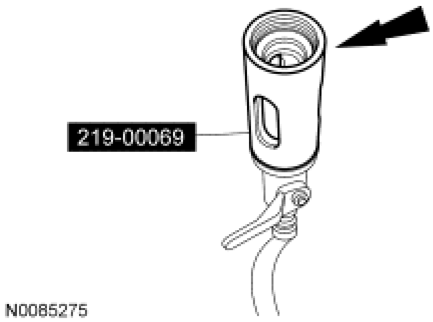


Fig. 208: Filling Fluorescent Dye Injector Reservoir With 7 ml (0.25 oz.) Of Fluorescent Dye
Courtesy of FORD MOTOR CO.

4. Install the dye/lubricant injector between the low-pressure service gauge port valve and the R-134a Refrigerant Center or R-134a Manifold Gauge Set.
5. Open all valves and inject the fluorescent dye into the refrigerant system.
6. When fluorescent dye injection is complete, close all valves.
7. Recover the refrigerant from the dye/lubricant injector.
8. Remove the dye/lubricant injector from the low-pressure service gauge port valve and the R-134a Refrigerant Center or R-134a Manifold Gauge Set.

Fluorescent Dye Injection - Using an R-134a Loop/Add On Injector Kit-Set

NOTE: **Fluorescent refrigerant system dye is added to the refrigerant system at the factory to assist in refrigerant system leak diagnosis using a Rotunda-approved ultraviolet black light. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant capacity has been lost due to a fitting separation, hose rupture or other damage.**

NOTE: **Before using the R-134a Loop/Add On Injector Kit-Set for the first time, refer to the equipment manufacturer's instructions on evacuation of non-condensable gases from the hoses.**

NOTE: **Refrigerant system pressure should be between 413-551 kPa (60-80 psi) at 24°C (75°F).**

1. Verify that the valves on the deluxe injector loop kit are closed.

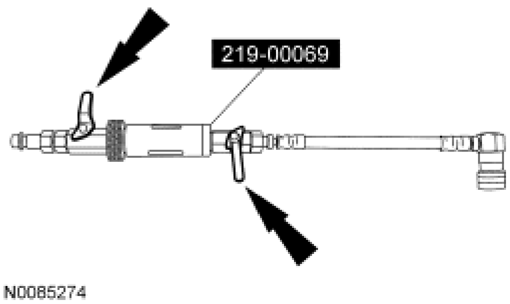


Fig. 209: Verifying Valves On Dye/Lubricant Injector Are Closed
Courtesy of FORD MOTOR CO.

2. Fill the R-134a Loop/Add On Injector Kit-Set reservoir with 7 ml (0.25 oz.) of fluorescent dye.

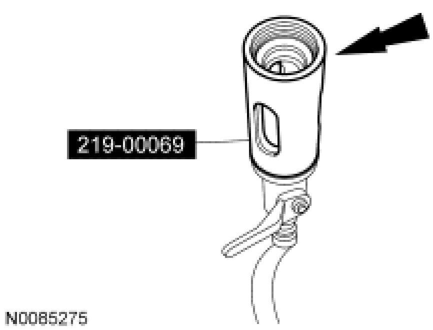


Fig. 210: Filling Fluorescent Dye Injector Reservoir With 7 ml (0.25 oz.) Of Fluorescent Dye
Courtesy of FORD MOTOR CO.

3. Install the R-134a Loop/Add On Injector Kit-Set between the high-pressure and low-pressure service gauge port valves.

NOTE: **Make sure all tools and hoses are clear of the engine cooling fan and drive belt before starting the engine.**

4. Start the engine.
5. Open the high-pressure service valve.

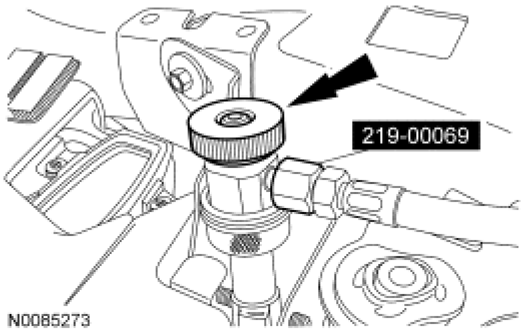


Fig. 211: Installing R-134A Loop/Add On Injector Kit-Set Between High-Pressure & Low-Pressure Service Gauge Port Valves
Courtesy of FORD MOTOR CO.

6. Open all valves and inject the fluorescent dye into the refrigerant system.

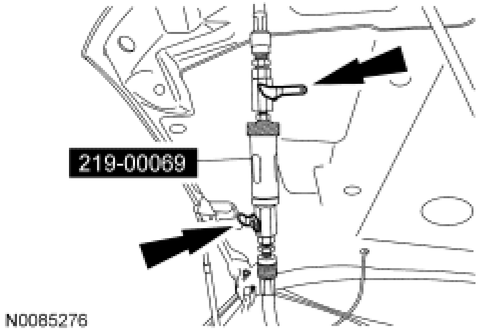


Fig. 212: Opening All Valves & Inject Fluorescent Dye Into Refrigerant System
Courtesy of FORD MOTOR CO.

7. Close the high-pressure service valve to allow the pressure inside the R-134a Loop/Add On Injector Kit-Set to equalize with the suction side of the refrigerant system.

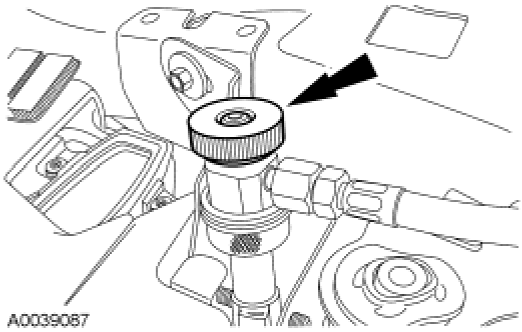


Fig. 213: Identifying High-Pressure Service Valve
Courtesy of FORD MOTOR CO.

NOTE: Close the valves on the R-134a Loop/Add On Injector Kit-Set while the A/C compressor is operating.

8. Close the valves on the R-134a Loop/Add On Injector Kit-Set.

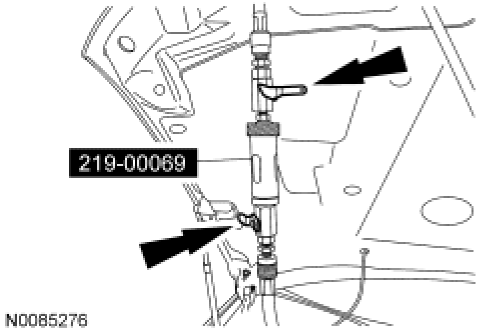


Fig. 214: Closing Valves On R-134A Loop/Add On Injector Kit-Set
Courtesy of FORD MOTOR CO.

NOTE: Leave all valves on the R-134a Loop/Add On Injector Kit-Set closed when not in use.

9. Disconnect the high-pressure and low-pressure service valves and remove the R-134a Loop/Add On Injector Kit-Set from the vehicle.

ELECTRONIC LEAK DETECTION

Special Tools

Illustration	Tool Name	Tool Number
	Heated Pentode Halogen Leak Detector	023-00178 or equivalent

NOTE: Good ventilation is necessary in the area where electronic A/C leak testing is to be carried out. If the surrounding air is contaminated with refrigerant gas, the Heated Pentode Halogen Leak Detector will indicate this gas all the time. Odors from other chemicals such as antifreeze, diesel fuel, disc brake cleaner or other cleaning solvents can cause the same problem. Using a fan to ventilate the area to be tested before proceeding with the leak detection procedure is helpful in removing small traces of contamination from the air, but the fan should be turned off during actual testing.

NOTE: R-134a is heavier than air, and will tend to move downward from the source of the leak if present. It is possible that a leak may not be detected if the leak detector tip is held above the leaking fitting, line or component. Always be sure to thoroughly leak test below the fitting, line or component for the presence of R-134a as well as leak testing above and around.

NOTE: The system pressure should be between 413-551 kPa (60-80 psi) at 24°C (75°F) with the engine off.

1. Leak test the refrigerant system using the leak detector. Follow the instructions included with the leak detector for handling and operation techniques.

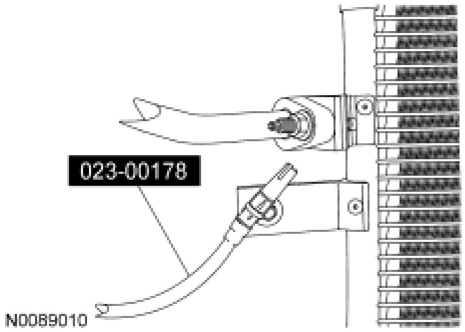
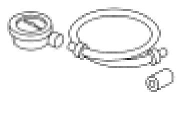
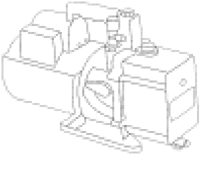
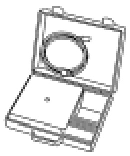


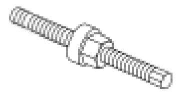
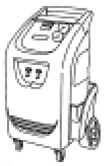
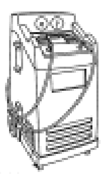
Fig. 215: Leak Test The Refrigerant System Using Leak Detector
Courtesy of FORD MOTOR CO.

2. If a leak is found, recover the refrigerant. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.
   - Repair the system.
   - Test the system for normal operation.

AIR CONDITIONING (A/C) SYSTEM RECOVERY, EVACUATION AND CHARGING

Special Tools

Illustration	Tool Name	Tool Number
	1.2 CFM Vacuum Pump	023-00162 or equivalent
	4.0 CFM Vacuum Pump	023-00163 or equivalent
	Automatic Refrigerant Charging Meter	023-00155 or equivalent

 ST1287-A	R-134a Manifold Gauge Set	023-00047 or equivalent
 ST3079A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant)	023-00181 or equivalent
 ST3081-A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant)	199-00067 or equivalent
 ST3080-A	R-134a Refrigerant Management Machine (SAE J-2788 Compliant)	265-00012 or equivalent

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

Refrigerant System Recovery

NOTE: **An air conditioning (A/C) refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts the shop's bulk refrigerant at risk of contamination. If the vehicle's A/C refrigerant is contaminated, refer the customer to the service facility that carried out the last A/C service. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturer procedures and instructions.**

NOTE: **Ford Motor Company recommends use of an R-134a Refrigerant Management Machine to carry out recovery. If an R-134a Refrigerant Management Machine is not available, refrigerant system recovery may be accomplished using a separate recovery station.**

NOTE: **Leaks in refrigerant system service equipment, hoses or gauges can cause a**

leak in vacuum that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Prior to recovering, the purity of the refrigerant must be verified. For additional information, refer to **Refrigerant Identification Testing**.
2. Connect an R-134a Refrigerant Management Machine to the low- and high-pressure service gauge port valves following the operating instructions provided by the equipment manufacturer.
3. Recover the refrigerant from the system following the operating instructions provided by the equipment manufacturer. Note the amount of oil removed during the refrigerant recovery (if any). Add that same amount back into the system once repairs are complete.
4. Once the R-134a Refrigerant Center has recovered the refrigerant, switch OFF the power supply.
5. Allow the system to set for about 2 minutes, and observe the system vacuum reading. If the vacuum is not lost, disconnect the recovery equipment.
6. If the system does lose vacuum, repeat Steps 3 through 5 until the vacuum level remains stable for 2 minutes.
7. Carry out the required repairs.

Refrigerant System Evacuation Using an R-134a Refrigerant Management Machine

NOTE: Ford Motor Company recommends use of an R-134a Refrigerant Management Machine to carry out recovery, evacuation and charging of the refrigerant system. If an R-134a Refrigerant Management Machine is not available, evacuation may be accomplished using a separate Vacuum Pump and R-134a Manifold Gauge Set.

NOTE: Leaks in refrigerant system service equipment, hoses or gauges can cause a leak in vacuum that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Connect an R-134a Refrigerant Management Machine to the low- and high-pressure service gauge port valves following the operating instructions provided by the equipment manufacturer.
2. Evacuate the system until the low-pressure gauge reads at least 99.4 kPa (29.5 in-Hg) of vacuum and as close to 101.1 kPa (30 in-Hg) as possible. Continue to operate the Vacuum Pump for a minimum of 45 minutes.
3. Turn OFF the Vacuum Pump. Observe the low-pressure gauge for 5 minutes to make sure that the system vacuum is held. If vacuum is not held for 5 minutes, leak test the system, repair the leak and evacuate the system again.

Refrigerant System Evacuation Using an R-134a Manifold Gauge Set

NOTE: Ford Motor Company recommends use of an R-134a Refrigerant Management Machine to carry out evacuation of the refrigerant system. If an R-134a Refrigerant Management Machine is not available, refrigerant system evacuation may be accomplished using a separate Vacuum Pump and R-134a Manifold Gauge Set.

NOTE: Leaks in refrigerant system service equipment, hoses or gauges can cause a leak in vacuum that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Connect the R-134a Manifold Gauge Set to the low-side and high-side service gauge port valves.
2. Connect the center (yellow) hose from the R-134a Manifold Gauge Set to the suction port on the Vacuum Pump.
3. Open all valves on the R-134a Manifold Gauge Set and both service gauge port valves.
4. Turn on the Vacuum Pump and evacuate the system until the low-pressure gauge reads at least 99.4 kPa (29.5 in-Hg) of vacuum and as close to 101.1 kPa (30 in-Hg) as possible. Continue to operate the Vacuum Pump for a minimum of 45 minutes.
5. Close the high-side and low-side valves on the R-134a Manifold Gauge Set (not the service gauge port valves) and turn OFF the Vacuum Pump.
6. Observe the low-pressure gauge for 5 minutes to make sure that the system vacuum is held. If vacuum is not held for 5 minutes, leak test the system, repair the leak and evacuate the system again.

Refrigerant System Charging Using an R-134a Refrigerant Management Machine

NOTE: Ford Motor Company recommends use of an R-134a Refrigerant Management Machine to carry out charging of the refrigerant system. If an R-134a Refrigerant Management Machine is not available, refrigerant system charging may be accomplished using a separate Automatic Refrigerant Charging Meter and R-134a Manifold Gauge Set.

NOTE: Leaks in refrigerant system service equipment, hoses or gauges can cause a leak that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **Refrigerant Oil Adding**.
2. Connect an R-134a Refrigerant Management Machine to the low-side and high-side service gauge port valves following the operating instructions provided by the equipment manufacturer.
3. Set the refrigerant charge amount, and charge the refrigerant system following the instructions provided by the equipment manufacturer.

Refrigerant System Charging Using an R-134a Manifold Gauge Set and Automatic Refrigerant Charging Motor

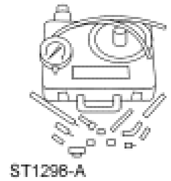
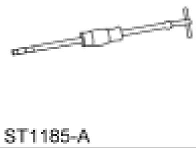
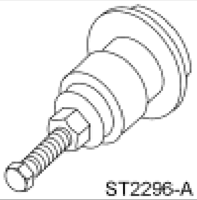
NOTE: Ford Motor Company recommends use of an R-134a Refrigerant Management Machine to carry out charging of the refrigerant system. If an R-134a Refrigerant Management Machine is not available, refrigerant system charging may be accomplished using a separate Automatic Refrigerant Charging Meter and R-134a Manifold Gauge Set.

NOTE: Leaks in refrigerant system service equipment, hoses or gauges can cause a leak that may be misinterpreted as a problem with the vehicle's refrigerant system. It is necessary to leak-test all refrigerant system service equipment, hoses and gauges on a weekly basis to verify that no leaks are present.

1. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **Refrigerant Oil Adding**.
2. Assemble the R-134a Manifold Gauge Set, Automatic Refrigerant Charging Meter and R-134a supply tank following the Automatic Refrigerant Charging Meter operating instructions.
3. Charge the refrigerant system following the Automatic Refrigerant Charging Meter operating instructions.
4. If the refrigerant flow stops before the refrigerant charge is complete, start the engine, select MAX A/C operation and allow the refrigerant charge to complete.

AIR CONDITIONING (A/C) SYSTEM FLUSHING

Special Tools

Illustration	Tool Name	Tool Number
	A/C Flush Adapter Kit	219-00074 or equivalent
	A/C Flush and Purge Fitting Kit	219-00024 or equivalent
	A/C Flush and Purge Machine	219-00022 (part of 219-00023) or equivalent

Material

Item	Specification
A/C System Flushing Solvent	-

YN-23	
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

WARNING: **Take the following precautions when repairing an air conditioning system containing R-134a:**

- **Always wear safety goggles.**
- **Avoid contact with liquid refrigerant R-134a. R-134a vaporizes at approximately -25°C (-13°F) under atmospheric pressure and will freeze skin tissue.**
- **Never allow refrigerant R-134a gas to escape in quantity in an occupied space. It will displace the oxygen needed to support life.**
- **Never use a torch in an atmosphere containing R-134a gas. R-134a is non-toxic at all normal conditions, but it decomposes when exposed to high temperatures such as a torch flame. During decomposition it releases irritating and toxic gasses (as described in the MSDS sheet from the manufacturer). Decomposition products are hydrofluoric acid, carbon dioxide and water.**

Failure to follow these instructions may result in serious personal injury.

NOTE: **An air conditioning (A/C) refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts the shop's bulk refrigerant at risk of contamination. If the vehicle's A/C refrigerant is contaminated, refer the customer to the service facility that carried out the last A/C service. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturer procedures and instructions.**

NOTE: **Receiver/drier cartridge, Thermostatic Expansion Valve (TXV), and hoses with mufflers should be removed when flushing the air conditioning (A/C) system. Internal plumbing of these devices makes it impossible to correctly remove any residual-flushing agent. These components are typically discarded after A/C system contamination. Hoses without mufflers can normally be reused unless they are clogged with foreign material. The 3.785L (1 gal) of A/C System Flushing Solvent YN-23 and FL1-A filter used in A/C Flush and Purge Machine 219-00022 are intended for use on one vehicle only. They may be used to flush both the A/C condenser core and the A/C evaporator core on an individual vehicle, but under no circumstances should they be used on more than one vehicle.**

NOTE: **Only the A/C Flush and Purge Machine 219-00022 and A/C Systems Flushing Solvent, is approved for use on Ford vehicles. No other flushing device or**

solvent is approved for flushing heat exchangers (air conditioning [A/C] condenser, A/C evaporator). Use of any other flusher or solvent may cause damage to the A/C system and the flushing unit.

NOTE: Prior to using the A/C Flush and Purge Machine 219-00022 for the first time, review the operating instructions.

NOTE: Ford Motor Company has approved a procedure to provide technicians with a non-CFC method of flushing contaminated A/C system heat exchangers. The procedure allows the specific components to be cleaned and flushed while installed in their normal in-vehicle location. The types of contamination flushed include particle matter that results from A/C compressor or desiccant failure and gummy residue that can form when refrigerant oil is overheated during A/C compressor seizure. The flushing process is a 2-step procedure that involves the use of an A/C Flush and Purge Machine 219-00022 to:

- **circulate the flushing solvent through the heat exchanger in the reverse direction of normal refrigerant flow (back-flushing). Particulate matter picked up during flushing is filtered from the returning solvent before the solvent is returned to the reservoir for continued circulation.**
- **remove the flushing solvent from the heat exchanger. In this step of the procedure, pressurized air 621-862 kPa (90-125 psi) is used to push and evaporate any remaining flush solvent from the heat exchanger.**

1. Remove the receiver/drier cartridge. For additional information, refer to **CLIMATE CONTROL** article.

   NOTE: The condenser core must be flushed with the receiver/drier cartridge removed. Do not install a new receiver/drier cartridge at this time.

2. With the receiver/drier cartridge removed, reinstall the receiver/drier plug and snap ring into the condenser core.
3. Remove the condenser inlet and outlet fitting nuts and disconnect the fittings.
4. Connect the A/C Flush and Purge Machine to the condenser inlet and outlet fittings using the correct adapters from the A/C Flush Adapter Kit.
5. Flush the condenser core for a minimum of 30 minutes.
6. Turn the A/C Flush and Purge machine to the PURGE mode and run for a minimum of 20 minutes.
7. Disconnect the A/C Flush and Purge machine and adapters from the condenser core.
8. Install new gasket seals and connect the A/C condenser inlet and outlet fittings.
9. Remove the snap ring and receiver/drier plug.

   NOTE: Do not charge the refrigerant system after the condenser core is installed.

10. Install a new receiver/drier cartridge. For additional information, refer to **CLIMATE CONTROL** article.

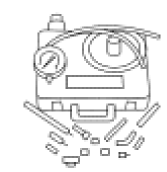
11. Remove the Thermostatic Expansion Valve (TXV).
12. Connect the A/C Flush and Purge Machine to the evaporator core fitting using the correct adapter from the A/C Flush and Purge Fitting Kit.
13. Flush the evaporator core for a minimum of 20 minutes.
14. Turn the A/C Flush and Purge Machine to the PURGE mode and run for a minimum of 20 minutes.
15. Disconnect the A/C Flush and Purge Machine and adapter from the evaporator core fitting.
16. Install a new front TXV. For additional information, refer to **CLIMATE CONTROL** article.

NOTE: It is necessary to evacuate the refrigerant system for a minimum of one hour to evaporate any traces of flush solvent that may remain in the system.

17. Evacuate the refrigerant system for one hour. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.
18. If a new A/C compressor is not to be installed, lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **Refrigerant Oil Adding**.
19. If a new A/C compressor is not to be installed, evacuate, leak test and charge the refrigerant system. For additional information, refer to**Air Conditioning (A/C) System Recovery, Evacuation and Charging** .

REFRIGERANT SYSTEM FILTERING FOLLOWING AIR CONDITIONING (A/C) COMPRESSOR INSTALLATION

Special Tools

Illustration	Tool Name	Tool Number
 ST1298-A	A/C Flush Adapter Kit	219-00074 or equivalent
 ST1185-A	A/C Flush and Purge Fitting Kit	219-00024 or equivalent

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

NOTE: On vehicles being serviced for an internal compressor or desiccant failure, a new Thermostatic Expansion Valve (TXV) and any hoses containing mufflers

must be installed prior to filtering the air conditioning (A/C) system. Internal plumbing of these devices makes it impossible to correctly remove any foreign material/debris. These components are typically discarded after A/C system contamination. Hoses without mufflers can normally be reused unless they are clogged with foreign material. The F8VZ-19E773-AB filter is intended for use on one vehicle only.

1. Remove the receiver/drier cartridge. For additional information, refer to **CLIMATE CONTROL** article.

NOTE: The refrigerant system must be filtered with the receiver/drier cartridge removed. Do not install a new receiver/drier cartridge at this time.

2. With the receiver/drier cartridge removed, reinstall the receiver/drier plug and snap ring into the condenser core.
3. Remove the condenser outlet fitting nut and disconnect the fitting.
   - Discard the gasket seal.

NOTE: The flexible extension adapters included in the A/C Flush Adapter Kit (219-00074) are designed for low-pressure flushing and are not designed for use with a charged refrigerant system. Do not make the condenser fitting connections using the flexible extension adapters or damage to the adapters and loss of refrigerant will occur.

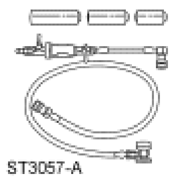
NOTE: Use flexible refrigerant hose of 17,238 kPa (2,500 psi) burst rating.

4. Using the correct adapters and service hoses, install the pancake filter between the condenser and the condenser outlet fitting.
5. Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **Refrigerant Oil Adding**.
6. Evacuate and charge the refrigerant system. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.
7. Provide adequate airflow to the front of the vehicle (with a fan, if necessary). Start the engine and allow it to idle briefly. Select A/C operation and set the blower speed to HI. Verify that the A/C is operating correctly.
8. Gradually bring the engine up to 1,200 RPM by running it at lower RPM for short periods (first at 800 RPM, then at 1,000 RPM). Set the engine at 1,200 RPM and run it for one hour with the A/C system operating.
9. Stop the engine.
10. Recover the refrigerant. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.
11. Remove the pancake filter, hoses and adapters from the vehicle.
12. Install a new gasket seal and connect the condenser outlet fitting.
13. Remove and discard the receiver/drier plug snap ring and the receiver/drier plug.

14. Install a new receiver/drier cartridge. For additional information, refer to **CLIMATE CONTROL** article.
15. Evacuate, leak test and charge the refrigerant system. For additional information refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.

REFRIGERANT OIL ADDING

Special Tools

Illustration	Tool Name	Tool Number
	R-134a Loop/Add On Injector Kit-Set	219-00069 or equivalent

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

Refrigerant Oil Adding

NOTE: During normal A/C operation, oil is circulated through the system with the refrigerant, and a small amount is retained in each component. If certain components of the system are removed, some of the refrigerant oil will go with the component. To maintain the original total oil charge, it is necessary to compensate for the oil lost by adding oil to the system with the new part.

1. Refer to the chart below for refrigerant oil adding amounts and methods of installation.

Component	PAG Oil Amount	Method of Adding
A/C Compressor	See heading below	Add directly to A/C compressor before installation
Receiver/Drier Desiccant Cartridge	60 ml (2 fl. oz.) added to the amount collected during refrigerant	Inject to low-side service port during system charging

	recovery	
Evaporator Core	45 ml (1.5 fl. oz.) added to the amount collected during refrigerant recovery	Add directly to evaporator core inlet tube or inject to low-side service port during system charging
Condenser Core	60 ml (2 fl. oz.) added to the amount collected during refrigerant recovery	Add directly to condenser core inlet or inject to low-side service port during system charging
Evaporator Core Orifice or Thermostatic Expansion Valve	The amount collected during refrigerant recovery	Inject to low-side service port during system charging
A/C Pressure Relief Valve	60 ml (2 fl. oz.) added to the amount collected during refrigerant recovery	Inject to low-side service port during system charging
Refrigerant Hose/Line	60 ml (2 fl. oz.) added to the amount collected during refrigerant recovery[a]	Inject to low-side service port during system charging
	60 ml (2	

O-ring Leak Repair	fl. oz.) added to the amount collected during refrigerant recovery[b]	Inject to low-side service port during system charging
Service Port Leak Repair	60 ml (2 fl. oz.) added to the amount collected during refrigerant recovery	Inject to low-side service port during system charging

[a] If an excessive amount of refrigerant oil is lost due to a hose rupture/separation or other damage, the total system refrigerant oil capacity must be added.

[b] The amount specified may be used for one or multiple O-ring leak repairs. Do not multiply the refrigerant oil amount by the number of O-ring leaks being repaired.

Refrigerant Oil Adding for New A/C Compressor Installation

NOTE: Service A/C compressors are shipped without refrigerant oil.

1. Rotate the old A/C compressor shaft 8 to 10 full rotations (clockwise) while collecting the refrigerant oil in a clean measuring cup.
    - Add the same amount plus the amount collected during refrigerant recovery.

Oil Injection Using a Dye/Lubricant Injector

NOTE: The dye/lubricant injector is included as part of the 219-00069 R-134a Loop/Add On Injector Kit-Set.

NOTE: If fluorescent leak detection dye is also to be added during A/C charging, the dye may be added to the dye/lubricant injector along with the refrigerant oil.

1. Evacuate the refrigerant system. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.
2. Assemble the dye/lubricant injector using the correct adapters to match the amount of refrigerant compressor oil to be injected.
3. Verify that all the valves on the dye/lubricant injector are closed.

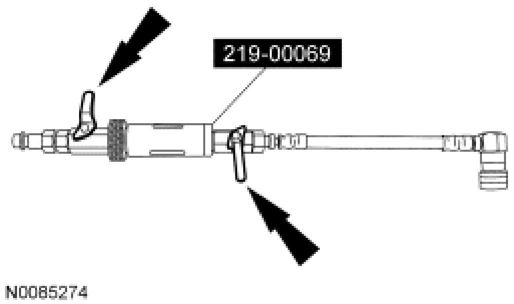


Fig. 216: Verifying All Valves On Dye/Lubricant Injector Are Closed
Courtesy of FORD MOTOR CO.

4. Fill the dye/lubricant injector with the correct amount of new refrigerant compressor oil.

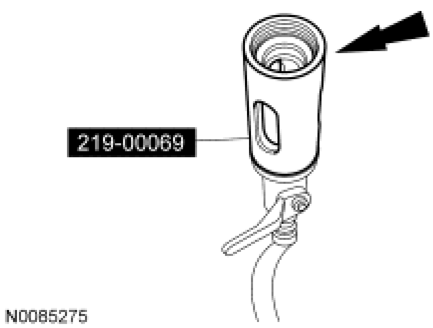


Fig. 217: Filling Dye/Lubricant Injector With Correct Amount Of New Refrigerant Compressor Oil
Courtesy of FORD MOTOR CO.

5. Install the dye/lubricant injector between the low-side service gauge port valve and the refrigerant service station or manifold gauge set.
6. Open all valves and charge the refrigerant system. For additional information, refer to **Air Conditioning (A/C) System Recovery, Evacuation and Charging**.

REFRIGERANT IDENTIFICATION TESTING

Special Tools

Illustration	Tool Name	Tool Number
	Refrigerant Identifier with Air-Radiator	198-00003 or equivalent

Refrigerant Identification

NOTE: A Refrigerant Identifier with Air-Radiator must be used to identify gas samples taken directly from the refrigeration system or storage containers prior to recovering or charging the refrigerant system.

1. Follow the instructions included with the Refrigerant Identifier with Air-Radiator to obtain the sample for testing.
2. The Refrigerant Identifier with Air-Radiator will display one of the following:
   - If the purity level of R-134a is 98% or greater by weight, the green PASS LED will light. The weight concentrations of R-134a, R-12, R-22, hydrocarbons and air will be displayed on the digital display.
   - If refrigerant R-134a does not meet the 98% purity level, the red FAIL LED will light and an alarm will sound alerting the user of potential hazards. The weight concentrations of R-134a, R-12, R-22 and hydrocarbons will be displayed on the digital display.
   - If hydrocarbon concentrations are 2% or greater by weight, the red FAIL LED will light, "Hydrocarbon High" will be displayed on the digital display, and an alarm will sound alerting the user of potential hazards. The weight concentrations of R-134a, R-12, R-22 and hydrocarbons will also be displayed on the digital display.
3. The percentage of air contained in the sample will be displayed if the R-134a content is 98% or greater. The scan tool eliminates the effect of air when determining the refrigerant sample content because air is not considered a contaminant, although air can affect A/C system performance. When the scan tool has determined that a refrigerant source is pure (R-134a is 98% or greater by weight) and air concentration levels are 2% or greater by weight, the scan tool will prompt the user if an air purge is desired.
4. If contaminated refrigerant is detected, repeat the refrigerant identification test to verify that the refrigerant is indeed contaminated.

Contaminated Refrigerant Handling

NOTE: If contaminated refrigerant is detected, DO NOT recover the refrigerant into R-134a recovery/recycling equipment. Recovery of contaminated refrigerant will contaminate the recovered refrigerant supply and may damage the recovery/recycling equipment.

NOTE: A new suction accumulator or receiver/drier must be installed as directed by the A/C system flushing procedure.

1. Recover the contaminated refrigerant using suitable recovery-only equipment designed for capturing and storing contaminated refrigerant only.
   - If this equipment is not available, contact an A/C service facility in the area with the correct equipment to carry out this service.
2. Determine and correct the cause of the customers initial concern.
3. Flush the A/C system.
4. Dispose of the contaminated refrigerant in accordance with all federal, state and local regulations.

AIR CONDITIONING (A/C) ODOR TREATMENT

Special Tools

Illustration	Tool Name	Tool Number
	Flexible Applicator Tool Kit	258-00004
	30 oz. Sure Shot Pressure Sprayer	167-R4700 or equivalent

Material

Item	Specification
A/C Cooling Coil Coating YN-29	-

A/C Odor Treatment

WARNING: Carry out this procedure in a well-ventilated area with all vehicle windows and doors opened. Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION, seek medical advice. On Ford/Motorcraft products in the USA or Canada call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS), if available. Failure to follow these instructions may result in serious personal injury.

NOTE: There are typically 4 types of objectionable odors found in a vehicle:

- **Chemical odors**
- **Environmental odors**
- **Human and other interior-generated odors**
- **Microbiological odors**

Before determining that A/C order treatment is required, the source and the circumstances under which the odor occurs must be determined.

NOTE: Chemical odors are usually constant regardless of the climate control system setting although they may be enhanced by A/C operation. Most chemical odors are caused by fluid leaks or incorrectly cured adhesives. Chemical odors can be eliminated by repairing the leaking component and removing any residue.

NOTE: **Environmental odors usually occur for a short time and diminish after the vehicle passes through the affected area. These odors are typically only detected when the vehicle windows are open, or when the climate control system is operating in a mode that allows for fresh air. Environmental odors cannot be eliminated because they are external in source, but they may be minimized by switching to a climate control setting that uses recirculated air.**

NOTE: **Human and other interior-generated odors occur while the source is present and may linger for a short time after. These odors may be more noticeable during A/C operation. Human odors may be eliminated by removing the source and cleaning the affected area.**

NOTE: **Microbiological odors, if in the A/C system, usually last for about 30 seconds after the system is turned on. They will be detected while the A/C is turned on and using either outside or recirculated air. Microbiological odors that occur in areas other than the A/C system (for example, water in doors or wet carpeting) may last indefinitely and will be more intense when recirculated air is used. Microbiological odors will not be present at temperatures at or below 10°C (50° F).**

Microbiological odors can be eliminated by removing the source and treating the affected area. Standing water must be allowed to drain and dry out. A/C systems may be treated by using A/C cooling coil coating as described in the service procedure below.

Microbiological odors result from microbial growth supported by warm temperatures and moisture. Microbiological odors are described as musty/mildew type smells and may occur on/in:

- **foam seals.**
- **rubber seals.**
- **adhesives.**
- **standing water.**
- **water soaked carpet/trim.**

1. Identify the type of odor present in the vehicle. Do not proceed with A/C odor treatment if the odor source is found to be outside of the A/C system. Refer to the following chart for examples.

Odor Source	Odor Description
Chemical Odors	
Coolant	Sweet smell
Fuel	Gasoline or diesel fuel smell

Oil	Oil type or burning smell
Power Steering Fluid	Oil type or burning smell
Transmission Fluid	Oil type or burning smell
Washer Fluid	Alcohol type smell
Gear Lube	Garlic/sulfur smell
Refrigerant Oil	Ether type smell
Carpet/trim Adhesives	Fishy, urine or sweet smell
Evaporator Core Coating	Wet cement type smell
Environmental Odors	
Exhaust	Exhaust, fuel or burning type smell
Industrial Pollutants	Various smells
Dust	Musty, mildew or wet cement type smell
Pollen	Sweet smell
Tobacco	Burning, tar smell
Human and Other Interior Generated Odors	
Body Secretions	Body odor
Perfuming Agents	Sweet or fragrance smell
Clothing	Musty, mildew or body odors
	Sweet,

Food/Beverage	musty, mildew or fishy smell
Microbiological Odors	
Microbiological Odors Occurring Inside of A/C System	Musty, mildew smell lasting about 30 seconds after A/C is turned on
Microbiological Odors Occurring Outside of A/C System	Musty, mildew smell lasting indefinitely and possibly more pronounced when using recirculated air

2. Identify the source of the odor.
   - Check the passenger and driver side carpet for moisture. Continue diagnosis if moisture is found.
   - Check the blower motor and blower motor cover (if equipped) for moisture resulting from water bypassing the cowl baffling system. Continue diagnosis if moisture is present.
   - Check the evaporator core drain tube for restriction.
   - Check the cowl top panel and air inlet screen for standing water or foreign material. If possible, remove any standing water and clean the air inlet screen using a wet/dry vacuum.
3. Open all vehicle windows.
4. Disconnect the A/C pressure transducer electrical connector.
5. Set the following.
   - Enable the A/C using fresh air inlet.
   - Adjust the temperature setting to full warm.
   - Adjust the blower motor speed to HI.
6. Run the engine for 25 minutes to dry out the A/C system.
7. Turn the ignition OFF.
8. Remove the blower motor.
9. Remove the blower motor resistor (if equipped) or blower motor speed control (if equipped).

CAUTION: To avoid damage to the vehicle interior, do not spill or spray this product on any interior surface.

10. Add one full bottle of A/C cooling coil coating to the applicator or sprayer.
11. Insert the nozzle into the evaporator housing and direct the spray toward the evaporator core face. Spray the entire evaporator core face until empty.
12. Install the blower motor and blower motor resistor (if equipped) or blower motor speed control (if equipped).
13. Repeat Steps 6 through 8 to cure the evaporator core coating.
14. Connect the A/C pressure transducer electrical connector.

2008 HVAC

Climate Control - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B	177 ml (6 fl oz)
R-134a Refrigerant YN-19 (US); CYN-16-P or CYN-16-R (Canada)	WSH-M17B19-A	0.59 kg (21 oz)

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Magnetic Clutch	
Air gap between pulley and clutch disc	0.3-0.6 mm (0.012-0.024 in)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
A/C compressor bolts	25	18	-
A/C compressor clutch disc and hub bolt	14	10	-
A/C compressor manifold and tube suction fitting nut	15	11	-
A/C compressor manifold bolt	15	11	-
A/C compressor nut	25	18	-
A/C compressor stud	9	-	80
A/C (peanut) fitting nuts	15	11	-
A/C pressure relief valve	10	-	89
Condenser inlet fitting nut	15	11	-
Heater core and evaporator core housing nuts	9	-	80
High-pressure Schrader-type valve	2.5	-	22
High-pressure service gauge port valve cap	0.8	-	7
Low-pressure Schrader-type valve	1.8	-	16
Low-pressure service gauge port valve cap	0.8	-	7

Secondary air injection pump bolts	30	22	-
Thermostatic expansion valve (TXV) fitting nut	15	11	-
TXV manifold and tube bracket bolt	8	-	71
Washer reservoir filler neck bolt	6	-	53

DESCRIPTION AND OPERATION

AIR CONDITIONING

The refrigerant system components include the following:

- A/C compressor
- A/C clutch assembly
- A/C condenser core
- A/C evaporator core
- Receiver/drier cartridge
- Connecting refrigerant lines
- Thermostatic Expansion Valve (TXV)

The refrigerant system incorporates an A/C compressor controlled by the PCM through an A/C clutch relay. The climate control assembly sends an A/C request signal to the instrument cluster module, which relays the request to the PCM. An evaporator discharge air temperature sensor is used to disengage the A/C compressor clutch when the evaporator core temperature falls below an acceptable temperature.

The A/C compressor clutch will only be engaged by the PCM if all of the following conditions are met:

- The HVAC module is set to a mode which provides an A/C request to the PCM via the Instrument Cluster (IC).
- The evaporator discharge air temperature sensor is reading an acceptable temperature.
- The A/C pressure transducer is reading an acceptable pressure in the high side of the refrigerant system.
- The A/C compressor relay is switched to the closed position by the PCM.
- The engine coolant temperature is not excessively high.
- The PCM has not detected a Wide Open Throttle (WOT) condition.

An A/C pressure relief valve is installed in the A/C compressor to protect the refrigerant system against excessively high refrigerant pressures.

Refrigerant flow into the evaporator core is metered by a TXV.

A/C Compressor and Clutch Assembly

NOTE: **Internal A/C compressor components are not serviced separately. The A/C compressor is serviced only as an assembly. The clutch disc and hub, A/C**

compressor pulley and bearing and clutch field coil are serviceable.

The A/C compressor has the following characteristics:

- A non-serviceable shaft seal
- A pressure relief valve is installed in the rear of the compressor to protect the refrigerant system against excessively high refrigerant pressures
- The A/C compressor uses PAG oil or equivalent. This oil contains special additives required for the A/C compressor
- The A/C compressor oil may have some slightly dark-colored streaks while maintaining normal oil viscosity. This is normal for this A/C compressor because of break-in wear that can discolor the oil
- Use standard oil matching procedures when installing new compressors

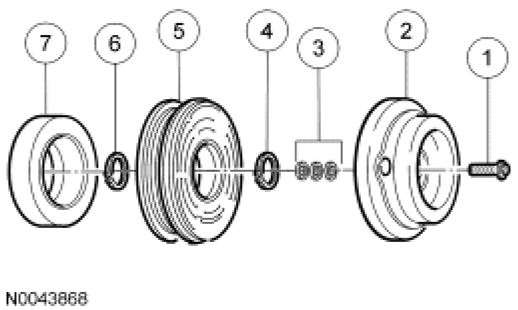


Fig. 1: A/C Compressor Clutch Assembly
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712303	A/C clutch disc and hub bolt
2	19D786	A/C clutch disc and hub
3	19D648	A/C clutch disc and hub spacers
4	W712302	A/C compressor pulley snap ring
5	19D784	A/C compressor pulley
6	W712301	A/C clutch field coil snap ring
7	19D798	A/C clutch field coil

When battery voltage is applied to the A/C compressor clutch field coil, the clutch plate and hub assembly is drawn toward the A/C clutch pulley. The magnetic force locks the clutch plate and hub assembly and the A/C clutch pulley together as one unit, causing the compressor shaft to rotate. When battery voltage is removed from the A/C compressor clutch field coil, springs in the clutch plate and hub assembly move the clutch plate away from the A/C clutch pulley.

A/C Pressure Relief Valve

NOTE: **If the A/C compressor is operating within limits and the A/C pressure relief valve is venting, or if the A/C pressure relief valve is leaking around the threads,**

replace the A/C pressure relief valve and O-ring. If the A/C pressure relief valve still vents after it is replaced, diagnose the refrigerant system for a restriction.

An A/C pressure relief valve is incorporated in the A/C compressor to prevent damage to the A/C compressor and other system components by relieving unusually high system discharge pressure buildups. For specifications regarding operating pressure(s), refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

The A/C pressure relief valve is a separate component and can be replaced separately from the A/C compressor. It is necessary to recover the refrigerant before removing the A/C pressure relief valve.

A/C Condenser/Power Steering Combo Cooler

The A/C condenser/power steering combo cooler is an aluminum fin-and-tube design heat exchanger located in front of the vehicle radiator. It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat and by condensing gas to liquid refrigerant as it is cooled.

The receiver/drier is incorporated onto the LH side of the condenser core. The receiver/drier cartridge is a separate component and can be removed and installed separately from the condenser core.

The top portion of the condenser/power steering combo cooler is partitioned from the refrigerant system and is used for power steering fluid cooling.

Receiver/Drier Cartridge

NOTE: **Installation of a new receiver/drier cartridge is not required when repairing the A/C system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier cartridge. Damage to the receiver/drier cartridge includes physical damage or moisture contamination. Moisture contamination results only from a complete loss of refrigerant, and equalization of the refrigerant system pressure with atmospheric pressure for a period longer than one hour. If even a slight amount of positive refrigerant pressure is present in the refrigerant system before repairs are carried out, the receiver/drier cartridge does not need to be replaced.**

The receiver/drier is integral to the A/C condenser/power steering combo cooler. It stores high-pressure liquid after it leaves the condenser core. A receiver/drier cartridge mounted inside the receiver/drier removes any retained moisture from the refrigerant. The receiver/drier cartridge is a separate component and can be removed and installed separately from the A/C condenser/power steering combo cooler.

Evaporator Core

The evaporator core is an aluminum plate/fin type and is located in the heater core and evaporator core housing. A mixture of refrigerant and oil enters the bottom of the evaporator core through the evaporator core inlet tube and continues out of the evaporator core through the evaporator core outlet tube. Air from the blower motor is cooled and dehumidified as it flows through the evaporator core fins.

Thermostatic Expansion Valve (TXV)

The Thermostatic Expansion Valve (TXV) is located between the evaporator core lines and the TXV manifold and tube assembly at the rear of the engine compartment. The TXV provides a restriction to the flow of refrigerant from the high-pressure side of the refrigerant system and separates the low-pressure and high-pressure sides of the refrigerant system. Refrigerant entering and exiting the evaporator core passes through the TXV through 2 separate flow paths. An internal temperature sensing bulb senses the temperature of the refrigerant flowing out of the evaporator core and adjusts an internal pin-type valve to meter the refrigerant flow into the evaporator core. The internal pin-type valve decreases the amount of refrigerant entering the evaporator core at lower temperatures and increases the amount of refrigerant entering the evaporator core at higher temperatures.

Evaporator Discharge Air Temperature Sensor

The evaporator discharge air temperature sensor contains a thermistor which receives a reference voltage from the PCM. The thermistor then varies the resistance to the reference voltage based on the evaporator discharge air temperature. The resulting voltage is returned to the PCM where it is interpreted as an evaporator air discharge temperature reading.

The PCM maintains evaporator core temperature and prevents icing of the evaporator core, by disengaging the A/C compressor clutch when the evaporator discharge air temperature sensor reading falls below acceptable levels, and by engaging the A/C compressor clutch when the discharge air temperature rises above acceptable levels.

The evaporator discharge air temperature sensor is located inside of the heater core and evaporator core housing in the air-stream leaving the evaporator core.

A/C Pressure Transducer

The A/C pressure transducer monitors the compressor discharge pressure and communicates with the PCM. The PCM will interrupt A/C compressor operation in the event that the A/C pressure transducer indicates high system discharge pressures. It is also used to sense low charge conditions. If the pressure is below a predetermined value for a given ambient temperature, the PCM will not allow the clutch to engage.

Service Gauge Port Valves

The high-pressure service gauge port valve is located on the condenser-to-evaporator line.

The low-pressure service gauge port valve is located on the TXV manifold and tube assembly.

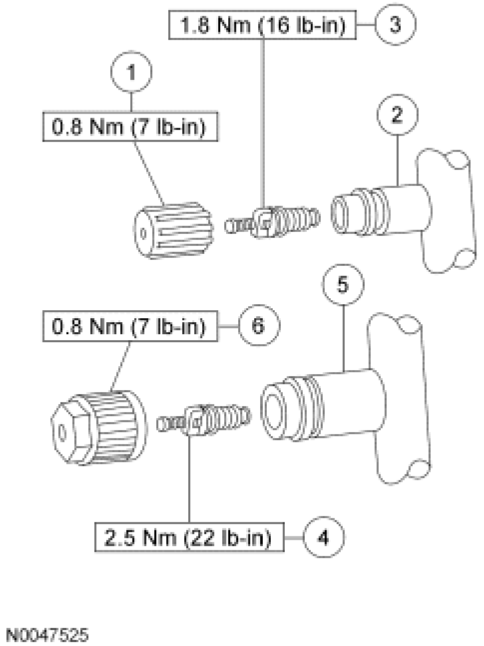


Fig. 2: Service Gauge Port Valves With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	19D702	Low-pressure service gauge port valve cap
2	-	Low-pressure service gauge port valve
3	19D701	Low-pressure Schrader-type valve
4	19D701	High-pressure Schrader-type valve
5	-	High-pressure service gauge port valve
6	19D702	High-pressure service gauge port valve cap

The fitting is an integral part of the refrigeration line or component.

- Special couplings are required for both the high-side and low-side service gauge ports.
- A very small amount of leakage will always be detectable around the Schrader-type valve with the service gauge port valve cap removed, and is considered normal. A new Schrader-type valve core can be installed if the seal leaks excessively.
- The service gauge port valve caps are used as primary seals in the refrigerant system to prevent leakage through the Schrader-type valves from reaching the atmosphere. Always install and tighten the A/C service gauge port valve caps to the correct torque after they are removed.

Refrigerant System Dye

Fluorescent refrigerant system dye is added to the refrigerant system at the factory to assist in refrigerant system leak diagnosis using a Rotunda-approved ultraviolet blacklight. It is not necessary to add additional dye to the refrigerant system before diagnosing leaks, even if a significant amount of refrigerant has been removed from the system. Additional refrigerant system dye should only be added if more than 50% of the refrigerant system lubricant capacity has been lost due to a fitting separation or hose rupture. Refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

AIR DISTRIBUTION AND FILTERING

NOTE: This vehicle is not equipped from the factory with a cabin air filter.

There are 2 sources of air available to the air distribution system:

- Outside air
- Recirculated air

Recirculated air is always used when the HVAC module is set to the MAX A/C mode on vehicles equipped with Electronic Manual Temperature Control (EMTC). Vehicles equipped with Electronic Automatic Temperature Control (EATC) use recirculated air only when the RECIRC function is selected in any mode other than DEFROST, or when required by the HVAC module in the AUTOMATIC mode.

Air distribution within the vehicle is determined by the EMTC systems or the EATC system in the AUTOMATIC mode. The air distribution mode on vehicles equipped with EATC can be overridden by the driver if desired. Airflow mode control doors are used to direct airflow within the heater core and evaporator core housing. Electric mode door actuators are used to position these airflow mode doors.

Vehicles equipped with dual-zone EATC use 2 separate temperature blend doors. This allows individual temperature settings to be selected for the RH and LH air outlets. The airflow mode doors are not partitioned for separate RH and LH airflow positions. Therefore, the airflow mode will always remain similar for the RH and LH sides of the vehicle regardless of the temperatures selected.

Air enters the passenger compartment from the:

- instrument panel registers.
- floor duct.
- windshield defroster.
- side window demisters.
- rear footwell duct (if equipped).

Passenger compartment air is exhausted from the vehicle through open windows or body air vents.

CONTROL COMPONENTS

Electronic Manual Temperature Control

The Electronic Manual Temperature Control (EMTC) components are used to select:

- air inlet source (outside or recirculated).
- blower motor speed.
- discharge air temperature (temperature blend).
- discharge air location (defrost, panel, floor).
- A/C compressor operation.

Control System Inputs

The EMTC system has 2 system control inputs.

HVAC Module

The HVAC module integrates the temperature control, airflow mode selection, A/C request button, recirculated air request button and rear defog switch into a single unit.

The temperature control switch setting determines air temperature. Movement of the temperature display from COOL (blue) to WARM (red) causes a corresponding movement of the temperature blend door and determines the air discharge temperature that the air distribution system will maintain. The temperature control switch is an integral part of the HVAC module and cannot be installed separately.

The A/C request button determines A/C compressor operation, except when the function selected is OFF, MAX or DEFROST. The A/C request button is an integral part of the HVAC module and cannot be installed separately.

The recirculated air request button can select recirculated air in any mode except DEFROST, and fresh air in any mode except MAX A/C or OFF.

The rear defog button signals activation of the heated backlight. The rear defog button is an integral part of the HVAC module and cannot be installed separately.

The HVAC module is not equipped with self-test capabilities.

Blower Motor Switch

The blower motor switch is mounted in the HVAC module and controls blower motor speed by adding or bypassing resistors in the blower motor resistor in all modes except OFF.

Control System Outputs

The EMTC system has 3 system outputs.

Blower Motor Resistor

The blower motor resistor:

- is located on the heater core and evaporator core housing near the blower motor.
- has 3 resistor elements mounted on the resistor board to provide 4 blower motor speeds.

- depending on the blower motor switch position, series resistance is added or bypassed in the blower motor circuit to decrease or increase blower motor speed.

Temperature Blend Door Actuator

The temperature blend door actuator:

- is located on the heater core and evaporator core housing.
- moves the temperature blend door on command from the HVAC module.
- contains a reversible electric motor and a potentiometer. The potentiometer wiper is connected to the actuator output shaft and moves with the output shaft to indicate the position of the temperature blend door.
- applies a 5-volt signal to one end of the potentiometer and ground to the other. The voltage available at the wiper indicates the position of the potentiometer. The expressed value of the actuator wiper voltage is sent to the HVAC module and is matched with an expected wiper voltage value. The HVAC module then drives the actuator motor in whichever direction is necessary to make the actuator wiper voltage agree with the expected HVAC module wiper voltage value.

Mode Door Actuator

The mode door actuator:

- uses a cam setup to direct system airflow to the vehicle interior as determined by the HVAC module.
- contains a reversible electric motor.
- contains a potentiometer. The potentiometer wiper is connected to the actuator output shaft and moves with the output shaft to indicate the position of the mode door.
- applies a 5-volt signal to one end of the potentiometer and ground to the other. The voltage available at the wiper indicates the position of the potentiometer. The expressed value of the actuator wiper voltage is sent to the HVAC module and is matched with an expected wiper voltage value. The HVAC module then drives the actuator motor in whichever direction is necessary to make the actuator wiper voltage agree with the expected HVAC module wiper voltage value.

Air Inlet Mode Door Actuator

The air inlet mode door actuator:

- moves the air inlet door between the FRESH and RECIRC positions on command from the HVAC module.
- contains a reversible electric motor.
- automatically stops when it reaches the full FRESH or full RECIRC position and does not report its position back to the HVAC module.

Electronic Automatic Temperature Control (EATC)

Two different Electronic Automatic Temperature Control (EATC) systems are available:

- Single-zone EATC (Fusion/Milan)
- Dual-zone EATC (MKZ)

The HVAC module analyzes input from the following major sources:

- Temperature, airflow direction, blower, A/C and RECIRC selection (made by the vehicle occupants)
- In-vehicle temperature sensor
- Ambient temperature sensor
- Solar radiation sensor
- Vehicle speed
- Engine coolant temperature

Using these inputs, the HVAC module determines the correct conditions for the following outputs:

- A/C compressor operation
- Blower speed
- Temperature blend door position
- DEFROST/PANEL/FLOOR door position
- Air inlet door position

Control System Inputs

The EATC system has 4 control system inputs.

HVAC Module

The HVAC module:

- is located in the instrument panel.
- has a vacuum fluorescent display for displaying set temperature, airflow direction, blower speed and DTCs.
- utilizes an On-Board Diagnostic (OBD) feature to supply the technician with DTCs. These DTCs direct the technician to the inoperative component.

In-Vehicle Temperature Sensor

The in-vehicle temperature sensor operates in the following manner:

- A thermistor in the in-vehicle temperature sensor measures air temperature inside the passenger compartment.
- An aspirator hose and elbow is connected between the heater core and evaporator core housing and the in-vehicle temperature sensor.
- The aspirator hose and elbow takes air from the heater core and evaporator core housing air stream to create a suction in the in-vehicle temperature sensor.

- The suction draws in-vehicle air into the in-vehicle temperature sensor and across the thermistor.

Solar Radiation Sensor (Sunload Sensor)

The solar radiation sensor supplies information to the HVAC module indicating sunload.

Ambient Temperature Sensor

The ambient temperature sensor signal is received by the HVAC module and indicates the outside air temperature. The ambient temperature sensor is located in front of the radiator on the radiator support.

Control System Outputs

The EATC system has 3 control system outputs.

Blower Motor Speed Control

The blower speed control:

- is located on the heater core and evaporator core housing near the blower motor.
- varies the blower motor speed and is controlled by the HVAC module software.

Temperature Blend Door Actuator(s)

Single-zone EATC systems use one temperature blend door actuator. Dual-zone EATC systems use 2 separate temperature blend door actuators to control 2 separate temperature blend doors for the driver and passenger sides of the vehicle. The temperature blend door actuator(s):

- is/are located on the heater core and evaporator core housing.
- move the temperature blend door(s) on command from the HVAC module.
- each contain a reversible electric motor and a potentiometer. The potentiometer wiper is connected to the actuator output shaft and moves with the output shaft to indicate the position of the temperature blend doors.

A 5-volt signal is applied to one end of the potentiometer and ground to the other. The voltage available at the wiper indicates the position of the potentiometer. The expressed value of the actuator wiper voltage is sent to the HVAC module and is matched with an expected wiper voltage value. The HVAC module then drives the actuator motor in whichever direction is necessary to make the actuator wiper voltage agree with the expected HVAC module wiper voltage value.

Mode Door Actuator

The mode door actuator:

- uses a cam setup to position the 2 airflow mode doors to direct system airflow to the vehicle interior as determined by the HVAC module settings.
- contains a reversible electric motor.

- contains a potentiometer. The potentiometer wiper is connected to the actuator output shaft and moves with the output shaft to indicate the position of the mode door.

A 5-volt signal is applied to one end of the potentiometer and ground to the other. The voltage available at the wiper indicates the position of the potentiometer. The expressed value of the actuator wiper voltage is sent to the HVAC module and is matched with an expected wiper voltage value. The HVAC module then drives the actuator motor in whichever direction is necessary to make the actuator wiper voltage agree with the expected HVAC module wiper voltage value.

Air Inlet Mode Door Actuator

The air inlet mode door actuator:

- moves the air inlet door between the FRESH and RECIRC positions on command from the HVAC module.
- contains a reversible electric motor.
- automatically stops when it reaches the full FRESH or full RECIRC position and does not report its position back to the HVAC module.

HEATING AND VENTILATION

The heating and ventilation system has the following features:

- Controls the temperature and, during A/C operation, reduces the relative humidity of the air inside the vehicle
- Delivers heated or cooled air to maintain the vehicle interior temperature and comfort level
- Cooling or heating can be adjusted to maintain the desired temperature
- Uses a reheat method to provide conditioned air to the passenger compartment
- All airflow from the blower motor passes through the A/C evaporator core
- Temperature blending is controlled by the temperature blend door(s), which regulate(s) the amount of air that flows through and around the heater core, where it is then mixed and distributed

Heater Core

The heater core consists of fins and tubes arranged to extract heat from the engine coolant and transfer the heat to air passing through the plenum.

Blower Motor

The blower motor pulls air from the air inlet and forces it into the heater core and evaporator core housing where it is mixed and distributed.

Heater Core and Evaporator Core Housing

The heater core and evaporator core housing directs airflow from the blower motor through the evaporator core and heater core. All airflow from the blower motor passes through the evaporator core. The airflow is then

directed through or around the heater core by the temperature blend door(s). Vehicles equipped with dual-zone Electronic Automatic Temperature Control (EATC) use a partitioned heater core and evaporator core housing with 2 electric actuator-positioned temperature blend doors. This allows for separate temperatures to be selected for the driver and passenger sides of the passenger compartment. Manual systems and single-zone EATC systems use a single electric actuator-positioned temperature blend door to direct airflow through or around the heater core.

REMOVAL AND INSTALLATION

AIR CONDITIONING (A/C) COMPRESSOR - 2.3L

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

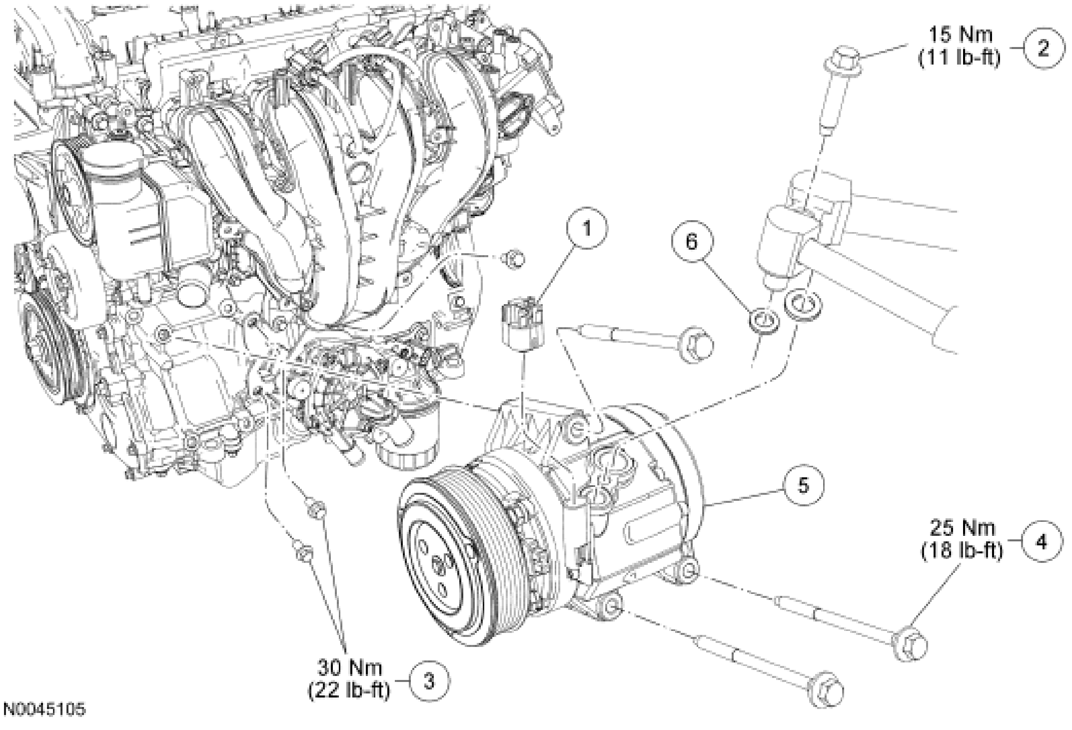


Fig. 3: Exploded View Of Air Conditioning (A/C) Compressor With Torque Specifications - 2.3L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Field coil electrical connector (part of 12B637)
2	W701625	A/C compressor manifold bolt
3	W500032	Secondary air injection pump bolts (3 required)

4	W710649	A/C compressor bolt (3 required)
5	19703	A/C compressor
6	19B596	Gasket seal (2 required)

REMOVAL AND INSTALLATION

CAUTION: If installing a new air conditioning (A/C) compressor due to an internal failure of the old unit, you must carry out the following procedures to remove contamination from the A/C system. Failure to remove contamination from the A/C system, if present, will result in poor A/C performance and/or damage to the new A/C compressor and other components.

- **If A/C flushing equipment is available, carry out flushing of the A/C system prior to installing a new A/C compressor. For additional information, refer to CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS article.**
- **If A/C flushing equipment is not available, carry out filtering of the A/C system after a new A/C compressor has been installed. For additional information, refer to CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS article.**
- **Install a new thermostatic expansion valve (TXV), as directed by the A/C flushing or filtering procedure.**
- **Install a new receiver/drier cartridge as directed by the A/C flushing or filtering procedure.**

NOTE: If installing a new A/C compressor, the A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil must be inspected and transferred from the old unit to the new unit if suitable for reuse.

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier cartridge. Damage to the receiver/drier cartridge includes physical damage or moisture contamination. Moisture contamination results only from a complete loss of refrigerant, and equalization of the refrigerant system pressure with atmospheric pressure for a period longer than 1 hour. If even a slight amount of positive refrigerant pressure is present in the refrigerant system before repairs are carried out, the receiver/drier cartridge does not need to be replaced.

1. If flushing of the A/C system has not been carried out, recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

3. Remove the lower engine splash shield.
4. Remove the drive belt from the A/C compressor pulley.
5. Disconnect the field coil electrical connector.
6. Remove the A/C compressor manifold bolt.
   - Discard the gasket seals.
   - To install, tighten to 15 Nm (11 lb-ft).
7. Remove the 3 secondary air injection pump bolts and position the pump aside (if equipped).
   - To install, tighten to 30 Nm (22 lb-ft).
8. Remove the 3 A/C compressor bolts.
   - To install, tighten to 25 Nm (18 lb-ft).
9. Remove the A/C compressor.
10. To install, reverse the removal procedure.
    - If a new A/C compressor is to be installed, the clutch assembly must be transferred from the old unit to the new unit. For additional information, refer to **Clutch and Clutch Field Coil** in this article.
    - Install new gasket seals.
    - If filtering of the A/C system is not to be carried out, lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
11. If filtering of the A/C system is not to be carried out, evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

AIR CONDITIONING (A/C) COMPRESSOR - 3.0L, 3.5L

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

NOTE: 3.0L shown, 3.5L similar.

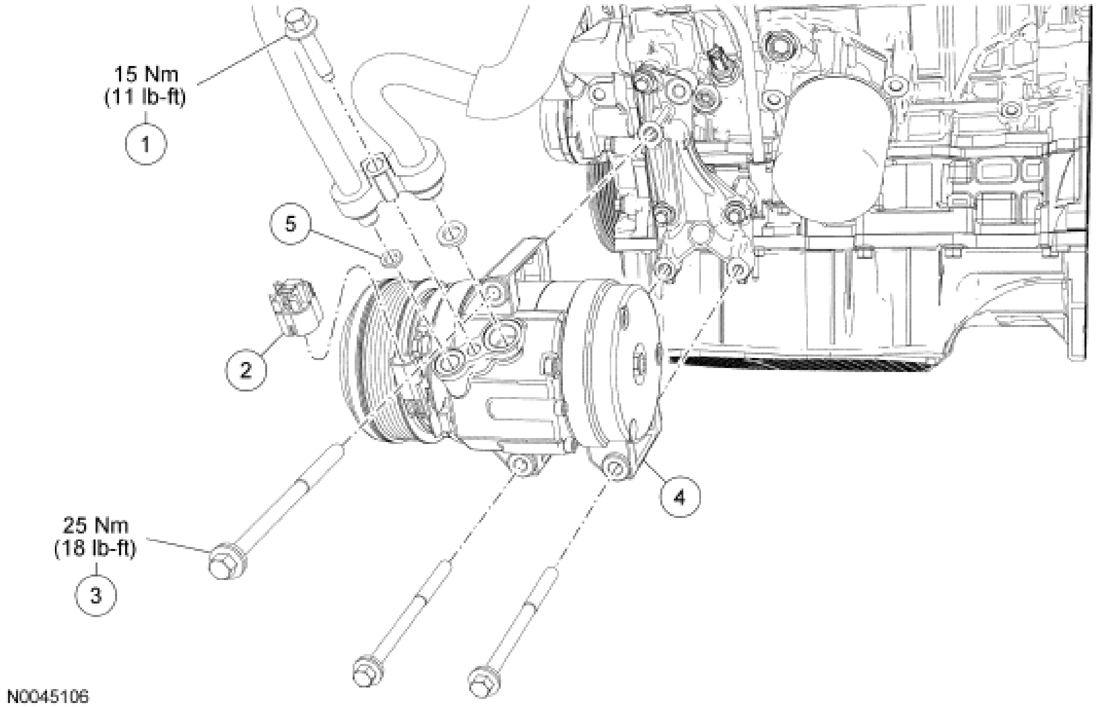


Fig. 4: Exploded View Of Air Conditioning (A/C) Compressor With Torque Specifications - 3.0L, 3.5L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701625	A/C compressor manifold bolt
2	-	Field coil electrical connector (part of 12B637)
3	W710649	A/C compressor bolt (3 required for 3.0L) (2 required for 3.5L)
4	19703	A/C compressor
5	19B596	Gasket seal (2 required)

REMOVAL AND INSTALLATION

CAUTION: If installing a new air conditioning (A/C) compressor due to an internal failure of the old unit, you must carry out the following procedures to remove contamination from the A/C system. Failure to remove contamination from the A/C system, if present, will result in poor A/C performance and/or damage to the new A/C compressor and other components.

- **If A/C flushing equipment is available, carry out flushing of the A/C system prior to installing a new A/C compressor. For additional information, refer to CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS article.**

- **If A/C flushing equipment is not available, carry out filtering of the A/C system after a new A/C compressor has been installed. For additional information, refer to CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS article.**
- **Install a new thermostatic expansion valve (TXV), as directed by the A/C flushing or filtering procedure.**
- **Install a new receiver/drier cartridge as directed by the A/C flushing or filtering procedure.**

NOTE: If installing a new A/C compressor, the A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil must be inspected and transferred from the old unit to the new unit if suitable for reuse.

NOTE: Installation of a new receiver/drier cartridge is not required when repairing the air conditioning system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier cartridge. Damage to the receiver/drier cartridge includes physical damage or moisture contamination. Moisture contamination results only from a complete loss of refrigerant, and equalization of the refrigerant system pressure with atmospheric pressure for a period longer than 1 hour. If even a slight amount of positive refrigerant pressure is present in the refrigerant system before repairs are carried out, the receiver/drier cartridge does not need to be replaced.

All vehicles

1. If flushing of the A/C system has not been carried out, recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
3. Remove the lower engine splash shield (if equipped).
4. Remove the drive belt from the A/C compressor pulley.
5. Remove the A/C compressor manifold bolt.
   - Discard the gasket seals.
   - To install, tighten to 15 Nm (11 lb-ft).
6. Disconnect the field coil electrical connector.

   3.0L vehicles

7. Remove the 3 A/C compressor bolts.
   - To install, tighten to 25 Nm (18 lb-ft).

   3.5L vehicles

8. Remove the 2 A/C compressor bolts.
    - To install, tighten to 25 Nm (18 lb-ft).
9. Remove the A/C compressor stud.
    1. Remove the A/C compressor nut.
    2. Remove the A/C compressor stud.
        - To install, tighten the stud to 9 Nm (80 lb-in).
        - To install, tighten the nut to 25 Nm (18 lb-ft).

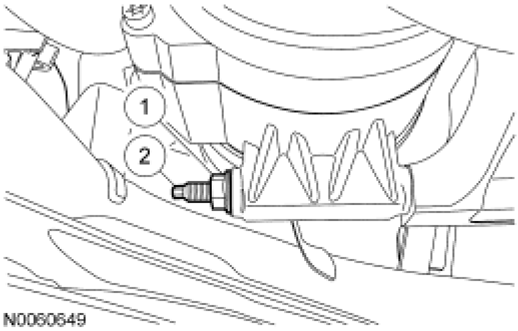


Fig. 5: Identifying A/C Compressor Nut & A/C Compressor Stud
Courtesy of FORD MOTOR CO.

All vehicles

10. Remove the A/C compressor.
11. To install, reverse the removal procedure.
    - If a new A/C compressor is to be installed, the clutch assembly must be transferred from the old unit to the new unit. For additional information, refer to **Clutch and Clutch Field Coil** in this article.
    - Install new gasket seals.
    - If filtering of the A/C system is not to be carried out, lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
12. If filtering of the A/C system is not to be carried out, evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

AIR CONDITIONING (A/C) EVAPORATOR DISCHARGE AIR TEMPERATURE SENSOR

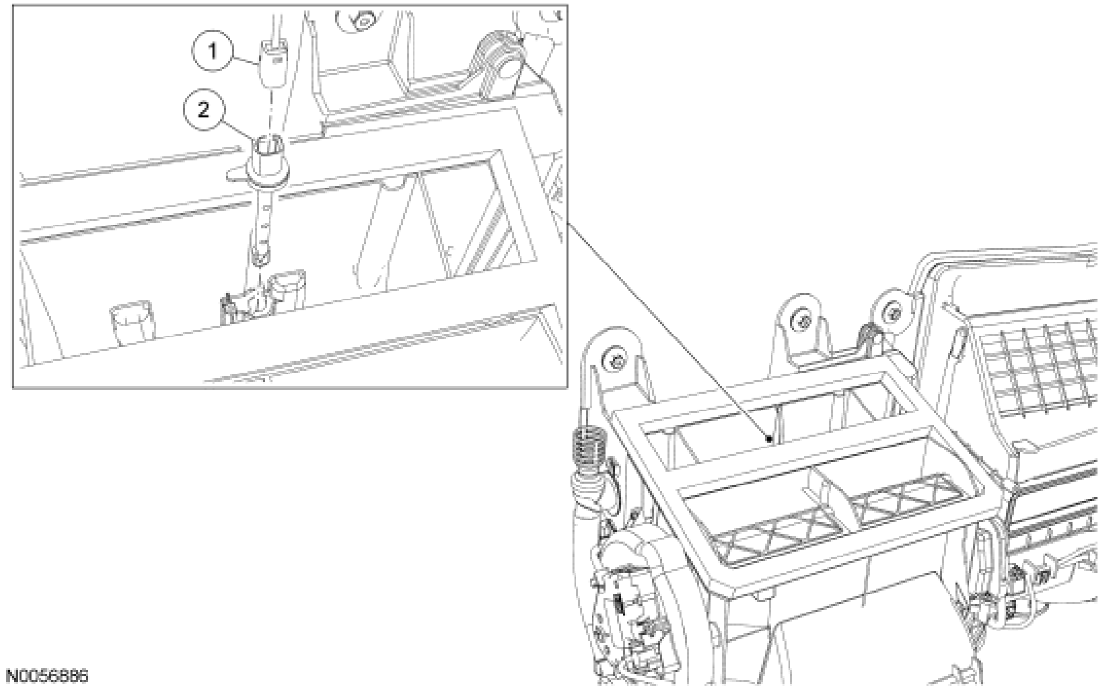


Fig. 6: Exploded View Of Air Conditioning (A/C) Evaporator Discharge Air Temperature Sensor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	A/C evaporator discharge air temperature sensor electrical connector (part of 19D887)
2	19C734	A/C evaporator discharge air temperature sensor

REMOVAL AND INSTALLATION

1. Remove the instrument panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Detach the A/C evaporator discharge air temperature sensor.
3. Disconnect the A/C evaporator discharge air temperature sensor electrical connector.
4. Remove the evaporator discharge air temperature sensor.
5. To install, reverse the removal procedure.

AIR CONDITIONING (A/C) PRESSURE RELIEF VALVE

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

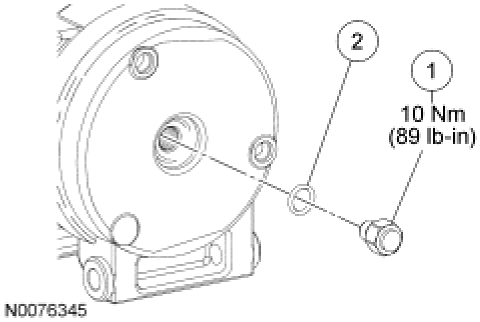


Fig. 7: Exploded View Of Air Conditioning (A/C) Pressure Relief Valve With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	19D644	A/C pressure relief valve
2	-	O-ring seal (part of 19D644)

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
3. Remove the A/C pressure relief valve and O-ring seal.
   - To install, tighten to 10 Nm (89 lb-in).

NOTE: A new O-ring seal will already be installed on the new A/C pressure relief valve service part.

4. To install, reverse the removal procedure.
   - Add the correct amount of clean PAG refrigerant oil to the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
5. Evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

AMBIENT AIR TEMPERATURE SENSOR

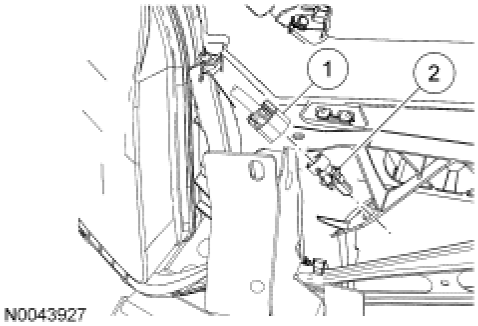


Fig. 8: Exploded View Of Ambient Air Temperature Sensor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Ambient air temperature sensor electrical connector (part of 14290)
2	19E642	Ambient air temperature sensor

REMOVAL AND INSTALLATION

Fusion or Milan vehicles

1. Remove the front bumper cover. For additional information, refer to **BUMPERS** article.

   MKZ vehicles

2. Remove the radiator grille upper sight shield.

   All vehicles

3. Disconnect the ambient air temperature sensor electrical connector.
4. Remove the ambient air temperature sensor.
5. To install, reverse the removal procedure.

BLOWER MOTOR

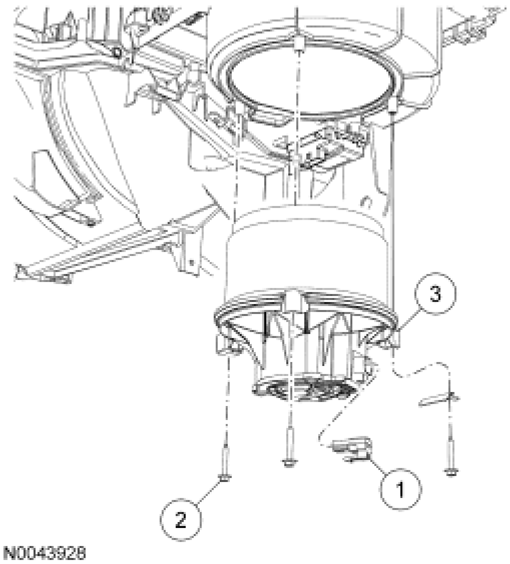


Fig. 9: Exploded View Of Blower Motor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Blower motor electrical connector (part of 19D887)
2	-	Blower motor screw (3 required)
3	19805	Blower motor

REMOVAL AND INSTALLATION

MKZ vehicles

1. Remove the RH lower instrument panel insulator.

   All vehicles

2. Disconnect the blower motor electrical connector.
3. Remove the 3 blower motor screws.
4. Remove the blower motor.
5. To install, reverse the removal procedure.

BLOWER MOTOR RESISTOR

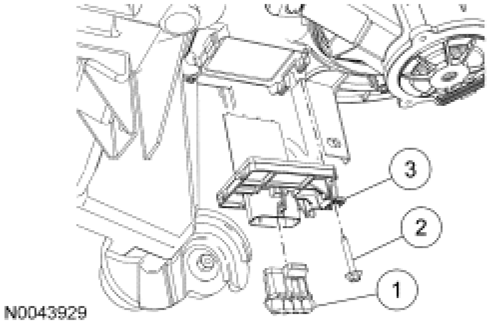


Fig. 10: Exploded View Of Blower Motor Resistor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Blower motor resistor electrical connector (part of 19D887)
2	-	Blower motor resistor screw
3	18591	Blower motor resistor

REMOVAL AND INSTALLATION

1. Disconnect the blower motor resistor electrical connector.
2. Remove the blower motor resistor screw.
3. Remove the blower motor resistor.
4. To install, reverse the removal procedure.

BLOWER MOTOR SPEED CONTROL

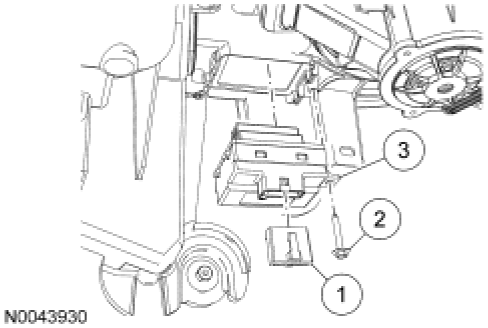


Fig. 11: Exploded View Of Blower Motor Speed Control
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Blower motor speed control electrical connector (part of 19D887)
2	-	Blower motor speed control screw

3	19E624	Blower motor speed control

REMOVAL AND INSTALLATION

MKZ vehicles

1. Remove the RH lower instrument panel insulator.

   All vehicles

2. Disconnect the blower motor speed control electrical connector.
3. Remove the blower motor speed control screw.
4. Remove the blower motor speed control.
5. To install, reverse the removal procedure.

BLOWER MOTOR SWITCH

REMOVAL AND INSTALLATION

1. Remove the climate control assembly. For additional information, refer to **Heating Ventilation Air Conditioning (HVAC) Module** in this article.
2. Pull and remove the blower motor switch knob.
3. Depress the tab and rotate the blower counterclockwise to remove.

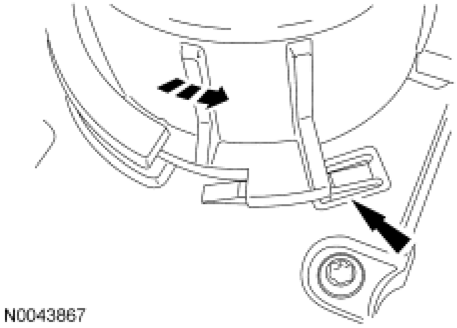


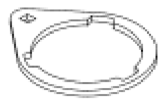
Fig. 12: Identifying Blower Motor Switch Components
Courtesy of FORD MOTOR CO.

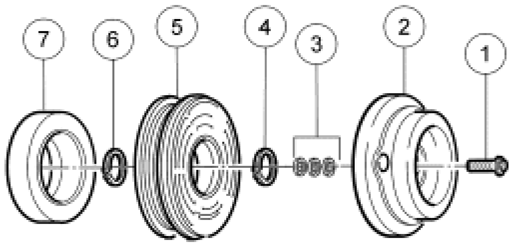
4. To install, reverse the removal procedure.

CLUTCH AND CLUTCH FIELD COIL

Special Tools

Illustration	Tool Name	Tool Number
	Holding Fixture, Compressor	

 ST2946-A	Clutch Disc and Hub	412-134



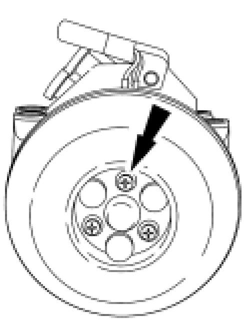
N0043868

Fig. 13: A/C Compressor Clutch Assembly
Courtesy of FORD MOTOR CO.

Item	**Part Number**	**Description**
1	W712303	A/C clutch disc and hub bolt
2	19D786	A/C clutch disc and hub
3	19D648	A/C clutch disc and hub spacers
4	W712302	A/C compressor pulley snap ring
5	19D784	A/C compressor pulley
6	W712301	A/C clutch field coil snap ring
7	19D798	A/C clutch field coil

REMOVAL

1. Remove the A/C compressor. For additional information, refer to **Air Conditioning (A/C) Compressor - 2.3L** or **Air Conditioning (A/C) Compressor - 3.0L, 3.5L** in this article.
2. Remove the 3 screws and the A/C clutch shield (if equipped).



N0045760

Fig. 14: Locating A/C Clutch Shield Screw

Courtesy of FORD MOTOR CO.

3. Remove the A/C clutch disc and hub bolt.
    1. Hold the A/C clutch disc and hub with the special tool.
    2. Remove the A/C clutch disc and hub bolt.

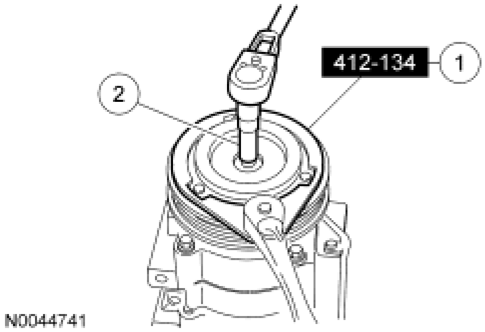


Fig. 15: A/C Clutch Disc & Hub Bolt
Courtesy of FORD MOTOR CO.

4. Remove the A/C clutch disc and hub.
5. Remove the A/C compressor pulley snap ring.
6. Remove the A/C compressor pulley.
7. Remove the A/C clutch field coil electrical connector clip screw.

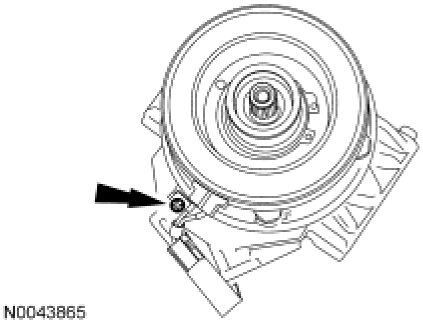


Fig. 16: Locating A/C Clutch Field Coil Electrical Connector Clip Screw
Courtesy of FORD MOTOR CO.

8. Remove the A/C clutch field coil snap ring.
9. Remove the A/C clutch field coil.

INSTALLATION

NOTE:	**If installing a new A/C compressor, the A/C clutch components should be reused unless obvious signs of damage are found. If excessive grooving is found, a new A/C clutch disc and hub and A/C compressor pulley must be installed together. Otherwise, each component can be installed individually**

where needed.

1. Visually inspect the A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil for damage.
   - Inspect for physical damage, including cracked or melted components or discoloration due to excessive heat.
   - Inspect for excessive wear, including grooving in the A/C clutch disc and hub or A/C compressor pulley that is more than fingernail depth.
   - Inspect for roughness in the A/C compressor pulley bearing.
2. Clean the A/C clutch field coil and pulley mounting surfaces.
3. Install the A/C clutch field coil.
4. Install the A/C clutch field coil snap ring.
5. Install the A/C clutch field coil electrical connector clip screw.

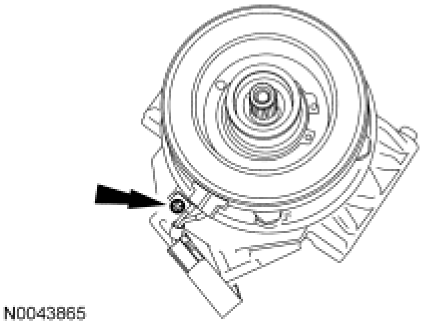


Fig. 17: Locating A/C Clutch Field Coil Electrical Connector Clip Screw
Courtesy of FORD MOTOR CO.

NOTE: The A/C clutch pulley is a tight fit on the A/C compressor head. It must be correctly aligned during installation.

6. Install the A/C clutch pulley.
7. Install the A/C clutch pulley snap ring.
8. Place one nominal thickness A/C clutch disc and hub spacer inside the clutch hub spline opening.
9. Install the A/C clutch disc and hub assembly.
10. Install the A/C clutch disc and hub bolt.
    1. Hold the A/C clutch disc and hub with the special tool.
    2. Install the A/C clutch disc and hub bolt.
    3. Tighten to 14 Nm (10 lb-ft).

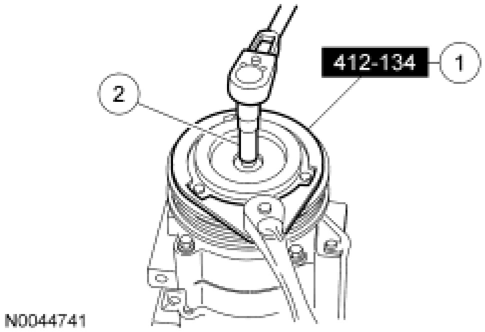


Fig. 18: A/C Clutch Disc & Hub Bolt
Courtesy of FORD MOTOR CO.

11. Install the A/C clutch shield and the 3 screws.

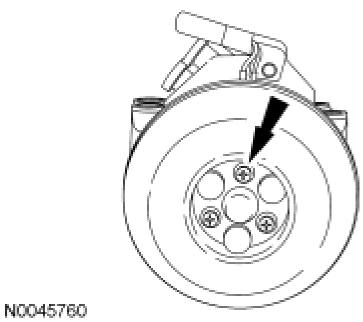


Fig. 19: Locating A/C Clutch Shield Screw
Courtesy of FORD MOTOR CO.

12. Measure and adjust the clutch air gap by removing or adding A/C clutch hub spacers.

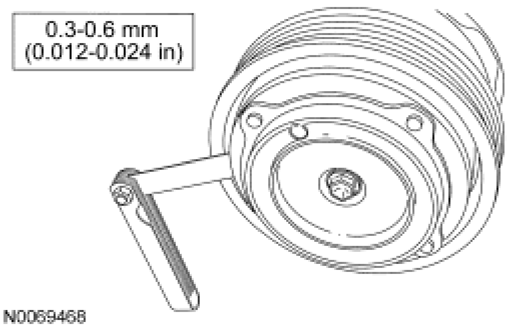


Fig. 20: Checking A/C Compressor Clutch Air Gap
Courtesy of FORD MOTOR CO.

13. Install the A/C compressor. For additional information, refer to **Air Conditioning (A/C) Compressor - 2.3L** or **Air Conditioning (A/C) Compressor - 3.0L, 3.5L** in this article.

COMPRESSOR MANIFOLD AND TUBE ASSEMBLY - 2.3L

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

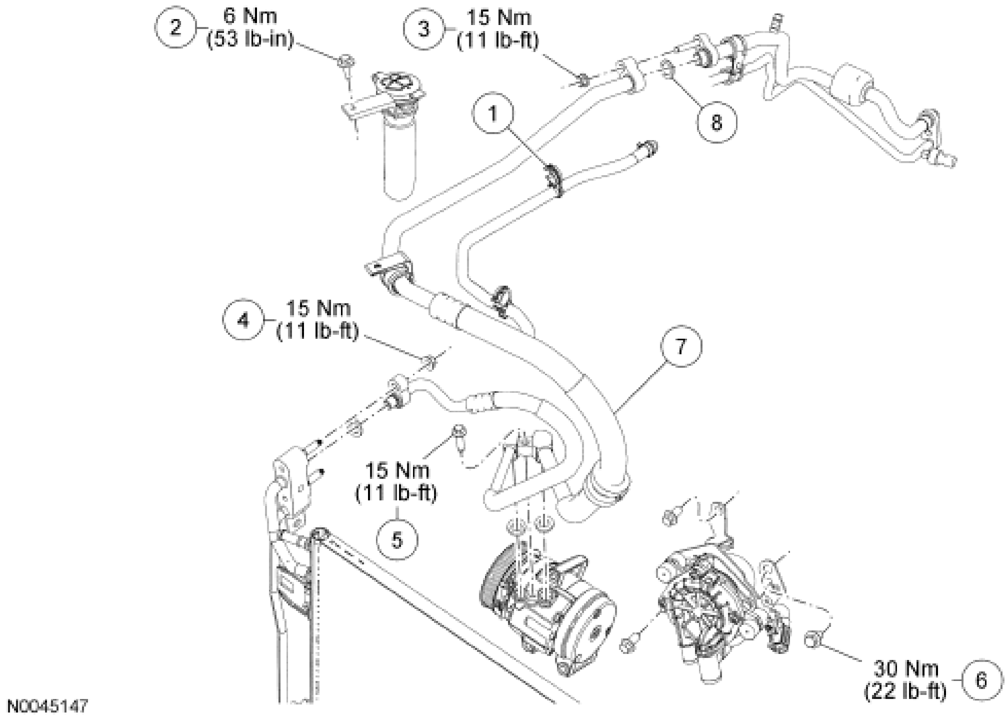


Fig. 21: Exploded View Of Compressor Manifold & Tube Assembly With Torque Specifications - 2.3L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Coolant reservoir hose retainer (2 required)
2	W505422	Washer reservoir filler neck bolt
3	W520413	Compressor manifold and tube suction fitting nut
4	W520413	Condenser inlet fitting nut
5	W701625	Compressor manifold bolt
6	W500032	Secondary air injection pump bolt (3 required)
7	19D734	Compressor manifold and tube assembly
8	19B596	Gasket seal (4 required)

REMOVAL AND INSTALLATION

1. Recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
3. Detach the 2 coolant reservoir hose retainers from the compressor manifold and tube assembly.
4. Remove the washer reservoir filler neck bolt.
   - To install, tighten to 6 Nm (53 lb-in).
5. Remove the compressor manifold and tube suction fitting nut and disconnect the fitting.
   - Discard the gasket seal.
   - To install, tighten to 15 Nm (11 lb-ft).
6. Remove the condenser inlet fitting nut and disconnect the fitting.
   - Discard the gasket seal.
   - To install, tighten to 15 Nm (11 lb-ft).
7. Remove the lower engine splash shield.
8. Remove the compressor manifold bolt and detach the manifold from the A/C compressor.
   - Discard the gasket seals.
   - To install, tighten to 15 Nm (11 lb-ft).
9. Remove the 3 secondary air injection pump bolts and position the secondary air injection pump aside (if equipped).
   - To install, tighten to 30 Nm (22 lb-ft).
10. Remove the compressor manifold and tube assembly.
11. To install, reverse the removal procedure.
    - Install new gasket seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
12. Evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

COMPRESSOR MANIFOLD AND TUBE ASSEMBLY - 3.0L, 3.5L

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

NOTE: **3.0L shown, 3.5L similar.**

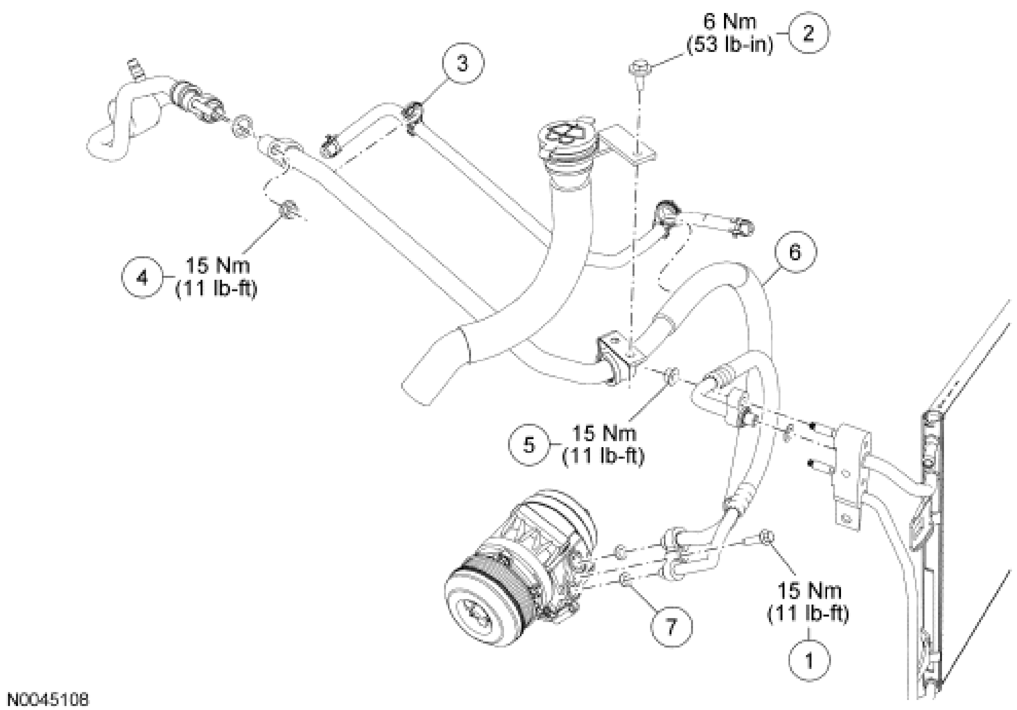


Fig. 22: Exploded View Of Compressor Manifold & Tube Assembly With Torque Specifications - 3.0L, 3.5L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701625	Compressor manifold bolt
2	W505422	Washer reservoir filler neck bolt
3	-	Coolant reservoir hose retainer (2 required)
4	W520413	Compressor manifold and tube suction fitting nut
5	W520413	Condenser inlet fitting nut
6	19D734	Compressor manifold and tube assembly
7	19B596	Gasket seal (4 required)

REMOVAL AND INSTALLATION

CAUTION: Do not stress or bend the aluminum lines on the compressor manifold and tube assembly to facilitate removal. Bending or squeezing the lines together may damage the welds and lead to premature failure of the line.

All vehicles

1. Recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
3. Remove the lower engine splash shield (if equipped).
4. Remove the compressor manifold bolt and detach the manifold from the A/C compressor.
    - Discard the gasket seals.
    - To install, tighten to 15 Nm (11 lb-ft).
5. Detach the 2 coolant reservoir hose retainers from the compressor manifold and tube assembly.
6. Remove the washer reservoir filler neck bolt.
    - To install, tighten to 6 Nm (53 lb-in).
7. Remove the compressor manifold and tube suction fitting nut and disconnect the fitting.
    - Discard the gasket seal.
    - To install, tighten to 15 Nm (11 lb-ft).
8. Remove the condenser inlet fitting nut and disconnect the fitting.
    - Discard the gasket seal.
    - To install, tighten to 15 Nm (11 lb-ft).

3.5L vehicles

NOTE: **Be sure not to strike the A/C lines against any hard object such as the exhaust manifold when removing the compressor manifold and tube assembly.**

9. Remove the compressor manifold and tube assembly.
    1. Rotate the compressor manifold and tube counterclockwise enough to allow it to be lifted between the exhaust manifold shield and alternator.
    2. Remove the compressor manifold and tube assembly.

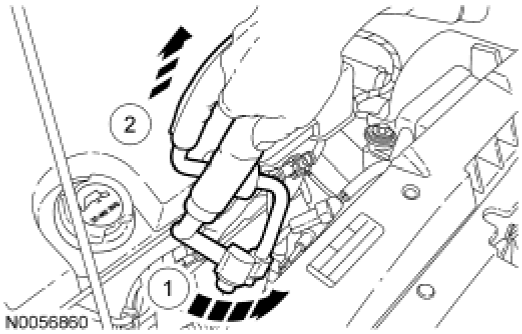


Fig. 23: Rotating Compressor Manifold & Tube Counterclockwise
Courtesy of FORD MOTOR CO.

3.0L vehicles

NOTE: **Be sure not to strike the A/C lines against any hard object such as the**

exhaust manifold when removing the compressor manifold and tube assembly.

10. Remove the compressor manifold and tube assembly.

    All vehicles

11. To install, reverse the removal procedure.
    - Install new gasket seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
12. Evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

CONDENSER CORE

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

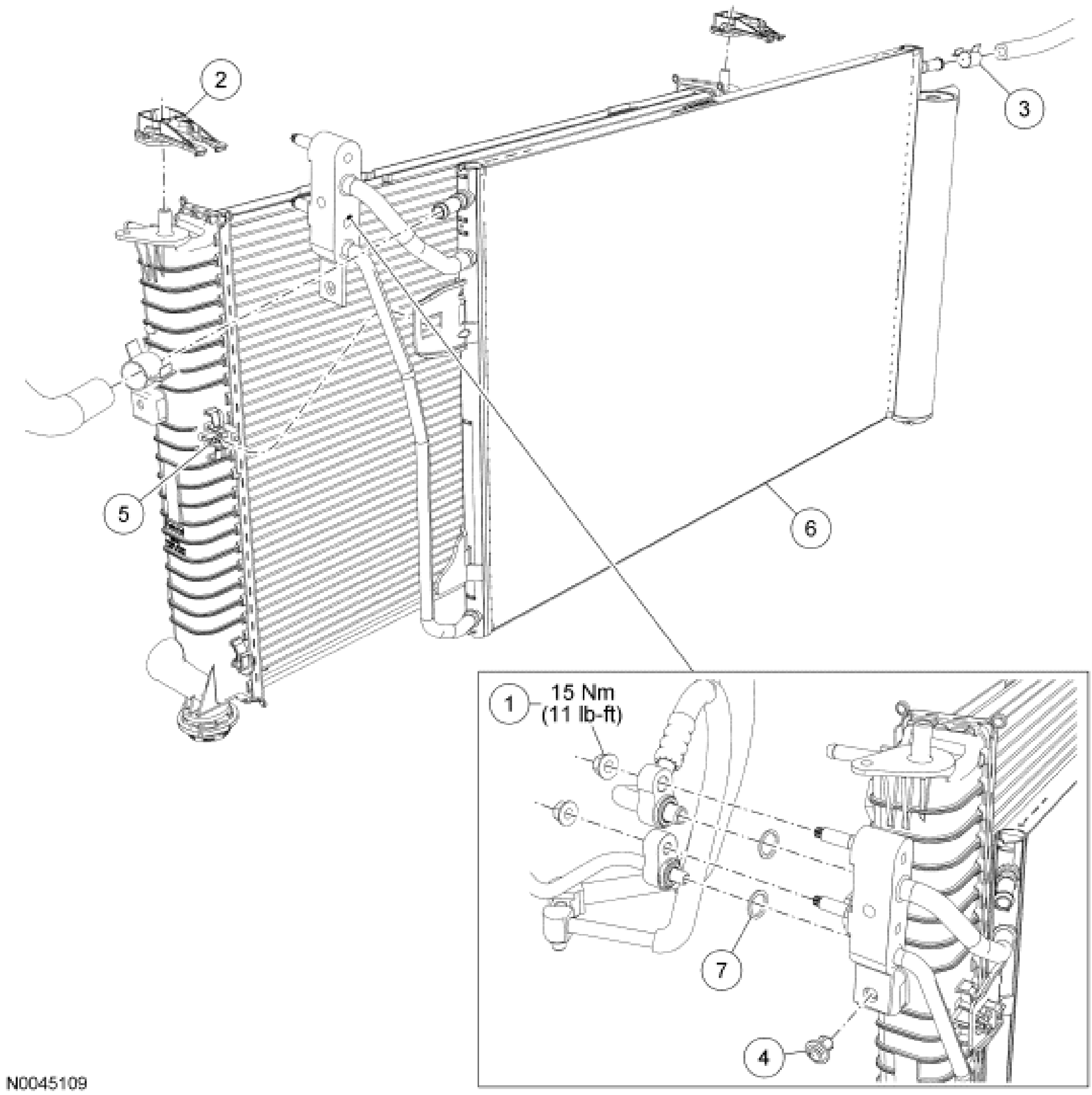


Fig. 24: Exploded View Of Condenser Core With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W520413	Condenser fitting nut (2 required)
2	8A193	Radiator bracket (2 required)
3	W525884	Power steering hose clamp (2 required)
4	W711622	Condenser manifold rivet
5	-	Condenser clip (2 required) (part of 8005)
6	19712	Condenser core
7	19B596	Gasket seal (2 required)

REMOVAL AND INSTALLATION

NOTE: New A/C condenser service parts are shipped with a new receiver/drier cartridge installed in the integral receiver/drier.

1. Recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
2. With the vehicle in NEUTRAL position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
3. Remove the cooling fan. For additional information, refer to **ENGINE COOLING** article.
4. Remove the washer reservoir filler neck bolt.
5. Remove the 2 condenser fitting nuts and disconnect the fittings.
   - Discard the gasket seals.
   - To install, tighten to 15 Nm (11 lb-ft).
6. Unclip the 2 radiator brackets from the radiator core support and position the cooling module rearward.
7. Remove the 2 radiator brackets.

   NOTE: Position a drain pan underneath each power steering hose connection.

8. Release the 2 power steering hose clamps at the condenser and disconnect the hoses.
9. Remove the condenser manifold rivet.
10. Release the 2 condenser clips at the radiator and detach the condenser from the radiator.
11. Remove the condenser core.
12. To install, reverse the removal procedure.
    - Install new gasket seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
13. Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.
14. Evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

EVAPORATOR CORE

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

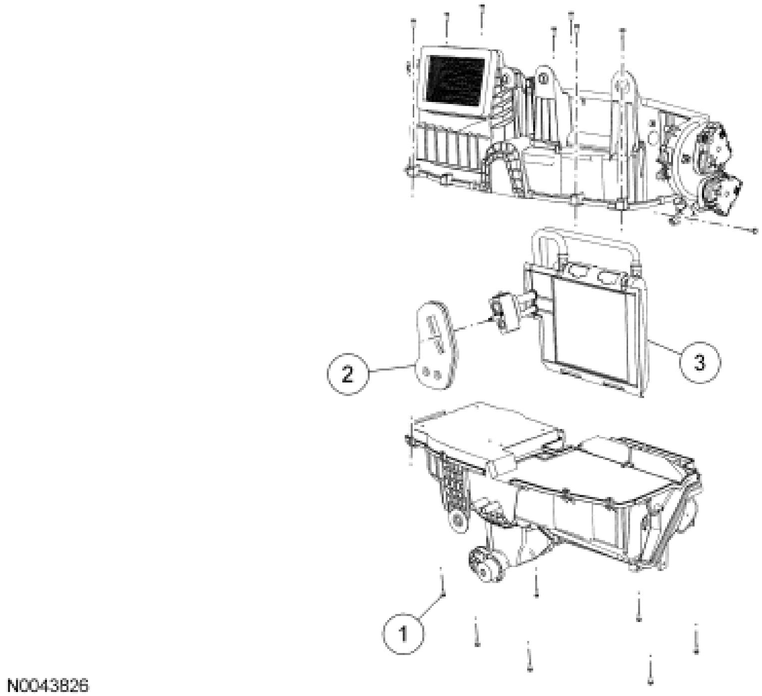


Fig. 25: Exploded View Of Evaporator Core
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712320	Evaporator core cover screw (15 required)
2	19W700	Dash panel seal
3	19860	Evaporator core

REMOVAL AND INSTALLATION

NOTE: If an evaporator core leak is suspected, the evaporator core must be leak tested before it is removed from the vehicle.

1. Remove the heater core and evaporator core housing. For additional information, refer to **Heater Core And Evaporator Core Housing** in this article.
2. Detach the wire harness from the heater core and evaporator core housing.
3. Remove the 15 evaporator core cover screws.
4. Separate the 2 halves of the heater core and evaporator core housing.
5. Remove the dash panel seal.
6. Remove the evaporator core.
7. To install, reverse the removal procedure.
   - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND**

DIAGNOSTICS article.

HEATER CORE

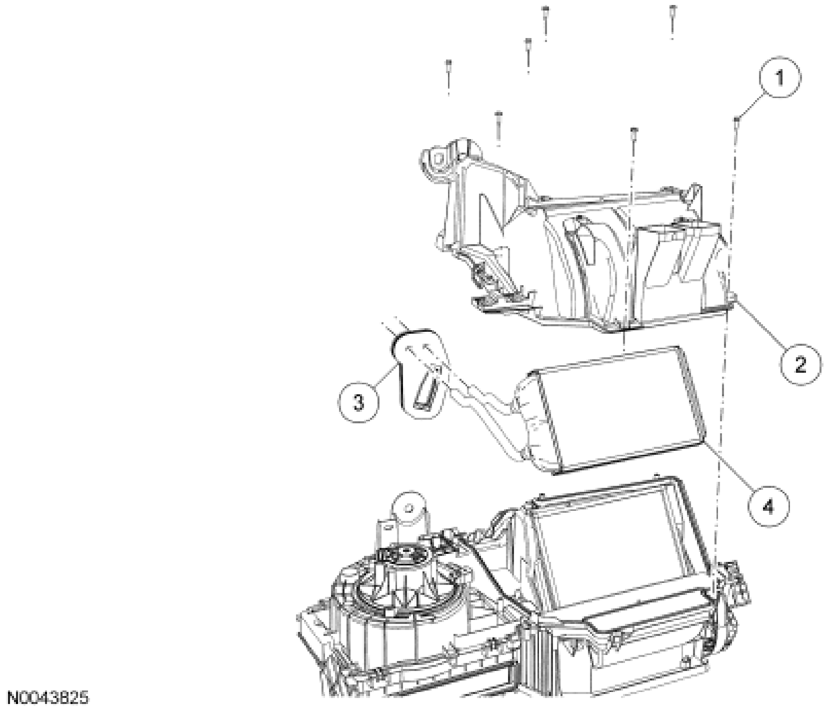


Fig. 26: Exploded View Of Heater Core
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712320	Heater core cover screw (8 required)
2	18B300	Heater core cover
3	19C593	Dash panel seal
4	18476	Heater core

REMOVAL AND INSTALLATION

NOTE: **If a heater core leak is suspected, the heater core must be pressure leak tested before it is removed from the vehicle. For additional information, refer to CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS article.**

1. Remove the heater core and evaporator core housing. For additional information, refer to **Heater Core And Evaporator Core Housing** in this article.
2. Detach the wire harness from the heater core cover.
3. Remove the 8 heater core cover screws.
4. Remove the heater core cover.

5. Remove the dash panel seal from the heater core tubes.
6. Remove the heater core.
7. To install, reverse the removal procedure.

HEATING VENTILATION AIR CONDITIONING (HVAC) MODULE

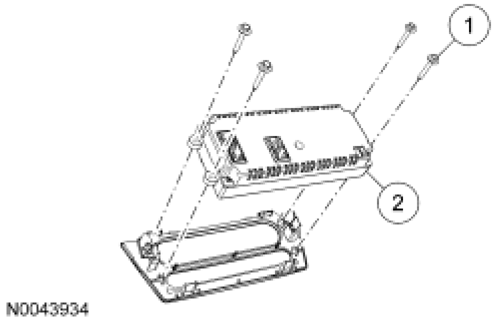


Fig. 27: Exploded View Of Climate Control Assembly
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505823	HVAC module screw (4 required)
2	19980	HVAC module

REMOVAL AND INSTALLATION

1. Remove the instrument panel lower center finish panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Remove the 4 HVAC module screws.
3. Remove the HVAC module.
4. To install, reverse the removal procedure.

HEATER CORE AND EVAPORATOR CORE HOUSING

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

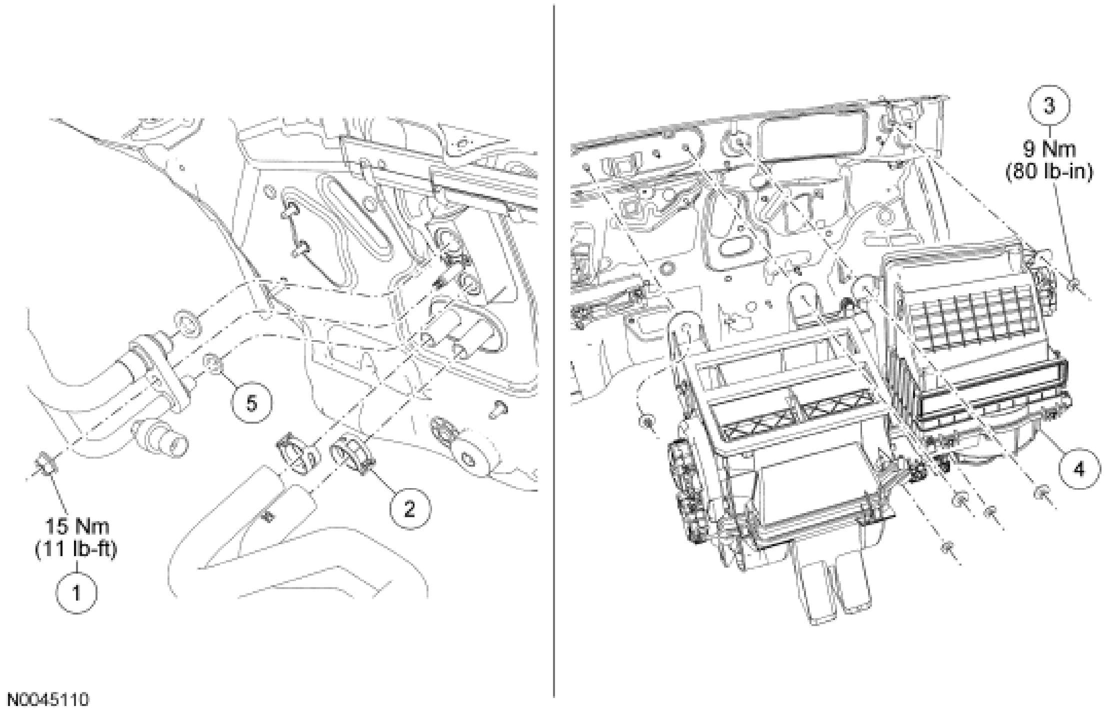


Fig. 28: Exploded View Of Heater Core & Evaporator Core Housing With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W520413	Thermostatic expansion valve (TXV) fitting nut
2	8287	Heater hose clamp (2 required)
3	N621907	Heater core and evaporator core housing nut (6 required)
4	-	Heater core and evaporator core housing
5	19B596	Gasket seal (2 required)

REMOVAL AND INSTALLATION

3.0L or 3.5L vehicles

1. Remove the lower cowl panel grille. For additional information, refer to **FRONT END BODY PANELS** article.

   All vehicles

2. Recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
3. Drain the engine coolant. For additional information, refer to **ENGINE COOLING** article.
4. Remove the instrument panel. For additional information, refer to **INSTRUMENT PANEL AND**

CONSOLE article.

5. Disconnect the A/C pressure transducer electrical connector and detach the wire harness from the thermostatic expansion valve (TXV) stud.

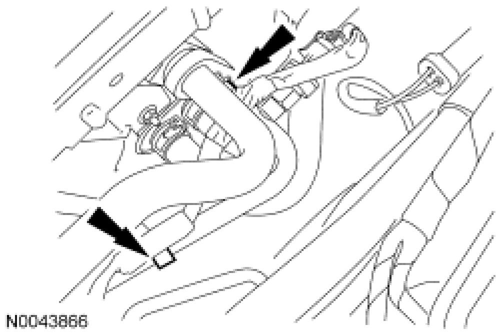


Fig. 29: Locating A/C Pressure Transducer Electrical Connector
Courtesy of FORD MOTOR CO.

6. Remove the TXV fitting nut and disconnect the fitting.
   - Discard the gasket seals.
   - To install, tighten to 15 Nm (11 lb-ft).
7. Release the heater hoses clamps and disconnect the hoses from the heater core
8. Remove the 6 heater core and evaporator core housing nuts.
   - To install, tighten to 9 Nm (80 lb-in).
9. Remove the heater core and evaporator core housing.
10. To install, reverse the removal procedure.
    - Install new gasket seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
11. Fill the engine coolant level. For additional information, refer to **ENGINE COOLING** article.
12. Evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

IN-VEHICLE TEMPERATURE SENSOR

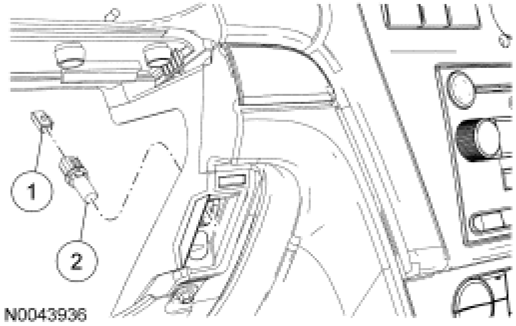


Fig. 30: Exploded View Of In-Vehicle Temperature Sensor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	In-vehicle temperature sensor electrical connector (part of 14401)
2	19C734	In-vehicle temperature sensor

REMOVAL AND INSTALLATION

1. Remove the lower steering column shroud screws.
2. Remove the lower steering column shroud.
3. Disconnect the in-vehicle temperature sensor electrical connector.
4. Remove the in-vehicle temperature sensor.
5. To install, reverse the removal procedure.

MODE DOOR ACTUATOR - AIR INLET DOOR

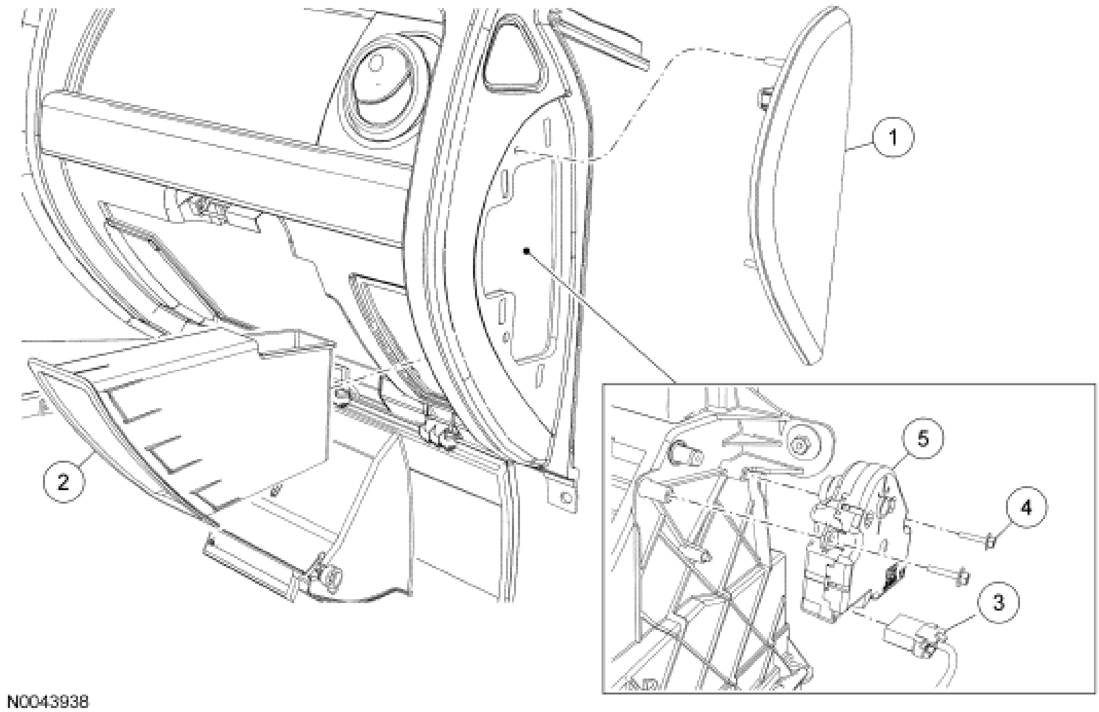


Fig. 31: Exploded View Of Mode Door Actuator - Air Inlet Door
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5404480	RH instrument panel end panel
2	5406010	Glove compartment storage bin

3	-	Air inlet mode door actuator electrical connector (part of 19D887)
4	W712320	Air inlet mode door actuator screw (2 required)
5	19E616	Air inlet mode door actuator

REMOVAL AND INSTALLATION

1. Lower the glove compartment.
2. Remove the RH instrument panel end panel.
3. Remove the glove compartment storage bin.
4. Disconnect the air inlet mode door actuator electrical connector.
5. Remove the air inlet mode door actuator.
6. To install, reverse the removal procedure.

MODE DOOR ACTUATOR - DEFROST/PANEL/FLOOR DOOR

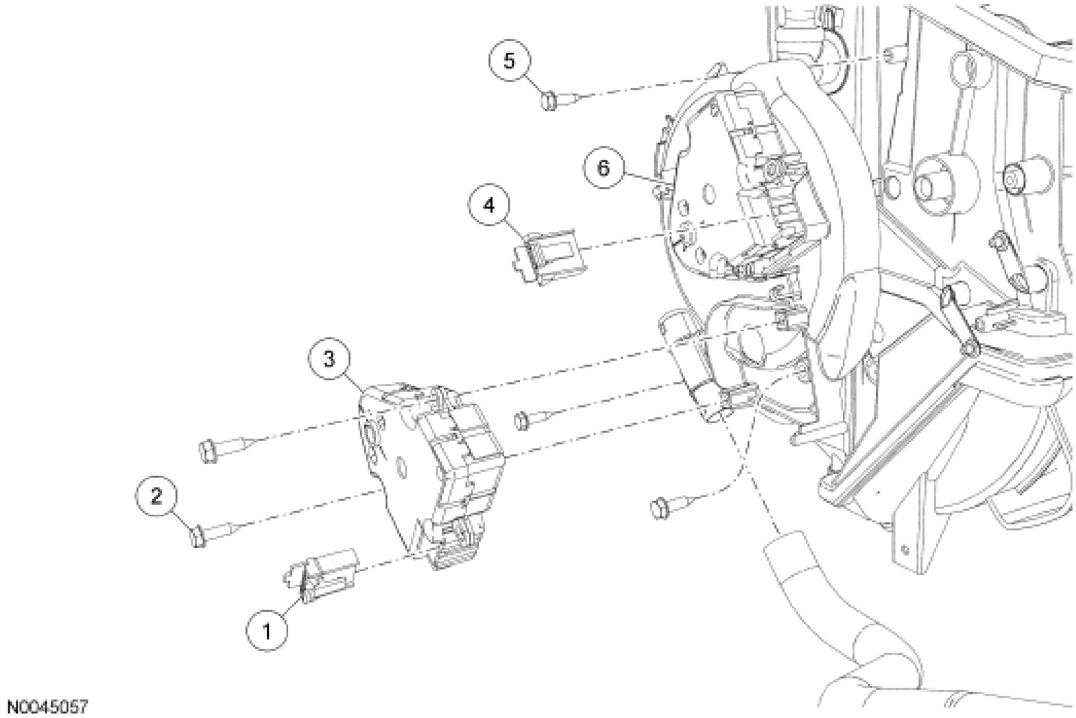


Fig. 32: Exploded View Of Mode Door Actuator - Defrost/Panel/Floor Door
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	LH temperature blend door actuator electrical connector (part of 19D887)
2	W712320	LH temperature blend door actuator screw (2 required)

3	19E616	LH temperature blend door actuator
4	-	DEFROST/PANEL/FLOOR mode door actuator electrical connector (part of 19D887)
5	W712320	DEFROST/PANEL/FLOOR mode door actuator and cam assembly screw
6	19C772	DEFROST/PANEL/FLOOR mode door actuator and cam assembly

REMOVAL AND INSTALLATION

1. Remove the instrument panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Disconnect the LH temperature blend door actuator electrical connector.
3. Remove the 2 LH temperature blend door actuator screws.
4. Remove the LH temperature blend door actuator.
5. Disconnect the DEFROST/PANEL/FLOOR mode door actuator electrical connector.
6. Remove the 3 DEFROST/PANEL/FLOOR mode door actuator and cam assembly screws.
7. Remove the DEFROST/PANEL/FLOOR mode door actuator and cam assembly.
8. To install, reverse the removal procedure.

RECEIVER DRIER CARTRIDGE

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

REMOVAL AND INSTALLATION

NOTE: **Care must be taken to minimize exposure of the receiver/drier cartridge to outside air. If multiple air conditioning (A/C) system components are being removed and installed, the receiver/drier cartridge should be installed last. The new receiver/drier cartridge should not be removed from its packaging until it is ready to be installed. Evacuation of the A/C system must be started as soon as the receiver/drier cartridge is installed. Excessive exposure of the receiver/drier cartridge to outside air will result in moisture contamination of the receiver/drier cartridge desiccant.**

NOTE: **Installation of a new receiver/drier cartridge is not required when repairing the A/C system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the receiver/drier cartridge. Damage to the receiver/drier cartridge includes physical damage or moisture contamination. Moisture contamination results only from a complete loss of refrigerant, and equalization of the refrigerant system pressure with atmospheric pressure for a**

period longer than one hour. If even a slight amount of positive refrigerant pressure is present in the refrigerant system before repairs are carried out, the receiver/drier cartridge does not need to be replaced.

1. Recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer **JACKING AND LIFTING** article.
3. Remove the lower radiator air deflector.
4. Unscrew and remove the plastic receiver/drier cap.

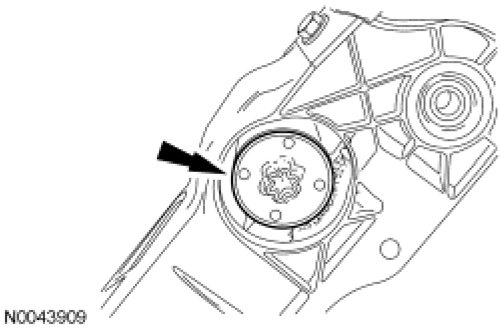


Fig. 33: Locating Plastic Receiver/Drier Cap
Courtesy of FORD MOTOR CO.

NOTE:	**If the receiver/drier plug is difficult to remove, open a refrigerant system fitting to relieve any vacuum created during refrigerant recovery, and attempt to remove the plug again.**

5. Remove the receiver/drier plug.
    1. Push the receiver/drier plug upwards and remove the snap ring.
    2. Install the bolt included with the A/C desiccant cartridge service kit in the center of the receiver drier plug and remove the plug.

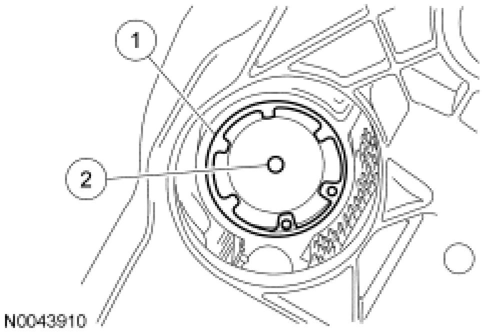


Fig. 34: Identifying Snap Ring And Receiver Drier Plug
Courtesy of FORD MOTOR CO.

6. Using a suitable tool, grasp the receiver/drier cartridge grab handle and remove the receiver/drier cartridge.

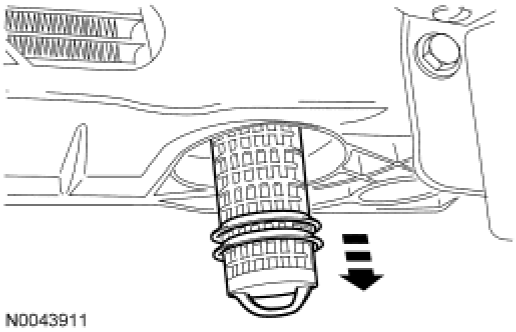


Fig. 35: Removing A/C Desiccant Cartridge
Courtesy of FORD MOTOR CO.

7. To install, reverse the removal procedure.
   - Lubricate the receiver/drier plug O-ring seals using residual refrigerant oil from inside the receiver/drier.
   - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
8. Evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

REGISTER - CENTER, FUSION/MILAN

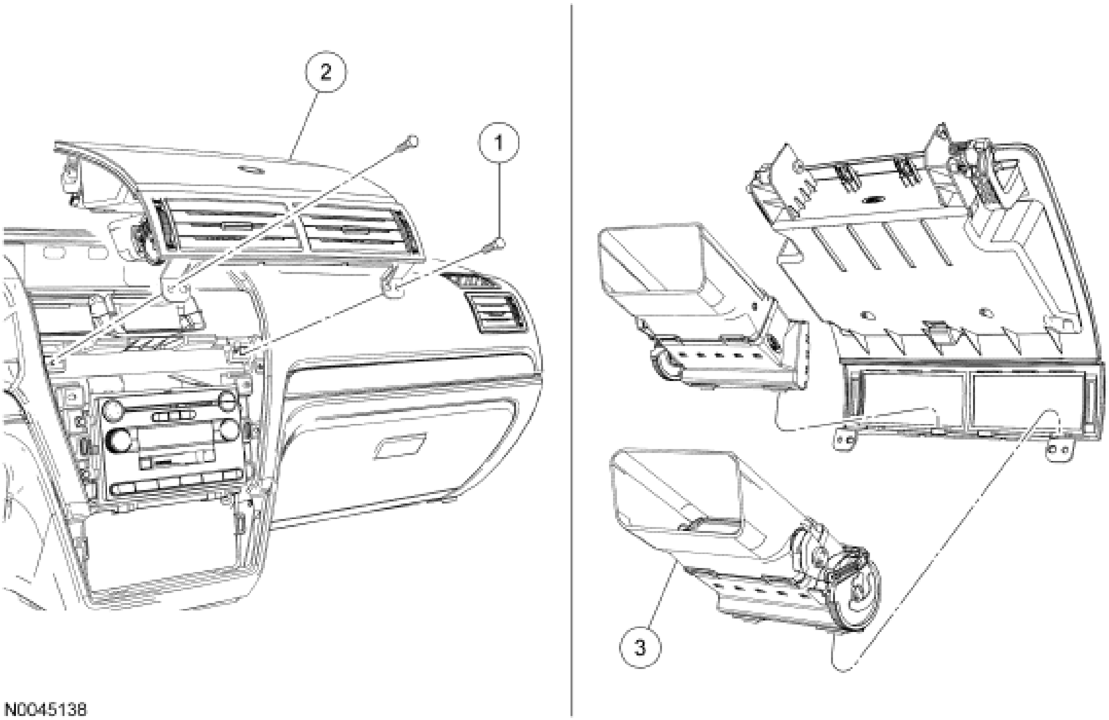


Fig. 36: Exploded View Of Register - Center, Fusion/Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Upper instrument panel storage bin screw (2 required)
2	5413594	Upper instrument panel storage bin
3	19893	Center instrument panel register (2 required)

REMOVAL AND INSTALLATION

1. Remove the audio unit bezel.
2. Remove the 2 upper instrument panel storage bin screws.
3. Remove the upper instrument panel storage bin.
4. Release the 3 upper clips on each register and remove the 2 center instrument panel registers.
5. To install, reverse the removal procedure.

REGISTER - DRIVER AND PASSENGER SIDE, FUSION/MILAN

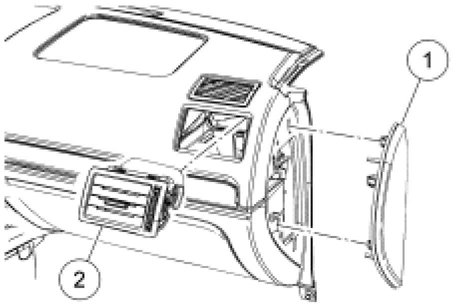


Fig. 37: Exploded View Of Register - Driver and Passenger Side, Fusion/Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5404480	Instrument panel end panel
2	19893	Register

REMOVAL AND INSTALLATION

NOTE: Passenger side register shown, driver side similar.

1. Remove the instrument panel end panel.
2. Working through the instrument panel end panel opening, release the 2 lower register clips and remove the driver or passenger side instrument panel register.
3. To install, reverse the removal procedure.

REGISTER - MKZ

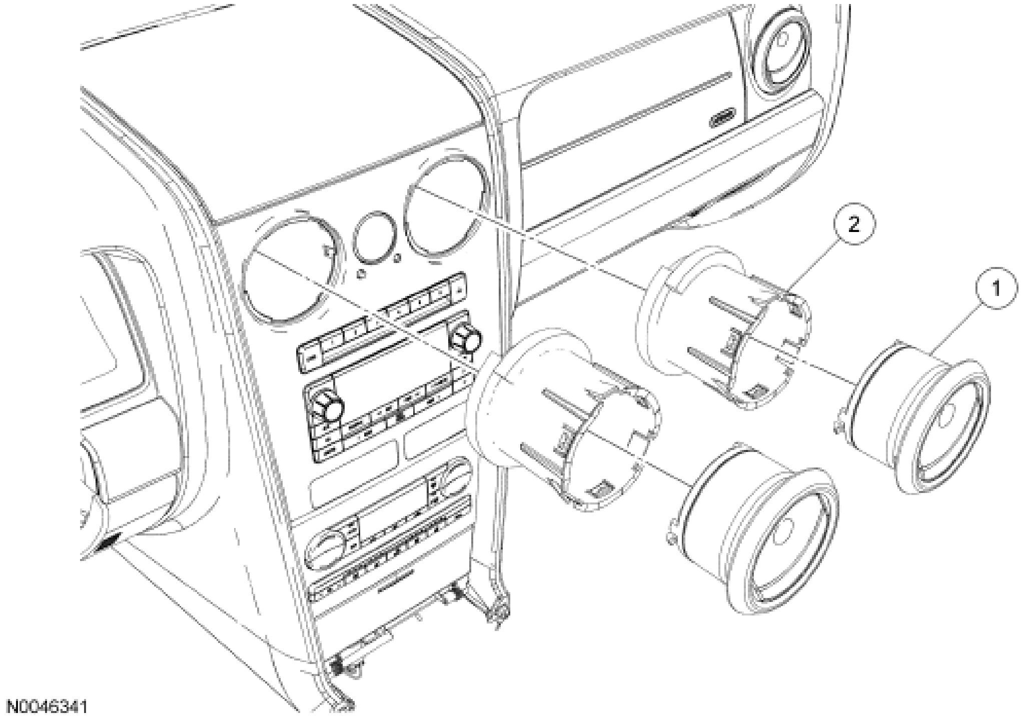


Fig. 38: Exploded View Of Register - MKZ
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Register barrel (part of 19893)
2	-	Register housing (part of 19893)

REMOVAL AND INSTALLATION

NOTE: Center registers shown, outer registers similar.

NOTE: To avoid damage to the instrument panel registers, rotate either left or right and pull straight out. Do not wiggle the register from side to side to free it.

1. Open the register barrel vanes, grasp the inside of the register barrel and pull the register barrel straight out.
2. Release the 3 tabs and remove the register housing.

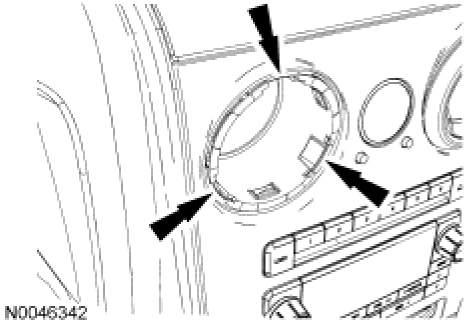


Fig. 39: Locating Register Housing Tabs
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.

TEMPERATURE BLEND DOOR ACTUATOR - LH

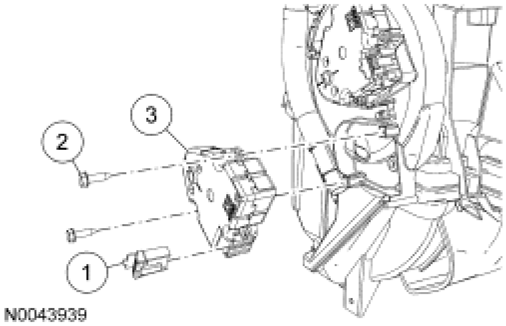


Fig. 40: Exploded View Of Temperature Blend Door Actuator - LH
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	LH temperature blend door actuator electrical connector (part of 19D887)
2	W712320	LH temperature blend door actuator screw (2 required)
3	19E616	LH temperature blend door actuator

REMOVAL AND INSTALLATION

NOTE: The LH temperature blend door actuator can be accessed from below the LH side of the instrument panel.

1. Disconnect the LH temperature blend door actuator.
2. Remove the 2 LH temperature blend door actuator screws.
3. Remove the LH temperature blend door actuator.
4. To install, reverse the removal procedure.

TEMPERATURE BLEND DOOR ACTUATOR - RH, DUAL-ZONE EATC

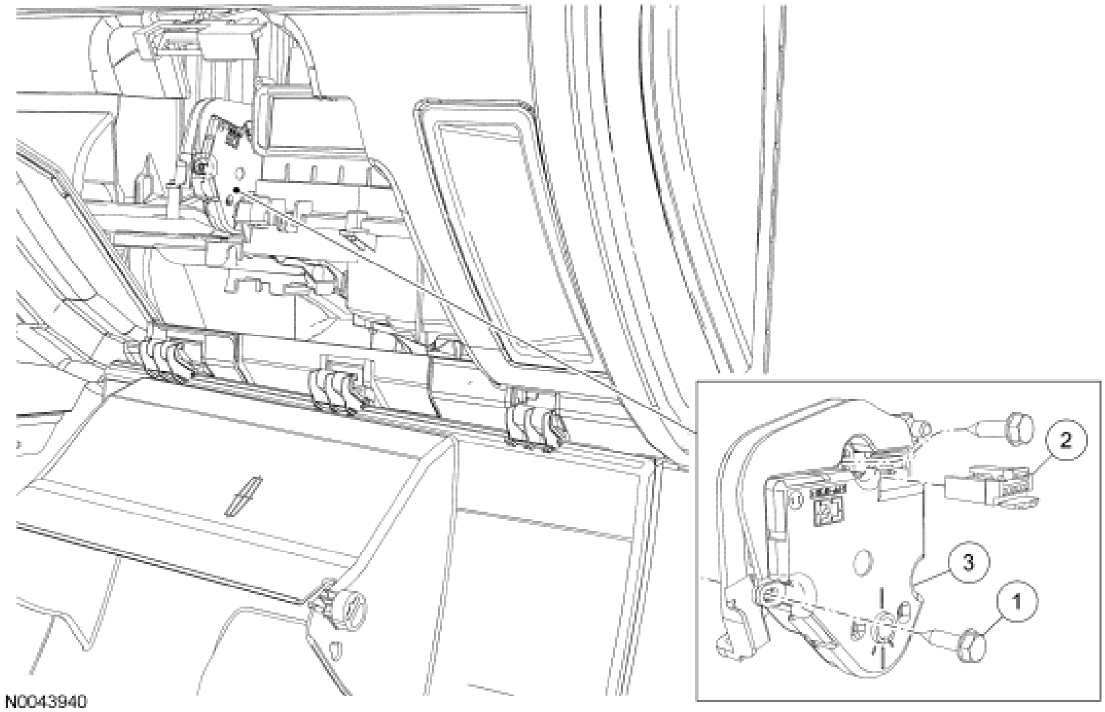


Fig. 41: Exploded View Of Temperature Blend Door Actuator - RH, Dual-Zone EATC
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712320	RH temperature blend door actuator screw (2 required)
2	-	RH temperature blend door actuator electrical connector (part of 19D887)
3	19E616	RH temperature blend door actuator

REMOVAL AND INSTALLATION

1. Remove the passenger air bag module. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
2. Disconnect the RH temperature blend door actuator electrical connector.
3. Remove the 2 RH temperature blend door actuator bracket screws.
4. Detach the wire harness from the RH temperature blend door actuator bracket.
5. Remove the RH temperature blend door actuator.
6. To install, reverse the removal procedure.

THERMOSTATIC EXPANSION VALVE

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

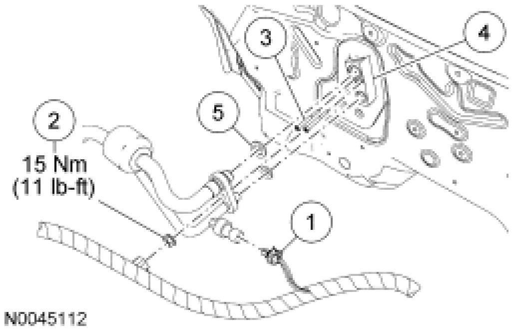


Fig. 42: Exploded View Of Thermostatic Expansion Valve With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	A/C pressure transducer electrical connector (part of 14290)
2	W520413	Thermostatic expansion valve (TXV) fitting nut
3	7A711	TXV bolt (2 required)
4	19849	TXV
5	19B596	Gasket seal (4 required)

REMOVAL AND INSTALLATION

1. Recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
2. Disconnect the A/C pressure transducer electrical connector and detach the wire harness from the thermostatic expansion valve (TXV) stud.
3. Remove the TXV fitting nut and disconnect the fitting.
   - Discard the gasket seals.
   - To install, tighten to 15 Nm (11 lb-ft).
4. Remove the 2 TXV bolts.
5. Remove the TXV.
   - Discard the gasket seals.
6. To install, reverse the removal procedure.
   - Install new gasket seals.
   - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

7. Evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

THERMOSTATIC EXPANSION VALVE MANIFOLD AND TUBE ASSEMBLY

Material

Item	Specification
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D	WSH-M1C231-B

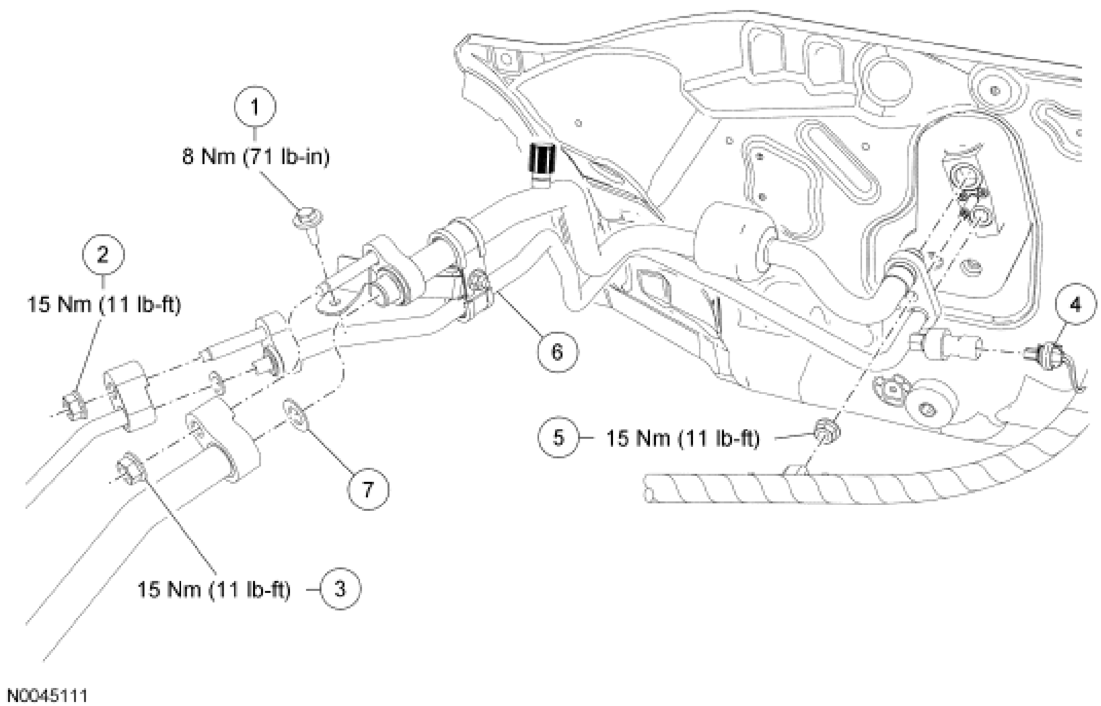


Fig. 43: Exploded View Of Thermostatic Expansion Valve Manifold & Tube Assembly With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W707399	Thermostatic expansion valve (TXV) manifold and tube bracket bolt
2	W520413	Condenser-to-evaporator line fitting nut
3	W520413	Compressor manifold and tube suction fitting nut
4	14290	A/C pressure transducer electrical connector
5	W520413	TXV fitting nut
6	19835	TXV manifold and tube
7	19B596	Gasket seal (4 required)

REMOVAL AND INSTALLATION

All vehicles

1. Recover the refrigerant. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

   3.5L vehicles

2. Detach the power steering reservoir from the bracket and position the power steering reservoir aside.

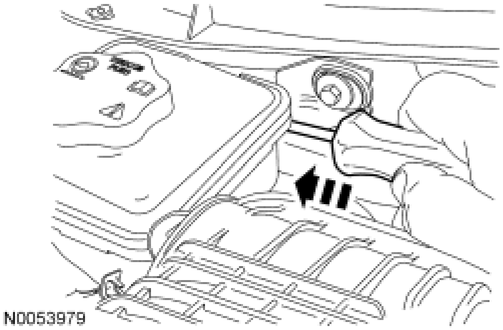


Fig. 44: Detaching Power Steering Reservoir From Bracket
Courtesy of FORD MOTOR CO.

All vehicles

3. Remove the TXV manifold and tube bracket bolt.
   - To install, tighten to 8 Nm (71 lb-in).
4. Detach the wire harness clip from the TXV manifold and tube assembly.

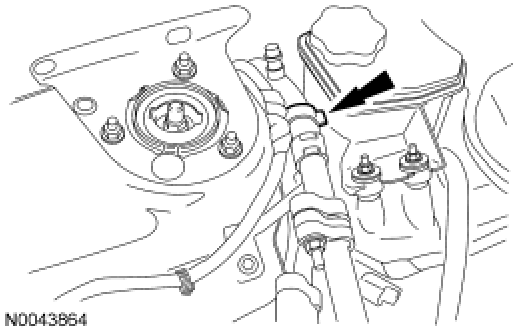


Fig. 45: Locating Wire Harness Clip
Courtesy of FORD MOTOR CO.

5. Remove the condenser-to-evaporator line fitting nut and disconnect the fitting.
   - Discard the gasket seal.
   - To install, tighten to 15 Nm (11 lb-ft).

6. Remove the compressor manifold and tube suction fitting nut and disconnect the fitting.
   - Discard the gasket seal.
   - To install, tighten to 15 Nm (11 lb-ft).
7. Disconnect the A/C pressure transducer electrical connector and detach the wire harness from the TXV manifold and tube.
8. Remove the TXV fitting nut and disconnect the fitting.
   - Discard the gasket seals.
   - To install, tighten to 15 Nm (11 lb-ft).
9. Remove the TXV manifold and tube assembly.
10. To install, reverse the removal procedure.
    - Install new gasket seals.
    - Lubricate the refrigerant system with the correct amount of clean PAG oil. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
11. Evacuate, leak test and charge the refrigerant system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

2008 ACCESSORIES & BODY, CAB

Clock - Fusion, Milan & MKZ

DESCRIPTION AND OPERATION

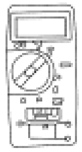
CLOCK

The stand-alone analog clock is mounted in the center of the instrument panel finish panel and is set using the 2 buttons located to either side of the clock face or the single knob located to the side of the face.

DIAGNOSTIC TESTS

CLOCK

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Clock	• Smart junction box (SJB) fuse 13 (7.5A) • Wiring, terminals or connectors

3. If an obvious cause for an observed or reported concern is found, correct the cause before proceeding to the next step.
4. If the fault is not visually evident, verify the symptom. Go to **Symptom Chart**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The clock illumination is inoperative/does not operate correctly	• Wiring, terminals or connectors • Clock • Smart junction box (SJB)	• **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article.
• The clock operation is erratic/inoperative	• Fuse • Wiring, terminals or connectors • Clock	• Go to **Pinpoint Test A**.

Pinpoint Tests

Pinpoint Tests A: The Clock Operation Is Erratic/Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Horn/Cigar Lighter for schematic and connector information.

Normal Operation

The clock receives battery voltage from the smart junction box (SJB) through circuit SBP07 (WH/RD). Ground for the clock is supplied through circuit GD116 (BK/VT).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Clock

PINPOINT TEST A: THE CLOCK OPERATION IS ERRATIC/INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 CHECK CIRCUIT SBP07 (WH/RD) FOR AN OPEN

- Key in OFF position.
- Disconnect: Clock C2016

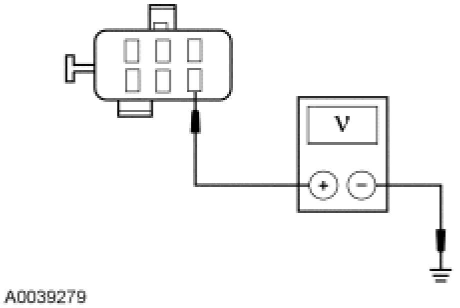


Fig. 1: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the clock C2016-6, circuit SBP07 (WH/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A2.

  NO : VERIFY that the SJB fuse 13 (7.5A) is OK. If OK, REPAIR the circuit. If not OK, REFER to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ to identify the possible causes of the circuit short. TEST the system for normal operation.

A2 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

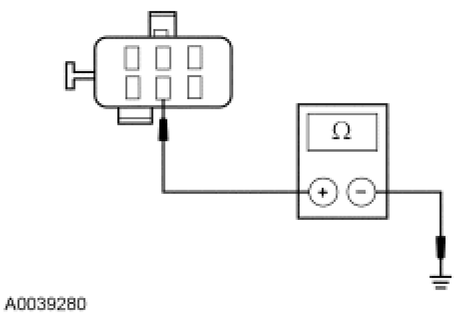


Fig. 2: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clock C2016-5, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new clock. REFER to **Clock - Fusion, Milan** or **Clock - MKZ**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

REMOVAL AND INSTALLATION

CLOCK - FUSION, MILAN

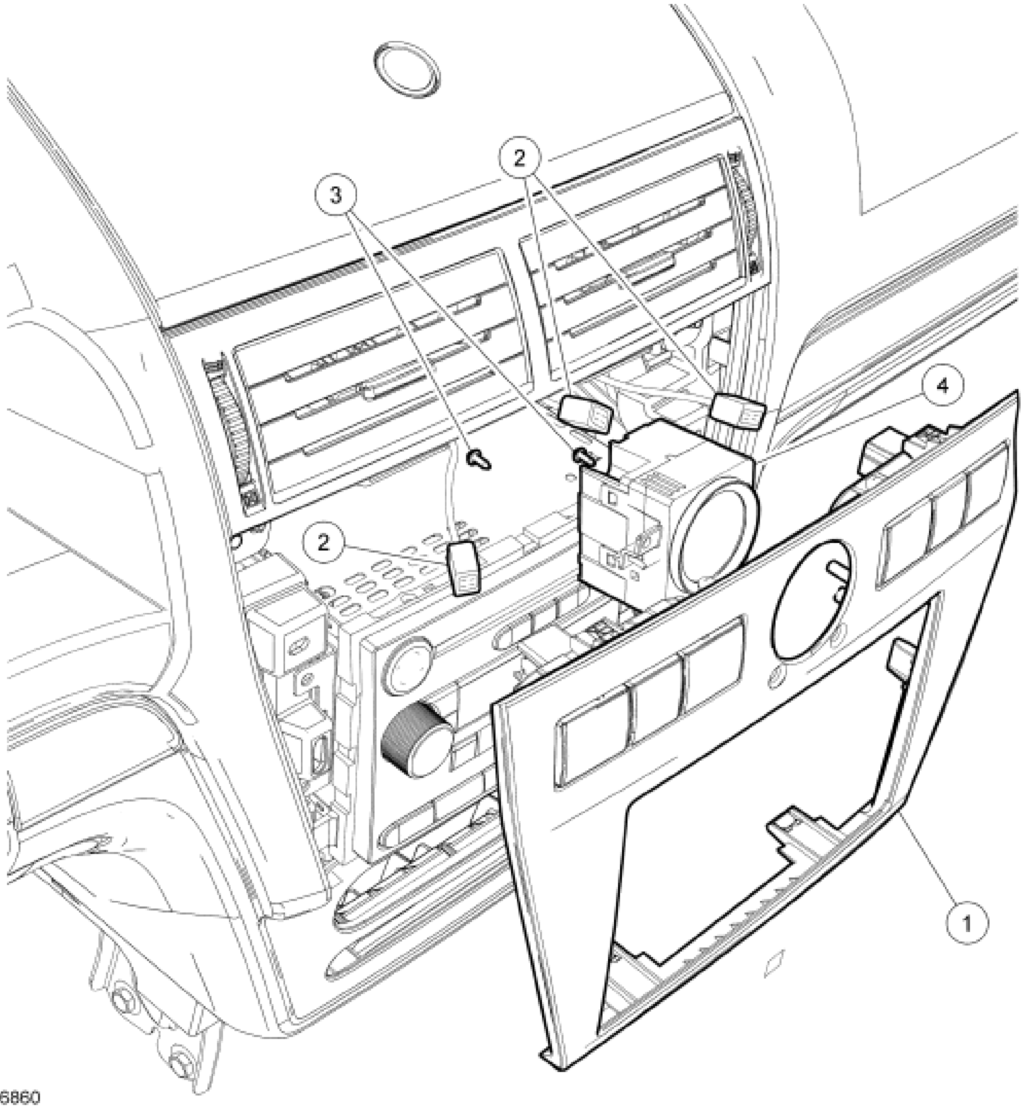


Fig. 3: Exploded View Of Clock - Fusion, Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5404302	Instrument panel center finish panel
2	-	Clock electrical wiring harness connector(s) (part of 14405)
3	W506921	Clock screws (2 required)
4	15000	Clock

REMOVAL AND INSTALLATION

1. Remove the instrument panel center finish panel by pulling rearward to release the spring clips.
    - Disconnect the electrical connectors as required.
2. Disconnect the electrical connectors as required.

3. Remove the 2 screws and the clock from the panel.
4. To install, reverse the removal procedure.

CLOCK - MKZ

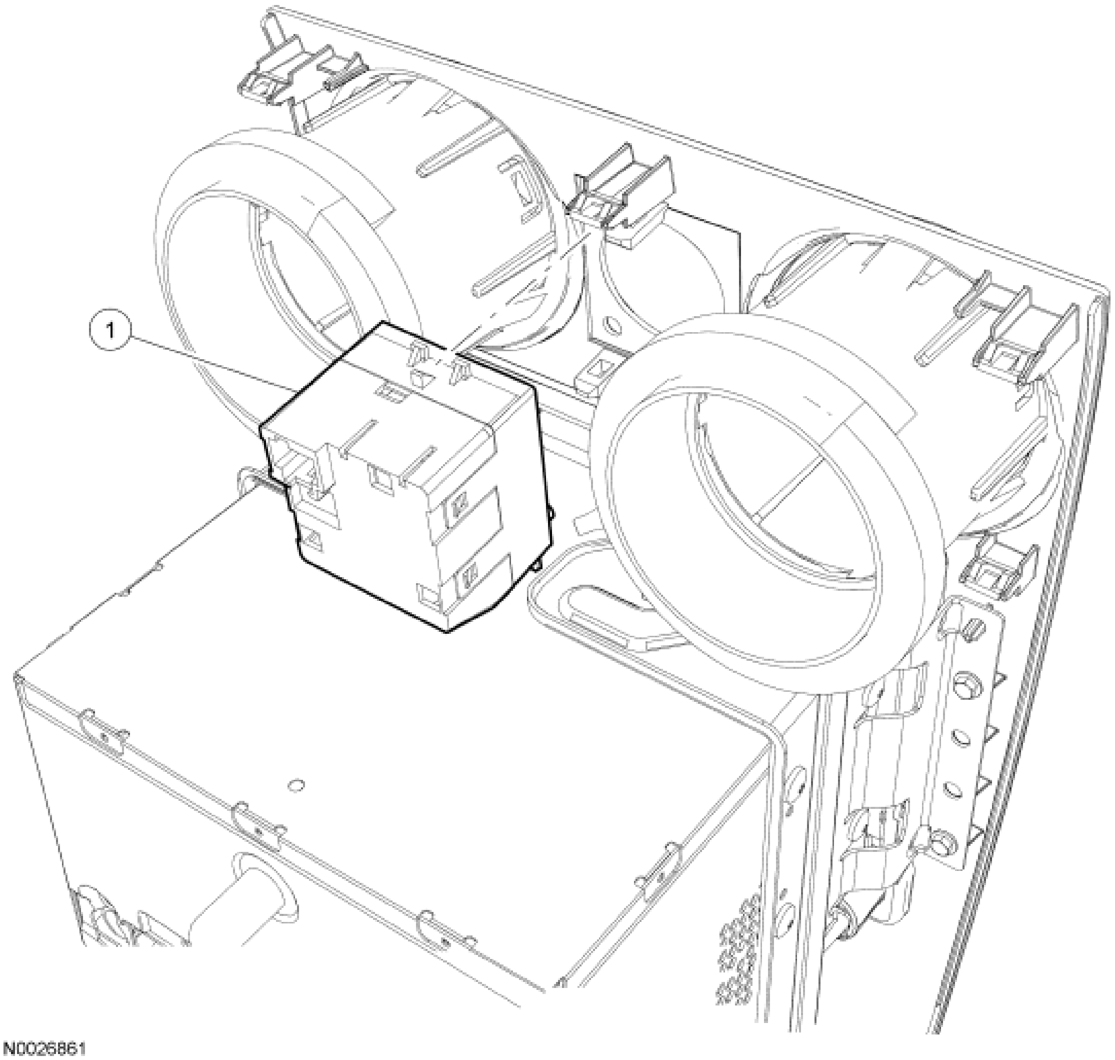


Fig. 4: Exploded View Of Clock - MKZ
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	15000	Clock

REMOVAL AND INSTALLATION

1. Remove the instrument panel center finish panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.

2. Release the locator tabs and remove the clock from the panel.
3. To install, reverse the removal procedure.

2008 TRANSMISSIONS

Clutch Controls - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A	-
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B	-

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Clutch hydraulic tube	17	13	-
Clutch master cylinder nuts	21	15	-
Clutch pedal bracket nut	21	15	-
Clutch slave cylinder bolts	19	14	-
PCM bolts	10	-	89
PCM bracket nuts	10	-	89

DESCRIPTION AND OPERATION

CLUTCH CONTROLS

The clutch controls system consists of the following components:

- Clutch pedal
- Clutch master cylinder
- Clutch slave cylinder
- Clutch hydraulic fluid tube

When the clutch pedal is depressed, the clutch master cylinder transmits fluid pressure to the clutch slave cylinder. The clutch slave cylinder and the clutch release fork transfer the clutch pedal motion to the clutch release bearing. The release bearing presses against the pressure plate diaphragm spring, releasing the clutch disc.

The clutch master cylinder uses brake fluid and shares a common reservoir with the brake master cylinder.

DIAGNOSTIC TESTS

CLUTCH CONTROLS

For diagnosis and testing of the clutch controls, refer to **MANUAL TRANSAXLE/TRANSMISSION AND CLUTCH - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

CLUTCH PEDAL

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

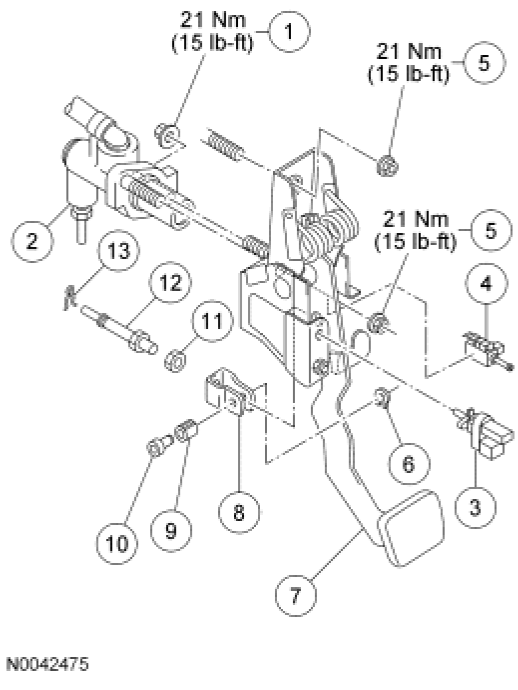


Fig. 1: Exploded View Of Clutch Pedal With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Clutch master cylinder nut (2 required)
2	7A543	Clutch master cylinder
3	-	Clutch switch (cruise control cancel)
4	11A152	Clutch pedal position (CPP) switch
5	-	Clutch pedal bracket nuts

6	-	Retaining clip
7	-	Clutch pedal and bracket assembly
8	-	Master cylinder push rod clevis
9	-	Clevis bushing
10	-	Clevis pin
11	-	Push rod lock nut
12	-	Master cylinder push rod
13	-	Retaining clip

REMOVAL AND INSTALLATION

1. Remove the battery and the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
2. Remove the PCM.
    1. Disconnect the electrical connectors.
    2. Remove the PCM bolts.

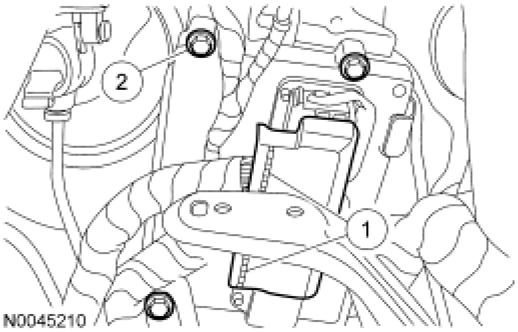


Fig. 2: Identifying PCM Bolts
Courtesy of FORD MOTOR CO.

3. Remove the PCM bracket.

Fig. 3: Locating PCM Bracket
Courtesy of FORD MOTOR CO.

4. Remove the clutch master cylinder nut.

- To install, tighten to 21 Nm (15 lb-ft).

5. Working under the instrument panel, disconnect the clutch switch electrical connector.
6. Disconnect the clutch pedal position (CPP) electrical connector.
7. Remove the clutch master cylinder nut and the clutch pedal bracket nut.
    - To install, tighten to 21 Nm (15 lb-ft).
8. Remove the clutch pedal and bracket assembly.

NOTE: Make sure to align the push rod into the clutch master cylinder piston as the pedal assembly is installed.

9. To install, reverse the removal procedure.
    - Apply a small amount of grease to the:
        - clevis bushing.
        - end of the clutch switch.
        - end of the master cylinder push rod.
10. Check the clutch pedal height and the clutch pedal free play. Adjust as necessary. For additional information, refer to **MANUAL TRANSAXLE/TRANSMISSION AND CLUTCH - GENERAL INFORMATION** article.

CLUTCH MASTER CYLINDER

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A

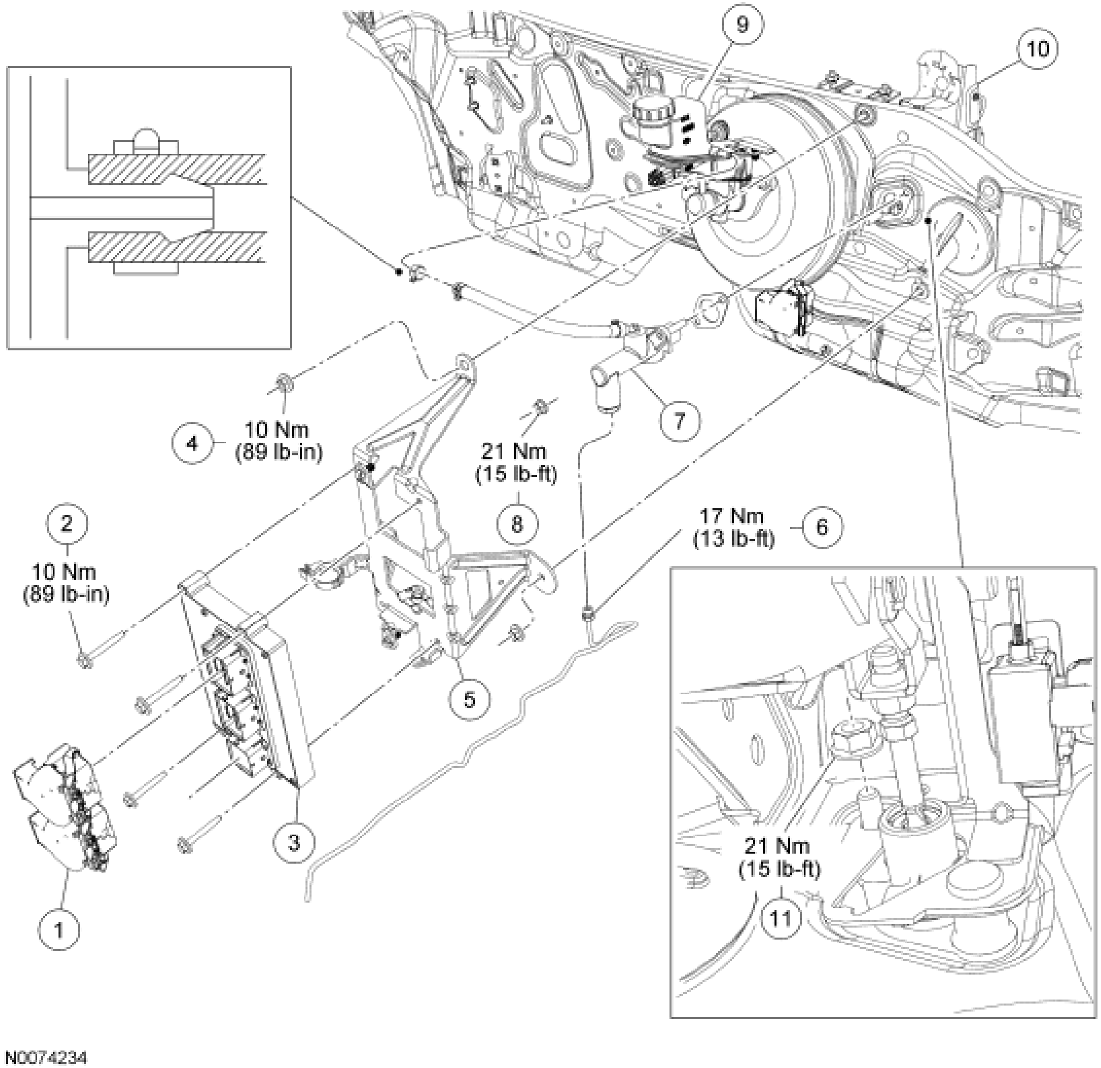


Fig. 4: Exploded View Of Clutch Master Cylinder With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	PCM electrical connector
2	W505428-S	PCM bolt (4 required)
3	12A650	PCM
4	N804795-S	PCM bracket nut (3 required)
5	12A659	PCM bracket
6	-	Clutch hydraulic line
7	7A543	Clutch master cylinder
8	-	Clutch master cylinder nut
9	2K478	Clutch system reservoir
10	7519	Clutch pedal and bracket

11	-	Clutch master cylinder nut

REMOVAL AND INSTALLATION

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, wash it immediately with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or new installation, air may get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

1. Working under the instrument panel, remove the clutch master cylinder nut.
    - To install, tighten to 21 Nm (15 lb-ft).
2. Using a suitable suction tool, remove the brake fluid to just below the clutch reservoir hose.

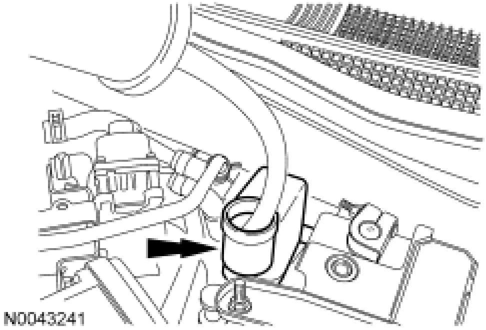


Fig. 5: Locating Brake Fluid To Clutch Reservoir Hose

Courtesy of FORD MOTOR CO.

3. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
4. Remove PCM.
    1. Disconnect the electrical connectors.
    2. Remove the 3 PCM bolts.
    3. To install, tighten to 10 Nm (89 lb-in).

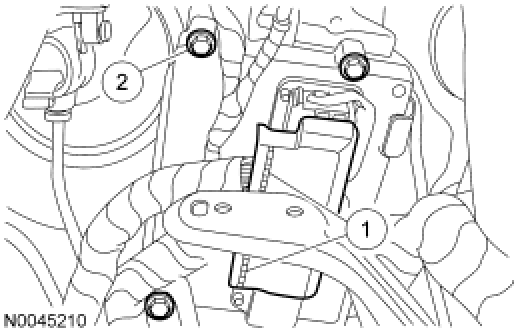


Fig. 6: Identifying PCM Bolts
Courtesy of FORD MOTOR CO.

5. Remove 3 PCM bracket nuts and the PCM bracket.
    - To install, tighten to 10 Nm (89 lb-in).

Fig. 7: Locating PCM Bracket
Courtesy of FORD MOTOR CO.

6. Disconnect the clutch master cylinder-to-clutch slave cylinder hydraulic tube.
    - To install, tighten to 17 Nm (13 lb-ft).

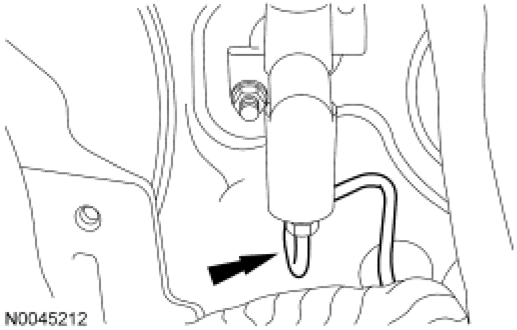


Fig. 8: Locating Clutch Master Cylinder-To-Clutch Slave Cylinder Hydraulic Line
Courtesy of FORD MOTOR CO.

7. Disconnect the clutch master cylinder-to-clutch reservoir hose.
8. Remove the clutch master cylinder nut.
   - To install, tighten to 21 Nm (15 lb-ft).
9. Remove the clutch master cylinder assembly.
10. To install, reverse the removal procedure.
11. Bleed the clutch hydraulic system. For additional information, refer to **MANUAL TRANSAXLE/TRANSMISSION AND CLUTCH - GENERAL INFORMATION** article.

CLUTCH SLAVE CYLINDER

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1 or PM-1-C (US); CPM-1 or CPM-1-C (Canada)	ESA-M6C25-A or WSS-M6C62-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

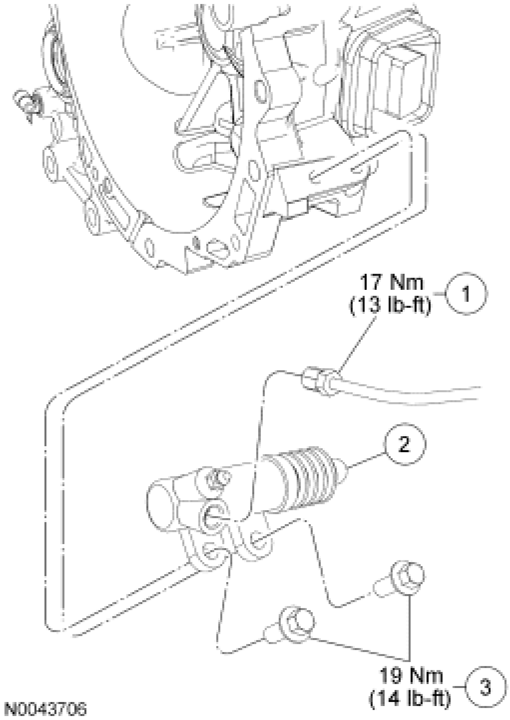


Fig. 9: Exploded View Of Clutch Slave Cylinder With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7T504	Clutch hydraulic line
2	7A508	Clutch slave cylinder
3	-	Clutch slave cylinder bolts (2 required)

REMOVAL AND INSTALLATION

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, wash it immediately with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or new installation, air may get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

1. Using a suitable suction tool, remove the brake fluid to just below the clutch reservoir hose.

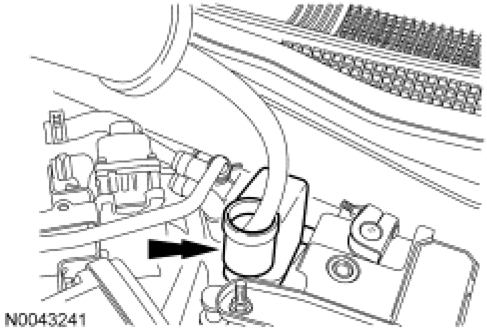


Fig. 10: Locating Brake Fluid To Clutch Reservoir Hose
Courtesy of FORD MOTOR CO.

2. Disconnect the clutch slave cylinder-to-clutch master cylinder tube.

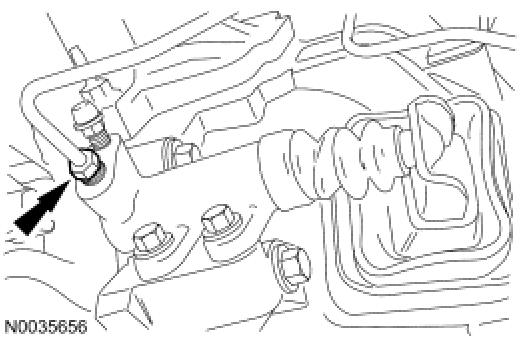


Fig. 11: Locating Clutch Slave Cylinder-To-Clutch Master Cylinder Line
Courtesy of FORD MOTOR CO.

3. Remove the 2 clutch slave cylinder bolts and the clutch slave cylinder.
    - To install, tighten to 19 Nm (14 lb-ft).

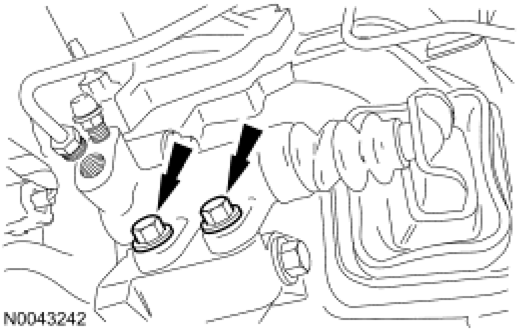


Fig. 12: Identifying Clutch Slave Cylinder Bolts
Courtesy of FORD MOTOR CO.

WARNING: **Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.**

4. To install, reverse the removal procedure.
   - Apply a small amount of grease on the end of the slave cylinder push rod.
   - Bleed the air from the system. For additional information, refer to **MANUAL TRANSAXLE/TRANSMISSION AND CLUTCH - GENERAL INFORMATION** article.

2008 TRANSMISSIONS

Clutch - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Diaphragm spring finger misalignment	0.6 mm (0.024 in) maximum

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Clutch pressure plate bolts	29	21
Flywheel bolts[a]	-	-

[a] Refer to **FLYWHEEL** for the specification.

DESCRIPTION AND OPERATION

CLUTCH

The clutch system includes the following components:

- Flywheel
- Clutch disc
- Clutch pressure plate
- Clutch release fork
- Clutch release bearing

The clutch is a single plate, dry-friction disc with a diaphragm-style spring clutch pressure plate. The clutch disc has a hub which is splined to the transmission input shaft. The clutch disc has friction material where it contacts the flywheel and the clutch pressure plate. The clutch pressure plate applies pressure to the clutch disc, holding

it tightly against the surface of the flywheel. In the engaged position, the diaphragm spring holds the clutch pressure plate against the clutch disc, so that engine torque is transmitted to the input shaft.

When the clutch pedal is depressed, the release bearing pushes the diaphragm spring center of the clutch pressure plate toward the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted to the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transaxle.

DIAGNOSTIC TESTS

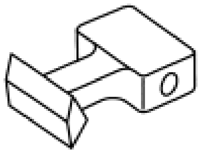
CLUTCH

Refer to **MANUAL TRANSAXLE/TRANSMISSION AND CLUTCH - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

CLUTCH DISC AND PRESSURE PLATE

Special Tools

Illustration	Tool Name	Tool Number
	Flywheel Holding Tool	303-103 (T74P-6375-A)
	Dial Indicator Gauge With Holding Fixture	100-002

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

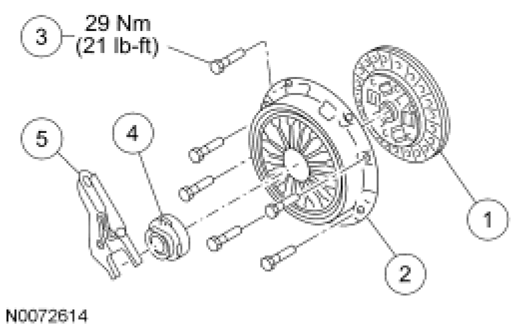


Fig. 1: Exploded View Of Clutch Disc and Pressure Plate With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7550	Clutch disc
2	7563	Clutch pressure plate
3	-	Clutch pressure plate bolt (6 required)
4	7548	Clutch release bearing
5	7515	Clutch release fork

REMOVAL

1. Remove the transaxle. For additional information, refer to **MANUAL TRANSAXLE/TRANSMISSION** article.
2. Inspect the clutch pressure plate.
   - Check the diaphragm spring fingers for discoloration, scoring, bent or broken segments.
   - Using the special tool, rotate the flywheel and check for spring ends that are higher or lower than the rest.
     - The specification is 0.6 mm (0.02 in) maximum.

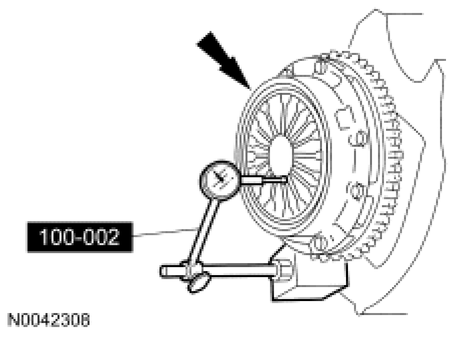


Fig. 2: Inspecting Clutch Pressure Plate
Courtesy of FORD MOTOR CO.

3. Using the special tool, lock the flywheel to the engine.

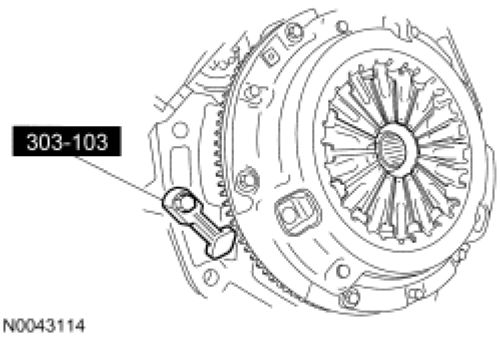


Fig. 3: Identifying Special Tool (303-103)
Courtesy of FORD MOTOR CO.

NOTE: **Loosen each bolt, one turn at a time in a star pattern, until spring tension is released.**

4. Using a suitable clutch disc aligner, remove the bolts, the clutch pressure plate and the clutch disc.

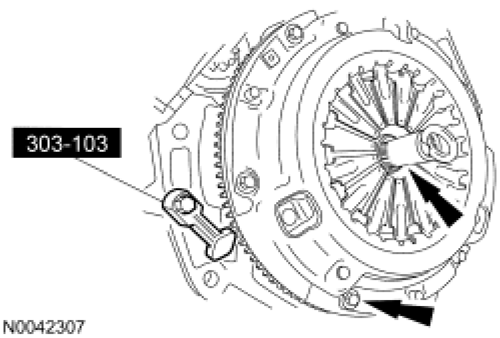


Fig. 4: Locating Bolts And Clutch Disc Aligner
Courtesy of FORD MOTOR CO.

NOTE: **Do not use cleaners with a petroleum base and do not immerse the clutch pressure plate in solvent.**

5. Using a suitable commercial alcohol-based solvent, clean the clutch pressure plate.
6. Inspect the clutch pressure plate surface for burn marks, scores, flatness, ridges or cracks. For additional information, refer to **MANUAL TRANSAXLE/TRANSMISSION AND CLUTCH - GENERAL INFORMATION** article.
    - Maximum clearance for flatness check is 0.3 mm (0.012 in).

CAUTION: **If the clutch disc is saturated with oil, inspect the rear engine crankshaft seal or transmission input shaft seal for leakage. If leakage is found, install a new seal prior to clutch disc installation. For additional information, refer to ENGINE - 2.3L article or MANUAL TRANSAXLE/TRANSMISSION article.**

NOTE: **Use an emery cloth to remove minor imperfections in the clutch disc lining surface.**

7. Inspect the clutch disc for the following:
   - Oil or grease saturation
   - Worn or loose facings
   - Warpage or loose rivets at the hub
   - Wear or rust on the splines
   - Install a new clutch disc if any of the these conditions are present.
8. Check the clutch disc runout. For additional information, refer to **MANUAL TRANSAXLE/TRANSMISSION AND CLUTCH - GENERAL INFORMATION** article.
9. If necessary, conduct a flywheel runout check. For additional information, refer to **MANUAL TRANSAXLE/TRANSMISSION AND CLUTCH - GENERAL INFORMATION** article.
10. Remove the clutch release bearing.

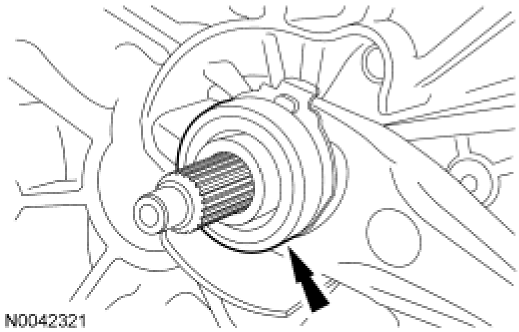


Fig. 5: Locating Clutch Release Bearing
Courtesy of FORD MOTOR CO.

11. Inspect the clutch release bearing for wear or damage.
    - Rotate the bearing while applying pressure in the axial direction. If the bearing feels rough, sticks or has excessive resistance, install a new bearing.

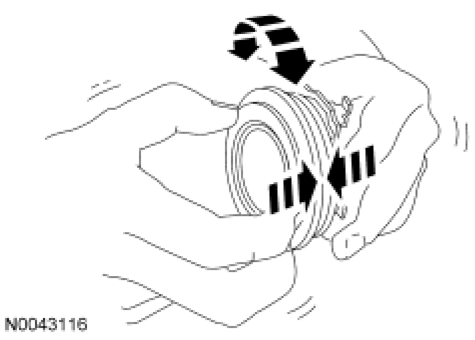


Fig. 6: Inspecting Clutch Release Bearing For Wear Or Damage
Courtesy of FORD MOTOR CO.

12. Inspect the release bearing guide tube for wear or damage.
    - Slide the release bearing on the guide tube. Check for roughness or sticking.
13. Remove the clutch release fork. Inspect the fork for wear or damage.

INSTALLATION

1. Apply a very small amount of grease in the clutch disc hub. Wipe off excess grease to avoid contaminating the clutch disc and affecting clutch function.
2. Using a suitable clutch disc aligner, position the clutch disc on the flywheel.

Item	Part Number	Description
1	-	Transaxle side
2	-	Engine side

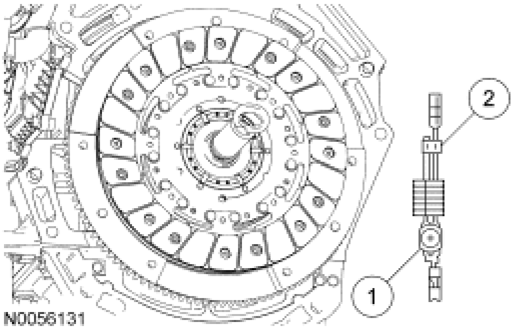


Fig. 7: Identifying Transaxle Side & Engine Side
Courtesy of FORD MOTOR CO.

3. Position the clutch pressure plate on the flywheel and to the dowels. Install the 6 clutch pressure plate bolts.
    - Tighten the bolts one turn at a time in a star pattern. Tighten to 29 Nm (21 lb-ft).

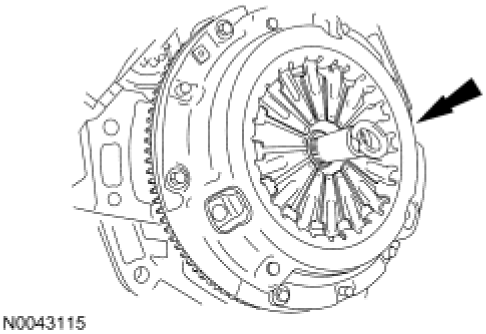


Fig. 8: Locating Clutch Pressure Plate On Flywheel
Courtesy of FORD MOTOR CO.

4. Apply a small amount of grease to:
    - the clutch release fork fingers.

- the clutch release fork spring.
- the guide tube.
- the clutch slave cylinder end that contacts the release fork.

5. Install the clutch release bearing and the clutch release fork.

NOTE: Apply a very small amount of grease to the transmission input shaft end and on the splines.

6. Install the transaxle. For additional information, refer to **MANUAL TRANSAXLE/TRANSMISSION** article.

2008 SPECIFICATIONS INDEX

Fusion, Milan & MKZ

SPECIFICATIONS INDEX

FUSION, MILAN & MKZ SPECIFICATIONS INDEX

System	Specification/Procedure
Air Conditioning	
Service	**SPECIFICATIONS**
Torque	**SPECIFICATIONS**
Axle Nut/Hub Nut	
Front & Rear	188 Ft. Lbs. (255 N.m)
Battery	**SPECIFICATIONS**
Brakes	
Bleeding Sequence	**BRAKE SYSTEM BLEEDING**
Disc & Drum Brakes w/Torque	**SPECIFICATIONS**
Charging	
Generator w/Torque	**SPECIFICATIONS**
Drive Belts	
2.3L	
Adjustment	**BELT TENSIONER - MECHANICAL**
Belt Routing	**ACCESSORY DRIVE**
3.0L (4V)	
Adjustment	**BELT TENSIONER - MECHANICAL**
Belt Routing	**ACCESSORY DRIVE**
3.5L	
Adjustment	**BELT TENSIONER - MECHANICAL**
Belt Routing	**ACCESSORY DRIVE**
Engine Cooling	
General Service Specification	**SPECIFICATIONS**
Radiator Cap Pressure	13-18 psi (89-124 kPa)
Thermostat R & I	
2.3L	**THERMOSTAT HOUSING - 2.3L**
3.0L (4V)	**THERMOSTAT - 3.0L**
3.5L	**THERMOSTAT - 3.5L**
Water Pump R & I	
2.3L	**COOLANT PUMP - 2.3L**
3.0L (4V)	**COOLANT PUMP - 3.0L**
3.5L	**COOLANT PUMP - 3.5L**
Engine Mechanical	
2.3L	

Compression	**COMPRESSION TEST**
Oil Pressure (Hot @ 2000 RPM)	29-39 psi (200-268 kPa)
Overhaul	**SPECIFICATIONS**
Torque	**SPECIFICATIONS**
3.0L (4V)	
Compression	**COMPRESSION TEST**
Oil Pressure (Minimum at 1,500 RPM with engine warmed up after 10 minutes of idling)	25 psi (172 kPa)
Overhaul	**SPECIFICATIONS**
Torque	**SPECIFICATIONS**
3.5L	
Compression	**COMPRESSION TEST**
Oil Pressure (Minimum at 1,500 RPM with engine at normal operating temperature)	30 psi (207 kPa)
Overhaul	**SPECIFICATIONS**
Torque	**SPECIFICATIONS**
Fluid Specifications	See FLUIDS under MAINTENANCE tab. From within Manager or Service Writer, click the "30/60/90 Interval" or "Maint." button.
Flywheel/Flex Plate Torque	
2.3L	
Manual	**INSTALLATION**
Automatic	**INSTALLATION**
3.0L (4V)	
Manual	N/A
Automatic	59 Ft. Lbs. (80 N.m)
3.5L	
Manual	N/A
Automatic	59 Ft. Lbs. (80 N.m)
Fuel System	
Fuel Filter Location	N/A
Fuel Filter R & I	N/A
Pressure Release Procedure	**FUEL SYSTEM PRESSURE RELEASE**
Pressure Specification	**FUEL PRESSURE SPECIFICATIONS**
Fuel Pressure Test Procedure	**A: No Start** STEP A10 CHECK THE FUEL PRESSURE
Ignition	
Firing Order & Cylinder Identification	
2.3L	**FIRING ORDER & CYLINDER IDENTIFICATION**
3.0L (4V)	**FIRING ORDER & CYLINDER IDENTIFICATION**

3.5L	**FIRING ORDER & CYLINDER IDENTIFICATION**
Ignition Wires (Routing)	Coil on plug
Spark Plugs	
2.3L	
Type	Motorcraft 6M8G-12405-BB
Gap	.049 - .053 In. (1.25-1.35 mm)
Torque	9 Ft. Lbs. (12 N.m)
3.0L (4V)	
Type	Motorcraft AGSF-32N
Gap	.052-0.56 In. (1.32-1.42 mm)
Torque	11 Ft. Lbs. (15 N.m)
3.5L	
Type	Motorcraft AYFS-22FM
Gap	.051-0.57 In. (1.29-1.45 mm)
Torque	11 Ft. Lbs. (15 N.m)
Starting	
Starter w/Torque	**SPECIFICATIONS**
Wheel Alignment	
Adjustment Specifications	**SPECIFICATIONS**
Torque	**SPECIFICATIONS**
Wheel & Tire	
Wheel Lug Nut Torque	98 Ft. Lbs. (133 N.m) Torque specifications are for clean, dry bolt and nut threads. Never use oil or grease on wheel bolts or nuts.

2008 ACCESSORIES & BODY, CAB

Component Testing - Fusion, Milan & MKZ

INTRODUCTION

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it. See **Fig. 1**.

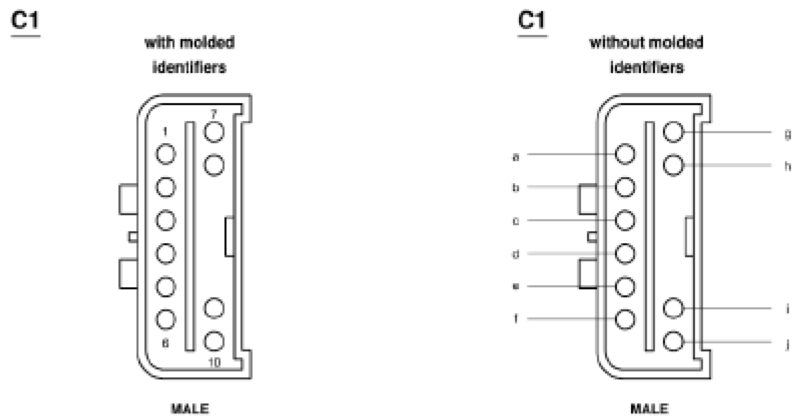


Fig. 1: Connector Terminals
Courtesy of FORD MOTOR CO.

The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

COMPONENT TESTING

MULTIFUNCTION SWITCH, WIPER/WASHER PORTION

Schematic

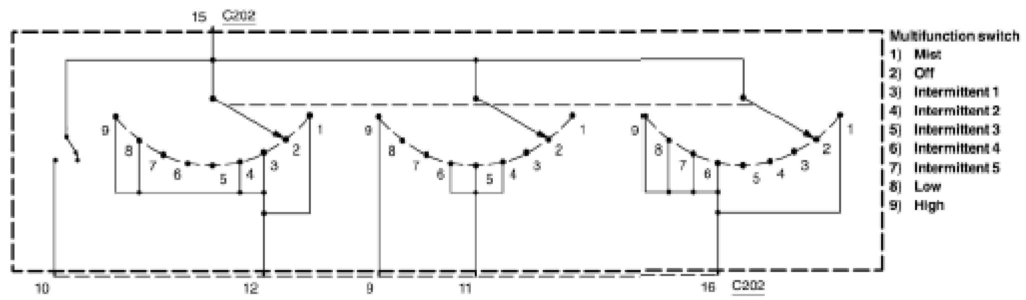


Fig. 2: Multifunction Switch, Wiper/Washer Portion - Schematic
Courtesy of FORD MOTOR CO.

Terminals

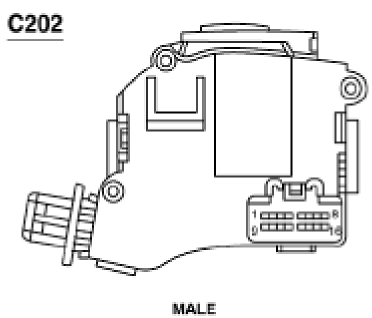


Fig. 3: Multifunction Switch, Wiper/Washer Portion - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure

MULTIFUNCTION SWITCH, WIPER/WASHER PORTION - COMPONENT TESTING

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Washer switch circuit	10 and 15	On	Closed circuit
		Rest	Open circuit
Wiper switch circuit	9 and 15	Off	Open circuit
		High	Closed circuit
		Low	Open circuit
	11 and 15	Off	Open circuit
		High	Open circuit
		Low	Open circuit
	12 and 15	Off	Open circuit
		High	Closed circuit
		Low	Closed circuit
	15 and 16	Off	Open circuit
		High	Closed circuit
		Low	Closed circuit

Intermittent wiper circuit	15 and 16	Interval 1	Open circuit
		Interval 2	Open circuit
		Interval 3	Open circuit
		Interval 4	Closed circuit
		Interval 5	Closed circuit
	11 and 15	Interval 1	Open circuit
		Interval 2	Closed circuit
		Interval 3	Closed circuit
		Interval 4	Closed circuit
		Interval 5	Open circuit
	12 and 15	Interval 1	Closed circuit
		Interval 2	Closed circuit
		Interval 3	Open circuit
		Interval 4	Open circuit
		Interval 5	Open circuit

MULTIFUNCTION SWITCH

Schematic

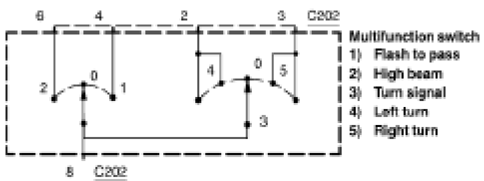


Fig. 4: Multifunction Switch - Schematic
Courtesy of FORD MOTOR CO.

Terminals

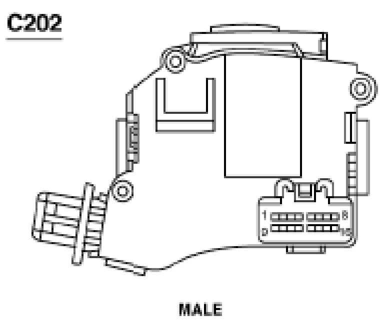


Fig. 5: Multifunction Switch - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure

MULTIFUNCTION SWITCH - COMPONENT TESTING

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Turn signal	2 and 8	Left turn	Closed circuit
	3 and 8	Right turn	Closed circuit
Flash-to-pass	6 and 8	Pull and hold lever stalk toward steering wheel	Open circuit
	4 and 8		Closed circuit
High beam/Low beam	6 and 8	Lever stalk in detent toward steering wheel	Closed circuit
	4 and 8		

MAIN LIGHT SWITCH

Schematic

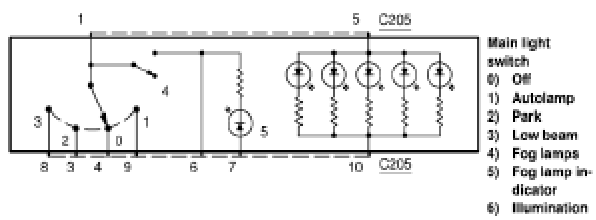


Fig. 6: Main Light Switch - Schematic
Courtesy of FORD MOTOR CO.

Terminals

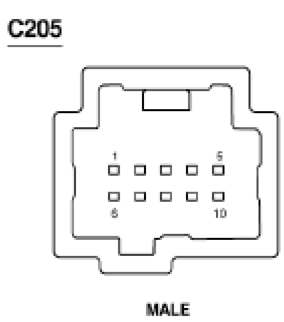


Fig. 7: Main Light Switch - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure

MAIN LIGHT SWITCH - COMPONENT TESTING

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Headlamp circuit	1 and 8	Off	Open circuit
		Park	Open circuit
		Head	Closed circuit

		Auto	Open circuit
Autolamp Circuit	1 and 9	Off	Open circuit
		Park	Open circuit
		Head	Open circuit
		Auto	Closed circuit
Parking Lamps	1 and 3	Off	Open circuit
		Park	Closed circuit
		Head	Open circuit
		Auto	Open circuit
Fog lamps	1 and 6	Off	Open circuit
		Fog lamps	Closed circuit

ILLUMINATION DIMMER SWITCH

Schematic

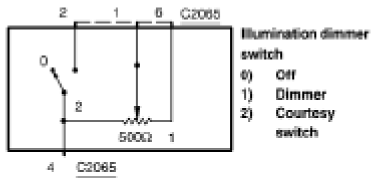


Fig. 8: Illumination Dimmer Switch - Schematic
Courtesy of FORD MOTOR CO.

Terminals

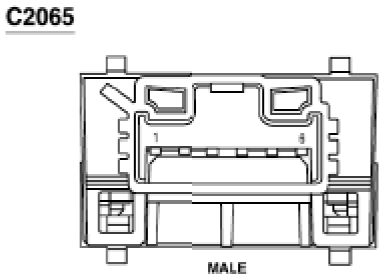


Fig. 9: Illumination Dimmer Switch - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure

ILLUMINATION DIMMER SWITCH - COMPONENT TESTING

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Interior lamps Circuit	4 and 2	Interior lamps	Closed circuit
		Off	Open circuit

Illumination dimmer resistor	4 and 1	Rotate knob clockwise	Ohmmeter will show smoothly increasing resistance

IGNITION SWITCH

Schematic

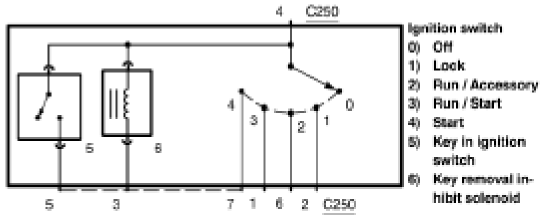


Fig. 10: Ignition Switch - Schematic
Courtesy of FORD MOTOR CO.

Terminal locations

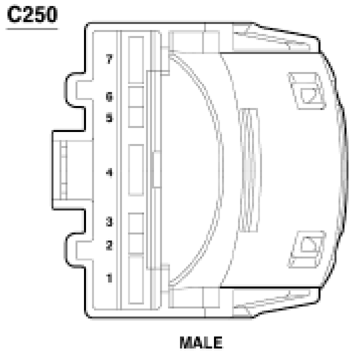


Fig. 11: Ignition Switch - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure

IGNITION SWITCH - COMPONENT TESTING

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Starter relay circuit	4 and 7	Off	Open circuit
		Acc	Open circuit
		Run	Open circuit
		Start	Closed circuit
Run/Start power circuit	4 and 1	Off	Open circuit
		Acc	Open circuit
		Run	Closed circuit

		Start	Closed circuit
Run/Acc power circuit	4 and 6	Off	Open circuit
		Acc	Closed circuit
		Run	Closed circuit
		Start	Open circuit
Key reminder circuit	4 and 5	Key In	Closed circuit
		Key Out	Open circuit
Key removal inhibit circuit	4 and 3		65-75ohms

POWER SEAT SWITCH, 8-WAY POWER SEAT

Schematic

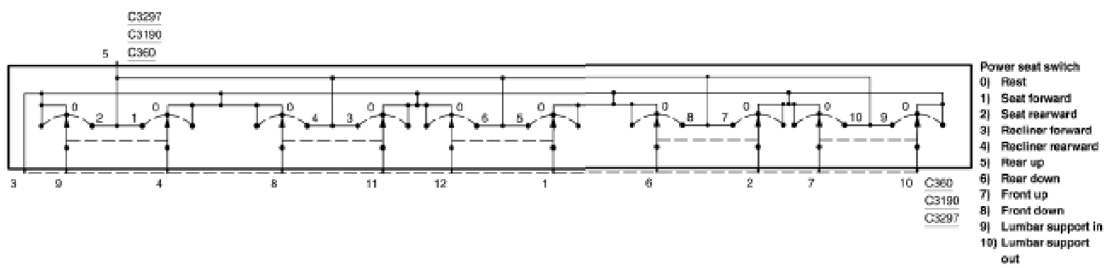


Fig. 12: Power Seat Switch, 8-Way Power Seat - Schematic
Courtesy of FORD MOTOR CO.

Terminals

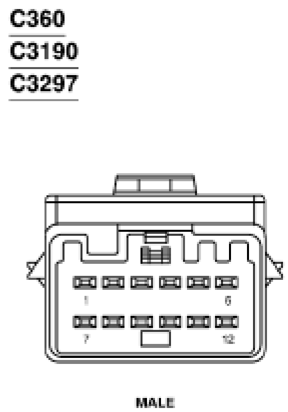


Fig. 13: Power Seat Switch, 8-Way Power Seat - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure

POWER SEAT SWITCH, 8-WAY POWER SEAT - COMPONENT TESTING

	Connect self-powered test light	Move switch to these	A good switch

Circuit to test	or ohmmeter to terminals	positions	will indicate
Forward/Rearward circuit	5 and 4	Forward	Closed circuit
		Rest/Rearward	Open circuit
	5 and 9	Rest/Forward	Open circuit
		Rearward	Closed circuit
Front up/down circuit	5 and 2	Up	Closed circuit
		Rest/Down	Open circuit
	5 and 6	Rest/Up	Open circuit
		Down	Closed circuit
Rear up/down circuit	5 and 1	Up	Closed circuit
		Rest/Down	Open circuit
	5 and 12	Rest/Up	Open circuit
		Down	Closed circuit
Forward/Rearward recliner Circuit	5 and 8	Rest/Forward	Open circuit
		Rearward	Closed circuit
	5 and 3	Forward	Closed circuit
		Rest/Rearward	Open circuit

POWER SEAT SWITCH, 6-WAY POWER SEAT

Schematic

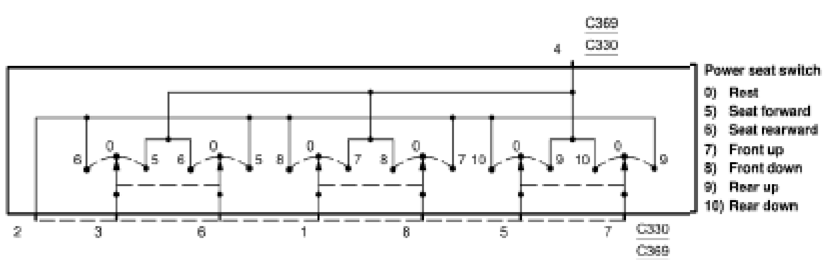


Fig. 14: Power Seat Switch, 6-Way Power Seat - Schematic
Courtesy of FORD MOTOR CO.

Terminals

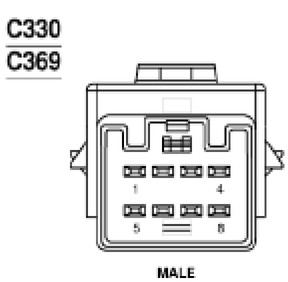


Fig. 15: Power Seat Switch, 6-Way Power Seat - Terminals

Courtesy of FORD MOTOR CO.

Component testing procedure

POWER SEAT SWITCH, 6-WAY POWER SEAT - COMPONENT TESTING

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Forward/Rearward circuit	4 and 3	Forward	Closed circuit
	6 and 2		Closed circuit
	4 and 6	Rearward	Closed circuit
	3 and 2		Closed circuit
Front up/down circuit	4 and 1	Up	Closed circuit
	8 and 2		Closed circuit
	4 and 8	Down	Closed circuit
	1 and 2		Closed circuit
Rear up/down circuit	4 and 5	Up	Closed circuit
	7 and 2		Closed circuit
	7 and 4	Down	Closed circuit
	5 and 2		Closed circuit

MASTER WINDOW CONTROL SWITCH - FUSION / MILAN

Schematic

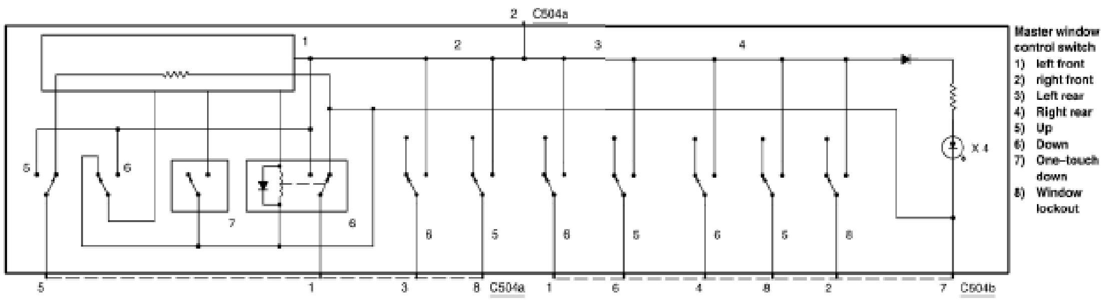


Fig. 16: Master Window Control Switch - Fusion / Milan - Schematic
Courtesy of FORD MOTOR CO.

Terminals

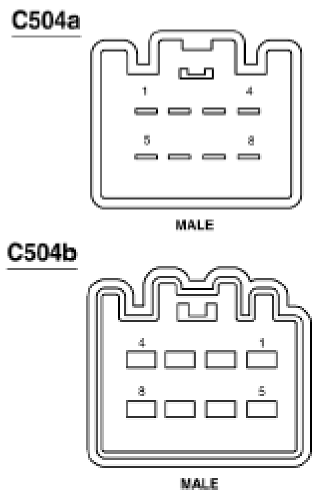


Fig. 17: Master Window Control Switch - Fusion / Milan - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure

MASTER WINDOW CONTROL SWITCH - FUSION / MILAN - COMPONENT TESTING

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Switch lock	2, C504a and 2, C504b	Unlock	Closed circuit
		Lock	Open circuit
Left front window circuit	2, C504a and 5, C504a	Up	Closed circuit
Right front window circuit	2, C504a and 3, C504a	Down	Closed circuit
	2, C504a and 8, C504a	Up	Closed circuit
	7, C504b and 8, C504a 7, C504b and 3, C504a	Rest	Closed circuit
Left rear window circuit	2, C504a and 1, C504b	Up	Closed circuit
	2, C504a and 6, C504b	Down	Closed circuit
	7, C504b and 1, C504b 7, C504b and 6, C504b	Rest	Closed circuit
Right rear window Circuit	2, C504a and 8, C504b	Up	Closed circuit
	2, C504a and 4, C504b	Down	Closed circuit
	7, C504b and 8, C504b 7, C504b and 4, C504b	Rest	Closed circuit

MASTER WINDOW CONTROL SWITCH [] MKZ

Schematic

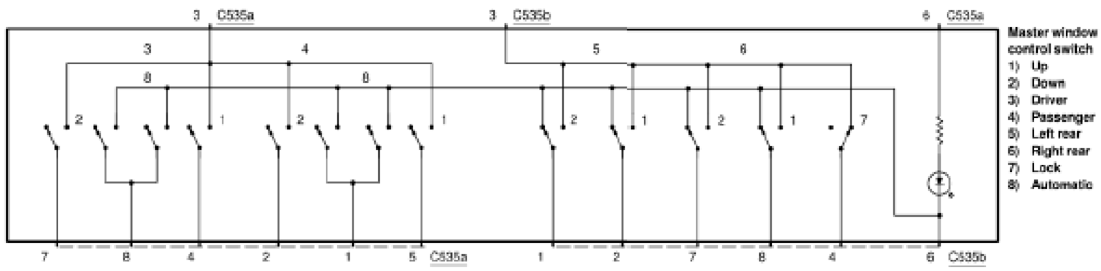


Fig. 18: Master Window Control Switch - MKZ - Schematic
Courtesy of FORD MOTOR CO.

Terminals

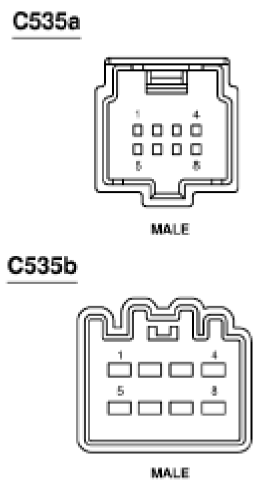


Fig. 19: Master Window Control Switch - MKZ - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure

MASTER WINDOW CONTROL SWITCH - MKZ - COMPONENT TESTING

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Switch lock	3, C535b and 4, C535b	Lock On	Closed circuit
		Lock Off	Open circuit
Left front window circuit	3, C535a and 4, C535a	Up	Closed circuit
	3, C535a and 7, C535a	Down	Closed circuit
	3, C535a and 8, C535a	One-Touch Up/Down	Closed circuit
Right front window circuit	3, C535a and 5, C535a	Up	Closed circuit
	3, C535a and 2, C535a	Down	Closed circuit
	3, C535a and 1, C535a	One-Touch Up/Down	Closed circuit
Left rear window circuit	3, C535b and 2, C535b	Up	Closed circuit
	3, C535b and 1, C535b	Down	Closed circuit

Right rear window circuit	3, C535b and 8, C535b	Up	Closed circuit
	3, C535a and 7, C535b	Down	Closed circuit

WINDOW CONTROL SWITCH, PASSENGER SIDE - MKZ

Window switch - Schematic

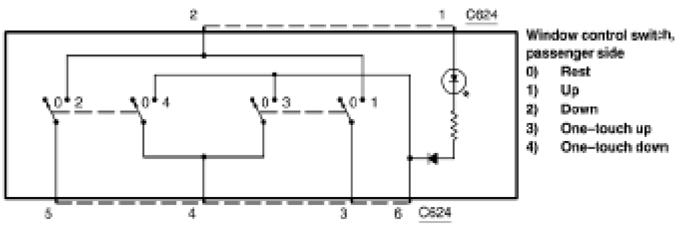


Fig. 20: Window Control Switch, Passenger Side - MKZ - Schematic
Courtesy of FORD MOTOR CO.

Terminals

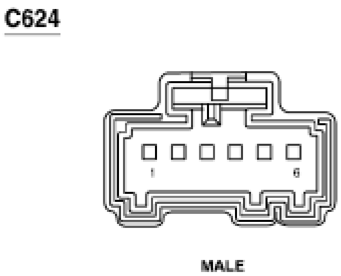


Fig. 21: Window Control Switch, Passenger Side - MKZ - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure

WINDOW CONTROL SWITCH, PASSENGER SIDE - MKZ - COMPONENT TESTING

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
One-Touch Up/Down	4 and 6	One-Touch Up/Down	Closed circuit
		Neutral	Open circuit
Right front window circuit	2 and 3	Up	Closed circuit
	5 and 2	Down	Closed circuit

WINDOW CONTROL SWITCHES

Schematic

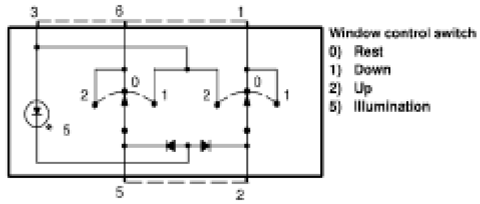


Fig. 22: Window Control Switches - Schematic
Courtesy of FORD MOTOR CO.

Terminals

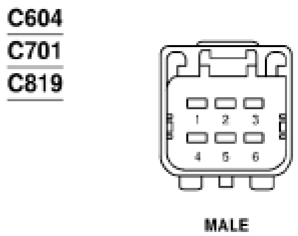


Fig. 23: Window Control Switches - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure

WINDOW CONTROL SWITCHES - COMPONENT TESTING

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Window control switches	2 and 3, 5 and 6	Up	Closed circuit
	1 and 2, 3 and 5	Down	Closed circuit
	6 and 5	Rest	Closed circuit
	1 and 2		

EXTERIOR REAR VIEW MIRROR SWITCH

Schematic

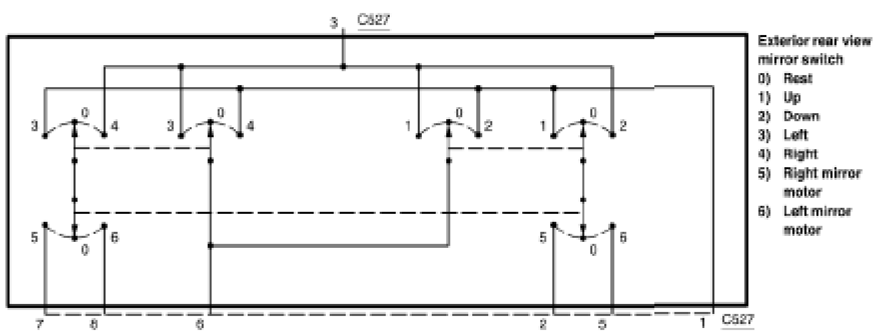


Fig. 24: Exterior Rear View Mirror Switch - Schematic

Courtesy of FORD MOTOR CO.

Terminal locations

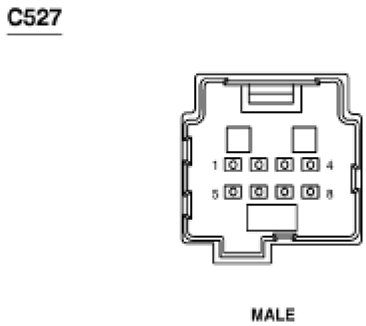


Fig. 25: Exterior Rear View Mirror Switch - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure

EXTERIOR REAR VIEW MIRROR SWITCH - COMPONENT TESTING

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Left mirror		Selector switch Left	
Up	6 and 3 1 and 5	Up	Closed circuit
Down	3 and 5 6 and 1	Down	Closed circuit
Left	6 and 3 5 and 4	Left	Closed circuit
Right	6 and 1 3 and 8	Right	Closed circuit
Right mirror		Selector switch Right	
Up	6 and 3 2 and 1	Up	Closed circuit
Down	3 and 2 6 and 1	Down	Closed circuit
Left	6 and 3 7 and 1	Left	Closed circuit
Right	3 and 7 6 and 1	Right	Closed circuit

POWER DOOR LOCK SWITCH

Schematic

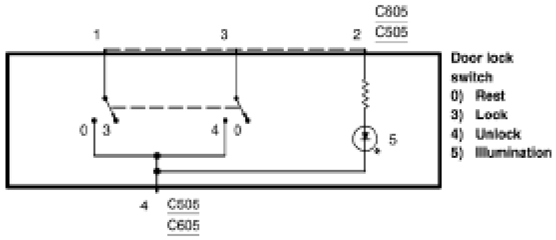


Fig. 26: Power Door Lock Switch - Schematic
Courtesy of FORD MOTOR CO.

Terminal locations

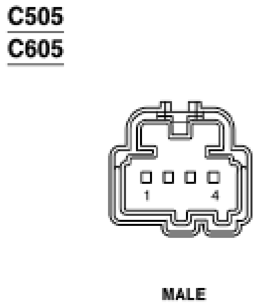


Fig. 27: Power Door Lock Switch - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure

POWER DOOR LOCK SWITCH - COMPONENT TESTING

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Lock/unlock circuit	3 and 4	Rest	Open circuit
		Lock	Open circuit
		Unlock	Closed circuit
	1 and 4	Rest	Open circuit
		Lock	Closed circuit
		Unlock	Open circuit

ROOF OPENING PANEL SWITCH

Schematic

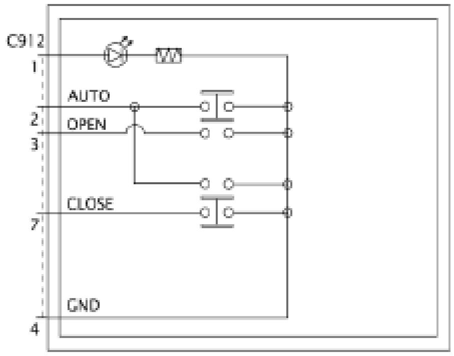


Fig. 28: Roof Opening Panel Switch - Schematic
Courtesy of FORD MOTOR CO.

Terminals

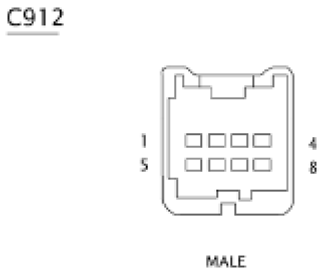


Fig. 29: Roof Opening Panel Switch - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure

ROOF OPENING PANEL SWITCH - COMPONENT TESTING

Circuit to test	Connect self powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Tilt	4 and 2	Tilt	Closed circuit
Slide	4 and 7	Close	Closed circuit
	4 and 3	Open	Closed circuit
	4 and 2	Auto open	Closed circuit

RELAY-MINI ISO

Schematic

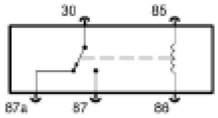


Fig. 30: Relay-Mini ISO - Schematic

Courtesy of FORD MOTOR CO.

Terminals

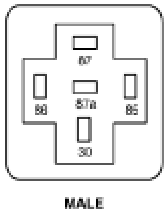


Fig. 31: Relay-Mini ISO - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure (no voltage applied)

RELAY-MINI ISO (NO VOLTAGE APPLIED) - COMPONENT TESTING

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	50-100ohms
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil - Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

RELAY - MICRO ISO

Schematic

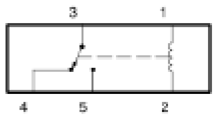


Fig. 32: Relay - Micro ISO - Schematic
Courtesy of FORD MOTOR CO.

Terminals

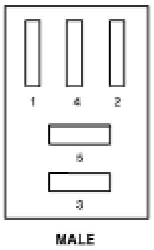


Fig. 33: Relay - Micro ISO - Terminals
Courtesy of FORD MOTOR CO.

Component testing procedure (no voltage applied)

RELAY - MICRO ISO (NO VOLTAGE APPLIED) - COMPONENT TESTING

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	100-150ohms
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

2008 ELECTRICAL

Connector Views - Fusion, Milan & MKZ

CONNECTOR VIEWS

Connector: C100	Description:	Harness:	Base Part #:
	A/C CLUTCH FIELD COIL	12B637/14B060	19D798

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	GD121 (BK-YE)	18	GROUND - FENDER FRONT LEFT # 2ND STUD	
B	CH401 (VT-WH)	18	RELAY - A/C CLUTCH	

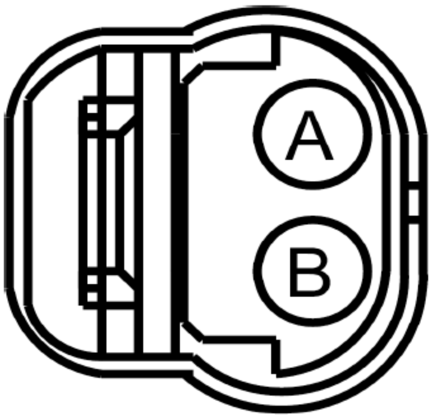


Fig. 1: A/C Clutch Field Coil Connector End View (C100)

Connector: C101	Description:	Harness:	Base Part #:
	CRANKSHAFT POSITION SENSOR	12B637/12C508	6C315

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE135 (GN-BN)	20	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN) -	
2	VE711 (YE-VT)	20	SENSOR - CRANKSHAFT POSITION (CKPP) +	

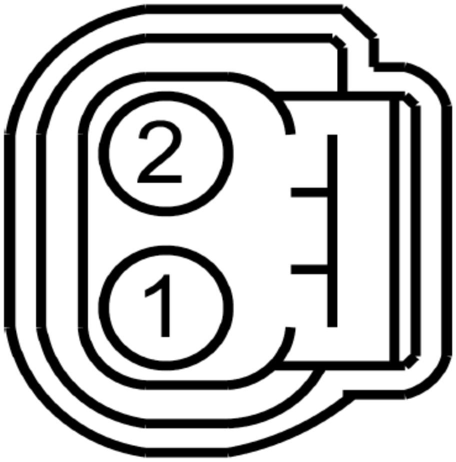


Fig. 2: Crankshaft Position Sensor Connector End View (C101)

Connector: C102A	Description:	Harness:	Base Part #:
	GENERATOR	12B637/14B060	10300

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CDC15 (VT)	20	GENERATOR (ALTERNATOR) # LOAD INPUT (GENLI)	
2	CDC10 (BU-OG)	20	CTRL MOD. - POWERTRAIN # GENERATOR REGULATOR CONTROL (GENRC)	
3	SBB17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	

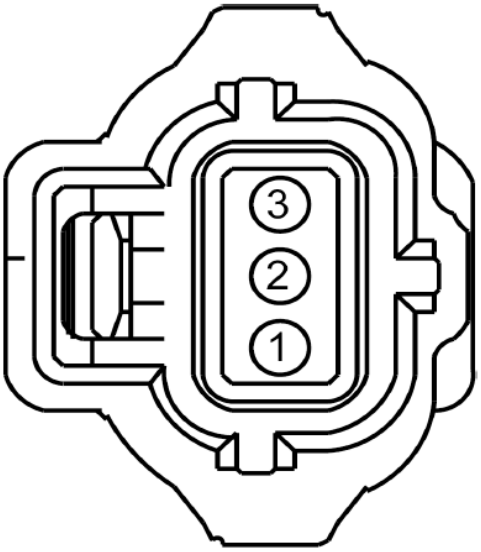
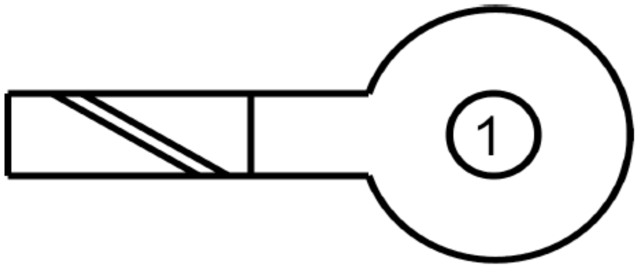


Fig. 3: Generator Connector End View (C102A)

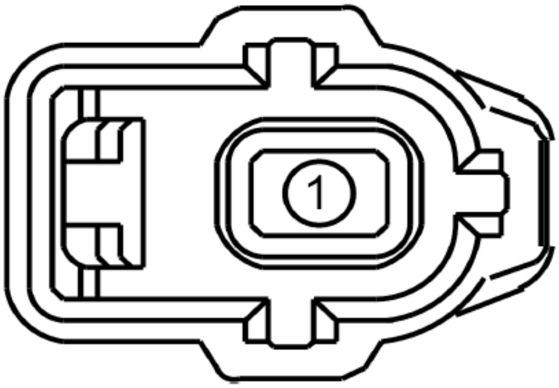
Connector: C102B	Description:	Harness:	Base Part #:
	GENERATOR	14B060	10300



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SDC14 (RD)	4	GENERATOR (ALTERNATOR) B+	

Fig. 4: Generator Connector End View (C102B)

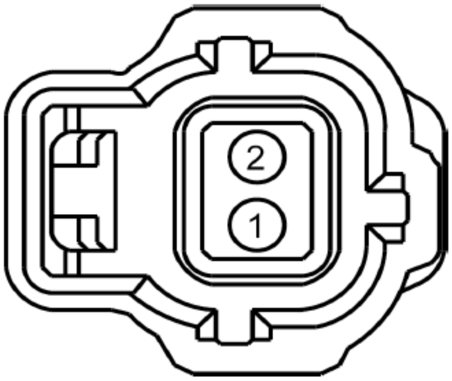
Connector: C103	Description:	Harness:	Base Part #:
	OIL PRESSURE SWITCH	12B637/12C508	9278



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CMC24 (GY)	18	SWITCH - OIL PRESSURE	

Fig. 5: Oil Pressure Switch Connector End View (C103)

Connector: C107	Description:	Harness:	Base Part #:
	CYLINDER-HEAD TEMPERATURE SENSOR	12B637	6G004

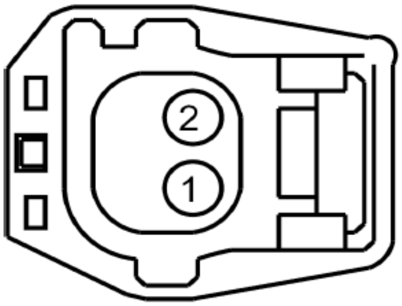


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE712 (BU-GY)	18	SENSOR - CYLINDER HEAD TEMPERATURE (CHT)	
2	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	

Fig. 6: Cylinder Head Temperature Sensor Connector End View (C107)

Connector: C108

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699

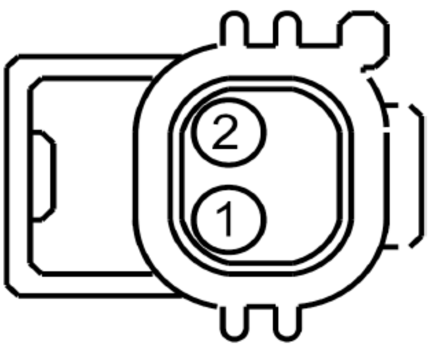


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	18	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	
2	RE323 (WH-BN)	18	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	

Fig. 7: Knock Sensor Connector End View (C108)

Connector: C109

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	18	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	
2	RE323 (WH-BN)	18	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	

Fig. 8: Knock Sensor Connector End View (C109)

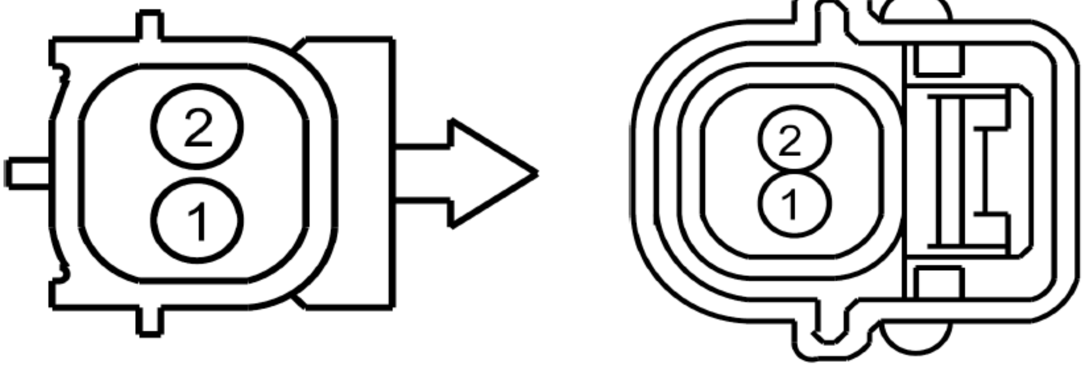
Inline: C110

Description: Inline

Base Part #:

MALE Harness: 12C508

FEMALE Harness: 14B485



Pin	Circuit	Gauge	Qualifier
1	VE712 (BU-GY)	20	
2	RE405 (GN-WH)	20	

Fig. 9: Inline Connector End View (C110)

Connector: C111

Description: COIL ON PLUG (COP) 1

Harness: 12B637

Base Part #: 12029

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE303 (WH-VT)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 1 (COP-A)	
2	CBP48 (GY-YE)	18	FUSE - 48 OR CIRCUIT BREAKER	

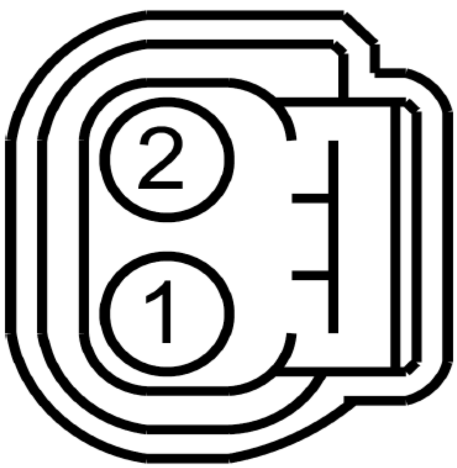


Fig. 10: Coil On Plug 1 Connector End View (C111)

Connector: C112	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 2	12B637	12029

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE305 (BU-OG)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 2	
2	CBP48 (GY-YE)	18	FUSE - 48 OR CIRCUIT BREAKER	

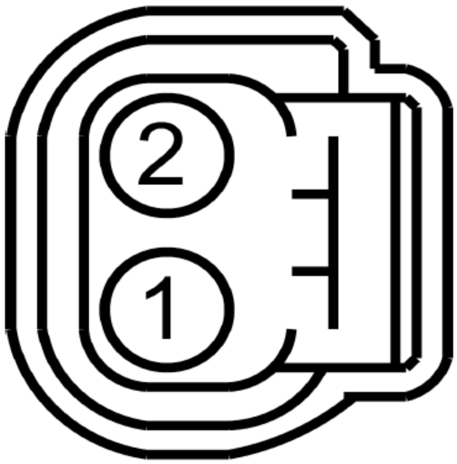


Fig. 11: Coil On Plug 2 Connector End View (C112)

Connector: C113	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 3	12B637	12029

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE307 (WH-BN)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 3	
2	CBP48 (GY-YE)	18	FUSE - 48 OR CIRCUIT BREAKER	

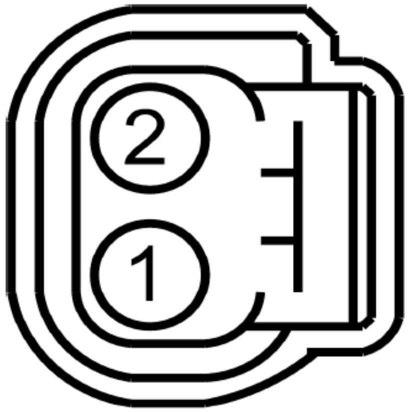


Fig. 12: Coil On Plug 3 Connector End View (C113)

Connector: C114	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 4	12B637	12029

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE304 (YE-BU)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 4	
2	CBP48 (GY-YE)	18	FUSE - 48 OR CIRCUIT BREAKER	

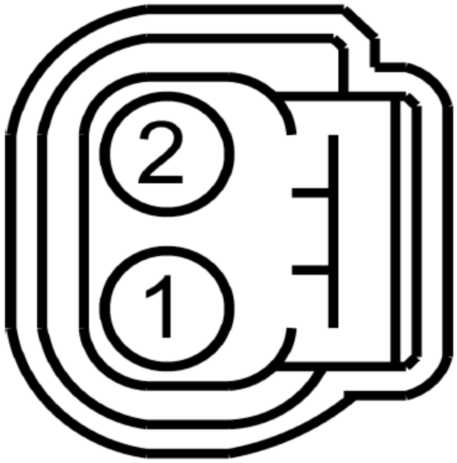


Fig. 13: Coil On Plug 4 Connector End View (C114)

Connector: C115	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 5	12B637	12029

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE306 (GN-VT)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 5	
2	CBP48 (GY-YE)	18	FUSE - 48 OR CIRCUIT BREAKER	

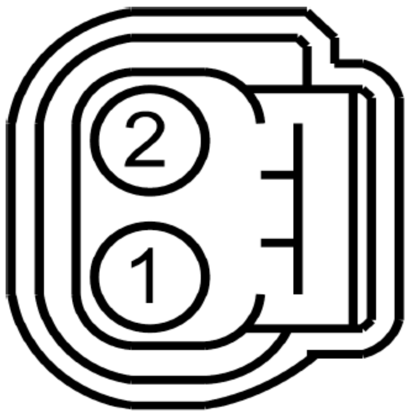


Fig. 14: Coil On Plug 5 Connector End View (C115)

Connector: C116	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 6	12B637	12029

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE308 (VT-BN)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 6 (COP-F)	
2	CBP48 (GY-YE)	18	FUSE - 48 OR CIRCUIT BREAKER	

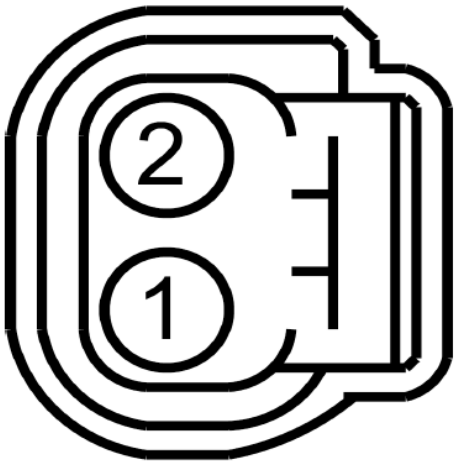


Fig. 15: Coil On Plug 6 Connector End View (C116)

Connector: C121	Description:	Harness:	Base Part #:
	POWER STEERING PRESSURE SWITCH	12B637	3N824

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VCS10 (BU-GN)	18	TRANSDUCER - POWER STEERING PRESSURE (PSPT)	
2	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	

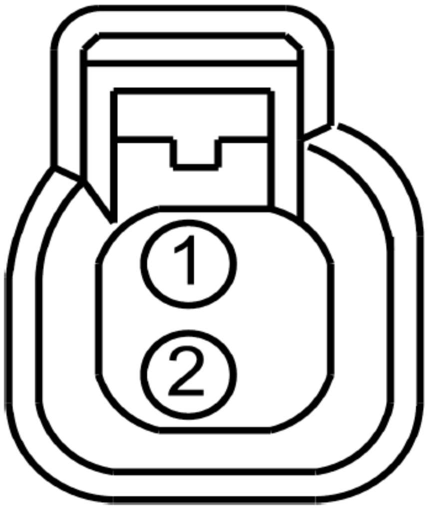
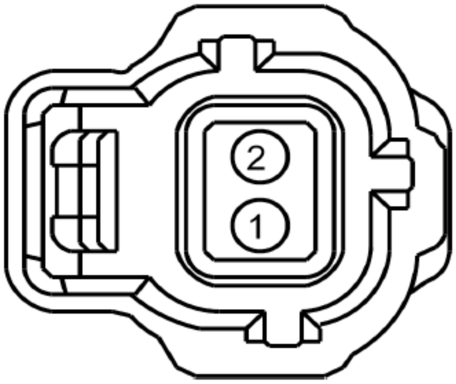


Fig. 16: Power Steering Pressure Switch Connector End View (C121)

Connector: C123	Description:	Harness:	Base Part #:
	EVAPORATIVE EMISSION (EVAP) CANISTER PURGE VALVE	14290	9C915



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP49 (VT-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	
2	CE132 (BN-YE)	20	CTRL MOD. - POWERTRAIN # ELECTRIC VAPOR MANAGEMENT VALVE (EVMV)	

Fig. 17: Evaporative Emissions Canister Purge Valve Connector End View (C123)

Connector: C124	Description:	Harness:	Base Part #:
	BRAKE FLUID LEVEL SWITCH	14290	2L414

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CMC19 (GY-VT)	20	SWITCH - LOW LEVEL BRAKE FLUID	
2	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	

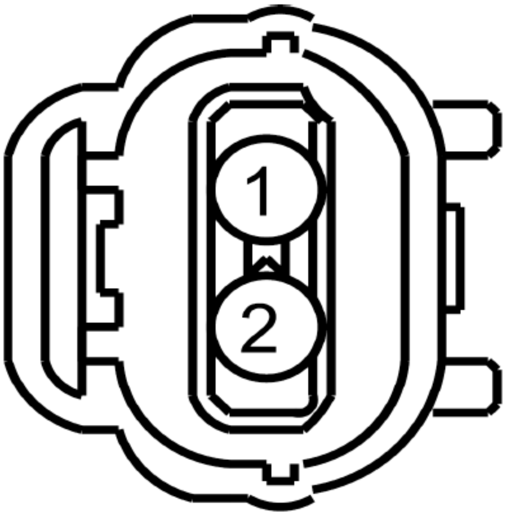


Fig. 18: Brake Fluid Level Switch Connector End View (C124)

Connector: C125	Description:	Harness:	Base Part #:
	WINDSHIELD WIPER MOTOR	14290	17508

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW09 (BN-BU)	16	SWITCH - FRONT WIPER PARK POSITION	
2	SBB09 (RD)	16	FUSE - 9 OR CIRCUIT BREAKER	
3	CRW15 (BN-WH)	16	CTRL MOD. - FRONT WIPER HIGH	
4	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
5	CRW16 (GY-BN)	16	CTRL MOD. - FRONT WIPER LOW	

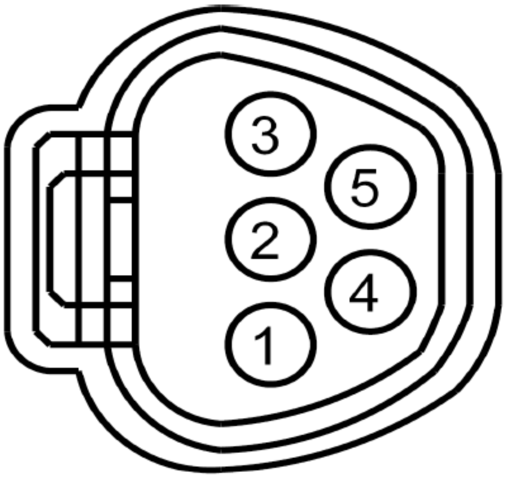


Fig. 19: Windshield Wiper Motor Connector End View (C125)

Connector: C127	Description:	Harness:	Base Part #:
	ANTI-THEFT HOOD SWITCH	14290	19A434

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL25 (BU-OG)	20	SWITCH - HOOD # AJAR	
2	GD123 (BK-GY)	20	GROUND - FENDER FRONT RIGHT	

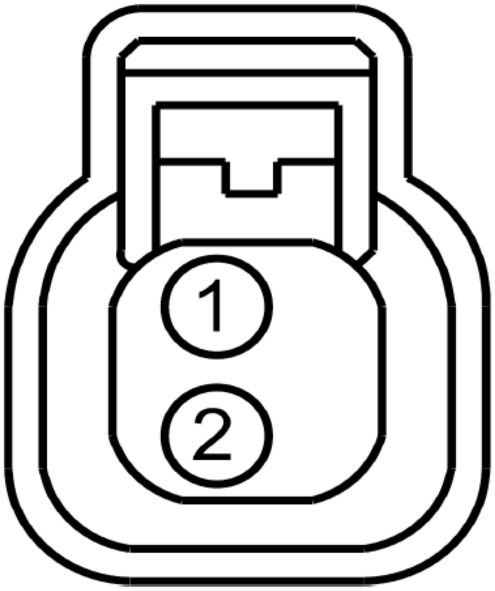


Fig. 20: Anti-Theft Hood Switch Connector End View (C127)

Connector: C131	Description:	Harness:	Base Part #:
	HORN	14290	13832

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD123 (BK-GY)	20	GROUND - FENDER FRONT RIGHT	
2	CBP05 (YE)	16	FUSE - 2 OR CIRCUIT BREAKER	

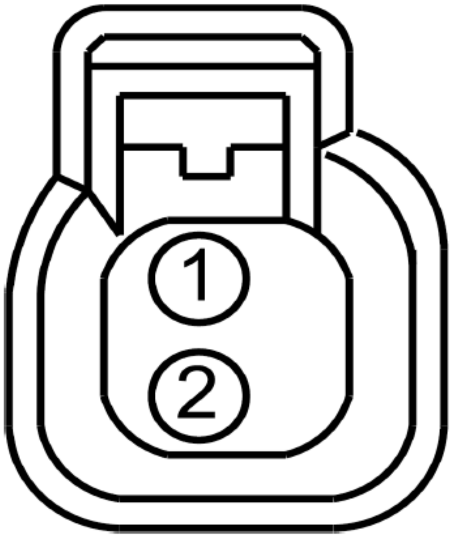


Fig. 21: Horn Connector End View (C131)

Connector: C132	Description:	Harness:	Base Part #:
	AMBIENT AIR TEMPERATURE SENSOR	14290	19E642

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	VH407 (YE-GN)	20	SENSOR - AMBIENT TEMP.	
B	RH104 (BU-BN)	20	CTRL MOD. - CLIMATE # SENSOR RETURN	

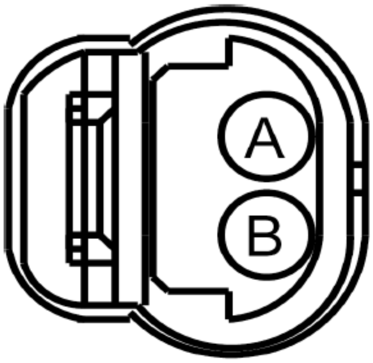
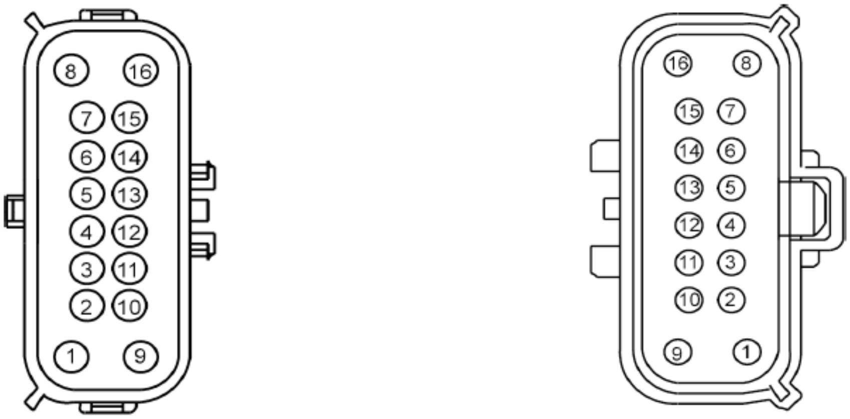


Fig. 22: Ambient Air Temperature Sensor Connector End View (C132)

Inline: C133

Description:
Inline

Base Part #:



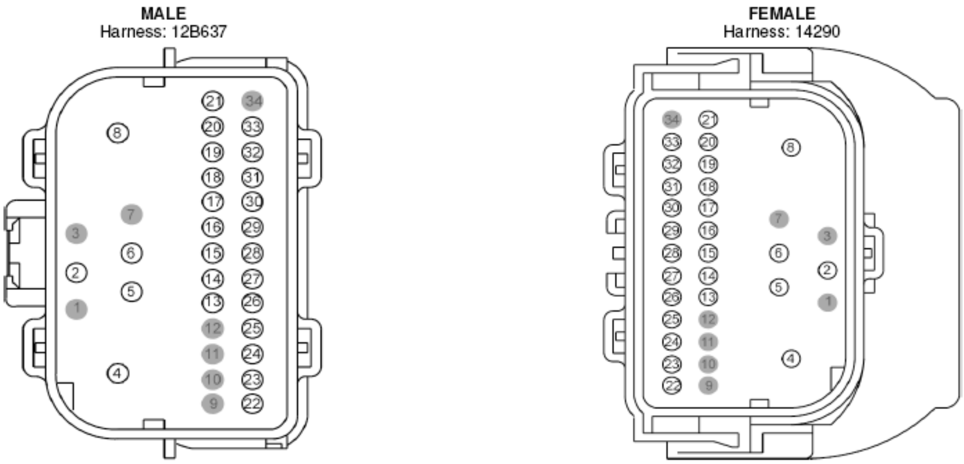
Pin	Circuit	Gauge	Qualifier
1	CDC25 (BN-GN)	14	3.5L
1	CBP48 (GY-YE)	18	
2	CBP18 (GY-OG)	20	
3	CBP19 (BN-WH)	20	
4	SBB17 (RD)	18	
5	VDB04 (WH-BU)	20	3.5L
5	CMC24 (GY)	18	
6	GD121 (BK-YE)	18	
7	CET40 (GN-OG)	20	
8	CH401 (VT-WH)	18	
9	CDC15 (VT)	20	3.5L
9	CBP46 (WH-BU)	18	
10	CBP19 (BN-WH)	20	
11	SBB16 (VT-RD)	20	
12	GD120 (BK-GN)	18	
13	DE135 (BK)	18	
13	VDB05 (WH)	20	3.5L
14	VDB04 (WH-BU)	20	
15	VDB05 (WH)	20	
16	CDC10 (BU-OG)	20	3.5L
16	CBP49 (VT-GY)	18	

Fig. 23: Inline Connector End View (C133)

Inline: C134

Description: Inline

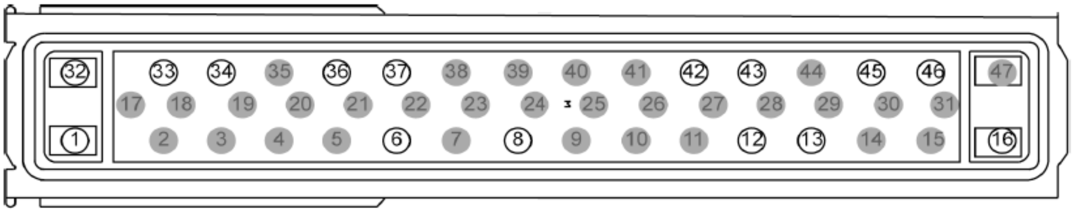
Base Part #:



Pin	Circuit	Gauge	Qualifier
1	*	*	
2	CDC25 (BN-GN)	14	
3	*	*	
4	CE402 (GY-YE)	12	
5	CBP12 (GN-WH)	18	
6	CE404 (VT-GY)	18	
7	*	*	
8	GD121 (BK-YE)	12	
9	*	*	
10	*	*	
11	*	*	
12	*	*	
13	VET15 (YE-GY)	18	
14	VET27 (BN-YE)	20	
15	VET14 (VT-GN)	18	
16	CET45 (YE-BU)	18	
17	CET44 (BU-BN)	18	
18	CET43 (GY)	18	
19	CET42 (GN-VT)	18	
20	CET37 (BN-WH)	20	
21	CET19 (VT-GY)	18	
22	RET33 (WH-VT)	20	
23	VET33 (WH-OG)	18	
24	VE822 (YE-BU)	18	
25	VE806 (BN-WH)	20	
26	CET18 (GY-YE)	18	
27	CBP18 (GY-OG)	18	
28	CE613 (WH-VT)	20	
29	VET13 (GY-BU)	18	
30	VET26 (BN-GN)	20	
31	DET33 (BK)	18	
32	VET28 (GY-VT)	20	
33	CET46 (YE-GN)	18	
34	*	*	

Fig. 24: Inline Connector End View (C134)

Connector: C135	Description:	Harness:	Base Part #:
	ANTI-LOCK BRAKE SYSTEM (ABS) MODULE	14290	2C219



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB08 (VT-RD)	10	FUSE - 8 OR CIRCUIT BREAKER	
2	*	*	not used	
3	*	*	not used	
4	*	*	not used	
5	*	*	not used	
6	CES09 (VT-OG)	20	SWITCH - BRAKE PEDAL # SPEED CONTROL DEACTIVATION (BPS)	
7	*	*	not used	
8	CBP19 (BN-WH)	20	FUSE - 28 OR CIRCUIT BREAKER	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
13	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
14	*	*	not used	
15	*	*	not used	
16	GD123 (BK-GY)	20	GROUND - FENDER FRONT RIGHT	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	*	*	not used	
22	*	*	not used	
23	*	*	not used	
24	*	*	not used	
25	*	*	not used	
26	*	*	not used	
27	*	*	not used	
28	*	*	not used	
29	*	*	not used	
30	*	*	not used	
31	*	*	not used	
32	SBB10 (YE-RD)	12	FUSE - 10 OR CIRCUIT BREAKER	
33	RCA19 (VT)	20	CTRL MOD. - SENSOR WHEEL SPEED RIGHT FRONT	
34	VCA05 (GY-VT)	20	SENSOR - WHEEL SPEED RIGHT FRONT	
35	*	*	not used	
36	VCA04 (BU-OG)	20	SENSOR - WHEEL SPEED LEFT REAR	
37	RCA18 (BN-GN)	20	CTRL MOD. - SENSOR WHEEL SPEED LEFT REAR	
38	*	*	not used	
39	*	*	not used	
40	*	*	not used	
41	*	*	not used	
42	RCA20 (BN)	20	CTRL MOD. - SENSOR WHEEL SPEED RIGHT REAR	
43	VCA06 (WH-OG)	20	SENSOR - WHEEL SPEED RIGHT REAR	
44	*	*	not used	
45	VCA03 (VT-WH)	20	SENSOR - WHEEL SPEED LEFT FRONT	
46	RCA17 (YE)	20	CTRL MOD. - SENSOR WHEEL SPEED LEFT FRONT	
47	*	*	not used	

Fig. 25: Anti-Lock Brake System Module Connector End View (C135)

Connector: C137

Description:	Harness:	Base Part #:
WINDSHIELD WASHER PUMP MOTOR	14290	PIA

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW14 (BU-WH)	20	CTRL MOD. - FRONT WASHER	
2	GD123 (BK-GY)	20	GROUND - FENDER FRONT RIGHT	

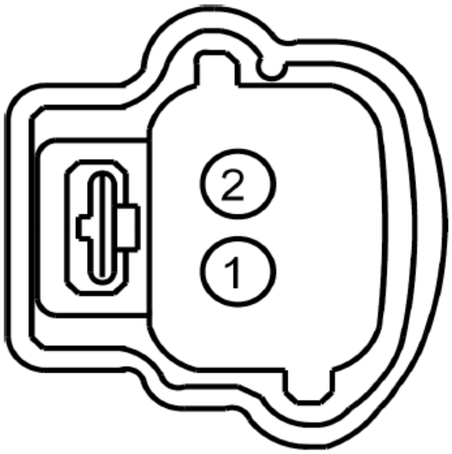


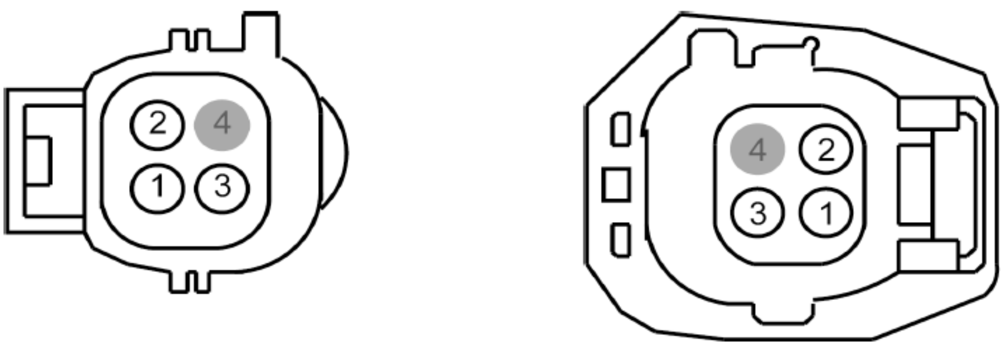
Fig. 26: Windshield Washer Pump Motor Connector End View (C137)

Inline: C139

Description:	Base Part #:
Inline	

MALE
Harness: 12B637

FEMALE
Harness: 14290



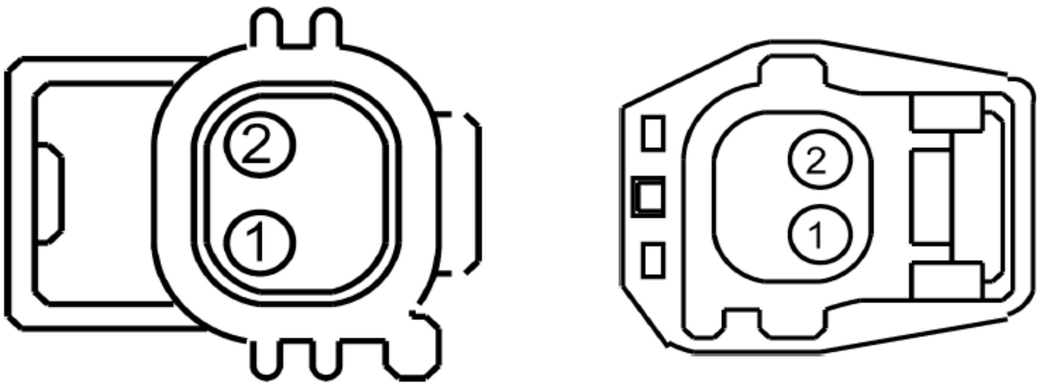
Pin	Circuit	Gauge	Qualifier
1	CDC25 (BN-GN)	14	
2	VDB04 (WH-BU)	20	
3	VDB05 (WH)	20	
4	*	*	

Fig. 27: Inline Connector End View (C139)

Inline: C140

Description: Inline

Base Part #:



Pin	Circuit	Gauge	Qualifier
1	VCS10 (BU-GN)	18	
2	CET34 (BN-GN)	20	

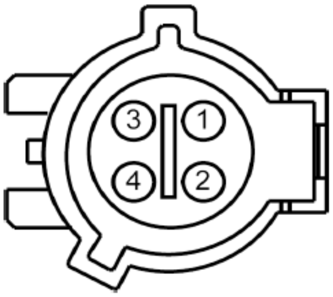
Fig. 28: Inline Connector End View (C140)

Connector: C141

Description: HEATED OXYGEN SENSOR (HO2S) #22

Harness: 12B637/12C508

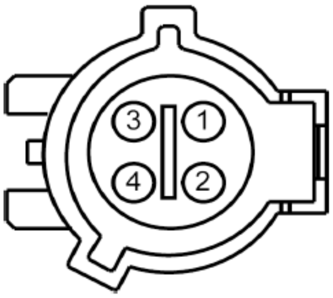
Base Part #: 9G444



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE234 (BU-WH)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 2ND (HTR22)	
2	CBP49 (VT-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	
2	CBP14 (VT-OG)	20	FUSE - 49 OR CIRCUIT BREAKER	3.5L
3	VE733 (WH)	18	SENSOR - HEATED OXYGEN POST CAT. 2ND (HO2S22)	
4	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	

Fig. 29: Heated Oxygen Sensor 22 Connector End View (C141)

Connector: C142	Description:	Harness:	Base Part #:
	HEATED OXYGEN SENSOR (HO2S) #12	12B637/12C508	9G444



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE233 (WH-OG)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 1ST OR UNIQUE (HTR12)	
2	CBP49 (VT-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	
2	CBP14 (VT-OG)	20	FUSE - 49 OR CIRCUIT BREAKER	3.5L
3	VE731 (YE-GN)	18	SENSOR - HEATED OXYGEN POST CAT. 1ST OR UNIQUE (HO2S12)	
4	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	

Fig. 30: Heated Oxygen Sensor 12 Connector End View (C142)

Connector: C143	Description:	Harness:	Base Part #:
	TURBINE SHAFT SPEED (TSS) SENSOR	12B637	7M101

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VET33 (WH-OG)	20	TURBINE SHAFT SPEED (TSS) SENSOR SIGNAL	
2	RET33 (WH-VT)	20	TURBINE SHAFT SPEED (TSS) SENSOR SIGNAL RETURN	

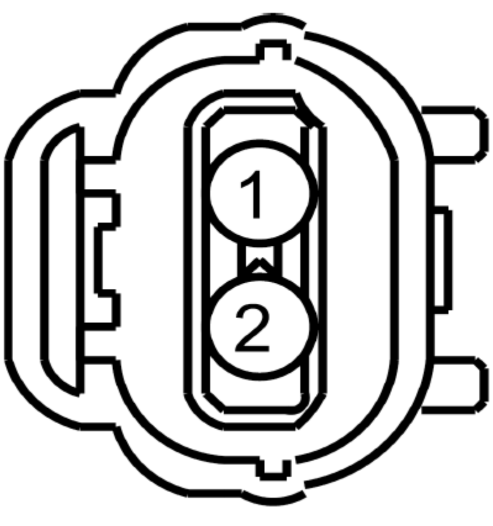
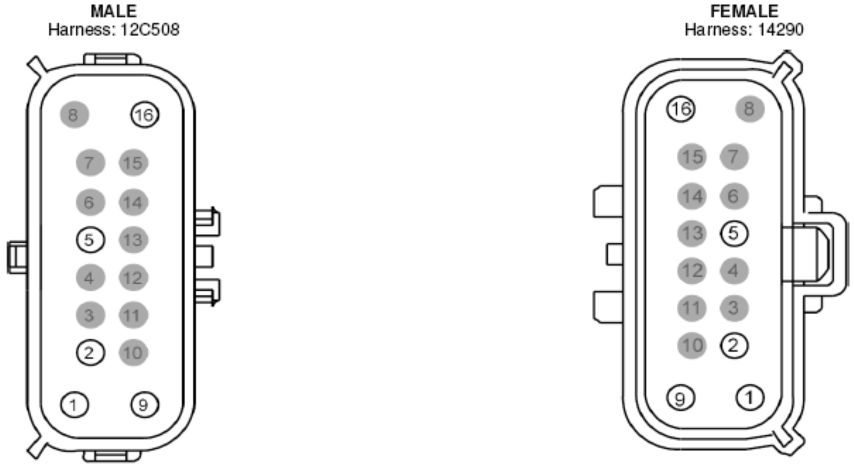


Fig. 31: Turbine Shaft Speed Sensor Connector End View (C143)

Inline: C144

Description:
Inline

Base Part #:



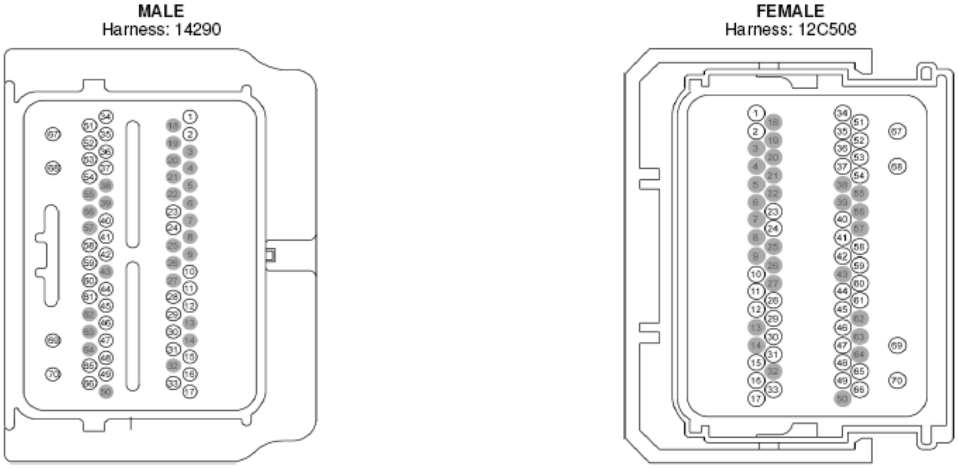
Pin	Circuit	Gauge	Qualifier
1	CBB46 (WH-BU)	18	
2	ZA145 (OG-GY)	20	12C508
2	CBP49 (VT-GY)	18	14290
3	*	*	
4	*	*	
5	CMC24 (GY)	18	12C508
5	CMC24 (GY)	20	14290
6	*	*	
7	*	*	
8	*	*	
9	CE608 (VT-GN)	20	12C508
9	CBP46 (WH-BU)	18	14290
10	*	*	
11	*	*	
12	*	*	
13	*	*	
14	*	*	
15	*	*	
16	CBP14 (VT-OG)	18	12C508
16	CBP49 (VT-GY)	18	14290

Fig. 32: Inline Connector End View (C144)

Inline: C145

Description: Inline

Base Part #:



Pin	Circuit	Gauge	Qualifier
1	CE233 (WH-OG)	18	
2	CE234 (BU-WH)	18	
3	*	*	
4	*	*	
5	*	*	
6	*	*	
7	*	*	
8	*	*	
9	*	*	
10	CE308 (VT-BN)	18	
11	CE307 (WH-BN)	18	
12	CE306 (GN-VT)	18	
13	*	*	
14	*	*	

Fig. 33: Inline (1 Of 2) Connector End View (C145) (1 Of 2)

15	CE305 (BU-OG)	18
16	CE304 (YE-BU)	18
17	CE303 (WH-VT)	18
18	*	*
19	*	*
20	*	*
21	*	*
22	*	*
23	VE731 (YE-GN)	18
24	VE733 (WH)	18
25	*	*
26	*	*
27	*	*
28	VE737 (WH-BU)	18
29	VE735 (VT-GN)	18
30	RE324 (BN-GN)	18
31	VE802 (BN-BU)	18
32	*	*
33	CE321 (YE)	18
34	CE412 (YE-VT)	18
35	CE206 (GY-YE)	18
36	CE208 (YE-OG)	18
37	CE210 (GN-WH)	18
38	*	*
39	*	*
40	DE135 (BK)	18
41	VE712 (BU-GY)	20
42	RE429 (GY-OG)	20
43	*	*
44	VE707 (GN-VT)	20
45	VE706 (BN-BU)	20
46	RE135 (GN-BN)	20
47	VE711 (YE-VT)	20
48	RE323 (WH-BN)	20
49	VE801 (VT-OG)	20
50	*	*
51	CE426 (BU-GN)	18
52	CE205 (GN-BU)	18
53	CE207 (VT-GY)	18
54	CE209 (BN)	18
55	*	*
56	*	*
57	*	*
58	RE405 (GN-WH)	18
59	RE134 (BU-OG)	20
60	VE819 (GN-VT)	20
61	VE818 (BN)	20
62	*	*
63	*	*
64	*	*
65	CE328 (YE-VT)	18
66	LE134 (YE)	20
67	CE421 (VT)	20
68	CE422 (WH-OG)	20
69	CE235 (GN-BN)	18
70	CE236 (GY-VT)	18

Fig. 34: Inline (2 Of 2) Connector End View (C145) (2 Of 2)

Connector: C150	Description:	Harness:	Base Part #:
	WHEEL SPEED SENSOR, LEFT FRONT	14290	2C204

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VCA03 (VT-WH)	20	SENSOR - WHEEL SPEED LEFT FRONT +	
2	RCA17 (YE)	20	CTRL MOD. - SENSOR WHEEL SPEED LEFT FRONT -	

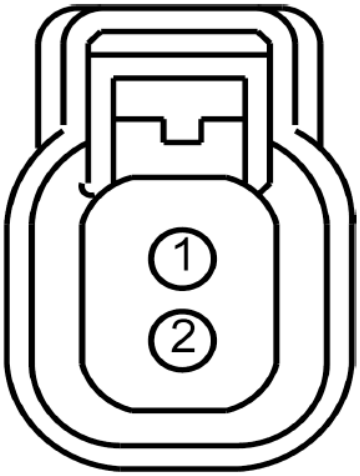


Fig. 35: Left Front Wheel Speed Sensor Connector End View (C150)

Connector: C151	Description:	Harness:	Base Part #:
	PARKING LAMP, LEFT FRONT 1	14290	13411

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 4 OR CIRCUIT BREAKER	
2	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	

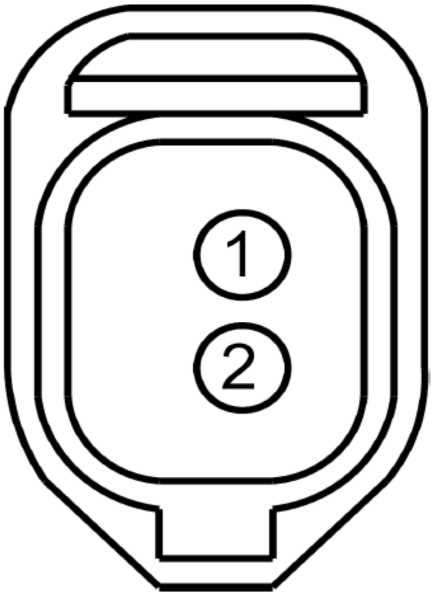


Fig. 36: Left Front 1 Parking Lamp Connector End View (C151)

Connector: C152	Description:	Harness:	Base Part #:
	FOG LAMP, LEFT FRONT	14290	13N021

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	CLF12 (BN-YE)	18	RELAY - FOG LAMPS FRONT	
B	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	

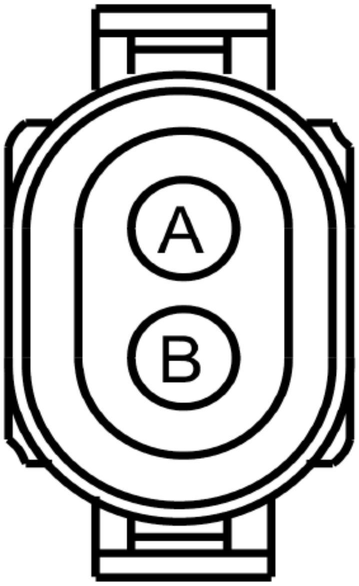


Fig. 37: Left Front Fog Lamp Connector End View (C152)

Connector: C160	Description:	Harness:	Base Part #:
	WHEEL SPEED SENSOR, RIGHT FRONT	14290	2C204

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VCA05 (GY-VT)	20	SENSOR - WHEEL SPEED RIGHT FRONT +	
2	RCA19 (VT)	20	CTRL MOD. - SENSOR WHEEL SPEED RIGHT FRONT -	

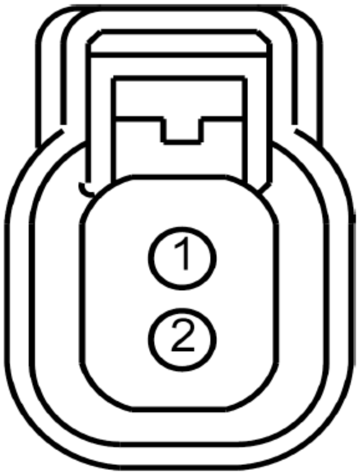


Fig. 38: Right Front Wheel Speed Sensor Connector End View (C160)

Connector: C161	Description:	Harness:	Base Part #:
	PARKING LAMP, RIGHT FRONT 1	14290	13411

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 4 OR CIRCUIT BREAKER	
2	GD123 (BK-GY)	20	GROUND - FENDER FRONT RIGHT	

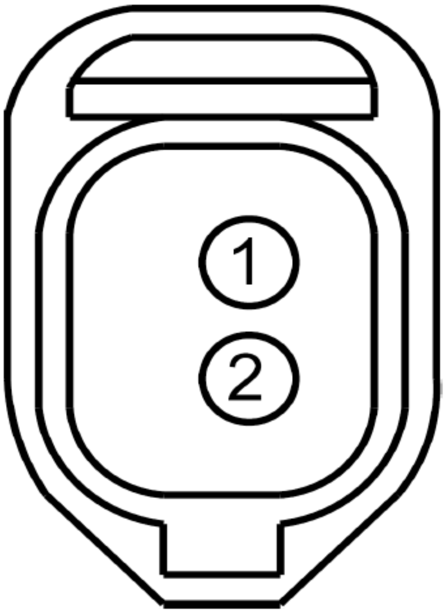


Fig. 39: Right Front 1 Parking Lamp Connector End View (C161)

Connector: C162	Description:	Harness:	Base Part #:
	FOG LAMP, RIGHT FRONT	14290	13N021

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	CLF12 (BN-YE)	18	RELAY - FOG LAMPS FRONT	
B	GD123 (BK-GY)	16	GROUND - FENDER FRONT RIGHT	

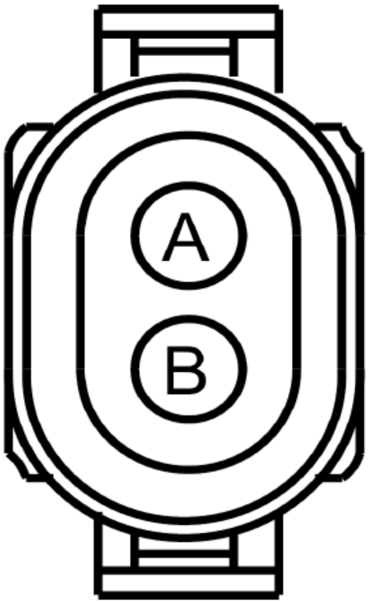


Fig. 40: Right Front Fog Lamp Connector End View (C162)

Connector: C169	Description:	Harness:	Base Part #:
	REVERSING LAMPS SWITCH	12B637	7B229

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP18 (GY-OG)	26	FUSE - 18 OR CIRCUIT BREAKER	
2	CBP12 (GN-WH)	20	REVERSE LAMPS SWITCH OUTPUT	

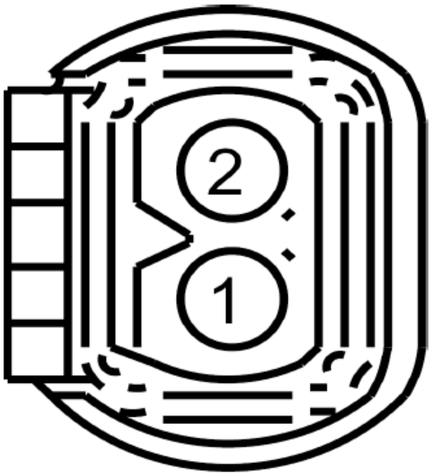
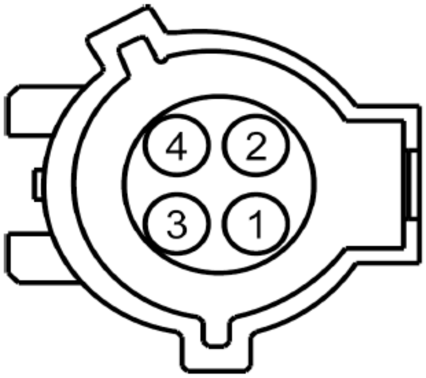


Fig. 41: Reversing Lamps Switch Connector End View (C169)

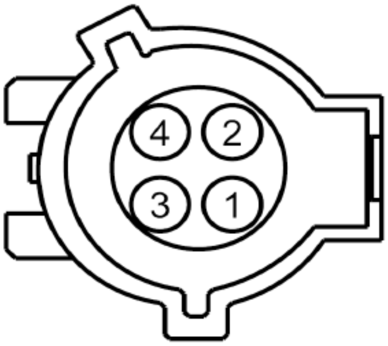
Connector: C171	Description:	Harness:	Base Part #:
	HEATED OXYGEN SENSOR (HO2S) #11	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP49 (VT-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	
2	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	
3	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
4	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	

Fig. 42: Heated Oxygen Sensor 11 Connector End View (C171)

Connector: C172	Description:	Harness:	Base Part #:
	HEATED OXYGEN SENSOR (HO2S) #21	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP49 (VT-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	
2	CE236 (GY-VT)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 2ND (HTR21)	
3	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
4	VE737 (WH-BU)	18	SENSOR - HEATED OXYGEN PRE CAT. 2ND (HO2S21)	

Fig. 43: Heated Oxygen Sensor 21 Connector End View (C172)

Connector: C174	Description:	Harness:	Base Part #:
	IGNITION TRANSFORMER CAPACITOR 1	12C508	18801

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBB46 (WH-BU)	18	FUSE - 48 OR CIRCUIT BREAKER	

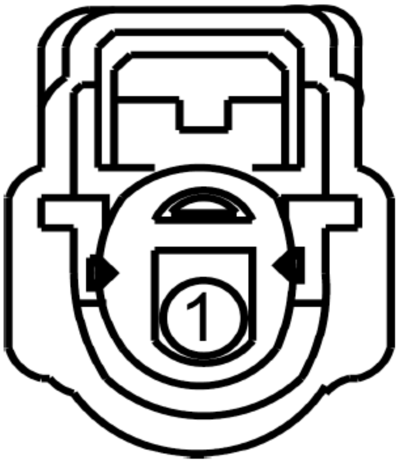
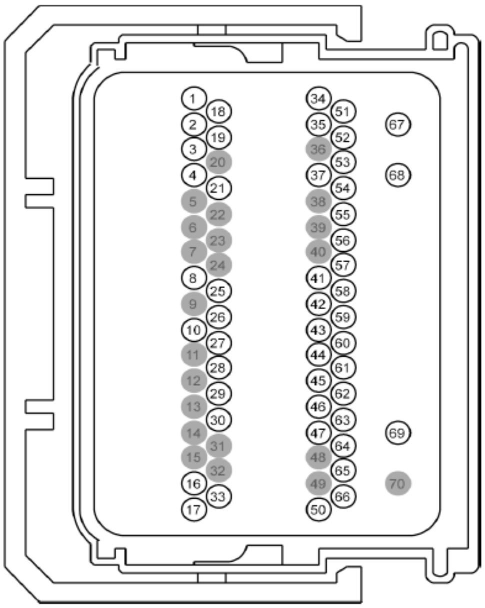


Fig. 44: Ignition Transformer Capacitor 1 Connector End View (C174)

Connector: C175B

Description:	Harness:	Base Part #:
POWERTRAIN CONTROL MODULE (PCM)	14290	12A659



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE404 (VT-GY)	20	CTRL MOD. - POWERTRAIN # SECONDARY THERMACTOR AIR DIVERTER VALVE (SAIRD)	
2	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
3	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
4	CE132 (BN-YE)	20	CTRL MOD. - POWERTRAIN # ELECTRIC VAPOR MANAGEMENT VALVE (EVMV)	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	VEC03 (WH-BU)	20	CTRL MOD. - COOLING FAN CONTROL VARIABLE (FC-V)	
9	*	*	not used	
10	CDC35 (BU-WH)	18	SWITCH - IGNITION # START	
11	*	*	not used	
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	CET40 (GN-OG)	20	SWITCH - TRANSMISSION RANGE # PARK/NEUTRAL (TRSW-PN)	
17	CE904 (GN-VT)	20	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	
18	CE903 (BU-OG)	20	SWITCH - CLUTCH PEDAL POSITION # BOTTOM OF TRAVEL (CPP-BT)	
19	CE336 (GN-WH)	18	SWITCH - IGNITION # START	
20	*	*	not used	
21	LE136 (GN-OG)	20	CTRL MOD. - POWERTRAIN # ACCELERATOR PEDAL POSITION SENSOR 1 (APP1VREF)	
22	*	*	not used	
23	*	*	not used	
24	*	*	not used	
25	VE701 (YE-OG)	20	SENSOR - ACCELERATOR PEDAL POSITION # 1 (APP1)	
26	VE702 (BU-WH)	20	SENSOR - ACCELERATOR PEDAL POSITION # 2 (APP2)	
27	VE703 (GN-WH)	20	SENSOR - ACCELERATOR PEDAL POSITION # 3 (APP3)	
28	LE137 (BU-GY)	20	CTRL MOD. - POWERTRAIN # ACCELERATOR PEDAL POSITION SENSOR 2 (APP2VREF)	

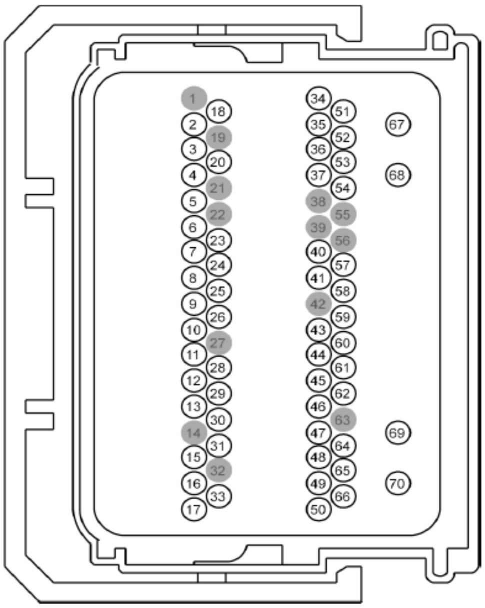
Fig. 45: Powertrain Control Module (1 Of 2) Connector End View (C175B) (1 Of 2)

29	LE230 (BN-BU)	20	CTRL MOD. - POWERTRAIN # FUEL TANK PRESSURE TRANSDUCER REF. VOLT. (FTPTREF)
30	CE608 (VT-GN)	18	RELAY - FUEL PUMP
31	*	*	not used
32	*	*	not used
33	LE424 (YE-GN)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE COWL (C-VREF)
34	CDC12 (YE)	20	CTRL MOD. - POWERTRAIN # STARTER MOTOR CONTROL (SMC)
35	CE302 (YE-BU)	12	CTRL MOD. - POWERTRAIN # POWERTRAIN CONTROL RELAY
36	*	*	not used
37	CBP18 (GY-OG)	20	FUSE - 26 OR CIRCUIT BREAKER
38	*	*	not used
39	*	*	not used
40	*	*	not used
41	VE808 (BU-GY)	20	SENSOR - MASS AIR FLOW RH BANK OR 2ND BANK (MAF)
42	RE325 (VT-BN)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. RH BANK OR 2ND BANK (MAFRTN)
43	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)
44	VE922 (VT-GN)	20	TRANSDUCER - FUEL TANK PRESSURE (FTPT)
45	CBP46 (WH-BU)	18	FUSE - 46 OR CIRCUIT BREAKER
46	CCB08 (VT-WH)	20	SWITCH - BRAKE ON/OFF (BOO) NORMAL OPEN
47	CES09 (VT-OG)	20	SWITCH - BRAKE PEDAL # SPEED CONTROL DEACTIVATION (BPS)
48	*	*	not used
49	*	*	not used
50	SBB45 (GY-RD)	20	FUSE - 45 OR CIRCUIT BREAKER
51	CBP47 (GN-BU)	20	FUSE - 47 OR CIRCUIT BREAKER
52	CBP47 (GN-BU)	20	FUSE - 47 OR CIRCUIT BREAKER
53	VH406 (VT-BN)	20	SENSOR - A/C EVAPORATOR TEMPERATURE (ACET)
54	SBB23 (WH-RD)	20	FUSE - 23 OR CIRCUIT BREAKER
55	CDB08 (BU-RD)	20	CONNECTOR - DIAGNOSTIC # FLASH EEPROM POWER SUPPLY (FEPS)
56	VES10 (WH)	20	SWITCH - SPEED CONTROL COMMAND (SCCS)
57	RES08 (GN-BN)	20	CTRL MOD. - POWERTRAIN # SPEED CONTROL COMMAND RETURN (SCCSRTN)
58	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C)
59	RE137 (YE-GN)	20	CTRL MOD. - POWERTRAIN # ACCELERATOR PEDAL POSITION SENSOR 2 (APP2RTN)
60	RE136 (VT-GN)	20	CTRL MOD. - POWERTRAIN # ACCELERATOR PEDAL POSITION SENSOR 1 (APP1RTN)
61	CE114 (GN-BU)	20	CTRL MOD. - POWERTRAIN # CANISTER VENT SOLENOID (CANVNT)
62	VE225 (YE-OG)	20	CTRL MOD. - POWERTRAIN # FUEL PUMP MODULE COMMAND (FPC)
63	VH433 (VT-OG)	20	TRANSDUCER - A/C PRESSURE (ACPT)
64	CH302 (WH-BN)	20	CTRL MOD. - POWERTRAIN # A/C CLUTCH CONTROL RELAY / WOT AC CUTOFF (ACCR)
65	VE806 (BN-WH)	20	SENSOR - MANUAL OUTPUT SHAFT SPEED (MOSS-V)
66	GD120 (BK-GN)	18	GROUND - FENDER FRONT LEFT
67	GD120 (BK-GN)	16	GROUND - FENDER FRONT LEFT
68	GD120 (BK-GN)	16	GROUND - FENDER FRONT LEFT
69	GD120 (BK-GN)	16	GROUND - FENDER FRONT LEFT
70	*	*	not used

Fig. 46: Powertrain Control Module (2 Of 2) Connector End View (C175B) (2 Of 2)

Connector: C175E

Description:	Harness:	Base Part #:
POWERTRAIN CONTROL MODULE (PCM)	12B637/14290	12A659



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	CE321 (YE)	18	CTRL MOD. - POWERTRAIN # POS. CRANKCASE VENTIL. VALVE HEATER CONTROL (PCVHC)	
3	VE731 (YE-GN)	18	SENSOR - HEATED OXYGEN POST CAT. 1ST OR UNIQUE (HO2S12)	
4	VE733 (WH)	18	SENSOR - HEATED OXYGEN POST CAT. 2ND (HO2S22)	
5	VE733 (WH)	18	SENSOR - HEATED OXYGEN POST CAT. 2ND (HO2S22)	PZEV
6	CE301 (GY-OG)	20	CTRL MOD. - POWERTRAIN # EGRMC1	
6	CE328 (YE-VT)	18	CTRL MOD. - POWERTRAIN # POS. CRANKCASE VENTIL. FITTING HEATER CONTROL (PCVFHC)	3.5L
7	CE102 (YE-BU)	20	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 2) (EGRMC) (-)	
8	CE103 (BU-BN)	20	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 3) (EGRMC)	
9	CE104 (GN)	20	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 4) (EGRMC)	
10	CE308 (VT-BN)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 6 (COP-F)	3.0L
11	CE306 (GN-VT)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 2 (COP-B)	2.3L
11	CE306 (GN-VT)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 5 (COP-E)	3.0L
11	CE307 (WH-BN)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 5 (COP-E)	3.5L
12	CE304 (YE-BU)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 3 (COP-C)	2.3L
12	CE304 (YE-BU)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 4 (COP-D)	3.0L
12	CE306 (GN-VT)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 4 (COP-D)	3.5L
13	CDC10 (BU-OG)	20	CTRL MOD. - POWERTRAIN # GENERATOR REGULATOR CONTROL (GENRC) GEN COM	
14	*	*	not used	
15	CE307 (WH-BN)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 3 (COP-C)	3.0L
15	CE305 (BU-OG)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 3 (COP-C)	3.5L
16	CE305 (BU-OG)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 4 (COP-D)	2.3L
16	CE305 (BU-OG)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 2 (COP-B)	3.0L
16	CE304 (YE-	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG	3.5L

Fig. 47: Powertrain Control Module (1 Of 3) Connector End View (C175E) (1 Of 3)

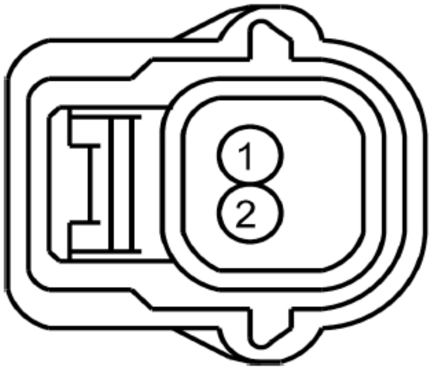
	BU)		ASSEMBLY 2 (COP-B)	
17	CE303 (WH-VT)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 1 (COP-A)	
18	VE716 (YE)	20	SENSOR - ENGINE COOLANT TEMPERATURE (ECT)	
18	VE712 (BU-GY)	20	SENSOR - CYLINDER HEAD TEMPERATURE (CHT)	3.5L
19	*	*	not used	
20	LE111 (VT-GN)	20	CTRL MOD. - POWERTRAIN # BUFFERED POWER SUPPLY SENSORS (VBPWR)	
21	*	*	not used	
22	*	*	not used	
23	CE233 (WH-OG)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 1ST OR UNIQUE (HTR12)	
24	CE234 (BU-WH)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 2ND (HTR22)	
25	CE234 (BU-WH)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 2ND (HTR13)	2.3L
26	CDC15 (VT)	20	GENERATOR (ALTERNATOR) # LOAD INPUT (GENLI) GEN MON	
27	*	*	not used	
28	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	
29	VE737 (WH-BU)	18	SENSOR - HEATED OXYGEN PRE CAT. 2ND (HO2S21)	
30	RE324 (BN-GN)	18	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 2ND (KS2N) [KSL2-]	
31	VE802 (BN-BU)	18	SENSOR - KNOCK 2ND (KS2P) [KSL2+]	
32	*	*	not used	
33	RE429 (GY-OG)	20	CTRL MOD. - POWERTRAIN # VARIABLE RELUCTANCE SENSOR (VRSRTN) (CAMSHAFT POSITION)	
34	CE412 (YE-VT)	18	CTRL MOD. - POWERTRAIN # THROTTLE ACTUATOR CONTROL MOTOR (TACM+)	
35	CE206 (GY-YE)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 2 (INJ)	
36	CE208 (YE-OG)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 4 (INJ)	
37	CE210 (GN-WH)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 6 (INJ)	
38	*	*	not used	
39	*	*	not used	
40	DE135 (BK)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKP)	
41	VE712 (BU-GY)	20	SENSOR - CYLINDER HEAD TEMPERATURE (CHT)	
42	*	*	not used	
43	VE519 (WH-OG)	20	MONITOR - SWIRL CONTROL VALVE (SCVM)	
44	VE707 (GN-VT)	20	SENSOR - CAMSHAFT POSITION BANK 2 IN+EX / IN (CMP2) [CID-H] (CID2)	
	VE706 (BN-		SENSOR - CAMSHAFT POSITION BANK 1 IN+EX / IN (CMP1)	

Fig. 48: Powertrain Control Module (2 Of 3) Connector End View (C175E) (2 Of 3)

45	BU)	20	[CID-H] (CID1)	
46	RE135 (GN-BN)	20	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	
47	VE711 (YE-VT)	20	SENSOR - CRANKSHAFT POSITION (CKPP)	
48	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	
49	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	
50	CE411 (BN-WH)	20	CTRL MOD. - POWERTRAIN # SWIRL CONTROL VALVE	
51	CE426 (BU-GN)	18	CTRL MOD. - POWERTRAIN # THROTTLE ACTUATOR CONTROL MOTOR (TACM-)	
52	CE205 (GN-BU)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 1 (INJ)	
53	CE207 (VT-GY)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 3 (INJ)	
54	CE209 (BN)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 5 (INJ)	
55	*	*	not used	
56	*	*	not used	
57	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	
58	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
59	RE427 (YE-VT)	20	CTRL MOD. - POWERTRAIN # THROTTLE POSITION (TPRTN)	
59	RE134 (BU-OG)	20	CTRL MOD. - POWERTRAIN # ELECTRONIC THROTTLE CONTROL (ETCRTN)	3.5L
60	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	
61	VE818 (BN)	20	SENSOR - THROTTLE POSITION # NEGATIVE SLOPE (TP1-NS)	
62	VE803 (BU-GN)	20	SENSOR - MANIFOLD ABSOLUTE PRESSURE (MAP)	
63	*	*	not used	
64	CE316 (GN)	20	CTRL MOD. - POWERTRAIN # INTAKE MANIFOLD TUNING VALVE (IMTV)	
65	VCS10 (BU-GN)	20	TRANSDUCER - POWER STEERING PRESSURE (PSPT)	
66	LE428 (BU-WH)	20	CTRL MOD. - POWERTRAIN # THROTTLE POSITION (TPREF)	
66	LE134 (YE)	20	CTRL MOD. - POWERTRAIN # ELECTRONIC THROTTLE CONTROL (ETCREF)	3.5L
67	CE421 (VT)	20	CTRL MOD. - POWERTRAIN # VARIABLE CAMSHAFT TIMING VALVE 1 (VCT1)	
68	CE422 (WH-OG)	20	CTRL MOD. - POWERTRAIN # VARIABLE CAMSHAFT TIMING VALVE 2 (VCT2)	
69	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	
70	CE236 (GY-VT)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 2ND (HTR21)	

Fig. 49: Powertrain Control Module (3 Of 3) Connector End View (C175E) (3 Of 3)

Connector: C177	Description:	Harness:	Base Part #:
	FRONT IMPACT SEVERITY SENSOR	14290	14B006



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VR213 (VT-GN)	20	SENSOR - IMPACT FRONT 1ST OR LEFT FEED	
2	RR129 (YE-GY)	20	CTRL MOD. - SENSOR IMPACT FRONT 1ST OR LEFT RETURN	

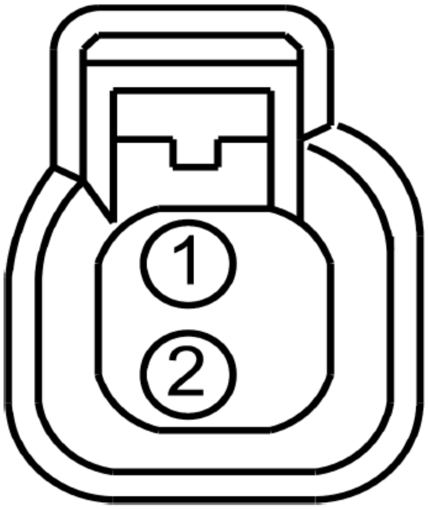
Fig. 50: Front Impact Severity Sensor Connector End View (C177)

Connector: C180	Description:	Harness:	Base Part #:
	CAMSHAFT POSITION SENSOR 1	12C508	6B288

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE429 (GY-OG)	20	CTRL MOD. - POWERTRAIN # VARIABLE RELUCTANCE SENSOR (VRSRTN) (CAMSHAFT POSITION)	
2	VE706 (BN-BU)	20	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX / IN (CMP1) [CID-H] (CID1)	

Fig. 51: Camshaft Position Sensor 1 Connector End View (C180)

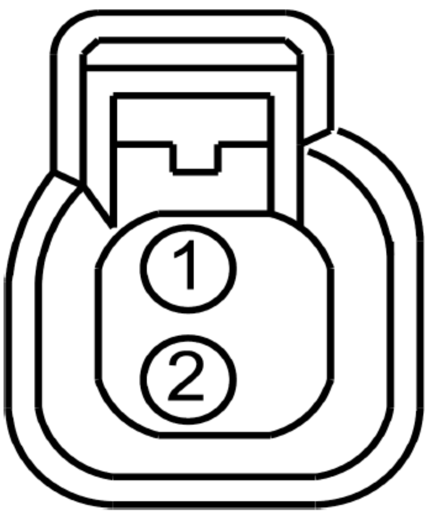
Connector: C181	Description:	Harness:	Base Part #:
	FUEL INJECTOR 1	12B637/12C508	9F593



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE205 (GN-BU)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 1 (INJ)	2.3L
1	CBP46 (WH-BU)	18	FUSE - 46 OR CIRCUIT BREAKER	3.0L
1	CE205 (GN-BU)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 1 (INJ)	3.5L
2	CBP46 (WH-BU)	18	FUSE - 46 OR CIRCUIT BREAKER	2.3L
2	CE205 (GN-BU)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 1 (INJ)	3.0L
2	CE608 (VT-GN)	20	RELAY - FUEL PUMP	3.5L

Fig. 52: Fuel Injector 1 Connector End View (C181)

Connector: C182	Description:	Harness:	Base Part #:
	FUEL INJECTOR 2	12B637/12C508	9F593



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE206 (GY-YE)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 2 (INJ)	2.3L
1	CBP46 (WH-BU)	18	FUSE - 46 OR CIRCUIT BREAKER	3.0L
1	CE206 (GY-YE)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 2 (INJ)	3.5L
2	CBP46 (WH-BU)	18	FUSE - 46 OR CIRCUIT BREAKER	2.3L
2	CE206 (GY-YE)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 2 (INJ)	3.0L
2	CE608 (VT-GN)	20	RELAY - FUEL PUMP	3.5L

Fig. 53: Fuel Injector 2 Connector End View (C182)

Connector: C183	Description:	Harness:	Base Part #:
	FUEL INJECTOR 3	12B637/12C508	9F593

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE207 (VT-GY)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 3 (INJ)	2.3L
1	CBP46 (WH-BU)	18	FUSE - 46 OR CIRCUIT BREAKER	3.0L
1	CE207 (VT-GY)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 3 (INJ)	3.5L
2	CBP46 (WH-BU)	18	FUSE - 46 OR CIRCUIT BREAKER	2.3L
2	CE207 (VT-GY)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 3 (INJ)	3.0L
2	CE608 (VT-GN)	20	RELAY - FUEL PUMP	3.5L

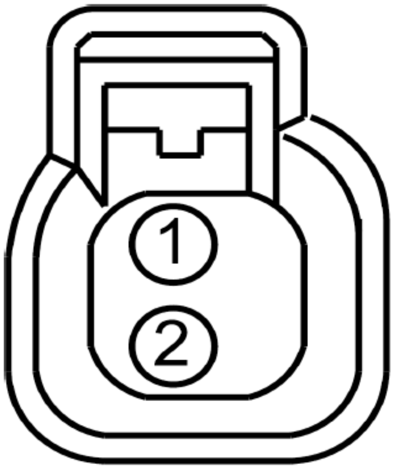


Fig. 54: Fuel Injector 3 Connector End View (C183)

Connector: C184	Description:	Harness:	Base Part #:
	FUEL INJECTOR 4	12B637/12C508	9F593

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE208 (YE-OG)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 4 (INJ)	2.3L
1	CBP46 (WH-BU)	18	FUSE - 46 OR CIRCUIT BREAKER	3.0L
1	CE208 (YE-OG)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 4 (INJ)	3.5L
2	CBP46 (WH-BU)	18	FUSE - 46 OR CIRCUIT BREAKER	2.3L
2	CE208 (YE-OG)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 4 (INJ)	3.0L
2	CE608 (VT-GN)	20	RELAY - FUEL PUMP	3.5L

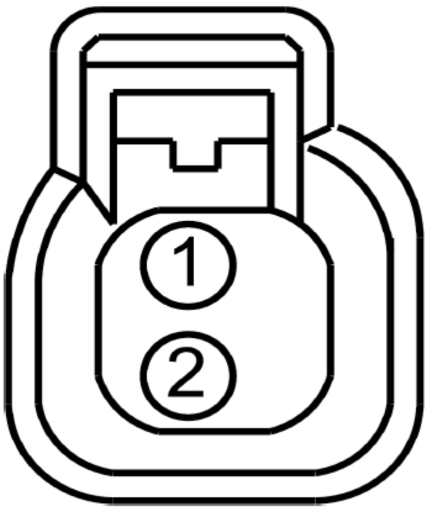


Fig. 55: Fuel Injector 4 Connector End View (C184)

Connector: C185	Description:	Harness:	Base Part #:
	FUEL INJECTOR 5	12B637/12C508	9F593

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP46 (WH-BU)	18	FUSE - 46 OR CIRCUIT BREAKER	3.0L
1	CE209 (BN)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 5 (INJ)	3.5L
2	CE209 (BN)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 5 (INJ)	3.0L
2	CE608 (VT-GN)	18	RELAY - FUEL PUMP	3.5L

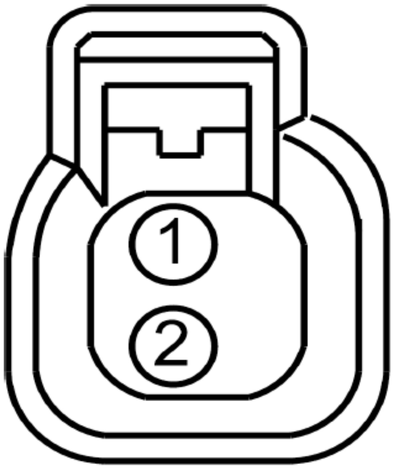


Fig. 56: Fuel Injector 5 Connector End View (C185)

Connector: C186	Description:	Harness:	Base Part #:
	FUEL INJECTOR 6	12B637/12C508	9F593

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP46 (WH-BU)	18	FUSE - 46 OR CIRCUIT BREAKER	3.0L
1	CE210 (GN-WH)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 6 (INJ)	3.5L
2	CE210 (GN-WH)	18	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 6 (INJ)	3.0L
2	CE608 (VT-GN)	20	RELAY - FUEL PUMP	3.5L

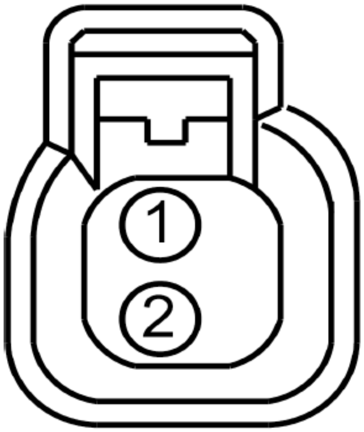
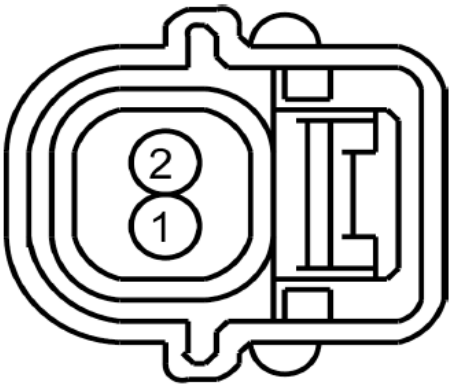


Fig. 57: Fuel Injector 6 Connector End View (C186)

Connector: C190	Description:	Harness:	Base Part #:
	HEATED POSITIVE CRANKCASE VENTILATION (PCV) VALVE	12B637/12C508	6A666



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP49 (VT-GY)	18	FUSE - 49 OR CIRCUIT BREAKER	3.0L
1	ZA145 (OG-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	3.5L
2	CE321 (YE)	18	CTRL MOD. - POWERTRAIN # POS. CRANKCASE VENTIL. VALVE HEATER CONTROL (PCVHC)	3.0L
2	CE321 (YE)	20	CTRL MOD. - POWERTRAIN # POS. CRANKCASE VENTIL. VALVE HEATER CONTROL (PCVHC)	3.5L

Fig. 58: Heated Positive Crankcase Ventilation Valve Connector End View (C190)

Connector: C191	Description:	Harness:	Base Part #:
	INTAKE MANIFOLD TUNING VALVE (IMTV)	12B637	14A464

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE316 (GN)	18	CTRL MOD. - POWERTRAIN # INTAKE MANIFOLD TUNING VALVE (IMTV)	
2	CBP49 (VT-GY)	18	FUSE - 49 OR CIRCUIT BREAKER	

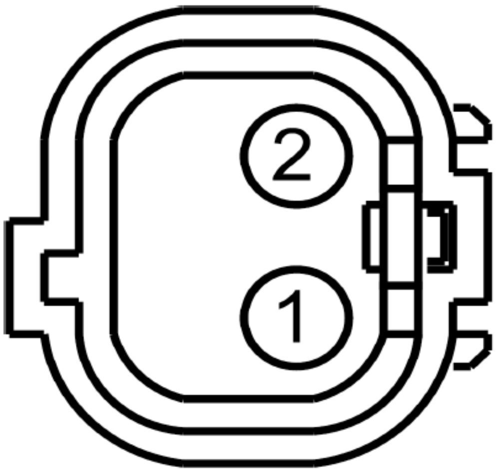


Fig. 59: Intake Manifold Tuning Valve Connector End View (C191)

Connector: C193	Description:	Harness:	Base Part #:
	OUTPUT SHAFT SPEED (OSS) SENSOR	12B637	7H103

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD120 (BK-GN)	20	GROUND - FENDER FRONT LEFT	
2	VET26 (BN-GN)	20	OUTPUT SHAFT SPEED (OSS) SIGNAL	
3	CE613 (WH-VT)	20	FNR5 RELAY SWITCHED OUTPUT	

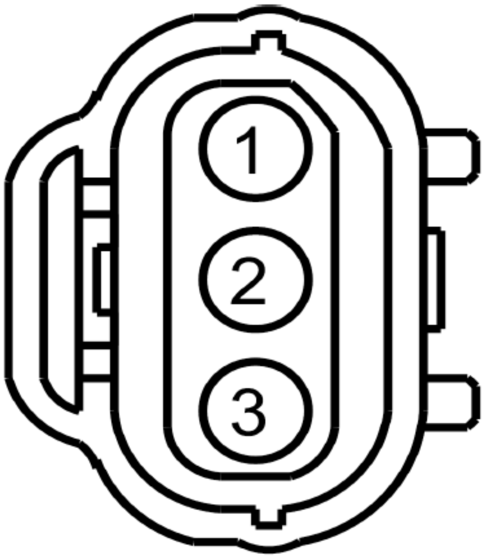


Fig. 60: Output Shaft Speed Sensor Connector End View (C193)

Connector: C194	Description:	Harness:	Base Part #:
	IGNITION TRANSFORMER CAPACITOR 2	12C508	18801

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBB46 (WH-BU)	18	FUSE - 48 OR CIRCUIT BREAKER	

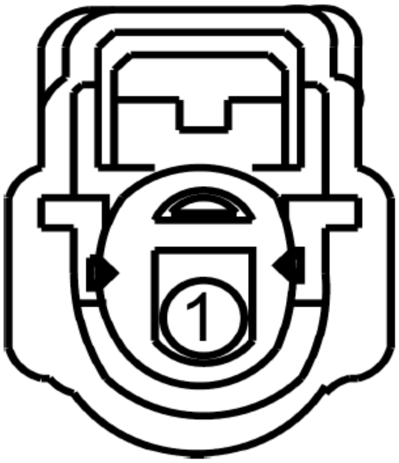
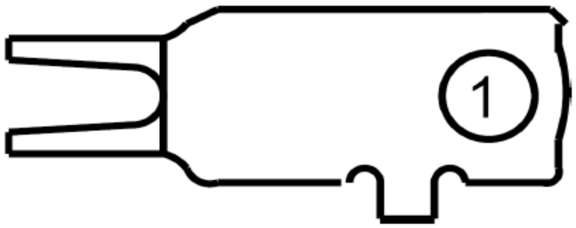


Fig. 61: Ignition Transformer Capacitor 2 Connector End View (C194)

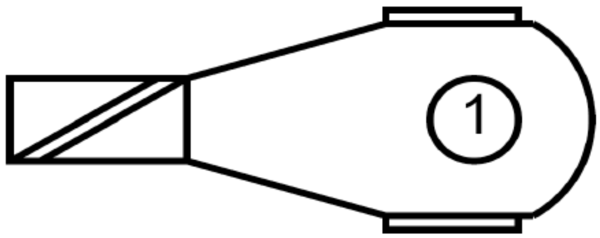
Connector: C197A	Description:	Harness:	Base Part #:
	STARTER MOTOR	14B060	11002



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SDC02 (RD)	04	Battery cable +	

Fig. 62: Starter Motor Connector End View (C197A)

Connector: C197B	Description:	Harness:	Base Part #:
	STARTER MOTOR	12B637/14B060	11002

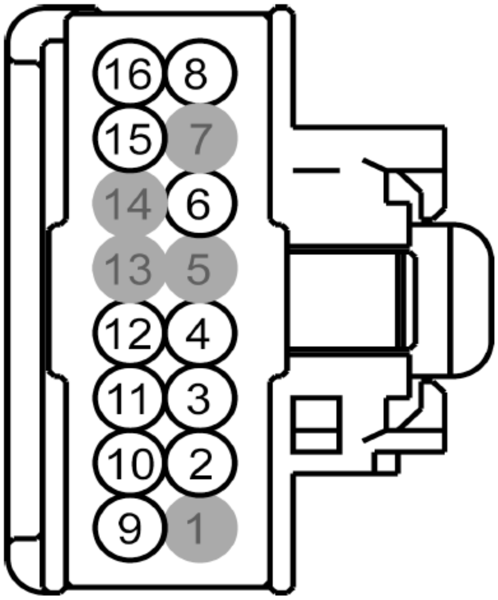


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CDC25 (BN-GN)	14	RELAY - STARTER	

Fig. 63: Starter Motor Connector End View (C197B)

Connector: C202

Description:	Harness:	Base Part #:
MULTIFUNCTION SWITCH	14401	13K359

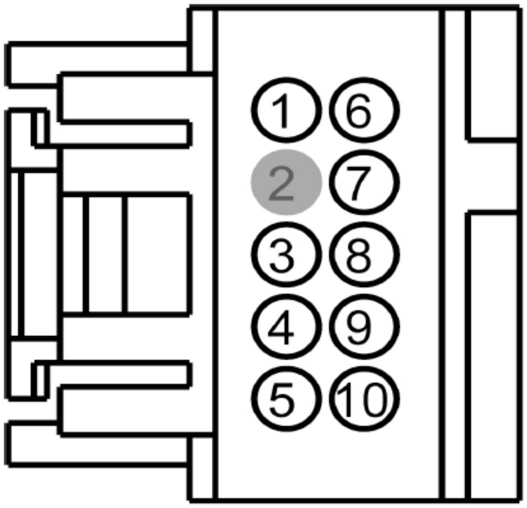


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	CLS39 (VT-WH)	20	SWITCH - TURN LEFT	
3	CLS41 (GY-YE)	20	SWITCH - TURN RIGHT	
4	CLF27 (GN-BN)	20	SWITCH - FLASH TO PASS	
5	*	*	not used	
6	CLF17 (WH-OG)	20	SWITCH - BEAM HIGH	
7	*	*	not used	
8	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
9	CRW08 (VT-OG)	22	SWITCH - FRONT WIPER HIGH (H)	
10	CRW07 (GY-BN)	22	SWITCH - FRONT WASHER	
11	CRW18 (VT-WH)	22	SWITCH - FRONT WIPER INTERVAL (B)	
12	CRW17 (GN-VT)	22	SWITCH - FRONT WIPER INTERVAL (A)	
13	*	*	not used	
14	*	*	not used	
15	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
16	CRW19 (BU-OG)	22	SWITCH - FRONT WIPER INTERVAL (C)	

Fig. 64: Multifunction Switch Connector End View (C202)

Connector: C205

Description:	Harness:	Base Part #:
MAIN LIGHT SWITCH	14401	11654



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
2	*	*	not used	
3	CLS34 (GY)	20	SWITCH - PARK LAMPS	
4	CLF23 (WH-VT)	20	SWITCH - HEADLAMP OFF	
5	VLN04 (VT-GY)	22	CTRL MOD. - IP/SWITCH ILLUMINATION	
6	CLF21 (GY-VT)	20	SWITCH - FOG LAMPS FRONT	
7	CLF28 (BN-WH)	20	CTRL MOD. - INDICATOR FOG LAMPS FRONT	
8	CLF18 (BU-WH)	20	SWITCH - BEAM LOW	
9	CLF19 (VT-GN)	20	SWITCH - AUTOLAMP ON	
10	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	

Fig. 65: Main Light Switch Connector End View (C205)

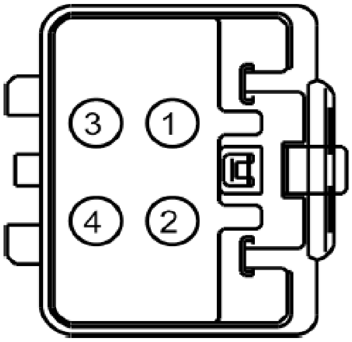
Inline: C210

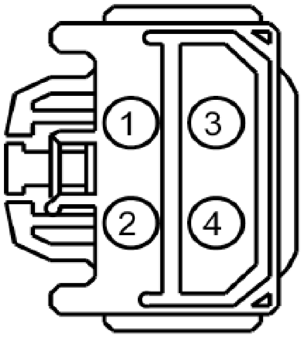
Description:
Inline

Base Part #:

MALE
Harness: 19D887

FEMALE
Harness: 14401





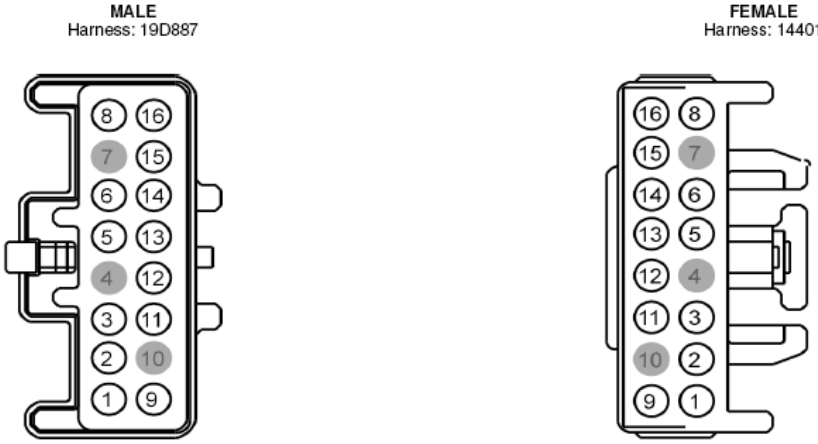
Pin	Circuit	Gauge	Qualifier
1	CH402 (YE-GN)	12	19D887
1	CH402 (YE-GN)	10	14401
2	CH430 (VT-OG)	10	
3	CH429 (GY-BN)	14	
4	CH428 (GN-WH)	16	

Fig. 66: Inline Connector End View (C210)

Inline: C211

Description:
Inline

Base Part #:



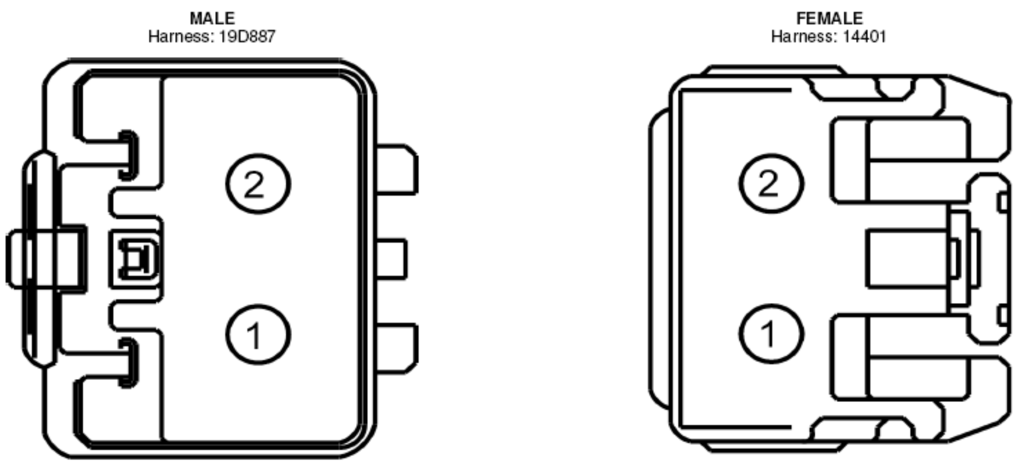
Pin	Circuit	Gauge	Qualifier
1	CH228 (YE-GY)	20	
2	CH233 (VT-BN)	20	
3	LH111 (BN-WH)	20	
4	*	*	
5	CH229 (WH-BU)	20	
6	CH234 (YE-GN)	20	
7	*	*	
8	VH436 (YE-VT)	20	
9	VH439 (GY-VT)	20	
10	*	*	
11	CH208 (GN-OG)	20	
12	CH207 (BU-GY)	20	
13	VH406 (VT-BN)	20	
14	RE407 (YE-VT)	20	
15	RH111 (GY-BU)	20	
16	GD115 (BK-GY)	16	

Fig. 67: Inline Connector End View (C211)

Inline: C212

Description:
Inline

Base Part #:



Pin	Circuit	Gauge	Qualifier
1	CH402 (YE-GN)	12	19D887
1	CH402 (YE-GN)	10	14401
2	GD115 (BK-GY)	12	19D887
2	GD115 (BK-GY)	10	14401

Fig. 68: Inline Connector End View (C212)

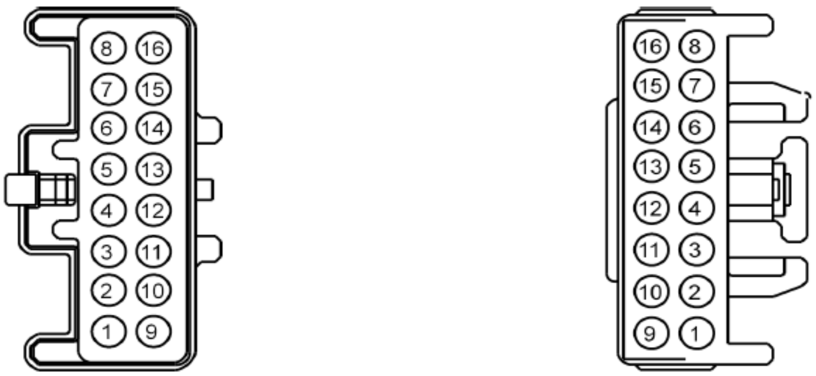
Inline: C213

Description:
Inline

Base Part #:

MALE
Harness: 19D887

FEMALE
Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	CH228 (YE-GY)	20	
2	CH233 (VT-BN)	20	EATC
2	CH212 (BU-OG)	20	DATC
3	LH111 (BN-WH)	20	
4	CH238 (YE-OG)	20	DATC
5	CH229 (WH-BU)	20	
6	CH234 (YE-GN)	20	EATC
6	CH213 (BN-GN)	20	DATC
7	CH239 (BU-WH)	20	
8	VH436 (YE-VT)	20	
9	VH439 (GY-VT)	20	EATC
9	VH441 (WH-BN)	20	DATC
10	VH101 (WH-VT)	18	
11	CH208 (GN-OG)	20	
12	CH207 (BU-GY)	20	
13	VH406 (VT-BN)	20	
14	RH104 (BU-BN)	20	
15	RH111 (GY-BU)	20	
16	VH440 (BU-BN)	20	DATC

Fig. 69: Inline Connector End View (C213)

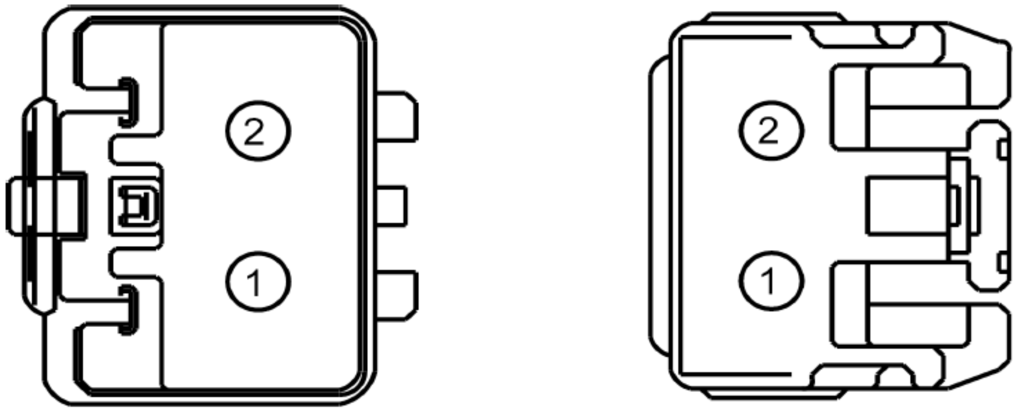
Inline: C214

Description: Inline

Base Part #:

MALE Harness: 14290

FEMALE Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	CH402 (YE-GN)	10	
2	SBB14 (BN-RD)	18	

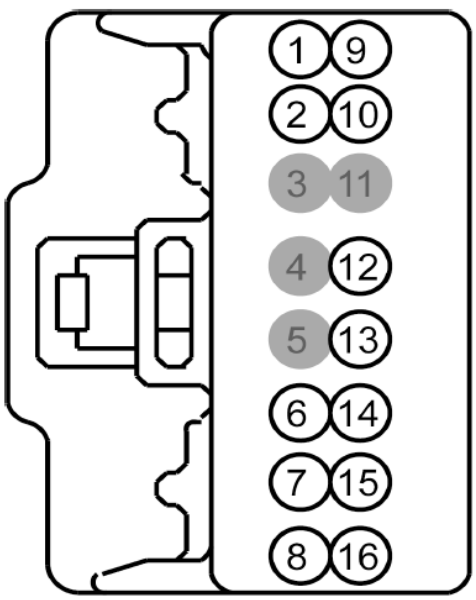
Fig. 70: Inline Connector End View (C214)

Connector: C218A

Description: CLOCKSPRING

Harness: 14401

Base Part #: 14A664

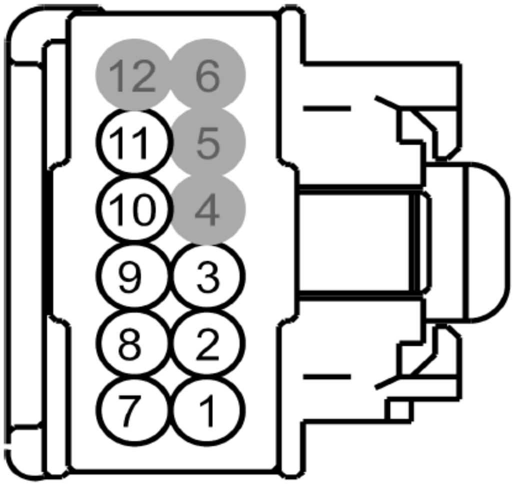


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR101 (VT-BN)	20	CTRL MOD. - AIR BAG DRIVER 1	
2	CR102 (BU)	20	CTRL MOD. - AIR BAG DRIVER 2	
3	*	*	not used	
4	*	*	not used	
5	*	*	not used	
6	VME54 (BU-OG)	20	SWITCH - VOICE NAV	
7	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
8	CRH02 (BU-WH)	20	SWITCH - HORN	
9	RR101 (YE-GN)	20	CTRL MOD. - AIR BAG DRIVER 1	
10	RR102 (WH)	20	CTRL MOD. - AIR BAG DRIVER 2	
11	*	*	not used	
12	RME24 (BU-WH)	22	CTRL MOD. - AUDIO # SWITCH REDUNDANT AUDIO	
13	VME14 (GY-YE)	22	SWITCH - REDUNDANT AUDIO	
14	RES08 (GN-BN)	20	CTRL MOD. - POWERTRAIN # SPEED CONTROL COMMAND RETURN (SCCSRTN)	
15	VES10 (WH)	20	SWITCH - SPEED CONTROL COMMAND (SCCS)	
16	VLN04 (VT-GY)	20	CTRL MOD. - IP/SWITCH ILLUMINATION	

Fig. 71: Clockspring Connector End View (C218A)

Connector: C218B

Description:	Harness:	Base Part #:
CLOCKSPRING	14672	14A664



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRH02 (BU-WH)	20	SWITCH - HORN	
2	GD165 (BK)	20	GROUND - STEERING COLUMN BRACKET	
3	VME54 (BU-OG)	22	SWITCH - VOICE NAV	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	VLN04 (VT-GY)	22	CTRL MOD. - IP/SWITCH ILLUMINATION	
8	VES10 (WH)	22	SWITCH - SPEED CONTROL COMMAND (SCCS)	
9	RES08 (GN-BN)	22	CTRL MOD. - POWERTRAIN # SPEED CONTROL COMMAND RETURN (SCCSRTN)	
10	VME14 (GY-YE)	22	SWITCH - REDUNDANT AUDIO	
11	RME24 (BU-WH)	22	CTRL MOD. - AUDIO # SWITCH REDUNDANT AUDIO	
12	*	*	not used	

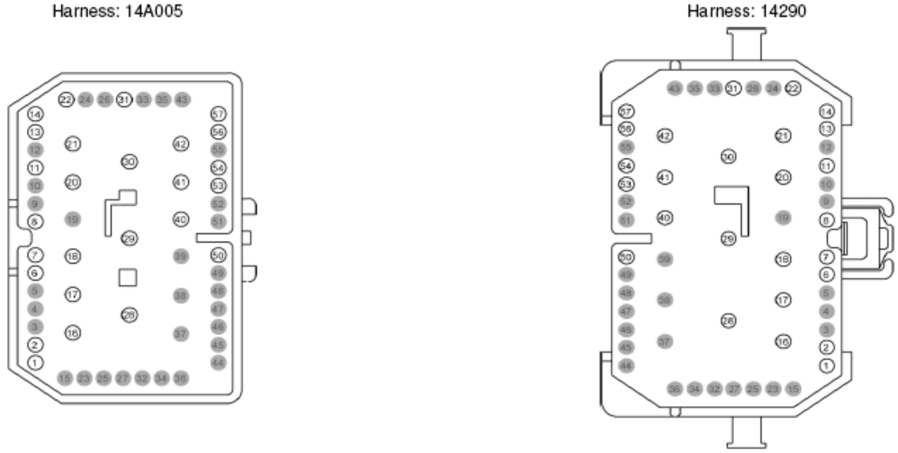
Fig. 72: Clockspring Connector End View (C218B)

Inline: C219

Description:	Base Part #:
Inline	

MALE
Harness: 14A005

FEMALE
Harness: 14290



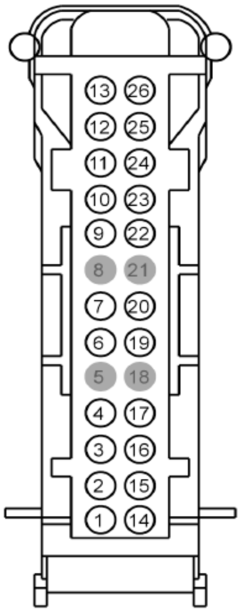
Pin	Circuit	Gauge	Qualifier
1	VR213 (VT-GN)	20	
2	RR129 (YE-GY)	20	
3	*	*	
4	*	*	
5	*	*	
6	VE922 (VT-GN)	20	
7	LE230 (BN-BU)	20	
8	RE407 (YE-VT)	20	
9	*	*	
10	*	*	
11	CBP12 (GN-WH)	20	
12	*	*	
13	VDB05 (WH)	20	
14	VDB04 (WH-BU)	20	

Fig. 73: Inline (1 Of 2) Connector End View (C219) (1 Of 2)

15	*	*	
16	SBB34 (YE-RD)	14	14A005
16	SBB34 (YE-RD)	12	14290
17	SBB35 (BU-RD)	14	14A005
17	SBB35 (BU-RD)	12	14290
18	SBB22 (BN-RD)	16	
19	*	*	
20	SBB20 (GN-RD)	14	14A005
20	SBB20 (GN-RD)	16	14290
21	SBB21 (GY-RD)	14	14A005
21	SBB21 (GY-RD)	16	14290
22	SBB15 (WH-RD)	20	
23	*	*	
24	*	*	
25	*	*	
26	*	*	
27	*	*	
28	SBB11 (BU-RD)	16	
28	SBB11 (BU-RD)	12	MKZ
29	SBB12 (GN-RD)	12	14A005
29	SBB12 (GN-RD)	14	14290
30	CE608 (VT-GN)	12	
31	CE114 (GN-BU)	20	
32	*	*	
33	*	*	
34	*	*	
35	*	*	
36	*	*	
37	*	*	
38	*	*	
39	*	*	
40	SBB33 (RD)	14	14A005
40	SBB33 (RD)	16	14290
41	SBB31 (WH-RD)	12	14A005
41	SBB31 (WH-RD)	14	14290
42	SBB32 (VT-RD)	12	
43	*	*	
44	*	*	
45	*	*	
46	*	*	
47	*	*	
48	*	*	
49	*	*	
50	SBB23 (WH-RD)	20	
51	*	*	
52	*	*	
53	RCA18 (BN-GN)	20	
54	VCA04 (BU-OG)	20	
55	*	*	
56	RCA20 (BN)	20	
57	VCA06 (WH-OG)	20	

Fig. 74: Inline (2 Of 2) Connector End View (C219) (2 Of 2)

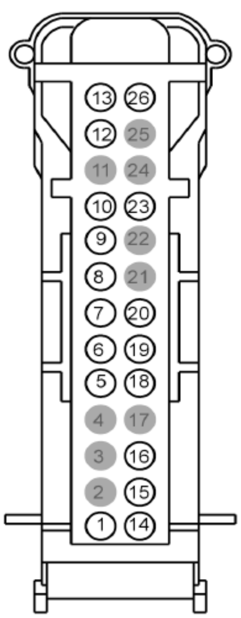
Connector: C220	Description:	Harness:	Base Part #:
	INSTRUMENT CLUSTER (IC)	14401	10849



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW	
2	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH	
3	VRT23 (VT-GY)	22	TRANSCEIVER - PASSIVE ANTI THEFT (IMMOBILIZER) # RX DATA (RX_IN)	
4	VRT24 (YE-OG)	22	TRANSCEIVER - PASSIVE ANTI THEFT (IMMOBILIZER) # TX CNTRL	
5	*	*	not used	
6	CBP23 (BN-YE)	20	FUSE - 23 OR CIRCUIT BREAKER	
7	CDC30 (BU-GY)	18	SWITCH - IGNITION # KEY IN	
8	*	*	not used	
9	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
10	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
11	RMC27 (WH-BN)	22	CTRL MOD. - INSTRUMENT CLUSTER # SWITCH INFORMATION / MESSAGE CENTER SELECT	
12	RMC32 (GN-BU)	20	CTRL MOD. - SENSOR FUEL LEVEL	
13	RMC33 (WH-VT)	20	CTRL MOD. - SENSOR FUEL LEVEL 2	
14	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
15	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
16	VMC31 (YE-GN)	22	COMPASS MOD. # +	
17	VMC30 (BU-GY)	22	COMPASS MOD. # -	
18	*	*	not used	
19	SBP07 (WH-RD)	20	FUSE - 13 OR CIRCUIT BREAKER	
20	CBP20 (YE-VT)	20	FUSE - 27 OR CIRCUIT BREAKER	
21	*	*	not used	
22	CCA15 (YE-GY)	22	SWITCH - IVD/TCS DISABLE	
23	CH434 (GY-YE)	22	SWITCH - CLIMATE MODE # AC	
24	CMC29 (GN-VT)	22	SWITCH - INFORMATION / MESSAGE CENTER SELECT	
25	VMC11 (YE-VT)	20	SENSOR - FUEL LEVEL (FLI)	
26	VMC23 (GN-OG)	20	SENSOR - FUEL LEVEL 2 (FLI)	

Fig. 75: Instrument Cluster Connector End View (C220)

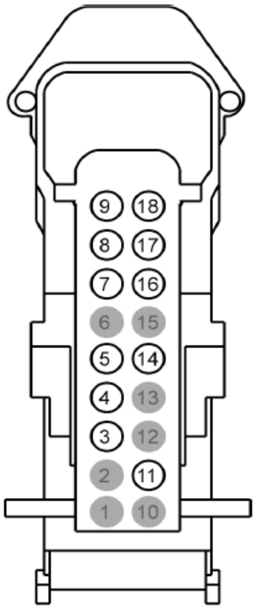
Connector: C228A	Description:	Harness:	Base Part #:
	HVAC-EATC	14401	19980



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
2	*	*	not used	
3	*	*	not used	
4	*	*	not used	
5	LH111 (BN-WH)	20	CTRL MOD. - CLIMATE # DOOR POSITION SENSORS ALSO GENERIC VREF IN LOGICAL SCHEMATICS	
6	CH234 (YE-GN)	20	CTRL MOD. - CLIMATE # DOOR MOTOR TEMP. COIL 2 / OPEN (IF PLUS)	
7	CH233 (VT-BN)	20	CTRL MOD. - CLIMATE # DOOR MOTOR TEMP. COIL 1 / CLOSE (IF PLUS)	
8	CH207 (BU-GY)	20	CTRL MOD. - CLIMATE # DOOR MOTOR RECIRC. COIL 1 / CLOSE (IF PLUS)	
9	CH208 (GN-OG)	20	CTRL MOD. - CLIMATE # DOOR MOTOR RECIRC. COIL 2 / OPEN (IF PLUS)	
10	CH122 (WH-OG)	22	CTRL MOD. - CLIMATE # HEATER REAR WINDOW REQUEST	
11	*	*	not used	
12	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH	
13	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW	
14	CH229 (WH-BU)	20	CTRL MOD. - CLIMATE # DOOR MOTOR DEFROST COIL 2 / OPEN (IF PLUS)	
15	RH111 (GY-BU)	20	CTRL MOD. - CLIMATE # DOOR POSITION SENSORS ALSO GENERIC VREF RETURN IN LOGICAL SCHEMATICS	
16	VH436 (YE-VT)	20	SENSOR - DOOR POSITION DEFROST	
17	*	*	not used	
18	VH439 (GY-VT)	20	SENSOR - DOOR POSITION TEMP.	
19	CBP20 (YE-VT)	20	FUSE - 27 OR CIRCUIT BREAKER	
20	CH228 (YE-GY)	20	CTRL MOD. - CLIMATE # DOOR MOTOR DEFROST COIL 1 / CLOSE (IF PLUS)	
21	*	*	not used	
22	*	*	not used	
23	CH123 (VT-GN)	20	CTRL MOD. - BLOWER MOTOR RELAY	
24	*	*	not used	
25	*	*	not used	
26	SBP07 (WH-RD)	20	FUSE - 13 OR CIRCUIT BREAKER	

Fig. 76: HVAC-EATC Connector End View (C228A)

Connector: C228B	Description:	Harness:	Base Part #:
	HVAC-EATC	14401	19980



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	RH104 (BU-BN)	20	CTRL MOD. - CLIMATE # SENSOR RETURN	
4	VH414 (GN-BU)	20	SENSOR - INCAR TEMP.	
5	CHS09 (GY)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER INDICATOR LOW	
6	*	*	not used	
7	CHS29 (WH-BU)	20	SWITCH - SEAT HEATER FRONT DRIVER SIDE	
8	CHS30 (GY-YE)	20	SWITCH - SEAT HEATER FRONT PASSENGER SIDE	
9	CHS13 (VT-BN)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER INDICATOR HIGH	
10	*	*	not used	
11	CHS04 (YE-GY)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER INDICATOR LOW	
12	*	*	not used	
13	*	*	not used	
14	VH101 (WH-VT)	18	CTRL MOD. - CLIMATE # BLOWER MOTOR CONTROL	
15	*	*	not used	
16	CHS14 (GN)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER INDICATOR HIGH	
17	VH407 (YE-GN)	20	SENSOR - AMBIENT TEMP.	
18	VH416 (VT-GY)	22	SENSOR - SUN LOAD # LEFT	

Fig. 77: HVAC-EATC Connector End View (C228B)

Connector: C233	Description:	Harness:	Base Part #:
	IN-VEHICLE TEMPERATURE SENSOR	14401	19C734

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RH104 (BU-BN)	20	CTRL MOD. - CLIMATE # SENSOR RETURN	
2	VH414 (GN-BU)	20	SENSOR - INCAR TEMP.	

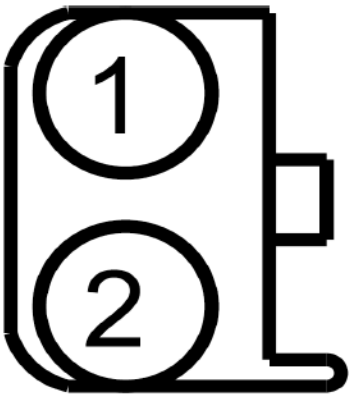


Fig. 78: In-Vehicle Temperature Sensor Connector End View (C233)

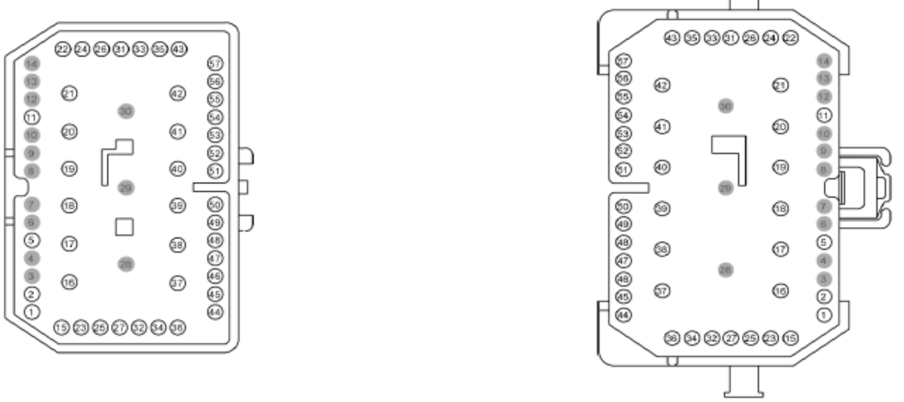
Inline: C237

Description: Inline

Base Part #:

MALE Harness: 14A005

FEMALE Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	VMC31 (YE-GN)	22	
2	VMC30 (BU-GY)	22	
3	*	*	
4	*	*	
5	VLN04 (VT-GY)	22	
6	*	*	
7	*	*	
8	*	*	
9	*	*	
10	*	*	
11	CHS09 (GY)	20	
12	*	*	
13	*	*	
14	*	*	

Fig. 79: Inline (1 Of 2) Connector End View (C237) (1 Of 2)

15	VDB06 (GY-OG)	20	
16	CLN09 (YE-GN)	18	
17	VMC23 (GN-OG)	20	
18	RMC33 (WH-VT)	20	
19	DME13 (NONE)	18	
20	VMM13 (YE-GN)	20	
21	RMM13 (BU)	20	
22	RME06 (GY-YE)	18	
23	VDB07 (VT-OG)	20	
24	VME06 (GN)	18	
25	CME44 (YE-GN)	20	
26	RME17 (GY)	22	
27	CME27 (YE-VT)	20	
28	*	*	
29	*	*	
30	*	*	
31	VME17 (GN)	22	
32	DMN07 (GY)	18	
33	DME17 (BK)	18	
34	RMN07 (VT)	22	
35	RME18 (YE)	22	
36	VMN07 (GY)	22	
37	VME42 (VT-BN)	20	
38	RME42 (YE-BU)	20	
39	VME41 (GN-OG)	20	
40	RME41 (BU-BN)	20	
41	DME41 (BK)	18	
42	VET13 (GY-BU)	18	
43	VME18 (VT)	22	
44	VME28 (BN-VT)	20	14A005
44	VME28 (BN-VT)	18	14401
44	VME07 (WH)	20	
45	RME28 (BN-GN)	18	14401
45	RME28 (BN-GN)	20	14A005
45	RME07 (WH-BN)	20	
46	VME29 (GN-WH)	20	14A005
46	VME29 (GN-WH)	18	14401
46	VME10 (WH-VT)	20	
47	RME29 (BU-WH)	20	14A005
47	RME29 (BU-WH)	18	14401
47	RME10 (WH-OG)	20	
48	VME09 (BN-GN)	20	
49	RME09 (BN-YE)	20	
50	VME12 (BN-WH)	20	
51	RME12 (BN-BU)	20	
52	VDB07 (VT-OG)	20	
53	VDB06 (GY-OG)	20	
54	SME23 (VT-RD)	22	
55	DME22 (BK)	18	
56	RME22 (GN-WH)	20	
57	VME22 (VT-GN)	20	

Fig. 80: Inline (2 Of 2) Connector End View (C237) (2 Of 2)

Inline: C238

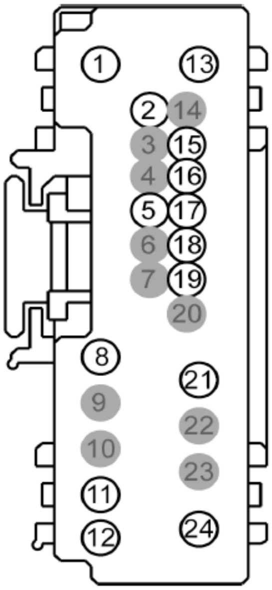
Description:
Inline

Base Part #:

Pin	Circuit	Gauge	Qualifier
1	*	*	
2	CDB08 (BU-RD)	20	
3	VH406 (VT-BN)	20	
4	RES08 (GN-BN)	20	
5	VES10 (WH)	20	
6	*	*	
7	CET34 (BN-GN)	20	
8	CDC35 (BU-WH)	18	
9	*	*	
10	RE407 (YE-VT)	20	
11	VH407 (YE-GN)	20	
12	RH104 (BU-BN)	20	
13	*	*	
14	CH123 (VT-GN)	20	
15	*	*	
16	CDC35 (BU-WH)	20	Without OTIS
16	CE336 (GN-WH)	18	

Fig. 81: Inline Connector End View (C238)

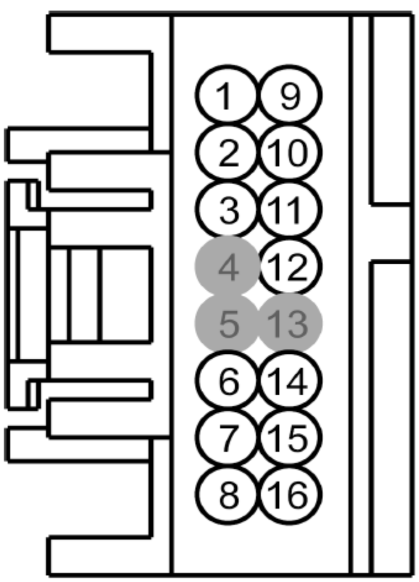
Connector: C240A	Description:	Harness:	Base Part #:
	AUDIO CONTROL MODULE (ACM)	14401	18806



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP11 (BU-RD)	18	FUSE - 18 OR CIRCUIT BREAKER	
2	CBP02 (GN)	20	FUSE - 12 OR CIRCUIT BREAKER	
3	*	*	not used	
4	*	*	not used	
5	CME44 (YE-GN)	18	CTRL MOD. - ANTENNA POWER # REAR WINDOW	
6	*	*	not used	
7	*	*	not used	
8	VME17 (GN)	22	CTRL MOD. - AUDIO # RADIO LEFT	
9	*	*	not used	
10	*	*	not used	
11	VME18 (VT)	22	CTRL MOD. - AUDIO # RADIO RIGHT	
12	RME18 (YE)	22	CTRL MOD. - AUDIO # RADIO RIGHT	
13	GD114 (BK-BU)	16	GROUND - CROSS CAR BEAM	
14	*	*	not used	
15	CBP13 (GY-BN)	20	FUSE - 22 OR CIRCUIT BREAKER	
16	RME24 (BU-WH)	22	CTRL MOD. - AUDIO # SWITCH REDUNDANT AUDIO	
17	VME54 (BU-OG)	20	SWITCH - VOICE NAV	
18	VME14 (GY-YE)	22	SWITCH - REDUNDANT AUDIO	
19	RME24 (BU-WH)	22	CTRL MOD. - AUDIO # SWITCH REDUNDANT AUDIO	
20	*	*	not used	
21	RME17 (GY)	22	CTRL MOD. - AUDIO # RADIO LEFT	
22	*	*	not used	
23	*	*	not used	
24	DME17 (BK)	18	CTRL MOD. - AUDIO # RADIO SHIELD	

Fig. 82: Audio Control Module Connector End View (C240A)

Connector: C240C	Description:	Harness:	Base Part #:
	AUDIO CONTROL MODULE (ACM)	14401	18806



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME41 (GN-OG)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO LEFT +	
2	RME41 (BU-BN)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO LEFT -	
3	DME45 (BK)	18	JACK - AUDIO # EXT. AUX IN SHIELD	
4	*	*	not used	
5	*	*	not used	
6	VME46 (BU-GN)	20	JACK - AUDIO # EXT. AUX IN RIGHT (+)	
7	VME45 (BU)	20	JACK - AUDIO # EXT. AUX IN LEFT (+)	
8	RME45 (YE-GN)	20	JACK - AUDIO # EXT. AUX IN LEFT (-)	
9	VME42 (VT-BN)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO RIGHT +	
10	RME42 (YE-BU)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO RIGHT -	
11	VMM13 (YE-GN)	20	MICROPHONE - PHONE/VOICE CONTROL	
12	RMM13 (BU)	20	MICROPHONE - PHONE/VOICE CONTROL	
13	*	*	not used	
14	RME46 (WH-GN)	20	JACK - AUDIO # EXT. AUX IN RIGHT (-)	
15	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH	
16	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW	

Fig. 83: Audio Control Module Connector End View (C240C)

Connector: C240D	Description:	Harness:	Base Part #:
	AUDIO CONTROL MODULE (ACM)	14401	18806

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VMN07 (GY)	22	CTRL MOD. - AUDIO # NAVIGATION VOICE	
2	RMN07 (VT)	22	CTRL MOD. - AUDIO # NAVIGATION VOICE	
3	DMN07 (GY)	18	CTRL MOD. - AUDIO # NAVIGATION VOICE SHIELD	
4	CME27 (YE-VT)	20	CTRL MOD. - AUDIO # ENABLE / CLIPPING	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	

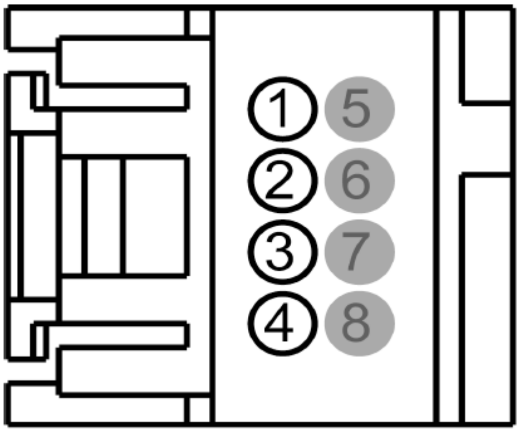


Fig. 84: Audio Control Module Connector End View (C240D)

Connector: C250	Description:	Harness:	Base Part #:
	IGNITION SWITCH	14401	11572

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CDC34 (WH-OG)	18	SWITCH - IGNITION # RUN; START	
2	*	*	not used	
3	CET22 (GY-BN)	20	CTRL MOD. - POWERTRAIN # TRANSMISSION RANGE OUTPUT PARK (TRO-P)	
4	SBB14 (BN-RD)	18	FUSE - 14 OR CIRCUIT BREAKER	
5	CDC30 (BU-GY)	18	SWITCH - IGNITION # KEY IN	
6	CDC33 (VT-GN)	20	SWITCH - IGNITION # RUN; ACCESSORY	
7	CDC35 (BU-WH)	20	SWITCH - IGNITION # START	

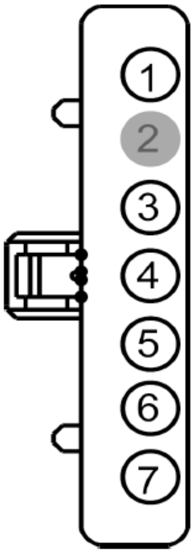
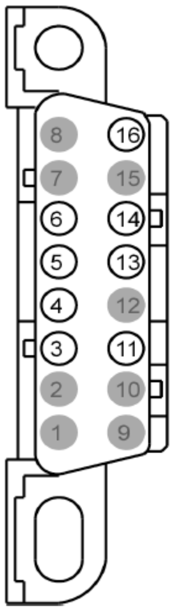


Fig. 85: Ignition Switch Connector End View (C250)

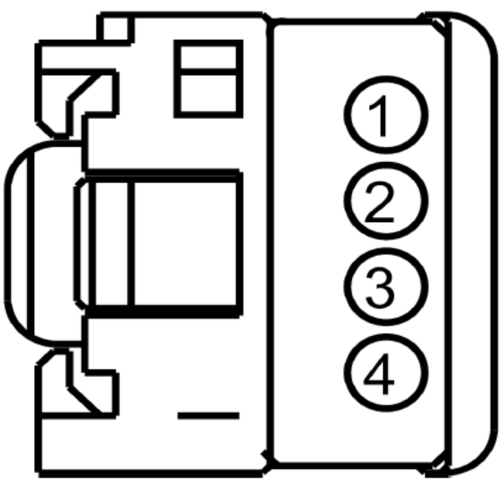
Connector: C251	Description:	Harness:	Base Part #:
	DATA LINK CONNECTOR (DLC)	14401	14489



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH	
4	GD116 (BK-VT)	18	GROUND - CROSS CAR BEAM # 3RD STUD	
5	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
6	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW	
12	*	*	not used	
13	CDB08 (BU-RD)	20	CONNECTOR - DIAGNOSTIC # FLASH EEPROM POWER SUPPLY (FEPS)	
14	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
15	*	*	not used	
16	SBP11 (BU-RD)	18	FUSE - 18 OR CIRCUIT BREAKER	

Fig. 86: Data Link Connector End View (C251)

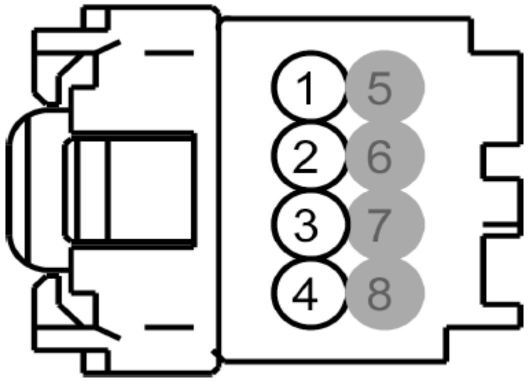
Connector: C252	Description:	Harness:	Base Part #:
	PASSIVE ANTI-THEFT TRANSCEIVER MODULE	14401	15607



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP18 (GY-OG)	20	FUSE - 18 OR CIRCUIT BREAKER	
2	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
3	VRT24 (YE-OG)	22	TRANSCEIVER - PASSIVE ANTI THEFT (IMMOBILIZER) # TX CNTRL	
4	VRT23 (VT-GY)	22	TRANSCEIVER - PASSIVE ANTI THEFT (IMMOBILIZER) # RX DATA (RX_IN)	

Fig. 87: Passive Anti-Theft Transceiver Module Connector End View (C252)

Connector: C253	Description:	Harness:	Base Part #:
	MESSAGE CENTER SWITCH	14401	10D889



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VLN04 (VT-GY)	22	CTRL MOD. - IP/SWITCH ILLUMINATION	
2	RMC27 (WH-BN)	22	CTRL MOD. - INSTRUMENT CLUSTER # SWITCH INFORMATION / MESSAGE CENTER SELECT	
3	CMC29 (GN-VT)	22	SWITCH - INFORMATION / MESSAGE CENTER SELECT	
4	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	

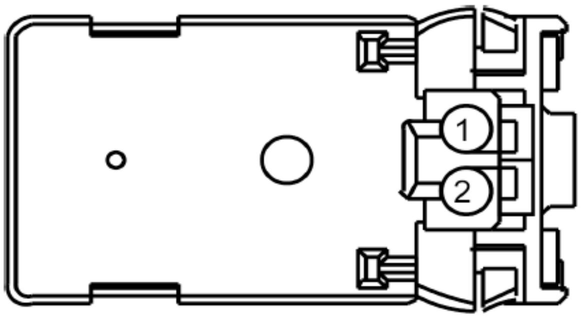
Fig. 88: Message Center Switch Connector End View (C253)

Connector: C254	Description:	Harness:	Base Part #:
	GLOVE BOX LAMP	14401	14413

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLN09 (YE-GN)	18	RELAY - BATTERY SAVER (E.G. SWITCH OFF INTERIOR LIGHTING)	

Fig. 89: Glove Box Lamp Connector End View (C254)

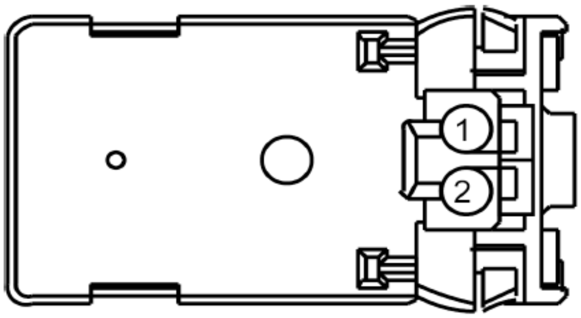
Connector: C256A	Description:	Harness:	Base Part #:
	PASSENGER AIR BAG MODULE	14401	044A74



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR103 (GY-BU)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 1 SIGNAL	
2	RR103 (VT-GN)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 1 RTN	

Fig. 90: Passenger Air Bag Module Connector End View (C256A)

Connector: C256B	Description:	Harness:	Base Part #:
	PASSENGER AIR BAG MODULE	14401	044A74



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR104 (YE-GY)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 2 SIGNAL	
2	RR104 (WH-BU)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 2 RTN	

Fig. 91: Passenger Air Bag Module Connector End View (C256B)

Connector: C271	Description:	Harness:	Base Part #:
	FRONT BLOWER MOTOR SPEED CONTROLLER	19D887	19E624

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	GD115 (BK-GY)	12	GROUND - CROSS CAR BEAM # 2ND STUD	
B	VH101 (WH-VT)	18	CTRL MOD. - CLIMATE # BLOWER MOTOR CONTROL	
C	CH402 (YE-GN)	12	RELAY - FRONT BLOWER	
D	VH301 (YE-BU)	12	CTRL MOD. - BLOWER VARIABLE SPEED # BLOWER MOTOR	
E	CH218 (GN-VT)	12	CTRL MOD. - CLIMATE # VARIABLE SPEED BLOWER CONTROL OUTPUT	

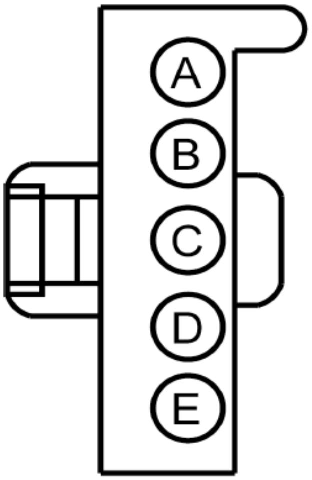


Fig. 92: Front Blower Motor Speed Controller Connector End View (C271)

Connector: C278	Description:	Harness:	Base Part #:
	BRAKE PEDAL POSITION SWITCH	14290	13480

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP04 (GN-RD)	20	FUSE - 21 OR CIRCUIT BREAKER	
2	CBP49 (VT-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	
3	CES09 (VT-OG)	20	SWITCH - BRAKE PEDAL # SPEED CONTROL DEACTIVATION (BPS)	
4	CCB08 (VT-WH)	20	SWITCH - BRAKE ON/OFF (BOO) NORMAL OPEN	

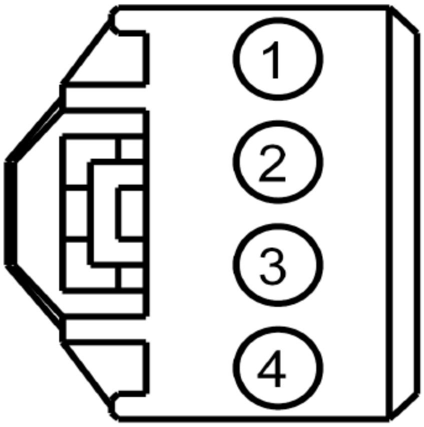


Fig. 93: Brake Pedal Position Switch Connector End View (C278)

Connector: C282	Description:	Harness:	Base Part #:
	INERTIA FUEL SHUTOFF (IFS) SWITCH	14A005	9341

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE911 (VT-WH)	12	SWITCH - INERTIA POWER OFF (ISPO)	
2	CE608 (VT-GN)	12	RELAY - FUEL PUMP	
3	*	*	not used	

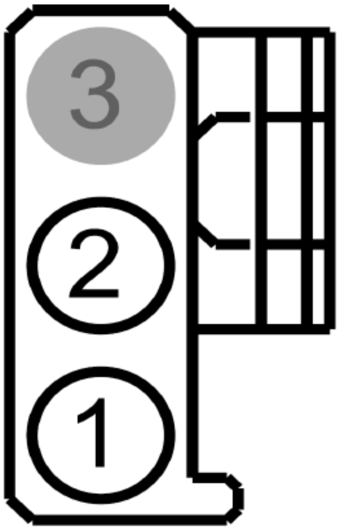


Fig. 94: Inertia Fuel Shutoff Switch Connector End View (C282)

Connector: C286	Description:	Harness:	Base Part #:
	SUNLOAD SENSOR	14401	13A018

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VH417 (YE-OG)	22	SENSOR - SUN LOAD # RIGHT	DATC
2	VLF14 (BU-BN)	22	SENSOR - AUTOLAMP DAY/NIGHT	
3	VH416 (VT-GY)	22	SENSOR - SUN LOAD # LEFT	
4	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	

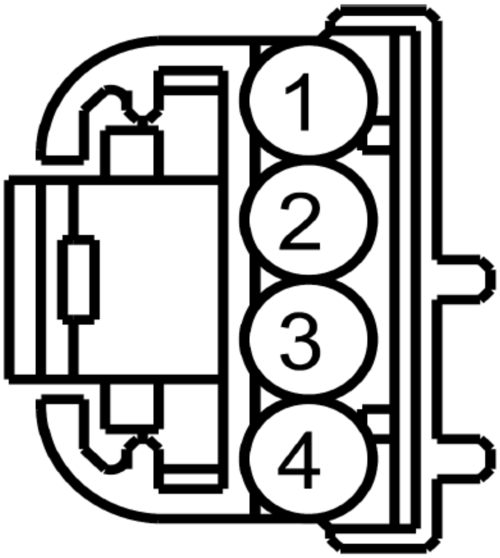


Fig. 95: Sunload Sensor Connector End View (C286)

Connector: C288	Description:	Harness:	Base Part #:
	BLOWER MOTOR	19D887	19805

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	CH402 (YE-GN)	12	RELAY - FRONT BLOWER	Man. A/C
A	CH218 (GN-VT)	12	CTRL MOD. - CLIMATE # VARIABLE SPEED BLOWER CONTROL OUTPUT	Auto A/C
B	CH430 (VT-OG)	12	SWITCH - FRONT BLOWER # POSITION 4 (HIGH)	Man. A/C
B	VH301 (YE-BU)	12	CTRL MOD. - BLOWER VARIABLE SPEED # BLOWER MOTOR	Auto A/C

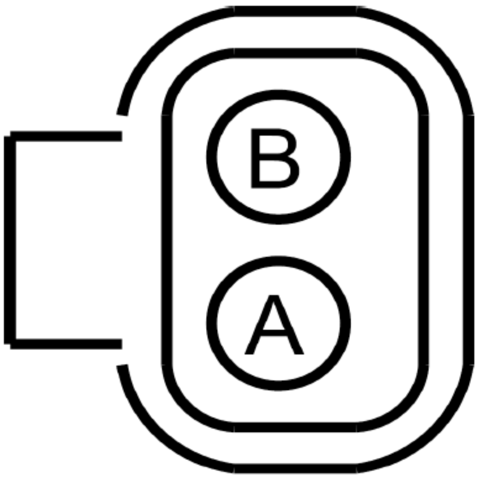


Fig. 96: Blower Motor Connector End View (C288)

Connector: C289	Description:	Harness:	Base Part #:
	FRESH/ RECIRCULATION DOOR ACTUATOR	19D887	18B545

Pin	Circuit	Gauge	Circuit Function	Qualifier
5	CH207 (BU-GY)	20	CTRL MOD. - CLIMATE # DOOR MOTOR RECIRC. COIL 1 / CLOSE (IF PLUS)	
6	CH208 (GN-OG)	20	CTRL MOD. - CLIMATE # DOOR MOTOR RECIRC. COIL 2 / OPEN (IF PLUS)	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	

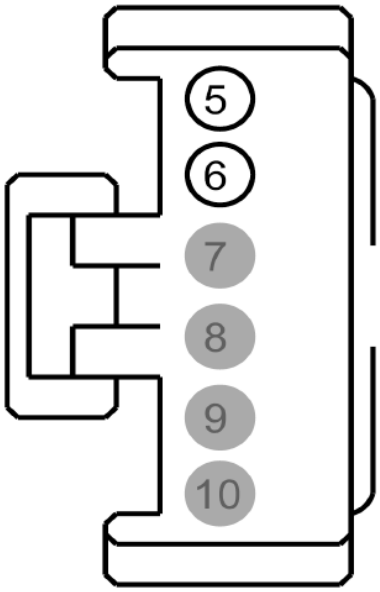
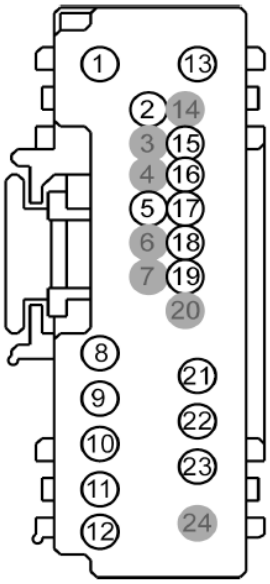


Fig. 97: Fresh/ Recirculation Door Actuator Connector End View (C289)

Connector: C290A

Description:	Harness:	Base Part #:
AUDIO CONTROL MODULE (ACM)	14401	18806

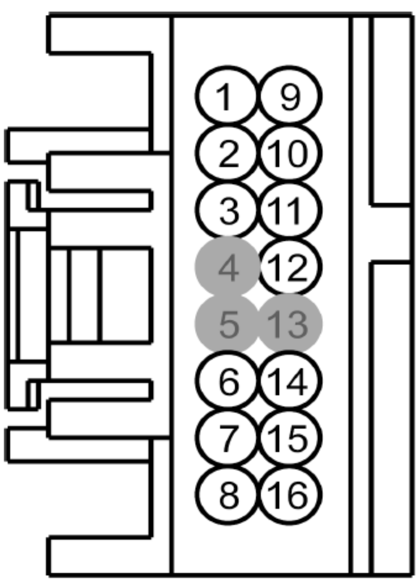


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP11 (BU-RD)	16	FUSE - 18 OR CIRCUIT BREAKER	
2	CBP02 (GN)	20	FUSE - 12 OR CIRCUIT BREAKER	
3	*	*	not used	
4	*	*	not used	
5	CME44 (YE-GN)	18	CTRL MOD. - ANTENNA POWER # REAR WINDOW	
6	*	*	not used	
7	*	*	not used	
8	VME07 (WH)	20	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT DOOR (WOOFER)	
9	VME09 (BN-GN)	20	CTRL MOD. - AUDIO # SPEAKER LEFT REAR	
10	VME12 (BN-WH)	20	CTRL MOD. - AUDIO # SPEAKER RIGHT REAR	
11	VME10 (WH-VT)	20	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT DOOR (WOOFER)	
12	RME10 (WH-OG)	20	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT DOOR (WOOFER)	
13	GD114 (BK-BU)	14	GROUND - CROSS CAR BEAM	
14	*	*	not used	
15	CBP13 (GY-BN)	20	FUSE - 22 OR CIRCUIT BREAKER	
16	RME24 (BU-WH)	22	CTRL MOD. - AUDIO # SWITCH REDUNDANT AUDIO	
17	VME54 (BU-OG)	20	SWITCH - VOICE NAV	
18	VME14 (GY-YE)	22	SWITCH - REDUNDANT AUDIO	
19	RME24 (BU-WH)	22	CTRL MOD. - AUDIO # SWITCH REDUNDANT AUDIO	
20	*	*	not used	
21	RME07 (WH-BN)	20	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT DOOR (WOOFER)	
22	RME09 (BN-YE)	20	CTRL MOD. - AUDIO # SPEAKER LEFT REAR	
23	RME12 (BN-BU)	20	CTRL MOD. - AUDIO # SPEAKER RIGHT REAR	
24	*	*	not used	

Fig. 98: Audio Control Module Connector End View (C290A)

Connector: C290C

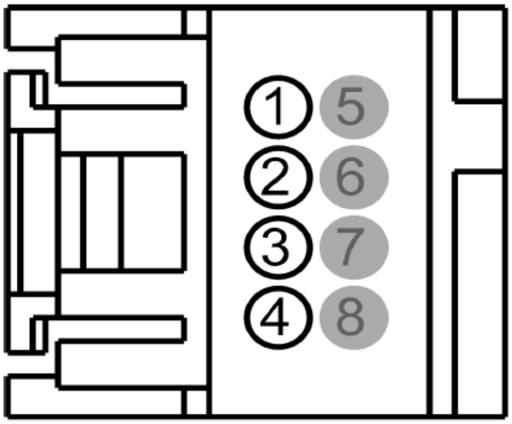
Description:	Harness:	Base Part #:
AUDIO CONTROL MODULE (ACM)	14401	18806



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME41 (GN-OG)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO LEFT +	
2	RME41 (BU-BN)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO LEFT -	
3	DME45 (BK)	18	JACK - AUDIO # EXT. AUX IN SHIELD	
4	*	*	not used	
5	*	*	not used	
6	VME46 (BU-GN)	20	JACK - AUDIO # EXT. AUX IN RIGHT (+)	
7	VME45 (BU)	20	JACK - AUDIO # EXT. AUX IN LEFT (+)	
8	RME45 (YE-GN)	20	JACK - AUDIO # EXT. AUX IN LEFT (-)	
9	VME42 (VT-BN)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO RIGHT +	
10	RME42 (YE-BU)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO RIGHT -	
11	VMM13 (YE-GN)	20	CTRL MOD. - AUDIO # MIC IN +	
12	RMM13 (BU)	20	CTRL MOD. - AUDIO # MIC IN -	
13	*	*	not used	
14	RME46 (WH-GN)	20	JACK - AUDIO # EXT. AUX IN RIGHT (-)	
15	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH	
16	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW	

Fig. 99: Audio Control Module Connector End View (C290C)

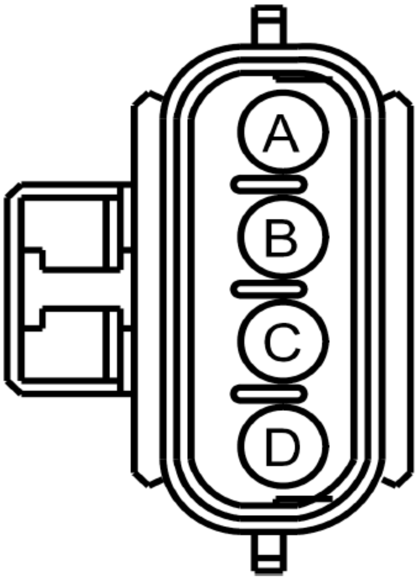
Connector: C290D	Description:	Harness:	Base Part #:
	AUDIO CONTROL MODULE (ACM)	14401	18806



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME22 (VT-GN)	20	CTRL MOD. - AUDIO # SUBWOOFER/AMPLIFIER AUDIO +	
2	RME22 (GN-WH)	20	CTRL MOD. - AUDIO # SUBWOOFER/AMPLIFIER AUDIO -	
3	DME22 (BK)	18	CTRL MOD. - AUDIO # SUBWOOFER/AMPLIFIER AUDIO SHIELD	
4	SME23 (VT-RD)	20	CTRL MOD. - AUDIO # SUBWOOFER/AMPLIFIER ENABLE	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	

Fig. 100: Audio Control Module Connector End View (C290D)

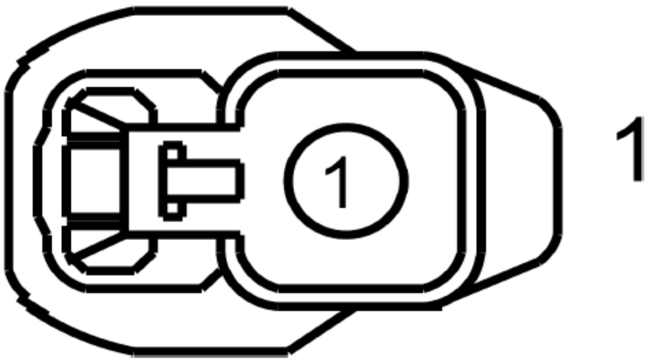
Connector: C293	Description:	Harness:	Base Part #:
	FRONT BLOWER MOTOR RESISTOR ASSEMBLY	19D887	18591



Pin	Circuit	Gauge	Circuit Function	Qualifier
A	CH428 (GN-WH)	16	SWITCH - FRONT BLOWER # POSITION 2 (MEDIUM LOW)	
B	CH429 (GY-BN)	14	SWITCH - FRONT BLOWER # POSITION 3 (MEDIUM HIGH)	
C	CH430 (VT-OG)	12	SWITCH - FRONT BLOWER # POSITION 4 (HIGH)	
D	GD115 (BK-GY)	16	GROUND - CROSS CAR BEAM # 2ND STUD	

Fig. 101: Front Blower Motor Resistor Assembly Connector End View (C293)

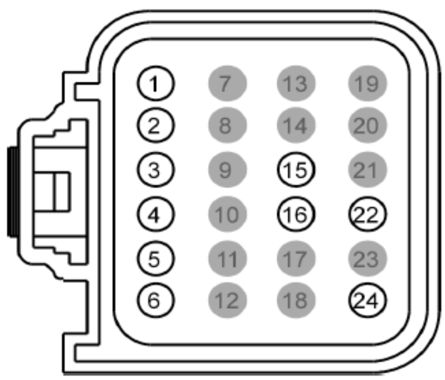
Connector: C306	Description:	Harness:	Base Part #:
	PARK BRAKE SWITCH	14A005	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCB09 (GY-BU)	20	SWITCH - ELEC.PARK BRAKE ON	

Fig. 102: Park Brake Switch Connector End View (C306)

Connector: C310A	Description:	Harness:	Base Part #:
	RESTRAINTS CONTROL MODULE (RCM)	14A005	14B321

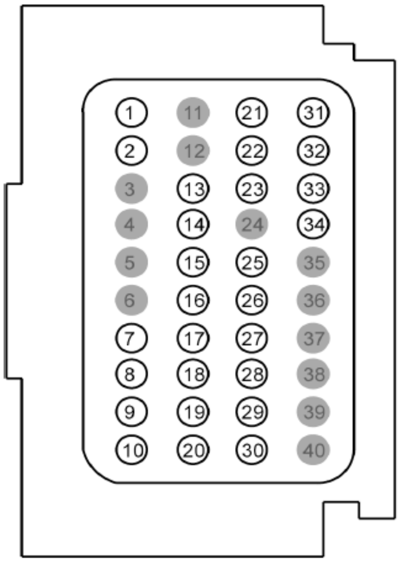


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR103 (GY-BU)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 1 SIGNAL	
2	RR103 (VT-GN)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 1 RTN	
3	RR101 (YE-GN)	20	CTRL MOD. - AIR BAG DRIVER 1 RTN	
4	CR101 (VT-BN)	20	CTRL MOD. - AIR BAG DRIVER 1 SIGNAL	
5	CR104 (YE-GY)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 2 SIGNAL	
6	RR104 (WH-BU)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 2 RTN	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	RR102 (WH)	20	CTRL MOD. - AIR BAG DRIVER 2 RTN	
16	CR102 (BU)	20	CTRL MOD. - AIR BAG DRIVER 2 SIGNAL	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	*	*	not used	
22	CR116 (GN-WH)	20	CTRL MOD. - INDICATOR PASSENGER AIR BAG DEACTIVATE	
23	*	*	not used	
24	CBP21 (BU-GY)	18	FUSE - 25 OR CIRCUIT BREAKER	

Fig. 103: Restraints Control Module Connector End View (C310A)

Connector: C310B

Description:	Harness:	Base Part #:
RESTRAINTS CONTROL MODULE (RCM)	14A005	14B321



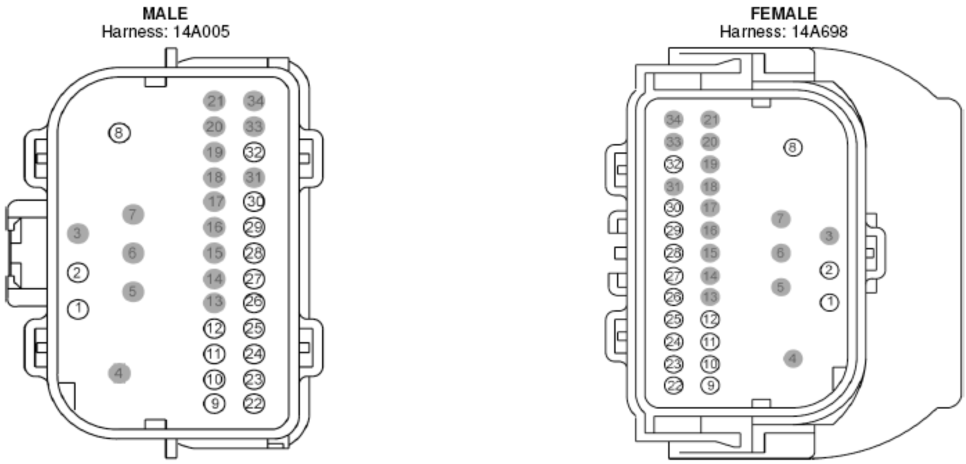
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR111 (BN-WH)	20	CTRL MOD. - INFLATABLE CURTAIN PASSENGER SIDE SIGNAL	
2	RR111 (YE-VT)	20	CTRL MOD. - INFLATABLE CURTAIN PASSENGER SIDE RTN	
3	*	*	not used	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	RR105 (GY-YE)	20	CTRL MOD. - AIR BAG SIDE SEAT MOUNTED FRONT DRIVER SIDE RTN	
8	CR105 (GN-BU)	20	CTRL MOD. - AIR BAG SIDE SEAT MOUNTED FRONT DRIVER SIDE SIGNAL	
9	CR106 (VT-GY)	20	CTRL MOD. - AIR BAG SIDE SEAT MOUNTED FRONT PASSENGER SIDE OUTBOARD SIGNAL	
10	RR106 (YE-OG)	20	CTRL MOD. - AIR BAG SIDE SEAT MOUNTED FRONT PASSENGER SIDE OUTBOARD RTN	
11	*	*	not used	
12	*	*	not used	
13	RR133 (GY-BN)	20	CTRL MOD. - SENSOR SIDE IMPACT ROW 2 DRIVER SIDE RTN	
14	VR219 (GN-WH)	20	SENSOR - SIDE IMPACT ROW 2 DRIVER SIDE SIGNAL	
15	VR220 (VT-OG)	20	SENSOR - SIDE IMPACT ROW 2 PASSENGER SIDE SIGNAL	
16	RR134 (BN-BU)	20	CTRL MOD. - SENSOR SIDE IMPACT ROW 2 PASSENGER SIDE RTN	
17	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
18	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
19	VR213 (VT-GN)	20	SENSOR - IMPACT FRONT 1ST OR LEFT SIGNAL	
20	RR129 (YE-GY)	20	CTRL MOD. - SENSOR IMPACT FRONT 1ST OR LEFT RTN	
21	CR109 (BN-BU)	20	CTRL MOD. - INFLATABLE CURTAIN DRIVER SIDE SIGNAL	
22	RR109 (BU-GN)	20	CTRL MOD. - INFLATABLE CURTAIN DRIVER SIDE RTN	
23	RR137 (BU-GY)	20	CTRL MOD. - SENSOR SEAT TRACK POSITION DRIVER RTN	
24	*	*	not used	
25	CR201 (BU-OG)	20	SENSOR - SEAT BELT BUCKLE (SEAT BELT REMINDER) FRONT DRIVER SIDE SIGNAL	EARLY
25	CR201 (GN-BU)	20	SENSOR - SEAT BELT BUCKLE (SEAT BELT REMINDER) FRONT DRIVER SIDE SIGNAL	LATE
26	CR203 (GY-VT)	20	SENSOR - SEAT BELT BUCKLE (SEAT BELT REMINDER) FRONT PASSENGER OUTBOARD SIGNAL	
27	RR131 (VT-GY)	20	CTRL MOD. - SENSOR SIDE IMPACT FRONT DRIVER SIDE RTN	
28	VR217 (GY-YE)	20	SENSOR - SIDE IMPACT FRONT DRIVER SIDE SIGNAL	
29	VR218 (YE-OG)	20	SENSOR - SIDE IMPACT FRONT PASSENGER SIDE SIGNAL	
30	RR132 (BU-WH)	20	CTRL MOD. - SENSOR SIDE IMPACT FRONT PASSENGER SIDE RTN	
31	CR120 (BU-OG)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT DRIVER SIDE SIGNAL	
32	RR120 (BN-GN)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT DRIVER SIDE RTN	
33	RR121 (VT)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT MIDDLE RTN	
34	CR121 (GY-VT)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT MIDDLE SIGNAL	
35	*	*	not used	
36	*	*	not used	
37	*	*	not used	
38	*	*	not used	
39	*	*	not used	
40	*	*	not used	

Fig. 104: Restraints Control Module Connector End View (C310B)

Inline: C311

Description:
Inline

Base Part #:



Pin	Circuit	Gauge	Qualifier
1	SBB11 (BU-RD)	16	
2	CHS02 (YE-BU)	16	
3	*	*	
4	*	*	
5	*	*	
6	*	*	
7	*	*	
8	GD139 (BK-YE)	12	
9	CBP24 (VT-GN)	20	
10	CR203 (GY-VT)	20	
11	VDB04 (WH-BU)	20	
12	VDB05 (WH)	20	
13	*	*	
14	*	*	
15	*	*	
16	*	*	
17	*	*	
18	*	*	
19	*	*	
20	*	*	
21	*	*	
22	CBP19 (BN-WH)	20	
23	CHS04 (YE-GY)	20	
24	CHS09 (GY)	20	
25	CHS13 (VT-BN)	20	
26	CHS14 (GN)	20	
27	CHS29 (WH-BU)	20	
28	RHS05 (YE-VT)	20	
29	VHS26 (VT)	20	
30	CHS30 (GY-YE)	20	
31	*	*	
32	GD127 (BK-BU)	20	
33	*	*	
34	*	*	

Fig. 105: Inline Connector End View (C311)

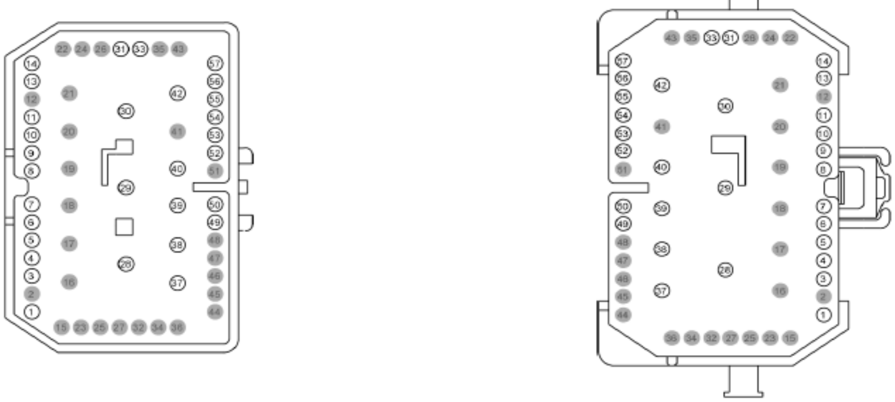
Inline: C312

Description: Inline

Base Part #:

MALE Harness: 14A698

FEMALE Harness: 14A005



Pin	Circuit	Gauge	Qualifier
1	GD127 (BK-BU)	20	
2	*	*	
3	CR203 (GY-VT)	20	
4	CBP24 (VT-GN)	20	
5	VDB05 (WH)	20	
6	VDB04 (WH-BU)	20	
7	CHS09 (GY)	20	
8	CHS30 (GY-YE)	20	
9	CHS29 (WH-BU)	20	
10	CHS14 (GN)	20	
11	CHS13 (VT-BN)	20	
12	*	*	
13	CHS04 (YE-GY)	20	
14	CBP19 (BN-WH)	20	

Fig. 106: Inline (1 Of 2) Connector End View (C312) (1 Of 2)

15	*	*
16	*	*
17	*	*
18	*	*
19	*	*
20	*	*
21	*	*
22	*	*
23	*	*
24	*	*
25	*	*
26	*	*
27	*	*
28	SBB11 (BU-RD)	16
29	SBB12 (GN-RD)	12
30	SBB31 (WH-RD)	12
31	RHS05 (YE-VT)	20
32	*	*
33	VHS26 (VT)	20
34	*	*
35	*	*
36	*	*
37	RHS02 (BU-OG)	16
38	CHS02 (YE-BU)	16
39	RHS01 (WH-VT)	16
40	CHS01 (GY-VT)	16
41	*	*
42	GD139 (BK-YE)	12
43	*	*
44	*	*
45	*	*
46	*	*
47	*	*
48	*	*
49	VDB07 (VT-OG)	20
50	VDB06 (GY-OG)	20
51	*	*
52	RHS15 (GY-BN)	20
53	VHS35 (VT-OG)	20
54	VHS18 (BN-GN)	20
55	VHS16 (BU-GN)	20
56	CHS03 (GN-BN)	20
57	RHS03 (GY-OG)	20

Fig. 107: Inline (2 Of 2) Connector End View (C312) (2 Of 2)

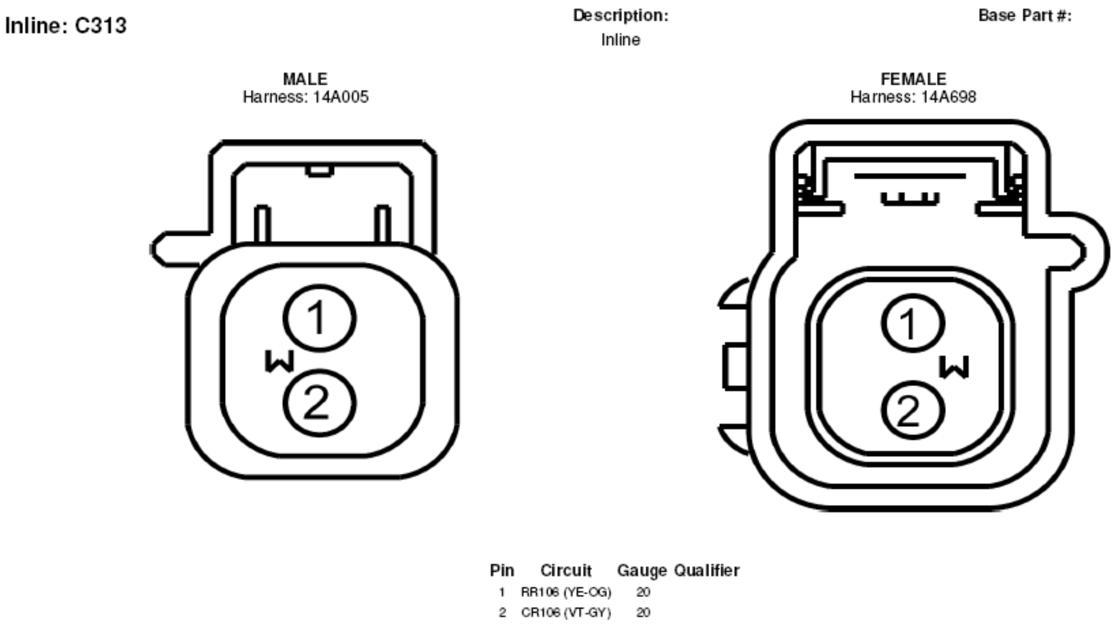


Fig. 108: Inline Connector End View (C313)

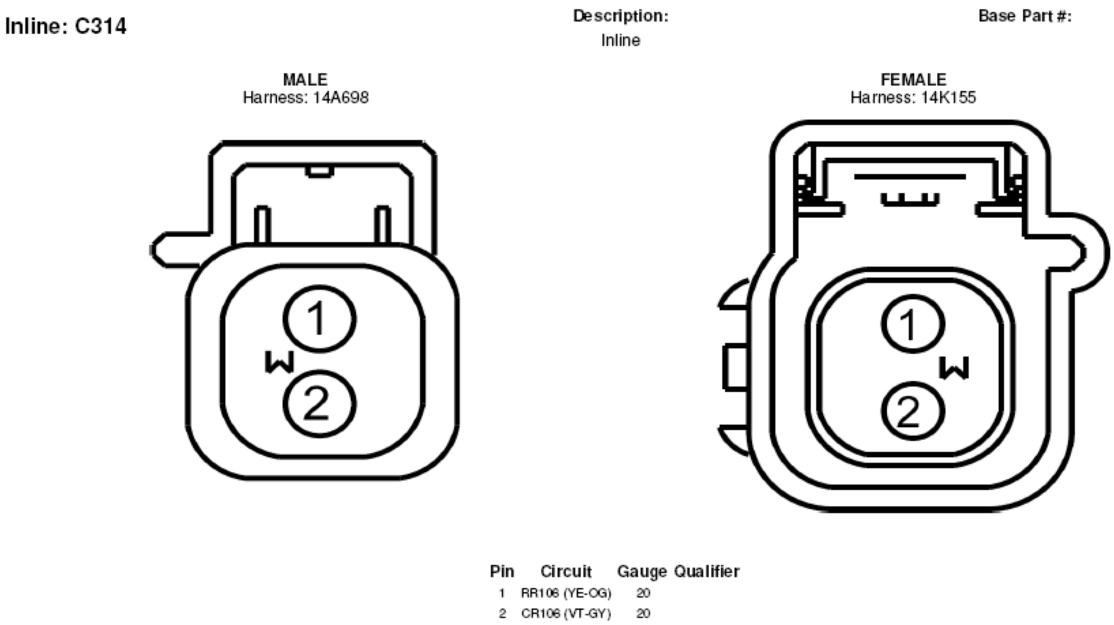
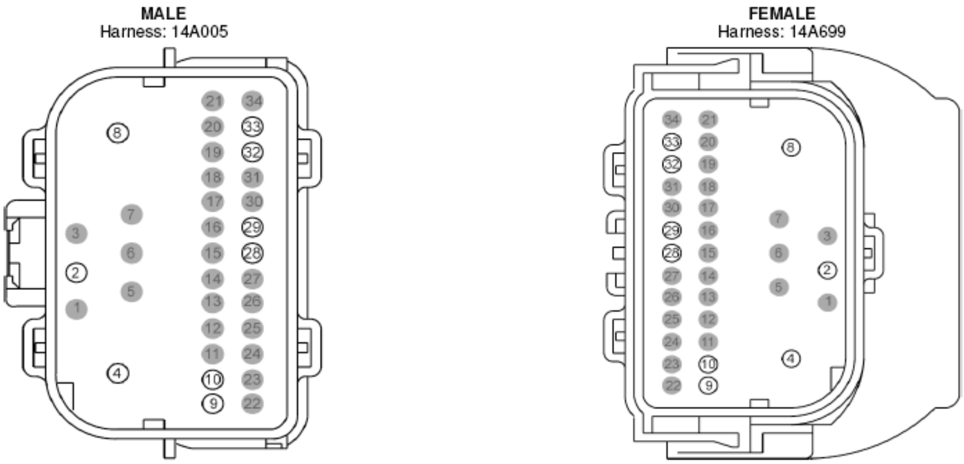


Fig. 109: Inline Connector End View (C314)

Inline: C315

Description: Inline

Base Part #:



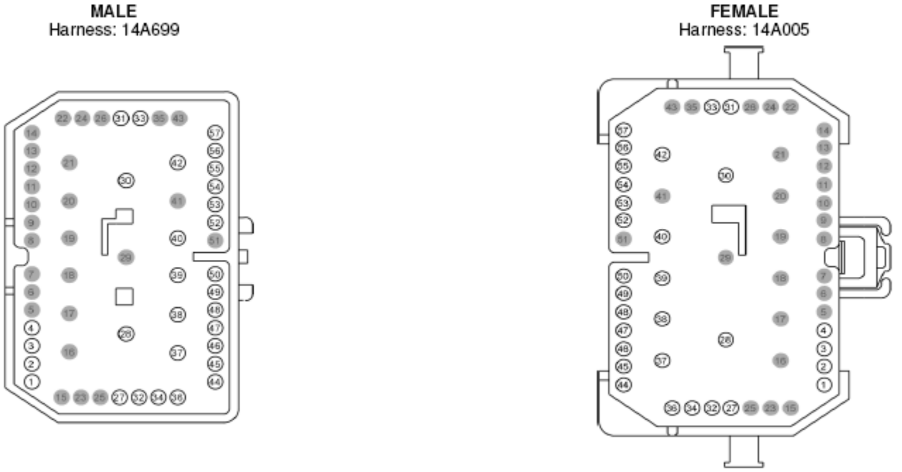
Pin	Circuit	Gauge	Qualifier
1	*	*	
2	CHS02 (YE-BU)	16	
3	*	*	
4	SBB32 (VT-RD)	12	
5	*	*	
6	*	*	
7	*	*	
8	GD126 (BK-WH)	12	
9	RR137 (BU-GY)	20	
10	CR201 (BU-OG)	20	EARLY
10	CR201 (GN-BU)	20	LATE
11	*	*	
12	*	*	
13	*	*	
14	*	*	
15	*	*	
16	*	*	
17	*	*	
18	*	*	
19	*	*	
20	*	*	
21	*	*	
22	*	*	
23	*	*	
24	*	*	
25	*	*	
26	*	*	
27	*	*	
28	RHS05 (YE-VT)	20	
29	VHS26 (VT)	20	
30	*	*	
31	*	*	
32	GD127 (BK-BU)	20	
33	GD127 (BK-BU)	20	
34	*	*	

Fig. 110: Inline Connector End View (C315)

Inline: C316

Description:
Inline

Base Part #:



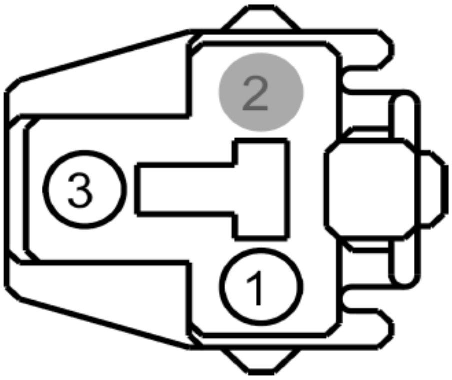
Pin	Circuit	Gauge	Qualifier
1	GD127 (BK-BU)	20	
2	GD127 (BK-BU)	20	
3	RR137 (BU-GY)	20	
4	CR201 (BU-OG)	20	EARLY
4	CR201 (GN-BU)	20	LATE
5	*	*	
6	*	*	
7	*	*	
8	*	*	
9	*	*	
10	*	*	
11	*	*	
12	*	*	
13	*	*	

Fig. 111: Inline (1 Of 2) Connector End View (C316) (1 Of 2)

14	*	*
15	*	*
16	*	*
17	*	*
18	*	*
19	*	*
20	*	*
21	*	*
22	*	*
23	*	*
24	*	*
25	*	*
26	*	*
27	RPM30 (YE)	20
28	GD126 (BK-WH)	12
29	*	*
30	SBB32 (VT-RD)	12
31	RHS05 (YE-VT)	20
32	VPM37 (BU-OG)	20
33	VHS26 (VT)	20
34	VPM38 (BN-GN)	20
35	*	*
36	CPM32 (WH-BU)	20
37	RHS02 (BU-OG)	16
38	CHS02 (YE-BU)	16
39	RHS01 (WH-VT)	16
40	CHS01 (GY-VT)	16
41	*	*
42	GD126 (BK-WH)	20
43	*	*
44	CPM34 (WH-BN)	20
45	CPM31 (YE-GY)	20
46	CPM33 (WH-VT)	20
47	LPM30 (GY-VT)	20
48	SBB15 (WH-RD)	20
49	VDB07 (VT-OG)	20
50	VDB06 (GY-OG)	20
51	*	*
52	RHS15 (GY-BN)	20
53	VHS35 (VT-OG)	20
54	VHS18 (BN-GN)	20
55	VHS16 (BU-GN)	20
56	CHS03 (GN-BN)	20
57	RHS03 (GY-OG)	20

Fig. 112: Inline (2 Of 2) Connector End View (C316) (2 Of 2)

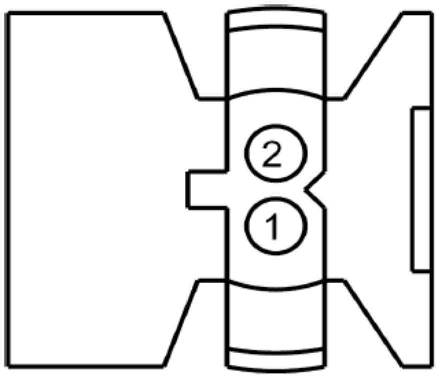
Connector: C319	Description:	Harness:	Base Part #:
	CIGAR LIGHTER, FRONT	14A005	15055



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP09 (RD)	16	FUSE - 15 OR CIRCUIT BREAKER	
2	*	*	not used	
3	GD126 (BK-WH)	16	GROUND - FLOOR CROSS MEMBER REAR LEFT	

Fig. 113: Front Cigar Lighter Connector End View (C319)

Connector: C323	Description:	Harness:	Base Part #:
	DRIVER SAFETY BELT RETRACTOR PRETENSIONER	14A005	611B09



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR120 (BU-OG)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT DRIVER SIDE SIGNAL	
2	RR120 (BN-GN)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT DRIVER SIDE RTN	

Fig. 114: Driver Safety Belt Retractor Pretensioner Connector End View (C323)

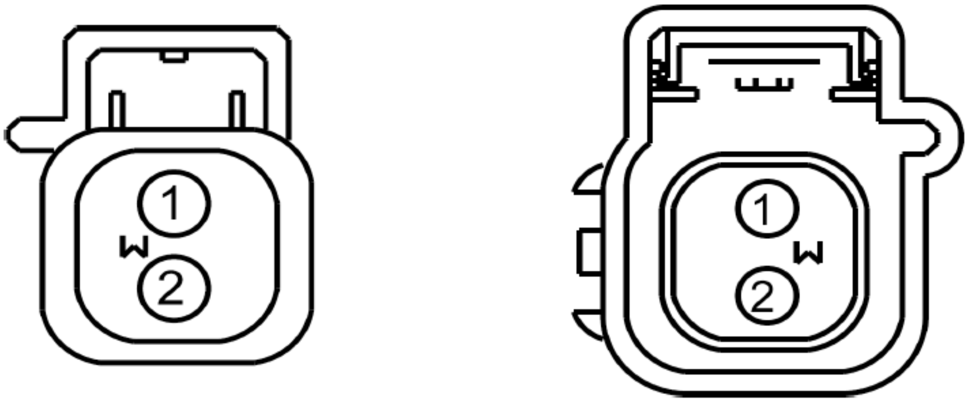
Inline: C327

Description: Inline

Base Part #:

MALE Harness: 14A005

FEMALE Harness: 14A699



Pin	Circuit	Gauge	Qualifier
1	RR105 (GY-YE)	20	
2	CR105 (GN-BU)	20	

Fig. 115: Inline Connector End View (C327)

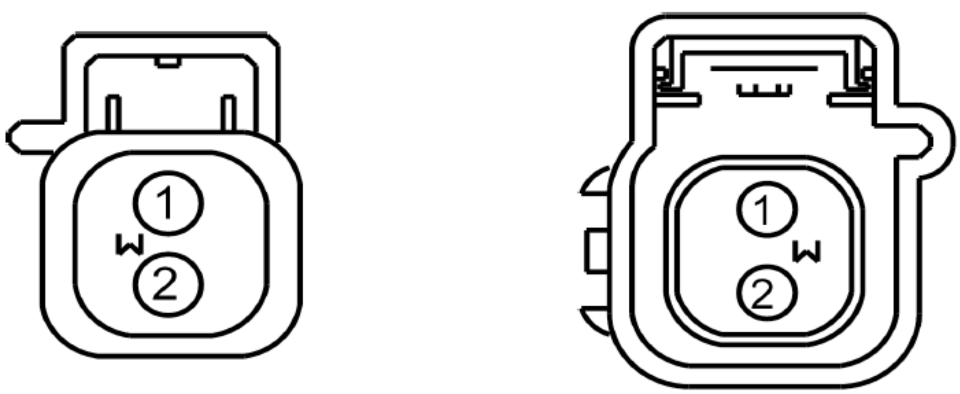
Inline: C328

Description: Inline

Base Part #:

MALE Harness: 14A699

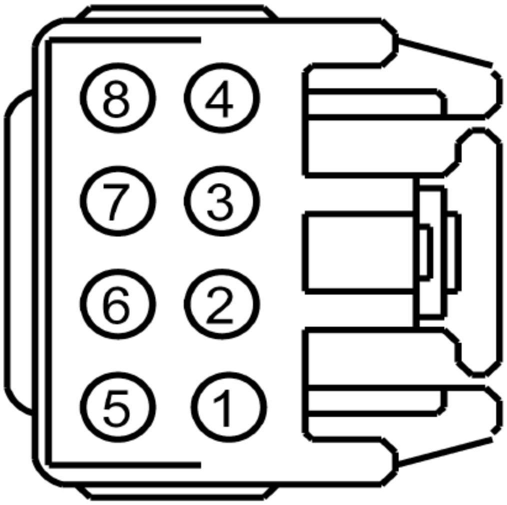
FEMALE Harness: 14K155



Pin	Circuit	Gauge	Qualifier
1	RR106 (YE-OG)	20	
2	CR106 (VT-GY)	20	

Fig. 116: Inline Connector End View (C328)

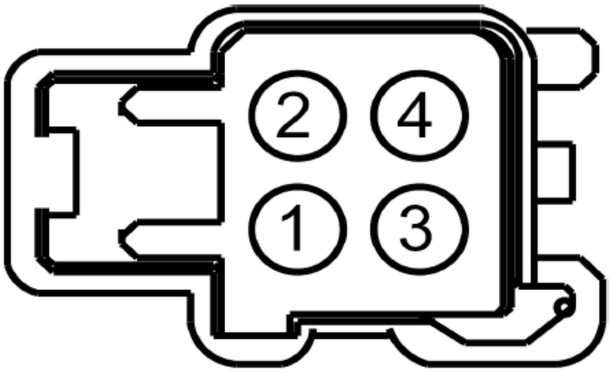
Connector: C330	Description:	Harness:	Base Part #:
	SEAT ADJUST SWITCH, PASSENGER SIDE FRONT	14A698	14A701



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPS37 (WH-BU)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER REAR HEIGHT UP	
2	GD139 (BK-YE)	12	GROUND - PILLAR A RIGHT # 2ND STUD	
3	CPS38 (GN-BU)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER REARWARD	
4	SBB31 (WH-RD)	12	FUSE - 31 OR CIRCUIT BREAKER	
5	CPS35 (VT-GN)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER FRONT HEIGHT UP	
6	CPS33 (WH)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER FORWARD	
7	CPS34 (GY-BU)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER FRONT HEIGHT DOWN	
8	CPS36 (YE-GY)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER REAR HEIGHT DOWN	

Fig. 117: Passenger Side Front Seat Adjust Switch Connector End View (C330)

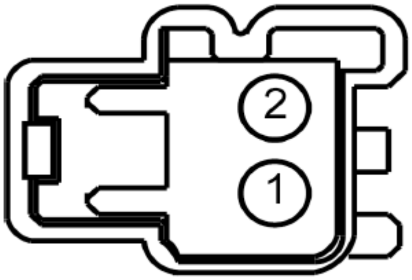
Connector: C334	Description:	Harness:	Base Part #:
	SEAT CUSHION HEATER, RIGHT FRONT	14A698	14D696



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CHS07 (GY-BU)	18	CTRL MOD. - HOT/COLD SEAT # PASSENGER CUSHION HEATER	
2	CHS12 (YE-GN)	18	HEATER - PASSENGER CUSHION / BACK	
3	VHS27 (WH-OG)	20	SENSOR - CUSHION TEMP. PASSENGER	
4	RHS05 (YE-VT)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER SENSOR CUSHION TEMP.	

Fig. 118: Right Front Seat Cushion Heater Connector End View (C334)

Connector: C335	Description:	Harness:	Base Part #:
	SEAT BACK HEATER, RIGHT FRONT	14C691	14D696



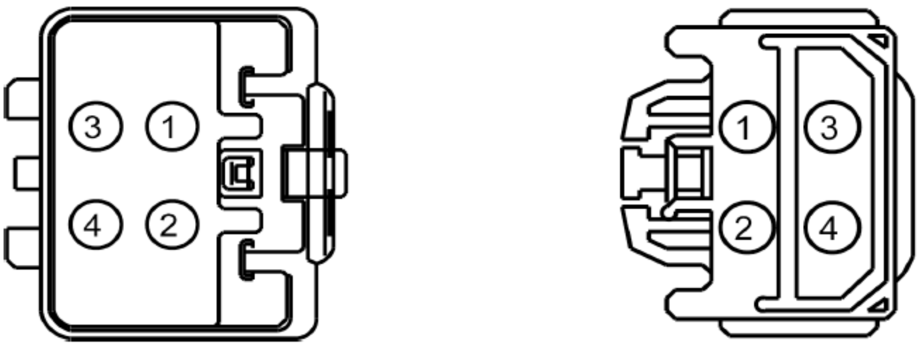
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CHS12 (YE-GN)	18	HEATER - PASSENGER CUSHION / BACK	
2	GD139 (BK-YE)	18	GROUND - PILLAR A RIGHT # 2ND STUD	

Fig. 119: Right Front Seat Back Heater Connector End View (C335)

Inline: C339	Description:	Base Part #:
	Inline	

MALE
Harness: 14A698

FEMALE
Harness: 14C691



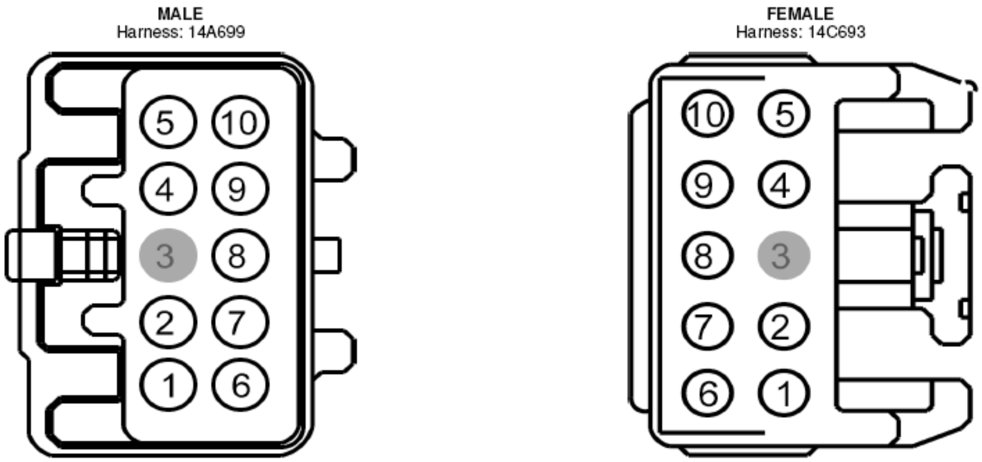
Pin	Circuit	Gauge	Qualifier
1	CPS20 (VT)	12	
2	CPS21 (WH-OG)	12	
3	CPS39 (GY-YE)	12	14A698
3	CPS39 (GY-YE)	14	14C691
4	CPS40 (VT-GY)	12	14A698
4	CPS40 (VT-GY)	14	14C691

Fig. 120: Inline Connector End View (C339)

Inline: C340

Description: Inline

Base Part #:



Pin	Circuit	Gauge	Qualifier
1	LPS12 (VT-RD)	20	
2	RPS13 (GN-OG)	20	
3	*	*	
4	CHS03 (GN-BN)	20	
5	VHS35 (VT-OG)	20	
6	CHS01 (GY-VT)	16	
7	RHS01 (WH-VT)	16	14A699
7	RHS01 (VT-BK)	16	14C693
8	RHS15 (GY-BN)	20	
9	CHS11 (VT-GN)	16	Heated seat
9	VHS16 (BU-GN)	20	Heated/Cooled seat
10	GD126 (BK-WH)	16	Heated seat
10	RHS03 (GY-OG)	16	Heated/Cooled seat

Fig. 121: Inline Connector End View (C340)

Connector: C356

Description: SEAT TRACK POSITION SENSOR, LEFT

Harness: 14A699

Base Part #: 14B416

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD127 (BK-BU)	20	GROUND - FLOOR CROSS MEMBER REAR RIGHT	
2	RR137 (BU-GY)	20	CTRL MOD. - SENSOR SEAT TRACK POSITION DRIVER	

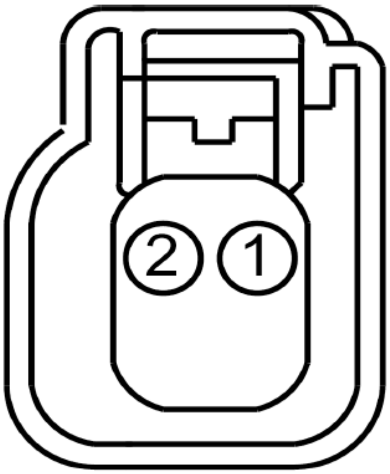
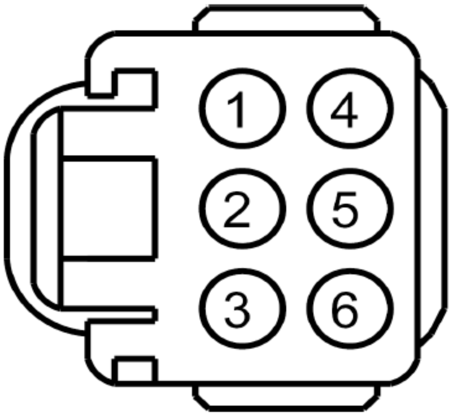


Fig. 122: Left Seat Track Position Sensor Connector End View (C356)

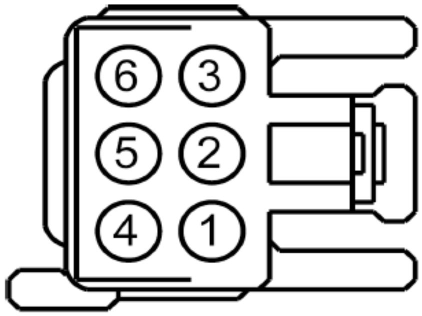
Connector: C357	Description:	Harness:	Base Part #:
	POWER SEAT MOTOR ASSEMBLY, LEFT	14A699	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPS27 (BU-BN)	14	SWITCH - SEAT ADJUST. DRIVER REAR HEIGHT UP	
2	CPS25 (WH-VT)	14	SWITCH - SEAT ADJUST. DRIVER FRONT HEIGHT UP	
3	CPS23 (GN-VT)	14	SWITCH - SEAT ADJUST. DRIVER FORWARD	W/O memory
3	CPS22 (BN)	14	SWITCH - SEAT ADJUST. DRIVER REARWARD	Memory
4	CPS26 (YE-BU)	14	SWITCH - SEAT ADJUST. DRIVER REAR HEIGHT DOWN	
5	CPS24 (GY)	14	SWITCH - SEAT ADJUST. DRIVER FRONT HEIGHT DOWN	
6	CPS28 (GN)	14	SWITCH - SEAT ADJUST. DRIVER REARWARD	W/O memory
6	CPS23 (GN-VT)	14	SWITCH - SEAT ADJUST. DRIVER FORWARD	Memory

Fig. 123: Left Power Seat Motor Assembly Connector End View (C357)

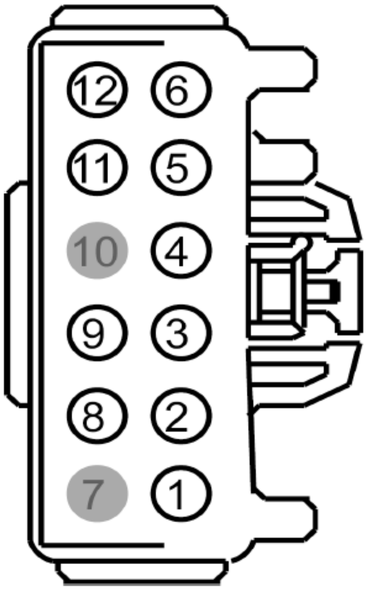
Connector: C358	Description:	Harness:	Base Part #:
	POWER SEAT MOTOR ASSEMBLY, LEFT	14A699	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VPS11 (GN-BN)	20	SENSOR - DRIVER SEAT REAR TILT	
2	VPS10 (BU-GN)	20	SENSOR - DRIVER SEAT FRONT TILT	
3	VPS09 (BN-BU)	20	SENSOR - DRIVER SEAT HORIZONTAL (FORWARD/REARWARD)	
4	RPS13 (GN-OG)	20	CTRL MOD. - DRIVER SEAT SENSORS POSITION	
5	RPS13 (GN-OG)	20	CTRL MOD. - DRIVER SEAT SENSORS POSITION	
6	RPS13 (GN-OG)	20	CTRL MOD. - DRIVER SEAT SENSORS POSITION	

Fig. 124: Left Power Seat Motor Assembly Connector End View (C358)

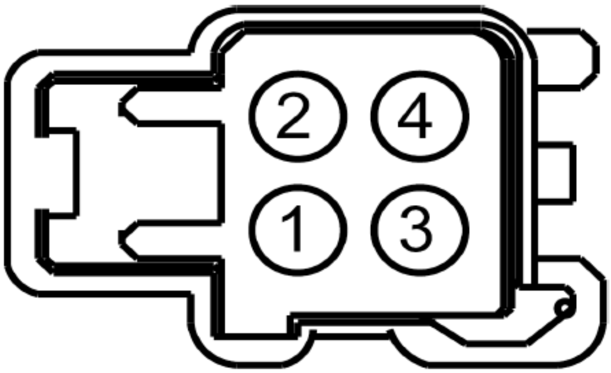
Connector: C360	Description:	Harness:	Base Part #:
	SEAT ADJUST SWITCH, DRIVER SIDE FRONT	14A699	14A701



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPS27 (BU-BN)	14	SWITCH - SEAT ADJUST. DRIVER REAR HEIGHT UP	
2	CPS25 (WH-VT)	14	SWITCH - SEAT ADJUST. DRIVER FRONT HEIGHT UP	
3	GD126 (BK-WH)	12	GROUND - FLOOR CROSS MEMBER REAR LEFT	
4	CPS23 (GN-VT)	14	SWITCH - SEAT ADJUST. DRIVER FORWARD	
5	SBB32 (VT-RD)	12	FUSE - 32 OR CIRCUIT BREAKER	
6	CPS24 (GY)	14	SWITCH - SEAT ADJUST. DRIVER FRONT HEIGHT DOWN	
7	*	*	not used	
8	CPS30 (VT-BN)	12	SWITCH - SEAT ADJUST. DRIVER RECLINE REARWARD	
9	CPS28 (GN)	14	SWITCH - SEAT ADJUST. DRIVER REARWARD	
10	*	*	not used	
11	CPS29 (WH-BN)	12	SWITCH - SEAT ADJUST. DRIVER RECLINE FORWARD	
12	CPS26 (YE-BU)	14	SWITCH - SEAT ADJUST. DRIVER REAR HEIGHT DOWN	

Fig. 125: Driver Side Front Seat Adjust Switch Connector End View (C360)

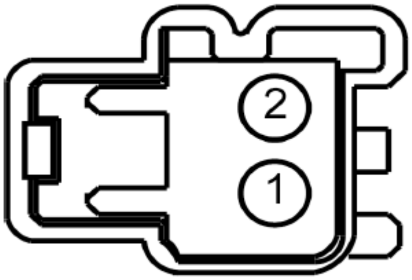
Connector: C364	Description:	Harness:	Base Part #:
	SEAT CUSHION HEATER, LEFT FRONT	14A699	14D696



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CHS02 (YE-BU)	16	CTRL MOD. - HOT/COLD SEAT # DRIVER CUSHION HEATER	
2	CHS11 (VT-GN)	16	HEATER - DRIVER CUSHION / BACK	
3	VHS26 (VT)	20	SENSOR - CUSHION TEMP. DRIVER	
4	RHS05 (YE-VT)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER SENSOR CUSHION TEMP.	

Fig. 126: Left Front Seat Cushion Heater Connector End View (C364)

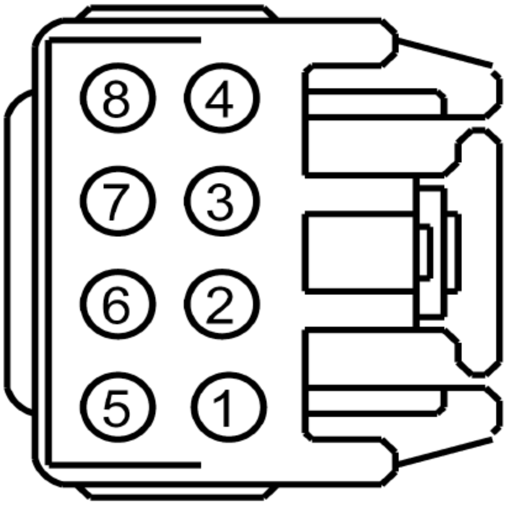
Connector: C365	Description:	Harness:	Base Part #:
	SEAT BACK HEATER, LEFT FRONT	14C693	14D696



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CHS11 (VT-GN)	16	HEATER - DRIVER CUSHION / BACK	
2	GD126 (BK-WH)	16	GROUND - FLOOR CROSS MEMBER REAR LEFT	

Fig. 127: Left Front Seat Back Heater Connector End View (C365)

Connector: C369	Description:	Harness:	Base Part #:
	SEAT ADJUST SWITCH, DRIVER SIDE FRONT	14A699	14A701



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPS26 (YE-BU)	14	SWITCH - SEAT ADJUST. DRIVER REAR HEIGHT DOWN	
2	GD126 (BK-WH)	12	GROUND - FLOOR CROSS MEMBER REAR LEFT	
3	CPS23 (GN-VT)	14	SWITCH - SEAT ADJUST. DRIVER AFT	
4	SBB32 (VT-RD)	12	FUSE - 32 OR CIRCUIT BREAKER	
5	CPS24 (GY)	14	SWITCH - SEAT ADJUST. DRIVER FRONT HEIGHT DOWN	
6	CPS22 (BN)	14	SWITCH - SEAT ADJUST. DRIVER FORWARD	
7	CPS25 (WH-VT)	14	SWITCH - SEAT ADJUST. DRIVER FRONT HEIGHT UP	
8	CPS27 (BU-BN)	14	SWITCH - SEAT ADJUST. DRIVER REAR HEIGHT UP	

Fig. 128: Driver Side Front Seat Adjust Switch Connector End View (C369)

Connector: C370	Description:	Harness:	Base Part #:
	CIGAR LIGHTER, FRONT	14401	15055

Pin	Circuit	Gauge	Circuit Function	Qualifier
A	SBP09 (RD)	16	FUSE - 15 OR CIRCUIT BREAKER	
B	CBP02 (GN)	20	FUSE - 12 OR CIRCUIT BREAKER	
C	GD115 (BK-GY)	14	GROUND - CROSS CAR BEAM # 2ND STUD	

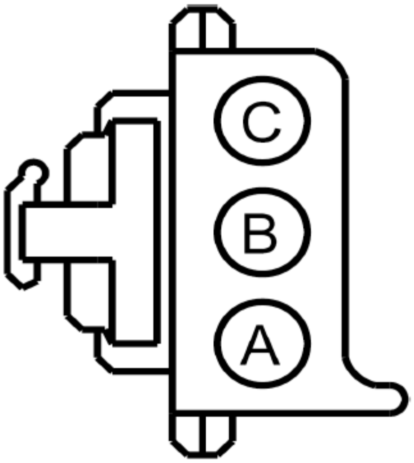
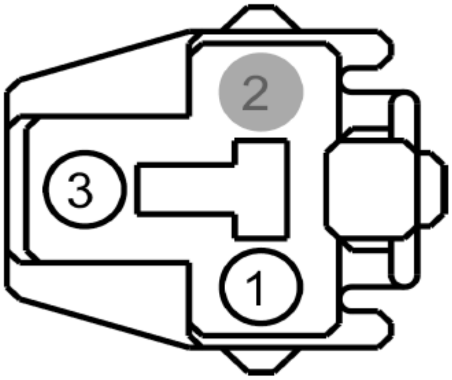


Fig. 129: Front Cigar Lighter Connector End View (C370)

Connector: C380	Description:	Harness:	Base Part #:
	POWER POINT	14A005	19N236



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB22 (BN-RD)	16	FUSE - 22 OR CIRCUIT BREAKER	
2	*	*	not used	
3	GD126 (BK-WH)	16	GROUND - FLOOR CROSS MEMBER REAR LEFT	

Fig. 130: Power Point Connector End View (C380)

Connector: C402A	Description:	Harness:	Base Part #:
	REAR WINDOW DEFROST GRID	14A005	PIA

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS38 (VT-WH)	12	SWITCH - REAR DEFROST RELAY	

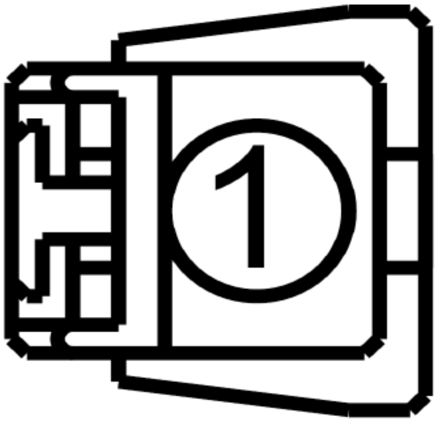
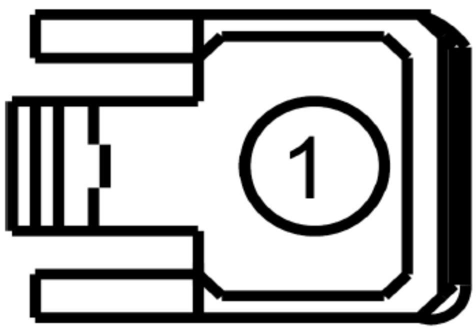


Fig. 131: Rear Window Defrost Grid Connector End View (C402A)

Connector: C402B	Description:	Harness:	Base Part #:
	REAR WINDOW DEFROST GRID	18C620	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD147 (BK)	12	GROUND - PILLAR C LEFT	

Fig. 132: Rear Window Defrost Grid Connector End View (C402B)

Inline: C408

Description: Inline

Base Part #:

MALE	FEMALE
Harness: 14A005/13A412	Harness: 14N139

Pin	Circuit	Gauge	Qualifier
1	RMP07 (GN-WH)	20	
2	VMP17 (YE-OG)	20	
3	VMP15 (YE-GN)	20	
4	LMP07 (BU-WH)	20	
5	CBP08 (GY-YE)	18	
6	VMP16 (YE-GY)	20	
7	VMP14 (WH-OG)	20	
8	GD171 (BK-GY)	20	

Fig. 133: Inline Connector End View (C408)

Connector: C413

Description:	Harness:	Base Part #:
TURN LAMP, LEFT REAR	14A005	13A505

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	
2	*	*	not used	
3	CLS18 (GY-BN)	20	CTRL MOD. - STOP/TURN LEFT	

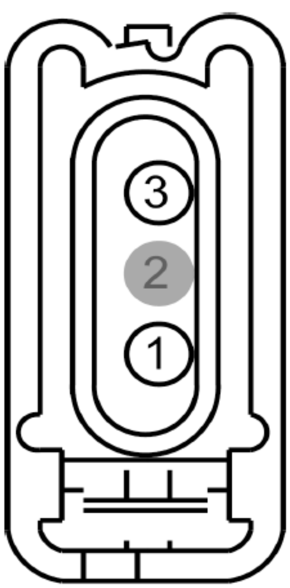


Fig. 134: Left Rear Turn Lamp Connector End View (C413)

Connector: C414A	Description:	Harness:	Base Part #:
	LAMP ASSEMBLY, LEFT REAR	14A005	13A505

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

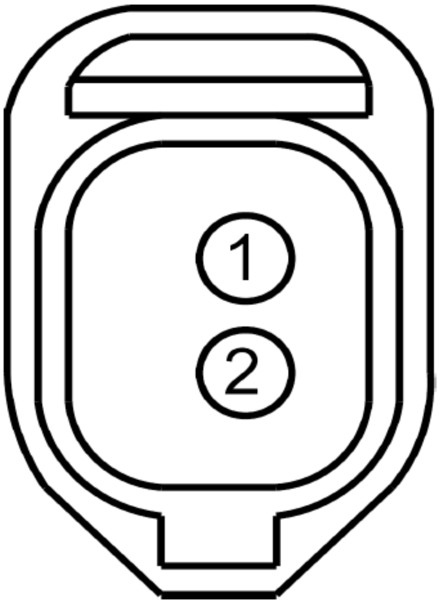


Fig. 135: Left Rear Lamp Assembly Connector End View (C414A)

Connector: C414B	Description:	Harness:	Base Part #:
	LAMP ASSEMBLY, LEFT REAR	14A005	13A505

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

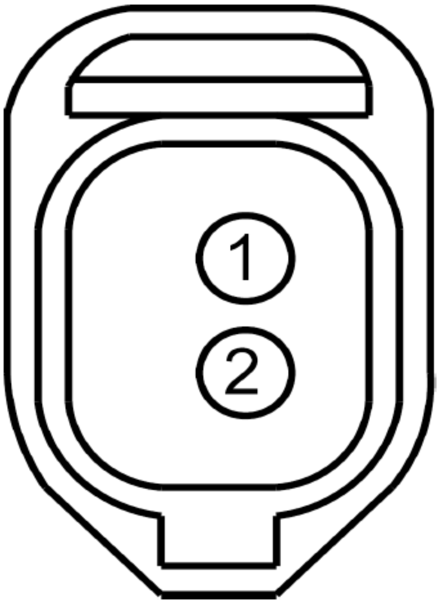


Fig. 136: Left Rear Lamp Assembly Connector End View (C414B)

Connector: C414C	Description:	Harness:	Base Part #:
	LAMP ASSEMBLY, LEFT REAR	14A005	13A505

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

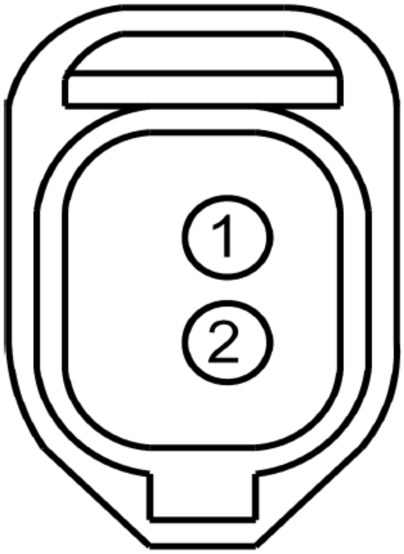


Fig. 137: Left Rear Lamp Assembly Connector End View (C414C)

Connector: C414D	Description:	Harness:	Base Part #:
	LAMP ASSEMBLY, LEFT REAR	14A005	13A505

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

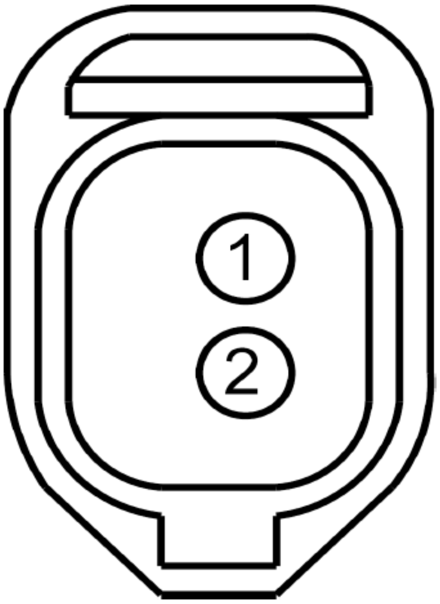


Fig. 138: Left Rear Lamp Assembly Connector End View (C414D)

Connector: C416

Description:	Harness:	Base Part #:
TURN LAMP, RIGHT REAR	14A005	13A504

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	
2	*	*	not used	
3	CLS19 (VT-OG)	20	CTRL MOD. - STOP/TURN RIGHT	

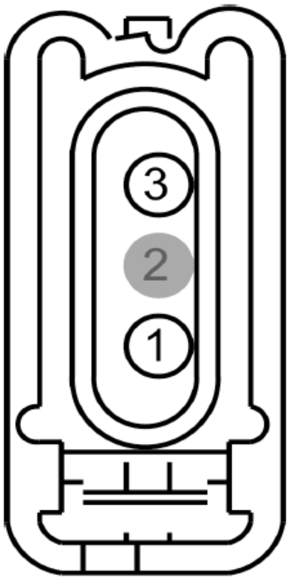


Fig. 139: Right Rear Turn Lamp Connector End View (C416)

Connector: C417A

Description:	Harness:	Base Part #:
LAMP ASSEMBLY, RIGHT REAR	14A005	13A504

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

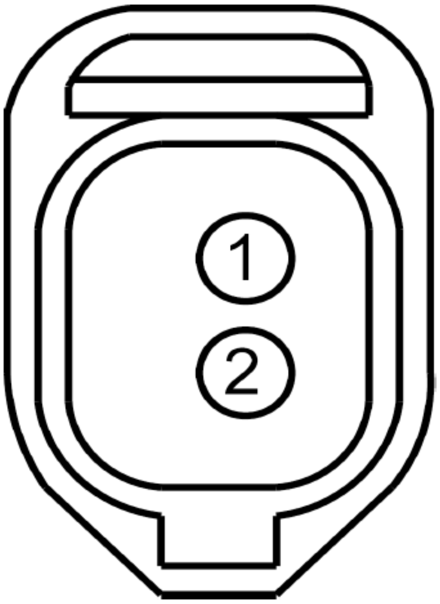


Fig. 140: Right Rear Lamp Assembly Connector End View (C417A)

Connector: C417B

Description:	Harness:	Base Part #:
LAMP ASSEMBLY, RIGHT REAR	14A005	13A504

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

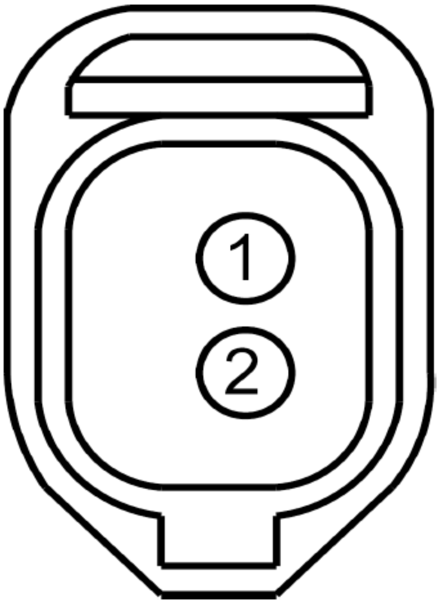


Fig. 141: Right Rear Lamp Assembly Connector End View (C417B)

Connector: C417C

Description:	Harness:	Base Part #:
LAMP ASSEMBLY, RIGHT REAR	14A005	13A504

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

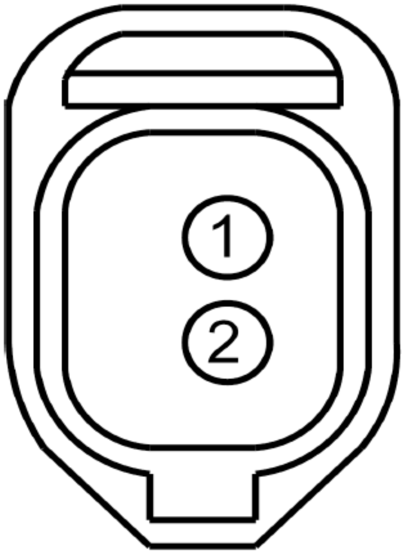
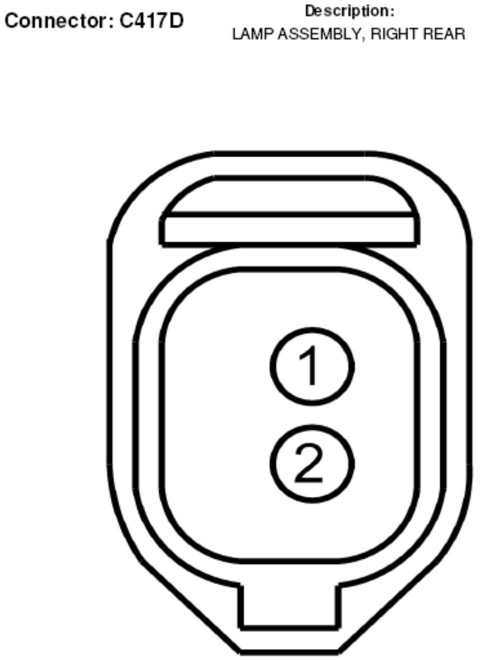
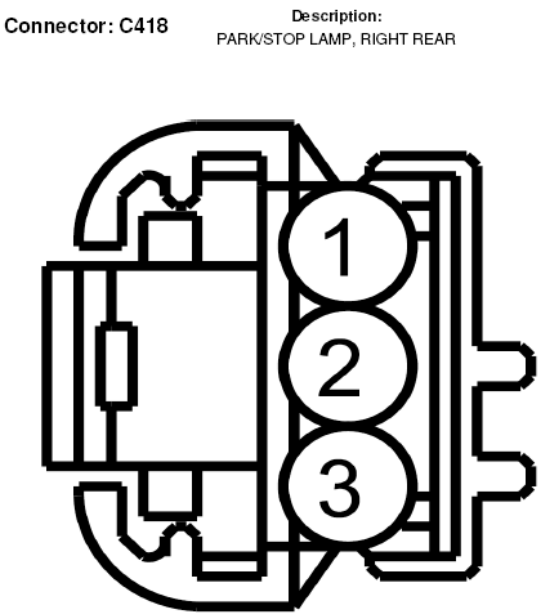


Fig. 142: Right Rear Lamp Assembly Connector End View (C417C)



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

Fig. 143: Right Rear Lamp Assembly Connector End View (C417D)



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS17 (YE-GY)	20	CTRL MOD. - STOP HIGH MOUNT	
2	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
3	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

Fig. 144: Right Rear Park Lamp / Stop Lamp Connector End View (C418)

Connector: C419	Description:	Harness:	Base Part #:
	PARK/STOP LAMP, LEFT REAR	14A005	13A505

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS17 (YE-GY)	20	CTRL MOD. - STOP HIGH MOUNT	
2	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
3	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

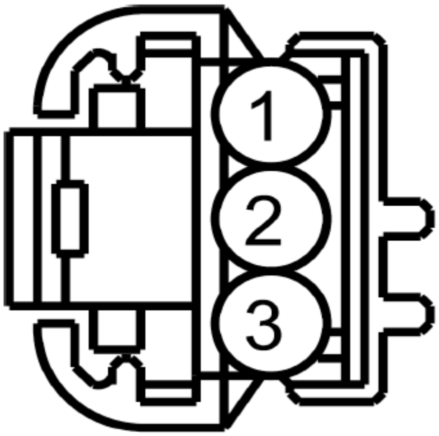


Fig. 145: Left Rear Park Lamp / Stop Lamp Connector End View (C419)

Connector: C426	Description:	Harness:	Base Part #:
	WHEEL SPEED SENSOR, RIGHT REAR	14A005	2C190

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RCA20 (BN)	20	CTRL MOD. - SENSOR WHEEL SPEED RIGHT REAR -	
2	*	*	not used	
3	VCA06 (WH-OG)	20	SENSOR - WHEEL SPEED RIGHT REAR +	

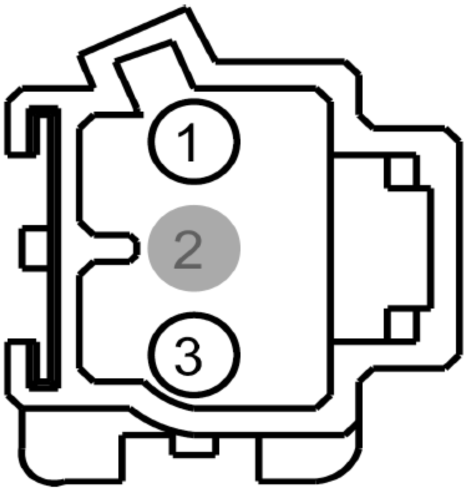


Fig. 146: Right Rear Wheel Speed Sensor Connector End View (C426)

Connector: C429	Description:	Harness:	Base Part #:
	LUGGAGE COMPARTMENT LID RELEASE SOLENOID/ AJAR SWITCH	14A005/13A412	432A38

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL44 (YE-OG)	20	SWITCH - LIFTGATE/DECKLID/CARGO # AJAR	
2	CPL10 (GN-WH)	16	CTRL MOD. - DOOR LOCK # LIFTGATE/DECKLID RELEASE	
3	GD171 (BK-GY)	16	GROUND - LIFTGATE/DECKLID CENTER	

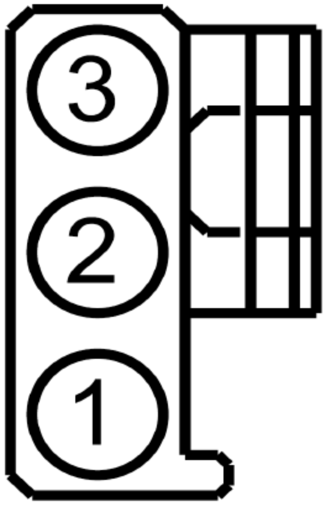
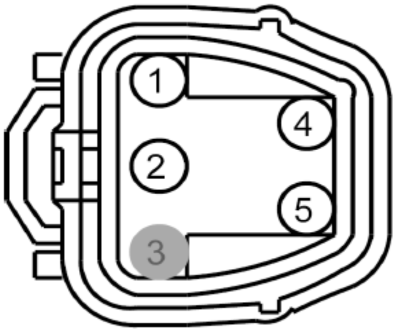


Fig. 147: Luggage Compartment Lid Release Solenoid / Luggage Compartment Lid Ajar Switch Connector End View (C429)

Connector: C433	Description:	Harness:	Base Part #:
	FUEL TANK UNIT	14A005	9H307



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RMC32 (GN-BU)	20	CTRL MOD. - SENSOR FUEL LEVEL	
2	VMC11 (YE-VT)	20	SENSOR - FUEL LEVEL (FLI)	
3	*	*	not used	
4	GD128 (BK-GN)	14	GROUND - FUEL TANK	
5	CE911 (VT-WH)	14	SWITCH - INERTIA POWER OFF (ISPO)	

Fig. 148: Fuel Tank Unit Connector End View (C433)

Connector: C435	Description:	Harness:	Base Part #:
	FUEL TANK PRESSURE TRANSDUCER SENSOR	14A005	PIA

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LE230 (BN-BU)	20	CTRL MOD. - POWERTRAIN # FUEL TANK PRESSURE TRANSDUCER REF. VOLT. (FTPTREF)	
2	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C)	
3	VE922 (VT-GN)	20	TRANSDUCER - FUEL TANK PRESSURE (FTPT)	

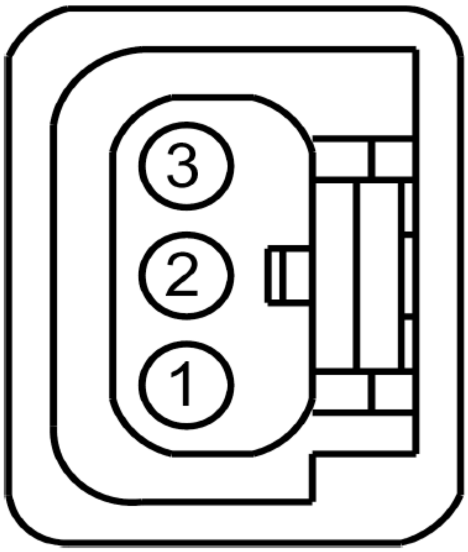


Fig. 149: Fuel Tank Pressure Transducer Sensor Connector End View (C435)

Connector: C440	Description:	Harness:	Base Part #:
	WHEEL SPEED SENSOR, LEFT REAR	14A005	2C190

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RCA18 (BN-GN)	20	CTRL MOD. - SENSOR WHEEL SPEED LEFT REAR -	
2	*	*	not used	
3	VCA04 (BU-OG)	20	SENSOR - WHEEL SPEED LEFT REAR +	

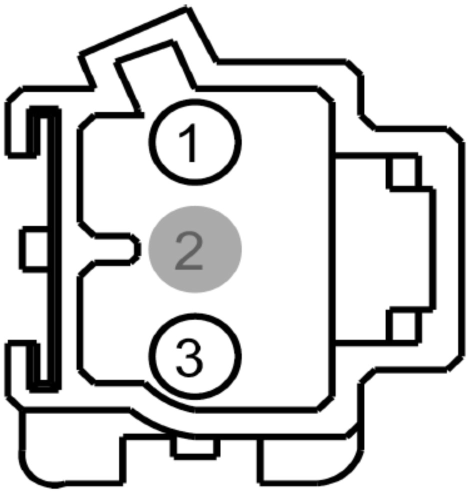


Fig. 150: Left Rear Wheel Speed Sensor Connector End View (C440)

Connector: C451	Description:	Harness:	Base Part #:
	REVERSING LAMP, LEFT	14A005/13A412	13405

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP12 (GN-WH)	20	FUSE - 1 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

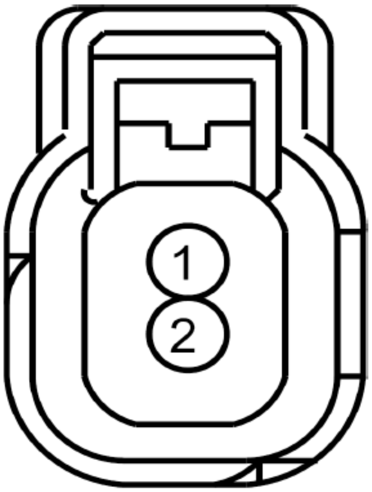


Fig. 151: Left Reversing Lamp Connector End View (C451)

Connector: C452	Description:	Harness:	Base Part #:
	LICENSE PLATE LAMP, LEFT	14N139	13550

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 4 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

Fig. 152: Left License Plate Lamp Connector End View (C452)

Connector: C454	Description:	Harness:	Base Part #:
	LICENSE PLATE LAMP, LEFT	13A412	13550

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 4 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

Fig. 153: Left License Plate Lamp Connector End View (C454)

Connector: C461	Description:	Harness:	Base Part #:
	REVERSING LAMP, RIGHT	14A005/13A412	13404

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP12 (GN-WH)	20	FUSE - 12 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

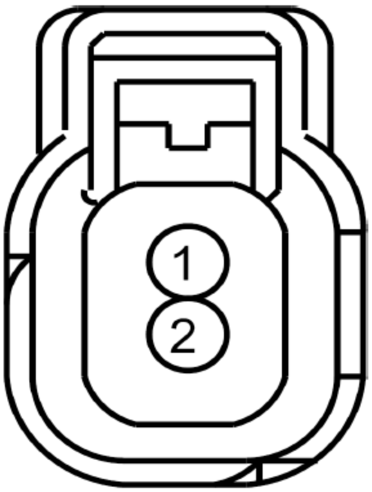


Fig. 154: Right Reversing Lamp Connector End View (C461)

Connector: C462	Description:	Harness:	Base Part #:
	LICENSE PLATE LAMP, RIGHT	14N139	13550

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 4 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

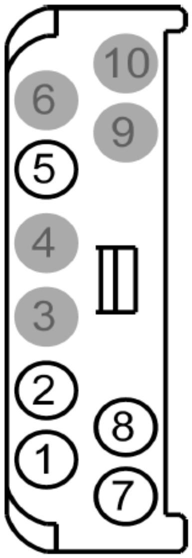
Fig. 155: Right License Plate Lamp Connector End View (C462)

Connector: C464	Description:	Harness:	Base Part #:
	LICENSE PLATE LAMP, RIGHT	14A005	13550

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 4 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

Fig. 156: Right License Plate Lamp Connector End View (C464)

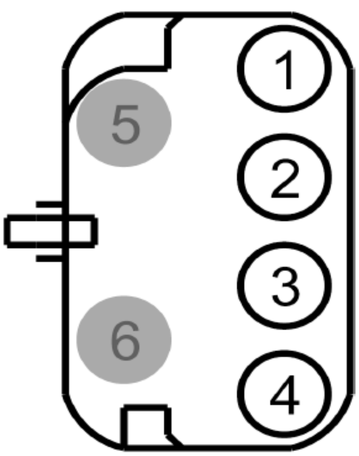
Connector: C466A	Description:	Harness:	Base Part #:
	SUBWOOFER AMPLIFIER	14A005	18T805



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SME23 (VT-RD)	20	CTRL MOD. - AUDIO # SUBWOOFER/AMPLIFIER ENABLE	
2	GD148 (BK-YE)	16	GROUND - PILLAR C RIGHT	
3	*	*	not used	
4	*	*	not used	
5	CBP06 (WH-BU)	16	FUSE - 17 OR CIRCUIT BREAKER	
6	*	*	not used	
7	VME22 (VT-GN)	20	CTRL MOD. - AUDIO # SUBWOOFER/AMPLIFIER AUDIO +	
8	RME22 (GN-WH)	20	CTRL MOD. - AUDIO # SUBWOOFER/AMPLIFIER AUDIO -	
9	*	*	not used	
10	*	*	not used	

Fig. 157: Subwoofer Amplifier Connector End View (C466A)

Connector: C466B	Description:	Harness:	Base Part #:
	SUBWOOFER AMPLIFIER	14A005	18T805



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME01 (GN-VT)	20	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER LEFT REAR	
2	RME01 (GY)	20	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER LEFT REAR	
3	VME02 (VT)	20	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER RIGHT REAR	
4	RME02 (YE)	20	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER RIGHT REAR	
5	*	*	not used	
6	*	*	not used	

Fig. 158: Subwoofer Amplifier Connector End View (C466B)

Connector: C475	Description:	Harness:	Base Part #:
	HIGH MOUNTED STOPLAMP	14A005	13A613

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS17 (YE-GY)	20	CTRL MOD. - STOP HIGH MOUNT	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

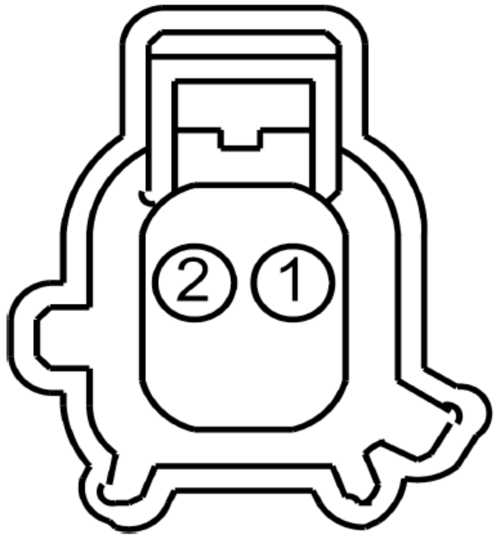


Fig. 159: High Mounted Stoplamp Connector End View (C475)

Connector: C487	Description:	Harness:	Base Part #:
	REVERSING LAMP, LEFT	14A005/13A412	13405

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP12 (GN-WH)	20	FUSE - 1 OR CIRCUIT BREAKER	Auto Trans
1	CBP12 (GN-WH)	20	REVERSING LAMPS SWITCH OUTPUT	Man Trans
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

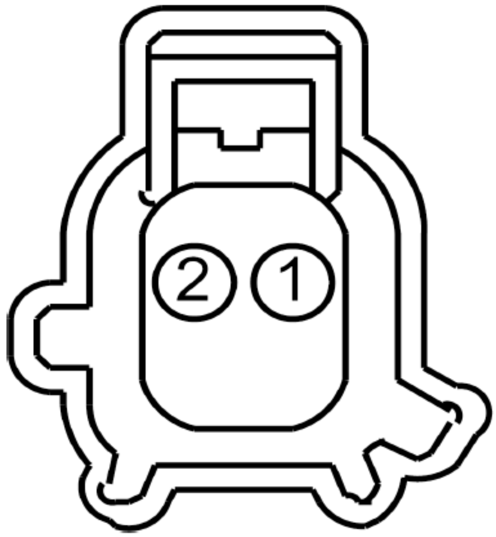


Fig. 160: Left Reversing Lamp Connector End View (C487)

Connector: C488	Description:	Harness:	Base Part #:
	REVERSING LAMP, RIGHT	14A005/13A412	13404

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP12 (GN-WH)	20	FUSE - 1 OR CIRCUIT BREAKER	Auto Trans
1	CBP12 (GN-WH)	20	REVERSING LAMPS SWITCH OUTPUT	Man Trans
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

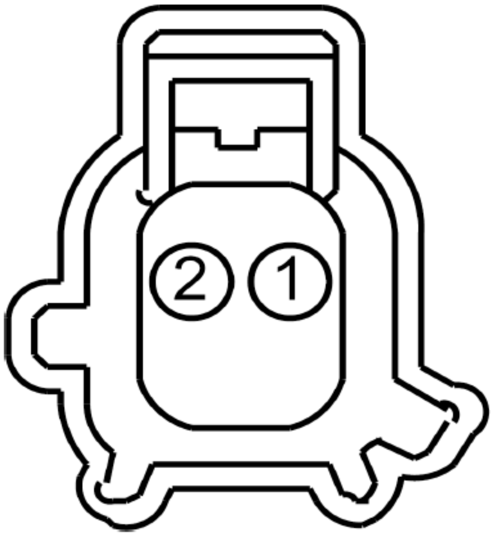


Fig. 161: Right Reversing Lamp Connector End View (C488)

Connector: C503	Description:	Harness:	Base Part #:
	MEMORY SET SWITCH	14631	14776

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPS55 (YE)	20	CTRL MOD. - MEMORY SET INDICATOR	
2	CPS15 (VT-WH)	20	SWITCH - MEMORY P1	
3	VLN04 (VT-GY)	22	CTRL MOD. - IP/SWITCH ILLUMINATION	
4	GD126 (BK-WH)	20	GROUND - FLOOR CROSS MEMBER REAR LEFT	
5	CPS14 (GY-VT)	20	SWITCH - MEMORY SET	
6	CPS16 (YE)	20	SWITCH - MEMORY P2	
7	GD126 (BK-WH)	20	GROUND - FLOOR CROSS MEMBER REAR LEFT	
8	*	*	not used	

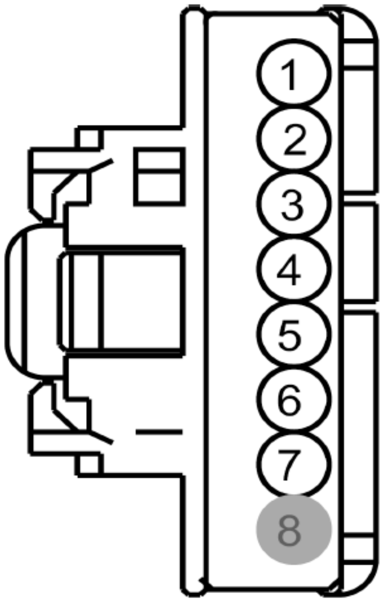
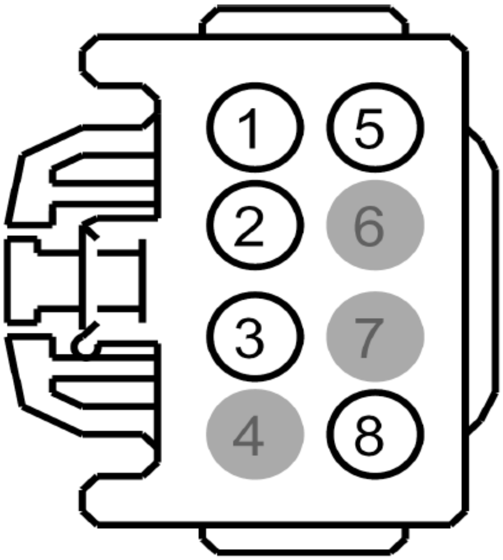


Fig. 162: Memory Set Switch Connector End View (C503)

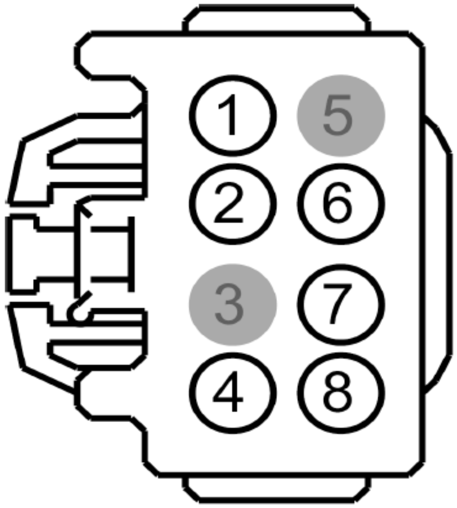
Connector: C504A	Description:	Harness:	Base Part #:
	MASTER WINDOW CONTROL SWITCH	14631	14529



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW10 (YE-VT)	14	SWITCH - POWER WINDOW DRIVER # DRIVER DOWN	
2	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
3	CPW12 (GN-OG)	16	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER DOWN	
4	*	*	not used	
5	CPW11 (BU-GY)	14	SWITCH - POWER WINDOW DRIVER # DRIVER UP	
6	*	*	not used	
7	*	*	not used	
8	CPW13 (BN-YE)	16	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER UP	

Fig. 163: Master Window Control Switch Connector End View (C504A)

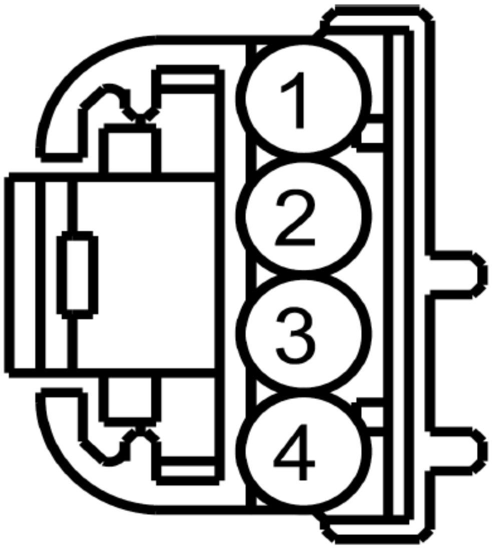
Connector: C504B	Description:	Harness:	Base Part #:
	MASTER WINDOW CONTROL SWITCH	14631	14529



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW15 (YE)	16	SWITCH - POWER WINDOW DRIVER # REAR LEFT DOWN	
2	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
3	*	*	not used	
4	CPW17 (BN-GN)	16	SWITCH - POWER WINDOW DRIVER # REAR RIGHT DOWN	
5	*	*	not used	
6	CPW16 (BU-OG)	16	SWITCH - POWER WINDOW DRIVER # REAR LEFT UP	
7	GD126 (BK-WH)	12	GROUND - FLOOR CROSS MEMBER REAR LEFT	
8	CPW18 (GY-VT)	16	SWITCH - POWER WINDOW DRIVER # REAR RIGHT UP	

Fig. 164: Master Window Control Switch Connector End View (C504B)

Connector: C505	Description:	Harness:	Base Part #:
	DOOR LOCK SWITCH, DRIVER SIDE	14631	14028



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL42 (GY-YE)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
2	CBP02 (GN)	20	FUSE - 12 OR CIRCUIT BREAKER	
2	VLN04 (VT-GY)	20	CTRL MOD. - IP/SWITCH ILLUMINATION	MKZ
3	CPL43 (VT-GY)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
4	GD126 (BK-WH)	20	GROUND - FLOOR CROSS MEMBER REAR LEFT	

Fig. 165: Driver Side Door Lock Switch Connector End View (C505)

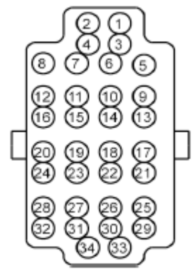
Inline: C510

Description:
Inline

Base Part #:

MALE
Harness: 14631

FEMALE
Harness: 14A005



Pin	Circuit	Gauge	Qualifier
1	SBB34 (YE-RD)	14	
2	CPW30 (GY-YE)	14	
3	VLN04 (VT-GY)	22	
4	CPW01 (BN-BU)	20	
5	CPW12 (GN-OG)	20	
6	CPL51 (BU-GN)	16	
6	VDB06 (GY-OG)	20	Memory
7	CPL11 (GY-BN)	16	
7	VDB07 (VT-OG)	20	Memory
8	CPW13 (BN-YE)	20	
9	CPL28 (VT-BN)	20	
9	LRD12 (BU-GY)	20	Memory
10	CPL26 (GN-VT)	20	
11	CBP02 (GN)	20	
12	CPK28 (WH)	20	
13	CPK29 (GY-BU)	20	
14	CPK30 (VT-GN)	20	
15	CPK31 (YE-GN)	20	
16	CPW31 (GN-WH)	20	
17	SBP15 (WH-RD)	20	
18	VME07 (WH)	18	14631
18	VME07 (WH)	20	14A005
19	RME07 (WH-BN)	18	14631
19	RME07 (WH-BN)	20	14A005
20	CPM23 (GY)	20	
20	RRD12 (BN)	20	Memory
21	CPM20 (BN-WH)	20	
22	CPM21 (YE-VT)	20	
23	CPL42 (GY-YE)	20	
24	CPL43 (VT-GY)	20	
25	VME08 (GN-OG)	18	
26	RME08 (GY-OG)	18	
27	CLN26 (BU)	18	
28	CBP16 (BU-GN)	20	
29	CPW15 (YE)	16	
30	CPW16 (BU-OG)	16	
31	CPW17 (BN-GN)	16	
32	CPW18 (GY-VT)	16	
33	CPW14 (VT-WH)	14	
34	GD126 (BK-WH)	14	

Fig. 166: Inline Connector End View (C510)

Connector: C513	Description:	Harness:	Base Part #:
	SPEAKER, LEFT FRONT	14631	18808

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME08 (GN-OG)	20	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT TWEETER +	
2	RME08 (GY-OG)	20	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT TWEETER -	

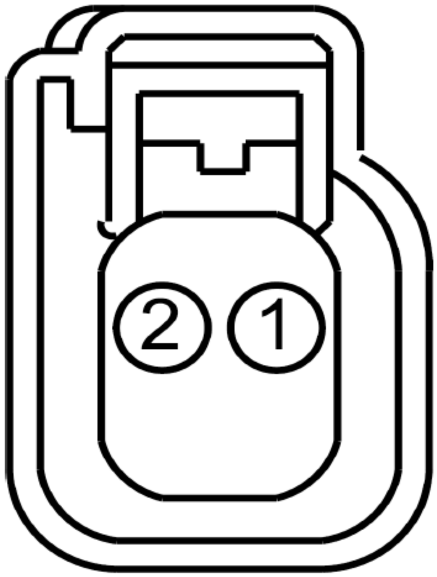
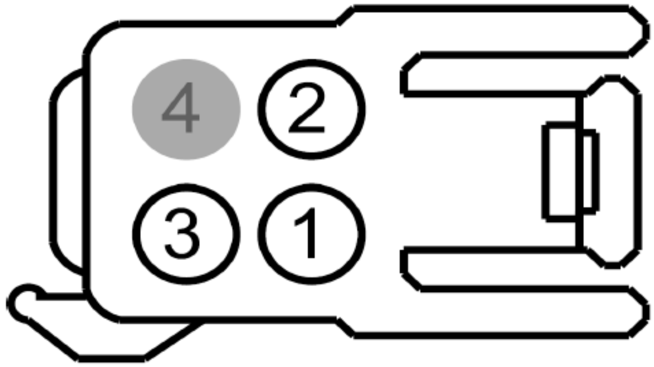


Fig. 167: Left Front Speaker Connector End View (C513)

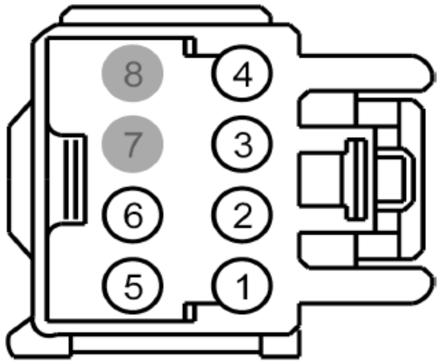
Connector: C516	Description:	Harness:	Base Part #:
	EXTERIOR REAR VIEW MIRROR, LH SIDE	14631	17D696



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPM17 (BU-GN)	20	SWITCH - POWER MIRROR # LEFT MIRROR UP/DOWN	
2	CPM23 (GY)	20	SWITCH - POWER MIRROR # COMMON ALL MOTORS	
3	CPM16 (BN-BU)	20	SWITCH - POWER MIRROR # LEFT MIRROR LEFT/RIGHT	
4	*	*	not used	

Fig. 168: Left Side Exterior Rearview Mirror Connector End View (C516)

Connector: C517	Description:	Harness:	Base Part #:
	EXTERIOR REAR VIEW MIRROR, LH SIDE	14631	17D696



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPM17 (BU-GN)	20	SWITCH - POWER MIRROR # LEFT MIRROR UP/DOWN	
2	CPM23 (GY)	20	SWITCH - POWER MIRROR # COMMON ALL MOTORS	
3	CPM16 (BN-BU)	20	SWITCH - POWER MIRROR # LEFT MIRROR LEFT/RIGHT	
4	CLN26 (BU)	18	RELAY - COURTESY LAMPS	
5	CBP16 (BU-GN)	20	FUSE - 9 OR CIRCUIT BREAKER	
6	GD126 (BK-WH)	20	GROUND - FLOOR CROSS MEMBER REAR LEFT	
7	*	*	not used	
8	*	*	not used	

Fig. 169: Left Side Exterior Rearview Mirror Connector End View (C517)

Connector: C518	Description:	Harness:	Base Part #:
	POWER WINDOW MOTOR, LEFT FRONT	14631	23394

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW11 (BU-GY)	14	SWITCH - POWER WINDOW DRIVER # DRIVER UP	
2	CPW10 (YE-VT)	14	SWITCH - POWER WINDOW DRIVER # DRIVER DOWN	

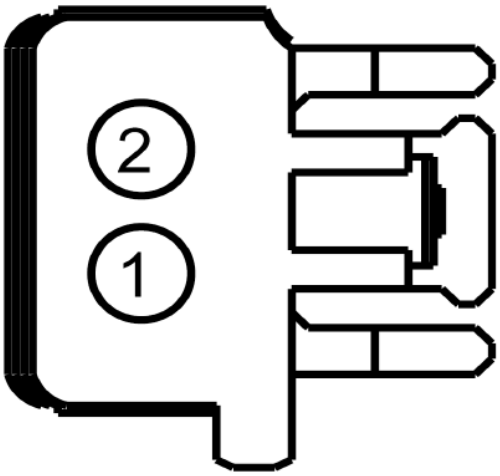
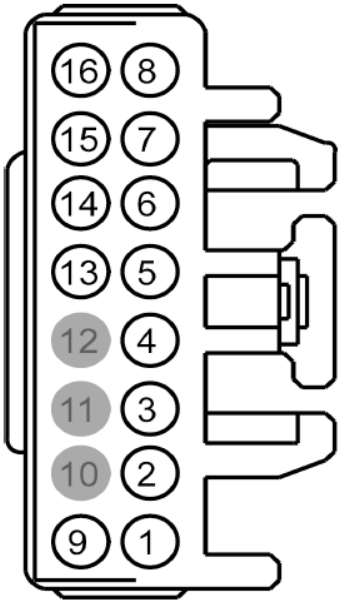


Fig. 170: Left Front Power Window Motor Connector End View (C518)

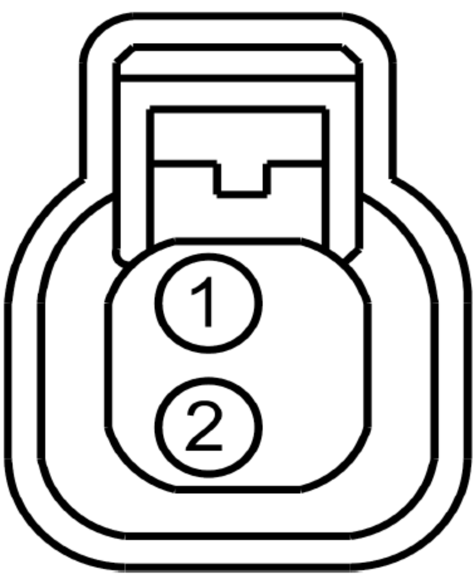
Connector: C522	Description:	Harness:	Base Part #:
	EXTERIOR REAR VIEW MIRROR, LH SIDE	14631	17D696



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPM29 (GN)	20	CTRL MOD. - LEFT MIRROR UP	
2	CPM26 (WH)	20	CTRL MOD. - LEFT MIRROR DOWN	
3	CPM27 (GY-BU)	20	CTRL MOD. - LEFT MIRROR LEFT	
4	CPM28 (BU-BN)	20	CTRL MOD. - LEFT MIRROR RIGHT	
5	CLN26 (BU)	18	RELAY - COURTESY LAMPS	
6	CBP16 (BU-GN)	20	FUSE - 9 OR CIRCUIT BREAKER	
7	GD126 (BK-WH)	20	GROUND - FLOOR CROSS MEMBER REAR LEFT	
8	RRD12 (BN)	20	CTRL MOD. - ELECTROCHROMIC MIRROR	
9	LRD12 (BU-GY)	20	CTRL MOD. - ELECTROCHROMIC MIRROR	
10	*	*	not used	
11	*	*	not used	
12	*	*	not used	
13	LPM30 (GY-VT)	20	CTRL MOD. - SENSORS MIRROR POSITION (LEFT)	
14	VPM36 (BN-YE)	20	SENSOR - LEFT MIRROR POSITION # VERTICAL	
15	VPM35 (YE-BU)	20	SENSOR - LEFT MIRROR POSITION # HORIZONTAL	
16	RPM30 (YE)	20	CTRL MOD. - SENSORS MIRROR POSITION (LEFT)	

Fig. 171: Left Side Exterior Rearview Mirror Connector End View (C522)

Connector: C523	Description:	Harness:	Base Part #:
	SPEAKER, LEFT FRONT	14631	18808



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME07 (WH)	20	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT DOOR (WOOFER) +	
1	VME07 (WH)	18	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT DOOR (WOOFER) +	THX audio, Navigation
2	RME07 (WH-BN)	20	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT DOOR (WOOFER) -	
2	RME07 (WH-BN)	18	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT DOOR (WOOFER) -	THX audio, Navigation

Fig. 172: Left Front Speaker Connector End View (C523)

Connector: C525 | **Description:** DOOR LOCK ACTUATOR, LEFT FRONT | **Harness:** 14631 | **Base Part #:** 14A626

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	CPL11 (GY-BN)	16	CTRL MOD. - DOOR LOCK # ALL LOCK	W/O memory
2	CPL02 (VT-GN)	16	CTRL MOD. - DOOR LOCK # DRIVER LOCK	Memory
3	*	*	not used	
4	*	*	not used	
5	CPL28 (VT-BN)	20	SWITCH - LATCH DRIVER # RESET	
6	GD126 (BK-WH)	20	GROUND - FLOOR CROSS MEMBER REAR LEFT	
7	*	*	not used	
8	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
9	*	*	not used	
10	CPL51 (BU-GN)	16	CTRL MOD. - DOOR LOCK # DRIVER UNLOCK	

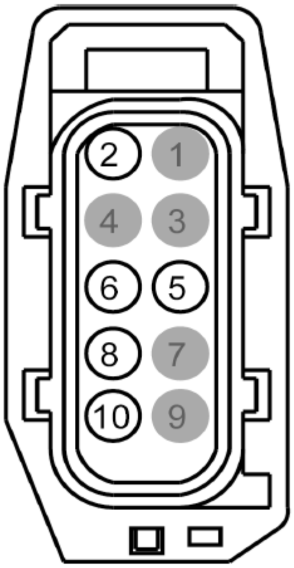


Fig. 173: Left Front Door Lock Actuator Connector End View (C525)

Connector: C527 | **Description:** EXTERIOR REAR VIEW MIRROR SWITCH | **Harness:** 14631 | **Base Part #:** 17B676

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD126 (BK-WH)	20	GROUND - FLOOR CROSS MEMBER REAR LEFT	
2	CPM21 (YE-VT)	20	SWITCH - POWER MIRROR # RIGHT MIRROR UP/DOWN	
3	SBP15 (WH-RD)	20	FUSE - 20 OR CIRCUIT BREAKER	
4	*	*	not used	
5	CPM17 (BU-GN)	20	SWITCH - POWER MIRROR # LEFT MIRROR UP/DOWN	
6	CPM23 (GY)	20	SWITCH - POWER MIRROR # COMMON ALL MOTORS	
7	CPM20 (BN-WH)	20	SWITCH - POWER MIRROR # RIGHT MIRROR LEFT/RIGHT	
8	CPM16 (BN-BU)	20	SWITCH - POWER MIRROR # LEFT MIRROR LEFT/RIGHT	

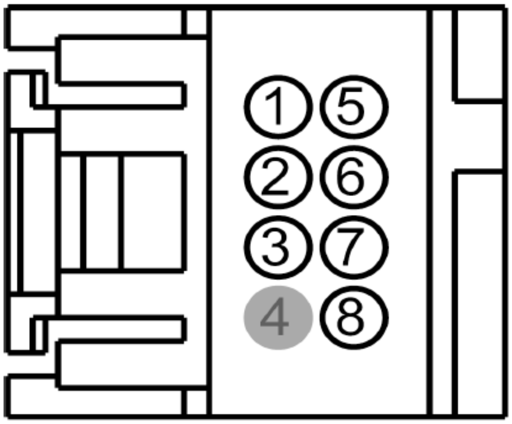
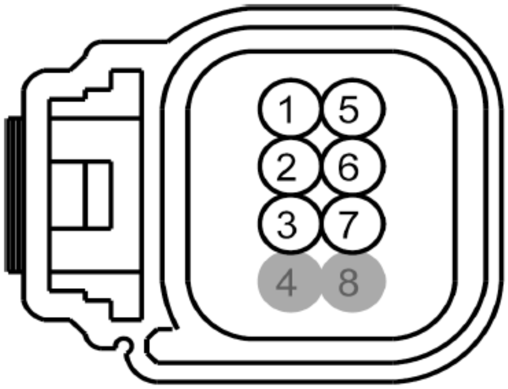


Fig. 174: Exterior Rear View Mirror Switch Connector End View (C527)

Connector: C530

Description:	Harness:	Base Part #:
KEYPAD SWITCH ASSEMBLY	14631	14A626

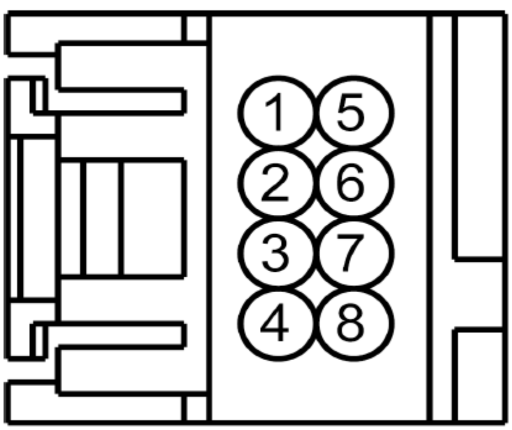


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPK31 (YE-GN)	20	SWITCH - KEYLESS KEYPAD LINE C	
2	GD126 (BK-WH)	20	GROUND - FLOOR CROSS MEMBER REAR LEFT	
3	GD126 (BK-WH)	20	GROUND - FLOOR CROSS MEMBER REAR LEFT	
4	*	*	not used	
5	CPK30 (VT-GN)	20	SWITCH - KEYLESS KEYPAD LINE B	
6	CPK28 (WH)	20	CTRL MOD. - SWITCH KEYLESS KEYPAD ILLUMINATION	
7	CPK29 (GY-BU)	20	SWITCH - KEYLESS KEYPAD LINE A	
8	*	*	not used	

Fig. 175: Keypad Switch Assembly Connector End View (C530)

Connector: C535A

Description:	Harness:	Base Part #:
MASTER WINDOW CONTROL SWITCH	14631	14529

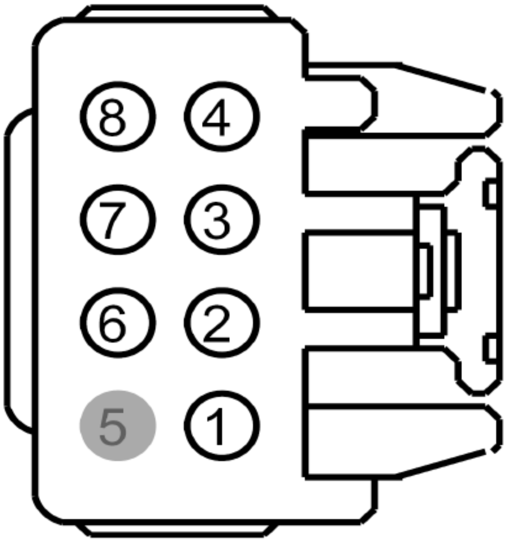


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW31 (GN-WH)	20	SWITCH - POWER WINDOW FRONT PASSENGER # AUTOMATIC ONE TOUCH	
2	CPW12 (GN-OG)	20	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER DOWN	
3	CBP02 (GN)	20	FUSE - 12 OR CIRCUIT BREAKER	
4	CPW11 (BU-GY)	20	SWITCH - POWER WINDOW DRIVER # DRIVER UP	
5	CPW13 (BN-YE)	20	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER UP	
6	VLN04 (VT-GY)	20	CTRL MOD. - IP/SWITCH ILLUMINATION	
7	CPW10 (YE-VT)	20	SWITCH - POWER WINDOW DRIVER # DRIVER DOWN	
8	CPW29 (VT-GY)	20	SWITCH - POWER WINDOW DRIVER # DRIVER AUTOMATIC ONE TOUCH	

Fig. 176: Master Window Control Switch Connector End View (C535A)

Connector: C535B

Description:	Harness:	Base Part #:
MASTER WINDOW CONTROL SWITCH	14631	14529

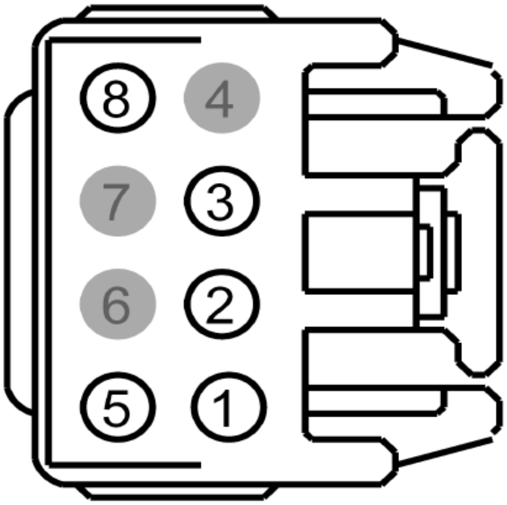


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW15 (YE)	16	SWITCH - POWER WINDOW DRIVER # REAR LEFT DOWN	
2	CPW16 (BU-OG)	16	SWITCH - POWER WINDOW DRIVER # REAR LEFT UP	
3	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
4	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
5	*	*	not used	
6	GD126 (BK-WH)	12	GROUND - FLOOR CROSS MEMBER REAR LEFT	
7	CPW17 (BN-GN)	16	SWITCH - POWER WINDOW DRIVER # REAR RIGHT DOWN	
8	CPW18 (GY-VT)	16	SWITCH - POWER WINDOW DRIVER # REAR RIGHT UP	

Fig. 177: Master Window Control Switch Connector End View (C535B)

Connector: C537A

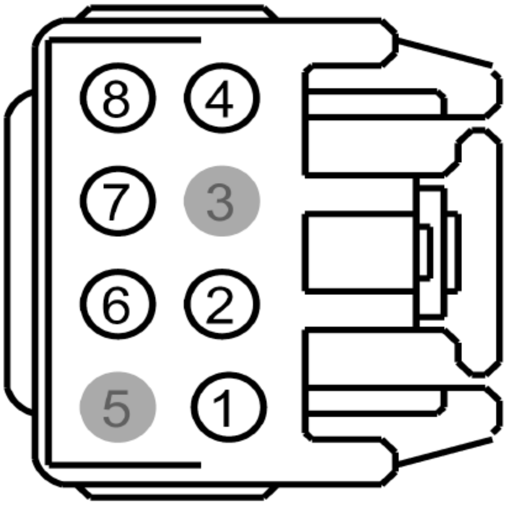
Description:	Harness:	Base Part #:
MASTER WINDOW CONTROL SWITCH	14631	14529



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW10 (YE-VT)	14	SWITCH - POWER WINDOW DRIVER # DRIVER DOWN	
2	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
3	CPW12 (GN-OG)	16	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER DOWN	
4	*	*	not used	
5	CPW11 (BU-GY)	14	SWITCH - POWER WINDOW DRIVER # DRIVER UP	
6	*	*	not used	
7	*	*	not used	
8	CPW13 (BN-YE)	16	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER UP	

Fig. 178: Master Window Control Switch Connector End View (C537A)

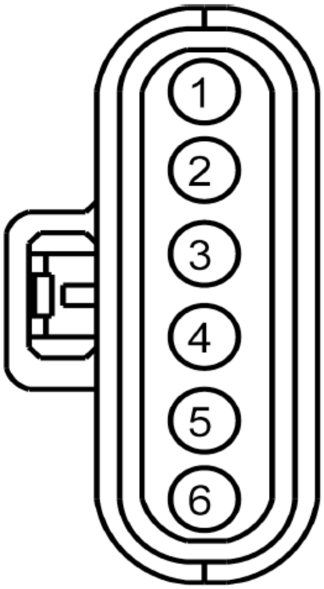
Connector: C537B	Description:	Harness:	Base Part #:
	MASTER WINDOW CONTROL SWITCH	14631	14529



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW15 (YE)	16	SWITCH - POWER WINDOW DRIVER # REAR LEFT DOWN	
2	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
3	*	*	not used	
4	CPW17 (BN-GN)	16	SWITCH - POWER WINDOW DRIVER # REAR RIGHT DOWN	
5	*	*	not used	
6	CPW16 (BU-OG)	16	SWITCH - POWER WINDOW DRIVER # REAR LEFT UP	
7	GD126 (BK-WH)	12	GROUND - FLOOR CROSS MEMBER REAR LEFT	
8	CPW18 (GY-VT)	16	SWITCH - POWER WINDOW DRIVER # REAR RIGHT UP	

Fig. 179: Master Window Control Switch Connector End View (C537B)

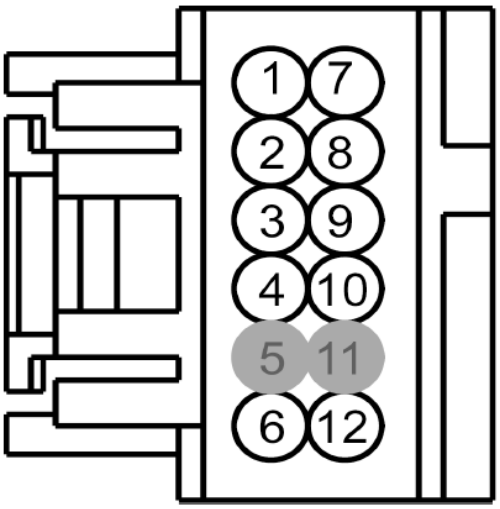
Connector: C540	Description:	Harness:	Base Part #:
	POWER WINDOW MOTOR, LEFT FRONT	14631	23394



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW10 (YE-VT)	20	SWITCH - POWER WINDOW DRIVER # DRIVER DOWN	
2	CPW01 (BN-BU)	20	CTRL MOD. - POWER WINDOW GLOBAL SET	
3	GD126 (BK-WH)	14	GROUND - FLOOR CROSS MEMBER REAR LEFT	
4	SBB34 (YE-RD)	14	FUSE - 34 OR CIRCUIT BREAKER	
5	CPW29 (VT-GY)	20	SWITCH - POWER WINDOW DRIVER # DRIVER AUTOMATIC ONE TOUCH	
6	CPW11 (BU-GY)	20	SWITCH - POWER WINDOW DRIVER # DRIVER UP	

Fig. 180: Left Front Power Window Motor Connector End View (C540)

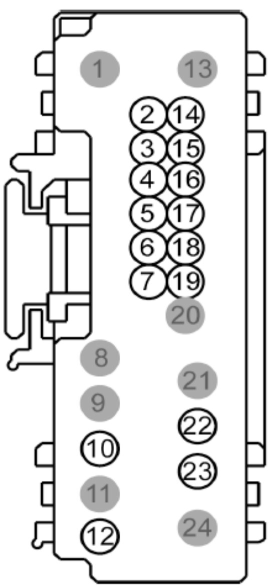
Connector: C568A	Description:	Harness:	Base Part #:
	DRIVER DOOR MODULE (DDM)	14631	203A28



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VPM36 (BN-YE)	20	SENSOR - LEFT MIRROR POSITION # VERTICAL	
2	CPM28 (BU-BN)	20	CTRL MOD. - LEFT MIRROR RIGHT	
3	CPM29 (GN)	20	CTRL MOD. - LEFT MIRROR UP	
4	CPM27 (GY-BU)	20	CTRL MOD. - LEFT MIRROR LEFT	
5	*	*	not used	
6	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW	
7	VPM35 (YE-BU)	20	SENSOR - LEFT MIRROR POSITION # HORIZONTAL	
8	CPM26 (WH)	20	CTRL MOD. - LEFT MIRROR DOWN	
9	RPM30 (YE)	20	CTRL MOD. - SENSORS MIRROR POSITION (LEFT)	
10	CPS55 (YE)	20	CTRL MOD. - MEMORY SET INDICATOR	
11	*	*	not used	
12	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH	

Fig. 181: Driver Door Module Connector End View (C568A)

Connector: C568B	Description:	Harness:	Base Part #:
	DRIVER DOOR MODULE (DDM)	14631	203A28



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	CPL28 (VT-BN)	20	SWITCH - LATCH DRIVER # RESET	
3	CPS14 (GY-VT)	20	SWITCH - MEMORY SET	
4	CPS15 (VT-WH)	20	SWITCH - MEMORY P1	
5	CPM20 (BN-WH)	20	SWITCH - POWER MIRROR # RIGHT MIRROR LEFT/RIGHT	
6	CPM21 (YE-VT)	20	SWITCH - POWER MIRROR # RIGHT MIRROR UP/DOWN	
7	CPM16 (BN-BU)	20	SWITCH - POWER MIRROR # LEFT MIRROR LEFT/RIGHT	
8	*	*	not used	
9	*	*	not used	
10	SBP15 (WH-RD)	20	FUSE - 20 OR CIRCUIT BREAKER	
11	*	*	not used	
12	GD126 (BK-WH)	20	GROUND - FLOOR CROSS MEMBER REAR LEFT	
13	*	*	not used	
14	CPL43 (VT-GY)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
15	CPL42 (GY-YE)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
16	CPS16 (YE)	20	SWITCH - MEMORY P2	
17	CPM17 (BU-GN)	20	SWITCH - POWER MIRROR # LEFT MIRROR UP/DOWN	
18	CPM23 (GY)	20	SWITCH - POWER MIRROR # COMMON ALL MOTORS	
19	LPM30 (GY-VT)	20	CTRL MOD. - SENSORS MIRROR POSITION (LEFT)	
20	*	*	not used	
21	*	*	not used	
22	CPL02 (VT-GN)	16	CTRL MOD. - DOOR LOCK # DRIVER LOCK	
23	CPL51 (BU-GN)	16	CTRL MOD. - DOOR LOCK # DRIVER UNLOCK	
24	*	*	not used	

Fig. 182: Driver Door Module Connector End View (C568B)

Connector: C569	Description:	Harness:	Base Part #:
	TWEETER, LEFT FRONT	14631	18808

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME08 (GN-OG)	20	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT TWEETER +	Audiophile
1	VME08 (GN-OG)	18	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT TWEETER +	THX audio
2	RME08 (GY-OG)	20	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT TWEETER -	Audiophile
2	RME08 (GY-OG)	18	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT TWEETER -	THX audio

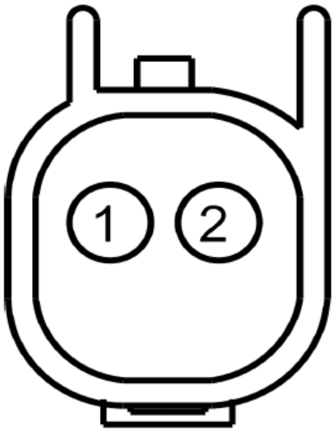


Fig. 183: Left Front Tweeter Connector End View (C569)

Connector: C603	Description:	Harness:	Base Part #:
	DOOR LOCK ACTUATOR, RIGHT FRONT	14630	14A626

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	CPL11 (GY-BN)	16	CTRL MOD. - DOOR LOCK # ALL LOCK	
3	*	*	not used	
4	*	*	not used	
5	*	*	not used	
6	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	
7	*	*	not used	
8	CPL31 (WH)	20	SWITCH - LATCH PASSENGER # AJAR	
9	*	*	not used	
10	CPL52 (VT-GY)	16	CTRL MOD. - DOOR LOCK # PASSENGER DOORS UNLOCK (ALL EXCLUDING DRIVER)	

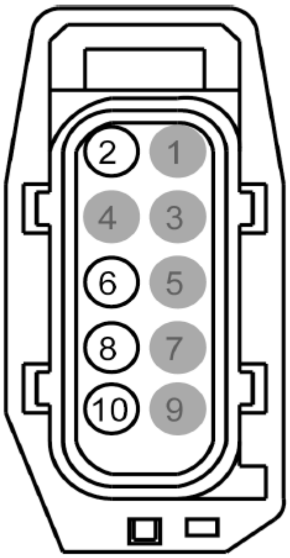
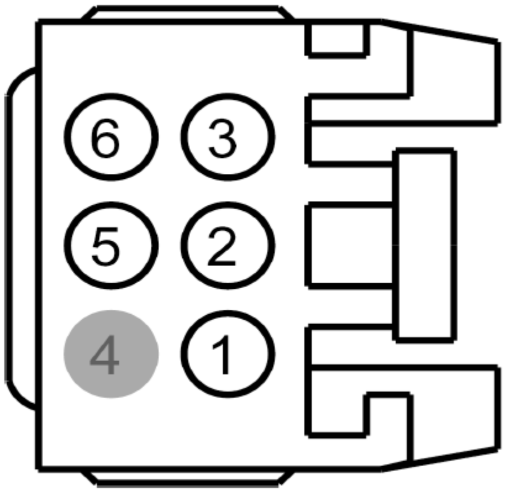


Fig. 184: Right Front Door Lock Actuator Connector End View (C603)

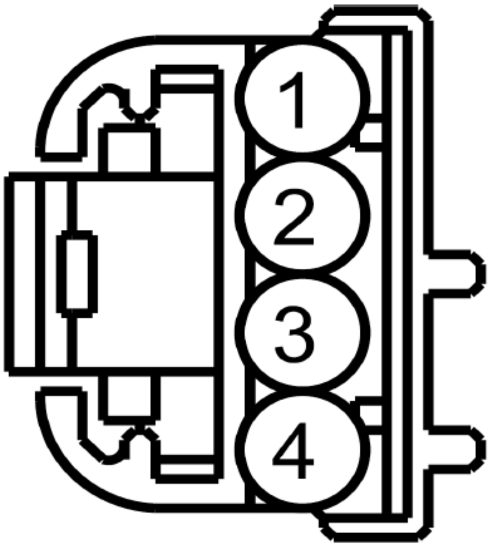
Connector: C604	Description:	Harness:	Base Part #:
	WINDOW CONTROL SWITCH, PASSENGER SIDE	14630	14529



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW12 (GN-OG)	14	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER DOWN	
2	CPW19 (VT)	14	SWITCH - POWER WINDOW FRONT PASSENGER # DOWN	
3	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
4	*	*	not used	
5	CPW20 (WH-OG)	14	SWITCH - POWER WINDOW FRONT PASSENGER # UP	
6	CPW13 (BN-YE)	14	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER UP	

Fig. 185: Passenger Side Window Control Switch Connector End View (C604)

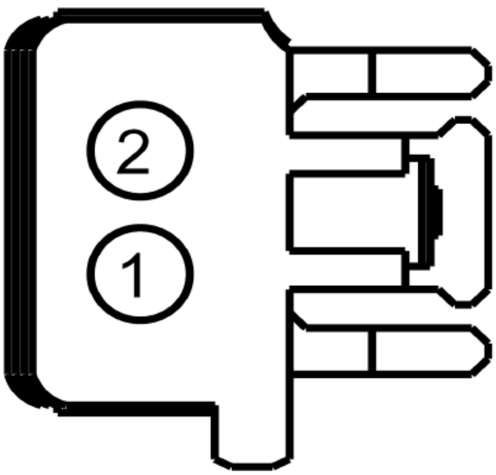
Connector: C605	Description:	Harness:	Base Part #:
	DOOR LOCK SWITCH, PASSENGER SIDE	14630	14028



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL42 (GY-YE)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
2	CBP02 (GN)	20	FUSE - 12 OR CIRCUIT BREAKER	Fusion / Milan
2	VLN04 (VT-GY)	20	CTRL MOD. - IP/SWITCH ILLUMINATION	MKZ
3	CPL43 (VT-GY)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
4	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	

Fig. 186: Passenger Side Door Lock Switch Connector End View (C605)

Connector: C608	Description:	Harness:	Base Part #:
	POWER WINDOW MOTOR, RIGHT FRONT	14630	23394



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW20 (WH-OG)	14	SWITCH - POWER WINDOW FRONT PASSENGER # UP	
2	CPW19 (VT)	14	SWITCH - POWER WINDOW FRONT PASSENGER # DOWN	

Fig. 187: Right Front Power Window Motor Connector End View (C608)

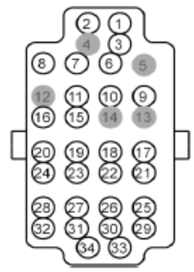
Inline: C610

Description:
Inline

Base Part #:

MALE
Harness: 14630

FEMALE
Harness: 14A005



Pin	Circuit	Gauge	Qualifier
1	CPW12 (GN-OG)	14	Fusion / Milan
1	SBB35 (BU-RD)	14	MKZ
2	CPW13 (BN-YE)	14	
3	VLN04 (VT-GY)	20	
4	*	*	
5	*	*	
6	CPL52 (VT-GY)	16	
7	CPL11 (GY-BN)	16	
8	CPM33 (WH-VT)	20	
9	CPM31 (YE-GY)	20	
10	CPL31 (WH)	20	
11	CBP02 (GN)	20	
12	*	*	
13	*	*	
14	*	*	
15	CPM34 (WH-BN)	20	
16	CPM32 (WH-BU)	20	
17	LPM30 (GY-VT)	20	
18	VME10 (WH-VT)	20	14630
18	VME10 (WH-VT)	18	14630 - THX
18	VME10 (WH-VT)	18	14A005
19	RME10 (WH-OG)	20	14630
19	RME10 (WH-OG)	18	14630 - THX
19	RME10 (WH-OG)	18	14A005
20	CPM23 (GY)	20	W/O memory
20	RPM30 (YE)	20	Memory
21	CPM20 (BN-WH)	20	W/O memory
21	VPM38 (BN-GN)	20	Memory
22	CPM21 (YE-VT)	20	W/O memory
22	VPM37 (BU-OG)	20	Memory
23	CPL42 (GY-YE)	20	
24	CPL43 (VT-GY)	20	
25	VME11 (VT-OG)	18	
26	RME11 (YE-OG)	18	
27	CLN26 (BU)	18	
28	CBP16 (BU-GN)	20	
29	CPW01 (BN-BU)	20	
30	CPW12 (GN-OG)	20	
31	CPW31 (GN-WH)	20	
32	CPW13 (BN-YE)	20	
33	CPW14 (VT-WH)	14	
34	GD139 (BK-YE)	14	

Fig. 188: Inline Connector End View (C610)

Connector: C612	Description:	Harness:	Base Part #:
	SPEAKER, RIGHT FRONT	14630	18808

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME10 (WH-VT)	20	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT DOOR (WOOFER) +	
1	VME10 (WH-VT)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT DOOR (WOOFER) +	THX audio, Navigation
2	RME10 (WH-OG)	20	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT DOOR (WOOFER) -	
2	RME10 (WH-OG)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT DOOR (WOOFER) -	THX audio, Navigation

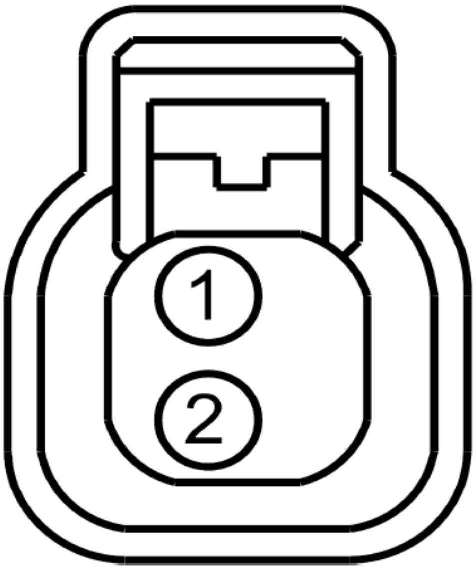


Fig. 189: Right Front Speaker Connector End View (C612)

Connector: C613	Description:	Harness:	Base Part #:
	SPEAKER, RIGHT FRONT	14630	18808

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME11 (VT-OG)	20	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT TWEETER +	
2	RME11 (YE-OG)	20	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT TWEETER -	

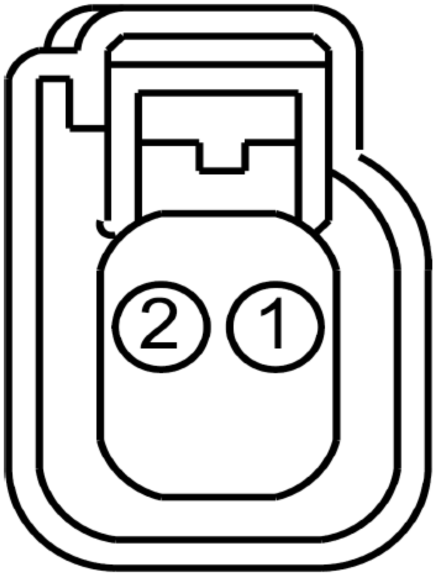
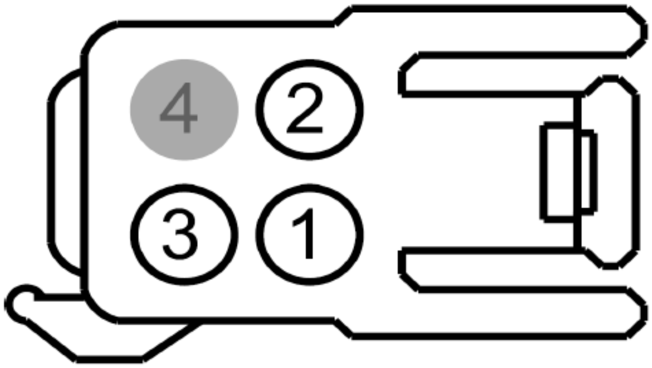


Fig. 190: Right Front Speaker Connector End View (C613)

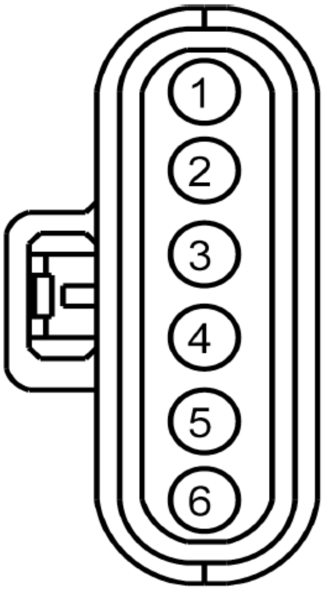
Connector: C622	Description:	Harness:	Base Part #:
	EXTERIOR REAR VIEW MIRROR, RH SIDE	14630	17D696



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPM21 (YE-VT)	20	SWITCH - POWER MIRROR # RIGHT MIRROR UP/DOWN	
2	CPM23 (GY)	20	SWITCH - POWER MIRROR # COMMON ALL MOTORS	
3	CPM20 (BN-WH)	20	SWITCH - POWER MIRROR # RIGHT MIRROR LEFT/RIGHT	
4	*	*	not used	

Fig. 191: Right Side Exterior Rearview Mirror Connector End View (C622)

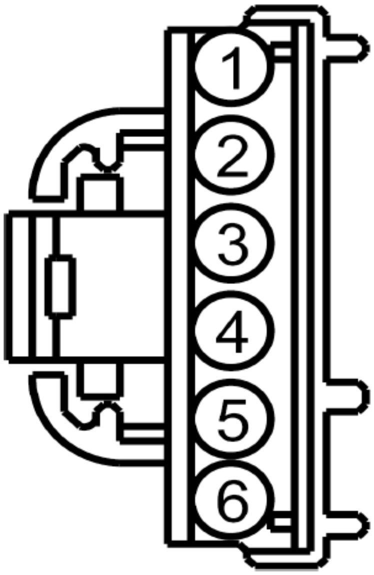
Connector: C623	Description:	Harness:	Base Part #:
	POWER WINDOW MOTOR, RIGHT FRONT	14630	23394



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW12 (GN-OG)	20	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER DOWN	
2	CPW01 (BN-BU)	20	CTRL MOD. - POWER WINDOW GLOBAL SET	
3	GD139 (BK-YE)	14	GROUND - PILLAR A RIGHT # 2ND STUD	
4	SBB35 (BU-RD)	14	FUSE - 35 OR CIRCUIT BREAKER	
5	CPW31 (GN-WH)	20	SWITCH - POWER WINDOW FRONT PASSENGER # AUTOMATIC ONE TOUCH	
6	CPW13 (BN-YE)	20	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER UP	

Fig. 192: Right Front Power Window Motor Connector End View (C623)

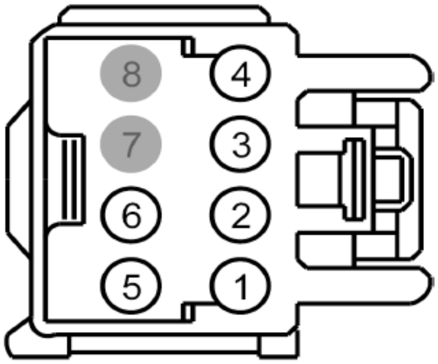
Connector: C624	Description:	Harness:	Base Part #:
	WINDOW CONTROL SWITCH, PASSENGER SIDE	14630	14529



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VLN04 (VT-GY)	22	CTRL MOD. - IP/SWITCH ILLUMINATION	
2	CBP02 (GN)	20	FUSE - 2 OR CIRCUIT BREAKER	
3	CPW13 (BN-YE)	20	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER UP	
4	CPW31 (GN-WH)	20	SWITCH - POWER WINDOW FRONT PASSENGER # AUTOMATIC ONE TOUCH	
5	CPW12 (GN-OG)	20	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER DOWN	
6	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	

Fig. 193: Passenger Side Window Control Switch Connector End View (C624)

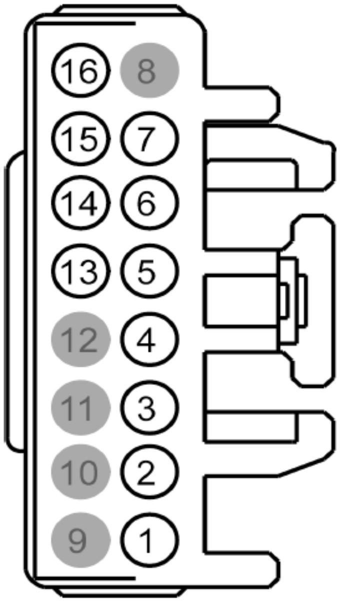
Connector: C625	Description:	Harness:	Base Part #:
	EXTERIOR REAR VIEW MIRROR, RH SIDE	14630	17D696



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPM21 (YE-VT)	20	SWITCH - POWER MIRROR # RIGHT MIRROR UP/DOWN	
2	CPM23 (GY)	20	SWITCH - POWER MIRROR # COMMON ALL MOTORS	
3	CPM20 (BN-WH)	20	SWITCH - POWER MIRROR # RIGHT MIRROR LEFT/RIGHT	
4	CLN26 (BU)	18	RELAY - COURTESY LAMPS	
5	CBP16 (BU-GN)	20	FUSE - 9 OR CIRCUIT BREAKER	
6	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	
7	*	*	not used	
8	*	*	not used	

Fig. 194: Right Side Exterior Rearview Mirror Connector End View (C625)

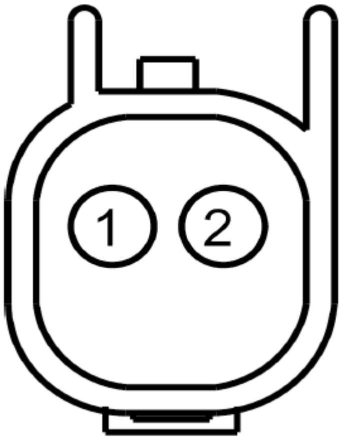
Connector: C626	Description:	Harness:	Base Part #:
	EXTERIOR REAR VIEW MIRROR, RH SIDE	14630	17D696



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPM34 (WH-BN)	20	CTRL MOD. - RIGHT MIRROR UP	
2	CPM31 (YE-GY)	20	CTRL MOD. - RIGHT MIRROR DOWN	
3	CPM32 (WH-BU)	20	CTRL MOD. - RIGHT MIRROR LEFT	
4	CPM33 (WH-VT)	20	CTRL MOD. - RIGHT MIRROR RIGHT	
5	CLN26 (BU)	18	RELAY - COURTESY LAMPS	
6	CBP16 (BU-GN)	20	FUSE - 16 OR CIRCUIT BREAKER	
7	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	*	*	not used	
13	LPM30 (GY-VT)	20	CTRL MOD. - SENSORS MIRROR POSITION (LEFT)	
14	VPM38 (BN-GN)	20	SENSOR - RIGHT MIRROR POSITION # VERTICAL	
15	VPM37 (BU-OG)	20	SENSOR - RIGHT MIRROR POSITION # HORIZONTAL	
16	RPM30 (YE)	20	CTRL MOD. - SENSORS MIRROR POSITION (LEFT)	

Fig. 195: Right Side Exterior Rearview Mirror Connector End View (C626)

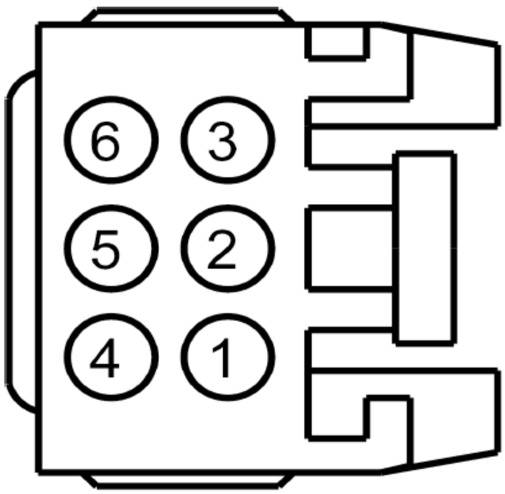
Connector: C645	Description:	Harness:	Base Part #:
	TWEETER, RIGHT FRONT	14630	18808



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME11 (VT-OG)	20	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT TWEETER +	
1	VME11 (VT-OG)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT TWEETER +	THX audio, Navigation
2	RME11 (YE-OG)	20	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT TWEETER -	
2	RME11 (YE-OG)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT TWEETER -	THX audio, Navigation

Fig. 196: Right Front Tweeter Connector End View (C645)

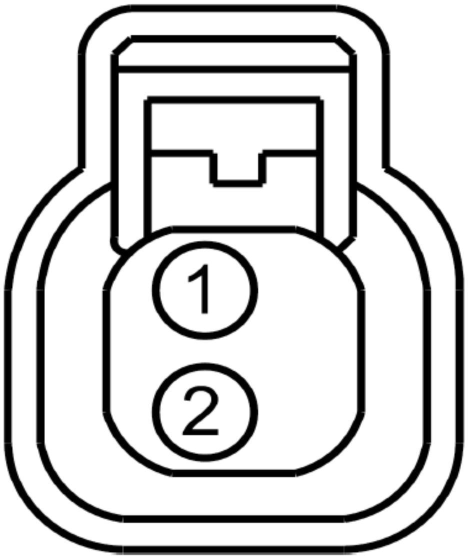
Connector: C701	Description:	Harness:	Base Part #:
	WINDOW CONTROL SWITCH, LEFT REAR	14633	14529



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW15 (YE)	14	SWITCH - POWER WINDOW DRIVER # REAR LEFT DOWN	
2	CPW22 (GN-VT)	14	SWITCH - POWER WINDOW REAR LEFT # UP	
3	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
4	VLN04 (VT-GY)	20	CTRL MOD. - IP/SWITCH ILLUMINATION	
5	CPW21 (BN)	14	SWITCH - POWER WINDOW REAR LEFT # DOWN	
6	CPW16 (BU-OG)	14	SWITCH - POWER WINDOW DRIVER # REAR LEFT UP	

Fig. 197: Left Rear Window Control Switch Connector End View (C701)

Connector: C702	Description:	Harness:	Base Part #:
	SPEAKER, LEFT REAR	14633	18808

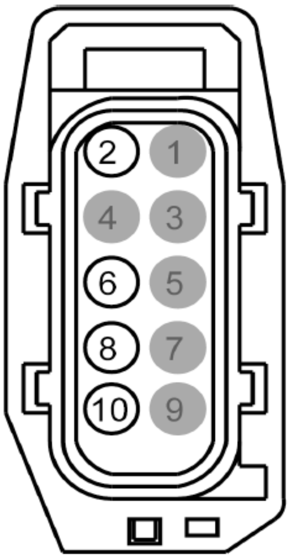


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME09 (BN-GN)	20	CTRL MOD. - AUDIO # SPEAKER LEFT REAR +	Base audio, Audiophile
1	VME09 (BN-GN)	18	CTRL MOD. - AUDIO # SPEAKER LEFT REAR +	THX audio, Navigation
2	RME09 (BN-YE)	20	CTRL MOD. - AUDIO # SPEAKER LEFT REAR -	Base audio, Audiophile
2	RME09 (BN-YE)	18	CTRL MOD. - AUDIO # SPEAKER LEFT REAR -	THX audio, Navigation

Fig. 198: Left Rear Speaker Connector End View (C702)

Connector: C704

Description:	Harness:	Base Part #:
DOOR LOCK ACTUATOR, LEFT REAR	14633	14A626



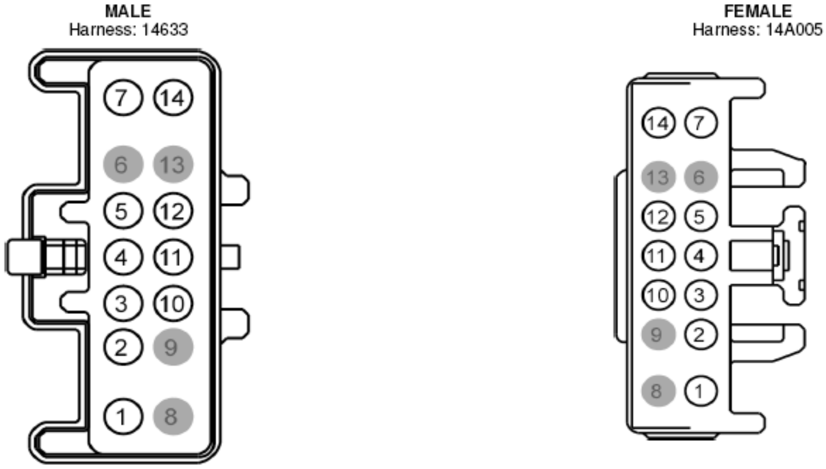
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	CPL11 (GY-BN)	16	CTRL MOD. - DOOR LOCK # ALL LOCK	
3	*	*	not used	
4	*	*	not used	
5	*	*	not used	
6	GD126 (BK-WH)	20	GROUND - FLOOR CROSS MEMBER REAR LEFT	
7	*	*	not used	
8	CPL36 (GN)	20	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
9	*	*	not used	
10	CPL52 (VT-GY)	16	CTRL MOD. - DOOR LOCK # PASSENGER DOORS UNLOCK (ALL EXCLUDING DRIVER)	

Fig. 199: Left Rear Door Lock Actuator Connector End View (C704)

Inline: C710

Description: Inline

Base Part #:



Pin	Circuit	Gauge	Qualifier
1	CPW14 (VT-WH)	14	
2	VLN04 (VT-GY)	20	
3	CPL36 (GN)	20	
4	VME09 (BN-GN)	20	Base audio, Audiophile
4	VME09 (BN-GN)	18	THX audio, Navigation
5	GD126 (BK-WH)	20	
6	*	*	
7	CPW15 (YE)	16	14A005
7	CPW15 (YE)	14	14633
8	*	*	
9	*	*	
10	CPL52 (VT-GY)	16	
11	RME09 (BN-YE)	20	Base audio, Audiophile
11	RME09 (BN-YE)	18	THX audio, Navigation
12	CPL11 (GY-BN)	16	
13	*	*	
14	CPW16 (BU-OG)	16	14A005
14	CPW16 (BU-OG)	14	14633

Fig. 200: Inline Connector End View (C710)

Connector: C726

Description: POWER WINDOW MOTOR, LEFT REAR

Harness: 14633

Base Part #: 23394

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW21 (BN)	14	SWITCH - POWER WINDOW REAR LEFT # DOWN	
2	CPW22 (GN-VT)	14	SWITCH - POWER WINDOW REAR LEFT # UP	

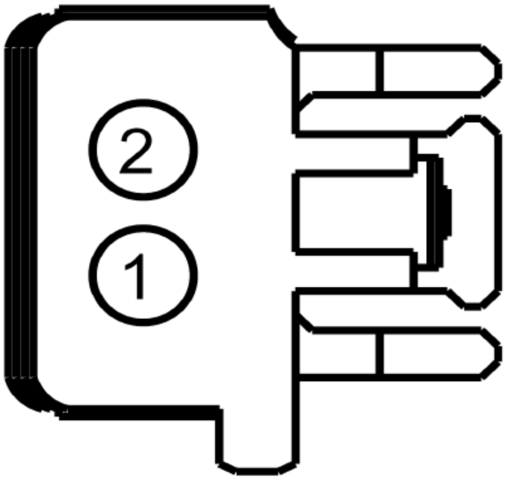
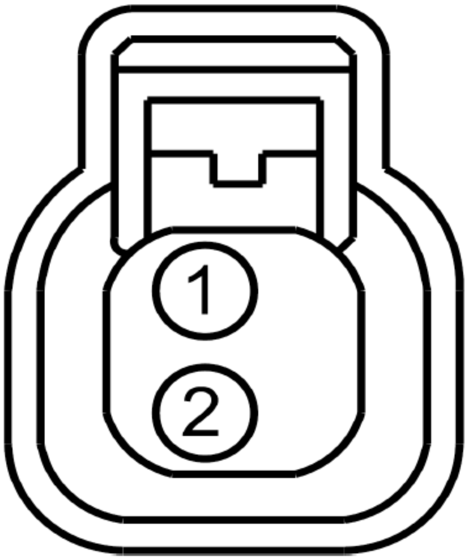


Fig. 201: Left Rear Power Window Motor Connector End View (C726)

Connector: C802

Description:	Harness:	Base Part #:
SPEAKER, RIGHT REAR	14632	18808

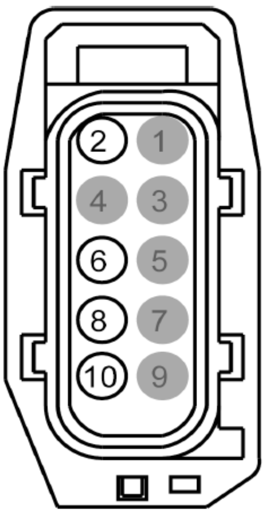


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME12 (BN-WH)	20	CTRL MOD. - AUDIO # SPEAKER RIGHT REAR +	Base audio, Audiophile
1	VME12 (BN-WH)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT REAR +	THX audio, Navigation
2	RME12 (BN-BU)	20	CTRL MOD. - AUDIO # SPEAKER RIGHT REAR -	Base audio, Audiophile
2	RME12 (BN-BU)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT REAR -	THX audio, Navigation

Fig. 202: Right Rear Speaker Connector End View (C802)

Connector: C804

Description:	Harness:	Base Part #:
DOOR LOCK ACTUATOR, RIGHT REAR	14632	14A626



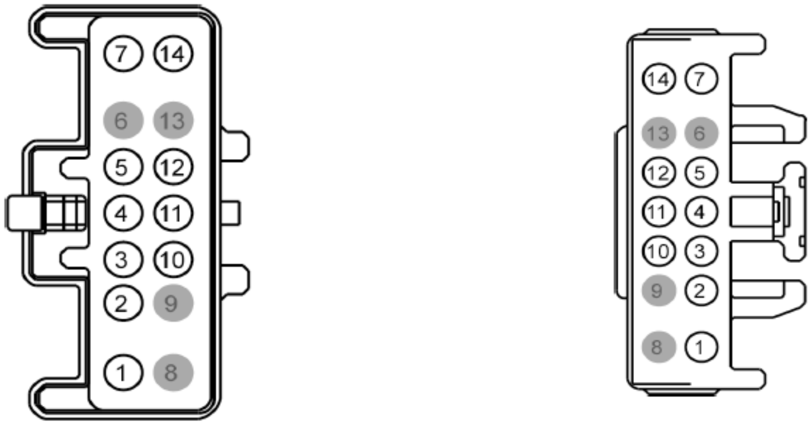
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	CPL11 (GY-BN)	16	CTRL MOD. - DOOR LOCK # ALL LOCK	
3	*	*	not used	
4	*	*	not used	
5	*	*	not used	
6	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	
7	*	*	not used	
8	CPL39 (YE)	20	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
9	*	*	not used	
10	CPL52 (VT-GY)	16	CTRL MOD. - DOOR LOCK # PASSENGER DOORS UNLOCK (ALL EXCLUDING DRIVER)	

Fig. 203: Right Rear Door Lock Actuator Connector End View (C804)

Inline: C810

Description: Inline

Base Part #:



Pin	Circuit	Gauge	Qualifier
1	CPW14 (VT-WH)	14	14632
1	CPW14 (VT-WH)	12	14A005
2	VLN04 (VT-GY)	20	14632
2	VLN04 (VT-GY)	22	14A005
3	CPL39 (YE)	20	
4	VME12 (VT-RD)	20	Base audio, Audiophile
4	VME12 (VT-RD)	18	THX audio, Navigation
5	GD139 (BK-YE)	20	
6	*	*	
7	CPW17 (BN-GN)	16	14A005
7	CPW17 (BN-GN)	14	14632
8	*	*	
9	*	*	
10	CPL52 (VT-GY)	16	
11	RME12 (YE-RD)	20	Base audio, Audiophile
11	RME12 (YE-RD)	18	THX audio, Navigation
12	CPL11 (GY-BN)	16	
13	*	*	
14	CPW18 (GY-VT)	16	14A005
14	CPW18 (GY-VT)	14	14632

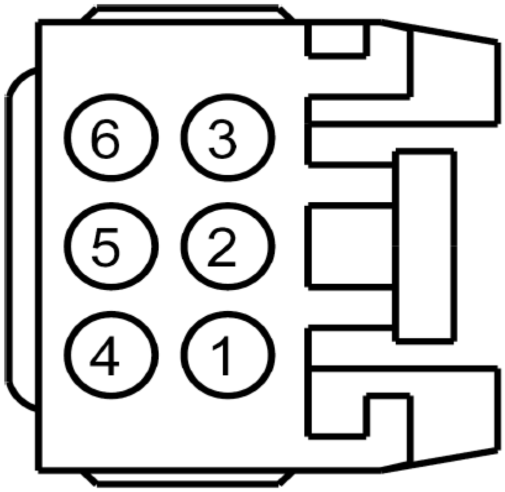
Fig. 204: Inline Connector End View (C810)

Connector: C819

Description: WINDOW CONTROL SWITCH, RIGHT REAR

Harness: 14632

Base Part #: 14529



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW17 (BN-GN)	14	SWITCH - POWER WINDOW DRIVER # REAR RIGHT DOWN	
2	CPW23 (GY)	14	SWITCH - POWER WINDOW REAR RIGHT # DOWN	
3	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
4	VLN04 (VT-GY)	20	CTRL MOD. - IP/SWITCH ILLUMINATION	
5	CPW24 (WH-VT)	14	SWITCH - POWER WINDOW REAR RIGHT # UP	
6	CPW18 (GY-VT)	14	SWITCH - POWER WINDOW DRIVER # REAR RIGHT UP	

Fig. 205: Right Rear Window Control Switch Connector End View (C819)

Connector: C828	Description:	Harness:	Base Part #:
	POWER WINDOW MOTOR, RIGHT REAR	14632	23394

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW24 (WH-VT)	14	SWITCH - POWER WINDOW REAR RIGHT # UP	
2	CPW23 (GY)	14	SWITCH - POWER WINDOW REAR RIGHT # DOWN	

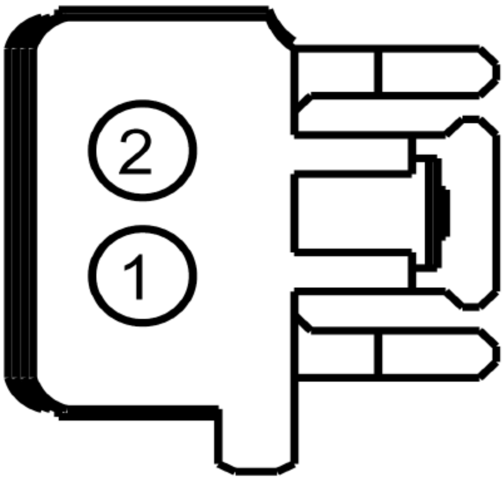


Fig. 206: Right Rear Power Window Motor Connector End View (C828)

Connector: C901	Description:	Harness:	Base Part #:
	INTERIOR LAMP, REAR	14334	13776

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLN26 (BU)	18	RELAY - COURTESY LAMPS	
2	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	
3	CLN09 (YE-GN)	18	RELAY - BATTERY SAVER (E.G. SWITCH OFF INTERIOR LIGHTING)	

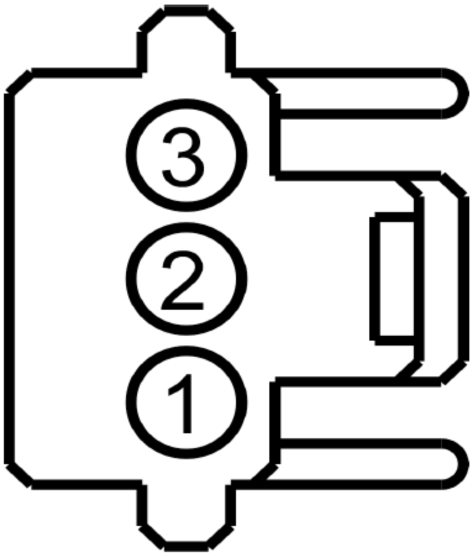


Fig. 207: Rear Interior Lamp Connector End View (C901)

Connector: C906	Description:	Harness:	Base Part #:
	VANITY MIRROR LAMP, RIGHT	14334	04100

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLN09 (YE-GN)	20	RELAY - BATTERY SAVER (E.G. SWITCH OFF INTERIOR LIGHTING)	
2	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	

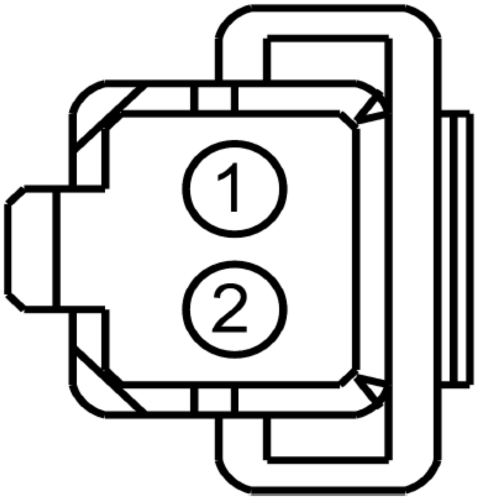


Fig. 208: Right Vanity Mirror Lamp Connector End View (C906)

Connector: C907	Description:	Harness:	Base Part #:
	VANITY MIRROR LAMP, LEFT	14334	04100

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLN09 (YE-GN)	20	RELAY - BATTERY SAVER (E.G. SWITCH OFF INTERIOR LIGHTING)	
2	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	

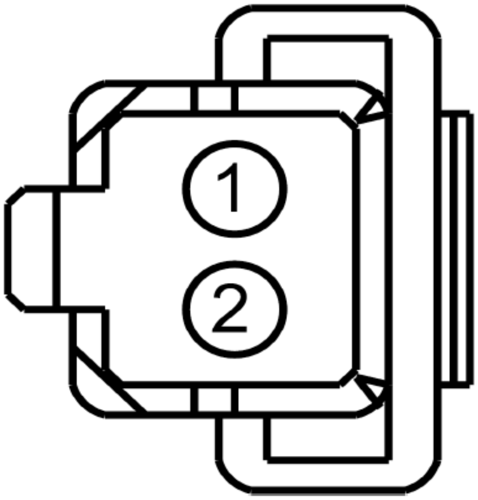
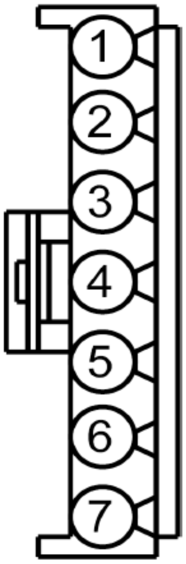


Fig. 209: Left Vanity Mirror Lamp Connector End View (C907)

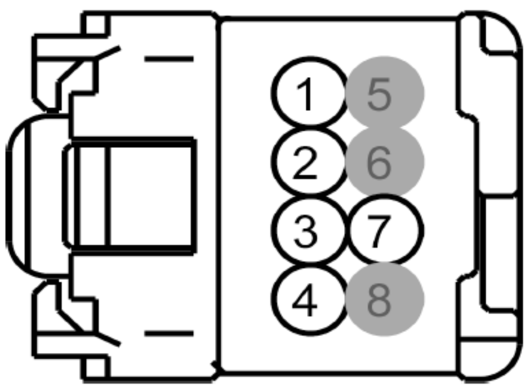
Connector: C911	Description:	Harness:	Base Part #:
	ELECTROCHROMATIC INSIDE MIRROR UNIT	14334	17700



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP02 (GN)	20	FUSE - 12 OR CIRCUIT BREAKER	
2	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	
3	CBP12 (GN-WH)	20	FUSE - 1 OR CIRCUIT BREAKER	
4	LRD12 (BU-GY)	20	CTRL MOD. - ELECTROCHROMIC MIRROR	
5	RRD12 (BN)	20	CTRL MOD. - ELECTROCHROMIC MIRROR	
6	VMC31 (GY-BU)	22	COMPASS MOD. # +	
7	VMC30 (BU-GY)	22	COMPASS MOD. # -	

Fig. 210: Electrochromatic Inside Mirror Unit Connector End View (C911)

Connector: C912	Description:	Harness:	Base Part #:
	ROOF OPENING PANEL SWITCH	14334	15B691



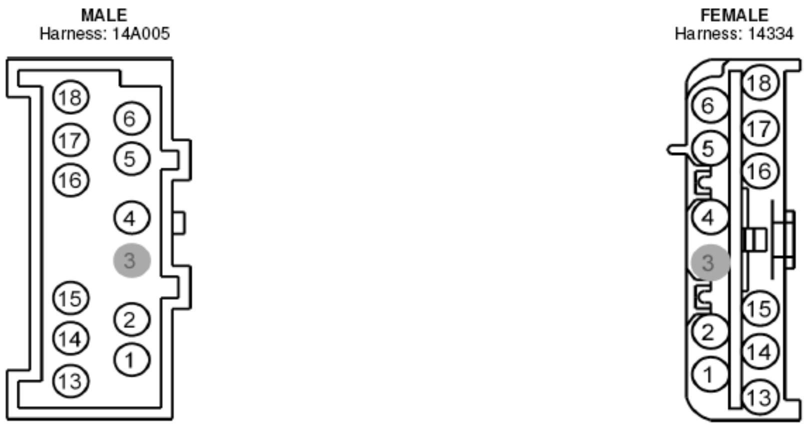
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP02 (GN)	20	FUSE - 12 OR CIRCUIT BREAKER	
2	CPR38 (WH-BU)	20	SWITCH - MOON/SUN ROOF TILT/AUTO	
3	CPR31 (VT-BN)	20	SWITCH - MOON/SUN ROOF OPEN	
4	CPR39 (VT-WH)	20	MOTOR/SMART - MOON/SUN ROOF SWITCH COMMON	
5	*	*	not used	
6	*	*	not used	
7	CPR40 (YE-OG)	20	SWITCH - MOON/SUN ROOF CLOSE	
8	*	*	not used	

Fig. 211: Roof Opening Panel Switch Connector End View (C912)

Inline: C913

Description: Inline

Base Part #:



Pin	Circuit	Gauge	Qualifier
1	CBP02 (GN)	20	
2	CBP12 (GN-WH)	20	
3	*	*	
4	CLN09 (YE-GN)	18	
5	RMM13 (BU)	20	
6	VMM13 (YE-GN)	20	
13	DMM13 (BK)	18	
14	VMC30 (BU-GY)	22	
15	VMC31 (GY-BU)	22	
16	CLN26 (BU)	18	
17	GD139 (BK-YE)	14	
18	SBB33 (RD)	14	

Fig. 212: Inline Connector End View (C913)

Connector: C918

Description: INTERIOR LAMP, FRONT

Harness: 14334

Base Part #: 13776

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLN26 (BU)	18	RELAY - COURTESY LAMPS	
2	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	
3	CLN09 (YE-GN)	18	RELAY - BATTERY SAVER (E.G. SWITCH OFF INTERIOR LIGHTING)	

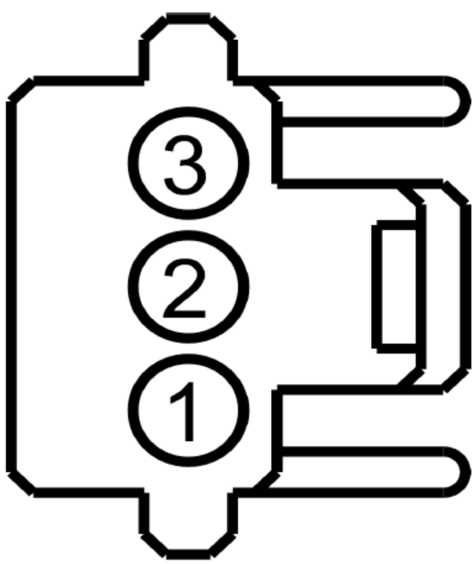


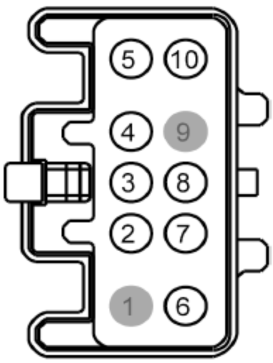
Fig. 213: Front Interior Lamp Connector End View (C918)

Inline: C919

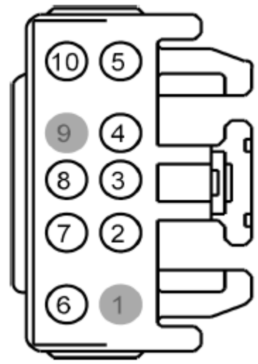
Description:
Inline

Base Part #:

MALE
Harness: 14A005



FEMALE
Harness: 14334



Pin	Circuit	Gauge	Qualifier
1	*	*	
2	VMC30 (BU-GY)	22	
3	VMC31 (YE-GN)	22	
4	CLN26 (BU)	18	
5	GD139 (BK-YE)	14	
6	SBB33 (RD)	14	
7	CBP02 (GN)	20	
8	CBP12 (GN-WH)	20	
9	*	*	
10	CLN09 (YE-GN)	18	

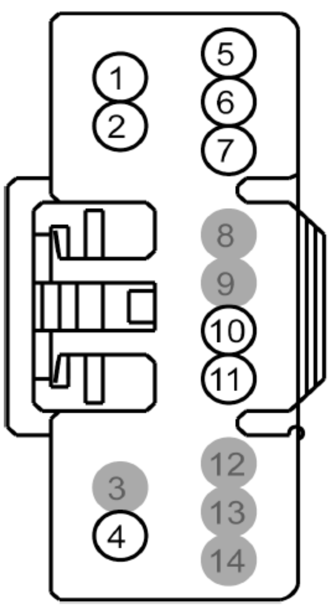
Fig. 214: Inline Connector End View (C919)

Connector: C921

Description:
ROOF OPENING PANEL MODULE

Harness:
14334

Base Part #:
15790



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB33 (RD)	14	FUSE - 33 OR CIRCUIT BREAKER	
2	CBP02 (GN)	20	FUSE - 12 OR CIRCUIT BREAKER	
3	*	*	not used	
4	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	
5	CPR31 (VT-BN)	20	SWITCH - MOON/SUN ROOF OPEN	
6	CPR40 (YE-OG)	20	SWITCH - MOON/SUN ROOF CLOSE	
7	CPR38 (WH-BU)	20	SWITCH - MOON/SUN ROOF TILT	
8	*	*	not used	
9	*	*	not used	
10	CPW01 (BN-BU)	20	CTRL MOD. - POWER WINDOW GLOBAL SET	
11	CPR39 (VT-WH)	20	MOTOR/SMART - MOON/SUN ROOF SWITCH COMMON	
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	

Fig. 215: Roof Opening Panel Module Connector End View (C921)

Connector: C930	Description:	Harness:	Base Part #:
	INTERIOR LAMP, FRONT	14334	13776

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	
2	CLN09 (YE-GN)	18	RELAY - BATTERY SAVER (E.G. SWITCH OFF INTERIOR LIGHTING)	
3	CLN26 (BU)	18	RELAY - COURTESY LAMPS	
4	*	*	not used	

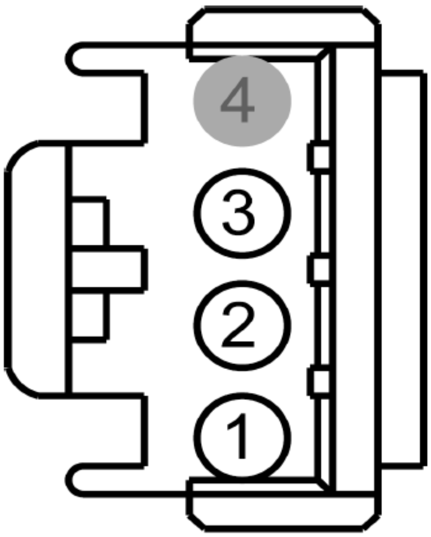
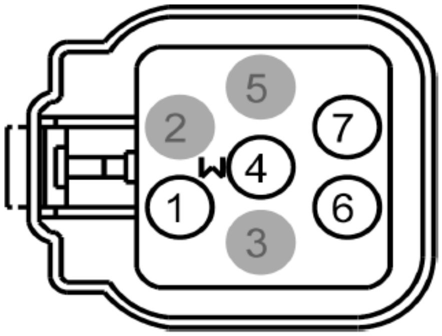


Fig. 216: Front Interior Lamp Connector End View (C930)

Connector: C1021	Description:	Harness:	Base Part #:
	HEADLAMP, LEFT	14290	13008



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	*	*	not used	
3	*	*	not used	
4	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
5	*	*	not used	
6	CLF04 (BN-BU)	20	CTRL MOD. - BEAM LOW LEFT	W/O HID
6	CLF30 (VT-BN)	20	RELAY- BEAM LOW LEFT	HID
7	CLS08 (VT-GN)	20	CTRL MOD. - PARK REAR LEFT	

Fig. 217: Left Headlamp Connector End View (C1021)

Connector: C1023	Description:	Harness:	Base Part #:
	PARK/TURN LAMP, LEFT FRONT	14290	13411

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD123 (BK-GY)	20	GROUND - FENDER FRONT RIGHT	Fusion / Milan
1	GD123 (BK-YE)	20	GROUND - FENDER FRONT RIGHT	MKZ
2	CBP08 (GY-YE)	20	FUSE - 4 OR CIRCUIT BREAKER	
3	CLS21 (BU-GN)	20	CTRL MOD. - TURN LAMP LEFT FRONT	

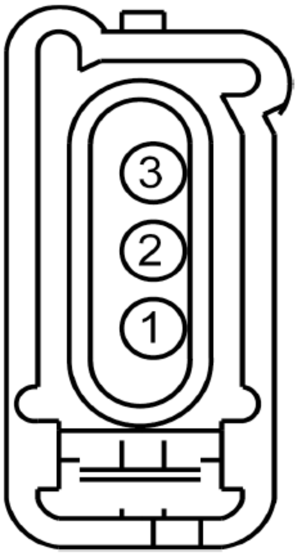
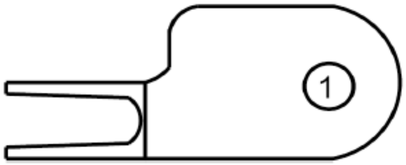


Fig. 218: Left Front Park Lamp / Turn Lamp Connector End View (C1023)

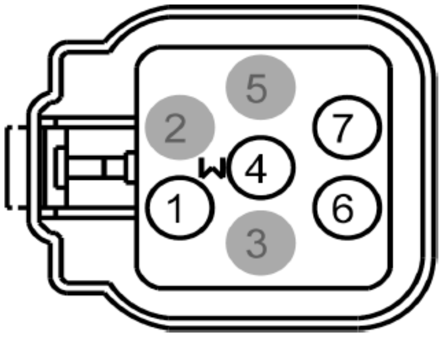
Connector: C1035	Description:	Harness:	Base Part #:
	BATTERY JUNCTION BOX (BJB)	14290	14A067



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SDC02 (RD)	04	BATTERY- # PLUS	

Fig. 219: Battery Junction Box Connector End View (C1035)

Connector: C1041	Description:	Harness:	Base Part #:
	HEADLAMP, RIGHT	14290	13008



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD123 (BK-GY)	18	GROUND - FENDER FRONT RIGHT	
2	*	*	not used	
3	*	*	not used	
4	GD123 (BK-GY)	20	GROUND - FENDER FRONT RIGHT	
5	*	*	not used	
6	CLF05 (BU-GN)	20	CTRL MOD. - BEAM LOW RIGHT	W/O HID
6	CLF31 (YE-GY)	20	RELAY- BEAM LOW RIGHT	HID
7	CLS08 (VT-GN)	20	CTRL MOD. - PARK REAR LEFT	

Fig. 220: Right Headlamp Connector End View (C1041)

Connector: C1043	Description:	Harness:	Base Part #:
	PARK/TURN LAMP, RIGHT FRONT	14290	13411

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CBP08 (GY-YE)	20	FUSE - 4 OR CIRCUIT BREAKER	
3	CLS25 (YE-VT)	20	CTRL MOD. - TURN LAMP RIGHT FRONT	

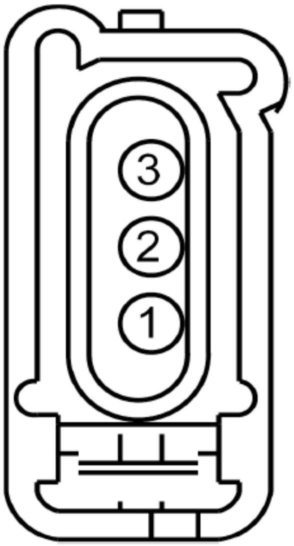
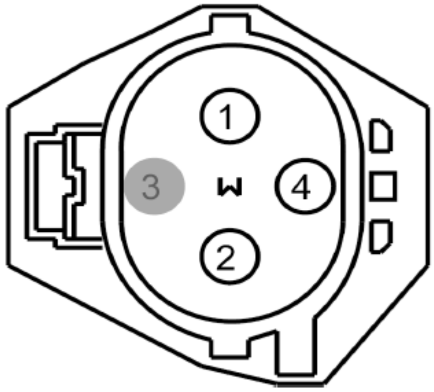


Fig. 221: Right Front Park Lamp / Turn Lamp Connector End View (C1043)

Connector: C1048	Description:	Harness:	Base Part #:
	ENGINE COOLING FAN MOTOR	14290	8C607



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB28 (GN-RD)	10	FUSE - 28 OR CIRCUIT BREAKER	
2	GD121 (BK-YE)	10	GROUND - FENDER FRONT LEFT # 2ND STUD	
3	*	*	not used	
4	VEC03 (WH-BU)	20	CTRL MOD. - COOLING FAN CONTROL VARIABLE (FC-V)	

Fig. 222: Engine Cooling Fan Motor Connector End View (C1048)

Connector: C1064	Description:	Harness:	Base Part #:
	ENGINE COOLANT TEMPERATURE (ECT) SENSOR	12B637	12A648

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE716 (YE)	20	SENSOR - ENGINE COOLANT TEMPERATURE (ECT)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	

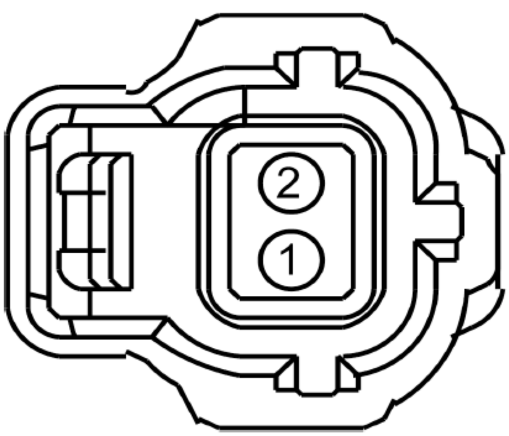


Fig. 223: Engine Coolant Temperature Sensor Connector End View (C1064)

Connector: C1087	Description:	Harness:	Base Part #:
	MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR	12B637	9F472

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE803 (BU-GN)	20	SENSOR - MANIFOLD ABSOLUTE PRESSURE (MAP)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREF)	

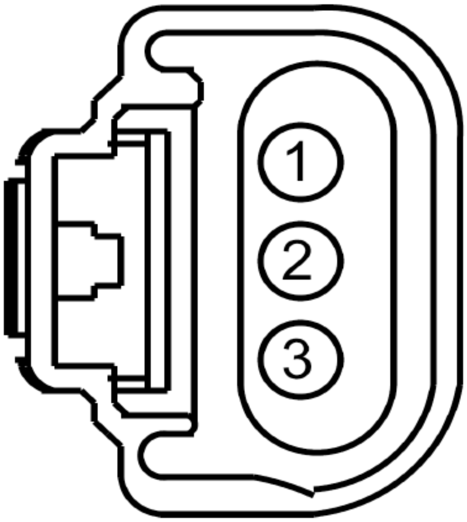


Fig. 224: Manifold Absolute Pressure Sensor Connector End View (C1087)

Connector: C1088	Description:	Harness:	Base Part #:
	INTERMEDIATE SHAFT SPEED SENSOR (ISS)	12B637	17271

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VET28 (GY-VT)	20	SENSOR RETURN	
2	VE822 (YE-BU)	20	INTERMEDIATE SHAFT SPEED SENSOR (ISS) SIGNAL	
3	CE613 (WH-VT)	20	FNR5 RELAY SWITCHED OUTPUT	

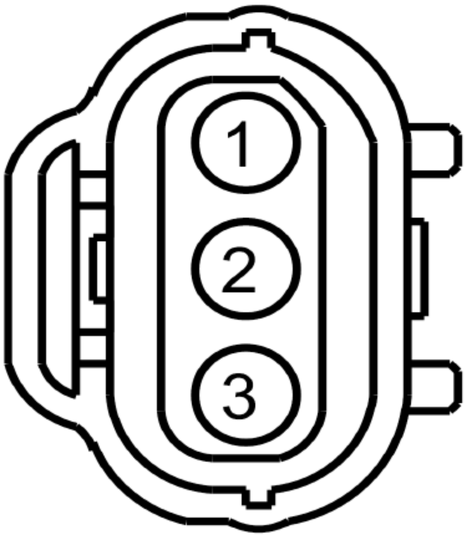


Fig. 225: Intermediate Shaft Speed Sensor Connector End View (C1088)

Connector: C1100A	Description:	Harness:	Base Part #:
	BATTERY	14B060	10655

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SDC02 (RD)	04	BATTERY- # PLUS	
1	SDC14 (RD)	04	GENERATOR (ALTERNATOR)	

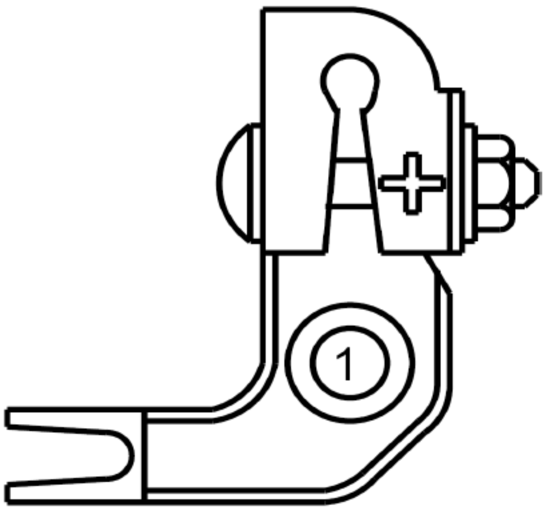
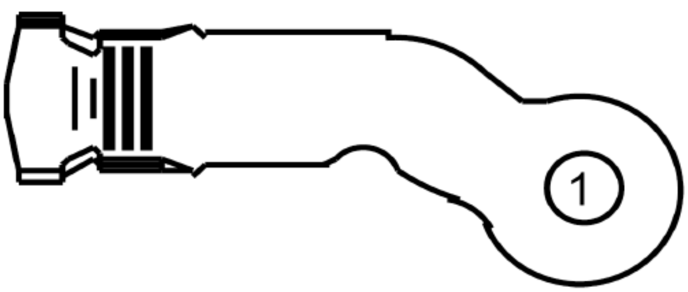


Fig. 226: Battery Connector End View (C1100A)

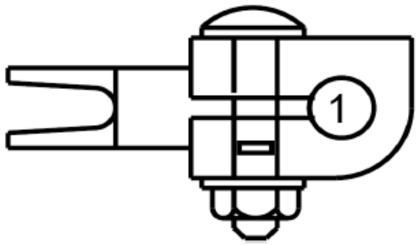
Connector: C1100B	Description:	Harness:	Base Part #:
	BATTERY	14290	10655



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SDC02 (RD)	04	BATTERY- # PLUS	

Fig. 227: Battery Connector End View (C1100B)

Connector: C1100C	Description:	Harness:	Base Part #:
	BATTERY	14B060	10655



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD108 (BK-VT)	04	GROUND - CHASSIS / BATTERY	
1	GD108 (BK-VT)	06	GROUND - CHASSIS / BATTERY	

Fig. 228: Battery Connector End View (C1100C)

Connector: C1107	Description:	Harness:	Base Part #:
	OUTPUT SHAFT SPEED (OSS) SENSOR	12B637	7H103

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE806 (BN-WH)	18	OUTPUT SHAFT SPEED (OSS) SENSOR SIGNAL	
2	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	

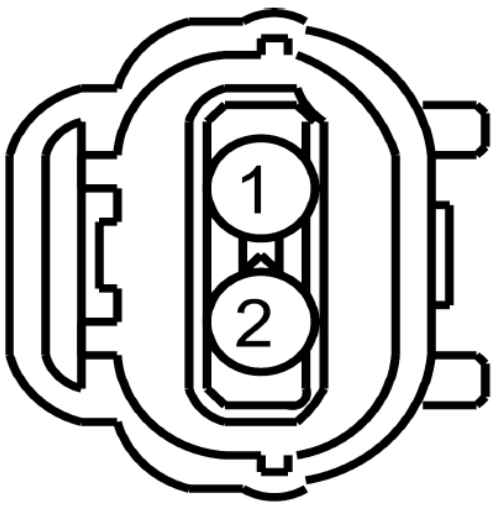


Fig. 229: Output Shaft Speed Sensor Connector End View (C1107)

Connector: C1113

Description:	Harness:	Base Part #:
PARKING LAMP, LEFT FRONT 2	14290	13411

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 4 OR CIRCUIT BREAKER	
2	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	

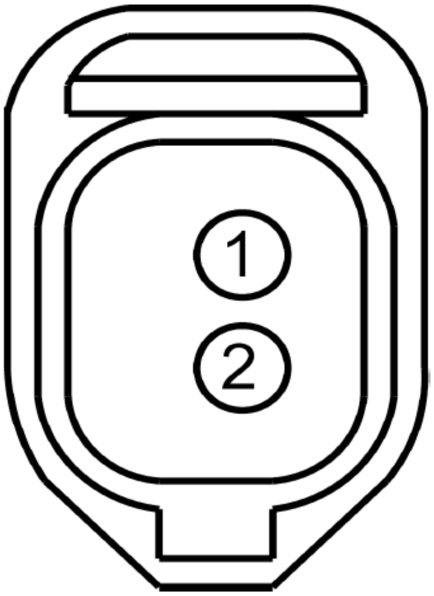


Fig. 230: Left Front 2 Parking Lamp Connector End View (C1113)

Connector: C1114

Description:	Harness:	Base Part #:
PARKING LAMP, RIGHT FRONT 2	14290	13411

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 4 OR CIRCUIT BREAKER	
2	GD123 (BK-GY)	20	GROUND - FENDER FRONT RIGHT	

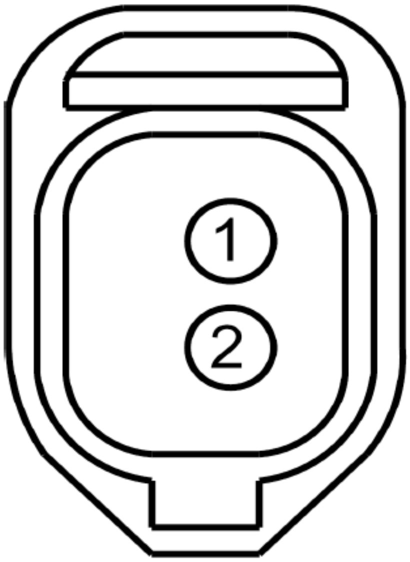


Fig. 231: Right Front 2 Parking Lamp Connector End View (C1114)

Connector: C1120	Description:	Harness:	Base Part #:
	CRANKSHAFT POSITION SENSOR	12B637	6C315

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	
2	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	

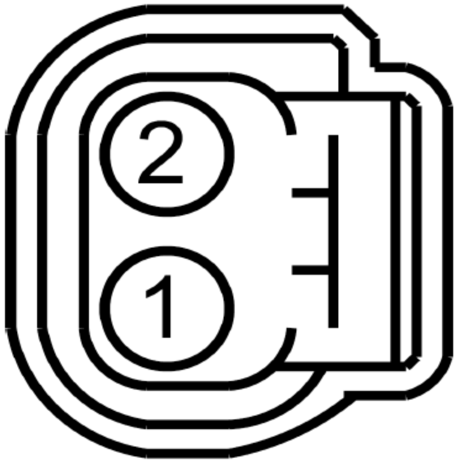


Fig. 232: Crankshaft Position Sensor Connector End View (C1120)

Connector: C1121	Description:	Harness:	Base Part #:
	POWER STEERING PRESSURE SWITCH	12B637/14B060	3N824

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VCS10 (BU-GN)	18	TRANSDUCER - POWER STEERING PRESSURE (PSPT)	

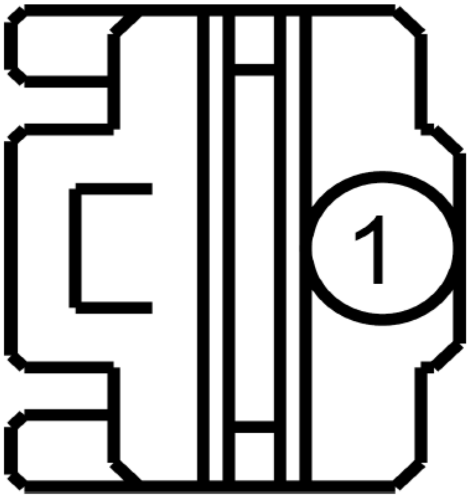
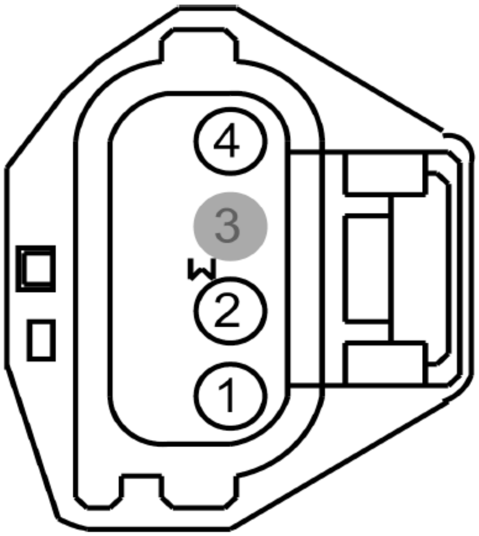


Fig. 233: Power Steering Pressure Switch Connector End View (C1121)

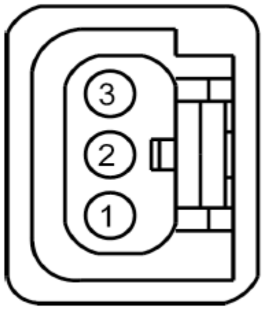
Connector: C1140	Description:	Harness:	Base Part #:
	MANIFOLD ABSOLUTE PRESSURE SENSOR	12B637	9F479



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE803 (BU-GN)	20	SENSOR - MANIFOLD ABSOLUTE PRESSURE (MAP)	
2	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREF)	
3	*	*	not used	
4	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	

Fig. 234: Manifold Absolute Pressure Sensor Connector End View (C1140)

Connector: C1161	Description:	Harness:	Base Part #:
	INTAKE MANIFOLD RUNNER CONTROL (IMRC) MONITOR	12B637	14A464



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE519 (WH-OG)	20	MONITOR - SWIRL CONTROL VALVE (SCVM)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREF)	

Fig. 235: Intake Manifold Runner Control Monitor Connector End View (C1161)

Connector: C1163	Description:	Harness:	Base Part #:
	INTAKE MANIFOLD RUNNER CONTROL	12B637	PIA

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE411 (BN-WH)	20	CTRL MOD. - POWERTRAIN # SWIRL CONTROL VALVE	
2	CBP49 (VT-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	

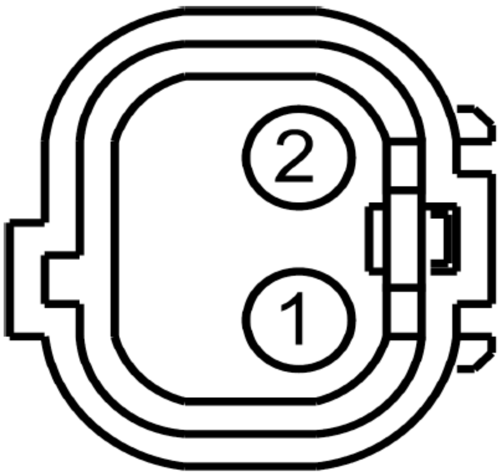
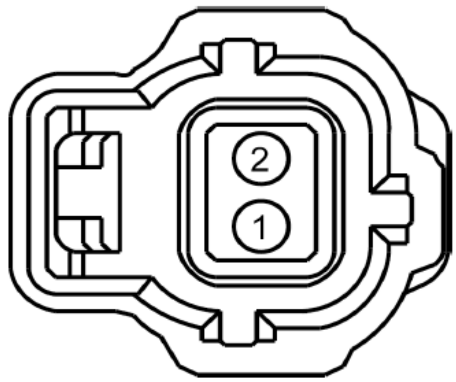


Fig. 236: Intake Manifold Runner Control Connector End View (C1163)

Connector: C1164	Description:	Harness:	Base Part #:
	CYLINDER HEAD TEMPERATURE (CHT) SENSOR	12C508	12A648



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE712 (BU-GY)	20	SENSOR - CYLINDER HEAD TEMPERATURE (CHT)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	

Fig. 237: Cylinder Head Temperature Sensor Connector End View (C1164)

Connector: C1180	Description:	Harness:	Base Part #:
	CAMSHAFT POSITION SENSOR 2	12C508	6B288

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE429 (GY-OG)	20	CTRL MOD. - POWERTRAIN # VARIABLE RELUCTANCE SENSOR (VRSRTN) (CAMSHAFT POSITION)	
2	VE707 (GN-VT)	20	SENSOR - CAMSHAFT POSITION BANK 2 IN+EX / IN (CMP2) [CID-H] (CID2)	

Fig. 238: Camshaft Position Sensor 2 Connector End View (C1180)

Connector: C1196	Description:	Harness:	Base Part #:
	IGNITION TRANSFORMER CAPACITOR	12B637	18801

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP48 (GY-YE)	18	FUSE - 48 OR CIRCUIT BREAKER	

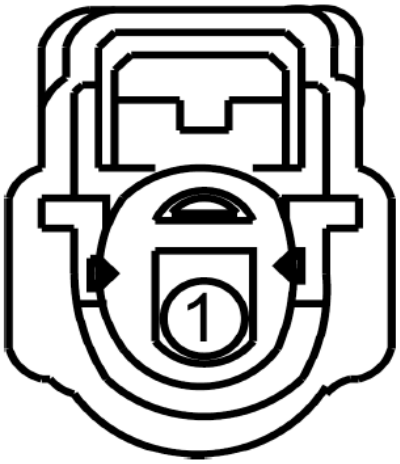


Fig. 239: Ignition Transformer Capacitor Connector End View (C1196)

Connector: C1260	Description:	Harness:	Base Part #:
	A/C PRESSURE TRANSDUCER SENSOR	14290	19D594

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C)	
2	LE424 (YE-GN)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE COWL (C-VREF)	
3	VH433 (VT-OG)	20	TRANSDUCER - A/C PRESSURE (ACPT)	
4	*	*	not used	

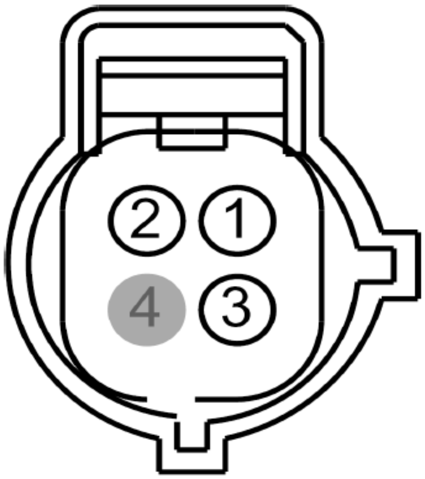


Fig. 240: A/C Pressure Transducer Sensor Connector End View (C1260)

Connector: C1366	Description:	Harness:	Base Part #:
	CAMSHAFT POSITION SENSOR 1	12B637	6B287

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE706 (BN-BU)	20	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX / IN (CMP1) [CID-H] (CID1)	
2	RE429 (GY-OG)	20	CTRL MOD. - POWERTRAIN # VARIABLE RELUCTANCE SENSOR (VRSRTN) (CAMSHAFT POSITION)	

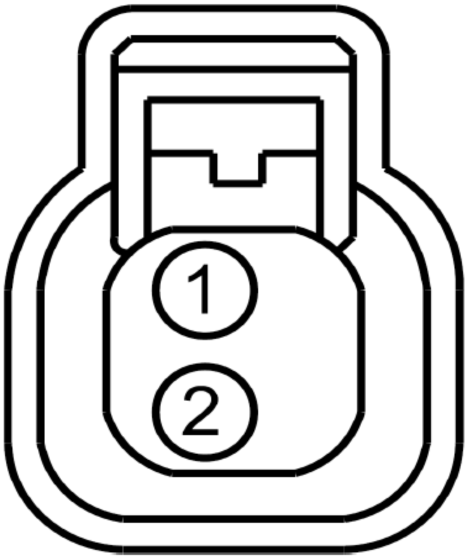


Fig. 241: Camshaft Position Sensor 1 Connector End View (C1366)

Connector: C1367	Description:	Harness:	Base Part #:
	CAMSHAFT POSITION SENSOR 2	12B637	6B288

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE707 (GN-VT)	20	SENSOR - CAMSHAFT POSITION BANK 2 IN+EX / IN (CMP2) [CID-H] (CID2)	
2	RE429 (GY-OG)	20	CTRL MOD. - POWERTRAIN # VARIABLE RELUCTANCE SENSOR (VRSRTN) (CAMSHAFT POSITION)	

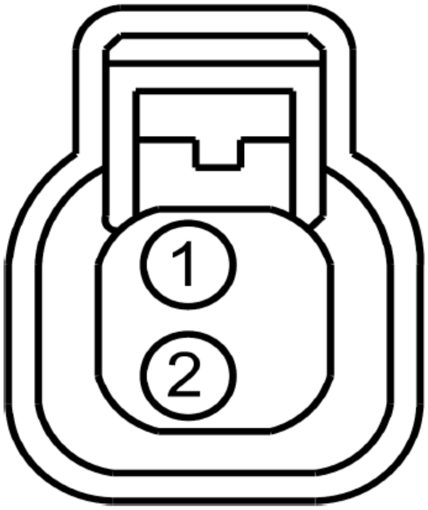


Fig. 242: Camshaft Position Sensor 2 Connector End View (C1367)

Connector: C1368	Description:	Harness:	Base Part #:
	ELECTRONIC THROTTLE CONTROL (ETC) MODULE	12B637	9F991

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE412 (YE-VT)	18	CTRL MOD. - POWERTRAIN # THROTTLE ACTUATOR CONTROL MOTOR (TACM+)	2.3L
1	CE426 (BU-GN)	18	CTRL MOD. - POWERTRAIN # THROTTLE ACTUATOR CONTROL MOTOR (TACM-)	3.0L
2	CE426 (BU-GN)	18	CTRL MOD. - POWERTRAIN # THROTTLE ACTUATOR CONTROL MOTOR (TACM-)	2.3L
2	CE412 (YE-VT)	18	CTRL MOD. - POWERTRAIN # THROTTLE ACTUATOR CONTROL MOTOR (TACM+)	3.0L
3	RE427 (YE-VT)	20	CTRL MOD. - POWERTRAIN # THROTTLE POSITION (TPRTN)	2.3L
3	VE818 (BN)	20	SENSOR - THROTTLE POSITION # NEGATIVE SLOPE (TP1-NS)	3.0L
4	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	2.3L
4	RE427 (YE-VT)	20	CTRL MOD. - POWERTRAIN # THROTTLE POSITION (TPRTN)	3.0L
5	LE428 (BU-WH)	20	CTRL MOD. - POWERTRAIN # THROTTLE POSITION (TPREF)	
6	VE818 (BN)	20	SENSOR - THROTTLE POSITION # NEGATIVE SLOPE (TP1-NS)	2.3L
6	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	3.0L

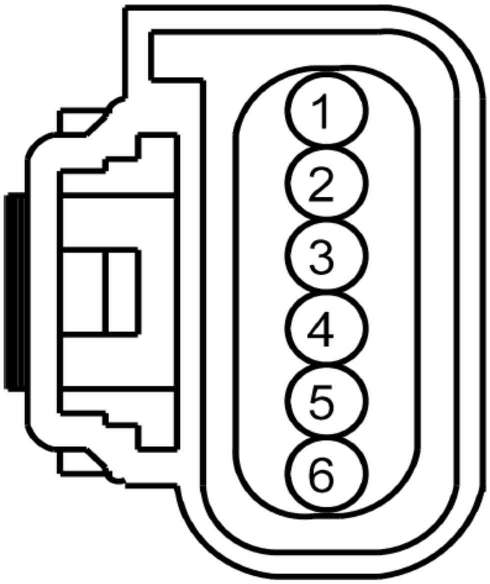


Fig. 243: Electronic Throttle Control Module Connector End View (C1368)

Connector: C1443	Description:	Harness:	Base Part #:
	SIDE LAMP, LEFT FRONT	14290	13200

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 4 OR CIRCUIT BREAKER	
2	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	

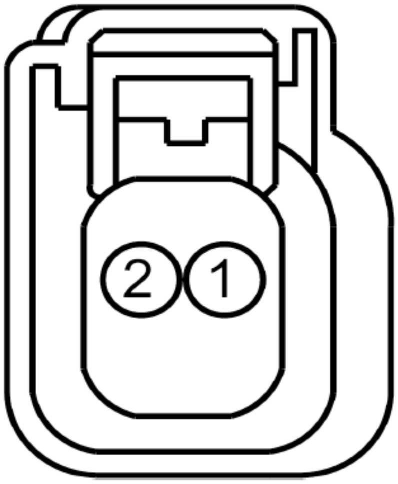


Fig. 244: Left Front Side Lamp Connector End View (C1443)

Connector: C1444	Description:	Harness:	Base Part #:
	SIDE LAMP, RIGHT FRONT	14290	13201

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 4 OR CIRCUIT BREAKER	
2	GD123 (BK-GY)	20	GROUND - FENDER FRONT RIGHT	

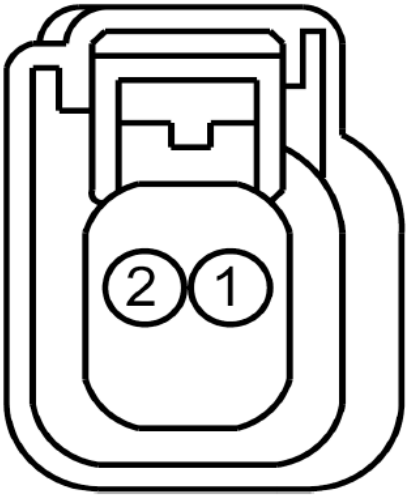


Fig. 245: Right Front Side Lamp Connector End View (C1444)

Connector: C1447	Description:	Harness:	Base Part #:
	DUAL KNOCK SENSOR	14290	PIA

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	
2	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	
3	VE802 (BN-BU)	18	SENSOR - KNOCK 2ND (KS2P) [KSL2+]	
4	RE324 (BN-GN)	18	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 2ND (KS2N) [KSL2-]	

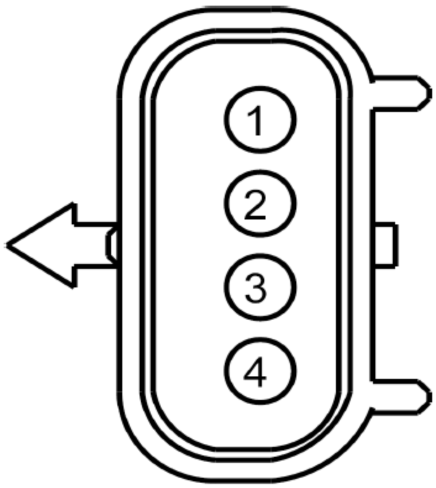
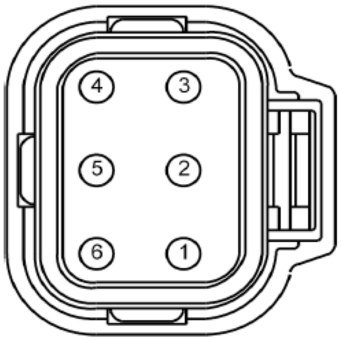


Fig. 246: Dual Knock Sensor Connector End View (C1447)

Connector: C1450	Description:	Harness:	Base Part #:
	STEPPER MOTOR EGR VALVE	12B637	W500225



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE301 (GY-OG)	20	CTRL MOD. - POWERTRAIN # EGRMC1	
2	CBP49 (VT-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	
3	CE102 (YE-BU)	20	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 2) (EGRMC) (-)	
4	CE103 (BU-BN)	20	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 3) (EGRMC)	
5	CBP49 (VT-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	
6	CE104 (GN)	20	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 4) (EGRMC)	

Fig. 247: Stepper Motor EGR Valve Connector End View (C1450)

Connector: C1451	Description:	Harness:	Base Part #:
	VARIABLE CAMSHAFT TIMING (VCT) VALVE 1	12B637/12C508	6B287

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP49 (VT-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	
1	CBP14 (VT-OG)	20	FUSE - 49 OR CIRCUIT BREAKER	3.5L
2	CE421 (VT)	18	CTRL MOD. - POWERTRAIN # VARIABLE CAMSHAFT TIMING VALVE 1 (VCT1)	
2	CE421 (VT)	20	CTRL MOD. - POWERTRAIN # VARIABLE CAMSHAFT TIMING VALVE 1 (VCT1)	3.5L

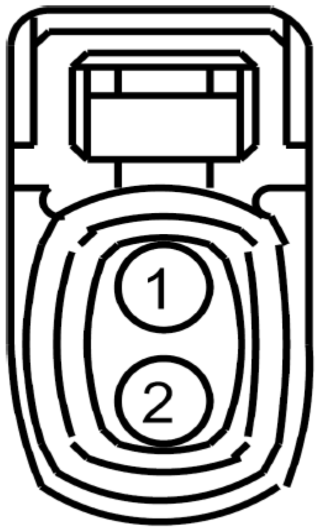


Fig. 248: Variable Camshaft Timing Valve 1 Connector End View (C1451)

Connector: C1452	Description:	Harness:	Base Part #:
	VARIABLE CAMSHAFT TIMING (VCT) VALVE 2	12B637/12C508	6B287

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP49 (VT-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	
1	CBP14 (VT-OG)	20	FUSE - 49 OR CIRCUIT BREAKER	3.5L
2	CE422 (WH-OG)	18	CTRL MOD. - POWERTRAIN # VARIABLE CAMSHAFT TIMING VALVE 2 (VCT2)	
2	CE422 (WH-OG)	20	CTRL MOD. - POWERTRAIN # VARIABLE CAMSHAFT TIMING VALVE 2 (VCT2)	3.5L

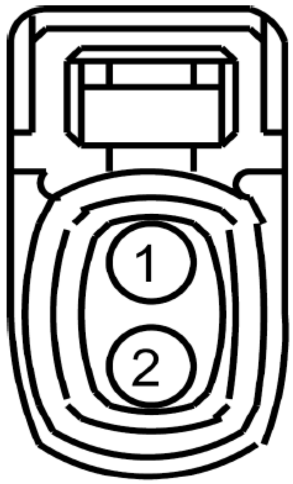
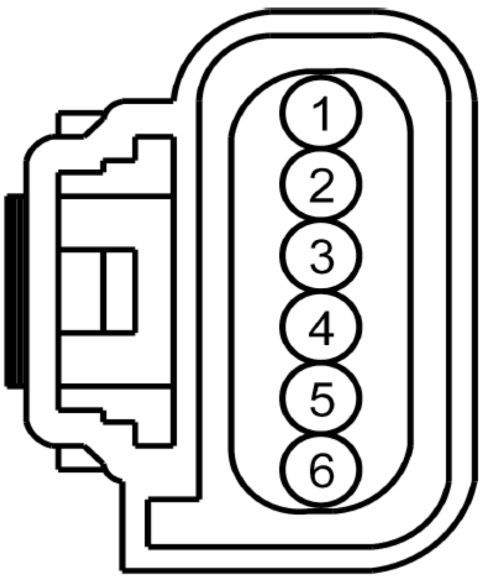


Fig. 249: Variable Camshaft Timing Valve 2 Connector End View (C1452)

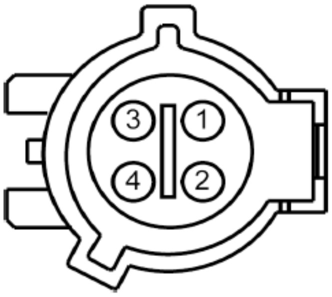
Connector: C1454	Description:	Harness:	Base Part #:
	MASS AIR FLOW/ INTAKE AIR TEMPERATURE (MAF/IAT) SENSOR	14290	12B579



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
2	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C)	
3	VE808 (BU-GY)	20	SENSOR - MASS AIR FLOW RH BANK OR 2ND BANK (MAF)	
4	RE325 (VT-BN)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. RH BANK OR 2ND BANK (MAFRTN)	
5	GD120 (BK-GN)	20	GROUND - FENDER FRONT LEFT	
6	CBP49 (VT-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	

Fig. 250: Mass Air Flow Sensor / Intake Air Temperature Sensor Connector End View (C1454)

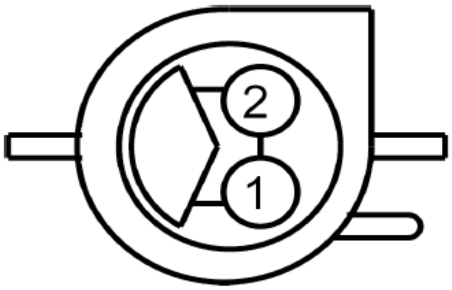
Connector: C1455	Description:	Harness:	Base Part #:
	HEATED OXYGEN SENSOR (HO2S) #13	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE234 (BU-WH)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 2ND (HTR13)	
2	CBP49 (VT-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	
3	VE733 (WH)	18	SENSOR - HEATED OXYGEN POST CAT. 2ND (HO2S13)	
4	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	

Fig. 251: Heated Oxygen Sensor 13 Connector End View (C1455)

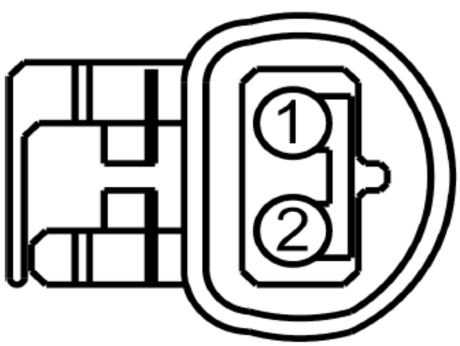
Connector: C1461	Description:	Harness:	Base Part #:
	SECONDARY AIR PUMP	12B637	9A486A



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	12	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CE402 (GY-YE)	12	CTRL MOD. - POWERTRAIN # SECONDARY AIR INJECTOR (SAIR)	

Fig. 252: Secondary Air Pump Connector End View (C1461)

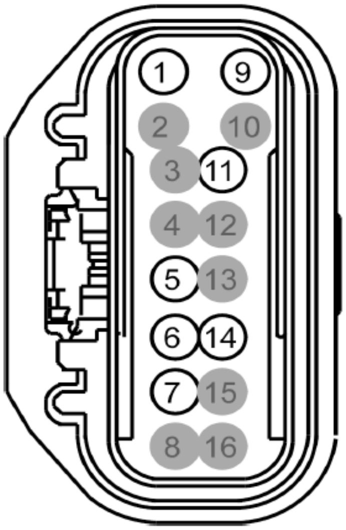
Connector: C1464	Description:	Harness:	Base Part #:
	SECONDARY AIR PUMP SOLENOID	12B637	W707374



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP49 (VT-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	
2	CE404 (VT-GY)	20	CTRL MOD. - POWERTRAIN # SECONDARY THERMACTOR AIR DIVERTER VALVE (SAIRD)	

Fig. 253: Secondary Air Pump Solenoid Connector End View (C1464)

Connector: C1533	Description:	Harness:	Base Part #:
	6 SPEED TRANSMISSION	12B637/14B060	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB16 (VT-RD)	20	FUSE - 16 OR CIRCUIT BREAKER	
2	*	*	not used	
3	*	*	not used	
4	*	*	not used	
5	CET40 (GN-OG)	20	SWITCH - TRANSMISSION RANGE # PARK/NEUTRAL (TRSW-PN)	
6	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW (CAN -)	
7	CET34 (BN-GN)	20	SWITCH - TRANSMISSION CONTROL / OVERDRIVE CANCEL (TCS)	
8	*	*	not used	
9	GD120 (BK-GN)	18	GROUND - FENDER FRONT LEFT	
10	*	*	not used	
11	CBP18 (GY-OG)	20	FUSE - 26 OR CIRCUIT BREAKER	
12	*	*	not used	
13	*	*	not used	
14	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH (CAN +)	
15	*	*	not used	
16	*	*	not used	

Fig. 254: 6 Speed Transmission Control Module Connector End View (C1533)

Connector: C1534	Description:	Harness:	Base Part #:
	COUPLER ASSEMBLY 1	12B637	PIA

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VET15 (YE-GY)	18	SHIFT SOLENOID PRESSURE CONTROL C (SSPCC)	
2	CET43 (GY)	18	PRESSURE CONTROL A (PCA +)	
3	VET13 (GY-BU)	18	SHIFT SOLENOID PRESSURE CONTROL A (SSPCA)	
4	VET28 (GY-VT)	20	SENSOR - TRANSMISSION RANGE/TFT SIGNAL RETURN	
5	VET27 (BN-YE)	20	SENSOR - TRANSMISSION FLUID TEMPERATURE (TFT) SIGNAL	
6	CET18 (GY-YE)	18	SHIFT SOLENOID PRESSURE CONTROL D (SSPCD)	
7	CET42 (GN-VT)	18	PRESSURE CONTROL A (PCA -)	
8	CET19 (VT-GY)	18	SHIFT SOLENOID PRESSURE CONTROL E (SSPCE)	
9	VET14 (VT-GN)	18	SHIFT SOLENOID PRESSURE CONTROL B (SSPCB)	

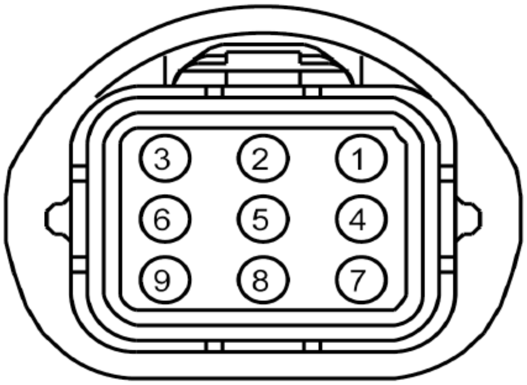
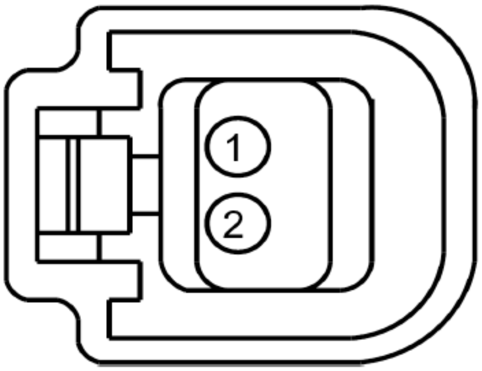


Fig. 255: Coupler Assembly 1 Connector End View (C1534)

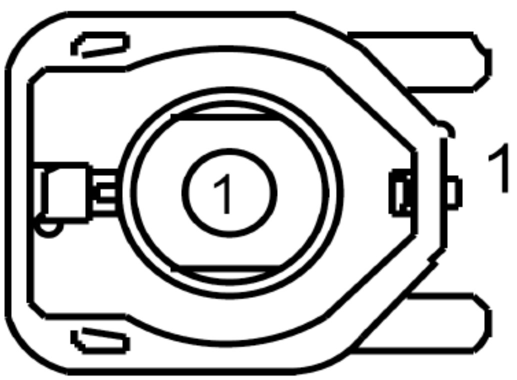
Connector: C1535	Description:	Harness:	Base Part #:
	COUPLER ASSEMBLY 2	12B637	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CET44 (BU-BN)	18	SHIFT SOLENOID PRESSURE CONTROL F (SSPCF)	
2	CET45 (YE-BU)	18	PRESSURE CONTROL B	

Fig. 256: Coupler Assembly 2 Connector End View (C1535)

Connector: C1536	Description:	Harness:	Base Part #:
	TRANSMISSION FLUID PRESSURE SWITCH	12B637	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CET46 (YE-GN)	20	SWITCH - TRANS FLUID PRESSURE (PS) SIGNAL	

Fig. 257: Transmission Fluid Pressure Switch Connector End View (C1536)

Connector: C1537	Description:	Harness:	Base Part #:
	TRANSMISSION RANGE SENSOR	12B637	7F293

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD120 (BK-GN)	18	GROUND - FENDER FRONT LEFT	
2	VET28 (GY-VT)	20	SENSOR - TRANSMISSION RANGE/TFT SIGNAL RETURN	
3	CET37 (BN-WH)	20	SWITCH - TRANSMISSION RANGE # 1 (TRSW-1) SIGNAL	
4	*	*	not used	
5	*	*	not used	
6	CET40 (GN-OG)	20	SWITCH - TRANSMISSION RANGE # PARK/NEUTRAL (TRSW-PN) SIGNAL	

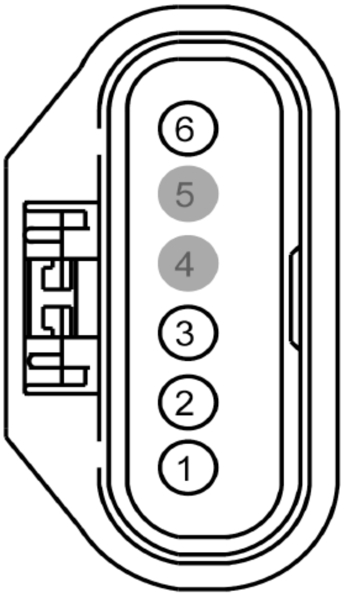


Fig. 258: Transmission Range Sensor Connector End View (C1537)

Connector: C1538	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 1	12B637	12029

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE303 (WH-VT)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 1 (COP-A)	
2	CBP48 (GY-YE)	18	FUSE - 48 OR CIRCUIT BREAKER	

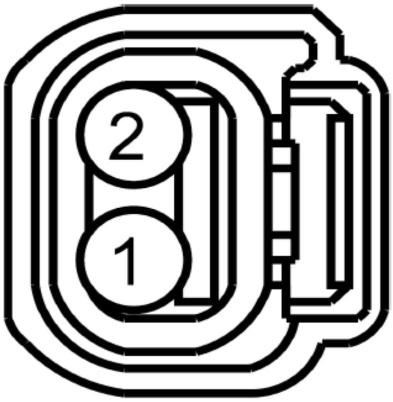


Fig. 259: Coil On Plug 1 Connector End View (C1538)

Connector: C1539	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 2	12B637	12029

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE306 (GN-VT)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 2 (COP-B)	
2	CBP48 (GY-YE)	18	FUSE - 48 OR CIRCUIT BREAKER	

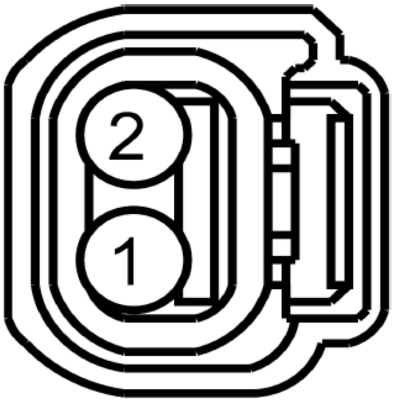


Fig. 260: Coil On Plug 2 Connector End View (C1539)

Connector: C1540	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 3	12B637	12029

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE304 (YE-BU)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 3 (COP-C)	
2	CBP48 (GY-YE)	18	FUSE - 48 OR CIRCUIT BREAKER	

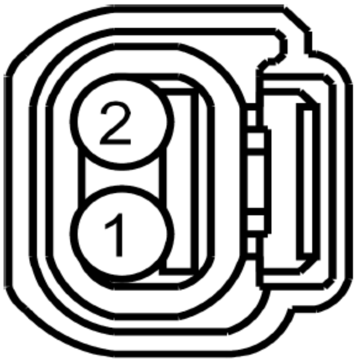


Fig. 261: Coil On Plug 3 Connector End View (C1540)

Connector: C1541	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 4	12B637	12029

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE305 (BU-OG)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 4 (COP-D)	
2	CBP48 (GY-YE)	18	FUSE - 48 OR CIRCUIT BREAKER	

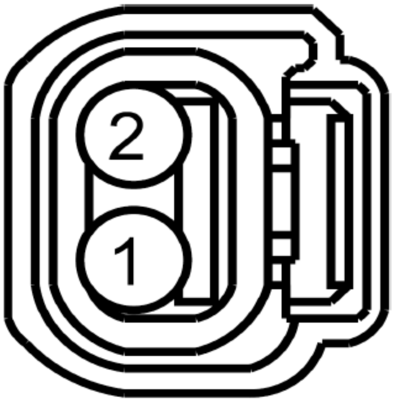


Fig. 262: Coil On Plug 4 Connector End View (C1541)

Connector: C1542	Description:	Harness:	Base Part #:
	VARIABLE CAMSHAFT TIMING (VCT) VALVE	12B637	6M280

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE421 (VT)	18	CTRL MOD. - POWERTRAIN # VARIABLE CAMSHAFT TIMING VALVE 1 (VCT1)	
2	CBP49 (VT-GY)	18	FUSE - 49 OR CIRCUIT BREAKER	

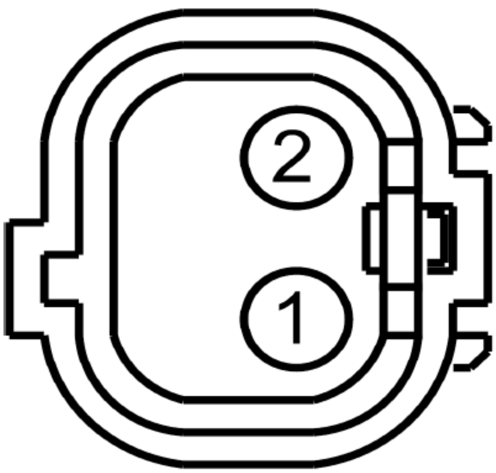


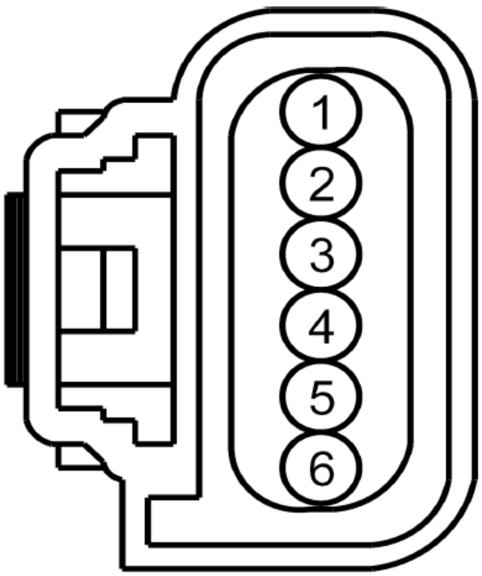
Fig. 263: Variable Camshaft Timing Valve Connector End View (C1542)

Connector: C1543	Description:	Harness:	Base Part #:
	CYLINDER IDENTIFICATION SENSOR	12B637	12K073

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LE111 (VT-GN)	20	CTRL MOD. - POWERTRAIN # BUFFERED POWER SUPPLY SENSORS (VBPWR)	
2	VE706 (BN-BU)	20	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX / IN (CMP1) [CID-H] (CID1)	
3	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	

Fig. 264: Cylinder Identification Sensor Connector End View (C1543)

Connector: C1568	Description:	Harness:	Base Part #:
	ELECTRONIC THROTTLE CONTROL (ETC) MODULE	12C508	9F991



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE818 (BN)	20	SENSOR - THROTTLE POSITION # NEGATIVE SLOPE (TP1-NS)	
2	RE134 (BU-OG)	20	CTRL MOD. - POWERTRAIN # ELECTRONIC THROTTLE CONTROL (ETCRTN)	
3	LE134 (YE)	20	CTRL MOD. - POWERTRAIN # ELECTRONIC THROTTLE CONTROL (ETCREF)	
4	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	
5	CE412 (YE-VT)	18	CTRL MOD. - POWERTRAIN # THROTTLE ACTUATOR CONTROL MOTOR (TACM+)	
6	CE426 (BU-GN)	18	CTRL MOD. - POWERTRAIN # THROTTLE ACTUATOR CONTROL MOTOR (TACM-)	

Fig. 265: Electronic Throttle Control Module Connector End View (C1568)

Connector: C1571	Description:	Harness:	Base Part #:
	HEATED OXYGEN SENSOR (HO2S) #11	12C508	9F472

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP14 (VT-OG)	20	FUSE - 49 OR CIRCUIT BREAKER	
2	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	
3	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
4	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	

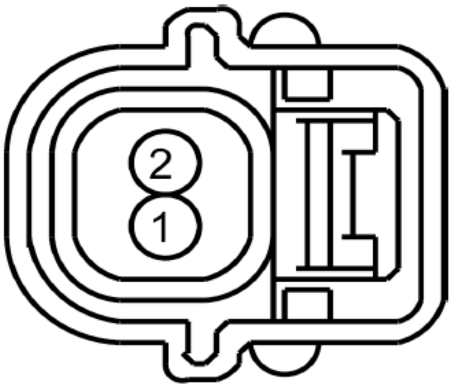
Fig. 266: Heated Oxygen Sensor 11 Connector End View (C1571)

Connector: C1572	Description:	Harness:	Base Part #:
	HEATED OXYGEN SENSOR (HO2S) #21	12C508	9F472

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP14 (VT-OG)	20	FUSE - 49 OR CIRCUIT BREAKER	
2	CE236 (GY-VT)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 2ND (HTR21)	
3	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
4	VE737 (WH-BU)	18	SENSOR - HEATED OXYGEN PRE CAT. 2ND (HO2S21)	

Fig. 267: Heated Oxygen Sensor 21 Connector End View (C1572)

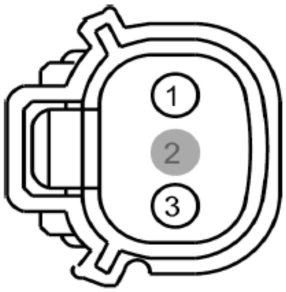
Connector: C1590	Description:	Harness:	Base Part #:
	HEATED POSITIVE CRANKCASE VENTILATION (PCV) FITTING	12B637	9F695



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE328 (YE-VT)	20	CTRL MOD. - POWERTRAIN # POS. CRANKCASE VENTIL. FITTING HEATER CONTROL (PCVFHC)	
2	ZA145 (OG-GY)	20	FUSE - 49 OR CIRCUIT BREAKER	

Fig. 268: Heated Positive Crankcase Ventilation Fitting Connector End View (C1590)

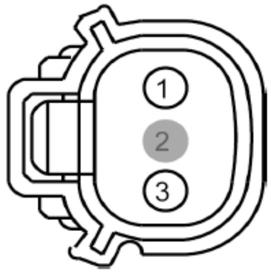
Connector: C1611	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 1	12C508	12029



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE303 (WH-VT)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 1 (COP-A)	
2	*	*	not used	
3	CBB46 (WH-BU)	16	FUSE - 48 OR CIRCUIT BREAKER	

Fig. 269: Coil On Plug 1 Connector End View (C1611)

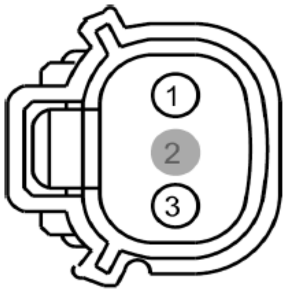
Connector: C1612	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 2	12C508	12029



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE304 (YE-BU)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 2 (COP-B)	
2	*	*	not used	
3	CBB46 (WH-BU)	16	FUSE - 48 OR CIRCUIT BREAKER	

Fig. 270: Coil On Plug 2 Connector End View (C1612)

Connector: C1613	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 3	12C508	12029

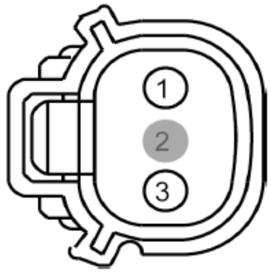


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE305 (BU-OG)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 3 (COP-C)	
2	*	*	not used	
3	CBB46 (WH-BU)	16	FUSE - 48 OR CIRCUIT BREAKER	

Fig. 271: Coil On Plug 3 Connector End View (C1613)

Connector: C1614

Description:	Harness:	Base Part #:
COIL ON PLUG (COP) 4	12C508	12029

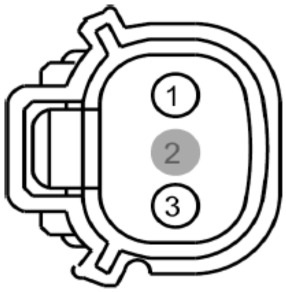


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE306 (GN-VT)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 4 (COP-D)	
2	*	*	not used	
3	CBB46 (WH-BU)	18	FUSE - 48 OR CIRCUIT BREAKER	

Fig. 272: Coil On Plug 4 Connector End View (C1614)

Connector: C1615

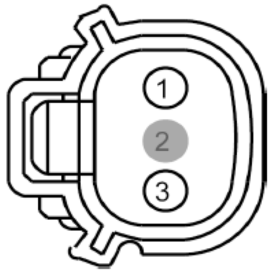
Description:	Harness:	Base Part #:
COIL ON PLUG (COP) 5	12C508	12029



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE307 (WH-BN)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 5 (COP-E)	
2	*	*	not used	
3	CBB46 (WH-BU)	16	FUSE - 48 OR CIRCUIT BREAKER	

Fig. 273: Coil On Plug 5 Connector End View (C1615)

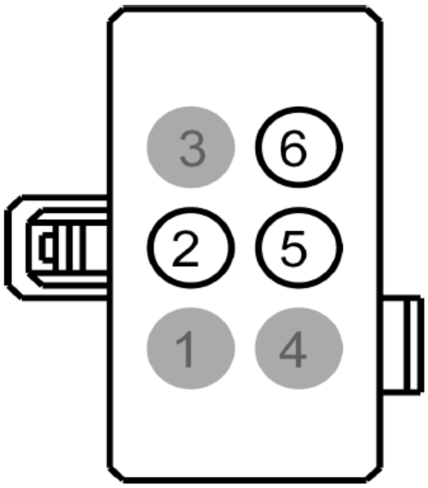
Connector: C1616	Description:	Harness:	Base Part #:
	COIL ON PLUG (COP) 6	12C508	12029



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE308 (VT-BN)	18	CTRL MOD. - POWERTRAIN # IGNITION COIL ON PLUG ASSEMBLY 6 (COP-F)	
2	*	*	not used	
3	CBB46 (WH-BU)	16	FUSE - 48 OR CIRCUIT BREAKER	

Fig. 274: Coil On Plug 6 Connector End View (C1616)

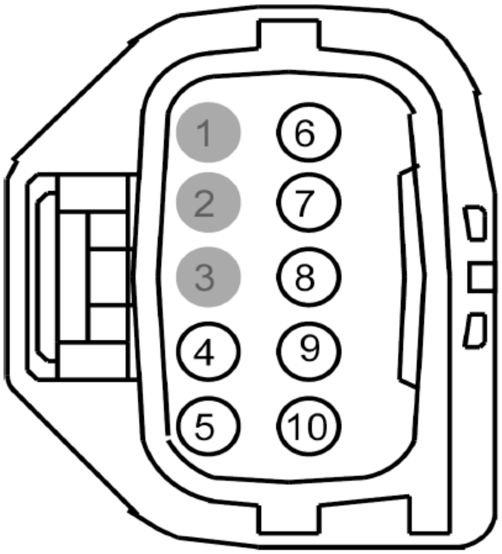
Connector: C2016	Description:	Harness:	Base Part #:
	CLOCK	14401	15000



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	CLN04 (BU-BN)	20	CTRL MOD. - IP/SWITCH ILLUMINATION	Fusion / Milan
2	VLN04 (VT-GY)	22	CTRL MOD. - IP/SWITCH ILLUMINATION	MKZ
3	*	*	not used	
4	*	*	not used	
5	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
6	SBP07 (WH-RD)	20	FUSE - 13 OR CIRCUIT BREAKER	

Fig. 275: Clock Connector End View (C2016)

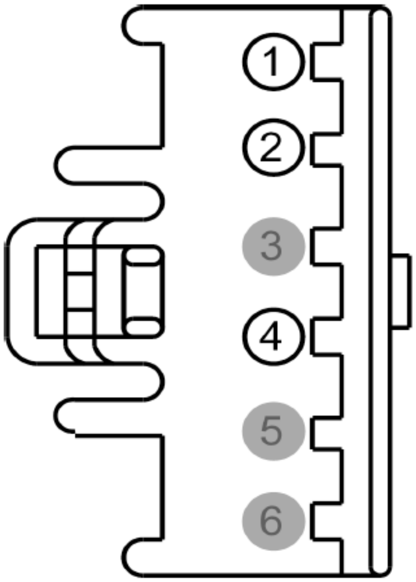
Connector: C2040	Description:	Harness:	Base Part #:
	ACCELERATOR PEDAL POSITION SENSOR	14290	9725



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	*	*	not used	
4	VE703 (GN-WH)	20	SENSOR - ACCELERATOR PEDAL POSITION # 3 (APP3)	
5	VE702 (BU-WH)	20	SENSOR - ACCELERATOR PEDAL POSITION # 2 (APP2)	
6	RE136 (VT-GN)	20	CTRL MOD. - POWERTRAIN # ACCELERATOR PEDAL POSITION SENSOR 1 (APP1RTN)	
7	VE701 (YE-OG)	20	SENSOR - ACCELERATOR PEDAL POSITION # 1 (APP1)	
8	LE136 (GN-OG)	20	CTRL MOD. - POWERTRAIN # ACCELERATOR PEDAL POSITION SENSOR 1 (APP1VREF)	
9	RE137 (YE-GN)	20	CTRL MOD. - POWERTRAIN # ACCELERATOR PEDAL POSITION SENSOR 2 (APP2RTN)	
10	LE137 (BU-GY)	20	CTRL MOD. - POWERTRAIN # ACCELERATOR PEDAL POSITION SENSOR 2 (APP2VREF)	

Fig. 276: Accelerator Pedal Position Sensor Connector End View (C2040)

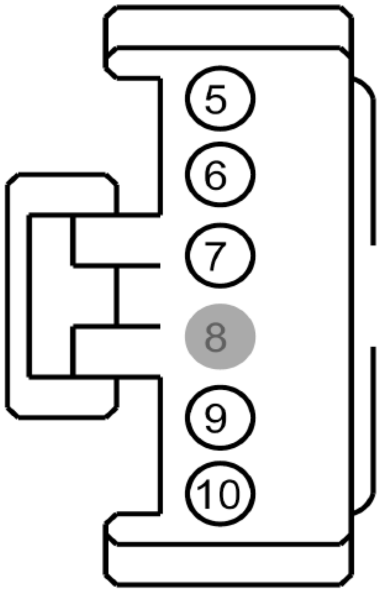
Connector: C2065	Description:	Harness:	Base Part #:
	DIMMER SWITCH	14401	11691



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VLN18 (BU-WH)	20	DIMMER - IP/SWITCH ILLUMINATION	
2	CLN28 (GN-BU)	20	SWITCH - DOME LAMP	
3	*	*	not used	
4	CLN27 (WH-BN)	20	CTRL MOD. - DIMMER INSTRUMENT	
5	*	*	not used	
6	*	*	not used	

Fig. 277: Dimmer Switch Connector End View (C2065)

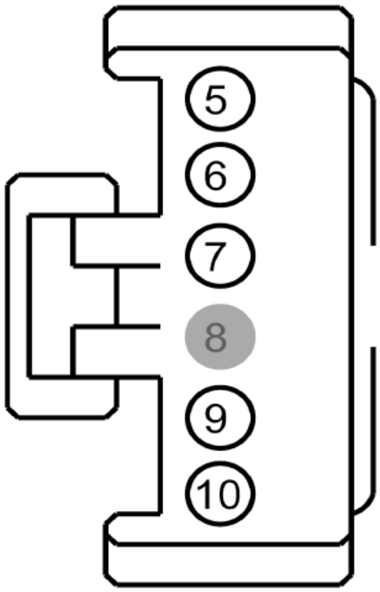
Connector: C2091	Description:	Harness:	Base Part #:
	TEMPERATURE BLEND DOOR ACTUATOR, DRIVER	19D887	18B545



Pin	Circuit	Gauge	Circuit Function	Qualifier
5	CH233 (VT-BN)	20	CTRL MOD. - CLIMATE # DOOR MOTOR TEMP. LEFT COIL 1 / CLOSE (IF PLUS)	EMTC/EATC
5	CH238 (YE-OG)	20	CTRL MOD. - CLIMATE # DOOR MOTOR TEMP. LEFT COIL 1 / CLOSE (IF PLUS)	DATC
6	CH234 (YE-GN)	20	CTRL MOD. - CLIMATE # DOOR MOTOR TEMP. LEFT COIL 2 / OPEN (IF PLUS)	EMTC/EATC
6	CH239 (BU-WH)	20	CTRL MOD. - CLIMATE # DOOR MOTOR TEMP. LEFT COIL 2 / OPEN (IF PLUS)	DATC
7	RH111 (GY-BU)	20	CTRL MOD. - CLIMATE # DOOR POSITION SENSORS ALSO GENERIC VREF RETURN IN LOGICAL SCHEMATICS	
8	*	*	not used	
9	VH439 (GY-VT)	20	SENSOR - DOOR POSITION TEMP. LEFT	EMTC/EATC
9	VH440 (BU-BN)	20	SENSOR - DOOR POSITION TEMP. LEFT	DATC
10	LH111 (BN-WH)	20	CTRL MOD. - CLIMATE # DOOR POSITION SENSORS	

Fig. 278: Driver Temperature Blend Door Actuator Connector End View (C2091)

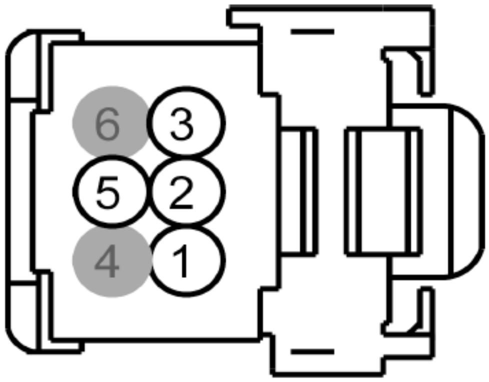
Connector: C2092	Description:	Harness:	Base Part #:
	TEMPERATURE BLEND DOOR ACTUATOR, PASSENGER	19D887	18B545



Pin	Circuit	Gauge	Circuit Function	Qualifier
5	CH212 (BU-OG)	20	CTRL MOD. - CLIMATE # DOOR MOTOR TEMP. RIGHT COIL 1 / CLOSE (IF PLUS)	
6	CH213 (BN-GN)	20	CTRL MOD. - CLIMATE # DOOR MOTOR TEMP. RIGHT COIL 2 / OPEN (IF PLUS)	
7	RH111 (GY-BU)	20	CTRL MOD. - CLIMATE # DOOR POSITION SENSORS ALSO GENERIC VREF RETURN IN LOGICAL SCHEMATICS	
8	*	*	not used	
9	VH411 (WH-BN)	20	SENSOR - DISCHARGE TEMP. # RIGHT	
10	LH111 (BN-WH)	20	CTRL MOD. - CLIMATE # DOOR POSITION SENSORS	

Fig. 279: Passenger Temperature Blend Door Actuator Connector End View (C2092)

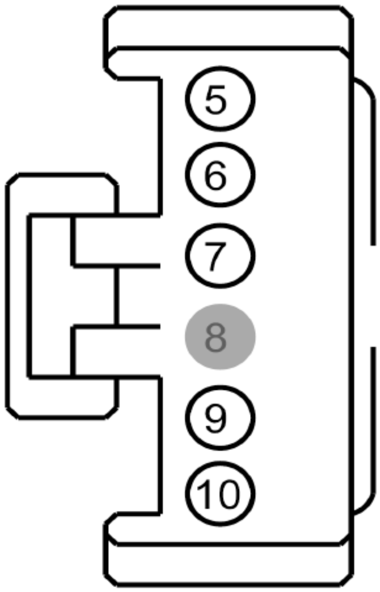
Connector: C2269	Description:	Harness:	Base Part #:
	LUGGAGE COMPARTMENT LID RELEASE SWITCH	14401	432A38



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
2	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
3	VLN04 (VT-GY)	22	CTRL MOD. - IP/SWITCH ILLUMINATION	
4	*	*	not used	
5	CPL45 (BN)	20	SWITCH - LIFTGATE/DECKLID RELEASE	
6	*	*	not used	

Fig. 280: Luggage Compartment Lid Release Switch Connector End View (C2269)

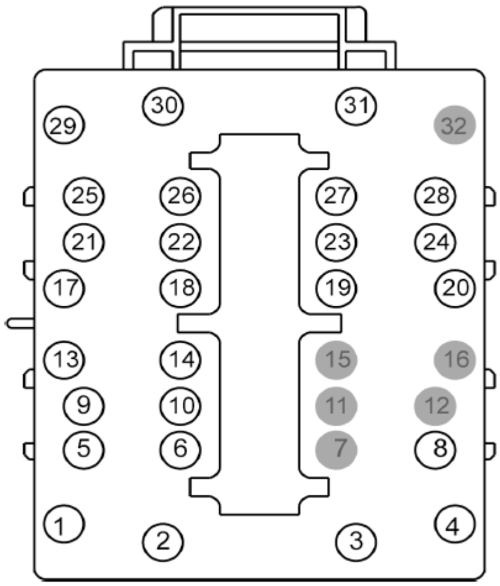
Connector: C2278	Description:	Harness:	Base Part #:
	MODE DOOR ACTUATOR	19D887	18B545



Pin	Circuit	Gauge	Circuit Function	Qualifier
5	CH228 (YE-GY)	20	CTRL MOD. - CLIMATE # DOOR MOTOR DEFROST COIL 1 / CLOSE (IF PLUS)	
6	CH229 (WH-BU)	20	CTRL MOD. - CLIMATE # DOOR MOTOR DEFROST COIL 2 / OPEN (IF PLUS)	
7	RH111 (GY-BU)	20	CTRL MOD. - CLIMATE # DOOR POSITION SENSORS ALSO GENERIC VREF RETURN IN LOGICAL SCHEMATICS	
8	*	*	not used	
9	VH436 (YE-VT)	20	SENSOR - DOOR POSITION DEFROST	
10	LH111 (BN-WH)	20	CTRL MOD. - CLIMATE # DOOR POSITION SENSORS	

Fig. 281: Mode Door Actuator Connector End View (C2278)

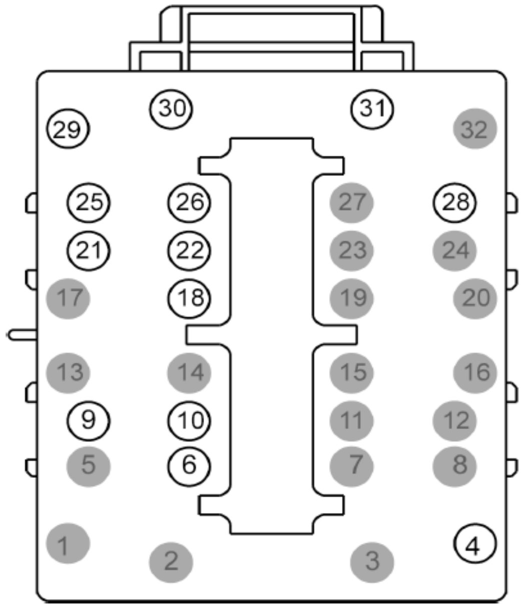
Connector: C2280A	Description:	Harness:	Base Part #:
	SMART JUNCTION BOX (SJB)	14290	14A067



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW03 (VT-WH)	16	RELAY - FRONT WIPER	
2	CRW15 (BN-WH)	16	CTRL MOD. - FRONT WIPER HIGH	
3	CRW16 (GY-BN)	16	CTRL MOD. - FRONT WIPER LOW	
4	SBB19 (BU-RD)	12	FUSE - 19 OR CIRCUIT BREAKER	
5	CLF04 (BN-BU)	20	CTRL MOD. - BEAM LOW LEFT	
6	CLF05 (BU-GN)	20	CTRL MOD. - BEAM LOW RIGHT	
7	*	*	not used	
8	SBP04 (GN-RD)	20	FUSE - 21 OR CIRCUIT BREAKER	
9	CLS25 (YE-VT)	20	CTRL MOD. - TURN LAMP RIGHT FRONT	
10	CLF29 (BN)	20	CTRL MOD. - FOG LAMPS FRONT	
11	*	*	not used	
12	*	*	not used	
13	CRW14 (BU-WH)	20	CTRL MOD. - FRONT WASHER	
14	RRW24 (GN-VT)	20	CTRL MOD. - RELAY FRONT WIPER RUN/PARK	
15	*	*	not used	
16	*	*	not used	
17	CDC25 (BN-GN)	14	RELAY - STARTER	
18	CDC12 (YE)	20	CTRL MOD. - POWERTRAIN # STARTER MOTOR CONTROL (SMC)	
19	CCB08 (VT-WH)	20	SWITCH - BRAKE ON/OFF (BOO) NORMAL OPEN	
20	CBP05 (YE)	16	FUSE - 2 OR CIRCUIT BREAKER	
21	CLS21 (BU-GN)	20	CTRL MOD. - TURN LAMP LEFT FRONT	
22	CBP18 (GY-OG)	20	FUSE - 26 OR CIRCUIT BREAKER	
23	CRW09 (BN-BU)	16	SWITCH - FRONT WIPER PARK POSITION	
24	CBP23 (BN-YE)	20	FUSE - 23 OR CIRCUIT BREAKER	
25	CMC19 (GY-VT)	20	SWITCH - LOW LEVEL BRAKE FLUID	
26	CMC24 (GY)	20	SWITCH - OIL PRESSURE	
27	CPL25 (BU-OG)	20	SWITCH - HOOD # AJAR	
28	CBP19 (BN-WH)	20	FUSE - 28 OR CIRCUIT BREAKER	
29	SBB06 (BN-RD)	12	FUSE - 6 OR CIRCUIT BREAKER	
30	CLS08 (VT-GN)	20	CTRL MOD. - HIGH BEAM RELAY	
31	CBP08 (GY-YE)	20	FUSE - 4 OR CIRCUIT BREAKER	
32	*	*	not used	

Fig. 282: Smart Junction Box Connector End View (C2280A)

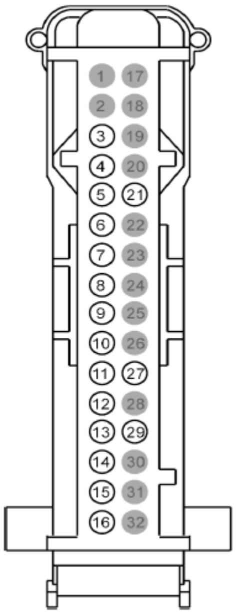
Connector: C2280B	Description:	Harness:	Base Part #:
	SMART JUNCTION BOX (SJB)	14401	14A067



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	*	*	not used	
4	CDC33 (VT-GN)	20	SWITCH - IGNITION # RUN; ACCESSORY	
5	*	*	not used	
6	CRH02 (BU-WH)	20	SWITCH - HORN	
7	*	*	not used	
8	*	*	not used	
9	SBP07 (WH-RD)	20	FUSE - 13 OR CIRCUIT BREAKER	
10	CBP21 (BU-GY)	18	FUSE - 25 OR CIRCUIT BREAKER	
11	*	*	not used	
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	CBP24 (VT-GN)	20	FUSE - 24 OR CIRCUIT BREAKER	
19	*	*	not used	
20	*	*	not used	
21	CBP13 (GY-BN)	20	FUSE - 22 OR CIRCUIT BREAKER	
22	CBP18 (GY-OG)	20	FUSE - 26 OR CIRCUIT BREAKER	
23	*	*	not used	
24	*	*	not used	
25	CBP20 (YE-VT)	20	FUSE - 27 OR CIRCUIT BREAKER	
26	CBP23 (BN-YE)	20	FUSE - 23 OR CIRCUIT BREAKER	
27	*	*	not used	
28	CBP02 (GN)	20	FUSE - 12 OR CIRCUIT BREAKER	
29	CDC34 (WH-OG)	18	SWITCH - IGNITION # RUN; START	
30	CE336 (GN-WH)	18	SWITCH - IGNITION # START	
31	SBP11 (BU-RD)	14	FUSE - 18 OR CIRCUIT BREAKER	
32	*	*	not used	

Fig. 283: Smart Junction Box Connector End View (C2280B)

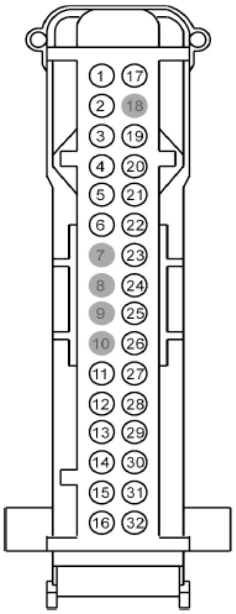
Connector: C2280C	Description:	Harness:	Base Part #:
	SMART JUNCTION BOX (SJB)	14A005	14A067



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CRT18 (YE-GY)	20	SWITCH - ANTI THEFT INHIBIT # LIFTGATE/DECKLID	
4	CPL42 (GY-YE)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
5	CPL28 (VT-BN)	20	SWITCH - LATCH DRIVER # RESET	
6	CPL44 (YE-OG)	20	SWITCH - LIFTGATE/DECKLID/CARGO # AJAR	
7	CPL39 (YE)	20	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
8	CPL36 (GN)	20	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
9	CCB09 (GY-BU)	20	SWITCH - ELEC.PARK BRAKE ON	
10	CPL43 (VT-GY)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
11	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
12	CPL31 (WH)	20	SWITCH - LATCH PASSENGER # AJAR	
13	CPK28 (WH)	20	CTRL MOD. - SWITCH KEYLESS KEYPAD ILLUMINATION	
14	VET13 (GY-BU)	18	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL HIGH SIDE PWM 1 (PC-H) [DPC]	
15	CPK29 (GY-BU)	20	SWITCH - KEYLESS KEYPAD LINE A	
16	CPK30 (VT-GN)	20	SWITCH - KEYLESS KEYPAD LINE B	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	CPK31 (YE-GN)	20	SWITCH - KEYLESS KEYPAD LINE C	
22	*	*	not used	
23	*	*	not used	
24	*	*	not used	
25	*	*	not used	
26	*	*	not used	
27	CLS17 (YE-GY)	20	CTRL MOD. - STOP HIGH MOUNT	
28	*	*	not used	
29	CPW01 (BN-BU)	20	CTRL MOD. - POWER WINDOW GLOBAL SET	
30	*	*	not used	
31	*	*	not used	
32	*	*	not used	

Fig. 284: Smart Junction Box Connector End View (C2280C)

Connector: C2280D	Description:	Harness:	Base Part #:
	SMART JUNCTION BOX (SJB)	14401	14A067

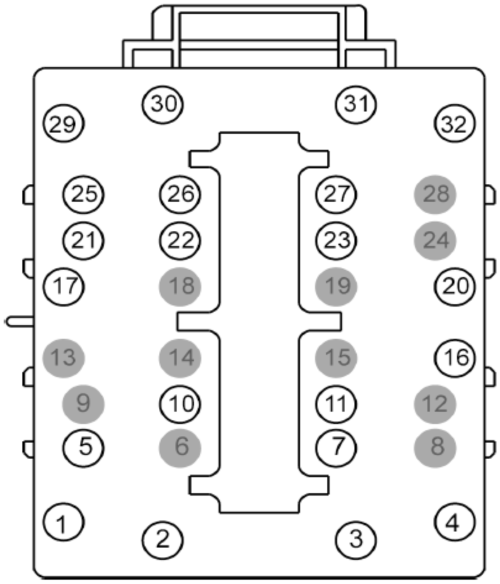


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW	
2	VLN04 (VT-GY)	20	CTRL MOD. - IP/SWITCH ILLUMINATION	
3	CLN04 (BU-BN)	20	CTRL MOD. - IP/SWITCH ILLUMINATION	
4	CLF28 (BN-WH)	20	CTRL MOD. - INDICATOR FOG LAMPS FRONT	
5	CLS34 (GY)	20	SWITCH - PARK LAMPS	
6	GD116 (BK-VT)	18	GROUND - CROSS CAR BEAM # 3RD STUD	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	CLN27 (WH-BN)	20	CTRL MOD. - DIMMER INSTRUMENT	
12	VLN18 (BU-WH)	20	DIMMER - IP/SWITCH ILLUMINATION	
13	VLF14 (BU-BN)	22	SENSOR - AUTOLAMP DAY/NIGHT	
14	CLS39 (VT-WH)	20	SWITCH - TURN LEFT	
15	CLF17 (WH-OG)	20	SWITCH - BEAM HIGH	
16	CH122 (WH-OG)	22	CTRL MOD. - CLIMATE # HEATER REAR WINDOW REQUEST	
17	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH	
18	*	*	not used	
19	CLF19 (VT-GN)	20	SWITCH - AUTOLAMP ON	
20	CLS32 (BN-YE)	20	SWITCH - HAZARD	
21	CRW19 (BU-OG)	22	SWITCH - FRONT WIPER INTERVAL (C)	
22	CRW18 (VT-WH)	22	SWITCH - FRONT WIPER INTERVAL (B)	
23	CRW17 (GN-VT)	22	SWITCH - FRONT WIPER INTERVAL (A)	
24	CLS41 (GY-YE)	20	SWITCH - TURN RIGHT	
25	CLF27 (GN-BN)	20	SWITCH - FLASH TO PASS	
26	CLN28 (GN-BU)	20	SWITCH - DOME LAMP	
27	CPL45 (BN)	20	SWITCH - LIFTGATE/DECKLID RELEASE	
28	CLF21 (GY-VT)	20	SWITCH - FOG LAMPS FRONT	
29	CLF18 (BU-WH)	20	SWITCH - BEAM LOW	
30	CLF23 (WH-VT)	20	SWITCH - HEADLAMP OFF	
31	CRW07 (GY-BN)	22	SWITCH - FRONT WASHER	
32	CRW08 (VT-OG)	22	SWITCH - FRONT WIPER HIGH (H)	

Fig. 285: Smart Junction Box Connector End View (C2280D)

Connector: C2280E

Description:	Harness:	Base Part #:
SMART JUNCTION BOX (SJB)	14A005	14A067

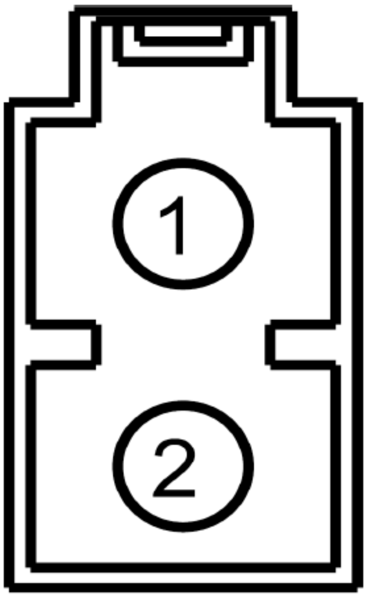


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS38 (VT-WH)	12	CTRL MOD. - ANTENNA/REAR DEFROST	
2	CLN09 (YE-GN)	18	RELAY - BATTERY SAVER (E.G. SWITCH OFF INTERIOR LIGHTING)	
3	CBP16 (BU-GN)	20	FUSE - 9 OR CIRCUIT BREAKER	
4	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
5	CBP24 (VT-GN)	20	FUSE - 24 OR CIRCUIT BREAKER	
6	*	*	not used	
7	CLS19 (VT-OG)	20	CTRL MOD. - STOP/TURN RIGHT	
8	*	*	not used	
9	*	*	not used	
10	SBP15 (WH-RD)	20	FUSE - 20 OR CIRCUIT BREAKER	
11	CLS18 (GY-BN)	20	CTRL MOD. - STOP/TURN LEFT	
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	CLN26 (BU)	18	RELAY - COURTESY LAMPS	
17	CPL11 (GY-BN)	16	CTRL MOD. - DOOR LOCK # ALL LOCK	
18	*	*	not used	
19	*	*	not used	
20	GD126 (BK-WH)	16	GROUND - FLOOR CROSS MEMBER REAR LEFT	
21	CBP12 (GN-WH)	20	FUSE - 1 OR CIRCUIT BREAKER	
22	CBP19 (BN-WH)	20	FUSE - 28 OR CIRCUIT BREAKER	
23	CPL10 (GN-WH)	16	CTRL MOD. - DOOR LOCK # LIFTGATE/DECKLID RELEASE	
24	*	*	not used	
25	CBP02 (GN)	20	FUSE - 12 OR CIRCUIT BREAKER	
26	CLS17 (YE-GY)	20	CTRL MOD. - STOP HIGH MOUNT	
27	CPL51 (BU-GN)	16	CTRL MOD. - DOOR LOCK # DRIVER UNLOCK	
28	*	*	not used	
29	CBP06 (WH-BU)	16	FUSE - 17 OR CIRCUIT BREAKER	
30	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
31	CPL52 (VT-GY)	16	CTRL MOD. - DOOR LOCK # PASSENGER DOORS UNLOCK (ALL EXCLUDING DRIVER)	
32	SBP09 (RD)	16	FUSE - 15 OR CIRCUIT BREAKER	

Fig. 286: Smart Junction Box Connector End View (C2280E)

Connector: C2280F

Description:	Harness:	Base Part #:
SMART JUNCTION BOX (SJB)	14290	14A067



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB02 (YE-RD)	10	FUSE - 2 OR CIRCUIT BREAKER	
2	SBB01 (RD)	10	FUSE - 1 OR CIRCUIT BREAKER	

Fig. 287: Smart Junction Box Connector End View (C2280F)

Connector: C2280G	Description:	Harness:	Base Part #:
	SMART JUNCTION BOX (SJB)	15603	14A067

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	COAX CABLE (BK)	-	ANTENNA	

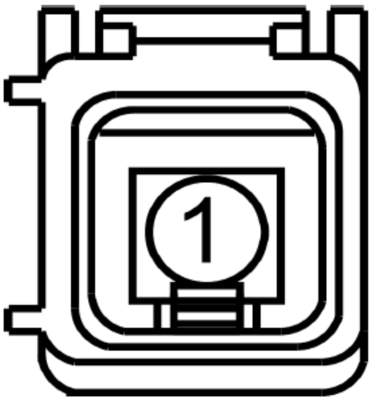


Fig. 288: Smart Junction Box Connector End View (C2280G)

Connector: C2295	Description:	Harness:	Base Part #:
	A/C EVAPORATIVE THERMISTOR	19D887	19C734

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C)	EMTC, EATC
1	RH104 (BU-BN)	20	CTRL MOD. - CLIMATE # SENSOR RETURN	DATC
2	VH406 (VT-BN)	20	SENSOR - A/C EVAPORATOR TEMPERATURE (ACET)	

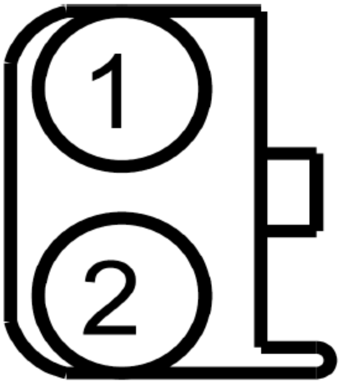
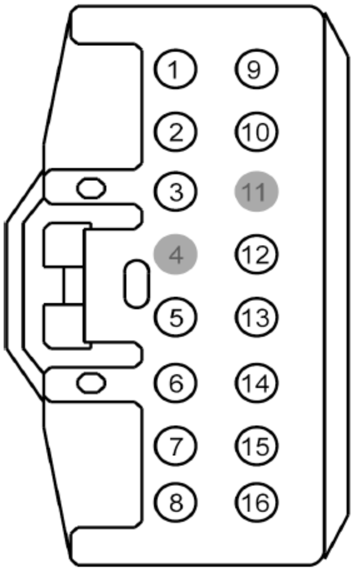


Fig. 289: A/C Evaporative Thermistor Connector End View (C2295)

Connector: C2352A

Description:	Harness:	Base Part #:
FNR5 TRANSMISSION	14290	PIA

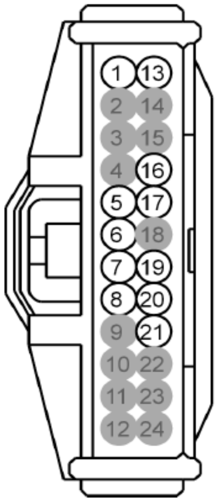


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD120 (BK-GN)	16	GROUND - FENDER FRONT LEFT	
2	CE613 (WH-VT)	16	FNR5 RELAY SWITCHED OUTPUT	
3	SBB23 (WH-RD)	20	FUSE - 23 OR CIRCUIT BREAKER	
4	*	*	not used	
5	CET42 (GN-VT)	18	PRESSURE CONTROL A (PCA -)	
6	CET43 (GY)	18	PRESSURE CONTROL A (PCA +)	
7	VET15 (YE-GY)	18	SHIFT SOLENOID PRESSURE CONTROL C (SSPCC)	
8	VET13 (GY-BU)	18	SHIFT SOLENOID PRESSURE CONTROL A (SSPCA)	
9	GD120 (BK-GN)	18	GROUND - FENDER FRONT LEFT	
10	CE613 (WH-VT)	16	FNR5 RELAY SWITCHED OUTPUT	
11	*	*	not used	
12	CET44 (BU-BN)	18	SHIFT SOLENOID PRESSURE CONTROL F (SSPCF)	
13	CET19 (VT-GY)	18	SHIFT SOLENOID PRESSURE CONTROL E (SSPCE)	
14	CET18 (GY-YE)	18	SHIFT SOLENOID PRESSURE CONTROL D (SSPCD)	
15	CET45 (YE-BU)	18	PRESSURE CONTROL B	
16	VET14 (VT-GN)	18	SHIFT SOLENOID PRESSURE CONTROL B (SSPCB)	

Fig. 290: FNR5 Transmission Control Module Connector End View (C2352A)

Connector: C2352B

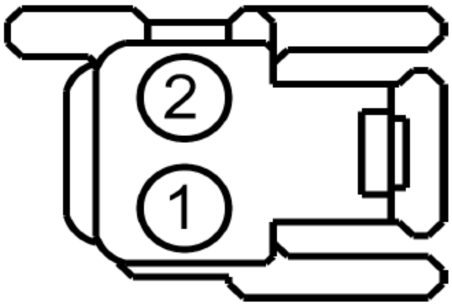
Description:	Harness:	Base Part #:
FNR5 TRANSMISSION	14290	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH (CAN +)	
2	*	*	not used	
3	*	*	not used	
4	*	*	not used	
5	VET28 (GY-VT)	20	SENSOR - TRANSMISSION RANGE/TFT SIGNAL RETURN	
6	VET27 (BN-YE)	20	SENSOR - TRANSMISSION FLUID TEMPERATURE (TFT) SIGNAL	
7	RET33 (WH-VT)	20	TURBINE SHAFT SPEED (TSS) SENSOR SIGNAL RETURN	
8	VET33 (WH-OG)	20	TURBINE SHAFT SPEED (TSS) SENSOR SIGNAL	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	*	*	not used	
13	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW (CAN -)	
14	*	*	not used	
15	*	*	not used	
16	RE406 (GY-VT)	20	FNR5 RELAY GROUND	
17	VET26 (BN-GN)	20	OUTPUT SHAFT SPEED (OSS) SENSOR SIGNAL	
18	*	*	not used	
19	VE822 (YE-BU)	20	INTERMEDIATE SHAFT SPEED SENSOR (ISS) SIGNAL	
20	CET46 (YE-GN)	20	SWITCH - PRESSURE (PS)	
21	CET37 (BN-WH)	20	SWITCH - TRANSMISSION RANGE SIGNAL	
22	*	*	not used	
23	*	*	not used	
24	*	*	not used	

Fig. 291: FNR5 Transmission Control Module Connector End View (C2352B)

Connector: C2353	Description:	Harness:	Base Part #:
	CLUTCH PEDAL POSITION (CPP) SWITCH	14290	11A152



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD120 (BK-GN)	20	GROUND - FENDER FRONT LEFT	
2	CE903 (BU-OG)	20	SWITCH - CLUTCH PEDAL POSITION # BOTTOM OF TRAVEL (CPP-BT)	

Fig. 292: Clutch Pedal Position Switch Connector End View (C2353)

Connector: C2354	Description:	Harness:	Base Part #:
	CLUTCH PEDAL SPEED CONTROL DEACTIVATOR SWITCH	14290	11A152

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	*	*	not used	
4	CE904 (GN-VT)	20	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	
5	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C)	

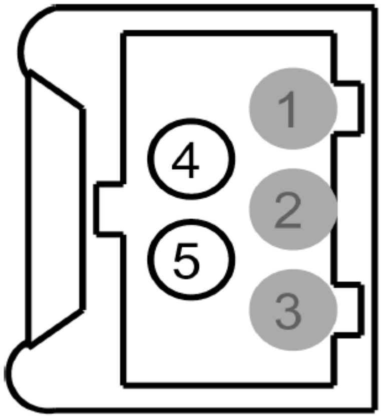
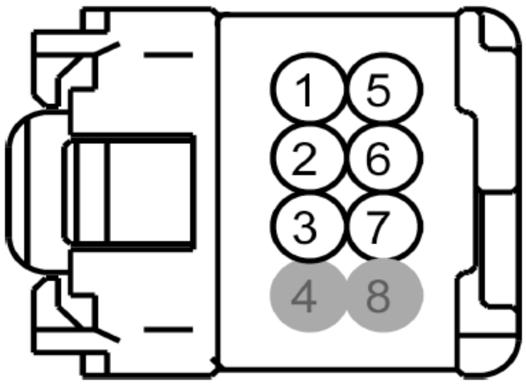


Fig. 293: Clutch Pedal Speed Control Deactivator Switch Connector End View (C2354)

Connector: C2355

Description:	Harness:	Base Part #:
HAZARD / PAD / TRACTION SWITCH	14401	13D734

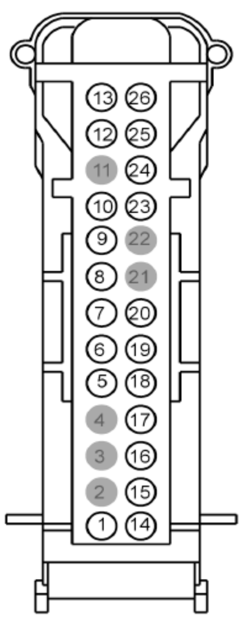


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
2	CR116 (GN-WH)	20	CTRL MOD. - INDICATOR PASSENGER AIR BAG DEACTIVATE	
3	CBP24 (VT-GN)	20	FUSE - 24 OR CIRCUIT BREAKER	
4	*	*	not used	
5	CLS32 (BN-YE)	20	SWITCH - HAZARD	
6	VLN04 (VT-GY)	22	CTRL MOD. - IP/SWITCH ILLUMINATION	
7	CCA15 (YE-GY)	22	SWITCH - IVD/TCS DISABLE	
8	*	*	not used	

Fig. 294: Hazard Switch / Passenger Side Airbag Deactivation Switch / Traction Switch Connector End View (C2355)

Connector: C2356A

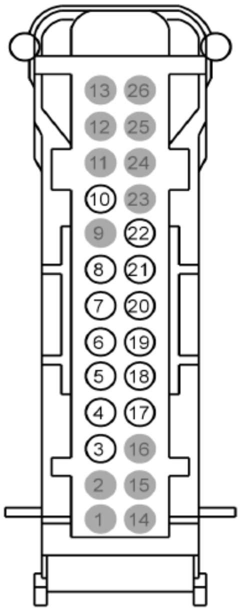
Description:	Harness:	Base Part #:
HVAC-DATC	14401	19980



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
2	*	*	not used	
3	*	*	not used	
4	*	*	not used	
5	LH111 (BN-WH)	20	CTRL MOD. - CLIMATE # DOOR POSITION SENSORS ALSO GENERIC VREF IN LOGICAL SCHEMATICS	
6	CH239 (BU-WH)	20	CTRL MOD. - CLIMATE # DOOR MOTOR TEMP. LEFT COIL 2 / OPEN (IF PLUS)	
7	CH238 (YE-OG)	20	CTRL MOD. - CLIMATE # DOOR MOTOR TEMP. LEFT COIL 1 / CLOSE (IF PLUS)	
8	CH208 (GN-OG)	20	CTRL MOD. - CLIMATE # DOOR MOTOR RECIRC. COIL 2 / OPEN (IF PLUS)	
9	CH207 (BU-GY)	20	CTRL MOD. - CLIMATE # DOOR MOTOR RECIRC. COIL 1 / CLOSE (IF PLUS)	
10	CH122 (WH-OG)	22	CTRL MOD. - CLIMATE # HEATER REAR WINDOW REQUEST	
11	*	*	not used	
12	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH	
13	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW	
14	CH229 (WH-BU)	20	CTRL MOD. - CLIMATE # DOOR MOTOR DEFROST COIL 2 / OPEN (IF PLUS)	
15	RH111 (GY-BU)	20	CTRL MOD. - CLIMATE # DOOR POSITION SENSORS ALSO GENERIC VREF RETURN IN LOGICAL SCHEMATICS	
16	VH436 (YE-VT)	20	SENSOR - DOOR POSITION DEFROST	
17	VH441 (WH-BN)	20	SENSOR - DOOR POSITION TEMP. RIGHT	
18	VH440 (BU-BN)	20	SENSOR - DOOR POSITION TEMP. LEFT	
19	CBP20 (YE-VT)	20	FUSE - 27 OR CIRCUIT BREAKER	
20	CH228 (YE-GY)	20	CTRL MOD. - CLIMATE # DOOR MOTOR DEFROST COIL 1 / CLOSE (IF PLUS)	
21	*	*	not used	
22	*	*	not used	
23	CH123 (VT-GN)	20	CTRL MOD. - BLOWER MOTOR RELAY	
24	CH213 (BN-GN)	20	CTRL MOD. - CLIMATE # DOOR MOTOR TEMP. RIGHT COIL 2 / OPEN (IF PLUS)	
25	CH212 (BU-OG)	20	CTRL MOD. - CLIMATE # DOOR MOTOR TEMP. RIGHT COIL 1 / CLOSE (IF PLUS)	
26	SBP07 (WH-RD)	20	FUSE - 13 OR CIRCUIT BREAKER	

Fig. 295: HVAC-DATC Connector End View (C2356A)

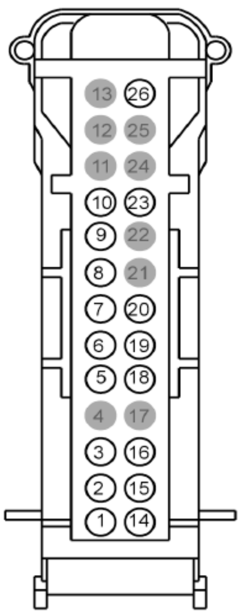
Connector: C2356B	Description:	Harness:	Base Part #:
	HVAC-DATC	14401	19980



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	RH104 (BU-BN)	20	CTRL MOD. - CLIMATE # SENSOR RETURN	
4	VH414 (GN-BU)	20	SENSOR - INCAR TEMP.	
5	VH417 (YE-OG)	22	SENSOR - SUN LOAD # RIGHT	
6	CHS29 (WH-BU)	20	SWITCH - SEAT HEATER FRONT DRIVER SIDE	
7	CHS04 (YE-GY)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER INDICATOR LOW	
8	CHS13 (VT-BN)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER INDICATOR HIGH	
9	*	*	not used	
10	VH406 (VT-BN)	20	SENSOR - A/C EVAPORATOR TEMPERATURE (ACET)	
11	*	*	not used	
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	VH407 (YE-GN)	20	SENSOR - AMBIENT TEMP.	
18	VH416 (VT-GY)	22	SENSOR - SUN LOAD # LEFT	
19	CHS30 (GY-YE)	20	SWITCH - SEAT HEATER FRONT PASSENGER SIDE	
20	CHS09 (GY)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER INDICATOR LOW	
21	CHS14 (GN)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER INDICATOR HIGH	
22	VH101 (WH-VT)	18	CTRL MOD. - CLIMATE # BLOWER MOTOR CONTROL	
23	*	*	not used	
24	*	*	not used	
25	*	*	not used	
26	*	*	not used	

Fig. 296: HVAC-DATC Connector End View (C2356B)

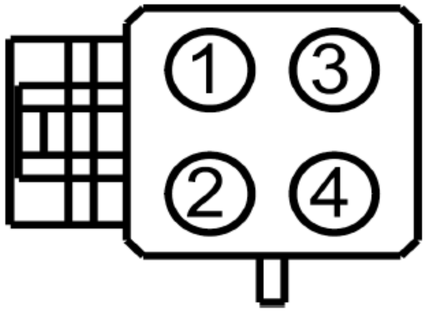
Connector: C2357A	Description:	Harness:	Base Part #:
	HVAC-EMTC	14401	19980



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
2	VLN04 (VT-GY)	22	CTRL MOD. - IP/SWITCH ILLUMINATION	
3	CH434 (GY-YE)	22	SWITCH - CLIMATE MODE # AC	
4	*	*	not used	
5	LH111 (BN-WH)	20	CTRL MOD. - CLIMATE # DOOR POSITION SENSORS ALSO GENERIC VREF IN LOGICAL SCHEMATICS	
6	CH234 (YE-GN)	20	CTRL MOD. - CLIMATE # DOOR MOTOR TEMP. COIL 2 / OPEN (IF PLUS)	
7	CH233 (VT-BN)	20	CTRL MOD. - CLIMATE # DOOR MOTOR TEMP. COIL 1 / CLOSE (IF PLUS)	
8	CH207 (BU-GY)	20	CTRL MOD. - CLIMATE # DOOR MOTOR RECIRC. COIL 1 / CLOSE (IF PLUS)	
9	CH208 (GN-OG)	20	CTRL MOD. - CLIMATE # DOOR MOTOR RECIRC. COIL 2 / OPEN (IF PLUS)	
10	CH122 (WH-OG)	22	CTRL MOD. - CLIMATE # HEATER REAR WINDOW REQUEST	
11	*	*	not used	
12	*	*	not used	
13	*	*	not used	
14	CH229 (WH-BU)	20	CTRL MOD. - CLIMATE # DOOR MOTOR DEFROST COIL 2 / OPEN (IF PLUS)	
15	RH111 (GY-BU)	20	CTRL MOD. - CLIMATE # DOOR POSITION SENSORS ALSO GENERIC VREF RETURN IN LOGICAL SCHEMATICS	
16	VH436 (YE-VT)	20	SENSOR - DOOR POSITION DEFROST	
17	*	*	not used	
18	VH439 (GY-VT)	20	SENSOR - DOOR POSITION TEMP.	
19	CBP20 (YE-VT)	20	FUSE - 27 OR CIRCUIT BREAKER	
20	CH228 (YE-GY)	20	CTRL MOD. - CLIMATE # DOOR MOTOR DEFROST COIL 1 / CLOSE (IF PLUS)	
21	*	*	not used	
22	*	*	not used	
23	CH123 (VT-GN)	20	CTRL MOD. - BLOWER MOTOR RELAY	
24	*	*	not used	
25	*	*	not used	
26	SBP07 (WH-RD)	20	FUSE - 13 OR CIRCUIT BREAKER	

Fig. 297: HVAC-EMTC Connector End View (C2357A)

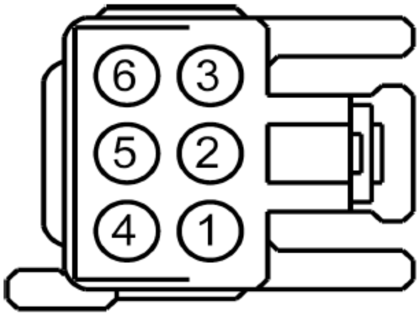
Connector: C2357B	Description:	Harness:	Base Part #:
	HVAC-EMTC	14401	19980



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD115 (BK-GY)	12	GROUND - CROSS CAR BEAM # 2ND STUD	
2	CH430 (VT-OG)	10	SWITCH - FRONT BLOWER # POSITION 4 (HIGH)	
3	CH429 (GY-BN)	14	SWITCH - FRONT BLOWER # POSITION 3 (MEDIUM HIGH)	
4	CH428 (GN-WH)	16	SWITCH - FRONT BLOWER # POSITION 2 (MEDIUM LOW)	

Fig. 298: HVAC-EMTC Connector End View (C2357B)

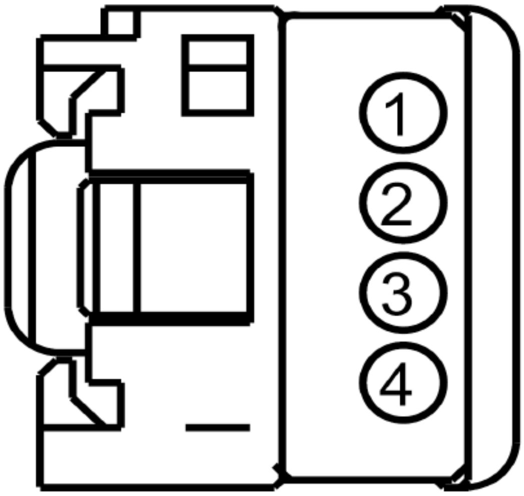
Connector: C2358	Description:	Harness:	Base Part #:
	INSTRUMENT PANEL SPEAKER	14401	18808



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME28 (BN-VT)	18	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT IP	
2	VME06 (GN)	18	CTRL MOD. - AUDIO # SPEAKER CENTER FRONT IP	
3	VME29 (GN-WH)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT IP	
4	RME28 (BN-GN)	18	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT IP	
5	RME06 (GY-YE)	18	CTRL MOD. - AUDIO # SPEAKER CENTER FRONT IP	
6	RME29 (BU-WH)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT IP	

Fig. 299: Instrument Panel Speaker Connector End View (C2358)

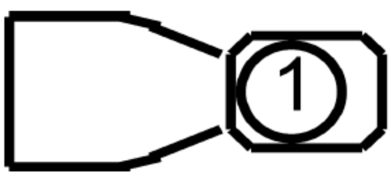
Connector: C2401	Description:	Harness:	Base Part #:
	AUDIO INPUT JACK	14401	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME46 (BU-GN)	20	JACK - AUDIO # EXT. AUX IN RIGHT (+)	
2	RME46 (WH-GN)	20	JACK - AUDIO # EXT. AUX IN RIGHT (-)	
3	RME45 (YE-GN)	20	JACK - AUDIO # EXT. AUX IN LEFT (-)	
4	VME45 (BU)	20	JACK - AUDIO # EXT. AUX IN LEFT (+)	

Fig. 300: Audio Input Jack Connector End View (C2401)

Connector: C2996	Description:	Harness:	Base Part #:
	HORN SWITCH, LEFT	14672	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRH02 (BU-WH)	20	SWITCH - HORN	

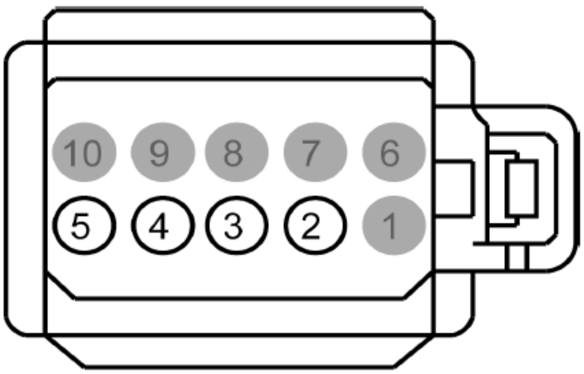
Fig. 301: Left Horn Switch Connector End View (C2996)

Connector: C2997	Description:	Harness:	Base Part #:
	HORN SWITCH, RIGHT	14672	PIA

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRH02 (BU-WH)	20	SWITCH - HORN	

Fig. 302: Right Horn Switch Connector End View (C2997)

Connector: C2998	Description:	Harness:	Base Part #:
	STEERING WHEEL SWITCH, LEFT	14672	9C888

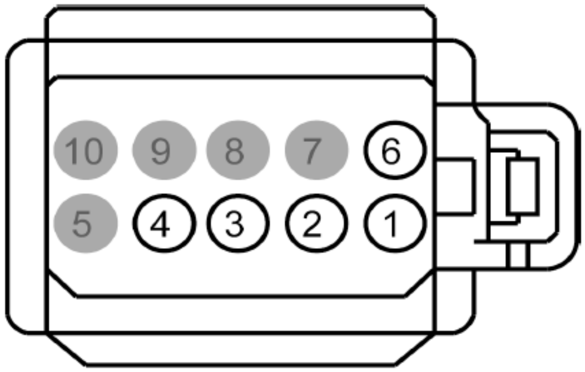


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	VLN04 (VT-GY)	22	CTRL MOD. - IP/SWITCH ILLUMINATION	
3	RES08 (GN-BN)	22	CTRL MOD. - POWERTRAIN # SPEED CONTROL COMMAND RETURN (SCCSRTN)	
4	GD165 (BK)	22	GROUND - STEERING COLUMN BRACKET	
5	VES10 (WH)	22	SWITCH - SPEED CONTROL COMMAND (SCCS)	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	

Fig. 303: Left Steering Wheel Switch Connector End View (C2998)

Connector: C2999

Description:	Harness:	Base Part #:
STEERING WHEEL SWITCH, RIGHT	14672	9C888



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VLN04 (VT-GY)	22	CTRL MOD. - IP/SWITCH ILLUMINATION	
2	VME14 (GY-YE)	22	SWITCH - REDUNDANT AUDIO	
3	GD165 (BK)	22	GROUND - STEERING COLUMN BRACKET	
4	RME24 (BU-WH)	22	CTRL MOD. - AUDIO # SWITCH REDUNDANT AUDIO	
5	*	*	not used	
6	VME54 (BU-OG)	22	CTRL MOD. - AUDIO # SWITCH VOICE NAV	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	

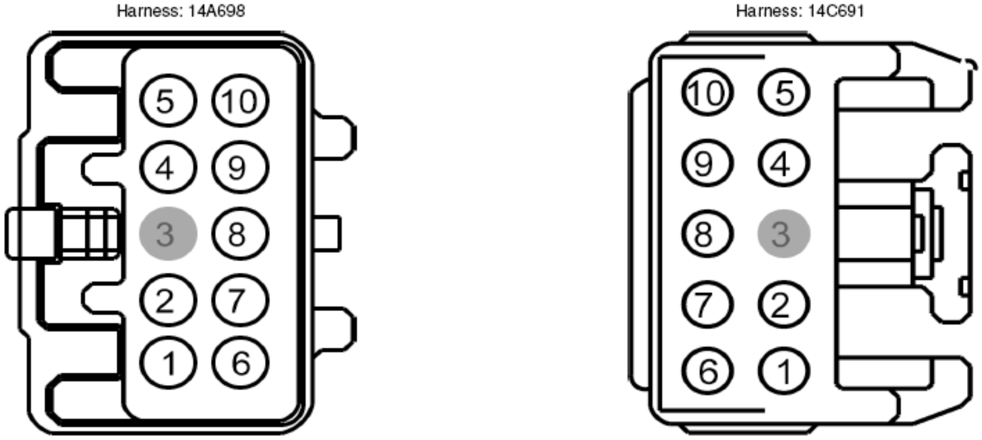
Fig. 304: Right Steering Wheel Switch Connector End View (C2999)

Inline: C3007

Description:	Base Part #:
Inline	

MALE
Harness: 14A698

FEMALE
Harness: 14C691

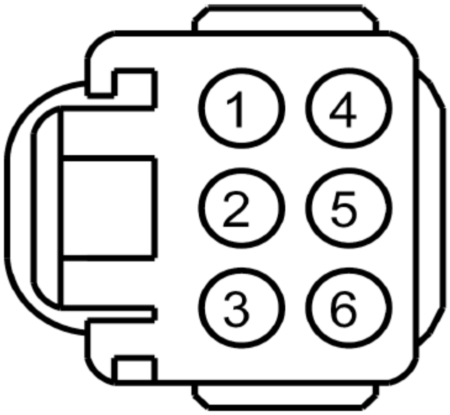


Pin	Circuit	Gauge	Qualifier
1	CHS12 (YE-GN)	18	Heated seat
2	GD139 (BK-YE)	18	Heated seat
3	*	*	
4	CHS08 (BN-YE)	20	14A698
4	CHS08 (GY-RD)	20	14C691
5	VHS36 (YE-BU)	20	
6	CHS06 (BU-BN)	18	
7	RHS06 (WH)	18	14A698
7	RHS06 (GN-BK)	18	14C691
8	RHS20 (GN-BU)	20	
9	VHS21 (BU-WH)	20	
10	RHS08 (VT-WH)	20	

Fig. 305: Inline Connector End View (C3007)

Connector: C3015

Description:	Harness:	Base Part #:
POWER SEAT MOTOR ASSEMBLY, RIGHT	14A698	PIA



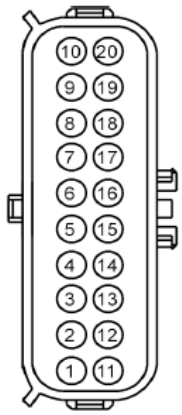
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPS37 (WH-BU)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER REAR HEIGHT UP	
2	CPS35 (VT-GN)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER FRONT HEIGHT UP	
3	CPS33 (WH)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER FORWARD	
4	CPS36 (YE-GY)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER REAR HEIGHT DOWN	
5	CPS34 (GY-BU)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER FRONT HEIGHT DOWN	
6	CPS38 (GN-BU)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER REARWARD	

Fig. 306: Right Power Seat Motor Assembly Connector End View (C3015)

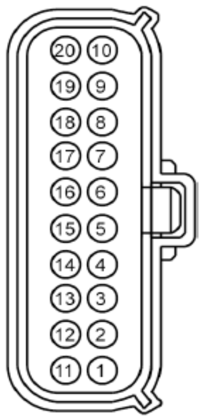
Inline: C3047

Description:	Base Part #:
Inline	

MALE
Harness: 14401



FEMALE
Harness: 14A005



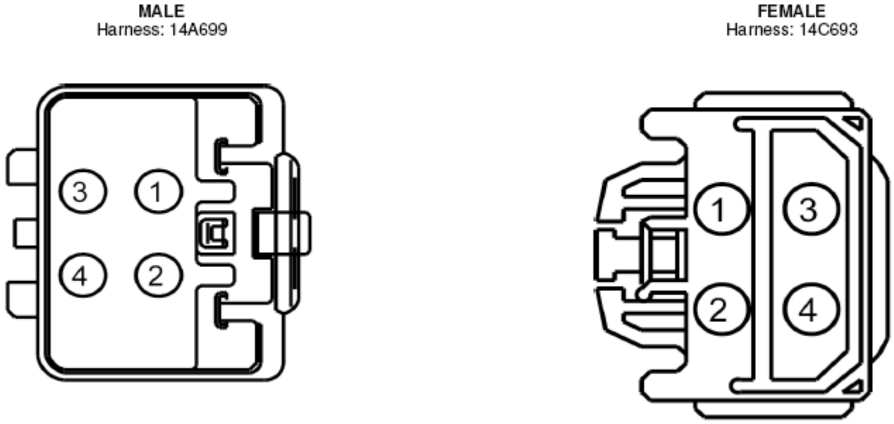
Pin	Circuit	Gauge	Qualifier
1	CR101 (VT-BN)	20	
2	CR102 (BU)	20	
3	CHS04 (YE-GY)	22	
4	CHS13 (VT-BN)	22	
5	CR103 (GY-BU)	20	
6	CR104 (YE-GY)	20	
7	CBP21 (BU-GY)	18	
8	VDB04 (WH-BU)	20	
9	VMC11 (YE-VT)	20	
10	CHS09 (GY)	22	
11	RR101 (YE-GN)	20	
12	RR102 (WH)	20	
13	CR116 (GN-WH)	20	
14	CHS29 (WH-BU)	22	
15	RR103 (VT-GN)	20	
16	RR104 (WH-BU)	20	
17	CHS30 (GY-YE)	22	
18	VDB05 (WH)	20	
19	CHS14 (GN)	22	
20	RMC32 (GN-BU)	20	

Fig. 307: Inline Connector End View (C3047)

Inline: C3049

Description: Inline

Base Part #:



Pin	Circuit	Gauge	Qualifier
1	CPS29 (WH-BN)	12	14A699
1	CPS29 (WH-BN)	14	14C693 - W/O Memory
1	CPS29 (GY-BK)	14	14C693 - Memory
2	CPS30 (VT-BN)	12	14A699
2	CPS30 (VT-BN)	14	14C693
3	CPS18 (BN-GN)	20	Memory
4	CPS19 (GY-VT)	20	Memory

Fig. 308: Inline Connector End View (C3049)

Inline: C3050

Description: Inline

Base Part #:

MALE Harness: 14A005

FEMALE Harness: 13A412

Pin	Circuit	Gauge	Qualifier
1	CPL10 (GN-WH)	16	
2	CLS18 (GY-BN)	20	
3	CBP08 (GY-YE)	18	
4	CPL44 (YE-OG)	20	
5	CRT18 (YE-GY)	20	
6	*	*	
7	*	*	
8	CLS17 (YE-GY)	20	
9	CBP12 (GN-WH)	20	
10	CLS19 (VT-OG)	20	
11	CLS17 (YE-GY)	20	
12	GD171 (BK-GY)	20	
13	VDB06 (GY-OG)	20	
14	VDB07 (VT-OG)	20	
15	*	*	
16	CBP19 (BN-WH)	20	

Fig. 309: Inline Connector End View (C3050)

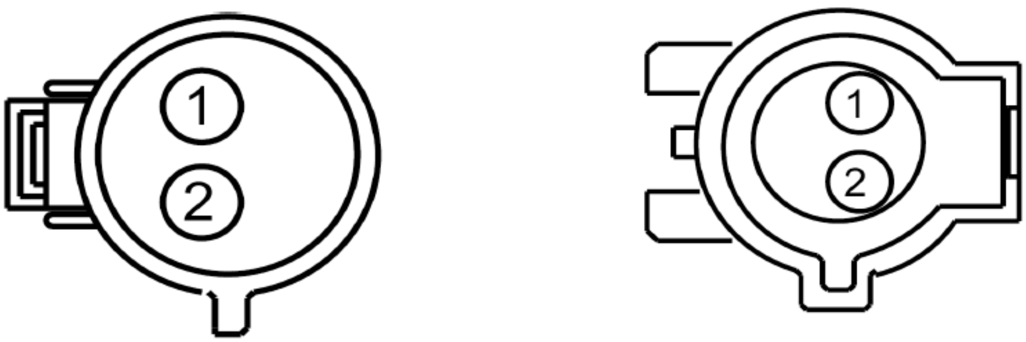
Inline: C3051

Description: Inline

Base Part #:

MALE Harness: 14A005

FEMALE Harness: 14A107



Pin	Circuit	Gauge	Qualifier
1	CCF21 (VT-WH)	20	
2	RCF21 (WH-VT)	20	

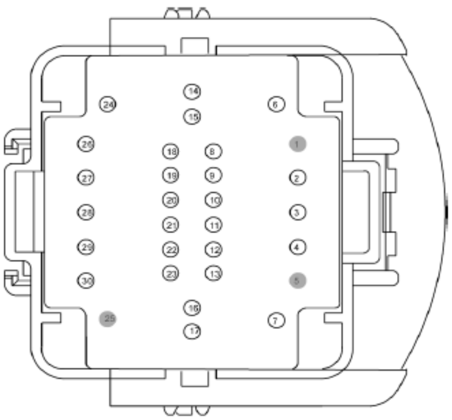
Fig. 310: Inline Connector End View (C3051)

Inline: C3052

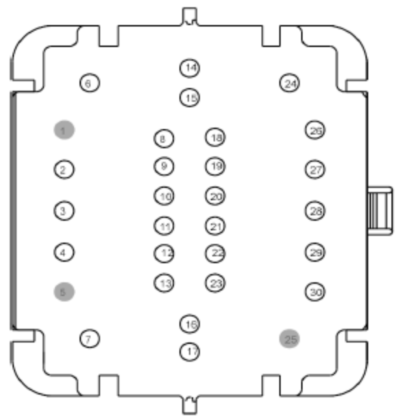
Description: Inline

Base Part #:

MALE
Harness: 14B079



FEMALE
Harness: 14A005



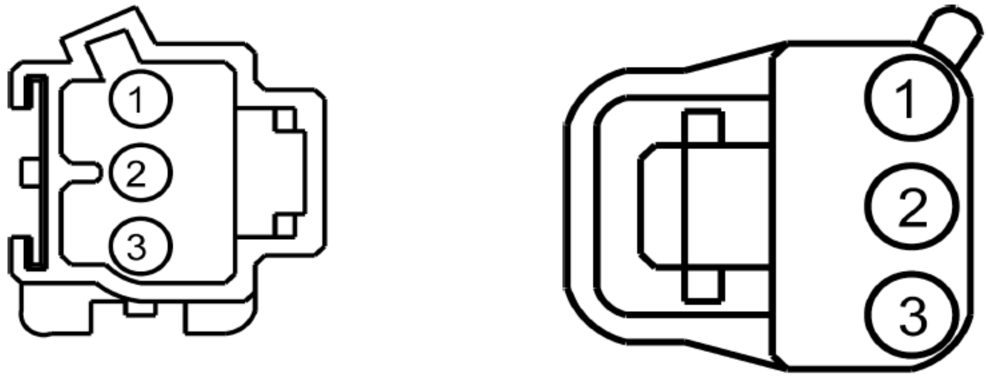
Pin	Circuit	Gauge	Qualifier
1	*	*	
2	VMM13 (YE-GN)	20	
3	RMM13 (BU)	20	
4	DMM13 (BK)	18	14A698
5	*	*	
6	SBB13 (GY-RD)	20	
7	GD148 (BK-YE)	20	
8	VME54 (BU-OG)	20	
9	VME53 (VT-GN)	20	
10	RME53 (BN-WH)	20	
11	DME52 (BK)	20	
12	VME52 (BU)	20	
13	RME52 (GY-OG)	20	
14	VDB06 (GY-OG)	20	
15	VDB07 (VT-OG)	20	
16	VDB04 (WH-BU)	20	
17	VDB05 (WH)	20	
18	RME24 (BU-WH)	20	
19	VME42 (VT-BN)	20	
20	RME42 (YE-BN)	20	
21	DME41 (BK)	20	
22	VME41 (GN-OG)	20	
23	RME41 (BU-BN)	20	
24	DMN14 (BK)	18	
25	*	*	
26	VMN14 (WH-VT)	20	
27	RMN14 (GY-BN)	20	
28	VMM02 (YE-GN)	20	
29	RMM02 (BU-WH)	20	
30	DMM02 (BK)	18	

Fig. 311: Inline Connector End View (C3052)

Inline: C3053

Description: Inline

Base Part #:



Pin	Circuit	Gauge	Qualifier
1	LRD12 (BU-GY)	22	14A005
1	LRD12 (BU-GY)	20	14334
2	RRD12 (BN)	22	14A005
2	RRD12 (BN)	20	14334
3	CPW01 (BN-BU)	20	

Fig. 312: Inline Connector End View (C3053)

Connector: C3055

Description: SIDE AIR CURTAIN MODULE, DRIVER

Harness: 14A005

Base Part #: 042D95

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR109 (BN-BU)	20	CTRL MOD. - INFLATABLE CURTAIN DRIVER SIDE +	
2	RR109 (BU-GN)	20	CTRL MOD. - INFLATABLE CURTAIN DRIVER SIDE -	

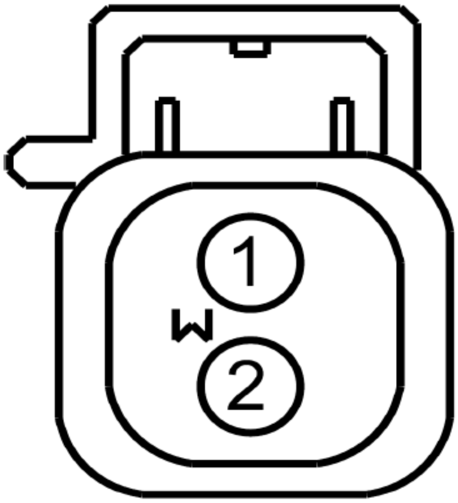


Fig. 313: Driver Side Air Curtain Module Connector End View (C3055)

Connector: C3056

Description:	Harness:	Base Part #:
SIDE AIR CURTAIN MODULE, PASSENGER	14A005	042D94

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR111 (BN-WH)	20	CTRL MOD. - INFLATABLE CURTAIN PASSENGER SIDE +	
2	RR111 (YE-VT)	20	CTRL MOD. - INFLATABLE CURTAIN PASSENGER SIDE -	

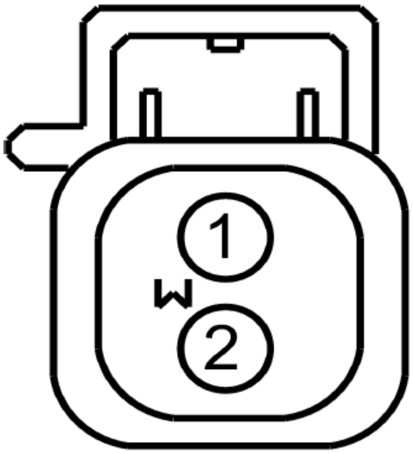
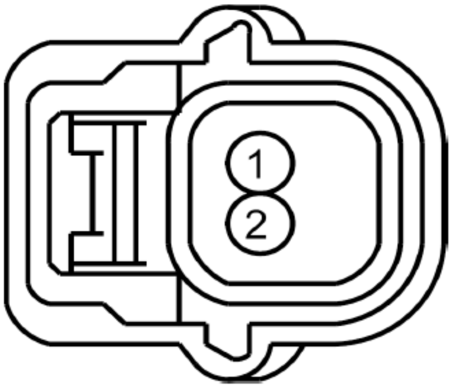


Fig. 314: Passenger Side Air Curtain Module Connector End View (C3056)

Connector: C3057

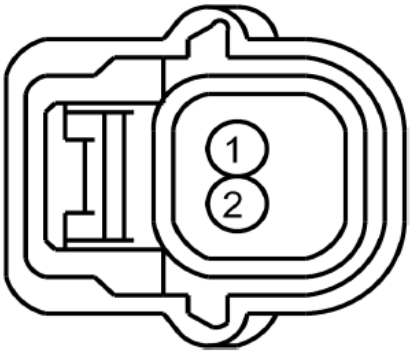
Description:	Harness:	Base Part #:
SIDE AIR CURTAIN SENSOR, LEFT 1	14A005	14B345



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VR217 (GY-YE)	20	SENSOR - SIDE IMPACT FRONT DRIVER SIDE SIGNAL	
2	RR131 (VT-GY)	20	CTRL MOD. - SENSOR SIDE IMPACT FRONT DRIVER SIDE RTN	

Fig. 315: Left 1 Side Air Curtain Sensor Connector End View (C3057)

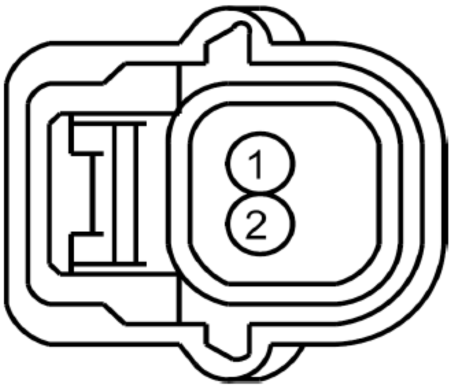
Connector: C3058	Description:	Harness:	Base Part #:
	SIDE AIR CURTAIN SENSOR, RIGHT 1	14A005	14B345



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VR218 (YE-OG)	20	SENSOR - SIDE IMPACT FRONT PASSENGER SIDE SIGNAL	
2	RR132 (BU-WH)	20	CTRL MOD. - SENSOR SIDE IMPACT FRONT PASSENGER SIDE RTN	

Fig. 316: Right 1 Side Air Curtain Sensor Connector End View (C3058)

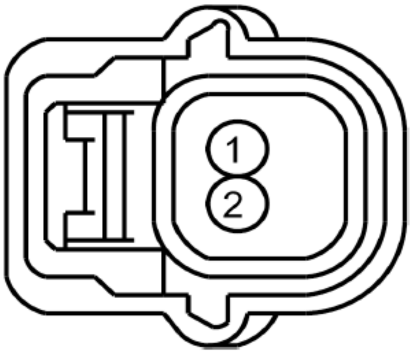
Connector: C3059	Description:	Harness:	Base Part #:
	SIDE AIR CURTAIN SENSOR, LEFT 2	14A005	14B345



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VR219 (GN-WH)	20	SENSOR - SIDE IMPACT ROW 2 DRIVER SIDE SIGNAL	
2	RR133 (GY-BN)	20	CTRL MOD. - SENSOR SIDE IMPACT ROW 2 DRIVER SIDE RTN	

Fig. 317: Left 2 Side Air Curtain Sensor Connector End View (C3059)

Connector: C3060	Description:	Harness:	Base Part #:
	SIDE AIR CURTAIN SENSOR, RIGHT 2	14A005	14B3345



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VR220 (VT-OG)	20	SENSOR - SIDE IMPACT ROW 2 PASSENGER SIDE SIGNAL	
2	RR134 (BN-BU)	20	CTRL MOD. - SENSOR SIDE IMPACT ROW 2 PASSENGER SIDE RTN	

Fig. 318: Right 2 Side Air Curtain Sensor Connector End View (C3060)

Connector: C3120	Description:	Harness:	Base Part #:
	SUBWOOFER, LEFT REAR	14A005	18808

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME01 (GN-VT)	20	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER LEFT REAR +	
2	RME01 (GY)	20	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER LEFT REAR -	

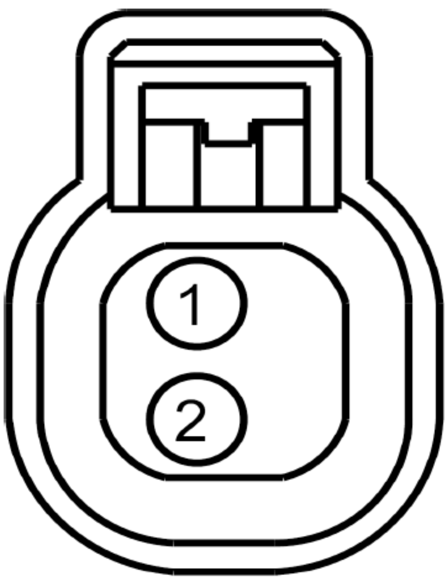


Fig. 319: Left Rear Subwoofer Connector End View (C3120)

Connector: C3121

Description: SUBWOOFER, RIGHT REAR

Harness: 14A005

Base Part #: 18808

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME02 (VT)	20	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER RIGHT REAR +	
2	RME02 (YE)	20	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER RIGHT REAR -	

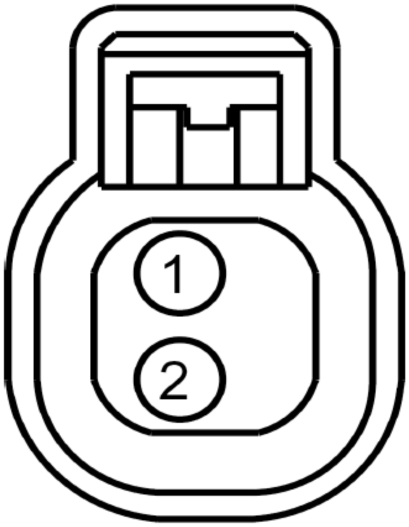


Fig. 320: Right Rear Subwoofer Connector End View (C3121)

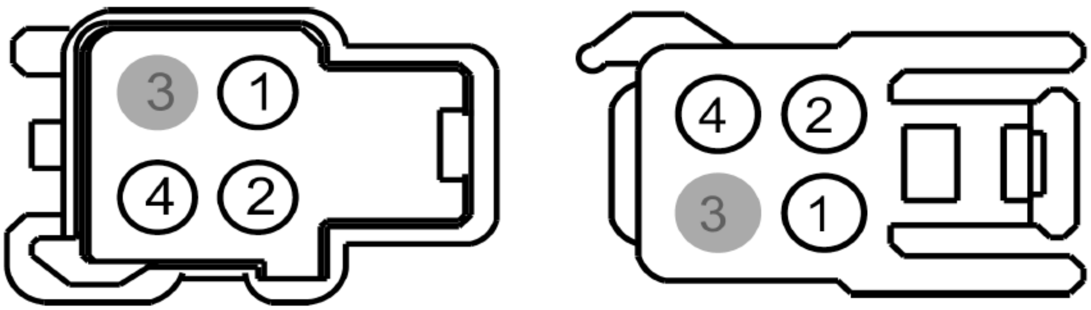
Inline: C3133

Description: Inline

Base Part #:

MALE
Harness: 14D375

FEMALE
Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	CBX07 (GN-RD)	22	14D375
1	CBP02 (GN)	18	14401
2	VLN04 (VT-GY)	22	14D375
2	VLN04 (VT-GY)	20	14401
3	*	*	
4	GD908 (BK)	22	14D375
4	GD116 (BK-VT)	18	14401

Fig. 321: Inline Connector End View (C3133)

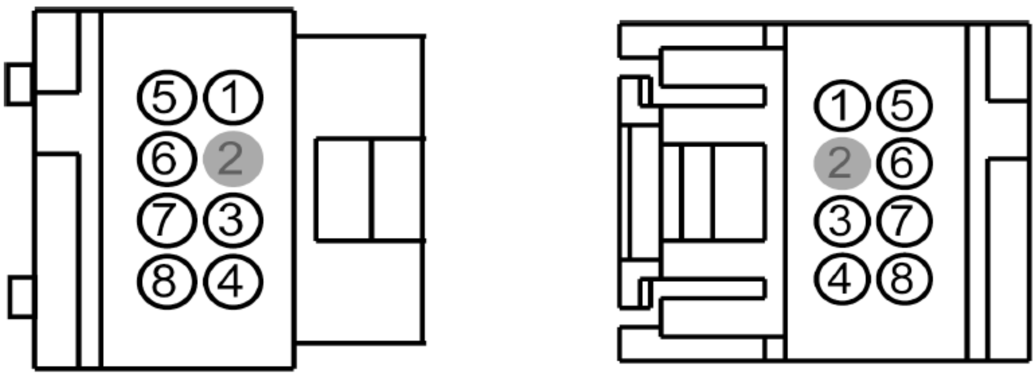
Inline: C3134

Description: Inline

Base Part #:

MALE
Harness: 13B239

FEMALE
Harness: 14D375



Pin	Circuit	Gauge	Qualifier
1	CBX07 (GN-RD)	22	
2	*	*	
3	CLN44 (OG)	22	
4	RLN44 (BN)	22	
5	CLN45 (GN)	22	
6	CLN46 (BU)	22	
7	VLN04 (VT-GY)	22	
8	GD908 (BK)	18	

Fig. 322: Inline Connector End View (C3134)

Inline: C3135

Description: Inline

Base Part #:

MALE
Harness: 14A577

FEMALE
Harness: 14A698

Pin	Circuit	Gauge	Qualifier
1	VR211 (WH-BN)	20	
2	CR140 (YE-GN)	20	
3	RR140 (GN-OG)	20	
4	VR212 (YE-GN)	20	
5	CR141 (BN-YE)	20	
6	RR141 (VT-BN)	20	

Fig. 323: Inline Connector End View (C3135)

Inline: C3136

Description:
Inline

Base Part #:

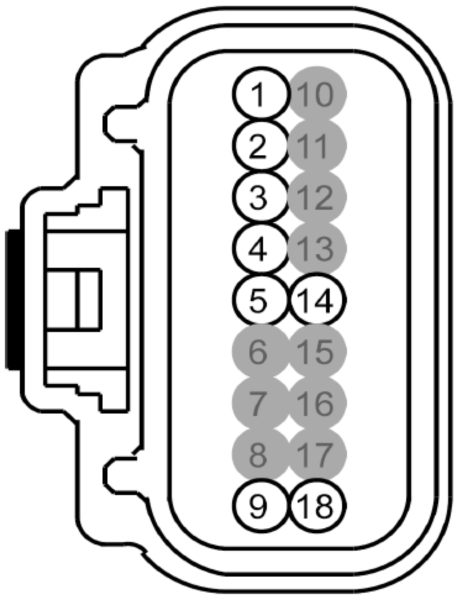
MALE
Harness: 14A578

FEMALE
Harness: 14A698

Pin	Circuit	Gauge	Qualifier
1	VR227 (VT-GN)	20	
2	CR154 (VT-OG)	20	
3	RR154 (VT-WH)	20	
4	VR226 (YE-GY)	20	
5	CR153 (GN-WH)	20	
6	RR153 (GY-BU)	20	

Fig. 324: Inline Connector End View (C3136)

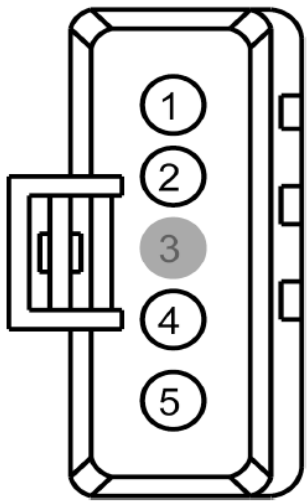
Connector: C3159	Description:	Harness:	Base Part #:
	OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM)	14A698	14B422



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP24 (VT-GN)	20	FUSE - 24 OR CIRCUIT BREAKER	
2	VR211 (WH-BN)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT RIGHT (#1) SIG	Early
2	CR140 (YE-GN)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT RIGHT (#1) FEED	Late
3	RR141 (VT-BN)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR RIGHT (#2) RTN	Early
3	VR211 (WH-BN)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR RIGHT (#1) SIG	Late
4	VR212 (YE-GN)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT LEFT (#2) SIG	Early
4	VR212 (YE-GN)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT RIGHT (#2) SIG	Late
5	RR140 (GN-OG)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR LEFT (#1) RTN	Early
5	RR140 (GN-OG)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR RIGHT (#1) RTN	Late
6	*	*	not used	Early
6	RR153 (GY-BU)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR LEFT (#1) RTN	Late
7	*	*	not used	Early
7	VR226 (YE-GY)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT LEFT (#1) SIG	
8	*	*	not used	Early
8	CR153 (GN-WH)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR LEFT (#1) FEED	Late
9	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
10	*	*	not used	Early
10	CR141 (BN-YE)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR RIGHT (#2) FEED	Late
11	*	*	not used	
12	*	*	not used	
13	*	*	not used	Early
13	RR141 (VT-BN)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR RIGHT (#2) RTN	Late
14	GD127 (BK-BU)	20	GROUND - FLOOR CROSS MEMBER REAR RIGHT	
15	*	*	not used	Early
15	RR154 (VT-WH)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR LEFT (#2) RTN	Late
16	*	*	not used	Early
16	VR227 (VT-GN)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT LEFT (#2) SIG	Late
17	*	*	not used	Early
17	CR154 (VT-OG)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR LEFT (#2) FEED	Late
18	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	

Fig. 325: Occupant Classification System Module Connector End View (C3159)

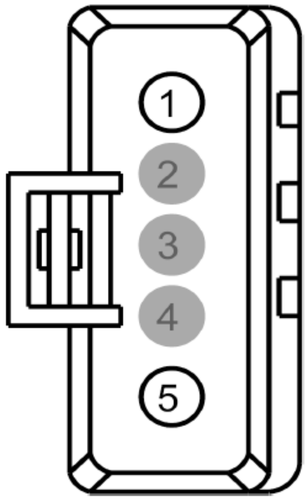
Connector: C3187	Description:	Harness:	Base Part #:
	RECLINER MOTOR, DRIVER SEAT	14C693	14547



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPS29 (WH-BN)	14	SWITCH - SEAT ADJUST. DRIVER RECLINE FORWARD	W/O memory
1	CPS29 (GY-BK)	20	SWITCH - SEAT ADJUST. DRIVER RECLINE FORWARD	Memory
2	RPS13 (GN-OG)	20	CTRL MOD. - DRIVER SEAT SENSORS POSITION	Memory
3	*	*	not used	
4	LPS12 (VT-RD)	20	CTRL MOD. - DRIVER SEAT SENSOR RECLINE	Memory
5	CPS30 (VT-BN)	14	SWITCH - SEAT ADJUST. DRIVER RECLINE REARWARD	

Fig. 326: Driver Seat Recliner Motor Connector End View (C3187)

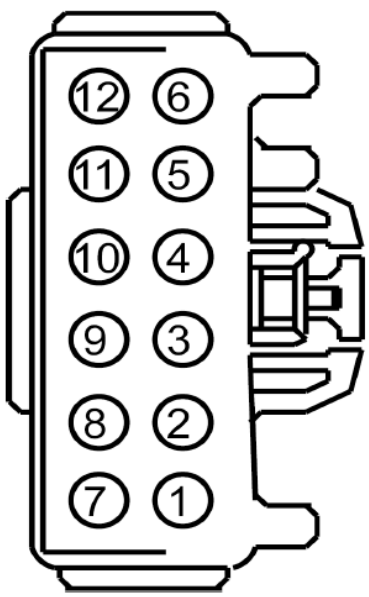
Connector: C3189	Description:	Harness:	Base Part #:
	RECLINER MOTOR, PASSENGER SEAT	14C691	14547



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPS39 (GY-YE)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER RECLINE FORWARD	
2	*	*	not used	
3	*	*	not used	
4	*	*	not used	
5	CPS40 (VT-GY)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER RECLINE REARWARD	

Fig. 327: Passenger Seat Recliner Motor Connector End View (C3189)

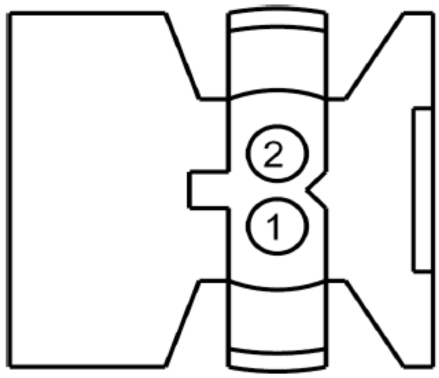
Connector: C3190	Description:	Harness:	Base Part #:
	SEAT CONTROL SWITCH, PASSENGER SIDE FRONT	14A698	14A701



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPS36 (YE-GY)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER REAR HEIGHT DOWN	
2	CPS34 (GY-BU)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER FRONT HEIGHT DOWN	
3	GD139 (BK-YE)	12	GROUND - PILLAR A RIGHT # 2ND STUD	
4	CPS33 (WH)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER FORWARD	
5	SBB31 (WH-RD)	12	FUSE - 31 OR CIRCUIT BREAKER	
6	CPS35 (VT-GN)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER FRONT HEIGHT UP	
7	CPS20 (VT)	12	SWITCH - FRONT PASSENGER LUMBAR PUMP	
8	CPS40 (VT-GY)	12	SWITCH - SEAT ADJUST. FRONT PASSENGER RECLINE REARWARD	
9	CPS38 (GN-BU)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER REARWARD	
10	CPS21 (WH-OG)	12	SWITCH - FRONT PASSENGER LUMBAR RELEASE	
11	CPS39 (GY-YE)	12	SWITCH - SEAT ADJUST. FRONT PASSENGER RECLINE FORWARD	
12	CPS37 (WH-BU)	14	SWITCH - SEAT ADJUST. FRONT PASSENGER REAR HEIGHT UP	

Fig. 328: Passenger Side Front Seat Control Switch Connector End View (C3190)

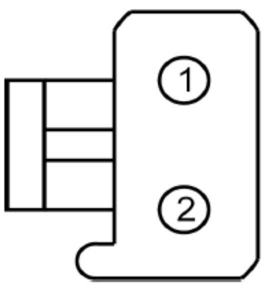
Connector: C3202	Description:	Harness:	Base Part #:
	PASSENGER SAFETY BELT RETRACTOR PRETENSIONER	14A005	611B08



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR121 (GY-VT)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT MIDDLE FEED	
2	RR121 (VT)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT MIDDLE RTN	

Fig. 329: Passenger Safety Belt Retractor Pretensioner Connector End View (C3202)

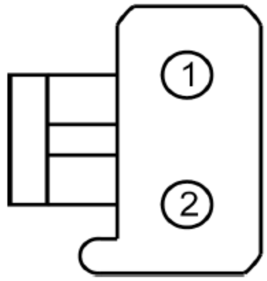
Connector: C3215	Description:	Harness:	Base Part #:
	LUMBAR MOTOR, DRIVER SEAT	14C693	65500



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPS18 (BN-GN)	20	SWITCH - DRIVER LUMBAR PUMP	
2	CPS19 (GY-VT)	20	SWITCH - DRIVER LUMBAR RELEASE	

Fig. 330: Driver Seat Lumbar Motor Connector End View (C3215)

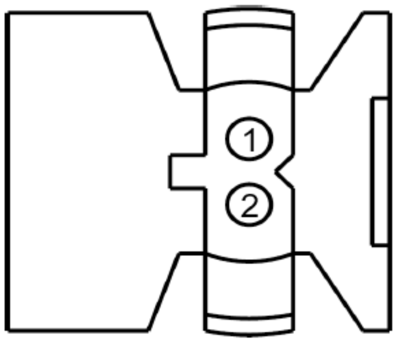
Connector: C3216	Description:	Harness:	Base Part #:
	LUMBAR MOTOR, PASSENGER SEAT	14C691	65500



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPS20 (VT)	12	SWITCH - FRONT PASSENGER LUMBAR PUMP	
2	CPS21 (WH-OG)	12	SWITCH - FRONT PASSENGER LUMBAR RELEASE	

Fig. 331: Passenger Seat Lumbar Motor Connector End View (C3216)

Connector: C3226	Description:	Harness:	Base Part #:
	SIDE THORAX AIR BAG MODULE, DRIVER	14K155	611D11

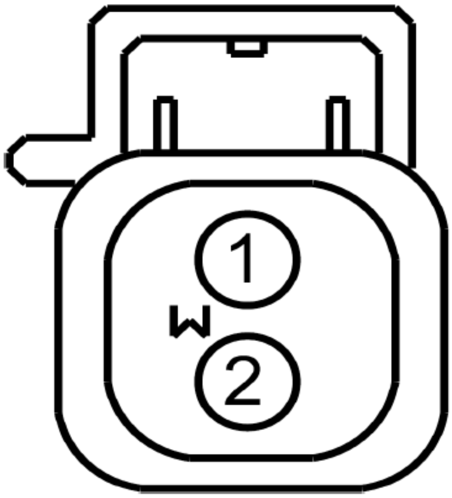


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR106 (VT-GY)	20	CTRL MOD. - AIR BAG SIDE SEAT MOUNTED FRONT PASSENGER SIDE OUTBOARD FEED	
2	RR106 (YE-OG)	20	CTRL MOD. - AIR BAG SIDE SEAT MOUNTED FRONT PASSENGER SIDE OUTBOARD RTN	

Fig. 332: Driver Side Thorax Airbag Module Connector End View (C3226)

Connector: C3227

Description:	Harness:	Base Part #:
SIDE THORAX AIR BAG MODULE, PASSENGER	14K155	611D11

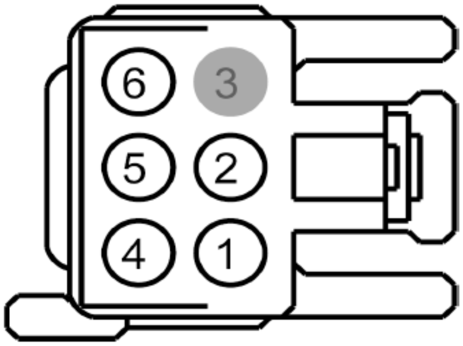


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR106 (VT-GY)	20	CTRL MOD. - AIR BAG SIDE SEAT MOUNTED FRONT PASSENGER SIDE OUTBOARD FEED	
2	RR106 (YE-OG)	20	CTRL MOD. - AIR BAG SIDE SEAT MOUNTED FRONT PASSENGER SIDE OUTBOARD RTN	

Fig. 333: Passenger Side Thorax Airbag Module Connector End View (C3227)

Connector: C3233

Description:	Harness:	Base Part #:
FLOOR SHIFTER	14401	PIA

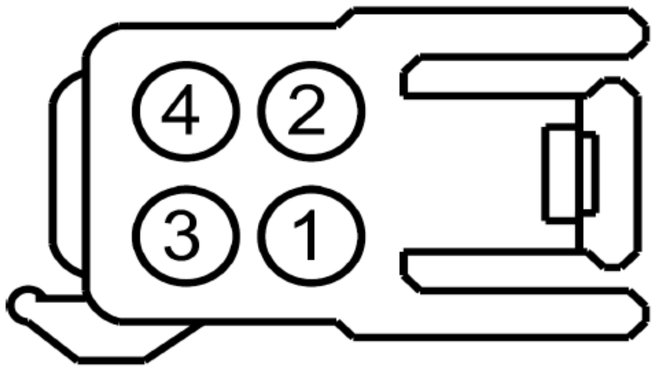


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VET13 (GY-BU)	18	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL HIGH SIDE PWM 1 (PC-H) [DPC]	
2	CET22 (GY-BN)	20	CTRL MOD. - POWERTRAIN # TRANSMISSION RANGE OUTPUT PARK (TRO-P)	
3	*	*	not used	
4	VLN04 (VT-GY)	22	CTRL MOD. - IP/SWITCH ILLUMINATION	
5	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	
6	CET34 (BN-GN)	20	SWITCH - TRANSMISSION CONTROL / OVERDRIVE CANCEL (TCS)	

Fig. 334: Floor Shifter Connector End View (C3233)

Connector: C3245

Description:	Harness:	Base Part #:
FLOOR SHIFTER	14401	7K004

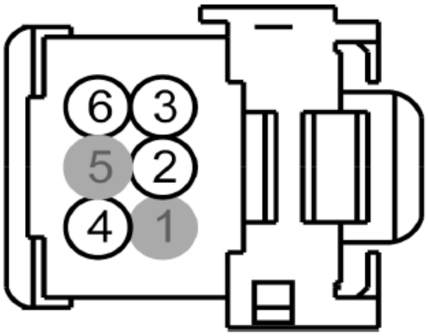


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VET13 (GY-BU)	18	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL HIGH SIDE PWM 1 (PC-H) [DPC]	
2	CET22 (GY-BN)	20	CTRL MOD. - POWERTRAIN # TRANSMISSION RANGE OUTPUT PARK (TRO-P)	
3	CLN04 (BU-BN)	20	CTRL MOD. - IP/SWITCH ILLUMINATION	
4	GD116 (BK-VT)	20	GROUND - CROSS CAR BEAM # 3RD STUD	

Fig. 335: Floor Shifter Connector End View (C3245)

Connector: C3250

Description:	Harness:	Base Part #:
AMBIENT LIGHTING SWITCH	13B239	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	CBX07 (GN-RD)	22	FUSE - 12 OR CIRCUIT BREAKER	
3	VLN04 (VT-GY)	22	CTRL MOD. - IP/SWITCH ILLUMINATION	
4	GD908 (BK)	22	GROUND - CROSS CAR BEAM # 3RD STUD	
5	*	*	not used	
6	CLN54 (BN-YE)	22	CTRL MOD. - AMBIENT LIGHTING SIGNAL	

Fig. 336: Ambient Lighting Switch Connector End View (C3250)

Connector: C3251	Description:	Harness:	Base Part #:
	AMBIENT LIGHTING MODULE	13B239	PIA

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBX07 (GN-RD)	22	FUSE - 12 OR CIRCUIT BREAKER	
2	CLN54 (BN-YE)	22	CTRL MOD. - AMBIENT LIGHTING SIGNAL	
3	*	*	not used	
4	RLN44 (BN)	22	CTRL MOD. - AMBIENT LIGHTING RTN	
5	CLN45 (GN)	22	CTRL MOD. - AMBIENT LIGHTING (GRN) FEED	
6	CLN46 (BU)	22	CTRL MOD. - AMBIENT LIGHTING (BLU) FEED	
7	CLN44 (OG)	22	CTRL MOD. - AMBIENT LIGHTING (RED) FEED	
8	GD908 (BK)	22	GROUND - CROSS CAR BEAM # 3RD STUD	

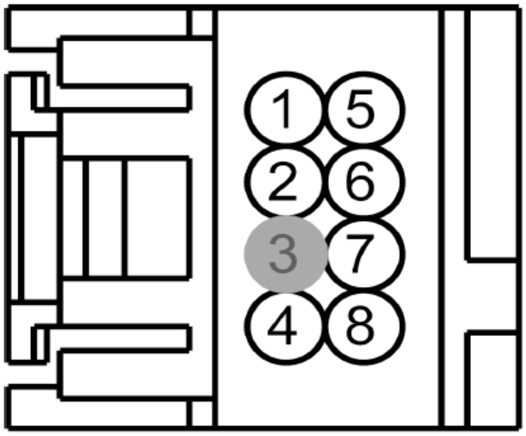


Fig. 337: Ambient Lighting Module Connector End View (C3251)

Connector: C3253	Description:	Harness:	Base Part #:
	4X4 CONTROL MODULE	14A005	7H417

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	*	*	not used	
4	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
5	CBP19 (BN-WH)	20	FUSE - 28 OR CIRCUIT BREAKER	
6	SBP15 (WH-RD)	20	FUSE - 20 OR CIRCUIT BREAKER	
7	*	*	not used	
8	CCF21 (VT-WH)	20	CTRL MOD. - POWERTRAIN # FOUR WHEEL DRIVE INTELLIGENT TORQUE CONTROL COUPLING SOLENOID +	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
13	*	*	not used	
14	*	*	not used	
15	GD126 (BK-WH)	20	GROUND - FLOOR CROSS MEMBER REAR LEFT	
16	RCF21 (WH-VT)	20	CTRL MOD. - POWERTRAIN # FOUR WHEEL DRIVE INTELLIGENT TORQUE CONTROL COUPLING SOLENOID -	

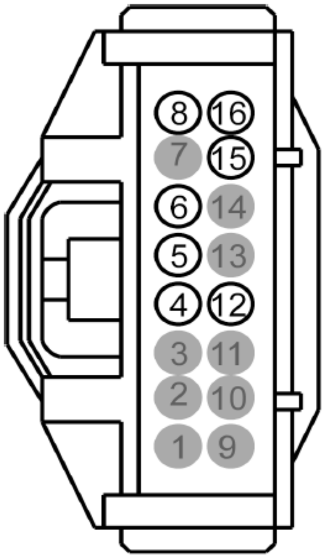
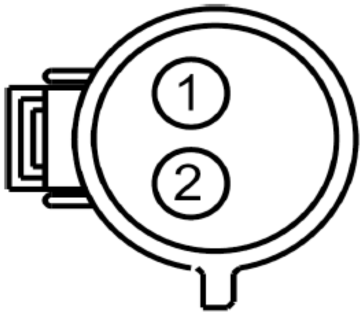


Fig. 338: Four Wheel Drive Control Module Connector End View (C3253)

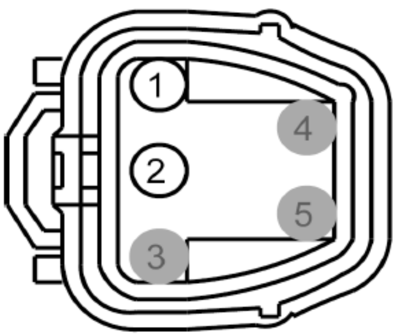
Connector: C3254	Description:	Harness:	Base Part #:
	ACTIVE TORQUE CONTROL COUPLING SOLENOID	14A107	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCF21 (VT-WH)	20	CTRL MOD. - POWERTRAIN # FOUR WHEEL DRIVE INTELLIGENT TORQUE CONTROL COUPLING SOLENOID +	
2	RCF21 (WH-VT)	20	CTRL MOD. - POWERTRAIN # FOUR WHEEL DRIVE INTELLIGENT TORQUE CONTROL COUPLING SOLENOID -	

Fig. 339: Active Torque Control Coupling Solenoid Connector End View (C3254)

Connector: C3270	Description:	Harness:	Base Part #:
	SECONDARY FUEL SENDER	14A005	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RMC33 (WH-VT)	20	CTRL MOD. - SENSOR FUEL LEVEL 2	
2	VMC23 (GN-OG)	20	SENSOR - FUEL LEVEL 2 (FLI)	
3	*	*	not used	
4	*	*	not used	
5	*	*	not used	

Fig. 340: Secondary Fuel Sender Connector End View (C3270)

Connector: C3293	Description:	Harness:	Base Part #:
	RAIL SENSOR, RH SIDE	14A698	61708

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RR141 (VT-BN)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR RIGHT (#2) RTN	
2	VR211 (WH-BN)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT RIGHT (#1) FEED	

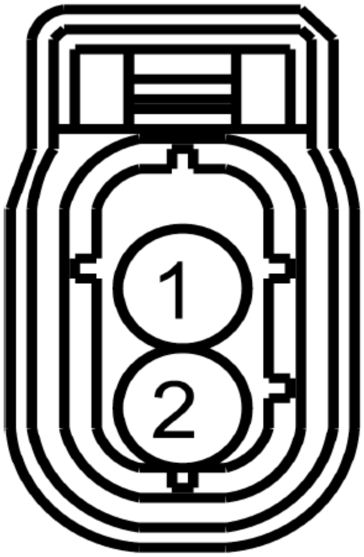


Fig. 341: Right Side Rail Sensor Connector End View (C3293)

Connector: C3294	Description:	Harness:	Base Part #:
	RAIL SENSOR, LH SIDE	14A698	61709

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RR140 (GN-OG)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR LEFT (#1) RTN	
2	VR212 (YE-GN)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT LEFT (#2) FEED	

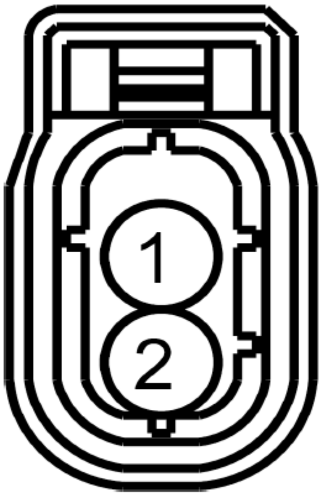
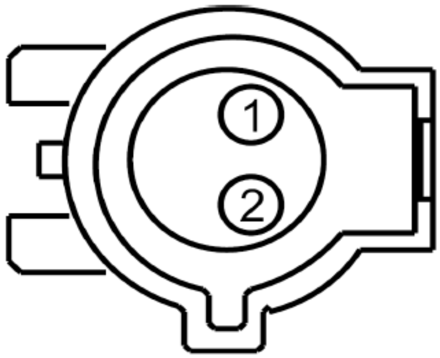


Fig. 342: Left Side Rail Sensor Connector End View (C3294)

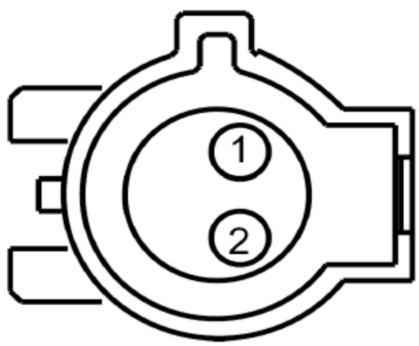
Connector: C3295	Description:	Harness:	Base Part #:
	SAFETY BELT BUCKLE SWITCH, PASSENGER	14A698	61202



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD127 (BK-BU)	20	GROUND - FLOOR CROSS MEMBER REAR RIGHT	
2	CR203 (GY-VT)	20	SENSOR - SEAT BELT BUCKLE (SEAT BELT REMINDER) FRONT PASSENGER OUTBOARD	

Fig. 343: Passenger Safety Belt Buckle Switch Connector End View (C3295)

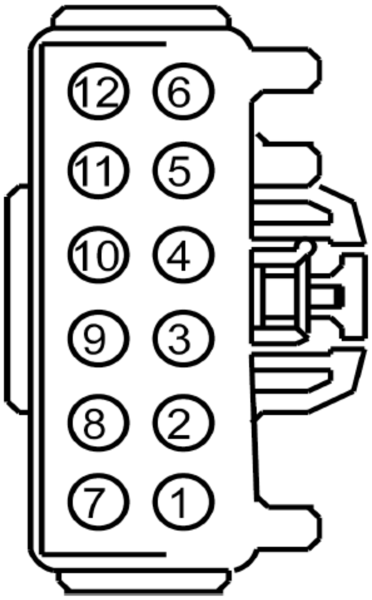
Connector: C3296	Description:	Harness:	Base Part #:
	SAFETY BELT BUCKLE SWITCH, DRIVER	14A699	61203



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD127 (BK-BU)	20	GROUND - FLOOR CROSS MEMBER REAR RIGHT	
2	CR201 (BU-OG)	20	SENSOR - SEAT BELT BUCKLE (SEAT BELT REMINDER) FRONT DRIVER SIDE	EARLY
2	CR201 (GN-BU)	20	SENSOR - SEAT BELT BUCKLE (SEAT BELT REMINDER) FRONT DRIVER SIDE	LATE

Fig. 344: Driver Safety Belt Buckle Switch Connector End View (C3296)

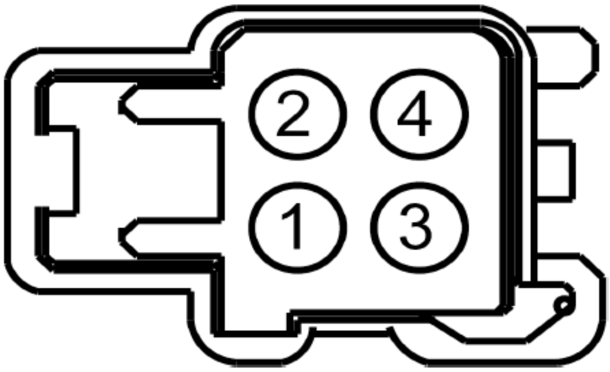
Connector: C3297	Description:	Harness:	Base Part #:
	SEAT ADJUST SWITCH, DRIVER SIDE FRONT	14A699	14A701



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPS05 (BU-WH)	20	CTRL MOD. - DRIVER SEAT REAR HEIGHT UP	
2	CPS03 (VT-GY)	20	CTRL MOD. - DRIVER SEAT FRONT HEIGHT UP	
3	GD126 (BK-WH)	20	GROUND - FLOOR CROSS MEMBER REAR LEFT	
4	CPS01 (GN-BU)	20	CTRL MOD. - DRIVER SEAT FORWARD	
5	SBB15 (WH-RD)	20	FUSE - 15 OR CIRCUIT BREAKER	
6	CPS02 (GY-YE)	20	CTRL MOD. - DRIVER SEAT FRONT HEIGHT DOWN	
7	CPS18 (BN-GN)	20	SWITCH - DRIVER LUMBAR PUMP	
8	CPS08 (VT-OG)	20	CTRL MOD. - DRIVER SEAT RECLINE REARWARD	
9	CPS06 (GN-WH)	20	CTRL MOD. - DRIVER SEAT REARWARD	
10	CPS19 (GY-VT)	20	SWITCH - DRIVER LUMBAR RELEASE	
11	CPS07 (GY-BN)	20	CTRL MOD. - DRIVER SEAT RECLINE FORWARD	
12	CPS04 (YE-OG)	20	CTRL MOD. - DRIVER SEAT REAR HEIGHT DOWN	

Fig. 345: Driver Side Front Seat Adjust Switch Connector End View (C3297)

Connector: C3298	Description:	Harness:	Base Part #:
	SEAT CUSHION HEATER MAT, LEFT FRONT	14A699	14D696



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CHS02 (YE-BU)	16	CTRL MOD. - HOT/COLD SEAT # DRIVER CUSHION HEATER	
2	CHS11 (VT-GN)	16	HEATER - DRIVER CUSHION / BACK	
3	VHS26 (VT)	20	SENSOR - CUSHION TEMP. DRIVER	
4	RHS05 (YE-VT)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER SENSOR CUSHION TEMP.	

Fig. 346: Left Front Seat Cushion Heater Mat Connector End View (C3298)

Connector: C3299A	Description:	Harness:	Base Part #:
	DRIVER SEAT MODULE (DSM)	14A699	13C789

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD126 (BK-WH)	12	GROUND - FLOOR CROSS MEMBER REAR LEFT	
2	SBB32 (VT-RD)	12	FUSE - 32 OR CIRCUIT BREAKER	

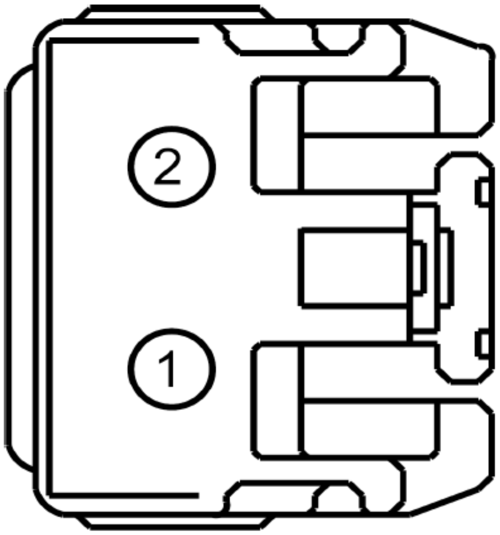


Fig. 347: Driver Seat Module Connector End View (C3299A)

Connector: C3299B	Description:	Harness:	Base Part #:
	DRIVER SEAT MODULE (DSM)	14A699	13C789

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	CPS02 (GY-YE)	20	CTRL MOD. - DRIVER SEAT FRONT HEIGHT DOWN	
3	CPS01 (GN-BU)	20	CTRL MOD. - DRIVER SEAT FORWARD	
4	CPS04 (YE-OG)	20	CTRL MOD. - DRIVER SEAT REAR HEIGHT DOWN	
5	CPS08 (VT-OG)	20	CTRL MOD. - DRIVER SEAT RECLINE REARWARD	
6	LPS12 (VT-RD)	20	CTRL MOD. - DRIVER SEAT SENSOR RECLINE	
7	VPS10 (BU-GN)	20	SENSOR - DRIVER SEAT FRONT TILT	
8	CPS27 (BU-BN)	16	SWITCH - SEAT ADJUST. DRIVER REAR HEIGHT UP	
9	CPS25 (WH-VT)	16	SWITCH - SEAT ADJUST. DRIVER FRONT HEIGHT UP	
10	CPS23 (GN-VT)	16	SWITCH - SEAT ADJUST. DRIVER REARWARD	
11	CPS29 (WH-BN)	16	SWITCH - SEAT ADJUST. DRIVER RECLINE FORWARD	
12	CPS22 (BN)	16	SWITCH - SEAT ADJUST. DRIVER FORWARD	
13	*	*	not used	
14	CPS03 (VT-GY)	20	CTRL MOD. - DRIVER SEAT FRONT HEIGHT UP	
15	CPS06 (GN-WH)	20	CTRL MOD. - DRIVER SEAT REARWARD	
16	CPS05 (BU-WH)	20	CTRL MOD. - DRIVER SEAT REAR HEIGHT UP	
17	CPS07 (GY-BN)	20	CTRL MOD. - DRIVER SEAT RECLINE FORWARD	
18	VPS11 (GN-BN)	20	SENSOR - DRIVER SEAT REAR TILT	
19	VPS09 (BN-BU)	20	SENSOR - DRIVER SEAT HORIZONTAL (FORWARD/REARWARD)	
20	RPS13 (GN-OG)	20	CTRL MOD. - DRIVER SEAT SENSORS POSITION	
21	CPS30 (VT-BN)	16	SWITCH - SEAT ADJUST. DRIVER RECLINE REARWARD	
22	CPS26 (YE-BU)	16	SWITCH - SEAT ADJUST. DRIVER REAR HEIGHT DOWN	
23	CPS24 (GY)	16	SWITCH - SEAT ADJUST. DRIVER FRONT HEIGHT DOWN	
24	*	*	not used	

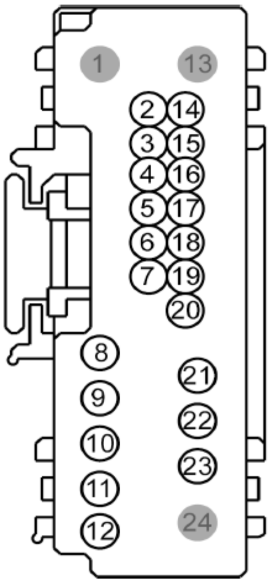
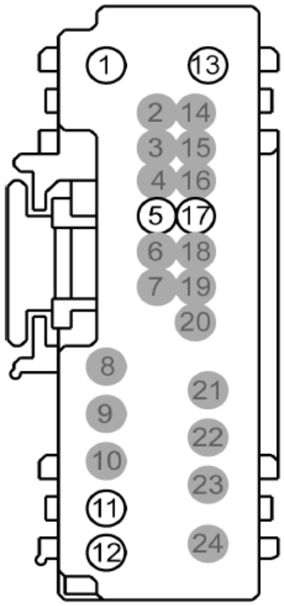


Fig. 348: Driver Seat Module Connector End View (C3299B)

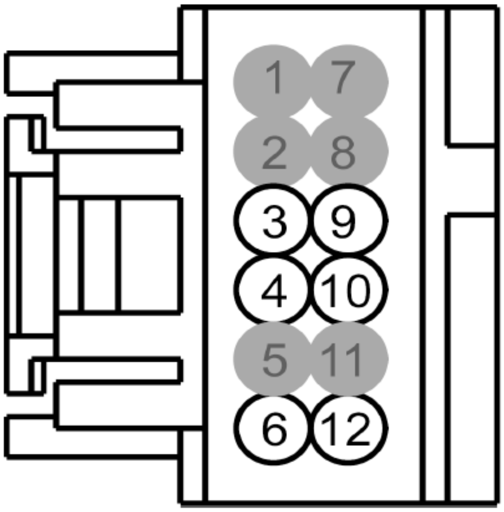
Connector: C3299C	Description:	Harness:	Base Part #:
	DRIVER SEAT MODULE (DSM)	14A699	13C789



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB15 (WH-RD)	20	FUSE - 15 OR CIRCUIT BREAKER	
2	*	*	not used	
3	*	*	not used	
4	*	*	not used	
5	LPM30 (GY-VT)	20	CTRL MOD. - SENSORS MIRROR POSITION (LEFT)	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH	
12	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW	
13	GD126 (BK-WH)	20	GROUND - FLOOR CROSS MEMBER REAR LEFT	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	RPM30 (YE)	20	CTRL MOD. - SENSORS MIRROR POSITION (LEFT)	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	*	*	not used	
22	*	*	not used	
23	*	*	not used	
24	*	*	not used	

Fig. 349: Driver Seat Module Connector End View (C3299C)

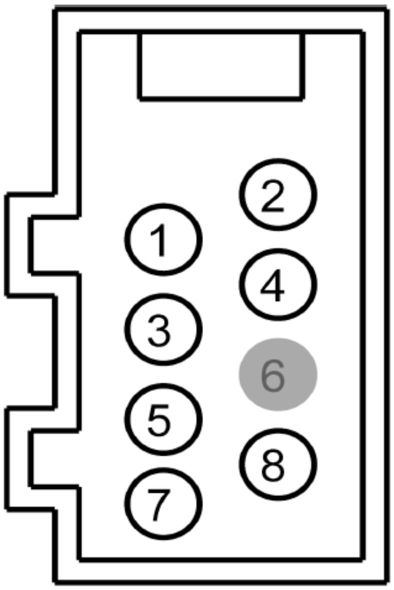
Connector: C3299D	Description:	Harness:	Base Part #:
	DRIVER SEAT MODULE (DSM)	14A699	13C789



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CPM34 (WH-BN)	20	CTRL MOD. - RIGHT MIRROR UP	
4	CPM31 (YE-GY)	20	CTRL MOD. - RIGHT MIRROR DOWN	
5	*	*	not used	
6	VPM37 (BU-OG)	20	SENSOR - RIGHT MIRROR POSITION # HORIZONTAL	
7	*	*	not used	
8	*	*	not used	
9	CPM33 (WH-VT)	20	CTRL MOD. - RIGHT MIRROR RIGHT	
10	CPM32 (WH-BU)	20	CTRL MOD. - RIGHT MIRROR LEFT	
11	*	*	not used	
12	VPM38 (BN-GN)	20	SENSOR - RIGHT MIRROR POSITION # VERTICAL	

Fig. 350: Driver Seat Module Connector End View (C3299D)

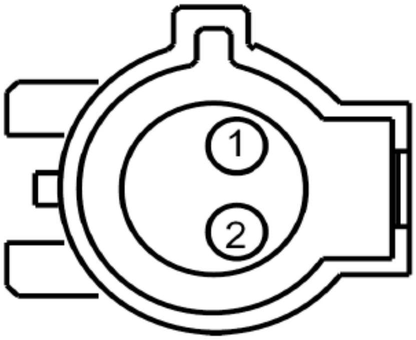
Connector: C3300	Description:	Harness:	Base Part #:
	SEAT CUSHION HEATER MAT, LEFT FRONT	14A699	14D696



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CHS02 (YE-BU)	16	CTRL MOD. - HOT/COLD SEAT# DRIVER CUSHION HEATER	
2	CHS03 (GN-BN)	20	CTRL MOD. - HOT/COLD SEAT# DRIVER FAN	
3	RHS02 (BU-OG)	16	CTRL MOD. - HOT/COLD SEAT# DRIVER CUSHION HEATER	
4	RHS03 (GY-OG)	20	CTRL MOD. - HOT/COLD SEAT# DRIVER FAN	
5	VHS26 (VT)	20	SENSOR - CUSHION TEMP. DRIVER	
6	*	*	not used	
7	VHS18 (BN-GN)	20	CTRL MOD. - HOT/COLD SEAT# DRIVER CUSHION BLOWER SPEED CONTROL	
8	RHS05 (YE-VT)	20	CTRL MOD. - HOT/COLD SEAT# DRIVER SENSOR CUSHION TEMP.	

Fig. 351: Left Front Seat Cushion Heater Mat Connector End View (C3300)

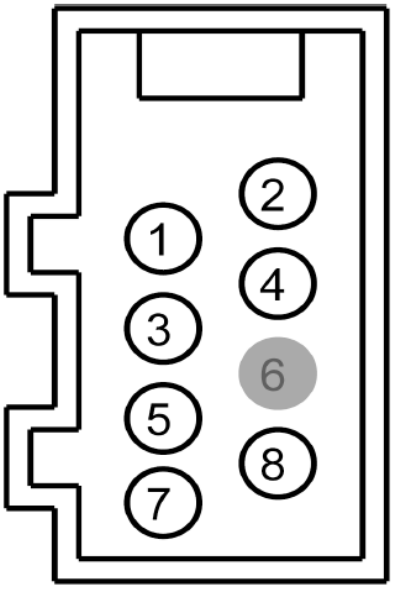
Connector: C3301	Description:	Harness:	Base Part #:
	SAFETY BELT BUCKLE SWITCH, PASSENGER	14A698	61202



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD127 (BK-BU)	20	GROUND - FLOOR CROSS MEMBER REAR RIGHT	
2	CR203 (GY-VT)	20	SENSOR - SEAT BELT BUCKLE (SEAT BELT REMINDER) FRONT PASSENGER OUTBOARD	

Fig. 352: Passenger Safety Belt Buckle Switch Connector End View (C3301)

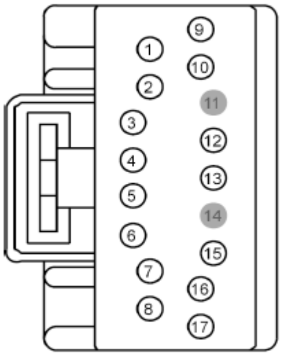
Connector: C3303	Description:	Harness:	Base Part #:
	SEAT CUSHION HEATER MAT, RIGHT FRONT	14A698	14D698



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CHS07 (GY-BU)	18	CTRL MOD. - HOT/COLD SEAT # PASSENGER CUSHION HEATER	
2	CHS08 (BN-YE)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER FAN	
3	RHS07 (BU)	18	CTRL MOD. - HOT/COLD SEAT # PASSENGER CUSHION HEATER	
4	RHS08 (VT-WH)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER FAN	
5	VHS27 (WH-OG)	20	SENSOR - CUSHION TEMP. PASSENGER	
6	*	*	not used	
7	VHS23 (BN-BU)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER CUSHION BLOWER SPEED CONTROL	
8	RHS10 (BU-OG)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER SENSOR CUSHION TEMP.	

Fig. 353: Right Front Seat Cushion Heater Mat Connector End View (C3303)

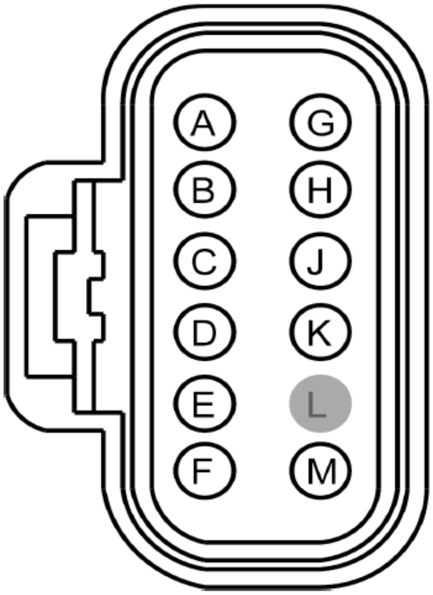
Connector: C3304	Description:	Harness:	Base Part #:
	HEATED SEAT MODULE	14A698	14C724



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB11 (BU-RD)	16	FUSE - 11 OR CIRCUIT BREAKER	
2	CBP19 (BN-WH)	20	FUSE - 28 OR CIRCUIT BREAKER	
3	CHS09 (GY)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER INDICATOR LOW	
4	CHS13 (VT-BN)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER INDICATOR HIGH	
5	CHS04 (YE-GY)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER INDICATOR LOW	
6	CHS14 (GN)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER INDICATOR HIGH	
7	GD139 (BK-YE)	16	GROUND - PILLAR A RIGHT # 2ND STUD	
8	CHS07 (GY-BU)	18	CTRL MOD. - HOT/COLD SEAT # PASSENGER CUSHION HEATER	
9	CHS02 (YE-BU)	16	CTRL MOD. - HOT/COLD SEAT # DRIVER CUSHION HEATER	
10	VHS26 (VT)	20	SENSOR - CUSHION TEMP. DRIVER	
11	*	*	not used	
12	CHS29 (WH-BU)	20	SWITCH - SEAT HEATER FRONT DRIVER SIDE	
13	RHS05 (YE-VT)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER SENSOR CUSHION TEMP.	
14	*	*	not used	
15	CHS30 (GY-YE)	20	SWITCH - SEAT HEATER FRONT PASSENGER SIDE	
16	VHS27 (WH-OG)	20	SENSOR - CUSHION TEMP. PASSENGER	
17	SBB11 (BU-RD)	16	FUSE - 11 OR CIRCUIT BREAKER	

Fig. 354: Heated Seat Module Connector End View (C3304)

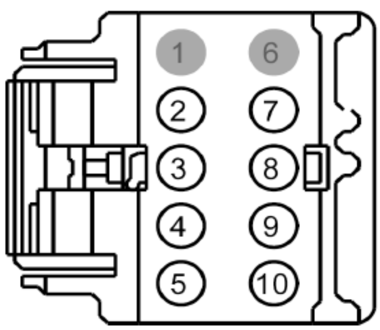
Connector: C3305A	Description:	Harness:	Base Part #:
	DUAL CLIMATE CONTROLLED SEAT MODULE (DCSM)	14A698	14C724



Pin	Circuit	Gauge	Circuit Function	Qualifier
A	CHS07 (GY-BU)	18	CTRL MOD. - HOT/COLD SEAT # PASSENGER CUSHION HEATER	
B	RHS07 (BU)	18	CTRL MOD. - HOT/COLD SEAT # PASSENGER CUSHION HEATER	
C	CHS06 (BU-BN)	18	CTRL MOD. - HOT/COLD SEAT # PASSENGER BACK HEATER	
D	RHS06 (WH)	18	CTRL MOD. - HOT/COLD SEAT # PASSENGER BACK HEATER	
E	SBB11 (BU-RD)	12	FUSE - 11 OR CIRCUIT BREAKER	
F	SBB12 (GN-RD)	12	FUSE - 12 OR CIRCUIT BREAKER	
G	CHS02 (YE-BU)	16	CTRL MOD. - HOT/COLD SEAT # DRIVER CUSHION HEATER	
H	RHS02 (BU-OG)	16	CTRL MOD. - HOT/COLD SEAT # DRIVER CUSHION HEATER	
J	CHS01 (GY-VT)	16	CTRL MOD. - HOT/COLD SEAT # DRIVER BACK HEATER	
K	RHS01 (WH-VT)	16	CTRL MOD. - HOT/COLD SEAT # DRIVER BACK HEATER	
L	*	*	not used	
M	GD139 (BK-YE)	14	GROUND - PILLAR A RIGHT # 2ND STUD	

Fig. 355: Dual Climate Controlled Seat Module Connector End View (C3305A)

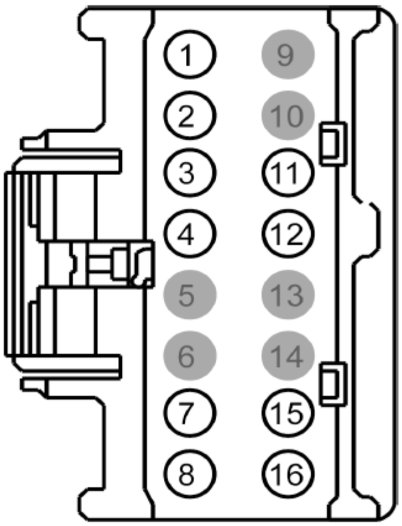
Connector: C3305B	Description:	Harness:	Base Part #:
	DUAL CLIMATE CONTROLLED SEAT MODULE (DCSM)	14A698	14C724



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	VHS27 (WH-OG)	20	SENSOR - CUSHION TEMP. PASSENGER	
3	RHS10 (BU-OG)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER SENSOR CUSHION TEMP.	
4	VHS36 (YE-BU)	20	SENSOR - BACK TEMP. PASSENGER	
5	RHS20 (GN-BU)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER SENSOR BACK TEMP.	
6	*	*	not used	
7	VHS26 (VT)	20	SENSOR - CUSHION TEMP. DRIVER	
8	RHS05 (YE-VT)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER SENSOR CUSHION TEMP.	
9	VHS35 (VT-OG)	20	SENSOR - BACK TEMP. DRIVER	
10	RHS15 (GY-BN)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER SENSOR BACK TEMP.	

Fig. 356: Dual Climate Controlled Seat Module Connector End View (C3305B)

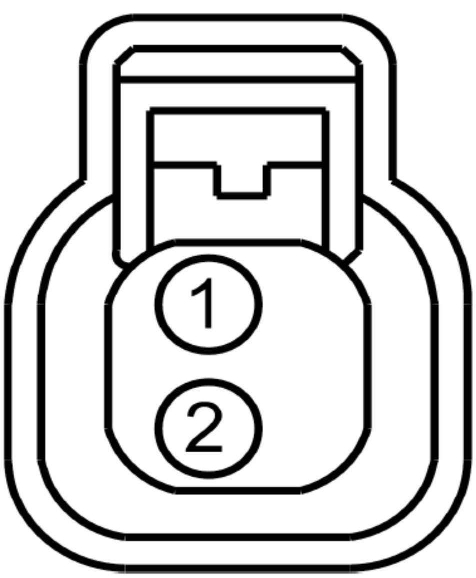
Connector: C3305C	Description:	Harness:	Base Part #:
	DUAL CLIMATE CONTROLLED SEAT MODULE (DCSM)	14A698	14C724



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH	
2	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW	
3	VHS23 (BN-BU)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER CUSHION BLOWER SPEED CONTROL	
4	VHS21 (BU-WH)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER BACK BLOWER SPEED CONTROL	
5	*	*	not used	
6	*	*	not used	
7	RHS08 (VT-WH)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER FAN	
8	CHS08 (BN-YE)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER FAN	
9	*	*	not used	
10	*	*	not used	
11	VHS18 (BN-GN)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER CUSHION BLOWER SPEED CONTROL	
12	VHS16 (BU-GN)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER BACK BLOWER SPEED CONTROL	
13	*	*	not used	
14	*	*	not used	
15	RHS03 (GY-OG)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER FAN	
16	CHS03 (GN-BN)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER FAN	

Fig. 357: Dual Climate Controlled Seat Module Connector End View (C3305C)

Connector: C3306	Description:	Harness:	Base Part #:
	THX SPEAKER, REAR CENTER	19A041	18808



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME30 (GN-BN)	18	CTRL MOD. - AUDIO # SPEAKER CENTER REAR +	
2	RME30 (VT-BN)	18	CTRL MOD. - AUDIO # SPEAKER CENTER REAR -	

Fig. 358: Rear Center THX Speaker Connector End View (C3306)

Connector: C3307	Description:	Harness:	Base Part #:
	THX SUBWOOFER SPEAKER, LEFT	19A041	18808

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME01 (GN-VT)	18	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER LEFT REAR +	
2	RME01 (GY)	18	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER LEFT REAR -	

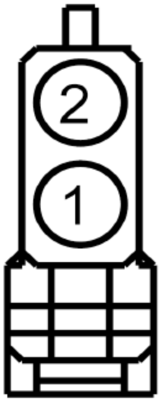


Fig. 359: Left THX Subwoofer Speaker Connector End View (C3307)

Connector: C3308	Description:	Harness:	Base Part #:
	THX SUBWOOFER SPEAKER, RIGHT	19A041	18808

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME02 (VT)	18	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER RIGHT REAR +	
2	RME02 (YE)	18	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER RIGHT REAR -	

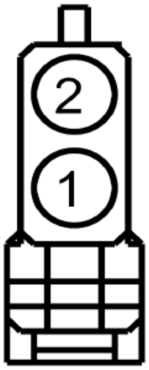
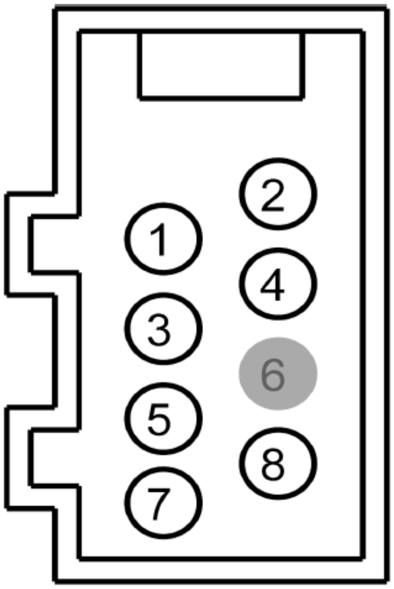


Fig. 360: Right THX Subwoofer Speaker Connector End View (C3308)

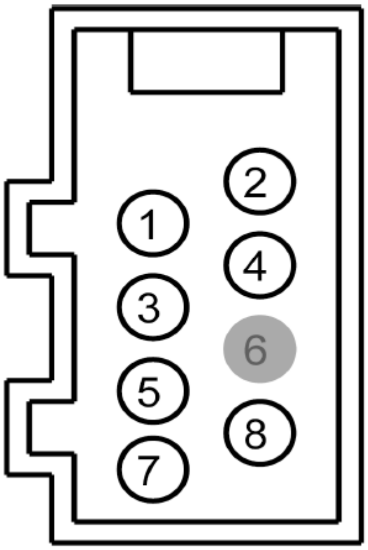
Connector: C3310	Description:	Harness:	Base Part #:
	SEAT BACKREST HEATER MAT, LEFT FRONT	14C693	14D696



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CHS01 (GY-VT)	16	CTRL MOD. - HOT/COLD SEAT # DRIVER BACK HEATER	
2	CHS03 (GN-BN)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER FAN	
3	RHS01 (VT-BK)	16	CTRL MOD. - HOT/COLD SEAT # DRIVER BACK HEATER	
4	RHS03 (GY-OG)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER FAN	
5	VHS35 (VT-OG)	20	SENSOR - BACK TEMP. DRIVER	
6	*	*	not used	
7	VHS16 (BU-GN)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER BACK BLOWER SPEED CONTROL	
8	RHS15 (GY-BN)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER SENSOR BACK TEMP.	

Fig. 361: Left Front Seat Backrest Heater Mat Connector End View (C3310)

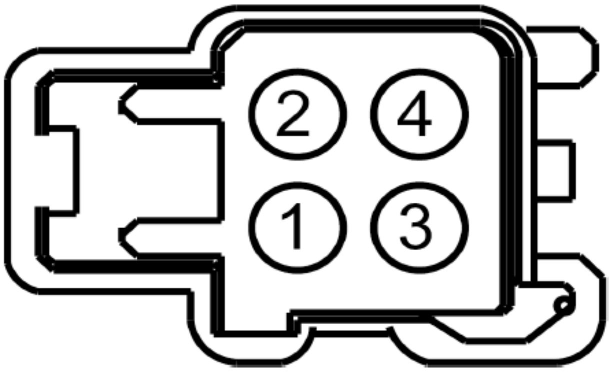
Connector: C3311	Description:	Harness:	Base Part #:
	SEAT BACKREST HEATER MAT, RIGHT FRONT	14C691	14D696



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CHS06 (BU-BN)	18	CTRL MOD. - HOT/COLD SEAT # PASSENGER BACK HEATER	
2	CHS08 (GY_RD)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER FAN	
3	RHS06 (GN-BK)	18	CTRL MOD. - HOT/COLD SEAT # PASSENGER BACK HEATER	
4	RHS08 (VT-WH)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER FAN	
5	VHS36 (YE-BU)	20	SENSOR - BACK TEMP. PASSENGER	
6	*	*	not used	
7	VHS21 (BU-WH)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER BACK BLOWER SPEED CONTROL	
8	RHS20 (GN-BU)	20	CTRL MOD. - HOT/COLD SEAT # PASSENGER SENSOR BACK TEMP.	

Fig. 362: Right Front Seat Backrest Heater Mat Connector End View (C3311)

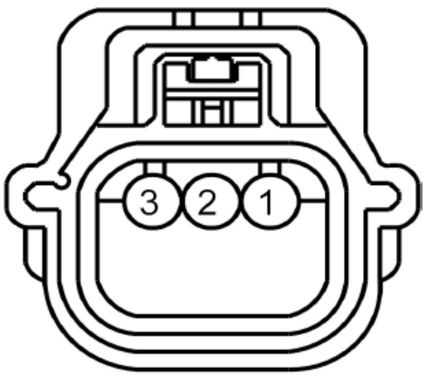
Connector: C3320	Description:	Harness:	Base Part #:
	SEAT CUSHION HEATER MAT, RIGHT FRONT	14A698	14D696



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CHS07 (GY-BU)	18	CTRL MOD. - HOT/COLD SEAT # PASSENGER CUSHION HEATER	
2	CHS12 (YE-GN)	18	HEATER - PASSENGER CUSHION / BACK	
3	VHS27 (WH-OG)	20	SENSOR - CUSHION TEMP. PASSENGER	
4	RHS05 (YE-VT)	20	CTRL MOD. - HOT/COLD SEAT # DRIVER SENSOR CUSHION TEMP.	

Fig. 363: Right Front Seat Cushion Heater Mat Connector End View (C3320)

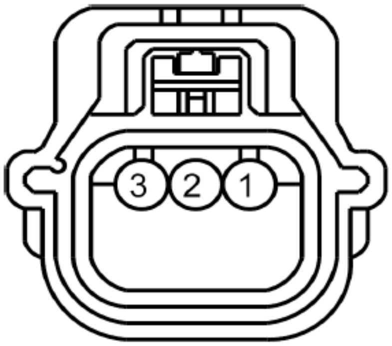
Connector: C3324	Description:	Harness:	Base Part #:
	OCCUPANT CLASSIFICATION SENSOR (OCS) 1	14A577	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR140 (VT-BN)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR RIGHT (#1) FEED	
2	RR140 (GN-OG)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT RIGHT (#1) RTN	
3	VR211 (WH-BN)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT RIGHT (#1) SIG	

Fig. 364: Occupant Classification Sensor 1 Connector End View (C3324)

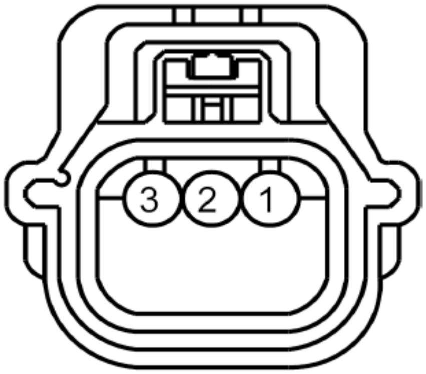
Connector: C3325	Description:	Harness:	Base Part #:
	OCCUPANT CLASSIFICATION SENSOR (OCS) 2	14A577	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR141 (BN-YE)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR RIGHT (#2) FEED	
2	RR141 (VT-BN)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT RIGHT (#2) RTN	
3	VR212 (YE-GN)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT RIGHT (#2) SIG	

Fig. 365: Occupant Classification Sensor 2 Connector End View (C3325)

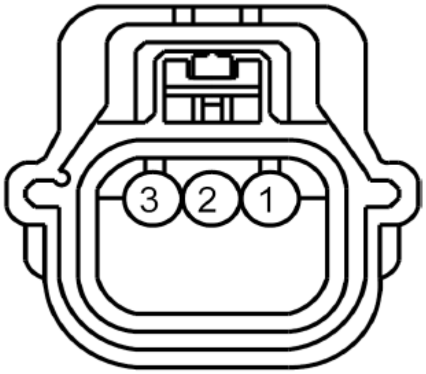
Connector: C3330	Description:	Harness:	Base Part #:
	OCCUPANT CLASSIFICATION SENSOR (OCS) 3	14A578	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR153 (GN-WH)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR LEFT (#1) FEED	
2	RR153 (GY-BU)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT LEFT (#1) RTN	
3	VR226 (YE-GY)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT LEFT (#1) SIG	

Fig. 366: Occupant Classification Sensor 3 Connector End View (C3330)

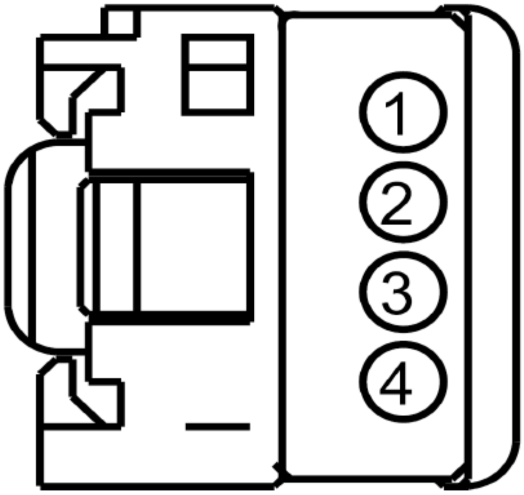
Connector: C3331	Description:	Harness:	Base Part #:
	OCCUPANT CLASSIFICATION SENSOR (OCS) 4	14A578	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR154 (VT-OG)	20	CTRL MOD. - OCCUPANT CLASSIFICATION WEIGHT SENSOR LEFT (#2) FEED	
2	RR154 (VT-WH)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT LEFT (#2) RTN	
3	VR227 (VT-GN)	20	SENSOR - OCCUPANT CLASSIFICATION WEIGHT LEFT (#2) SIG	

Fig. 367: Occupant Classification Sensor 4 Connector End View (C3331)

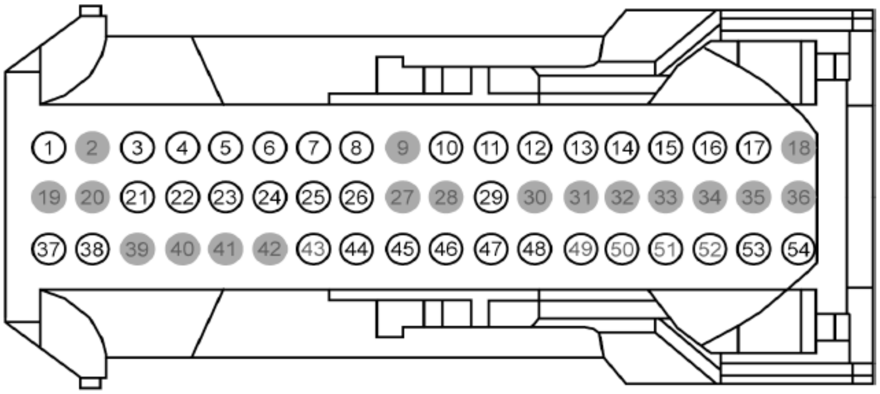
Connector: C3337	Description:	Harness:	Base Part #:
	AUDIO INPUT JACK	14B079	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME46 (BU-GN)	20	JACK - AUDIO # EXT. AUX IN RIGHT (+)	SYNC
2	RME46 (WH-GN)	20	JACK - AUDIO # EXT. AUX IN RIGHT (-)	SYNC
3	RME45 (YE-GN)	20	JACK - AUDIO # EXT. AUX IN LEFT (-)	SYNC
4	VME45 (BU)	20	JACK - AUDIO # EXT. AUX IN LEFT (+)	SYNC

Fig. 368: Audio Input Jack Connector End View (C3337)

Connector: C3338	Description:	Harness:	Base Part #:
	ACCESSORY PROTOCOL INTERFACE MODULE (APIM)	14401	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP13 (GY-RD)	20	FUSE - 13 OR CIRCUIT BREAKER	
2	*	*	not used	
3	VMN14 (WH-VT)	20	CTRL MOD. - NAVIGATION # AUDIO OUT (MONO)	
4	RMN14 (GY-BN)	20	CTRL MOD. - NAVIGATION # AUDIO OUT (MONO)	
5	VMM13 (YE-GN)	20	MICROPHONE - PHONE/VOICE CONTROL	
6	RMM13 (BU)	20	MICROPHONE - PHONE/VOICE CONTROL	
7	VME53 (VT-GN)	20	CTRL MOD. - AUDIO # SYNC AUDIO RIGHT	
8	RME53 (BN-WH)	20	CTRL MOD. - AUDIO # SYNC AUDIO RIGHT	
9	*	*	not used	
10	VME52 (BU)	20	CTRL MOD. - AUDIO # SYNC AUDIO LEFT	
11	RME52 (GY-OG)	20	CTRL MOD. - AUDIO # SYNC AUDIO LEFT	
12	VMM02 (YE-GN)	20	CTRL MOD. - PHONE/VOICE CONTROL # AUDIO (SER) TX	
13	RMM02 (BU-WH)	20	CTRL MOD. - PHONE/VOICE CONTROL # AUDIO (SER) TX	
14	VME54 (BU-OG)	20	SWITCH - SYNC AUDIO	
15	RME24 (BU-WH)	20	CTRL MOD. - AUDIO # SWITCH REDUNDANT AUDIO	

Fig. 369: Accessory Protocol Interface Module (1 Of 2) Connector End View (C3338) (1 Of 2)

16	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH
17	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW
18	*	*	not used
19	*	*	not used
20	*	*	not used
21	DMN14 (NONE)	18	CTRL MOD. - NAVIGATION # AUDIO OUT (MONO)
22	DME41 (BK)	18	DRAIN SHIELD
23	VME42 (VT-BN)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO RIGHT
24	RME42 (YE-BU)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO RIGHT
25	VME41 (GN-OG)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO LEFT
26	RME41 (BU-BN)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO LEFT
27	*	*	not used
28	*	*	not used
29	DMM02 (BK)	18	SHIELD
30	*	*	not used
31	*	*	not used
32	*	*	not used
33	*	*	not used
34	*	*	not used
35	*	*	not used
36	*	*	not used
37	GD148 (BK-YE)	20	GROUND - PILLAR C RIGHT
38	GD148 (BK-YE)	20	GROUND - PILLAR C RIGHT
39	*	*	not used
40	*	*	not used
41	*	*	not used
42	*	*	not used
43	*	*	not used
44	DME45 (BK)	18	JACK - AUDIO # EXT. AUX IN
45	VME45 (BU)	20	JACK - AUDIO # EXT. AUX IN LEFT (+)
46	RME45 (YE-GN)	20	JACK - AUDIO # EXT. AUX IN LEFT (-)
47	VME46 (BU-GN)	18	JACK - AUDIO # EXT. AUX IN RIGHT (+)
48	RME46 (WH-GN)	20	JACK - AUDIO # EXT. AUX IN RIGHT (-)
49	*	*	not used
50	*	*	not used
51	*	*	not used
52	*	*	not used
53	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH
54	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW

Fig. 370: Accessory Protocol Interface Module (2 Of 2) Connector End View (C3338) (2 Of 2)

Connector: C4009	Description:	Harness:	Base Part #:
	PARKING AID SENSOR, OUTER LEFT	14N139	131302

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LMP07 (BU-WH)	20	CTRL MOD. - PARKING AID # SENSORS REAR	
2	VMP15 (YE-GN)	20	SENSOR - PARKING AID # REAR # (LEFT OUTER)	
3	RMP07 (GN-WH)	20	CTRL MOD. - PARKING AID # SENSORS REAR	

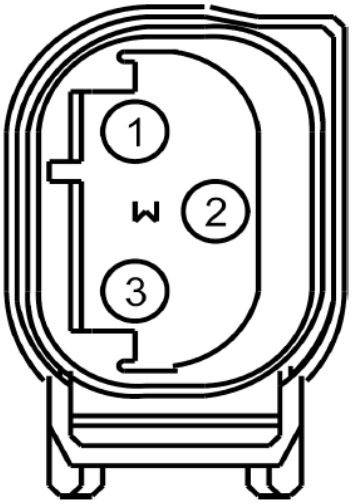


Fig. 371: Outer Left Parking Aid Sensor Connector End View (C4009)

Connector: C4010	Description:	Harness:	Base Part #:
	PARKING AID SENSOR, INNER LEFT	14N139	131302

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LMP07 (BU-WH)	20	CTRL MOD. - PARKING AID # SENSORS REAR	
2	VMP14 (WH-OG)	20	SENSOR - PARKING AID # REAR # (LEFT INNER)	
3	RMP07 (GN-WH)	20	CTRL MOD. - PARKING AID # SENSORS REAR	

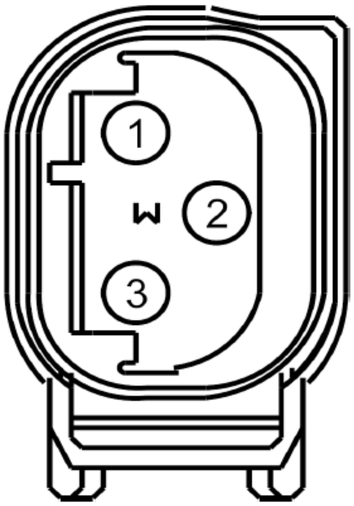


Fig. 372: Inner Left Parking Aid Sensor Connector End View (C4010)

Connector: C4011

Description:	Harness:	Base Part #:
PARKING AID SENSOR, OUTER RIGHT	14N139	131302

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LMP07 (BU-WH)	20	CTRL MOD. - PARKING AID # SENSORS REAR	
2	VMP17 (YE-OG)	20	SENSOR - PARKING AID # REAR # (RIGHT OUTER)	
3	RMP07 (GN-WH)	20	CTRL MOD. - PARKING AID # SENSORS REAR	

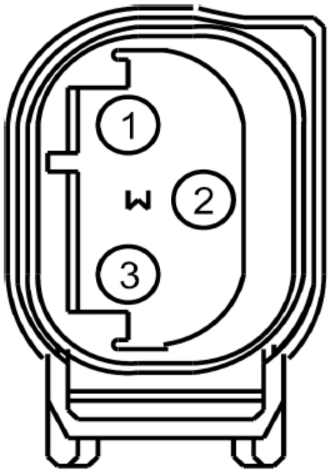


Fig. 373: Outer Right Parking Aid Sensor Connector End View (C4011)

Connector: C4012

Description:	Harness:	Base Part #:
PARKING AID SENSOR, INNER RIGHT	15K868	131302

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LMP07 (BU-WH)	20	CTRL MOD. - PARKING AID # SENSORS REAR	
2	VMP16 (YE-GY)	20	SENSOR - PARKING AID # REAR # (RIGHT INNER)	
3	RMP07 (GN-WH)	20	CTRL MOD. - PARKING AID # SENSORS REAR	

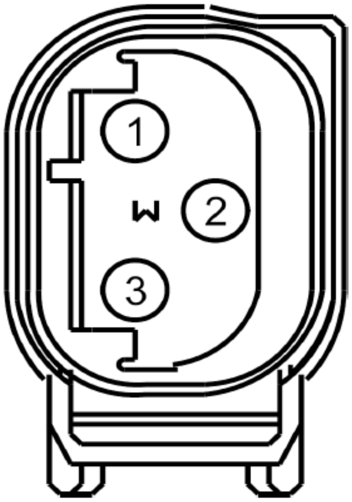
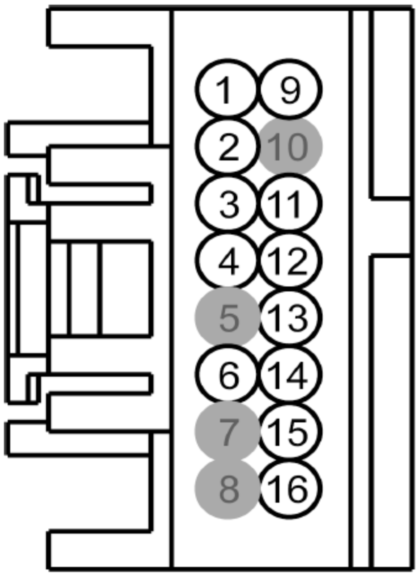


Fig. 374: Inner Right Parking Aid Sensor Connector End View (C4012)

Connector: C4014

Description:	Harness:	Base Part #:
PARKING AID MODULE (PAM)	14A005/13A412	15T850



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP19 (BN-WH)	20	FUSE - 28 OR CIRCUIT BREAKER	
2	CMP09 (BN-BU)	20	CTRL MOD. - PARKING AID # SOUNDER REAR +	
3	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH	
4	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	
5	*	*	not used	
6	RMP09 (BU-GN)	20	CTRL MOD. - PARKING AID # SOUNDER REAR -	
7	*	*	not used	
8	*	*	not used	
9	LMP07 (BU-WH)	20	CTRL MOD. - PARKING AID # SENSORS REAR	
10	*	*	not used	
11	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW	
12	RMP07 (GN-WH)	20	CTRL MOD. - PARKING AID # SENSORS REAR	
13	VMP16 (YE-GY)	20	SENSOR - PARKING AID # REAR # (RIGHT INNER)	
14	VMP14 (WH-OG)	20	SENSOR - PARKING AID # REAR # (LEFT INNER)	
15	VMP15 (YE-GN)	20	SENSOR - PARKING AID # REAR # (LEFT OUTER)	
16	VMP17 (YE-OG)	20	SENSOR - PARKING AID # REAR # (RIGHT OUTER)	

Fig. 375: Parking Aid Module Connector End View (C4014)

Connector: C4015

Description:	Harness:	Base Part #:
PARKING AID SPEAKER	14A005/13A412	15A866

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RMP09 (BU-GN)	20	CTRL MOD. - PARKING AID # SOUNDER REAR -	
2	CMP09 (BN-BU)	20	CTRL MOD. - PARKING AID # SOUNDER REAR +	

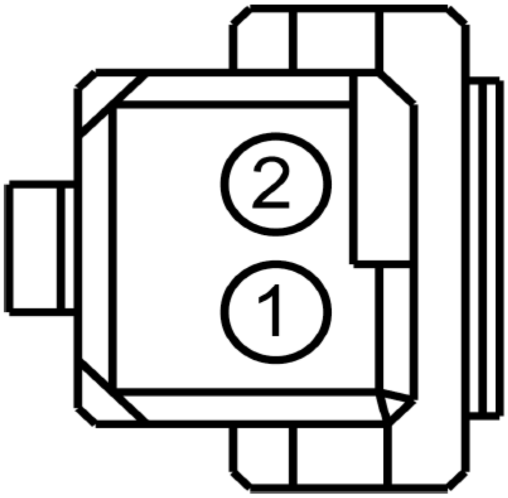


Fig. 376: Parking Aid Speaker Connector End View (C4015)

Connector: C4032	Description:	Harness:	Base Part #:
	PARK/TURN/STOP LAMP, RIGHT REAR	13A412	13A504

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	
2	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
3	CLS19 (VT-OG)	20	CTRL MOD. - STOP/TURN RIGHT	

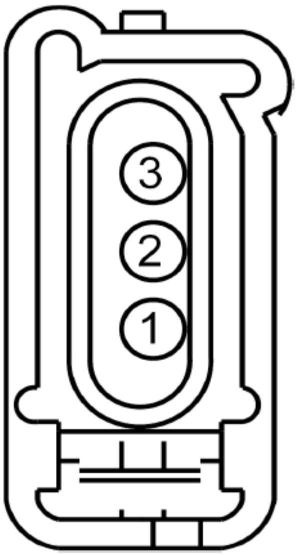


Fig. 377: Right Rear Park Lamp / Stop Lamp / Turn Lamp Connector End View (C4032)

Connector: C4035	Description:	Harness:	Base Part #:
	PARK/TURN/STOP LAMP, LEFT REAR	13A412	13A505

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	
2	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
3	CLS18 (GY-BN)	20	CTRL MOD. - STOP/TURN LEFT	

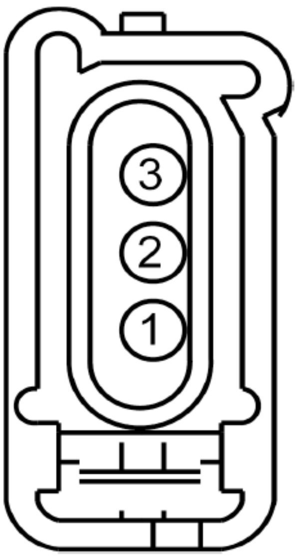


Fig. 378: Left Rear Park Lamp / Stop Lamp / Turn Lamp Connector End View (C4035)

Connector: C4111	Description:	Harness:	Base Part #:
	HIGH MOUNTED STOPLAMP	13A412	13A613

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS17 (YE-GY)	20	CTRL MOD. - STOP HIGH MOUNT	
2	*	*	not used	
3	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

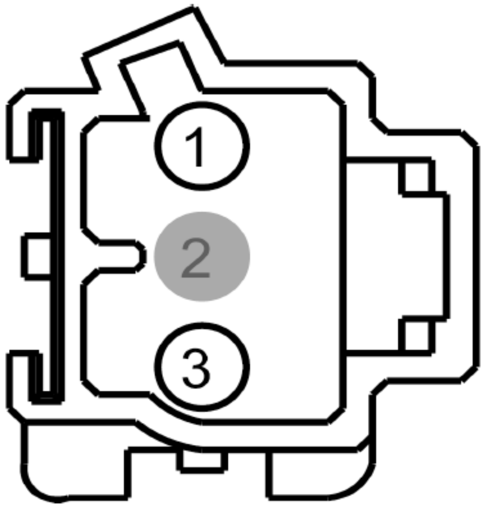
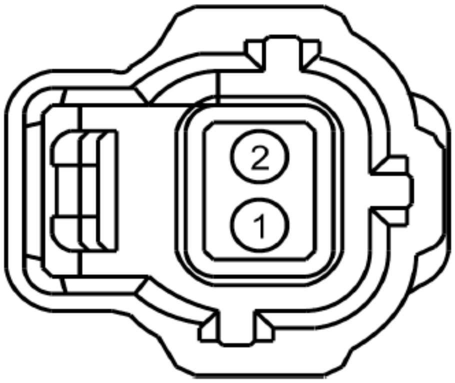


Fig. 379: High Mounted Stoplamp Connector End View (C4111)

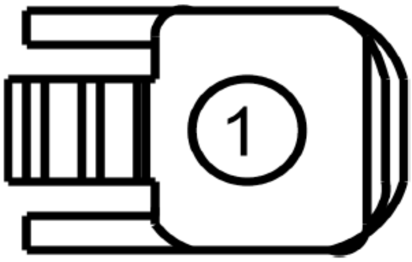
Connector: C4116	Description:	Harness:	Base Part #:
	EVAP CANISTER VENT CONTROL SOLENOID	14A005	9G676



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB23 (WH-RD)	20	FUSE - 23 OR CIRCUIT BREAKER	
2	CE114 (GN-BU)	20	CTRL MOD. - POWERTRAIN # CANISTER VENT SOLENOID (CANVNT)	

Fig. 380: Evaporative Emissions Canister Vent Control Solenoid Connector End View (C4116)

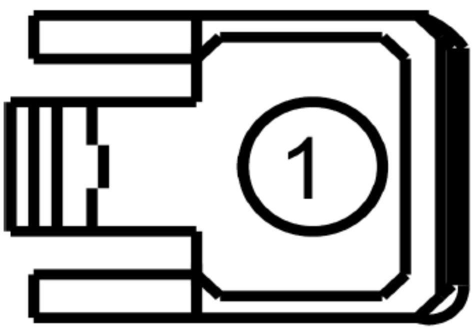
Connector: C4194A	Description:	Harness:	Base Part #:
	ANTENNA MODULE	14A005	19C029



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CME44 (YE-GN)	18	CTRL MOD. - ANTENNA POWER # REAR WINDOW	

Fig. 381: Antenna Module Connector End View (C4194A)

Connector: C4194B	Description:	Harness:	Base Part #:
	ANTENNA MODULE	14A005	19C029



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS38 (VT-WH)	14	CTRL MOD. - ANTENNA	

Fig. 382: Antenna Module Connector End View (C4194B)

Connector: C4198	Description:	Harness:	Base Part #:
	LUGGAGE COMPARTMENT LAMP	14A005	13776

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLN26 (BU)	18	RELAY - COURTESY LAMPS	
2	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	

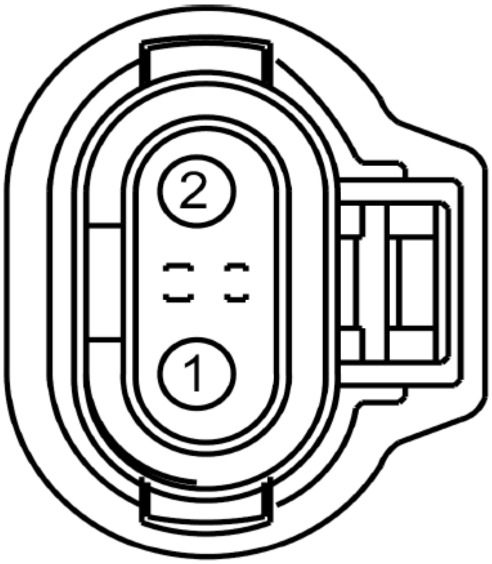


Fig. 383: Luggage Compartment Lamp Connector End View (C4198)

Connector: C4300	Description:	Harness:	Base Part #:
	SATELLITE DIGITAL AUDIO RECEIVER SYSTEM (SDARS) MODULE	14A005	18C851

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH	
2	*	*	not used	
3	GD148 (BK-YE)	20	GROUND - PILLAR C RIGHT	
4	*	*	not used	
5	VME41 (GN-OG)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO LEFT +	
6	VME42 (VT-BN)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO RIGHT +	
7	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW	
8	*	*	not used	
9	SBP15 (WH-RD)	20	FUSE - 20 OR CIRCUIT BREAKER	
10	DME41 (NONE)	18	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO	
11	RME41 (BU-BN)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO LEFT -	
12	RME42 (YE-BU)	20	CTRL MOD. - AUDIO # SATELLITE DIGITAL RADIO RIGHT -	

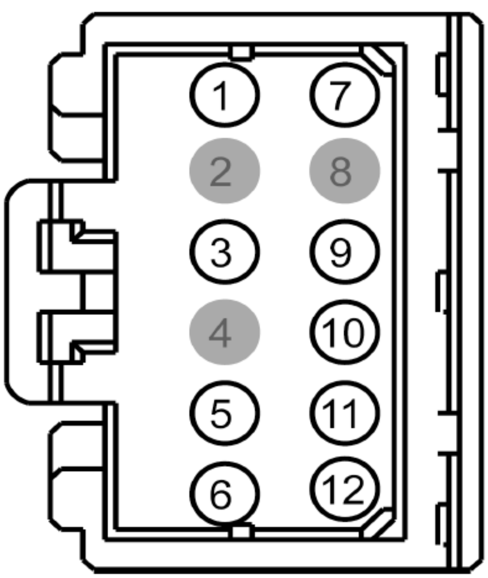


Fig. 384: Satellite Digital Audio Receiver System Module Connector End View (C4300)

Connector: C4320	Description:	Harness:	Base Part #:
	LUGGAGE COMPARTMENT DISARM SWITCH	14A005/13A412	PIA

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	
2	CRT18 (YE-GY)	20	SWITCH - ANTI THEFT INHIBIT # LIFTGATE/DECKLID	

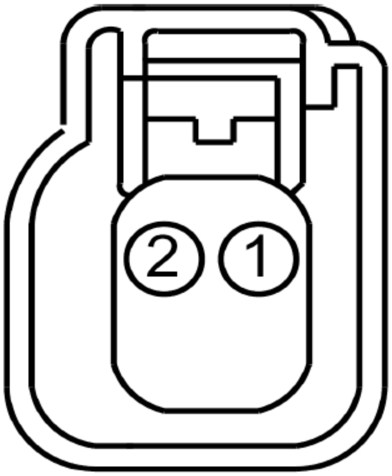


Fig. 385: Luggage Compartment Disarm Switch Connector End View (C4320)

Connector: C4326A	Description:	Harness:	Base Part #:
	AUDIO DIGITAL SIGNAL PROCESSING (DSP) MODULE	19A041	18B849

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RME28 (BN-GN)	18	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT IP -	
2	VME28 (BN-VT)	18	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT IP +	
3	RME06 (GY-YE)	18	CTRL MOD. - AUDIO # SPEAKER CENTER FRONT IP -	
4	VME06 (GN)	18	CTRL MOD. - AUDIO # SPEAKER CENTER FRONT IP +	
5	RME29 (BU-WH)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT IP -	
6	VME29 (GN-WH)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT IP +	
7	*	*	not used	
8	*	*	not used	
9	VME08 (GN-OG)	18	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT TWEETER +	
10	RME08 (GY-OG)	18	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT TWEETER -	
11	VME11 (VT-OG)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT TWEETER +	
12	RME11 (YE-OG)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT TWEETER -	
13	VME30 (GN-BN)	18	CTRL MOD. - AUDIO # SPEAKER CENTER REAR +	
14	RME30 (VT-BN)	18	CTRL MOD. - AUDIO # SPEAKER CENTER REAR -	

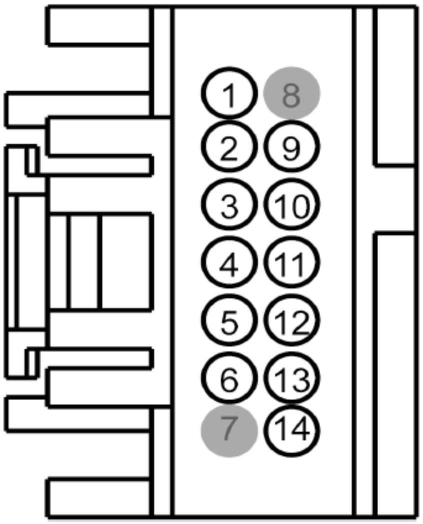
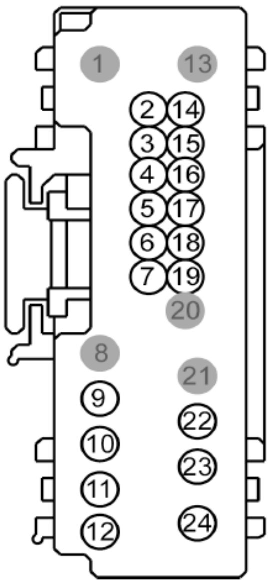


Fig. 386: Audio Digital Signal Processing Module Connector End View (C4326A)

Connector: C4326B

Description:	Harness:	Base Part #:
AUDIO DIGITAL SIGNAL PROCESSING (DSP) MODULE	14A005	18B849

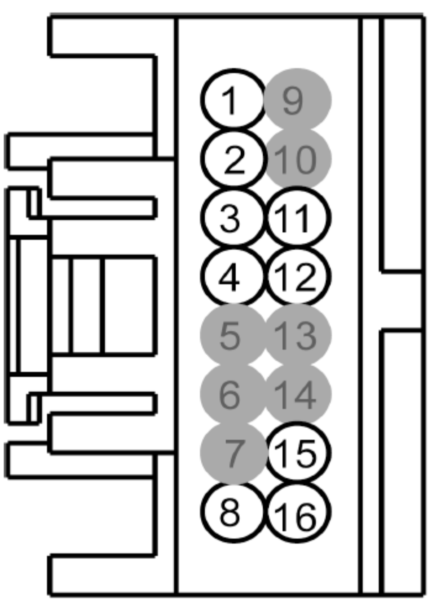


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RME07 (WH-BN)	18	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT DOOR (WOOFER) -	
3	VME07 (WH)	18	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT DOOR (WOOFER) +	
4	RME10 (WH-OG)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT DOOR (WOOFER) -	
5	VME10 (WH-VT)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT DOOR (WOOFER) +	
6	RME09 (BN-YE)	18	CTRL MOD. - AUDIO # SPEAKER LEFT REAR -	
7	VME09 (BN-GN)	18	CTRL MOD. - AUDIO # SPEAKER LEFT REAR +	
8	*	*	not used	
9	SBB21 (GY-RD)	14	FUSE - 21 OR CIRCUIT BREAKER	
10	SBB21 (GY-RD)	16	FUSE - 21 OR CIRCUIT BREAKER	
11	SBB20 (GN-RD)	14	FUSE - 20 OR CIRCUIT BREAKER	
12	SBB20 (GN-RD)	16	FUSE - 20 OR CIRCUIT BREAKER	
13	*	*	not used	
14	VME02 (VT)	18	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER RIGHT REAR +	
15	RME02 (YE)	18	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER RIGHT REAR -	
16	VME01 (GN-VT)	18	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER LEFT REAR +	
17	RME01 (GY)	18	CTRL MOD. - AUDIO # SPEAKER SUBWOOFER LEFT REAR -	
18	VME12 (BN-WH)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT REAR +	
19	RME12 (BN-BU)	18	CTRL MOD. - AUDIO # SPEAKER RIGHT REAR -	
20	*	*	not used	
21	*	*	not used	
22	GD148 (BK-YE)	16	GROUND - PILLAR C RIGHT	
23	GD148 (BK-YE)	16	GROUND - PILLAR C RIGHT	
24	GD148 (BK-YE)	16	GROUND - PILLAR C RIGHT	

Fig. 387: Audio Digital Signal Processing Module Connector End View (C4326B)

Connector: C4326C

Description:	Harness:	Base Part #:
AUDIO DIGITAL SIGNAL PROCESSING (DSP) MODULE	14A005	18B849



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME17 (GN)	22	CTRL MOD. - AUDIO # RADIO LEFT +	
2	RME17 (GY)	22	CTRL MOD. - AUDIO # RADIO LEFT -	
3	VME18 (VT)	22	CTRL MOD. - AUDIO # RADIO RIGHT +	
4	RME18 (YE)	22	CTRL MOD. - AUDIO # RADIO RIGHT -	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	CME27 (YE-VT)	20	CTRL MOD. - AUDIO # ENABLE / CLIPPING	
9	*	*	not used	
10	*	*	not used	
11	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH	
12	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW	
13	*	*	not used	
14	*	*	not used	
15	VMN07 (GY)	22	CTRL MOD. - AUDIO # NAVIGATION VOICE +	
16	RMN07 (VT)	22	CTRL MOD. - AUDIO # NAVIGATION VOICE -	

Fig. 388: Audio Digital Signal Processing Module Connector End View (C4326C)

Connector: C4327	Description:	Harness:	Base Part #:
	SIDE LAMP, RIGHT REAR	14A005/13A412	PIA

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

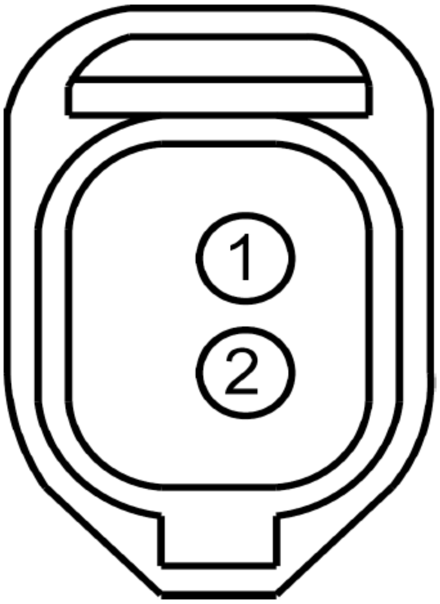


Fig. 389: Right Rear Side Lamp Connector End View (C4327)

Connector: C4328	Description:	Harness:	Base Part #:
	SIDE LAMP, LEFT REAR	14A005/13A412	PIA

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	18	FUSE - 4 OR CIRCUIT BREAKER	
2	GD171 (BK-GY)	20	GROUND - LIFTGATE/DECKLID CENTER	

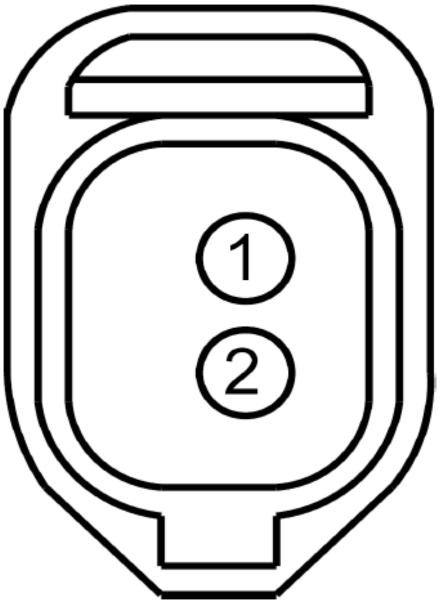
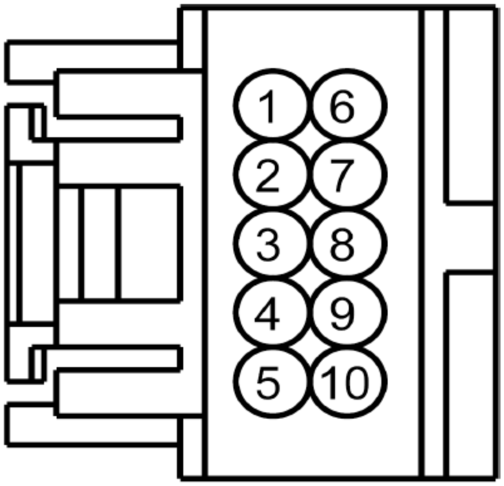


Fig. 390: Left Rear Side Lamp Connector End View (C4328)

Connector: C9030	Description:	Harness:	Base Part #:
	MULTIMEDIA INSIDE MIRROR UNIT	14334	PIA



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP02 (GN)	20	FUSE - 12 OR CIRCUIT BREAKER	
2	VMC30 (BU-GY)	22	COMPASS MOD. # -	
3	CBP12 (GN-WH)	20	FUSE - 1 OR CIRCUIT BREAKER	
4	VMM13 (YE-GN)	20	MICROPHONE - PHONE/VOICE CONTROL +	
5	RMM13 (BU)	20	MICROPHONE - PHONE/VOICE CONTROL -	
6	VMC31 (GY-BU)	22	COMPASS MOD. # +	
7	RRD12 (BN)	20	CTRL MOD. - ELECTROCHROMIC MIRROR -	
8	LRD12 (BU-GY)	20	CTRL MOD. - ELECTROCHROMIC MIRROR +	
9	DMM13 (NONE)	18	MICROPHONE - PHONE/VOICE CONTROL SHIELD	
10	GD139 (BK-YE)	20	GROUND - PILLAR A RIGHT # 2ND STUD	

Fig. 391: Multimedia Inside Mirror Unit Connector End View (C9030)

GENERAL INFORMATION

Diagnostic Connector (DLC) Locations

DOMESTIC CARS

CHRYSLER GROUP LLC

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.

CHRYSLER GROUP LLC - DOMESTIC CARS

Application	Connector Location
Acclaim	
1989-90	Under Left Side Of Dash
1991-92	On Left Front Fender Panel, Near Shock Tower
1993-94	Near Battery
1995	Behind Left Side Of Dash, Near Fuse Block
Aries, Caravelle, Dynasty, E Class, Executive Sedan, LeBaron Sedan, New Yorker, Reliant, Town & Country, 400 & 600	
1984-85	On Left Fender Apron, Behind Battery (2.2L Only)
1986-87	On Front Of Right Shock Tower (2.2L & 2.5L Only)
1988-89	On Left Fenderwell
1990	Under Left Side Of Dash
1991-92	On Left Front Fender Panel, Near Shock Tower
1993 (Except New Yorker)	Near Battery
1993 (New Yorker)	On Left Fender Panel Near PCM
Avenger (1995-00)	Under Center Of Dash, Near Center Console
Breeze, Cirrus & Stratus (1995)	Left Of Steering Column, On BCM
Charger, Horizon, Omni, Rampage, Scamp & Turismo	
1985-89	
2.2L Carbureted	On Left Fender Apron
2.2L Turbo	On Front Of Right Shock Tower
Concorde, Intrepid, LHS, New Yorker, Vision & 300M	
1993-95	Behind Left Side Of Dash
1996-97	Under Left Side Of Dash, Near Center

	Console
Daytona	
1984-87	On Front Of Right Shock Tower
1988-89	On Left Fenderwell
1990-92	On Left Front Fender Panel, Near Shock Tower
1993	On Left Front Inner Fender Or Under Steering Column
Dynasty	
1990	Under Left Side Of Dash
1991-93	On Left Fender Panel, Near SBEC/PCM
Fifth Avenue	
1990	Under Left Side Of Dash
1991-93	On Left Fender Panel Near SBEC/PCM
Horizon & Omni (1989-90)	Under Left Side Of Dash
Imperial	
1981-83	CCC Connector Left Of Air Cleaner
1990	Under Left Side Of Dash
1991-93	On Left Fender Panel Near SBEC/PCM
LeBaron Coupe & Convertible	
1985-87	On Right Front Shock Tower
1988-89	On Left Fenderwell
1990-92	On Left Front Fender Panel, Near Shock Tower
1993	On Left Front Inner Fender Or Under Steering Column
1994	Near Battery
1995	Behind Left Side Of Dash, Near Fuse Block
Lancer	
1985-87	On Right Front Shock Tower
1988-89	On Left Fenderwell
Laser	
1990-94	Above Left Kick Panel, Near Fuse Block
1995	Under Left Side Of Dash, Near Center Console
Monaco & Premier	
1990	On Right Front Fender Panel
1991-92	On Left Fender Panel, Next To SBEC
	Under Headlight Switch, Under Left Side

Neon (1995)	Of Dash
Shadow	
1985-87	On Right Front Shock Tower
1988	On Left Fenderwell
1989	Under Dash, To Right Of Steering Column
1990	On Left Fender Front Panel, Near SBEC
1991-92	On Left Front Fender Panel, Near Shock Tower
1993-94	Near Battery
Spirit & Sundance	
1985-87	On Right Front Shock Tower
1989-90	Under Left Side Of Dash
1991-92	On Left Front Fender Panel, Near Shock Tower
1993-94	Near Battery
1995	Behind Left Side Of Dash, Near Fuse Block
Talon	
1990-94	Above Left Kick Panel, Near Fuse Block
1995-98	Under Left Side Of Dash, Near Center Console

FORD MOTOR CO.

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.

FORD MOTOR CO. - DOMESTIC CARS

Application	**Connector Location**
Bobcat & Pinto	On Center Of Right Fender Apron
Capri	
1980-85	On Center Of Left Front Fender Apron
1986	On Left Rear Corner Of Engine Compartment
Continental	
1984-89	On Right Rear Corner Of Engine Compartment
1990-91	On Right Rear Corner Of Firewall, On Electronic Assembly Cover

1992	On Right Fender Apron
1993-94	VIP Connectors (2) On Right Rear Of Engine Compartment, On PCM Cover
Contour & Mystique	
1995	On Left Rear Corner Of Engine Compartment
Cougar & Thunderbird	
1982-90	On Left Fender Apron
1991	On Rear Of Right Front Fender Panel
1992	Front Of Right Shock Tower
1993	2 Connectors In Right Rear Corner Of Engine Compartment
1994	On Right Side Of Engine Compartment & Below Glove Box
1995	
3.8L	On Right Side Of Engine Compartment & Below Glove Box
4.6L	Behind Right Side Of Dash, Below Glove Box
1996	Lower Right Side Of Dash, Below Glove Box
Crown Victoria, Grand Marquis & Lincoln Town Car	
1983 & 1987	On Right Fender Apron
1985-86 & 1988-90	On Left Fender Apron
1992	On Left Front Fender Panel
1993-94	On Top Of Left Front Wheelwell
Escort, EXP, Lynx & Tracer	
1985-90	On Right Fender Apron Near Firewall
1991	On Left Rear Of Engine Compartment
1992	On Right Rear Of Engine Compartment, Near Cowl
1993-95	On Left Side Of Firewall
LTD & Marquis	
1983	On Left Fender Apron
1984-86	On Left Rear Corner Of Engine Compartment
Mark VII	
1984-87	On Right Rear Corner Of Engine Compartment
1988-90	Front Of Right Fender Apron
1991	On Right Side Of Engine Compartment, Near Thermactor Solenoids

Mark VIII	
1993-96	On Top Of Left Wheelwell
Mustang	
1980-85	On Center Of Left Front Fender Apron
1986-91	On Left Rear Corner Of Engine Compartment
1992	On Left Shock Tower, Near Ignition Coil
1993	2 Connectors On Right Front Strut Tower
1994-95	Behind Right Front Strut Tower & Right Of Steering Column
Probe	
1991-92	On Left Rear Corner Of Engine Compartment
1993	DLC - Behind Left Side Of Dash; STI Connector - On Left Inner Fender Panel
1994-95	On Left Front Inner Fender Panel
Sable & Taurus	
1986-87 (3.0L Only)	Near Alternator
1988-90	
2.5L	On Engine Harness Near PCV Hose
3.0L	On Right Rear Corner Of Engine Compartment
1991	On Right Rear Corner Of Engine Compartment, On ECA Cover
1992	On Right Rear Corner Of Engine Compartment, Below MAP Sensor
1993-95	Right Rear Of Engine Compartment
Tempo & Topaz	
1984-92	On Right Rear Corner Of Engine Compartment
1993-94	In Engine Compartment, On Left Strut Tower

GENERAL MOTORS

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

GENERAL MOTORS - DOMESTIC CARS

Application	**Connector Location**

Allante	Enter Diagnostic Mode By Pressing OFF & WARM Buttons On Instrument Panel
Bonneville (1980-81)	ECU Connector On Upper Right Kick Panel
Brougham (1987-92)	Bottom Center Of Instrument Panel
Camaro & Firebird (1980)	Diagnostic Ground Lead Connector On Right Shroud Above ECM
Caprice Classic	
1980-81	ECU Connector On Upper Right Kick Panel
1982-88	Under Center Of Instrument Panel
Catalina	ECU Connector On Upper Right Kick Panel
Cavalier (1982-88)	On Side Of Fuse Block
Cimarron	On Side Of Fuse Block
Century	Under Left Of Dash Ashtray
Corvette (1980-83)	In Center Console, Under Ashtray
Custom Cruiser	
1980-81	ECU Connector On Upper Right Kick Panel
1982-88	Under Center Of Instrument Panel
DeVille (1981-88)	Enter Diagnostic Mode By Pressing OFF & WARMER Buttons On Instrument Panel
Delta 88	ECU Connector On Upper Right Kick Panel
Eldorado (1981-88)	Enter Diagnostic Mode By Pressing OFF & WARMER Buttons On Instrument Panel
Electra (1980-81)	ECU Connector On Upper Right Kick Panel
Estate Wagon	ECU Connector On Upper Right Kick Panel
Fiero	Under Ashtray Or Cigar Lighter Panel Within Center Console
Firenza	On Side Of Fuse Block
Fleetwood (1981-88)	Enter Diagnostic Mode By Pressing OFF & WARMER Buttons On Instrument Panel
Fleetwood Brougham	On Bottom Center Of Dash, Near Ashtray
Impala (1982-88)	Under Center Of Instrument Panel
LeMans	ECM Connector On Right Kick Panel

	Or Under Left Side Of Dash
LeSabre (1980-81)	ECU Connector On Upper Right Kick Panel
LeSabre Wagon (1982-88)	Under Center Of Instrument Panel
Monza	Under Right Side Of Dash
Ninety-Eight (1980-81)	ECU Connector On Upper Right Kick Pane
Nova	Behind Right Strut Tower
Parisienne	Under Center Of Instrument Panel
Reatta	
1988-92 (MFI)	Enter Diagnostic Mode By Pressing OFF & WARM Buttons On Instrument Panel
1991-93	Above Parking Brake Pedal
Riviera	
1980-85 (Carbureted)	Under Left Or Center Of Dash
1986-92 (MFI)	Enter Diagnostic Mode By Pressing OFF & WARM Buttons On Instrument Panel
Safari	Under Center Of Instrument Panel
Seville (1981-88)	Enter Diagnostic Mode By Pressing OFF & WARMER Buttons On Instrument Panel
Skyhawk	Under Right Side Of Dash
Starfire	Under Right Side Of Dash
Sunbird	On Side Of Fuse Block, Under Right Side Of Dash
Toronado	
1980-85 (Carbureted)	Under Left Or Center Of Dash
1986-92 (MFI)	Enter Diagnostic Mode By Pressing OFF & WARM Buttons On Instrument Panel
Trofeo	
1988-92 (MFI)	Enter Diagnostic Mode By Pressing OFF & WARM Buttons On Instrument Panel
1991-93	Above Parking Brake Pedal
2000	On Side Of Fuse Block

DOMESTIC LIGHT TRUCKS & VANS

CHRYSLER GROUP LLC

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

CHRYSLER GROUP LLC - DOMESTIC LIGHT TRUCKS & VANS

Application	Connector Location
Caravan, Grand Caravan, Grand Voyager, Mini Ram Van, Town & Country, & Voyager	
1984-92	On Left Side Fender Apron
1993	On Left Fender Front Fender Panel, Near SBEC
1994-95	On Wiring Harness, On Center Of Firewall
Dakota	
1987-88	On Right Side Fender Apron
1989	On Left Side Of Firewall
1990-92	On Right Side Of Firewall
1993-95	On Right Rear Corner Of Engine Compartment
Jeep	
Cherokee (1992-95)	On Left Front Fender Apron, Behind Air Cleaner
Comanche	On Left Front Fender Apron, Behind Air Cleaner
Grand Cherokee & Wagoneer	
1993-95	
PCM	On Right Rear Of Engine Compartment, Near PCM
TCM	Behind Left Side Of Instrument Panel
Wrangler (1992-95)	On Left Side Of Firewall, Near PCM
Pickup & Ramcharger	
1985-90	On Left Side Of Firewall
1991-93	On Left Front Fender Panel, Next To SBEC/PCM
1995 Pickup	On Right Side Of Firewall
Ram Wagon & Van	
1985-90	On Left Side Of Firewall
1991-95	On Center Of Firewall, Near SBEC/PCM

FORD MOTOR CO.

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side**

of the dash, as mandated in 1996 by the Federal government.

FORD MOTOR CO. - DOMESTIC LIGHT TRUCKS & VANS

Application	**Connector Location**
Aerostar	
1986-90	On Left Front Fender
1991	Near Starter Relay
1992	On Left Front Inner Fender Panel
1993-95	On Left Side Of Firewall
Bronco	
1982-85	
6-Cylinder	On Left Front Fender
V8	On Right Inner Fender Panel
1986-87	On Right Front Fender, Near Starter Relay
1988-92	On Left Fender Apron
1993-95	2 Connectors In Left Rear Of Engine Compartment, On Bracket
1996-	Below Glove Box
Bronco II	
1983-85	On Right Front Inner Fender Panel (2.3L Only)
1986-90	On Right Front Fender Apron
Excursion	Behind Center Of Dash
Explorer & Mountaineer (1991-94)	On Right Rear Of Engine Compartment, Near A/C-Heater Blower
Pickup	
1982-85	
6-Cylinder	On Left Front Fender
V8	On Right Inner Fender Panel
1986-87	On Right Front Fender, Near Starter Relay
1988-92	On Left Fender Apron
1993-95	2 Connectors In Left Rear Of Engine Compartment, On Bracket
1996-	Below Center Of Instrument Panel
Pickup (F250 Heavy Duty & F350)	Under Right Side Of Dash
Ranger	
1983-85	On Right Front Inner Fender Panel (2.3L Only)
1986-90	On Right Front Fender Apron
1991	Behind Engine Compartment

	Fuse/Relay Block
1992	On Left Front Inner Fender Panel
1993-95	On Rear Of Engine Compartment Fuse/Relay Block
Van	
1986-92	On Right Fender Apron
1993-95	On Left Front Corner Of Engine Compartment
1996	
5.8L (49 State, Over 8600 GVW) & 7.5L (Except Calif.)	On Left Front Corner Of Engine Compartment
All Others	Under Left Side Of Dash
1997-98	
Diesel	Under Left Side Of Dash
All Others	Left Front Corner Of Engine Compartment
Villager (1993)	On Left Side Of Engine Compartment, Below Coolant Reservoir

GENERAL MOTORS

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

GENERAL MOTORS - DOMESTIC LIGHT TRUCKS & VANS

Application	**Connector Location**
Astro & Safari Van (1986-87)	Under Left Corner Of Cowl
"S" & "T" Series Blazer, Bravada, Envoy, Jimmy, Pickup & Sonoma	
1982-85	
1.9L	Under Left Side Of Dash, Behind ECM
2.0L & 2.8L	Under Ashtray
2.5L	Under Left Side Of Dash
1986-87	Under Ashtray
Van ("G" Series) (1982-87)	Under Driver's Seat

IMPORTED CARS & TRUCKS

ACURA

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side**

of the dash, as mandated in 1996 by the Federal government.

ACURA - IMPORTED CARS & TRUCKS

Application	Connector Location
Integra	
1991-93	Behind Right Kick Panel
1994-97	Behind Glove Compartment
1998-02	Behind Right Side Of Center Console
Legend	
1991-93	Under Right Side Of Dash, Above PGM-FI ECU/PCM
1994-95	Behind Glove Compartment
NSX (1997-01)	Under Glove Compartment
SLX	Behind Lower Left Corner Of Dash, Behind Cover
Vigor	
1992-93	Under Right Side Of Dash, Near Center Console
1994	Behind Glove Compartment
2.2CL & 2.3CL	In Front Of Shift Lever, Behind Ashtray
2.5TL	In Front Of Shift Lever, Behind Ashtray
3.0CL	In Front Of Shift Lever, Behind Ashtray
3.2TL & 3.5RL	In Front Of Shift Lever, Behind Ashtray

AUDI

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

AUDI - IMPORTED CARS & TRUCKS

Application	Connector Location
A4	
1996	Next To Rear Ashtray
1997-01 (1.8L Turbo)	Behind Cover, Under Left Side Of Steering Column
1997-99 (2.8L V6)	Under Cover, Next To Rear Ashtray
1997-	Under Left Side Of Dash, Behind Cover
A6	
1995	Under Ashtray, In Front Storage Compartment Of Center Console

1996-97	Under Cover, Next To Parking Brake Handle
Cabriolet	
1994-96	In Fuse/Relay Block, On Left Side Of Dash
1997-98	Under Ashtray, At Rear Of Center Console
Coupe GT, 4000S & 4000S Quattro	In Fuse Socket, On Fuel Pump Relay
80	In Fuse Socket, On Fuel Pump Relay
90	
1988-92	In Fuse Socket, On Fuel Pump Relay
1993	In Main Fuse/Relay Block, On Plenum Tray
1994-95	In Fuse/Relay Block, On Left Side Of Dash
100	
1989-91	Under Left Side Of Dash
1992-94	In Auxiliary Relay Station No. 1, On Left Rear Of Engine Compartment
5000CS Quattro, 5000CS Turbo & 5000S	In Fuse Socket, On Fuel Pump Relay

BENTLEY

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.

BENTLEY - IMPORTED CARS & TRUCKS

Application	Connector Location
1996-00	
All Models	In Glove Compartment
2001-04	
Arnage	Below Left Side Of Dash
2001-	
Azure Convertible	In Glove Compartment
Continental	In Glove Compartment

BMW

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.

BMW - IMPORTED CARS & TRUCKS

Application	Connector Location
Z3	Behind Cover, On Right Side Of Center Console
Z4 & Z8	Under Left Side Of Dash, Left Of Steering Column, Behind Cover
318 & 325	
1991	On Bracket, Above Thermostat Housing
1992-95	On Right Rear Of Engine Compartment
1996	Under Left Side Of Dash, Behind Panel Labeled OBD
330	Behind Cover, Under Left Side of Dash Above Hood & Trunk Releases
524t	On Top Rear Of Engine
525i & 535i	
1990-91 (Black 20-Pin Connector)	Left Rear Corner Of Engine Compartment
1992-95	Outside Of Engine Compartment Fuse/Relay Block
528e	On Intake Manifold Bracket, Behind Thermostat Housing
635CSi	On Bracket, Next To Fuse/Relay Block
735i	
1986-87	On Bracket, On Top Of Engine
1988-92	On Right Side Of Engine Compartment, On Shock Tower
740 & 750	Under Left Side Of Dash, Behind Panel Labeled OBD
740i & 740iL (1993-01)	Behind Cover On Lower Left Corner Of A/C Control Panel
745Li	In Left Side Kickpanel, Behind Cover Labeled OBD
750iL	Behind Cover On Lower Left Corner Of A/C Control Panel

DAIHATSU

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

DAIHATSU - IMPORTED CARS & TRUCKS

Application	Connector Location
Charade	At Upper Section Of Transmission

Rocky	On Right Front Fender Panel

CHRYSLER GROUP LLC

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.

CHRYSLER GROUP LLC - IMPORTED CARS & TRUCKS

Application	**Connector Location**
Colt & Summit	
1986-87	Above Inside Of Glove Compartment
1988	On Left Rear Corner Of Engine Compartment
1989-98	Under Left Side Of Dash, Near Fuse/Relay Block
Colt Vista	
1987	Behind Glove Compartment
1988-89	Under Left Side Of Dash, Near Hood Release Handle
1990-96	Under Right Side Of Dash
Conquest & Starion	Behind Glove Compartment
Expo	Under Left Side Of Dash, Near Fuse/Relay Block
Medallion	On Left Side Of Firewall
Pickup	Under Left Side Of Dash, Near Fuse/Relay Block
Ram-50	Under Left Side Of Dash, Near Fuse/Relay Block
Sigma	In Glove Compartment
Stealth	
1991-98	Under Left Side Of Dash, On Fuse/Relay Block
1999	Under Left Side Of Dash, Left Of Center Console
Summit Wagon	Under Right Side Of Dash
Vista Wagon	Under Right Side Of Dash

FERRARI

FERRARI - IMPORTED CARS & TRUCKS

Application	**Connector Location**

All Models	
1996-	Behind Left Side Of Dash

FORD MOTOR CO.

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

FORD MOTOR CO. - IMPORTED CARS & TRUCKS

Application	**Connector Location**
Aspire	
1994-95	On Left Rear Corner Of Engine Compartment
1996-97	Under Left Side Of Dash
Capri	
1991	Behind Right Side Of Dash, Behind Glove Compartment
1992	
1.3L	On Left Rear Corner Of Engine Compartment
1.6L	On Right Rear Corner Of Engine Compartment
1993-94	On Right Rear Corner Of Engine Compartment
Festiva	
1992-93	
1.3L	On Left Rear Corner Of Engine Compartment
1.6L	On Right Rear Corner Of Engine Compartment
Merkur XR4Ti	On Right Front Fender Apron, Near Battery
Scorpio	On Right Rear Corner Of Engine Compartment
Tracer	On Left Rear Corner Of Engine Compartment

GENERAL MOTORS

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

GENERAL MOTORS & GEO - IMPORTED CARS & TRUCKS

Application	Connector Location
LeMans	Behind Right Kick Panel, Above ECM
Metro	
1989-95	Under Left Side Of Dash, Near Fuse Block
1996	Under Right Side Of Dash, Near Center Console
1997-01	Under Left Side Of Dash
Prizm & Prizm LSi	
1989-95	On Left Front Strut Tower
1996-02	Under Left Side Of Dash
Spectrum	Under Right Side Of Dash, Above A/C-Heater Blower Motor
Sprint	On Left Front Shock Tower, Near Battery
Storm	
1990-91	Behind Right Side Of Dash, Above A/C-Heater Blower Motor
1992-93	Behind Right Kick Panel
Tracker	
1989-95	Under Left Side Of Dash, Near Fuse Block
1996	In Engine Compartment, Near MAP Sensor
1997-	Under Left Side Of Dash

HONDA

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

HONDA - IMPORTED CARS & TRUCKS

Application	Connector Location
Accord	
1990-95	Behind Right Side Of Dash, Above Kick Panel
1996-97	Behind Ashtray In Center Console
Civic (1992-95)	Behind Right Side Of Dash, Near PGM-FI ECM
Civic Del Sol	
1992-95	Behind Right Side Of Dash, Near

	PGM-FI ECM
1996-97	Under Removable Cover On Right Side Of Center Console
CR-V	Behind Passenger Side Of Center Console
Element	
2003-11	Above Gas Pedal, Below Fuse Block
Insight (2010-11)	Below Left-of-Center Of Dash
Odyssey	
1995	Behind Right Side Of Dash, Above Kick Panel
1996-98	Behind Passenger Side Of Center Console
Passport (1995)	Behind Left Kick Panel
Prelude	
1992-95	Behind Center Console
1996	Under Beverage Holder In Center Console
1997-02	Under Removable Cover On Right Side Of Center Console
S2000	Behind Right Side Of Center Console

HYUNDAI

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.

HYUNDAI - IMPORTED CARS & TRUCKS

Application	**Connector Location**
Accent (1995)	In Coin Box
Sonata	
1989	Under Left Side Of Dash, In Fuse Block
1990	
W/Passive Seat Belt Restraints	In Fuse Block
W/O Passive Seat Belt Restraints	On Lower Left Of Steering Column

INFINITI

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side

of the dash, as mandated in 1996 by the Federal government.

INFINITI - IMPORTED CARS & TRUCKS

Application	**Connector Location**
G20 (1993-95)	In ECCS Control Unit, Behind Center Console
I30 (1995)	Beside Fuse Box
J30	
1993	Under Left Side Of Dash
1994-95	In ECM, Behind Right Kick Panel
1996-98	Under Left Side Of Dash
M30	Under Left Side Of Dash, Near Fuse Block
Q45	
1990-93	Under Left Side Of Dash, Near Fuse Block
1994-95	In ECM, Behind Right Kick Panel

ISUZU

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

ISUZU - IMPORTED CARS & TRUCKS

Application	**Connector Location**
Amigo & Pickup	
1986-89	Under Left Side Of Dash
1990-95	Behind Left Kick Panel, Near ECM
1998-00	Lower Left Corner Of Dash, Behind Small Cover
Hombre	Under Lower Left Side Of Dash, Behind Cover
Impulse	
1986-89	Under Left Side Of Dash, Above ECU
1990-92	Behind Right Kick Panel
1993-95	Behind Left Kick Panel, Near ECM
I-Mark	Behind Right Side Of Dash, Above A/C-Heater Blower Motor
Oasis	Behind Right Side Of Center Console
Rodeo	
1991-95	Behind Left Kick Panel
1996-	Lower Left Side Of Dash, Behind

	Small Cover
Stylus	Behind Right Kick Panel
Trooper & Trooper II	
1986	Under Left Side Of Dash
1987-91	Under Center Console
1992	
DOHC	Behind Center Of Dash, Right Of Steering Column
SOHC	Under Left Side Of Dash
1993-95	Under Left Side Of Dash, Right Of Steering Column
1996-02	Lower Left Side Of Dash, Behind Small Cover
VehiCROSS	Under Left Side Of Dash

JAGUAR

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.

JAGUAR - IMPORTED CARS & TRUCKS

Application	**Connector Location**
XJR (1995-97)	Near Center Console
XJS	
1992	On Left Rear Trunk Wheel Arch, Behind Trim Panel
1993-94	Under Battery Tray, On Right Front Of Luggage Compartment
1995-96	Near Center Console
XJ6	
1992	On Left Rear Of Engine Compartment
1993-94	Under Battery Tray, On Right Front Of Luggage Compartment
1995-97	Under Left Side Of Dash, Near Center Console
XJ12	Near Center Console

KIA

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side

of the dash, as mandated in 1996 by the Federal government.

KIA - IMPORTED CARS & TRUCKS

Application	Connector Location
Sephia	
1994	On Center Of Firewall
1995 & 1996	
1.6L	Under Center Of Dash, Mounted On Floorboard
2.0L	Under Right Side Of Dash, Near Kick Panel
Sportage	
1994	On Center Of Firewall
1995 & 1996	
1.6L	Under Center Of Dash, Mounted On Floorboard
2.0L	Under Right Side Of Dash, Near Kick Panel

LAND ROVER

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

LAND ROVER - IMPORTED CARS & TRUCKS

Application	Connector Location
Defender 90	Behind Fuse Cover, In Center Of Console
Range Rover	Under Right Side Of Dash, In Footwell

LEXUS

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

LEXUS - IMPORTED CARS & TRUCKS

Application	Connector Location
ES Series	
1990-91	
DLC	Near Left Shock Tower
Total Diagnostic Communication Link Connector	Under Left Side Of Dash
1992-94	

DLC No. 1	On Bracket, Behind Right Front Strut Tower
DLC No. 2 & 3	Under Left Side Of Dash
1995-97	In Fuse Box At Lower Left Of Dash
GS Series	
1990-95	
DLC No. 1	On Bracket, On Top Of Engine
DLC No. 2	Under Left Side Of Dash
1996-00	In Fuse Box At Lower Left Of Dash
LS Series	
1990-94	
DLC No. 1	On Bracket, On Top Of Engine
DLC No. 2	Under Left Side Of Dash
1995-00	In Fuse Box At Lower Left Of Dash
SC Series	
1992-95	
DLC No. 1	On Bracket, Behind Right Front Strut Tower
DLC No. 2 & 3	Under Left Side Of Dash
1996-00	In Fuse Box At Lower Left Of Dash

MAZDA

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.

MAZDA - IMPORTED CARS & TRUCKS

Application	Connector Location
B-Series	
1987-88	On Right Front Fender Apron
1989-93	
Engine Control Check Connector (Black 6-Pin)	Near Windshield Washer Motor
Trouble Codes Connector (Green 1-Pin)	Near Black 6-Pin Connector (Engine Control)
1994-95	On Right Front Fender Panel
Miata (1990-95)	On Left Rear Of Engine Compartment, Near Master Cylinder
MPV (1989-95)	
Engine Control Unit (Green 6-Pin & 1-Pin Connectors)	On Left Side Of Engine Compartment, Near Inner Fender Panel
MX-3	Mounted On Bracket, On Left Front Strut Tower

MX-6 & 626	
1988	Behind Left Front Shock Tower
1989	On Left Front Corner Of Engine Compartment
1990-91	At ECU Connector Terminal
1992	On Left Rear Corner Of Engine Compartment
1993	On Side Of Fuse/Relay Block, Near Battery
1994-95	On Left Front Fender Apron
Navajo	
1991-93	On Right Rear Corner Of Engine Compartment
1994-95	On Right Front Fender Panel
Protege	
1987-89	On Passenger's Footwell (Left Foot Area)
1990-95	On Left Side Of Firewall, Near Wiper Motor
RX7	
1986-88 (3 Check Connectors)	At Left & Right Corners Of Engine Compartment
1989-91 (Green 6-Pin Connector)	Behind Ignition Coil
1993-95	On Bracket, On Left Front Strut Tower
323	
1986-88	Front Left Of Engine Compartment, Near Ignition Coil
1989 (Green 6-Pin & Green 1-Pin Connectors)	On Left Side Of Firewall
1990-95	On Left Side Of Firewall, Near Wiper Motor
929	
1989	Near Air Cleaner
1990-91 (Green 6-Pin Connector)	In Left Front Corner Of Engine Compartment
1992-93	Mounted On Air Cleaner Housing
1994-95	On Left Front Strut Tower

MERCEDES-BENZ

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

MERCEDES-BENZ - IMPORTED CARS & TRUCKS

Application	Connector Location
C-Class (1994)	On Right Rear Of Engine Compartment
E-Class	
1994-97	On Right Rear Of Engine Compartment
G-Class	Under Left Side Of Dash, Behind Cover
ML-Class	Under Left Side Of Dash, Behind Cover
S-Class	
140 Platform (1994-99)	On Right Rear Of Engine Compartment
190 Series	
1986-87	On Left Rear Of Engine Compartment
1988-93	
All Models	In Engine Compartment, On Left Front Fender
California (OBD)	On Right Side Of Firewall, Near Battery
1994	On Right Rear Of Engine Compartment
260E	
1987	On Left Front Fender Apron, Next To Ignition Control Module
1988-89	
All Models	In Engine Compartment, On Left Front Fender
California (OBD)	On Right Side Of Firewall, Near Battery
300 Series	
1986-87	On Left Front Fender Apron, Next To Ignition Control Module
1988-92	
All Models	In Engine Compartment, On Left Front Fender
California (OBD)	On Right Side Of Firewall, Near Battery
1993	
Except 300E	Left Fender Apron
300E	Right Rear Corner Of Engine Compartment
1994-95 (All Models)	On Right Rear Of Engine Compartment
400 & 500 Series	

1993	
12-Pin Connector	On Rear Of Left Front Inner Fender Panel
38-Pin (Impulse Readout)	In Module Box, On Right Rear Of Engine Compartment
1994-95	On Right Rear Of Engine Compartment
420SEL & 560 Series (Except 2.2L)	
1986-89	
All Models	In Engine Compartment, On Left Front Fender
California (OBD)	On Right Side Of Firewall, Near Battery
1990-91	In Engine Compartment, On Left Front Fender
560 Series (2.2L)	On Lower Left Side Of Engine Connector

MITSUBISHI

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

MITSUBISHI - IMPORTED CARS & TRUCKS

Application	Connector Location
Diamante (1992-98)	Under Left Side Of Dash, Near Fuse/Relay Block
Expo	Under Left Side Of Dash, Near Fuse/Relay Block
Montero	
1986-88	Left Rear Corner Of Engine Compartment
1989-91	Behind Glove Compartment
Pickup	Under Left Side Of Dash, Near Fuse/Relay Block
Raider	
1987-88	Left Rear Corner Of Engine Compartment
1989	Behind Glove Compartment
3000GT	
1991-98	Under Left Side Of Dash, On Fuse/Relay Block
1999	Under Left Side Of Dash, Left Of Center Console

NISSAN

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.

NISSAN - IMPORTED CARS & TRUCKS

Application	Connector Location
Altima	
1993-94	On Driver-Side Of Center Console, Above Accelerator Pedal
1995-96	Below Fuse Box
Maxima	
1989-94	Under Left Side Of Dash
1995-96	Below Fuse Box
NX & Sentra	Under Left Side Of Dash, Near Fuse Block
Pulsar NX	
1986	Above Right Side Of Dash, Below Wiper Motor
1987	Above Steering Column
Quest (1993-95)	
CONSULT Tester Connector	On Driver-Side Of Center Console, Above Accelerator Pedal
Self-Test Connector	Located Near Starter
Stanza	Below Center Of Dash, Near Center Console
Van	On Right Side Of Engine Compartment, Behind Fuel Filter
200SX (1995-96)	Below Fuse Box
240SX	
1991-94	Under Left Side Of Dash, Below Fuse Block
1995-96	In Glove Box
300ZX (1990)	Near Parking Brake

PEUGEOT

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.

PEUGEOT - IMPORTED CARS & TRUCKS

Application	Connector Location
505 Series	On Lower Left Side Of Engine Connector

PORSCHE

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.

PORSCHE - IMPORTED CARS & TRUCKS

Application	Connector Location
911 Series	
1992-95	In Passenger's Footwell
1996	Left Side Of Center Console
928S	Top Front Of Engine
944 Series	On Left Side Of Engine Compartment

RENAULT

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.

RENAULT - IMPORTED CARS & TRUCKS

Application	Connector Location
Sportwagon	
Engine Diagnostic	On Center Of Firewall
Fuel Injection Diagnostic	Right Rear Of Engine Compartment, Behind Airflow Meter

ROLLS-ROYCE

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.

ROLLS-ROYCE - IMPORTED CARS & TRUCKS

Application	Connector Location
All Models	
1996-00	In Glove Compartment
2001-	Under Left Side Of Dash

SAAB

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

SAAB - IMPORTED CARS & TRUCKS

Application	Connector Location
900 Series	
1986-90	In Front Of Fuse/Relay Panel
1991-93	Under Back Seat, On Right Side
1994	
Convertible	Under Rear Seat
Hatchback	Under Steering Column
All Others	Under Right Front Seat
9000 Series	
1990	On Left Side Of Engine Compartment
1991-92	Under Passenger's Seat
1993	On Left Of Firewall
1994-95	Under Right Front Seat

SUBARU

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

SUBARU - IMPORTED CARS & TRUCKS

Application	Connector Location
Brat, Coupe, Hatchback, Sedan & Wagon	
1987	
Read Memory Connector	Under Left Side Of Dash, Next To MFI/SMFI Control Unit
Test Mode Connector	
MFI	On Left Side Of Dash, Next To MFI Control Unit
Sequential MFI	On Left Side Of Firewall
1988-89	On Left Side Of Dash, Next To ECU
Forester	Under Left Side of Dash, Behind Cover
Justy	
1987-88	
Read Memory Connector (Factory)	On Right Front Fender, Near Strut Tower
Test Mode Connector	On Driver-Side Kick Panel Or ECU

1989-95	
Read Memory Connector (Factory)	Under Left Side Of Dash
Test Mode Connector	On Driver-Side Kick Panel Or ECU
Legacy	
1990-94	
Check Connector (Black Connector)	Behind Right Side Of Steering Column, Near Heater Case
Diagnostic Connector (Black 4-Pin Connector)	Behind Right Side Of Steering Column, Near Heater Case
Read Memory Connector (Black Connector)	Behind Knee Panel, Right Of Steering Column
Select Monitor Connector (Yellow Connector)	Behind Right Side Of Steering Column, Near Heater Case
Test Mode Connector (Green Connector)	Behind Knee Panel, Right Of Steering Column
1995-	Under Left Side Of Dash, Behind Cover
Loyale	
1990-91	
MFI (5-Pin Connector)	In Front Of ECU
SMFI (Yellow 9-Pin & Black 13-Pin Connectors)	Near Brake Booster
1992-95	
Diagnostic Check Connector (Yellow 9-Pin & Black 13-Pin Connectors)	Behind Brake Booster
Diagnostic Read-Memory Connector (2-Single Wire Connectors)	Behind Left Front Strut Tower
Outback & Outback Sport	Under Center Of Dash
SVX	
1992-96	Under Left Side Of Dash
1997	Right Of Steering Column, On Center Console

SUZUKI

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

SUZUKI - IMPORTED CARS & TRUCKS

Application	**Connector Location**
Esteem (1995)	Near Battery
Samurai	
1986-90	Under Right Side Of Dash, Behind Glove Compartment

1991-92	On Right Side Of Firewall
1993-95	Under Left Side Of Dash, In Fuse Block
Sidekick & X90	
1989-91	Under Left Side Of Dash, In Fuse Block
1992-93	
ALDL Connector	Under Left Side Of Dash
Engine Connector	Under Left Side Of Dash, Near Fuse Block
1994-96	In Engine Compartment, Near Battery
Swift	
1989-91	Under Left Side Of Dash, In Fuse Block
1992	
ALDL Connector	Under Left Side Of Dash
Diagnostic Test Terminal	In Fuse Block
1993-95	Under Left Side Of Dash, In Fuse Block

TOYOTA

NOTE: This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.

TOYOTA - IMPORTED CARS & TRUCKS

Application	**Connector Location**
Camry	
1983-90	Next To Brake Master Cylinder
1991	Near Left Front Shock Tower
1992-95	
4-Cylinder	Near Wiper Motor
V6	Under Left Side Of Dash
Celica	
1983-84	Next To Battery
1985-95	Behind Left Front Shock Tower
Celica Supra	Rear Of Battery, Near Relay Panel (2-Pin Connector)
Corolla	
Front Wheel Drive	
1987	Side Of Left Front Shock Tower (2-

	Pin Connector)
1988-94	Behind Left Front Shock Tower
Rear Wheel Drive	
1985-86	Side Of Right Front Shock Tower (2-Pin Connector)
1987	Right Rear Corner Of Engine Compartment
Cressida	
1988-93	
Check Connector	On Left Front Shock Tower
Total Diagnostic Communication Link Connector	Under Left Side Of Dash
Land Cruiser (1988-94)	Near Wiper Motor
MR2	
1986-90	Near Airflow Meter
1992-95	On Right Rear Of Engine Compartment, Near MAP Sensor
Paseo (1992-95)	On Side Of Engine Compartment Fuse/Relay Block No. 2, Near Battery
Pickup	
1984-86	Near Ignition Coil, Near Master Cylinder (2-Pin Connector)
1987-90	Right Front Inner Fender Panel, Near Relay Block
1992-94	On Side Of Engine Compartment Fuse/Relay Block No. 2, Near Battery
Previa	
1992-93	Under Front Of Driver's Seat
1994	
Except Supercharged	Under Center Console, Near Parking Brake Lever
Supercharged	Under Cover, On Top Center Of Instrument Panel
1995-97	On Top Center Of Instrument Panel
RAV4	Under Dash, Near Center Console
Starlet	
1981-82	On Instrument Panel Fuse Block, On Top Of Dash
1983-84	Right Rear Of Engine Compartment
Supra	
1986-90	Rear Of Battery, Near Relay Panel
1991-92	On Left Front Shock Tower
1993-94	
DLC No. 1	On Right Side Of Firewall

DLC No. 2	Under Left Side Of Dash, Near Kick Panel
Tacoma & T100	
1993	On Side Of Engine Compartment Fuse/Relay Block No. 2, Near Battery
1994-95	
Except OBD-II DLC	On Side Of Engine Compartment Fuse/Relay Block No. 2, Near Battery
OBD-II DLC	Under Left Side Of Dash
Tercel	
1987-90	In Engine Compartment, Next To Master Cylinder
1991-94	On Side Of Engine Compartment Fuse/Relay Block No. 2, Near Battery
1995-98	Near Steering Column
Van	Near Airflow Meter
4Runner	
1985-86	Near Ignition Coil, Next To Master Cylinder (2-Pin Connector)
1987-95	On Side Of Engine Compartment Fuse/Relay Block No. 2, Near Battery

VOLKSWAGEN

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

VOLKSWAGEN - IMPORTED CARS & TRUCKS

Application	**Connector Location**
Cabrio	
1996	In Center Console, Below Tachometer
1997-02	On Center Dash, Behind Panel Near Ashtray
Corrado	Under Center Console Trim Plate
Fox	Under Center Console, Near Shift Lever
Golf	
1993	On Center Of Dash, Below A/C-Heater Control Knobs
1994	Under Center Console
1998-03	In Center Console

Golf III 2.0L	
1995-96	Below A/C-Heater Control Panel
1997-98	On Center Dash, Behind Panel Adjacent To Ashtray
GTI	
1993	On Center Of Dash, Below A/C-Heater Control Knobs
1994	Under Center Console
GTI 2.8L	On Center Dash, Behind Panel Adjacent To Ashtray
Jetta	
1993	On Center Of Dash, Below A/C-Heater Control Knobs
1994	Under Center Console
Jetta III 2.0L	
1995-96	Below A/C-Heater Control Panel
1997-98	On Center Dash, Behind Panel Adjacent To Ashtray
Jetta/Jetta III 2.8L	On Center Dash, Behind Panel Adjacent To Ashtray
New Beetle	Lower Part of Dash, In Front Of Shift Lever
Passat	
1992-94	Under Center Console, Forward Of Shift Lever
1995-97	On Center Dash, Behind Panel Near Ashtray
Toureg	
2004-2007	In the cover of the drivers side footwell, to right of engine hood release lever

VOLVO

NOTE: **This table provides a quick reference for self-diagnostic connector locations, when available from manufacturer, that ARE NOT located at the lower left side of the dash, as mandated in 1996 by the Federal government.**

VOLVO - IMPORTED CARS & TRUCKS

Application	Connector Location
C30	Under Left Center Of Dash
C70	Behind Cover, Below Parking Brake Lever

S40	Under Left Center Of Dash
S70	Behind Cover, Below Parking Brake Lever
S90	Behind Cover, Below Parking Brake Lever
V40	Under Left Center Of Dash
V70 (1997-00)	Behind Cover Below Parking Brake Lever
V90	Behind Cover, Below Parking Brake Lever
240	
1986-92	Left Rear Corner Of Engine Compartment
1993	Behind Left Front Strut Tower
740 & 760	
1986-92	
Ignition System	On Left Front Fender Apron
Fuel Injection (1990-92 Only)	Left Rear Corner Of Engine Compartment
780	On Left Front Fender, Behind Air Cleaner Housing
850	
1993	On Center Console, Forward Of Shift Lever & Near ECM
1994-95	
Non-Turbo	On Right Front Strut Tower
Turbo	Behind Cover, Forward Of Shift Lever
1996-97	Behind Cover, Forward Of Shift Lever
940	
1991-93	
Ignition System	On Left Front Fender Apron
Fuel Injection	Left Rear Corner Of Engine Compartment
1994-95	Behind Left Front Strut Tower
960	
1992-95	On Left Front Strut Tower
1996	In Center Console, To Right Of Parking Brake Lever
1997	Behind Cover, Forward Of Shift Lever

2008 GENERAL INFORMATION

Driveline System - General Information - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Additive Friction Modifier XL-3 (US); CXL-3 (Canada)	EST-M2C118-A	-
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A	1.15L (2.43 pt)

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
End play	
Wheel bearing end play	0.00 mm (0.000 in) maximum
Runout	
Driveshaft runout	0.89 mm (0.035 in)
Pilot runout	0.15 mm (0.006 in) maximum
Wheel hub face runout	0.254 mm (0.010 in) maximum
Wheel hub flange bolt circle runout	0.38 mm (0.015 in) maximum

DESCRIPTION AND OPERATION

DRIVELINE SYSTEM

Driveline System

The driveline system consists of the following components:

- Center support bearing
- Driveshaft assembly
- Front halfshafts
- Rear halfshafts
- Active torque coupling/rear axle

On Front Wheel Drive (FWD) vehicles, the transaxle transmits power from the engine to the halfshafts.

On All-Wheel Drive (AWD) vehicles, power is transmitted from the engine through the transaxle to the Power

Transfer Unit (PTU). The PTU transfers engine power from the transaxle to the front halfshafts, and through the driveshaft to the active torque coupling/rear axle and halfshafts. For information on the PTU, refer to **FOUR WHEEL DRIVE (4WD) SYSTEMS** article or **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.

The engine angle is built into the engine mounts. If the engine angle is out of specification, the engine mounts must be inspected for damage. Refer to **ENGINE - 2.3L** article, **ENGINE - 3.0L (4V)** article or **ENGINE - 3.5L** article.

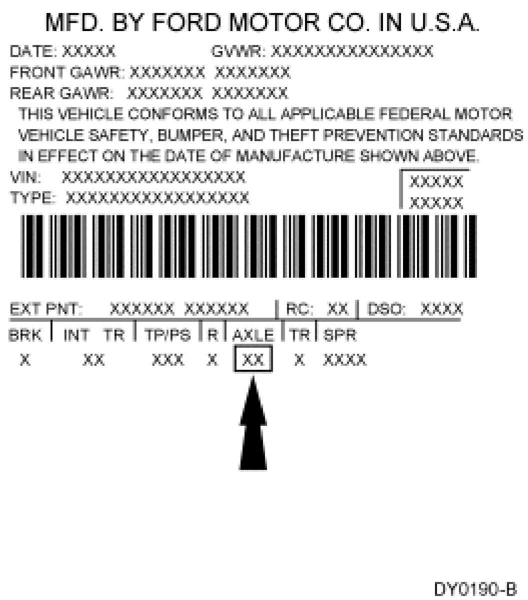


Fig. 1: Vehicle Certification (VC) Label Example
Courtesy of FORD MOTOR CO.

The Vehicle Certification (VC) label is located in the driver door jamb. The axle code is on the VC label. Refer to **IDENTIFICATION CODES** article.

The axle ratio is 2.93 and the ring gear has a diameter of 174 mm (6.85 in).

The wheel speed sensor rings for FWD vehicles are located on the front halfshafts and are mounted to the rear inner spindles.

The wheel speed sensor rings are located on the front and rear halfshafts for AWD vehicles.

Driveshaft

The driveshaft is a 3-piece shaft with rubber-isolated center bearings.

The driveshaft has traditional balance weights attached (spot-welded) by the manufacturer.

U-joints

The CV and U-joints are installed new with the driveshaft.

The front CV joint is:

- lubricated with a special lubricant and requires no additional lubrication.

The center U-joints are:

- a lubed-for-life design that requires no periodic lubrication.
- equipped with nylon thrust washers located at the base of each bearing cup which control end play, position the needle bearings and improve grease movement.

Rear Drive Unit

The active torque coupling/Rear Drive Unit (RDU) is serviced as an assembly.

The RDU housing cover uses a silicone sealant rather than a gasket.

Each halfshaft is held in the RDU case by a halfshaft circlip that is located on the inner CV joint stub shaft pilot bearing housing. When each halfshaft is installed, the halfshaft circlip engages a slot in the differential side gear.

The RDU operates as follows:

- The RDU pinion receives power from the engine through the transaxle, PTU, driveshaft and active torque coupling, and is always engaged.
- The pinion gear rotates the differential case, which is bolted to the differential case outer flange.
- Inside the differential case, 2 differential pinion gears are mounted on a differential pinion shaft that is pinned to the differential case.
- These differential pinion gears are engaged with the differential side gears, to which the halfshafts are splined.
- As the differential case turns, it rotates the halfshafts and rear wheels.
- When it is necessary for one wheel and halfshaft to rotate faster than the other, the faster turning differential side gear causes the differential pinion gears to roll on the slower turning differential side gear. This allows differential action between the 2 halfshafts.

Halfshafts

The drive halfshafts consist of the following components:

- Inner CV joints
- Outer CV joints
- CV joint boot clamps

- CV joint boots
- Tripod joint housings
- Retainer circlips
- Front intermediate shaft bearing

The front intermediate shaft bearing is pressed on and is only serviced as an assembly with the intermediate shaft.

NOTE:	**An inspection of the outer and inner constant velocity (CV) joint boots is necessary so that if damage or grease leakage is evident, installation of a new halfshaft can take place immediately. Continued operation with damage or grease leakage will result in CV joint wear and noise due to contamination and loss of the CV joint grease.**

- The inner and outer CV joints connect to a splined shaft. A circlip holds the cross groove inner race assembly (inner CV joint) together.
- A circlip retains the splined inner CV joint. Install a new axle circlip each time the halfshaft is removed from the vehicle.
- A wheel hub nut secures the side shaft assembly (interconnecting shaft and outer CV joint) to the wheel hub. Install a new wheel hub nut each time the halfshaft is removed from the vehicle.

Halfshaft Handling

NOTE:	**Handle the halfshaft only by the interconnecting shaft to avoid pull-apart and potential damage to the constant velocity (CV) joints. Damage will occur to an assembled inner CV joint if it is over-plunged outward from the joint housing or over angled.**

Handle all halfshaft components carefully during removal and installation procedures. Never use a hammer to remove or install the halfshafts. Never use the halfshaft assembly as a lever to position other components. Always support the free end of the halfshaft. Do not allow the boots to contact sharp edges or hot exhaust components. Do not drop assembled halfshafts. The impact may cut the boots from the inside without evidence of external damage.

DIAGNOSTIC TESTS

DRIVELINE SYSTEM

Principals of Operation

Driveline System - General Information

The driveline system enables the power generated by the engine and transferred through the transmission in Front Wheel Drive (FWD), or the transmission and the Power Transfer Unit (PTU) in All-Wheel Drive (AWD) to place the vehicle in motion. Rotational torque received from the transmission or PTU is delivered to the front

wheels by halfshafts or the rear axle by way of the driveshaft(s). The U-joints or CV joints at the ends of the shafts allow the shafts to rotate smoothly in an allowable angle plane. The rotational torque is introduced into the axle drive pinion which drives the differential ring gear. The ring gear is bolted to the axle differential which divides the torque between the left and right axle shafts, while permitting the shafts to turn at different speeds when required, such as when cornering.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

VISUAL INSPECTION CHART

Mechanical
• U-joints • CV joints • Center bearings • Driveshaft tubes • Mounting brackets • Flanges • Housing and cover damage • Differential bearings • Differential gear sets • Pinion bearings

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and Go to **Symptom Chart - NVH**.

Driveshaft Center U-Joint and CV Joint Inspection

With the vehicle in NEUTRAL, position it on a hoist. Refer to **JACKING AND LIFTING** article. Rotate the driveshaft by hand. Check for rough operation or seizure of the U-joints or CV joints. Install a new driveshaft if it shows signs of seizure, excessive wear or incorrect seating. Refer to **DRIVESHAFT** article.

Driveshaft Center Bearing

With the vehicle in NEUTRAL, position it on a hoist. Refer to **JACKING AND LIFTING** article. Rotate the driveshaft by hand. If the bearing shows signs of roughness or is noisy, install a new driveshaft assembly. Refer to **DRIVESHAFT** article.

Symptom Charts - NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

Symptom Charts - NVH

Condition	Possible Sources	Action
• Axle howling or whine - front or rear axle	• Axle lubricant low	• CHECK the lubricant level. FILL the axle to specification.
	• Axle housing damage	• INSPECT the axle housing for damage. INSTALL a new axle as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
	• Damaged or worn wheel hub bearings	• CHECK for abnormal wheel hub bearing play or roughness. REFER to **FRONT SUSPENSION** article or **REAR SUSPENSION** article.
	• Damaged or worn differential ring and pinion	• INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
	• Damaged or worn differential side or pinion bearings	• INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
• Driveline clunk - loud clunk when shifting from reverse to drive	• Incorrect axle lubricant level	• CHECK the lubricant level. FILL the axle to specification.
	• Excessive backlash in the axle	• CHECK the axle backlash. INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
	• Damaged or worn pinion bearings	• INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
	• Damaged or worn U-joints	• INSPECT the U-joints for wear or damage. INSTALL a new driveshaft as necessary. REFER to

		DRIVESHAFT article.
• Driveline clunk - occurs as the vehicle starts to move forward following a stop • Driveline clunk (Front Wheel Drive (FWD) vehicles) - occurs during acceleration or from cruise to coast/deceleration	• Worn driveshaft CV joint or U-joints with excessive play • Loose rear axle mount • Damaged or worn inner CV joint	• INSPECT the CV joint and U-joints for a worn condition. INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article. • CHECK the axle for loose bolts. TIGHTEN to specification. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article. • INSPECT the inner CV joint and boot. INSTALL a new CV joint as necessary. REFER to **FRONT DRIVE HALFSHAFTS** article.
• Clicking, popping or grinding - occurs while the vehicle is turning	• Inadequate or contaminated lubrication in the CV joints • Loose wheel end nut • Another component contacting the halfshaft	• CHECK the CV boots and joints for wear or damage. INSTALL new components as necessary. REFER to **FRONT DRIVE HALFSHAFTS** article. • CHECK wheel hub nut torque. REPAIR as necessary. REFER to **FRONT DRIVE HALFSHAFTS** article. • CHECK the halfshafts and the area around the halfshafts. REPAIR as necessary.
• High pitched chattering - noise from the rear axle when the vehicle is turning • Buzz - buzzing noise is the same at cruise or coast/deceleration	• Incorrect or contaminated lubricant • Damaged or worn differential (differential side gears and pinion gears) • Incorrect driveline angles	• CHECK the vehicle by driving in tight circles (5 clockwise, 5 counterclockwise). DRAIN and REFILL with the specified rear axle lubricant and friction modifier as necessary. • INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article. • CHECK for correct driveline angles. REPAIR as necessary. REFER to **Driveline Angle Measurement**.
• Rumble or boom - noise occurs at coast/deceleration, usually	• Driveshaft is out-of-	• CHECK the driveshaft for damage, missing balance weights or undercoating. REFER to **DRIVESHAFT BALANCING -**

driveshaft speed-related and noticeable over a wide range of speeds	balance	**USING THE MASTER TECH® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix)**.
	• U-joints are binding or seized	• ROTATE the driveshaft and CHECK for rough operation or seized U-joints. INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article.
• Grunting - normally associated with a shudder experienced during acceleration from a complete stop	• Driveshaft CV joint binding	• INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article.
	• Loose rear axle mount bolts or suspension fasteners	• INSPECT the rear suspension and axle. TIGHTEN the fasteners to specification. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
• Howl - can occur at various speeds and driving conditions. Affected by acceleration and deceleration	• Incorrect ring and pinion contact, incorrect bearing preload or gear damage	• INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
• Chuckle - heard at coast/deceleration. Also described as a knock	• Incorrect ring and pinion contact or damaged teeth on the coast side of the ring and pinion	• INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
• Knock - noise occurs at various speeds. Not affected by acceleration or deceleration	• Gear tooth damage to the drive side of the ring and pinion	• INSPECT and INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
• Scraping noise - a continuous low pitched noise starting at low speeds	• Worn or damaged pinion bearings	• INSTALL a new axle assembly as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
• Driveline shudder - occurs during acceleration from a slow speed or stop	• Rear drive axle assembly mispositioned	• CHECK the axle mounts and the rear suspension for damage or wear. REPAIR as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
	• Loose rear axle bolts	• CHECK the rear axle for loose bolts. TIGHTEN the bolts to specification. REFER to **REAR DRIVE**

		AXLE/DIFFERENTIAL article.
	• Driveline angles out of specification	• CHECK for correct driveline angles. REFER to **Driveline Angle Measurement**.
	• U-joints binding or seized	• ROTATE the driveshaft and CHECK for rough operation or seized U-joints. INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article.
	• Binding or damaged driveshaft CV joint	• INSPECT the driveshaft CV joint and coupling shaft for wear or damage. INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article.
• Driveline vibration - occurs at cruising speeds	• Worn U-joints	• CHECK for wear or incorrect seating. INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article.
	• Worn or damaged driveshaft center bearing support	• CHECK the insulator for damage or wear. ROTATE the driveshaft and CHECK for rough operation. INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article.
	• Loose axle pinion flange bolts	• INSPECT the axle pinion flange. TIGHTEN the pinion flange bolts to specification. REFER to **DRIVESHAFT** article.
	• Excessive axle pinion flange runout	• CARRY OUT a runout check. REPAIR as necessary. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
	• Driveshaft is out-of-balance	• CHECK the driveshaft for damage, missing balance weights or undercoating. CHECK the driveshaft balance. CARRY OUT a driveline vibration test. REFER to **Driveshaft Runout and Balancing**.
	• Binding or damaged driveshaft CV joint	• INSPECT the driveshaft CV joint for wear or damage. INSTALL a new driveshaft as necessary. REFER to **DRIVESHAFT** article.
	• Excessive driveshaft	• CARRY OUT a runout check. REFER to **Driveshaft Runout and**

	runout	**Balancing**.
	• Driveline angles out of specification	• CHECK for correct driveline angles. REPAIR as necessary. REFER to **Driveline Angle Measurement**.
	• Incorrectly seated CV joint in the wheel hub	• CHECK the outer CV joint for correct seating into the hub. REPAIR as necessary. REFER to **FRONT DRIVE HALFSHAFTS** article for the front CV joints or **REAR DRIVE HALFSHAFTS** article for the rear CV joints.

Analysis of Leakage

Clean up the leaking area enough to identify the exact source.

A plugged Rear Drive Unit (RDU) housing vent can cause excessive pinion seal lip wear due to internal pressure buildup.

Verify the RDU lubricant level is at least 3-5 mm (1/8-3/16 in) below the bottom of the fill hole.

Axle Vent

A plugged vent will cause excessive seal lip wear due to internal pressure buildup. If a leak occurs, check the vent. If the vent cannot be cleared, install a new vent.

Drive Pinion Seal

Leaks at the drive pinion seal originate from the following causes:

- Damaged seal
- Worn seal journal surface

Any damage to the seal bore (dings, dents, gouges or other imperfections) distorts the seal casing and allows leakage past the outer edge of the drive pinion seal.

The drive pinion seal can be torn, cut or gouged if it is not installed correctly. The spring that holds the drive pinion seal against the pinion flange may be knocked out and allow fluid to pass the lip.

Metal chips trapped at the sealing lip can cause oil leaks. These can cause a wear groove on the drive pinion flange and result in pinion seal wear.

When a seal leak occurs, install a new drive pinion seal and check the vent to make sure it is clean and free of foreign material.

A new drive pinion flange must be installed if any of these conditions exist.

Drive Pinion Nut

NOTE: **Install the drive pinion nut to the correct torque specifications or damage to the differential components may occur.**

On some high-mileage vehicles, oil may leak through the threads of the drive pinion nut. This condition can be corrected by installing a new nut.

Differential Seals

NOTE: **When installing shafts, do not allow splines to contact seals during installation or damage to the seals may occur.**

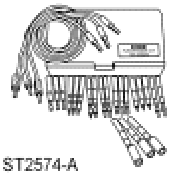
Halfshaft pilot bearing housing seals are susceptible to the same types of damage as drive pinion seals if incorrectly installed. The seal bore must be clean and the lip handled carefully to avoid cutting or tearing it. The seal journal surface must be free of nicks, gouges and rough surface texture.

For information on differential seals, refer to **REAR DRIVE AXLE/DIFFERENTIAL** article.

GENERAL PROCEDURES

DRIVELINE ANGLE MEASUREMENT

Special Tools

Illustration	Tool Name	Tool Number
 ST2574-A	Angle master II Driveline Inclinometer/Protractor	164-R2402 or equivalent

NOTE: **This procedure does not apply to CV joints, flex couplers or double cardan joints that are used in some driveshaft. This check is for single-cross and roller-style joints found in the driveshaft.**

NOTE: **Prior to checking driveline angularity, inspect the U-joints for correct operation.**

NOTE: **An incorrect driveline angle can cause a vibration or shudder. For additional information, refer to NOISE, VIBRATION AND HARSHNESS article.**

NOTE: **Driveline angularity is the angular relationship between the engine crankshaft, the driveshaft and the rear axle pinion. Factors determining driveline angularity include ride height, rear spring and engine mounts.**

All vehicles

1. Carry out the following preliminary setup steps:
   - Inspect the U-joints for correct operation.
   - Park the vehicle on a level surface such as a drive-on hoist, or back onto a front end alignment rack.
   - Verify the curb position ride height is within specifications with the vehicle unloaded and all of the tires are inflated to their normal operating pressures.
   - Calibrate the Angle master II Driveline Inclinometer/Protractor by placing it on a clean, flat level section of the frame rail and press the ALT-ZERO button.

   Vehicles with flat-flanged, split-pin or slip-flanged U-joints

   NOTE: If equipped, remove the snap ring to allow access to the base of the U-joint cup. Make sure the Angle master II Driveline Inclinometer/Protractor is seated against the U-joint cup.

   NOTE: Rotate the driveshaft until the flange U-joint cup is parallel with the floor. This will simplify taking measurements.

2. To check the U-joint operating angle, install the Angle master II Driveline Inclinometer/Protractor. Check and record the flange angle as angle A.

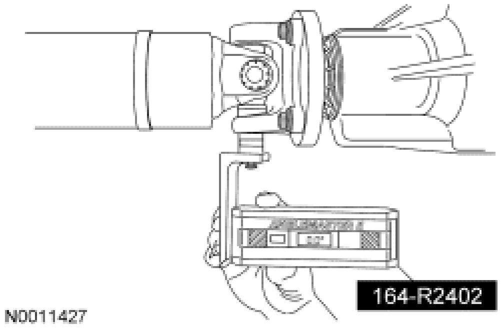


Fig. 2: Checking Flange Angle (1 Of 2)
Courtesy of FORD MOTOR CO.

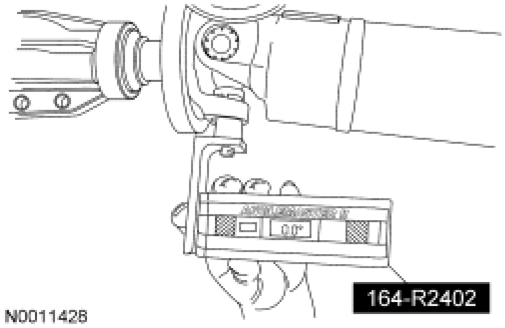


Fig. 3: Checking Flange Angle (2 Of 2)

Courtesy of FORD MOTOR CO.

3. Using the Angle master II Driveline Inclinometer/Protractor, measure the slope of the connecting component. Record the measurements of the component's angle as angle B.

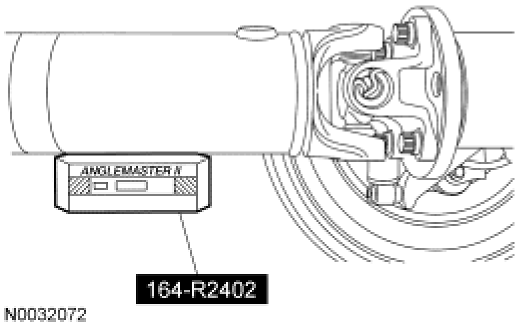


Fig. 4: Checking Driveshaft Angle
Courtesy of FORD MOTOR CO.

Multiple piece driveshaft

NOTE:	**Repeat this step for each center support bearing on the driveshaft.**

NOTE:	**It is not necessary to remove the U-joint snap ring, if equipped, for these measurements.**

4. Using the Angle master II Driveline Inclinometer/Protractor, measure the slope of the components in front and behind the center support bearing U-joint in the area indicated. Record the front component as angle A and the rear component as angle B.

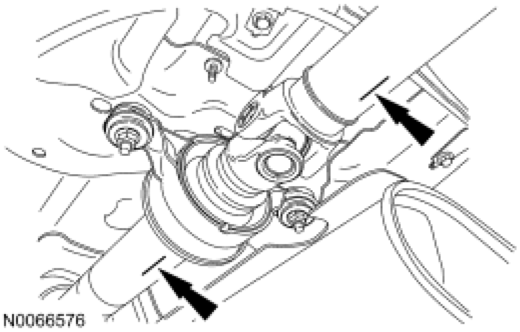


Fig. 5: Locating Index Mark On Driveshaft
Courtesy of FORD MOTOR CO.

All vehicles

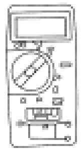
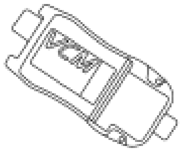
NOTE:	**When 2 connected components slope in the same direction, subtract the smallest number from the larger number to find the U-joint operating angle. When 2 connected components slope in the opposite direction, add**

the measurements to find the U-joint operating angle.

5. Calculate the difference in the slope of the components to determine the U-joint operating angle.
   - The U-joint operating angle is the angle formed by 2 yokes connected by a cross and bearing kit. Ideally, the operating angles on each connection of the driveshaft must:
     - be equal or within one degree of each other.
     - have a 3 degree maximum operating angle.
     - have at least 1/2 of one degree continuous operating angle.
6. If the angle is not within specifications, repair or adjust to obtain the correct angle. Inspect the engine mounts, transmission mounts, center support bearing mounting, rear suspension, rear axle, rear axle mounting or the frame for wear or damage.

DRIVESHAFT RUNOUT AND BALANCING

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	Dial Indicator Gauge with Holding Fixture 100-02 (TOOL-4201-C) or equivalent	
 ST2834-A	Master tech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix)	257-00018 or equivalent

Driveshaft Inspection

NOTE: **Driveline vibration exhibits a higher frequency and lower amplitude than high-speed shake. Driveline vibration is directly related to the speed of the vehicle and is noticed at various speeds. Driveline vibration can be perceived as a tremor in the floorpan or heard as a rumble, hum or boom.**

NOTE: **Refer to <u>SPECIFICATIONS</u> for all runout specifications.**

NOTE: **Do not make any adjustments before carrying out a road test. Do not change the tire pressure or the vehicle load.**

1. Carry out a visual inspection of the vehicle. Operate the vehicle and verify the condition by reproducing it during the road test.
   - The concern should be directly related to vehicle road speed, not affected by acceleration or deceleration or could not be reduced by coasting in NEUTRAL.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
    - The driveshaft should be kept at an angle equal to or close to the curb-weighted position. Use a twin-post hoist or a frame hoist with jackstands.
3. Inspect the driveshaft for damage, undercoating or incorrectly seated U-joints. Rotate the driveshaft slowly by hand and feel for binding or end play in the U-joint trunnions. Remove the driveshaft. For additional information, refer to **DRIVESHAFT** article. Inspect the slip yoke splines for any galling, dirt, rust or incorrect lubrication. Clean the driveshaft or install new U-joints as necessary. Install a new driveshaft if damaged. After any corrections or new components are installed, recheck for the vibration at the road test speed.
    - If the vibration is gone, test drive the vehicle.
    - If the vibration persists or the driveshaft passes visual inspection, measure the driveshaft runout.

Driveshaft Runout

1. Install the suitable Dial Indicator Gauge with Holding Fixture. Rotate the driveshaft by turning the axle and measure the runout at the front, the center and the rear of the driveshaft.
    - If the runout exceeds 0.89 mm (0.035 in) at the front or center, install a new driveshaft.
    - If the front and center is within 1 mm (0.254 in), but the rear runout is not, index-mark the rear runout high point and proceed to Step 2.
    - If the runout is within 0.89 mm (0.035 in) at all points, recheck for vibration at road test speed. If the vibration persists, balance the driveshaft. For additional information, refer to **DRIVESHAFT BALANCING - USING THE MASTER TECH® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix)**.

NOTE: Circular pinion flanges can be turned in 90 degree or 1/4 increments. Half-round pinion flanges are limited to 2 positions.

2. Index-mark the driveshaft to the pinion flange. Disconnect the driveshaft and rotate it 180 degrees. Reconnect the driveshaft. Recheck the runout at the rear of the driveshaft.
    - If the runout is still over specification, mark the high point and proceed to Step 3.
    - If the runout is within specification, check for the vibration at the road test speed. If the vibration is still present, balance the driveshaft. For additional information, refer to **DRIVESHAFT BALANCING - USING THE MASTER TECH® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix)**.
3. Excessive driveshaft runout can originate in the driveshaft itself or from the pinion flange. To find the source, compare the 2 high points previously determined.
    - If the index marks are close together, within 25 mm (1 in), the driveshaft is eccentric. Install a new driveshaft.
    - If the marks are on opposite sides of the driveshaft, 180 degrees apart, the slip yoke or pinion flange is responsible. Check the pinion flange runout. If the pinion flange runout exceeds specifications, a bent pinion is indicated.
    - If the pinion flange and pinion run outs are within specifications, road test and check for the vibration at the road test speed. If the vibration persists, balance the driveshaft. For additional

information, refer to **DRIVESHAFT BALANCING - USING THE MASTER TECH® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix)**.

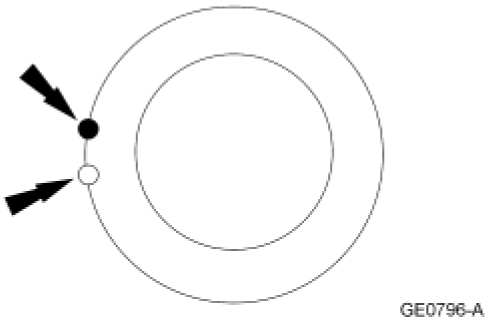


Fig. 6: Finding Excessive Driveshaft Runout (1 Of 2)
Courtesy of FORD MOTOR CO.

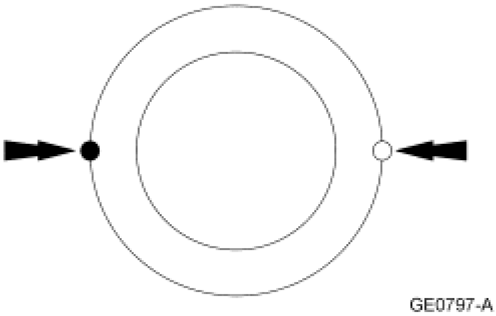


Fig. 7: Finding Excessive Driveshaft Runout (2 Of 2)
Courtesy of FORD MOTOR CO.

Driveshaft Balancing - Using the Master tech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix)

All vehicles

1. Install the Master tech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix) to the vehicle.
2. Working under the vehicle, install an accelerometer. The accelerometer can be attached and mounted near either the transmission or differential end of the driveshaft.
3. Clean an area of the driveshaft and install the reflective tape, then install the photo-tachometer sensor. The sensor should be placed at approximately a 20-degree angle from perpendicular to the surface of the reflective tape. Make sure the sensor does not get moved during the balance procedure.
    1. Reflective tape.
    2. Photo-tachometer sensor.

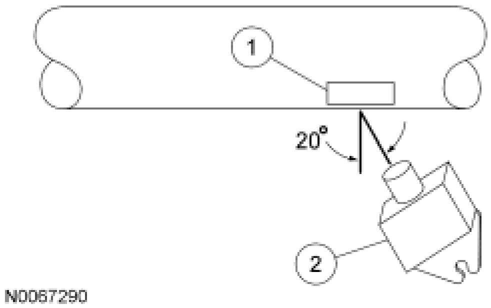


Fig. 8: Driveshaft Balancing - Using the MTS 4000
Courtesy of FORD MOTOR CO.

4. Using the Master tech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a driveshaft balance test with the driveshaft unmodified.

Vehicles with tapped pinion flanges

5. Label the tapped holes in the pinion flange numerically, starting at the top hole as 1. Mark the remaining holes 2, 3 and 4. Label in the direction of rotation.

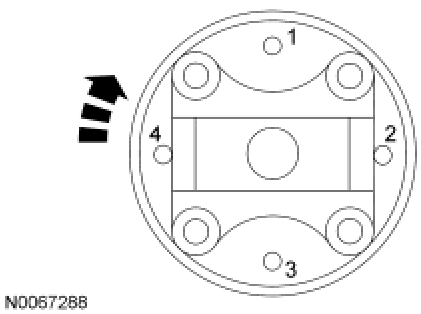


Fig. 9: Labeling Tapped Holes In The Pinion Flange
Courtesy of FORD MOTOR CO.

6. Using the Master tech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a second test with the 12 mm (0.47 in) test weight set screw in the No. 1 hole, previously marked on the pinion flange.
7. Remove the test weight, then install the weight combination directed by the Master tech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix).

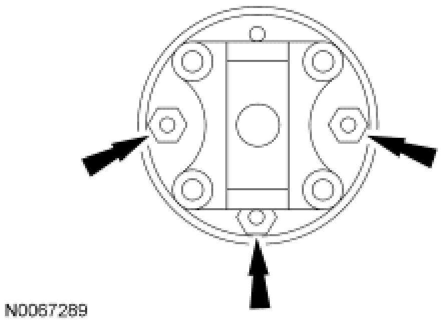


Fig. 10: Installing Weight Combination
Courtesy of FORD MOTOR CO.

Vehicles without tapped pinion flanges

8. Using the Master tech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a second test with a test weight. Using a metal band, secure the test weight to the end of the driveshaft. The weight should be placed at the end of the driveshaft tube, as close to the tube-to-yoke weld seam as possible. Mark the location of the test weight on the driveshaft, as shown in the figure below.
    1. Test weight.
    2. Tube-to-yoke weld seam.
    3. Driveshaft pinion flange.
    4. Select the test weight based on driveshaft size. Larger driveshaft use 10 g (0.353 oz). Smaller driveshaft use 5 g (0.176 oz).

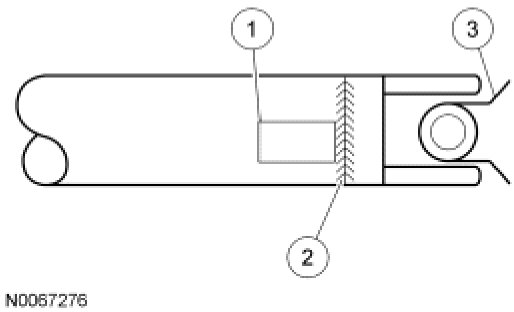


Fig. 11: Test Weight, Tube-To-Yoke Weld Seam, And Driveshaft Pinion Flange
Courtesy of FORD MOTOR CO.

9. Remove the test weight, then install the recommended weight at the position directed by the Master tech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix). Using a metal band and epoxy, secure the test weight to the driveshaft, as shown in the figure below.
    1. Test weight.
    2. Measure in this direction.
    3. Driveshaft diameter.
    4. Directional rotation.

5. Balance weight relative to test weight centerline.
6. The results are displayed with respect to the location to where the test weight was placed.

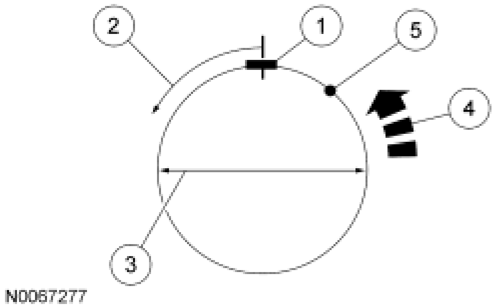


Fig. 12: Installing Weight In Recommended Position
Courtesy of FORD MOTOR CO.

All vehicles

10. Using the Master tech® Series MTS 4000 Driveline Balance and NVH Analyzer (Vetronix), run a third test to verify the repair.

Driveshaft Balancing - Hose Clamp Method

1. Install 1 or 2 hose clamps on the driveshaft, near the rear. Position of the hose clamp head(s) can be determined through trial and error.
2. Mark the rear of the driveshaft into 4 approximately equal sectors and number the marks 1 through 4. Install a hose clamp on the driveshaft with its head at position No. 1, as shown in the figure below. Check for vibration at road speed. Recheck with the clamp at each of the other positions to find the position that shows minimum vibration. If 2 adjacent positions show equal improvement, position the clamp head between them.

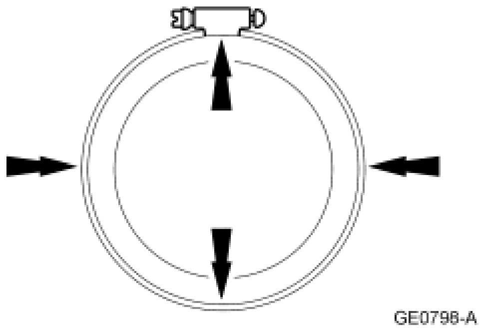


Fig. 13: Marking Rear Driveshaft Into Four Equal Sections
Courtesy of FORD MOTOR CO.

3. If the vibration persists, add a second clamp at the same position and recheck for vibration.

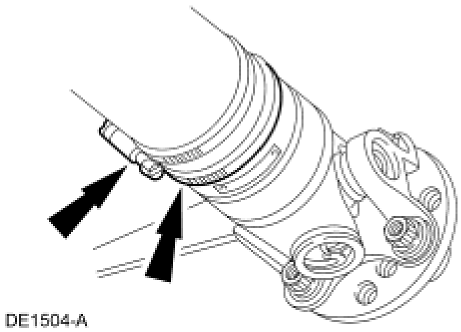


Fig. 14: Adding A Second Clamp
Courtesy of FORD MOTOR CO.

4. If no improvement is noted, rotate the clamps in opposite directions, equal distances from the best position determined in Step 2. Separate the clamp heads about 13 mm (1/2 in) and recheck for vibration at the road speed.

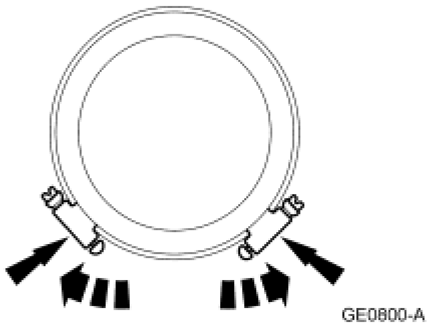


Fig. 15: Rotating Clamps In Opposite Directions
Courtesy of FORD MOTOR CO.

5. Repeat the process with increasing separation until the best combination is found or the vibration is reduced to an acceptable level.

DRIVESHAFT INDEXING

NOTE: If indexing the driveshaft does not eliminate the vibration, balance the driveshaft. For additional information, refer to Driveshaft Runout and Balancing.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

 NOTE: Do not reuse constant velocity (CV) joint bolts or flange bolts. Install new bolts or damage to the vehicle may occur.

2. Remove and discard the driveshaft-to-transfer case bolts.

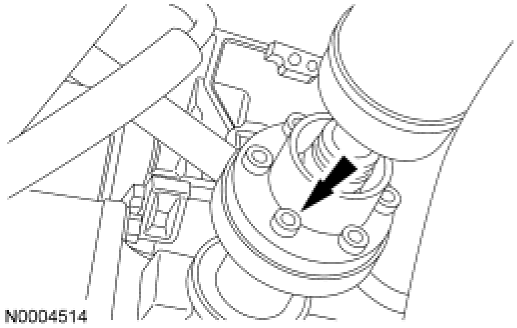


Fig. 16: Identifying Driveshaft Flange Bolts
Courtesy of FORD MOTOR CO.

3. Using a suitable pry bar as shown, separate the driveshaft from the Power Transfer Unit (PTU) flange.

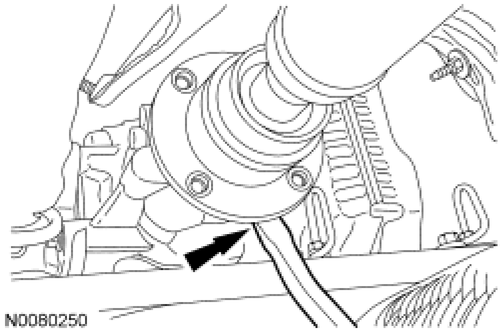


Fig. 17: Separating Driveshaft From Power Transfer Unit (PTU) Flange Using A Suitable Pry Bar
Courtesy of FORD MOTOR CO.

NOTE: Index-mark the shaft for reference.

4. Rotate the flange 90 degrees clockwise.

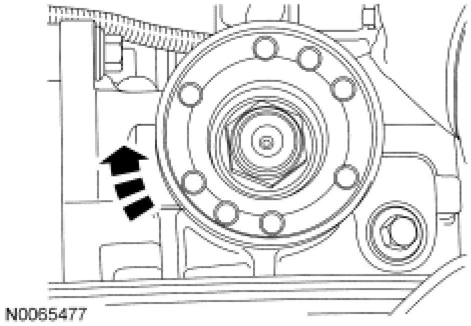


Fig. 18: Rotating Flange 90 Degrees Clockwise
Courtesy of FORD MOTOR CO.

5. Connect the front driveshaft and install the new bolts. For additional information, refer to **DRIVESHAFT** article.

NOTE: Do not reuse the bolts for the pinion yoke. Install new bolts or damage to the vehicle may occur.

6. Disconnect the rear driveshaft U-joint flange.
   - Discard the bolts.

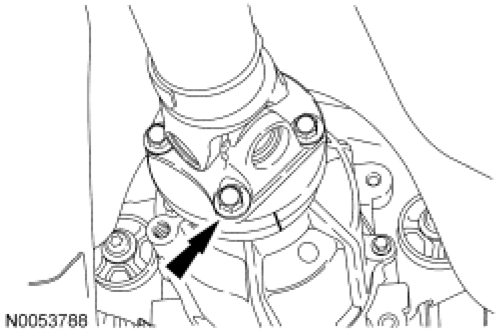


Fig. 19: Locating Rear Driveshaft Universal Joint Flange Bolts
Courtesy of FORD MOTOR CO.

7. Rotate the rear pinion 90 degrees clockwise.

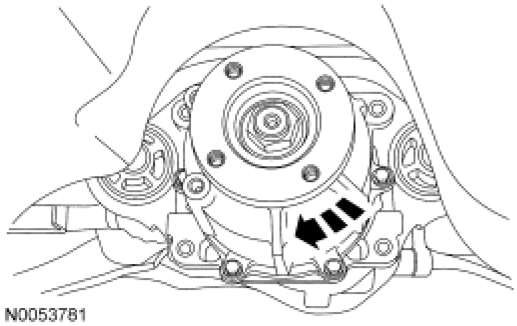


Fig. 20: Rotating Rear Pinion 90 Degrees Clockwise
Courtesy of FORD MOTOR CO.

8. Connect the rear driveshaft and install the new bolts. For additional information, refer to **DRIVESHAFT** article.
9. Test drive the vehicle.
10. Repeat the procedure if necessary.

2008 DRIVELINE/AXLES

Driveshaft - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Center bearing support nuts	55	41
Exhaust flex pipe nuts	40	30
Front driveshaft-to-power transfer unit (PTU) flange bolts	70	52
Rear driveshaft-to-pinion flange bolts	70	52

DESCRIPTION AND OPERATION

DRIVESHAFT

NOTE: All driveshaft assemblies are balanced. If undercoating the vehicle, protect the driveshaft to prevent overspray of any undercoating material.

The driveshaft assembly consists of the following:

- Rubber isolated center support bearings
- Constant velocity (CV) joint at the power transfer unit (PTU)
- U-joints at the center supports and pinion flange
- Assembly balanced with traditional balance weights
- Lubed-for-life joints requiring no periodic lubrication

The driveshaft transfers torque from the PTU to the rear axle. It is attached to the PTU flange with a CV joint. The 3-piece shaft is connected by a staked U-joint at each center bearing and attached to the rear pinion flange. The driveshaft joints allow the smooth continuous rotation of the driveshaft through the allowable angle planes and length variations required in normal vehicle operation. The driveshaft is always turning at front wheel speed. The driveshaft is not serviceable. A new driveshaft must be installed if worn or damaged.

UNIVERSAL JOINTS

The U-joints consist of the following:

- A single spider (cross)
- Lubed-for-life design and require no periodic lubrication
- Nylon thrust washers, located at each base of the bearing cup, which control end play, position the needle bearing and improve grease movement

- Grease seals located at the opening of each bearing cup to retain the grease for the bearing lubrication
- Bearing cups that retain the needle bearings and locate the spider on the centerline of the shaft bore to control shaft runout and balance

The U-joints are staked in place and are not serviced individually. If worn or damaged, install a new driveshaft assembly.

The 3 U-joints in this driveshaft assembly allow the driveshaft tubes to rotate smoothly through the varying angles of the power transfer unit (PTU), the center support bearings and the rear drive unit (RDU). The angles that cause the U-joints to accelerate and decelerate may cause vibration in the driveshaft assembly if the angles are either too great or too small. Refer to **DRIVELINE SYSTEM - GENERAL INFORMATION** article.

DIAGNOSTIC TESTS

DRIVESHAFT

Refer to **DRIVELINE SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

DRIVESHAFT

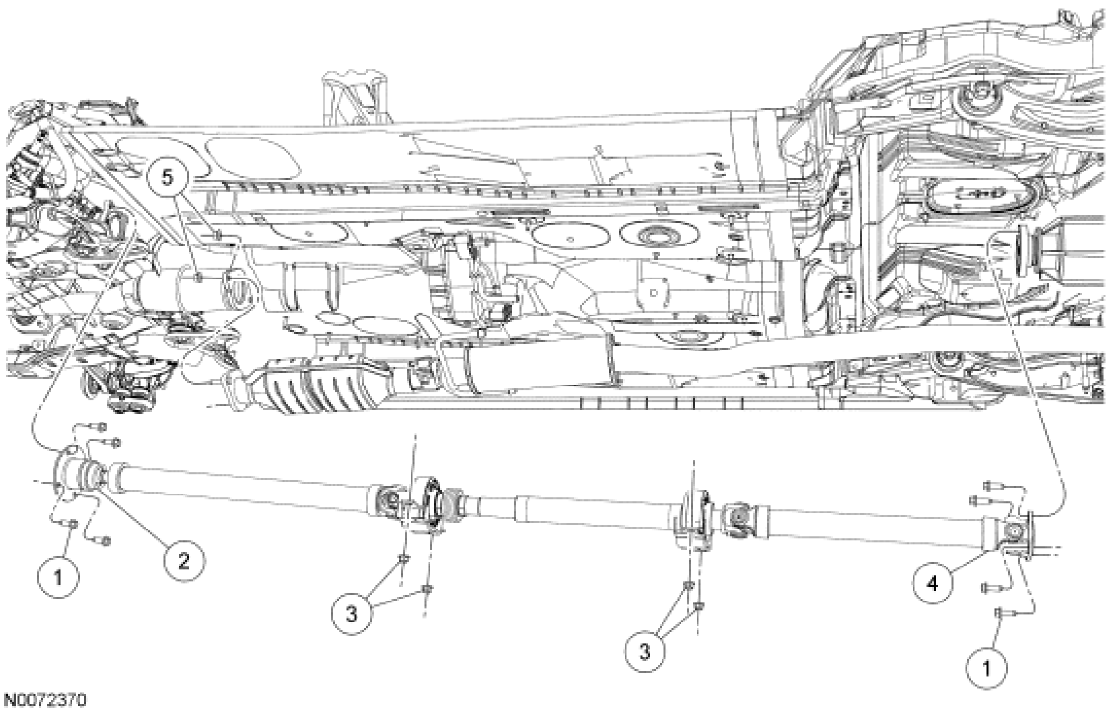


Fig. 1: Exploded View Of Driveshaft
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711918-S	Driveshaft flange bolts (8 required)
2	-	Front driveshaft flange
3	W711960	Center bearing support nuts (4 required)
4	-	Rear driveshaft flange
5	W705443-S	Exhaust flex pipe flange nuts (2 required)

REMOVAL AND INSTALLATION

NOTE: Index-mark both the driveshaft flanges.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article
2. Remove and discard the 2 nuts and separate the exhaust system at the flex pipe.
    - Install new nuts and tighten to 40 Nm (30 lb-ft).

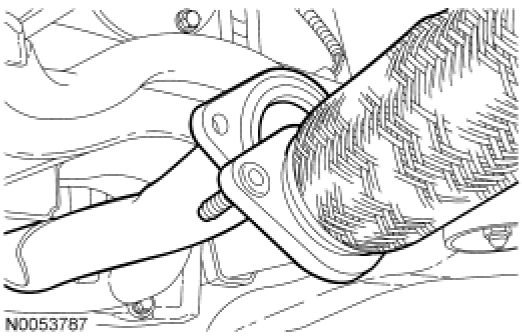


Fig. 2: Identifying Exhaust System At Flex Pipe
Courtesy of FORD MOTOR CO.

3. Support the exhaust system and remove the 2 front exhaust hangers.

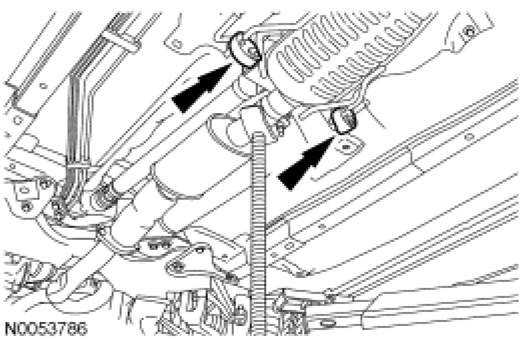


Fig. 3: Locating Front Exhaust Hangers
Courtesy of FORD MOTOR CO.

4. Carefully lower the exhaust system to allow clearance for removal of the driveshaft.

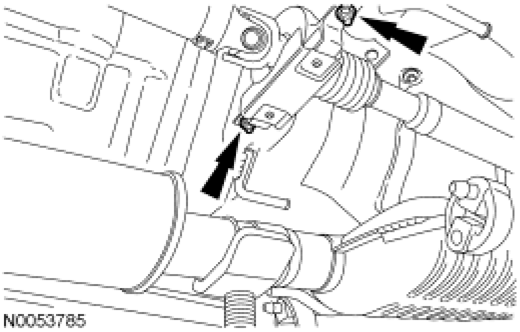


Fig. 4: Lowering Exhaust System To Allow Clearance For Removal Of Driveshaft
Courtesy of FORD MOTOR CO.

NOTE: Do not reuse the constant velocity (CV) joint bolts and washers.

5. Remove and discard the 4 front driveshaft-to-power transfer unit (PTU) flange bolts and washers.
   - Install new bolts and washers and tighten to 70 Nm (52 lb-ft).

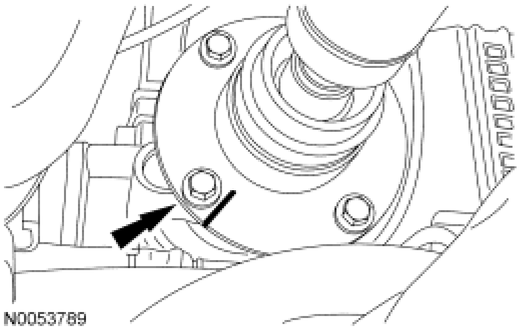


Fig. 5: Identifying Front Driveshaft-To-Transfer Case Bolts & Index Mark
Courtesy of FORD MOTOR CO.

6. Using a suitable pry bar as shown, separate the driveshaft flange from the PTU flange.

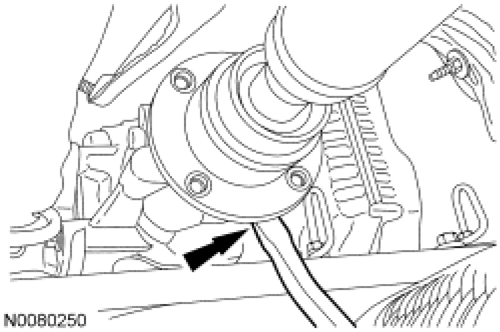


Fig. 6: Separating Driveshaft Flange From PTU Flange Using A Suitable Pry Bar
Courtesy of FORD MOTOR CO.

CAUTION: Do not reuse the bolts for the rear U-joint flange. Install new bolts.

7. Remove and discard the 4 rear driveshaft-to-pinion flange bolts.
    - Install new bolts and tighten to 70 Nm (52 lb-ft).

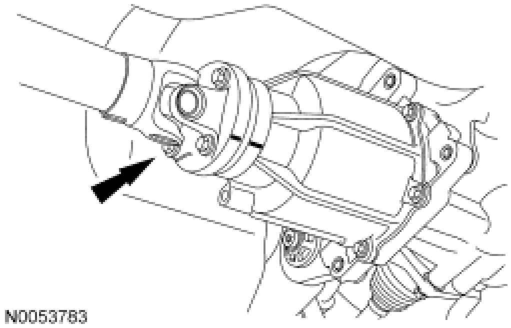


Fig. 7: Locating U-Joint Flange Bolts
Courtesy of FORD MOTOR CO.

8. With the help of an assistant, remove the 4 center bearing support nuts and the driveshaft.
    - To install, tighten to 55 Nm (41 lb-ft).

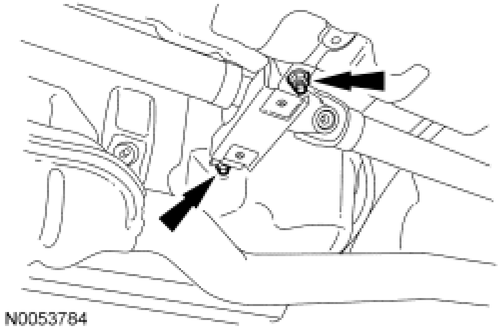


Fig. 8: Locating Center Bearing Support Nuts
Courtesy of FORD MOTOR CO.

NOTE: **If a driveshaft is installed and driveshaft vibration is encountered after installation, index the driveshaft. For additional information, refer to DRIVELINE SYSTEM - GENERAL INFORMATION article.**

9. To install, reverse the removal procedure.

2008 DTC INDEX

Fusion, Milan & MKZ

ANTI-THEFT - PASSIVE DTCS

INSTRUMENT CLUSTER (IC) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1600	PATS Ignition Key Transponder Signal is Not Received	No PATS key has been read by the IC. Go to **Pinpoint Test B** .
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	There is an unprogrammed PATS key. Go to **Pinpoint Test C** .
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	Only a partial PATS key was read. Go to **Pinpoint Test D** .
B1681	PATS Transceiver Module Signal is Not Received	The IC did not receive the PATS transceiver signal. Go to **Pinpoint Test E** .
B2103	Antenna Not Connected	There has been a PATS transceiver antenna failure. Go to **Pinpoint Test A** .
U0100	Lost Communication With ECM/PCM	**NOTE:** **If DTCs U0100 and U2510 are both present, address DTC U2510 first.** Go to **Pinpoint Test G** .
U2511	CAN - Data Mis-Match (Receive Data Does Not Match Expected)	**NOTE:** **If DTCs U2510 and U2511 are both present, address DTC U2510 first.** Go to **Pinpoint Test G** .

ANTI-THEFT - PERIMETER DTCS

DRIVER DOOR MODULE (DDM)

DRIVER DOOR MODULE (DDM) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B2116	Door Driver Reset Switch Stuck Failure	Go to **Pinpoint Test A** .

SMART JUNCTION BOX (SJB)

SMART JUNCTION BOX (SJB) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1520	Hood Switch Circuit Open	Go to **Pinpoint Test C** .
B2108	Trunk Key Cylinder Switch Failure	Go to **Pinpoint Test E** .
B2116	Door Driver Reset Switch Stuck Failure	Go to **Pinpoint Test A** .

AUTOMATIC TRANSAXLE/TRANSMISSION DTCS - AISIN AW21 DTCS

AUTOMATIC TRANSAXLE/TRANSMISSION DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Component	Description	Condition	Symptom	Perform Test
P0601	Transmission Control Module (TCM)	TCM Read-Only Memory (ROM) error.	TCM detected an internal software concern with ROM.	No engagements, no adaptive or self-learning strategy.	INSTALL a new TCM.
P0603	TCM	TCM Keep Alive Memory (KAM) error.	TCM detected an internal software concern with KAM.	No engagements, no adaptive or self-learning strategy.	INSTALL a new TCM.
P0604	TCM	TCM Random Access Memory (RAM) error.	TCM detected an internal software concern with RAM.	No engagements, no adaptive or self-learning strategy.	INSTALL a new TCM.
P0706	Transmission Range (TR)	TR sensor range or performance error.	TR sensor signal is out of normal range.	TR sensor indicates a stuck position (D-3rd gear), no adaptive or self learning strategy.	INSTALL a new TCM.
P0707	TR Sensor	TR sensor circuit low input.	TR sensor signal is below threshold of 0.127 volt, sensor/circuit electrical malfunction.	TR sensor indicates a stuck position (D-3rd gear), no adaptive or self learning strategy.	INSTALL a new TCM.
P0708	TR Sensor	TR sensor circuit high input.	TR sensor signal is above threshold of 4.87 volts, sensor/circuit electrical malfunction.	TR sensor indicates a stuck position (D-3rd gear), no adaptive or self learning strategy.	INSTALL a new TCM.
P0711	Transmission Fluid Temperature (TFT)	No change in TFT during operation.	PCM has detected no TFT change during operation. TFT	TFT indicates 80°C (176°F) at all times, no self learning strategy, no Torque	Go to **Pinpoint Test B** .

	Sensor		value stuck at some normal reading.	Converter Clutch (TCC) engagement.	
P0712	TFT Sensor	200°C (329°F) indicated, TFT sensor circuit grounded.	Voltage drop across TFT sensor exceeds scale set for temperature -43°C (-45°F).	TFT indicates 80°C (176°F) at all times, no self learning strategy, no TCC engagement.	Go to **Pinpoint Test B** .
P0713	TFT Sensor	-43°C (-45°F) indicated, TFT sensor circuit grounded.	Voltage drop across TFT sensor exceeds scale set for temperature -43°C (-45°F).	TFT indicates 80°C (176°F) at all times, no self learning strategy, no TCC engagement.	Go to **Pinpoint Test B** .
P0716	Turbine Shaft Speed (TSS) Sensor	TSS range out of performance, insufficient input from TSS.	PCM has detected a loss or noisy TSS signal during operation.	No TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test D** .
P0717	TSS Sensor	No TSS signal.	PCM has not detected a TSS signal. No TSS signal when Output Shaft Speed (OSS) signal present.	No TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test D** .
P0721	OSS Sensor	OSS range out of performance, insufficient input from OSS.	PCM has detected a loss or noisy OSS signal during operation.	No adaptive or self learning strategy.	Go to **Pinpoint Test C** .
P0722	OSS Sensor	No OSS signal.	PCM has detected no OSS signal.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test C** .
P0729	Transaxle	6th gear ratio.	No 6th gear ratio detected by TCM.	No 6th gear, no TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0730	Clutch Control Solenoids or Internal Parts	Gear ratio error.	PCM has detected a gear ratio error.	No self learning strategy.	Go to **Pinpoint Test A** .
P0731	Solenoid or	1st gear ratio.	No 1st gear ratio	No 1st gear, no TCC	Go to **Pinpoint Test A** .

	Internal Parts		detected by TCM.	engagements, no adaptive or self learning strategy.	
P0732	Solenoid or Internal Parts	2nd gear ratio.	No 2nd gear ratio detected by TCM.	No 2nd gear, no TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0733	Solenoid or Internal Parts	3rd gear ratio.	No 3rd gear ratio detected by TCM.	No 3rd gear, no TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0734	Solenoid or Internal Parts	4th gear ratio.	No 4th gear ratio detected by TCM.	No 4th gear, no TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0735	Solenoid or Internal Parts	5th gear ratio.	No 5th gear ratio detected by TCM.	No 5th gear, no TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0736	Transaxle	Reverse gear ratio.	No reverse gear ratio detected by TCM.	No reverse gear, no self learning strategy.	Go to **Pinpoint Test A** .
P0817	TCM/PCM Starter Circuit	Starter disable circuit open or shorted to power/ground.	TCM detected a failure in the starter lock circuit, failed ON or OFF Ignition switch is ON, TCM and PCM communication is normal. No voltage is detected on the start lock circuit for more than 0.1 second or a continuous 12-volt output is detected for more than 0.1 second. Conditions present 2 times to set DTC.	DTC is set. Warning lamp is illuminated.	Go to **Pinpoint Test E** .
P0961	Pressure Control	PCA circuit or solenoid	PCA circuit or solenoid (SLT)	No engagements, no adaptive or self	Go to **Pinpoint Test A** .

	Solenoid A (PCA)	failure.	failed during operation. Incorrect commanded current detected by TCM.	learning strategy.	
P0962	PCA	PCA solenoid signal or grounded circuits either short or open, solenoid circuit failure.	Voltage through PCA (SLT) is checked. An error will be noted if tolerance is exceeded.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0963	PCA	PCA solenoid short to power circuit failure.	Voltage through PCA (SLT) is checked. An error will be noted if tolerance is exceeded.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0973	Shift Solenoid A (SSA)	SSA solenoid or circuit shorted to ground.	Voltage through SSA (S1) circuit is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0974	SSA	SSA or circuit shorted to power or open.	Voltage through SSA (S1) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0976	Shift Solenoid B (SSB)	SSB solenoid or circuit shorted to ground.	Voltage through SSB (S2) circuit is checked. An error will be noted if tolerance is exceeded. Short to ground failure	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .

			detected.		
P0977	SSB	SSB solenoid or circuit shorted to power or open.	Voltage through SSB solenoid (S2) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0978	Shift Solenoid C (SSC)	SSC circuit or solenoid failure.	SSC circuit or solenoid (SLC1) failed during operation. Incorrect commanded current detected by TCM.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0979	SSC	SSC solenoid signal or grounded circuits either shorted or open, solenoid circuit failure.	Voltage through SSC (SLC1) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0980	SSC	SSC solenoid or circuit shorted to power.	Voltage through SSC (SLC1) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0981	Shift Solenoid D (SSD)	SSD circuit or solenoid failure.	SSD circuit or solenoid (SLC2) failed during operation. Incorrect	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .

			commanded current detected by TCM.		
P0982	SSD	SSD signal or grounded circuits either shorted or open, solenoid circuit failure.	Voltage through SSD (SLC2) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0983	SSD	SSD or circuit shorted to power.	Voltage through SSD (SLC2) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0984	Shift Solenoid E (SSE)	SSE circuit or solenoid failure.	SSE circuit or solenoid (SLC3) failed during operation. Incorrect commanded current detected by TCM.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0985	SSE	SSE signal or grounded circuits either shorted or open, solenoid circuit failure.	Voltage through SSE (SLC3) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0986	SSE	SSE or circuit shorted to power.	Voltage through SSE (SLC3) circuit is	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .

			checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.		
P0997	Shift Solenoid F (SSF)	SSF circuit or solenoid failure.	SSF circuit or solenoid (SLB1) failed during operation. Incorrect commanded current detected by TCM.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0998	SSF	SSF signal or grounded circuits either shorted or open, solenoid circuit failure.	Voltage through SSF (SLB1) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P0999	SSF	SSF or circuit shorted to power.	Voltage through SSF (SLB1) circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure or open circuit detected.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P1657	TCM	TCM communication link error.	Controller Area Network (CAN) link error detected by PCM.	No engagements, no adaptive or self learning strategy. Limited fuel and spark.	INSTALL a new TCM.
P2757	TCC Solenoid	TCC solenoid circuit failure, stuck OFF.	TCC solenoid circuit fails to provide voltage drop across	No TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .

			solenoid. Circuit open, shorted or PCM driver failure during on-board diagnostic.		
P2758	TCC Solenoid	TCC solenoid circuit failure, stuck ON.	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit open, shorted or PCM driver failure during on-board diagnostics.	No TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P2762	TCC Solenoid	TCC circuit or solenoid failure.	TCC circuit or solenoid failed during operation. Incorrect commanded current detected by TCM.	No engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P2763	TCC Solenoid	TCC circuit shorted to power.	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit shorted to power.	No TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .
P2764	TCC Solenoid	TCC solenoid signal or grounded circuits either short or open solenoid circuit failure.	TCC solenoid circuit fails to provide voltage drop across solenoid.	No TCC engagements, no adaptive or self learning strategy.	Go to **Pinpoint Test A** .

AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5 DTCS

AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5 DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Component	Description	Condition	Symptom	Perform Test
P0706	Transmission Range (TR) Sensor	TR circuit failure.	TR circuits, indicating an invalid pattern in TR_D. Condition caused by a	Increase in control pressure (harsh shifts). Defaults to D	Go to **Pinpoint Test C** .

			short to ground or an open in P, R, N, D or L range positions. This DTC can be set by an incorrectly adjusted TR sensor.	for an invalid position. Malfunction Indicator Lamp (MIL) on.	
P0707	TR Sensor	TR circuit low input.	TR circuits, indicating an invalid pattern in TR_D. Condition caused by a short to ground in P, R, N, D or L range positions. This DTC can be set by an incorrectly adjusted TR sensor.	Increase in control pressure (harsh shifts). Defaults to D for an invalid position. MIL on.	Go to **Pinpoint Test C** .
P0708	TR Sensor	TR circuit high input.	TR circuits, indicating an invalid pattern in TR_D. Condition caused by an open in P, R, N, D or L range positions. This DTC can be set by an incorrectly adjusted TR sensor.	Increase in control pressure (harsh shifts). Defaults to D for an invalid position. MIL on.	Go to **Pinpoint Test C** .
P0711	Transmission Fluid Temperature (TFT)	TFT sensor circuit malfunction.	Incorrect voltage drop across TFT sensor.	Possible firm shift feel.	Go to **Pinpoint Test B** .
P0712	TFT	157°C (315°F) indicated TFT sensor circuit grounded.	Voltage drop across TFT sensor too low for scale set for temperature 157°C (315°F).	Possible firm shift feel.	Go to **Pinpoint Test B** .
P0713	TFT	-40°C (-40°F) indicated TFT sensor circuit open.	Voltage drop across TFT sensor too high for scale set temperature -40°C (-40°F).	Possible firm shift feel.	Go to **Pinpoint Test B** .
P0715	Turbine Shaft Speed (TSS)	Insufficient input from TSS sensor.	Transmission Control Module (TCM) detected a loss of TSS signal during operation.	Harsh shifts, no Torque Converter Clutch (TCC) activation and harsh engagement.	Go to **Pinpoint Test G** .
P0720	Output Shaft Speed (OSS)	Insufficient input from OSS sensor.	TCM detected a loss of OSS signal during operation.	Harsh shift, possible abnormal shift schedule.	Go to **Pinpoint Test F** .
P0731	Shift Solenoid A (SEA), Shift Solenoid B (SSB), Shift	1st gear error.	No 1st gear.	Incorrect gear selection depending on failure or mode and manual lever position. Shift errors	REFER to Solenoid On/Off Charts. Go to **Pinpoint Test**

	Solenoid C (SSC), Shift Solenoid D (SSD), Shift Solenoid E (SSE), Shift Solenoid F (SSF) or Internal Parts			may also be due to other internal transmission concerns (stuck valves, damaged friction material). Engine RPM could be higher or lower than expected.	**A** .
P0732	SEA, SSB, SSC, SSD, SSE, SSF or Internal Parts	2nd gear error.	No 2nd gear.	Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material). Engine RPM could be higher or lower than expected.	REFER to Solenoid On/Off Charts. Go to **Pinpoint Test A** .
P0733	SEA, SSB, SSC, SSD, SSE, SSF or Internal Parts	3rd gear error.	No 3rd gear.	Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material). Engine RPM could be higher or lower than expected.	REFER to Solenoid On/Off Charts. Go to **Pinpoint Test A** .
P0734	SEA, SSB, SSC, SSD, SSE, SSF or Internal Parts	4th gear error.	No 4th gear.	Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged	REFER to Solenoid On/Off Charts. Go to **Pinpoint Test A** .

				friction material). Engine RPM could be higher or lower than expected.	
P0735	SEA, SSB, SSC, SSD, SSE, SSF or Internal Parts	5th gear error.	No 5th gear.	Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material). Engine RPM could be higher or lower than expected.	REFER to Solenoid On/Off Charts. Go to **Pinpoint Test A** .
P0745	Pressure Control Solenoid A (PCA) solenoid	PCA circuit failure.	Voltage through PCA solenoid is checked. Error is noted if tolerance is exceeded.	Open circuit causes maximum transmission line pressure, harsh engagement and shifts.	Go to **Pinpoint Test D** .
P0753	SEA	SEA solenoid circuit failure.	Shift Solenoid Pressure Control A (SSPCA) circuit failed to provide voltage drop across solenoid. Circuit open or shorted or TCM driver failure during On-Board Diagnostic (OBD).	No reverse gear (short) or no 4th gear (open). MIL off.	Go to **Pinpoint Test A** .
P0758	SSB	SSB solenoid circuit failure.	SSB circuit fails to provide voltage drop across solenoid. Circuit open or shorted or TCM driver failure during OBD.	Not all gears present. No converter clutch apply in 3rd and 4th gears. MIL off.	Go to **Pinpoint Test A** .
P0761	Shift Solenoid C (SSC)	SSC functional failure (stuck off).	Mechanical or hydraulic failure of the shift solenoid.	Not all gears present.	Go to **Pinpoint Test A** .
P0762	SSC	SSC functional failure (stuck on).	Mechanical or hydraulic failure of the shift solenoid.	Not all gears present.	Go to **Pinpoint Test A** .
P0763	SSC	SSC solenoid circuit	Shift Solenoid Pressure Control C (SSPCC) circuit	Not all gears present. MIL off.	Go to **Pinpoint Test**

		failure.	fails to provide voltage drop across solenoid. Circuit open or shorted or TCM driver failure during OBD.		**A** .
P0766	SSD	SSD functional failure (stuck off).	Mechanical or hydraulic failure of the shift solenoid.	Not all gears present.	Go to **Pinpoint Test A** .
P0767	SSD	SSD functional failure (stuck on).	Mechanical or hydraulic failure of the shift solenoid.	Not all gears present.	Go to **Pinpoint Test A** .
P0768	SSD	SSD solenoid circuit failure.	SSD circuit fails to provide voltage drop across solenoid. Circuit open, shorted or TCM driver circuit failure during OBD.	Not all gears present. MIL off.	Go to **Pinpoint Test A** .
P0771	SSE	SSE functional failure (stuck off).	Mechanical or hydraulic failure of the shift solenoid.	Not all gears present.	Go to **Pinpoint Test A** .
P0772	SSE	SSE functional failure (stuck on).	Mechanical or hydraulic failure of the shift solenoid.	Not all gears present.	Go to **Pinpoint Test A** .
P0773	SSE	SSE solenoid circuit failure.	SSE circuit failed to provide voltage drop across solenoid. Circuit open. Shorted or TCM driver circuit failed during OBD.	Not all gears present. MIL off.	Go to **Pinpoint Test A** .
P0777	Pressure Control Solenoid B (PCB) solenoid	PCB solenoid stuck on.	Mechanical or hydraulic failure of PCB.	Harsh engagement and shifts.	Go to **Pinpoint Test E** .
P0778	PCB	PCB solenoid circuit failure.	PCB circuit failed to provide voltage drop across solenoid. Circuit open or shorted or TCM driver failure during on-board diagnostic.	Harsh engagement and shifts.	Go to **Pinpoint Test E** .
P0791	Intermediate Shaft Speed	Insufficient input from	TCM detected a loss of intermediate shaft speed	Harsh shift, possible abnormal shift	Go to **Pinpoint Test**

	Sensor	intermediate shaft speed sensor.	signal during operation.	schedule.	**F** .
P0841	Transmission Fluid Pressure Switch	Transmission fluid pressure switch circuit failure open or shorted.	TCM has detected a loss of transaxle fluid pressure.	Harsh shifts, possible abnormal shift schedule.	Go to **Pinpoint Test H** .
P0882	TCM	TCM input power circuit voltage low.	TCM has detected a loss of voltage.	MIL on.	Go to **Pinpoint Test I** .
P1783	TFT	Transmission overtemp condition indicated.	Transmission fluid temperature exceeded 135°C (275°F).	Increase in control pressure.	Go to **Pinpoint Test B** .
P2707	SSF	SSF functional failure (stuck off).	Mechanical or hydraulic failure of the shift solenoid.	Not all gears present.	Go to **Pinpoint Test A** .
P2708	SSF	SSF functional failure (stuck on).	Mechanical or hydraulic failure of the shift solenoid.	Not all gears present, MIL off.	Go to **Pinpoint Test A** .
P2709	SSF	SSF solenoid circuit failure.	SSF circuit fails to provide voltage drop across solenoid. Circuit open. Shorted or TCM driver circuit failed during OBD.	Not all gears present, MIL off.	Go to **Pinpoint Test A** .
P0604	TCM	Internal TCM error.	TCM Random Access Memory (RAM) error.	MIL on.	INSTALL a new TCM.
P0605	TCM	Internal TCM error.	TCM Read-Only Memory (ROM) error.	MIL on.	INSTALL a new TCM.

CHARGING SYSTEM DTCS

CHARGING SYSTEM DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTCs	Description	Source	Perform Test
B1317	Battery Voltage High	Various Modules	Go to **Pinpoint Test B** .
B1318	Battery Voltage Low	Various Modules	Go to **Pinpoint Test F** .
B1676	Battery Voltage Out Of Range	Various Modules	Go to **Pinpoint Test F** .
P0563	System Voltage High	PCM	Go to **Pinpoint Test B** .

P0620	Generator Control Circuit	PCM	Go to **Pinpoint Test B** .
P0625	Generator Field Terminal Circuit - Low	PCM	Go to **Pinpoint Test B** .
P0626	Generator Field Terminal Circuit - High	PCM	Go to **Pinpoint Test B** .
P065B	Generator Control Circuit Range/Performance	PCM	Go to **Pinpoint Test B** .

CLIMATE CONTROL SYSTEM DTCS

HVAC MODULE DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1003	Mode Door Circuit Failure	Go to **Pinpoint Test F** .
B1251	Air Temperature Internal Sensor Circuit Open	Go to **Pinpoint Test D** .
B1253	Air Temperature Internal Sensor Circuit Short To Ground	Go to **Pinpoint Test D** .
B1255	Air Temperature External Sensor Circuit Open	Go to **Pinpoint Test E** .
B1257	Air Temperature External Sensor Circuit Short To Ground	Go to **Pinpoint Test E** .
B1676	Battery Voltage Out of Range	Go to **Pinpoint Test J** .
B2266	Left Side Blend Door Circuit Failure	Go to **Pinpoint Test Q** .
B2267	Right Side Blend Door Circuit Failure	Go to **Pinpoint Test Q** .
B2426	Passenger Solar Radiation Sensor Circuit Open	Go to **Pinpoint Test F** .
B2427	Passenger Solar Radiation Sensor Circuit Short to Ground	Go to **Pinpoint Test F** .
B2795	Driver Solar Radiation Sensor Circuit Short to Ground	Go to **Pinpoint Test F** .
B2796	Driver Solar Radiation Sensor Circuit Open	Go to **Pinpoint Test F** .
B2826	Front Evaporator Temp Sensor Circuit Failure	Go to **Pinpoint Test G** .
B2827	Front Evaporator Temp Sensor Short to Ground	Go to **Pinpoint Test G** .

ENGINE COOLING DTCS

PCM DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
P0217	Engine Coolant Overtemperature Condition	Go to **Pinpoint Test B** .
P1285	Cylinder Head Overtemperature Condition	Go to **Pinpoint Test B** .
P1299	Cylinder Head Overtemperature Protection Active	Go to **Pinpoint Test B** .
P0125	Insufficient Coolant Temp For Closed Loop Fuel Control	Go to **Pinpoint Test C** .
P0128	Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)	Go to **Pinpoint Test C** .

EXTERIOR LIGHTING DTCS

AUTOLAMPS

SMART JUNCTION BOX (SJB) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1472	Lamp Headlamp Input Circuit Short to Ground	Go to **Pinpoint Test H** .
B1578	Lamp Park Input Circuit Short to Ground	Go to **Pinpoint Test H** .
B1692	Autolamp Delay Circuit Short to Ground	Go to **Pinpoint Test H** .
B1791	Autolamp Sensor Input Circuit Open	Go to **Pinpoint Test H** .
B1793	Autolamp Sensor Input Circuit Short to Ground	Go to **Pinpoint Test G** .
B2498	Headlamp Switch Multiple Signals Input Active	Go to **Pinpoint Test H** .

FOG LAMPS

SMART JUNCTION BOX (SJB) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B2030	Front Fog Lamp Relay CKT Failure	Go to **Pinpoint Test R** .
B2254	Front Fog Lamp Switch Failure	Go to **Pinpoint Test T** .

HEADLAMPS

SMART JUNCTION BOX (SJB) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1472	Lamp Headlamp Input Circuit Short to Ground	Go to **Pinpoint Test E** .
B1510	Flash To Pass Switch Circuit Short to Ground	Go to **Pinpoint Test E** .
B1570	Lamp Headlamp High-Beam Circuit Short to Ground	Go to **Pinpoint Test E** .
B1578	Lamp Park Input Circuit Short to Ground	Go to **Pinpoint Test E** .
B1795	Lamp Headlamp Low-Beam Circuit Open	If a low beam is inoperative, go to **Pinpoint Test C** . If a low beam is always on, go to **Pinpoint Test E** .
B1797	Lamp Headlamp Low-Beam Circuit Short to Ground	Go to **Pinpoint Test C** .
B2498	Headlamp Switch Multiple Signals Input Active	Go to **Pinpoint Test E** .

TURN LAMPS

SMART JUNCTION BOX (SJB) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1799	Lamp Turn Signal Front Output Circuit Open	Go to **Pinpoint Test N** .
B1801	Lamp Turn Signal Front Output Circuit Short to Ground	Go to **Pinpoint Test N** .
B1875	Turn Signal/Hazard Switch Signal Circuit Failure	Go to **Pinpoint Test O** .
B2048	Left Rear Turn Lamp Circuit Short to Ground	For Milan or MKZ, go to **Pinpoint Test N** . For Fusion, REFER to **Stoplamp** to continue diagnosis of the turn lamp.
B2049	Left Rear Turn Lamp Circuit Open	For Milan or MKZ, go to **Pinpoint Test N** . For Fusion, REFER to **Stoplamp** to continue diagnosis of the turn lamp.
B2050	Right Rear Turn Lamp Circuit Short to Ground	For Milan or MKZ, go to **Pinpoint Test N** . For Fusion, REFER to **Stoplamp** to continue diagnosis of the turn lamp.
B2051	Right Rear Turn Lamp Circuit Open	For Milan or MKZ, go to **Pinpoint Test N** . For Fusion, REFER to **Stoplamp** to continue diagnosis of the turn lamp.
B2281	Right Turn Switch Short to Ground	Go to **Pinpoint Test M** .
B2282	Left Turn Switch Short to Ground	Go to **Pinpoint Test M** .

SMART JUNCTION BOX (SJB) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1485	Brake Pedal Input Short to Battery	Go to **Pinpoint Test K** .
B2048	Left Rear Turn Lamp Circuit Short to Ground	For Fusion, go to **Pinpoint Test J** . For Milan or MKZ, REFER to **Turn Signal and Hazard Lamps** .
B2049	Left Rear Turn Lamp Circuit Open	For Fusion, if the lamp is inoperative, go to **Pinpoint Test J** . For Fusion, if the lamp is always on, go to **Pinpoint Test K** . For Milan or MKZ, REFER to **Turn Signal and Hazard Lamps** .
B2050	Right Rear Turn Lamp Circuit Short to Ground	For Fusion, go to **Pinpoint Test J** . For Milan or MKZ, REFER to **Turn Signal and Hazard Lamps** .
B2051	Right Rear Turn Lamp Circuit Open	For Fusion, if the lamp is inoperative, go to **Pinpoint Test J** . For Fusion, if the lamp is always on, go to **Pinpoint Test K** . For Milan or MKZ, REFER to **Turn Signal and Hazard Lamps** .

FOUR WHEEL DRIVE (4WD) SYSTEMS DTCS

4X4 CONTROL MODULE DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Possible Causes	Source	Perform Test
B1317	Battery Voltage High	• Generator	4X4 Control Module	Go to **Pinpoint Test B** .
B1318	Battery Voltage Low	• Open fuse (B+) • Intermittent open on power circuit • 4X4 control module connector	4X4 Control Module	Go to **Pinpoint Test B** .
P1635	Tire/Axle Out of Acceptable Range	• Incorrect size tire installed on vehicle • Wheel speed sensor failure • Flat or under-inflated tire	4X4 Control Module	Go to **Pinpoint Test F** .
P1824	Four-Wheel Drive (4WD) Clutch Relay Circuit Failure	• Short to ground on Active Torque Coupling (ATC) solenoid (part of rear axle) high circuit • 4X4 control module failure	4X4 Control Module	Go to **Pinpoint Test D** .
P1825	4WD Clutch Relay Open Circuit	• 4X4 control module harness connector • Open in ATC solenoid (part of rear axle) low circuit • Open in ATC solenoid high circuit • Short to ground on ATC solenoid low circuit • Short to ground on ATC solenoid high circuit • Open coil inside ATC solenoid • Short to voltage in ATC solenoid low circuit • 4X4 control module	4X4 Control Module	Go to **Pinpoint Test D** .

		failure		
U0415	Invalid Data Received From Anti-lock Brake System (ABS) Control Module	• Invalid data received from ABS module • Data out of range	4X4 Control Module	Go to **Pinpoint Test C** .

FUEL SYSTEM - GENERAL INFORMATION DTCS

EVAPORATIVE EMISSION SYSTEM DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
P0446	Evaporative Emission System Vent Control Circuit	Go to **Pinpoint Test A** .
P0451	Evaporative Emission System Pressure Sensor/Switch Range/Performance	Go to **Pinpoint Test A** .
P0452	Evaporative Emission System Pressure Sensor/Switch Low	Go to **Pinpoint Test A** .
P0453	Evaporative Emission System Pressure Sensor/Switch High	Go to **Pinpoint Test A** .
P0454	Evaporative Emission System Pressure Sensor/Switch Intermittent	Go to **Pinpoint Test A** .
P1443	Evaporative Emission System Control Valve (Low/No Flow)	Go to **Pinpoint Test A** .
P1450	Unable to Bleed up Fuel Tank Vacuum	Go to **Pinpoint Test A** .
P1451	Evaporative Emission System Vent Control Circuit	Go to **Pinpoint Test A** .
P260F	Emission System Monitoring Processor Performance	Go to **Pinpoint Test A** .

GLASS, FRAMES & MECHANISMS DTCS

SMART JUNCTION BOX (SJB) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1345	Heated Rear Window Input Circuit Short to Ground	Go to **Pinpoint Test J** .
B2947	Global Opening/Closing Circuit Open	Go to **Pinpoint Test I** .
B2949	Global Opening/Closing Circuit Short to Battery	Go to **Pinpoint Test I** .

HANDLES, LOCKS, LATCHES & ENTRY SYSTEMS DTCS

DRIVER DOOR MODULE (DDM)

DRIVER DOOR MODULE (DDM) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B2574	Drivers Door LOCK Switch Short to Ground	Go to **Pinpoint Test H** .
B2575	Drivers Door UNLOCK Switch Short to Ground	Go to **Pinpoint Test H** .

INSTRUMENT CLUSTER (IC)

INSTRUMENT CLUSTER (IC) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1137	Data Not Programmed	Go to **Pinpoint Test R** .
B1139	Invalid Transmitter Identification Code	Go to **Pinpoint Test L** .

SMART JUNCTION BOX (SJB)

SMART JUNCTION BOX (SJB) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1139	Invalid Transmitter Identification Code	Go to **Pinpoint Test L** .
B1309	Power Door Lock Circuit Short to Ground	Go to **Pinpoint Test H** .
B1341	Power Door Unlock Circuit Short to Ground	Go to **Pinpoint Test H** .
B1554	Decklid Release Circuit Short to Ground	Go to **Pinpoint Test I** .
B1623	Lamp Keypad Output Circuit Failure	Go to **Pinpoint Test K** .
B2425	Remote Keyless Entry Out of Synchronization	Go to **Pinpoint Test L** .
B2695	Keypad_A Switch Circuit Failure	Go to **Pinpoint Test J** .
B2696	Keypad_B Switch Circuit Failure	Go to **Pinpoint Test J** .
B2697	Keypad_C Switch Circuit Failure	Go to **Pinpoint Test J** .

INFORMATION & ENTERTAINMENT SYSTEMS DTCS

ACCESSORY PROTOCOL INTERFACE MODULE (APIM)

ACCESSORY PROTOCOL INTERFACE MODULE (APIM) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1038	Microphone Input Circuit Failure	Go to **Pinpoint Test V** .
B1117	Audio Steering Wheel Button Stuck	Go to **Pinpoint Test G** .
B1136	Audio Steering Wheel Switch #2 Circuit Failure	Go to **Pinpoint Test G** .
U0184	Lost Communication With Radio (ACM)	Go to **Pinpoint Test R** .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	DISREGARD the DTC. CLEAR the DTCs.
U0249	Lost Communication With Entertainment Control Module -	DISREGARD the DTC. CLEAR the DTCs.

	Rear "B" (RCU)	
U0255	Lost Communication With Front Controls Interface Module	DISREGARD the DTC. CLEAR the DTCs.
U0256	Lost Communication With Front Display Interface Module	DISREGARD the DTC. CLEAR the DTCs.
U261C	USB #1 Device Error	Go to **Pinpoint Test T** .
U261D	USB #2 Device Error	DISREGARD the DTC. CLEAR the DTCs.

AUDIO CONTROL MODULE (ACM)

AUDIO CONTROL MODULE (ACM) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1117	Audio Steering Wheel Button Stuck	VERIFY that no steering wheel control switches are stuck and that no steering wheel control button was pressed during the self-test. If no concern is found, go to **Pinpoint Test G** .
B1119 (Navigation only)	Audio Disc DVD Player Thermal Shutdown	**NOTE:** **This DTC refers to the navigation DVD mechanism, not the DVD entertainment system.** The audio control module (ACM) was over-temperature. Navigation operation will resume after the ACM cools. This is normal operation. CLEAR the DTCs.
B1136 (Navigation only)	Audio Steering Wheel Switch #2 Circuit Failure	Go to **Pinpoint Test G** .
B2103	Antenna Not Connected	Go to **Pinpoint Test A** .
B2204 (Navigation only)	GPS Antenna Connection Open or Short	Go to **Pinpoint Test K** .
B2274	Phone Transceiver Active Circuit Failure	DISREGARD the DTC. CLEAR the DTCs.
B2384	Audio Reverse Aid Mute Input CKT Failure	DISREGARD the DTC. CLEAR the DTCs.
B2404	Audio Steering Wheel Switch Circuit Fault	Go to **Pinpoint Test G** .
B2405	Audio Disc CD Player Thermal Shutdown Fault	The ACM was over-temperature. Audio operation will resume after the ACM cools. This is normal operation. CLEAR the DTCs.
B2633 (Navigation only)	Driver-Front Microphone Circuit Failure	Go to **Pinpoint Test P** .
B2965	Audio System Speaker Circuit Fault	For the THX® audio system, go to **Pinpoint Test C** . For all others, go to **Pinpoint Test B** .

C1992	Vehicle Speed Circuit Failure	DISREGARD the DTC. CLEAR the DTCs.
P0812	Reverse Input Circuit	DISREGARD the DTC. CLEAR the DTCs.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	If the speed sensitive volume does not operate correctly, go to **Pinpoint Test Q** . If the navigation is inaccurate, go to **Pinpoint Test O** .
U0159	Lost Communication With Parking Assist Control Module (PAM)	Go to **Pinpoint Test N** .
U0193	Lost Communication With Digital Audio Control Module (SDARS)	Go to **Pinpoint Test H** .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	DISREGARD the DTC. CLEAR the DTCs.
U0197	Lost Communication With Telephone Control Module	Go to **Pinpoint Test R** .
U0238	Lost Communication With Digital Audio Control Module "D" (DSP)	Go to **Pinpoint Test D** .
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	DISREGARD the DTC. CLEAR the DTCs.
U2473	Unexpected Vehicle Speed (VSS)	Go to **Pinpoint Test O** .

AUDIO DIGITAL SIGNAL PROCESSING (DSP)

AUDIO DIGITAL SIGNAL PROCESSING (DSP) MODULE DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1158	Subwoofer #2 Open	Go to **Pinpoint Test C** .
B2913	Audio Subwoofer Not Connected	Go to **Pinpoint Test C** .
B2925	Subwoofer Speaker Short Circuit	Go to **Pinpoint Test C** .
B292A	Subwoofer #2 Speaker Short Circuit	**NOTE:** **Despite the DTC description, this DTC applies to the DSP module clip/enable circuit, not the subwoofer.** Go to **Pinpoint Test C** .
B2965	Audio System Speaker Circuit Fault	If the symptom is no audio from all speakers, go to **Pinpoint Test D** . If the symptom is no audio from one or more (but not all) speakers, go to **Pinpoint Test C** .
C1992	Vehicle Speed Circuit Failure	DISREGARD the DTC. CLEAR the DTCs.

U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	DISREGARD the DTC. CLEAR the DTCs.

SATELLITE DIGITAL AUDIO RECEIVER SYSTEM (SDARS)

SATELLITE DIGITAL AUDIO RECEIVER SYSTEM (SDARS) MODULE DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1031	SDARS Satellite Antenna Open	Go to **Pinpoint Test I** .
B1032	SDARS Satellite Antenna Short	Go to **Pinpoint Test I** .
U0184	Lost Communication With Radio (ACM)	Go to **Pinpoint Test H** .
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	DISREGARD the DTC. CLEAR the DTCs.
U0197	Lost Communication With Telephone Control Module	Go to **Pinpoint Test H** .
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	DISREGARD the DTC. CLEAR the DTCs.

INSTRUMENT CLUSTER (IC), MESSAGE CENTER & WARNING CHIMES DTCS

INSTRUMENT CLUSTER (IC)

INSTRUMENT CLUSTER (IC) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1202	Fuel Sender Circuit Open (fuel pump module)	If equipped with front wheel drive (FWD), go to **Pinpoint Test B** . If equipped with all wheel drive (AWD), go to **Pinpoint Test C** .
B1204	Fuel Sender Circuit Short to Ground (fuel pump module)	If equipped with front wheel drive (FWD), go to **Pinpoint Test B** . If equipped with all wheel drive (AWD), go to **Pinpoint Test C** .
B1318	Battery Voltage Low	Go to **Pinpoint Test AA** .
B1352	Ignition Key-In Circuit Failure	Go to **Pinpoint Test AI** .
B1360	Ignition Run/Acc Circuit Open	Go to **Pinpoint Test A** .
B2627	Fuel Sender Circuit Open	Go to **Pinpoint Test C** .

	#2 (secondary fuel sender)	
B2628	Fuel Sender Circuit Short to Ground #2 (secondary fuel sender)	Go to **Pinpoint Test C** .
B2844	Ignition Fault	Go to **Pinpoint Test AB** .
B2879	Fuel Tank Jet Pump Fault	Go to **Pinpoint Test C** .
U2013	Compass Module is Not Responding	Go to **Pinpoint Test AE** .

PCM

PCM DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
P0457	Evaporative Emission System Leak Detected (fuel cap loose/off)	Go to **Pinpoint Test V** .
P0460	Fuel Level Sensor A Circuit	If sent here from the PC/ED manual, go to **Pinpoint Test B** for front wheel drive (FWD). If sent here from the PC/ED manual, go to **Pinpoint Test C** for wagon or all wheel drive (AWD).
P0461	Fuel Level Sensor A Circuit Range/Performance	If sent here from the PC/ED manual, go to **Pinpoint Test B** for front wheel drive (FWD). If sent here from the PC/ED manual, go to **Pinpoint Test C** for wagon or all wheel drive (AWD).

SMART JUNCTION BOX (SJB)

SMART JUNCTION BOX (SJB) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B2479	Brake Park Switch Circuit Short to Ground	Go to **Pinpoint Test J** .
C1125	Brake Fluid Level Sensor Input Circuit Failure	Go to **Pinpoint Test J** .
C1284	Oil Pressure Switch Failure	Go to **Pinpoint Test S** .

INSTRUMENT CLUSTER & PANEL ILLUMINATION DTCS

SMART JUNCTION BOX (SJB) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1247	Panel Dim Switch Circuit Open	Go to **Pinpoint Test E** .
B2026	Incandescent Backlighting Output Circuit Failure	Go to **Pinpoint Test C** .
B2027	LED Backlighting Output Circuit Failure	Go to **Pinpoint Test C** .

INTERIOR LIGHTING DTCS

SMART JUNCTION BOX (SJB) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1320	Driver Door Ajar Circuit Open	Go to **Pinpoint Test C** .
B1328	Passenger Door Ajar Circuit Open	Go to **Pinpoint Test C** .
B1331	Decklid Ajar Rear Door Circuit Failure	Go to **Pinpoint Test C** .
B1336	Door Ajar RR Circuit Open	Go to **Pinpoint Test C** .
B1572	Door Ajar LR Circuit Open	Go to **Pinpoint Test C** .
B1688	Lamp Dome Input Circuit Short to Ground	Go to **Pinpoint Test C** .
B2499	Courtesy Lamp Output Failure	Go to **Pinpoint Test A** .

PARKING AID DTCS

PARKING AID MODULE (PAM) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1299	Power Supply Sensor Circuit Short to Ground	Go to **Pinpoint Test E** .
C1699	Left Rear Sensor Circuit Short to Vbat	Go to **Pinpoint Test C** .
C1700	Left Rear Sensor Circuit Failure or Blockage	Go to **Pinpoint Test B** .
C1701	Left Rear Sensor Circuit Fault	Go to **Pinpoint Test D** .
C1702	Right Rear Sensor Circuit Short to Vbat	Go to **Pinpoint Test C** .
C1703	Right Rear Sensor Circuit Failure or Blockage	Go to **Pinpoint Test B** .
C1704	Right Rear Sensor Circuit Fault	Go to **Pinpoint Test D** .
C1705	Left Rear Center Sensor Circuit Short to Vbat	Go to **Pinpoint Test C** .
C1706	Left Rear Center Sensor Circuit Failure	Go to **Pinpoint Test B** .
C1707	Left Rear Center Sensor Circuit Fault	Go to **Pinpoint Test D** .
C1708	Right Rear Center Sensor Circuit Short to Vbat	Go to **Pinpoint Test C** .
C1709	Right Rear Center Sensor Circuit Failure	Go to **Pinpoint Test B** .
C1710	Right Rear Center Sensor Circuit Fault	Go to **Pinpoint Test D** .
C1742	Rear Sounder Circuit Failure	Go to **Pinpoint Test F** .
C1743	Rear Sounder Circuit Short to Vbat	Go to **Pinpoint Test F** .
U0140	Lost Communication With Body Control Module (GEM)	Go to **Pinpoint Test G** .

U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Go to **Pinpoint Test H** .

POWERTRAIN DTC CHARTS AND DESCRIPTIONS - GASOLINE ENGINES DTCS

DIAGNOSTIC TROUBLE CODES (DTC) LIST

DTC	Description
DTC P0010	INTAKE CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1)
DTC P0011	INTAKE CAMSHAFT POSITION TIMING - OVER-ADVANCED (BANK 1)
DTC P0012	INTAKE CAMSHAFT POSITION TIMING - OVER-RETARDED (BANK 1)
DTC P0016	CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION - BANK 1 SENSOR A
DTC P0018	CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION - BANK 2 SENSOR A
DTC P0020	INTAKE CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 2)
DTC P0021	INTAKE CAMSHAFT POSITION TIMING - OVER-ADVANCED (BANK 2)
DTC P0022	INTAKE CAMSHAFT POSITION TIMING - OVER-RETARDED (BANK 2)
DTC P0030	HO2S HEATER CONTROL CIRCUIT (BANK 1, SENSOR 1)
DTC P0040	OXYGEN SENSOR SIGNALS SWAPPED BANK 1 SENSOR 1/BANK 2 SENSOR 1
DTC P0041	OXYGEN SENSOR SIGNALS SWAPPED BANK 1 SENSOR 2/BANK 2 SENSOR 2
DTC P0050	HO2S HEATER CONTROL CIRCUIT (BANK 2, SENSOR 1)
DTC P0053	HO2S HEATER RESISTANCE (BANK 1, SENSOR 1)
DTC P0054	HO2S HEATER RESISTANCE (BANK 1, SENSOR 2)
DTC P0055	HO2S HEATER RESISTANCE (BANK 1, SENSOR 3)
DTC P0059	HO2S HEATER RESISTANCE (BANK 2, SENSOR 1)
DTC P0060	HO2S HEATER RESISTANCE (BANK 2, SENSOR 2)
DTC P0068	MANIFOLD ABSOLUTE PRESSURE (MAP)/MASS AIR FLOW (MAF) - THROTTLE POSITION CORRELATION
DTC P0097	INTAKE AIR TEMPERATURE SENSOR 2 CIRCUIT LOW
DTC P0098	INTAKE AIR TEMPERATURE SENSOR 2 CIRCUIT HIGH
DTC P0102	MASS OR VOLUME AIR FLOW A CIRCUIT LOW
DTC P0103	MASS OR VOLUME AIR FLOW A CIRCUIT HIGH
DTC P0104	MASS OR VOLUME AIR FLOW A CIRCUIT INTERMITTENT/ERRATIC
DTC P0106	MANIFOLD ABSOLUTE PRESSURE (MAP/BARO) SENSOR RANGE/PERFORMANCE
DTC P0107	MANIFOLD ABSOLUTE PRESSURE (MAP)/BAROMETRIC PRESSURE (BARO) SENSOR LOW
DTC P0108	MANIFOLD ABSOLUTE PRESSURE (MAP)/BAROMETRIC PRESSURE (BARO) SENSOR HIGH
DTC P0109	MANIFOLD ABSOLUTE PRESSURE (MAP)/BAROMETRIC PRESSURE (BARO) SENSOR INTERMITTENT

DTC P0111	INTAKE AIR TEMPERATURE (IAT) SENSOR 1 CIRCUIT RANGE/PERFORMANCE
DTC P0112	INTAKE AIR TEMPERATURE (IAT) SENSOR 1 CIRCUIT LOW
DTC P0113	INTAKE AIR TEMPERATURE (IAT) SENSOR 1 CIRCUIT HIGH
DTC P0114	INTAKE AIR TEMPERATURE (IAT) SENSOR 1 INTERMITTENT/ERRATIC
DTC P0116	ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT RANGE/PERFORMANCE
DTC P0117	ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT LOW
DTC P0118	ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT HIGH
DTC P0119	ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT INTERMITTENT/ERRATIC
DTC P0121	THROTTLE/PEDAL POSITION SENSOR A CIRCUIT RANGE/PERFORMANCE
DTC P0122	THROTTLE/PEDAL POSITION SENSOR A CIRCUIT LOW
DTC P0123	THROTTLE/PEDAL POSITION SENSOR A CIRCUIT HIGH
DTC P0125	INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL
DTC P0127	INTAKE AIR TEMPERATURE (IAT) TOO HIGH
DTC P0128	COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)
DTC P012B	TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE
DTC P012C	TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT LOW
DTC P012D	TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT HIGH
DTC P012E	TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT INTERMITTENT/ERRATIC
DTC P0130	O2 CIRCUIT (BANK 1, SENSOR 1)
DTC P0132	O2 CIRCUIT HIGH VOLTAGE (BANK 1, SENSOR 1)
DTC P0133	O2 CIRCUIT SLOW RESPONSE (BANK 1, SENSOR 1)
DTC P0134	O2 CIRCUIT NO ACTIVITY DETECTED (BANK 1, SENSOR 1)
DTC P0135	O2 HEATER CIRCUIT (BANK 1, SENSOR 1)
DTC P0138	O2 CIRCUIT HIGH VOLTAGE (BANK 1, SENSOR 2)
DTC P0139	O2 CIRCUIT SLOW RESPONSE (BANK 1, SENSOR 2)
DTC P0141	O2 HEATER CIRCUIT (BANK 1, SENSOR 2)
DTC P0144	O2 CIRCUIT HIGH VOLTAGE (BANK 1, SENSOR 3)
DTC P0147	O2 HEATER CIRCUIT (BANK 1, SENSOR 3)
DTC P0148	FUEL DELIVERY ERROR
DTC P0150	O2 CIRCUIT (BANK 2, SENSOR 1)
DTC P0152	O2 CIRCUIT HIGH VOLTAGE (BANK 2, SENSOR 1)
DTC P0153	O2 CIRCUIT SLOW RESPONSE (BANK 2, SENSOR 1)
DTC P0154	O2 CIRCUIT NO ACTIVITY DETECTED (BANK 2, SENSOR 1)
DTC P0155	O2 HEATER CIRCUIT (BANK 2, SENSOR 1)

DTC P0158	O2 CIRCUIT HIGH VOLTAGE (BANK 2, SENSOR 2)
DTC P0159	O2 CIRCUIT SLOW RESPONSE (BANK 2, SENSOR 2)
DTC P0161	O2 HEATER CIRCUIT (BANK 2, SENSOR 2)
DTC P0171	SYSTEM TOO LEAN (BANK 1)
DTC P0172	SYSTEM TOO RICH (BANK 1)
DTC P0174	SYSTEM TOO LEAN (BANK 2)
DTC P0175	SYSTEM TOO RICH (BANK 2)
DTC P0180	FUEL TEMPERATURE SENSOR A CIRCUIT
DTC P0181	FUEL TEMPERATURE SENSOR A CIRCUIT RANGE/PERFORMANCE
DTC P0182	FUEL TEMPERATURE SENSOR A CIRCUIT LOW
DTC P0183	FUEL TEMPERATURE SENSOR A CIRCUIT HIGH
DTC P0190	FUEL RAIL PRESSURE SENSOR A CIRCUIT
DTC P0191	FUEL RAIL PRESSURE SENSOR A CIRCUIT RANGE/PERFORMANCE
DTC P0192	FUEL RAIL PRESSURE SENSOR A CIRCUIT LOW
DTC P0193	FUEL RAIL PRESSURE SENSOR A CIRCUIT HIGH
DTC P0196	ENGINE OIL TEMPERATURE (EOT) SENSOR CIRCUIT RANGE/PERFORMANCE
DTC P0197	ENGINE OIL TEMPERATURE (EOT) SENSOR CIRCUIT LOW
DTC P0198	ENGINE OIL TEMPERATURE (EOT) SENSOR CIRCUIT HIGH
DTC P020X	INJECTOR CIRCUIT/OPEN - CYLINDER X
DTC P0210	INJECTOR CIRCUIT/OPEN - CYLINDER 10
DTC P0217	ENGINE COOLANT OVER-TEMPERATURE CONDITION
DTC P0218	TRANSMISSION FLUID TEMPERATURE OVER-TEMPERATURE CONDITION
DTC P0219	ENGINE OVER SPEED CONDITION
DTC P0221	THROTTLE/PEDAL POSITION SENSOR/SWITCH B CIRCUIT RANGE/PERFORMANCE
DTC P0222	THROTTLE/PEDAL POSITION SENSOR/SWITCH B CIRCUIT LOW
DTC P0223	THROTTLE/PEDAL POSITION SENSOR/SWITCH B CIRCUIT HIGH
DTC P0230	FUEL PUMP PRIMARY CIRCUIT
DTC P0231	FUEL PUMP SECONDARY CIRCUIT LOW
DTC P0232	FUEL PUMP SECONDARY CIRCUIT HIGH
DTC P0297	VEHICLE OVER SPEED CONDITION
DTC P0298	ENGINE OIL OVER TEMPERATURE CONDITION
DTC P0300	RANDOM MISFIRE DETECTED
DTC P030X	CYLINDER X MISFIRE DETECTED
DTC P0310	CYLINDER 10 MISFIRE DETECTED
DTC P0315	CRANKSHAFT POSITION SYSTEM VARIATION NOT LEARNED.
DTC P0316	MISFIRE DETECTED ON STARTUP (FIRST 1000 REVOLUTIONS)
DTC P0320	IGNITION/DISTRIBUTOR ENGINE SPEED INPUT CIRCUIT
DTC P0325	KNOCK SENSOR 1 CIRCUIT (BANK 1)
DTC P0326	KNOCK SENSOR 1 CIRCUIT RANGE/PERFORMANCE (BANK 1)

DTC P0330	KNOCK SENSOR 2 CIRCUIT (BANK 2)
DTC P0331	KNOCK SENSOR 2 CIRCUIT RANGE/PERFORMANCE (BANK 2)
DTC P0340	CAMSHAFT POSITION SENSOR A CIRCUIT (BANK 1 OR SINGLE SENSOR)
DTC P0344	CAMSHAFT POSITION SENSOR A CIRCUIT INTERMITTENT (BANK 1 OR SINGLE SENSOR)
DTC P0345	CAMSHAFT POSITION SENSOR A CIRCUIT (BANK 2)
DTC P0349	CAMSHAFT POSITION SENSOR A CIRCUIT INTERMITTENT (BANK 2)
DTC P0350	IGNITION COIL PRIMARY/SECONDARY CIRCUIT
DTC P0351	IGNITION COIL A PRIMARY/SECONDARY CIRCUIT
DTC P0352	IGNITION COIL B PRIMARY/SECONDARY CIRCUIT
DTC P0353	IGNITION COIL C PRIMARY/SECONDARY CIRCUIT
DTC P0354	IGNITION COIL D PRIMARY/SECONDARY CIRCUIT
DTC P0355	IGNITION COIL E PRIMARY/SECONDARY CIRCUIT
DTC P0356	IGNITION COIL F PRIMARY/SECONDARY CIRCUIT
DTC P0357	IGNITION COIL G PRIMARY/SECONDARY CIRCUIT
DTC P0358	IGNITION COIL H PRIMARY/SECONDARY CIRCUIT
DTC P0359	IGNITION COIL I PRIMARY/SECONDARY CIRCUIT
DTC P0360	IGNITION COIL J PRIMARY/SECONDARY CIRCUIT
DTC P0400	EXHAUST GAS RECIRCULATION (EGR) FLOW
DTC P0401	EXHAUST GAS RECIRCULATION (EGR) FLOW INSUFFICIENT DETECTED
DTC P0402	EXHAUST GAS RECIRCULATION (EGR) FLOW EXCESSIVE DETECTED
DTC P0403	EXHAUST GAS RECIRCULATION (EGR) CONTROL CIRCUIT
DTC P0405	EXHAUST GAS RECIRCULATION (EGR) SENSOR A CIRCUIT LOW
DTC P0406	EXHAUST GAS RECIRCULATION (EGR) SENSOR A CIRCUIT HIGH
DTC P0410	SECONDARY AIR INJECTION (AIR) SYSTEM
DTC P0412	SECONDARY AIR INJECTION (AIR) SYSTEM - SWITCHING VALVE A CIRCUIT
DTC P0420	CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)
DTC P0430	CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 2)
DTC P0442	EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (SMALL LEAK)
DTC P0443	EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT
DTC P0446	EVAPORATIVE EMISSION SYSTEM VENT CONTROL CIRCUIT
DTC P0451	EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH RANGE/PERFORMANCE
DTC P0452	EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH LOW
DTC P0453	EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH HIGH
DTC P0454	EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH INTERMITTENT
DTC P0455	EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (GROSS LEAK/NO FLOW)
DTC P0456	EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (VERY SMALL LEAK)
DTC P0457	EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)

DTC P0460	FUEL LEVEL SENSOR A CIRCUIT
DTC P0461	FUEL LEVEL SENSOR A CIRCUIT RANGE/PERFORMANCE
DTC P0462	FUEL LEVEL SENSOR A CIRCUIT LOW
DTC P0463	FUEL LEVEL SENSOR A CIRCUIT HIGH
DTC P0480	FAN 1 CONTROL CIRCUIT
DTC P0481	FAN 2 CONTROL CIRCUIT
DTC P0482	FAN 3 CONTROL CIRCUIT
DTC P0483	FAN PERFORMANCE
DTC P0491	SECONDARY AIR INJECTION (AIR) SYSTEM INSUFFICIENT FLOW (BANK 1)
DTC P0500	VEHICLE SPEED SENSOR (VSS) A
DTC P0503	VEHICLE SPEED SENSOR (VSS) A INTERMITTENT/ERRATIC/HIGH
DTC P0504	BRAKE SWITCH CORRELATION
DTC P0505	IDLE AIR CONTROL (IAC) SYSTEM
DTC P0506	IDLE AIR CONTROL (IAC) SYSTEM RPM LOWER THAN EXPECTED
DTC P0507	IDLE AIR CONTROL (IAC) SYSTEM RPM HIGHER THAN EXPECTED
DTC P050A	COLD START IDLE AIR CONTROL PERFORMANCE
DTC P050B	COLD START IGNITION TIMING PERFORMANCE
DTC P050E	COLD START ENGINE EXHAUST TEMPERATURE OUT OF RANGE
DTC P0511	IDLE AIR CONTROL (IAC) CIRCUIT
DTC P0512	STARTER REQUEST CIRCUIT
DTC P0528	FAN SPEED SENSOR CIRCUIT NO SIGNAL
DTC P052A	COLD START CAMSHAFT POSITION TIMING OVER-ADVANCED (BANK 1)
DTC P052B	COLD START CAMSHAFT POSITION TIMING OVER-RETARDED (BANK 1)
DTC P052C	COLD START CAMSHAFT POSITION TIMING OVER-ADVANCED (BANK 2)
DTC P052D	COLD START CAMSHAFT POSITION TIMING OVER-RETARDED (BANK 2)
DTC P0532	A/C PRESSURE REFRIGERANT SENSOR A CIRCUIT LOW
DTC P0533	A/C REFRIGERANT PRESSURE SENSOR A CIRCUIT HIGH
DTC P0534	A/C REFRIGERANT CHARGE LOSS
DTC P0537	A/C EVAPORATOR TEMPERATURE SENSOR CIRCUIT LOW
DTC P0538	A/C EVAPORATOR TEMPERATURE SENSOR CIRCUIT HIGH
DTC P053A	POSITIVE CRANKCASE VENTILATION (PCV) HEATER CONTROL CIRCUIT / OPEN
DTC P0552	POWER STEERING PRESSURE (PSP) SENSOR/SWITCH CIRCUIT LOW
DTC P0553	POWER STEERING PRESSURE (PSP) SENSOR CIRCUIT HIGH INPUT
DTC P0563	SYSTEM VOLTAGE HIGH
DTC P0571	BRAKE SWITCH A CIRCUIT
DTC P0572	BRAKE SWITCH A CIRCUIT LOW
DTC P0573	BRAKE SWITCH A CIRCUIT HIGH
DTC P0579	CRUISE CONTROL MULTIFUNCTION INPUT A CIRCUIT RANGE / PERFORMANCE
DTC P0581	CRUISE CONTROL MULTIFUNCTION INPUT A CIRCUIT HIGH

DTC P0600	SERIAL COMMUNICATION LINK
DTC P0602	POWERTRAIN CONTROL MODULE (PCM) PROGRAMMING ERROR
DTC P0603	INTERNAL CONTROL MODULE KEEP ALIVE MEMORY (KAM) ERROR
DTC P0604	INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR
DTC P0605	INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR
DTC P0606	CONTROL MODULE PROCESSOR
DTC P0607	CONTROL MODULE PERFORMANCE
DTC P060A	INTERNAL CONTROL MODULE MONITORING PROCESSOR PERFORMANCE
DTC P060B	INTERNAL CONTROL MODULE A/D PROCESSING PERFORMANCE
DTC P060C	INTERNAL CONTROL MODULE MAIN PROCESSOR PERFORMANCE
DTC P060D	INTERNAL CONTROL MODULE ACCELERATOR PEDAL POSITION PERFORMANCE
DTC P0610	CONTROL MODULE VEHICLE OPTIONS ERROR
DTC P061B	INTERNAL CONTROL MODULE TORQUE CALCULATION PERFORMANCE
DTC P061C	INTERNAL CONTROL MODULE ENGINE RPM PERFORMANCE
DTC P061D	INTERNAL CONTROL MODULE ENGINE AIR MASS PERFORMANCE
DTC P061F	INTERNAL CONTROL MODULE THROTTLE ACTUATOR CONTROLLER PERFORMANCE
DTC P0620	GENERATOR CONTROL CIRCUIT
DTC P0622	GENERATOR FIELD TERMINAL CIRCUIT
DTC P0625	GENERATOR FIELD TERMINAL CIRCUIT LOW
DTC P0626	GENERATOR FIELD TERMINAL CIRCUIT HIGH
DTC P062C	INTERNAL CONTROL MODULE VEHICLE SPEED PERFORMANCE
DTC P0642	SENSOR REFERENCE VOLTAGE A CIRCUIT LOW
DTC P0643	SENSOR REFERENCE VOLTAGE A CIRCUIT HIGH
DTC P0645	AIR CONDITIONING CLUTCH RELAY (A/CCR) CONTROL CIRCUIT
DTC P064D	INTERNAL CONTROL MODULE O2 SENSOR PROCESSOR PERFORMANCE - BANK 1
DTC P064E	INTERNAL CONTROL MODULE O2 SENSOR PROCESSOR PERFORMANCE - BANK 2
DTC P0657	ACTUATOR SUPPLY VOLTAGE A CIRCUIT/OPEN
DTC P065B	GENERATOR CONTROL CIRCUIT RANGE/PERFORMANCE
DTC P0660	INTAKE MANIFOLD TUNING VALVE (IMTV) CONTROL CIRCUIT OPEN - BANK 1
DTC P0663	INTAKE MANIFOLD TUNING VALVE (IMTV) CONTROL CIRCUIT OPEN - BANK 2
DTC P0685	ELECTRONIC CONTROL MODULE (ECM)/POWERTRAIN CONTROL MODULE (PCM) POWER RELAY CONTROL CIRCUIT/OPEN
DTC P0689	ELECTRONIC CONTROL MODULE (ECM)/POWERTRAIN CONTROL MODULE (PCM) POWER RELAY SENSE CIRCUIT LOW
DTC P0690	ELECTRONIC CONTROL MODULE (ECM)/POWERTRAIN CONTROL MODULE (PCM) POWER RELAY SENSE CIRCUIT HIGH

DTC P0703	BRAKE SWITCH B INPUT CIRCUIT
DTC P0704	CLUTCH SWITCH INPUT CIRCUIT
DTC P0705	TRANSMISSION RANGE SENSOR A CIRCUIT (PRNDL) INPUT
DTC P0707	TRANSMISSION RANGE SENSOR A CIRCUIT LOW
DTC P0708	TRANSMISSION RANGE SENSOR A CIRCUIT HIGH
DTC P071X	TRANSMISSION CODE
DTC P0720	OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT
DTC P0721	OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT RANGE/PERFORMANCE
DTC P0722	OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT NO SIGNAL
DTC P0723	OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT INTERMITTENT
DTC P073X	TRANSMISSION CODE
DTC P074X	TRANSMISSION CODE
DTC P075X	TRANSMISSION CODE
DTC P076X	TRANSMISSION CODE
DTC P077X	TRANSMISSION CODE
DTC P078X	TRANSMISSION CODE
DTC P079X	TRANSMISSION CODE
DTC P0815	UPSHIFT SWITCH CIRCUIT
DTC P0830	CLUTCH PEDAL SWITCH A CIRCUIT
DTC P0833	CLUTCH PEDAL SWITCH B CIRCUIT
DTC P0840	TRANSMISSION FLUID PRESSURE SENSOR/SWITCH A CIRCUIT
DTC P09XX	TRANSMISSION CODE
DTC P1000	ON-BOARD DIAGNOSTIC (OBD) SYSTEMS READINESS TEST NOT COMPLETE
DTC P1001	KEY ON ENGINE RUNNING (KOER) NOT ABLE TO COMPLETE, KOER ABORTED
DTC P1100	MASS AIR FLOW (MAF) SENSOR CIRCUIT INTERMITTENT
DTC P1101	MASS AIR FLOW (MAF) SENSOR OUT OF SELF-TEST RANGE
DTC P1112	INTAKE AIR TEMPERATURE (IAT) CIRCUIT INTERMITTENT
DTC P1114	INTAKE AIR TEMPERATURE 2 (IAT2) CIRCUIT LOW (SUPERCHARGED/TURBOCHARGED ENGINES)
DTC P1115	INTAKE AIR TEMPERATURE 2 (IAT2) CIRCUIT HIGH (SUPERCHARGED/TURBOCHARGED ENGINES)
DTC P1116	ENGINE COOLANT TEMPERATURE (ECT) SENSOR OUT OF SELF-TEST RANGE
DTC P1117	ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT INTERMITTENT
DTC P1120	THROTTLE POSITION SENSOR A OUT OF RANGE LOW (RATCH TOO LOW)
DTC P1124	THROTTLE POSITION SENSOR A OUT OF SELF-TEST RANGE
DTC P1127	EXHAUST TEMPERATURE OUT OF RANGE, O2 SENSOR TESTS NOT COMPLETED
DTC P115E	THROTTLE ACTUATOR CONTROL (TAC) THROTTLE BODY AIR FLOW TRIM AT MAX LIMIT
DTC P117A	ENGINE OIL OVER TEMPERATURE - FORCED LIMITED POWER

DTC P1184	ENGINE OIL TEMPERATURE (EOT) SENSOR OUT OF SELF-TEST RANGE
DTC P1227	WASTEGATE FAILED CLOSED (OVER PRESSURE)
DTC P1228	WASTEGATE FAILED OPEN (UNDER PRESSURE)
DTC P1229	CHARGE AIR COOLER (CAC) PUMP DRIVER
DTC P1233	FUEL PUMP DRIVER MODULE DISABLED OR OFF LINE
DTC P1234	FUEL PUMP DRIVER MODULE DISABLED OR OFF LINE
DTC P1235	FUEL PUMP CONTROL OUT OF RANGE
DTC P1236	FUEL PUMP CONTROL OUT OF RANGE
DTC P1237	FUEL PUMP SECONDARY CIRCUIT
DTC P1238	FUEL PUMP SECONDARY CIRCUIT
DTC P1244	ALTERNATOR LOAD HIGH INPUT
DTC P1245	ALTERNATOR LOAD LOW INPUT
DTC P1246	ALTERNATOR LOAD INPUT
DTC P1260	THEFT DETECTED, VEHICLE IMMOBILIZED
DTC P1270	ENGINE RPM OR VEHICLE SPEED LIMITER REACHED
DTC P1285	CYLINDER HEAD OVER TEMPERATURE CONDITION
DTC P1288	CYLINDER HEAD TEMPERATURE (CHT) SENSOR OUT OF SELF-TEST RANGE
DTC P1289	CYLINDER HEAD TEMPERATURE (CHT) SENSOR CIRCUIT HIGH
DTC P128A	CYLINDER HEAD TEMPERATURE (CHT) SENSOR CIRCUIT INTERMITTENT/ERRATIC
DTC P1290	CYLINDER HEAD TEMPERATURE (CHT) SENSOR CIRCUIT LOW
DTC P1299	CYLINDER HEAD OVER TEMPERATURE PROTECTION ACTIVE
DTC P1336	CRANKSHAFT/CAMSHAFT SENSOR RANGE/PERFORMANCE
DTC P1397	SYSTEM VOLTAGE OUT OF SELF -TEST RANGE
DTC P1405	DIFFERENTIAL PRESSURE FEEDBACK SENSOR UPSTREAM HOSE OFF OR PLUGGED
DTC P1406	DIFFERENTIAL PRESSURE FEEDBACK SENSOR DOWNSTREAM HOSE OFF OR PLUGGED
DTC P1408	EXHAUST GAS RECIRCULATION (EGR) FLOW OUT OF SELF-TEST RANGE (NON-MIL)
DTC P1409	EXHAUST GAS RECIRCULATION (EGR) VACUUM REGULATOR SOLENOID CIRCUIT
DTC P1436	A/C EVAPORATOR AIR TEMPERATURE CIRCUIT LOW
DTC P1437	A/C EVAPORATOR AIR TEMPERATURE CIRCUIT HIGH
DTC P144A	EVAPORATIVE EMISSION SYSTEM PURGE VAPOR LINE RESTRICTED/BLOCKED
DTC P1450	UNABLE TO BLEED UP FUEL TANK VACUUM
DTC P1451	EVAPORATIVE EMISSION SYSTEM VENT CONTROL CIRCUIT
DTC P145E	PCV HEATER CONTROL B CIRCUIT
DTC P1460	WIDE OPEN THROTTLE A/C CUTOUT CIRCUIT
DTC P1461	A/C PRESSURE SENSOR CIRCUIT HIGH
DTC P1462	AIR CONDITIONING PRESSURE (A/CP) SENSOR LOW VOLTAGE DETECTED

DTC P1463	AIR CONDITIONING PRESSURE SENSOR (A/CP) INSUFFICIENT PRESSURE CHANGE
DTC P1464	A/C DEMAND OUT OF SELF-TEST RANGE
DTC P1469	RAPID A/C CYCLING
DTC P1474	FAN CONTROL PRIMARY CIRCUIT
DTC P1477	ADDITIONAL FAN RELAY CIRCUIT
DTC P1479	HIGH FAN CONTROL PRIMARY CIRCUIT
DTC P1489	PCV HEATER CONTROL CIRCUIT
DTC P1500	VEHICLE SPEED SENSOR (VSS)
DTC P1501	VEHICLE SPEED SENSOR (VSS) OUT OF SELF-TEST RANGE
DTC P1502	VEHICLE SPEED SENSOR (VSS) INTERMITTENT
DTC P1504	IDLE AIR CONTROL (IAC) CIRCUIT
DTC P1506	IDLE AIR CONTROL (IAC) OVERSPEED ERROR
DTC P1507	IDLE AIR CONTROL (IAC) UNDER SPEED ERROR
DTC P1512	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 1)
DTC P1513	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 2)
DTC P1516	INTAKE MANIFOLD RUNNER CONTROL (IMRC) INPUT ERROR (BANK 1)
DTC P1517	INTAKE MANIFOLD RUNNER CONTROL (IMRC) INPUT ERROR (BANK 2)
DTC P1518	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN BANK 1
DTC P1519	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED BANK 1
DTC P151A	INTAKE MANIFOLD RUNNER CONTROLLER PERFORMANCE
DTC P1520	INTAKE MANIFOLD RUNNER CONTROL (IMRC) CIRCUIT
DTC P1537	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 1)
DTC P1538	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 2)
DTC P1548	ENGINE AIR FILTER RESTRICTION
DTC P1549	INTAKE MANIFOLD COMMUNICATION CONTROL (IMCC) CIRCUIT (BANK 1)
DTC P1550	POWER STEERING PRESSURE (PSP) SENSOR OUT OF SELF-TEST RANGE
DTC P1572	BRAKE PEDAL SWITCH CIRCUIT
DTC P1575	PEDAL POSITION OUT OF SELF TEST RANGE
DTC P1633	KEEP ALIVE POWER (KAPWR) VOLTAGE TOO LOW
DTC P1635	TIRE/AXLE RATIO OUT OF ACCEPTABLE RANGE
DTC P1636	INDUCTIVE SIGNATURE CHIP COMMUNICATION ERROR
DTC P1639	VEHICLE ID (VID) BLOCK CORRUPTED, NOT PROGRAMMED
DTC P1640	POWERTRAIN DTCS AVAILABLE IN ANOTHER MODULE
DTC P1641	FUEL PUMP PRIMARY CIRCUIT
DTC P1646	LINEAR O2 SENSOR CONTROL CHIP (BANK 1)
DTC P1647	LINEAR O2 SENSOR CONTROL CHIP (BANK 2)
DTC P1650	POWER STEERING PRESSURE (PSP) SWITCH OUT OF SELF-TEST RANGE
DTC P1651	POWER STEERING PRESSURE (PSP) SWITCH INPUT
DTC P1674	CONTROL MODULE SOFTWARE CORRUPTED
DTC P1703	BRAKE SWITCH OUT OF SELF-TEST RANGE

DTC P1705	TRANSMISSION RANGE SENSOR OUT OF SELF-TEST RANGE
DTC P1709	PARK/NEUTRAL POSITION (PNP) SWITCH OUT OF SELF-TEST RANGE
DTC P1729	4X4L SWITCH
DTC P1780	TRANSMISSION CONTROL SWITCH (TCS) OUT OF SELF-TEST RANGE
DTC P1781	4X4L SWITCH OUT OF SELF-TEST RANGE
DTC P17XX	
DTC P18XX	
DTC P1900	OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT INTERMITTENT
DTC P1901	TURBINE SHAFT SPEED (TSS) SENSOR CIRCUIT INTERMITTENT
DTC P2004	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 1)
DTC P2005	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 2)
DTC P2006	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 1)
DTC P2007	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 2)
DTC P2008	INTAKE MANIFOLD RUNNER CONTROL (IMRC) CIRCUIT OPEN (BANK 1)
DTC P2014	INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT (BANK 1)
DTC P2015	INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT RANGE/PERFORMANCE (BANK 1)
DTC P2019	INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT (BANK 2)
DTC P2020	INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT RANGE/PERFORMANCE (BANK 2)
DTC P2065	FUEL LEVEL SENSOR B CIRCUIT
DTC P2066	FUEL LEVEL SENSOR B CIRCUIT RANGE/PERFORMANCE
DTC P2067	FUEL LEVEL SENSOR B CIRCUIT LOW
DTC P2068	FUEL LEVEL SENSOR B CIRCUIT HIGH
DTC P2070	INTAKE MANIFOLD TUNING VALVE (IMTV) STUCK OPEN BANK 1
DTC P2071	INTAKE MANIFOLD TUNING VALVE (IMTV) STUCK CLOSED BANK 1
DTC P2072	THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - ICE BREAKAGE
DTC P2096	POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1
DTC P2097	POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1
DTC P2098	POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 2
DTC P2099	POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 2
DTC P2100	THROTTLE ACTUATOR CONTROL (TAC) MOTOR CIRCUIT/OPEN
DTC P2101	THROTTLE ACTUATOR CONTROL (TAC) MOTOR RANGE/PERFORMANCE
DTC P2104	THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - FORCED IDLE
DTC P2105	THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - FORCED ENGINE SHUTDOWN
DTC P2107	THROTTLE ACTUATOR CONTROL (TAC) MODULE PROCESSOR
DTC P2110	THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - FORCED LIMITED RPM
DTC P2111	THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - STUCK OPEN
DTC P2112	THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - STUCK CLOSED
DTC P2121	THROTTLE/PEDAL POSITION SENSOR/SWITCH D CIRCUIT RANGE/PERFORMANCE

DTC P2122	THROTTLE/PEDAL POSITION SENSOR/SWITCH D CIRCUIT LOW
DTC P2123	THROTTLE/PEDAL POSITION SENSOR/SWITCH D CIRCUIT HIGH
DTC P2126	THROTTLE/PEDAL POSITION SENSOR/SWITCH E CIRCUIT RANGE/PERFORMANCE
DTC P2127	THROTTLE/PEDAL POSITION SENSOR/SWITCH E CIRCUIT LOW
DTC P2128	THROTTLE/PEDAL POSITION SENSOR/SWITCH E CIRCUIT HIGH
DTC P2131	THROTTLE/PEDAL POSITION SENSOR/SWITCH F CIRCUIT RANGE/PERFORMANCE
DTC P2132	THROTTLE/PEDAL POSITION SENSOR/SWITCH F CIRCUIT LOW
DTC P2133	THROTTLE/PEDAL POSITION SENSOR/SWITCH F CIRCUIT HIGH
DTC P2135	THROTTLE/PEDAL POSITION SENSOR/SWITCH A/B VOLTAGE CORRELATION
DTC P2138	THROTTLE/PEDAL POSITION SENSOR/SWITCH D/E VOLTAGE CORRELATION
DTC P2195	O2 SENSOR SIGNAL BIASED/STUCK LEAN - BANK 1, SENSOR 1
DTC P2196	O2 SENSOR SIGNAL BIASED/STUCK RICH - BANK 1, SENSOR 1
DTC P2197	O2 SENSOR SIGNAL BIASED/STUCK LEAN - BANK 2, SENSOR 1
DTC P2198	O2 SENSOR SIGNAL BIASED/STUCK RICH - BANK 2, SENSOR 1
DTC P2257	SECONDARY AIR INJECTION (AIR) SYSTEM CONTROL A CIRCUIT LOW
DTC P2258	SECONDARY AIR INJECTION (AIR) SYSTEM CONTROL A CIRCUIT HIGH
DTC P2270	O2 SENSOR SIGNAL STUCK LEAN - BANK 1, SENSOR 2
DTC P2271	O2 SENSOR SIGNAL STUCK RICH - BANK 1, SENSOR 2
DTC P2272	O2 SENSOR SIGNAL STUCK LEAN - BANK 2, SENSOR 2
DTC P2273	O2 SENSOR SIGNAL STUCK RICH - BANK 2, SENSOR 2
DTC P2274	O2 SENSOR SIGNAL STUCK LEAN - BANK 1, SENSOR 3
DTC P2275	O2 SENSOR SIGNAL STUCK RICH - BANK 1, SENSOR 3
DTC P2448	SECONDARY AIR INJECTION SYSTEM HIGH AIRFLOW (BANK 1)
DTC P260F	EVAPORATIVE SYSTEM MONITORING PROCESSOR PERFORMANCE
DTC PXXXX	
DTC U0101	LOST COMMUNICATION WITH TRANSAXLE CONTROL MODULE (TCM)
DTC U0121	LOST COMMUNICATION WITH THE ANTILOCK BRAKING SYSTEM (ABS) CONTROL MODULE
DTC U0155	LOST COMMUNICATION WITH INSTRUMENT PANEL CLUSTER CONTROL MODULE
DTC U0300	INTERNAL CONTROL MODULE SOFTWARE INCOMPATIBILITY
DTC U1039	SCP (J1850) INVALID OR MISSING DATA FOR VEHICLE SPEED
DTC UXXXX	NETWORK COMMUNICATION DIAGNOSTIC TROUBLE CODE (DTC)

REAR VIEW MIRRORS DTCS

DRIVER DOOR MODULE (DDM)

DRIVER DOOR MODULE (DDM) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1234	Mirror Switch Invalid Code	Go to **Pinpoint Test D** .
B1667	Mirror Driver Up/Down Motor Stalled	Go to **Pinpoint Test D** .
B1668	Mirror Driver Right/Left Motor Stalled	Go to **Pinpoint Test D** .
B2223	Driver Mirror Drive Circuit Failure	Go to **Pinpoint Test D** .
B2320	Driver Mirror Horizontal Feedback Potentiometer Circuit Failure	Go to **Pinpoint Test D** .
B2322	Driver Mirror Horizontal Feedback Potentiometer Circuit Short to Battery	Go to **Pinpoint Test D** .
B2324	Driver Mirror Vertical Feedback Potentiometer Circuit Failure	Go to **Pinpoint Test D** .
B2326	Driver Mirror Vertical Feedback Potentiometer Circuit Short to Battery	Go to **Pinpoint Test D** .

DRIVER SEAT MODULE (DSM)

DRIVER SEAT MODULE (DSM) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1669	Mirror Passenger Up/Down Motor Stalled	Go to **Pinpoint Test D** .
B1670	Mirror Passenger Right/Left Motor Stalled	Go to **Pinpoint Test D** .
B2224	Passenger Mirror Drive Circuit Failure	Go to **Pinpoint Test D** .
B2312	Passenger Mirror Horizontal Feedback Potentiometer Circuit Failure	Go to **Pinpoint Test D** .
B2314	Passenger Mirror Horizontal Feedback Potentiometer Circuit Short to Battery	Go to **Pinpoint Test D** .
B2316	Passenger Mirror Vertical Feedback Potentiometer Circuit Failure	Go to **Pinpoint Test D** .
B2318	Passenger Mirror Vertical Feedback Potentiometer Circuit Short to Battery	Go to **Pinpoint Test D** .

REAR VIEW MIRRORS DTCS

DRIVER DOOR MODULE (DDM)

DRIVER DOOR MODULE (DDM) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Retrieved	Perform Test
B1530	Memory Set Switch Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K** .
B1534	Memory 1 Switch Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K** .
B1538	Memory 2 Switch Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K** .
B2084	Memory SET Indicator Short to	On-Demand	Go to **Pinpoint Test K** .

	Ground	and Continuous	

DRIVER SEAT MODULE (DSM)

DRIVER SEAT MODULE (DSM) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Retrieved	Perform Test
B1663	Seat Driver Front Up/Down Motor Stalled	On-Demand	If the motor does not operate, go to **Pinpoint Test J** . If motor operates, go to **Pinpoint Test K** .
B1664	Seat Driver Rear Up/Down Motor Stalled	On-Demand	If the motor does not operate, go to **Pinpoint Test J** . If motor operates, go to **Pinpoint Test K** .
B1665	Seat Driver Forward/Backward Motor Stalled	On-Demand	If the motor does not operate, go to **Pinpoint Test J** . If motor operates, go to **Pinpoint Test K** .
B1666	Seat Driver Recline Motor Stalled	On-Demand	If the motor does not operate, go to **Pinpoint Test J** . If motor operates, go to **Pinpoint Test K** .
B1703	Seat Driver Recline Forward Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J** .
B1707	Seat Driver Recline Rearward Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J** .
B1711	Seat Driver Front Up Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J** .
B1715	Seat Driver Front Down Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J** .
B1719	Seat Driver Forward Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J** .
B1723	Seat Driver Rearward Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J** .
B1727	Seat Driver Rear Up Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J** .
B1731	Seat Driver Rear Down Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J** .
B1952	Seat Rear Up/Down Position Feedback Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test K** .

B1953	Seat Rear Up/Down Position Feedback Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K** .
B1956	Seat Front Up/Down Position Feedback Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test K** .
B1957	Seat Front Up/Down Position Feedback Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K** .
B1960	Seat Recline Forward/Backward Position Feedback Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test K** .
B1961	Seat Recline Forward/Backward Position Feedback Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K** .
B1964	Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test K** .
B1965	Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K** .

DUAL CLIMATE CONTROLLED SEAT MODULE (DCSM)

DUAL CLIMATE CONTROLLED SEAT MODULE (DCSM) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Retrieved	Perform Test
B103B	Thermo-electric Driver Overcurrent Low	On-Demand and Continuous	Go to **Pinpoint Test S** .
B103C	Thermo-electric Driver Open Load	On-Demand and Continuous	Go to **Pinpoint Test T** .
B103D	Blower Driver Overtemperature	On-Demand and Continuous	Go to **Pinpoint Test U** .
B1111	Driver Thermo-electric Device Control Overtemperature Fault	On-Demand and Continuous	Go to **Pinpoint Test S** .
B1113	Passenger Thermo-electric Device Control Overtemperature Fault	On-Demand and Continuous	Go to **Pinpoint Test V** .
B111B	Passenger Thermo-electric Driver Overcurrent Low	On-Demand and Continuous	Go to **Pinpoint Test V** .
B111C	Passenger Thermo-electric Driver Open Load	On-Demand and Continuous	Go to **Pinpoint Test W** .
B111D	Passenger Blower Driver Overtemperature	On-Demand and Continuous	Go to **Pinpoint Test X** .
B2729	Cushion Over-Temp Detected (Driver)	On-Demand and Continuous	Go to **Pinpoint Test Y** .

B272A	Passenger Cushion Over-Temp Detected	On-Demand and Continuous	Go to **Pinpoint Test Z** .
B272B	Passenger Back Over-Temp Detected	On-Demand and Continuous	Go to **Pinpoint Test AA** .
B272C	Driver Differential Temperature Fault	On-Demand and Continuous	Go to **Pinpoint Test AB** .
B272D	Passenger Differential Temperature Fault	On-Demand and Continuous	Go to **Pinpoint Test AC** .
B272E	Driver Ignition Run/Blower Circuit Short to Ground (this DTC sets for an open or short to voltage)	On-Demand and Continuous	Go to **Pinpoint Test AD** .
B272F	Passenger Ignition Run/Blower Circuit Short to Ground (this DTC sets for an open or short to voltage)	On-Demand and Continuous	Go to **Pinpoint Test AE** .
B2730	Back Over-Temp Detected (Driver)	On-Demand and Continuous	Go to **Pinpoint Test AF** .

SPEED CONTROL DTCS

PCM DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
P0579	Cruise Control Multifunction Input A Circuit Range/Performance	Go to **Pinpoint Test C** .
P0581	Cruise Control Multifunction Circuit High	Go to **Pinpoint Test C** .
P0833	Clutch Pedal Switch B Circuit	Go to **Pinpoint Test D** .
P1572	Brake Pedal Switch Circuit	Go to **Pinpoint Test B** .
P1703	Brake Switch Out of Self-Test Range	Go to **Pinpoint Test B** .

SUPPLEMENTAL RESTRAINT SYSTEM DTCS

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC[a]	Description	Retrieved From	Perform Test
Continuous Lamp	The Air Bag Warning Indicator is Illuminated Continuously	Restraints control module (RCM)	Go to **Pinpoint Test A** .
B1884	PAD Warning Lamp Circuit Failure	RCM	Go to **Pinpoint Test B** .
B1890	PAD Warning Lamp Circuit Short to Battery	RCM	Go to **Pinpoint Test C** .
B2290 (Rail Type System)	Occupant Classification System Fault	OCSM	**NOTE:** **If no on-demand or continuous DTC is present in the RCM and DTC B2290 is**

			only present in the OCSM continuous, CLEAR all OCSM DTCs and PROVE OUT the SRS. Go to **Pinpoint Test D** .
B2292	Restraint System - Safety Belt Pretensioner Fault	RCM	Go to **Pinpoint Test E** .
B2293	Restraint System - Air Bag Fault	RCM	Go to **Pinpoint Test F** .
B2294	Restraint System - Curtain Fault	RCM	Go to **Pinpoint Test G** .
B2295	Restraint System - Side Air Bag Fault	RCM	Go to **Pinpoint Test H** .
B2296	Restraint System - Impact Sensor Fault	RCM	Go to **Pinpoint Test I** .
B2434	Drivers Seat Belt Buckle Switch Circuit Short to Ground	RCM	Go to **Pinpoint Test J** .
B2435	Drivers Seat Belt Buckle Switch Resistance Out of Range	RCM	Go to **Pinpoint Test K** .
B2438	Passengers Seat Belt Buckle Switch Short to Ground	RCM	Go to **Pinpoint Test L** .
B2439	Passengers Seat Belt Buckle Switch Resistance Out of Range	RCM	Go to **Pinpoint Test M** .
B2691	Seat Belt Buckle Switch Circuit Fault, Front Driver's Side	RCM	Go to **Pinpoint Test N** .
B2692	Front Passenger's Seat Belt Buckle Switch Circuit Fault	RCM	Go to **Pinpoint Test O** .
B2792	Cross Link Between Firing Loops	RCM	Go to **Pinpoint Test P** .
C1946	Front Driver's Seat Track Position Switch Circuit Open	RCM	Go to **Pinpoint Test S** .
C1947	Front Driver's Seat Track Position Switch Circuit Short to Ground	RCM	Go to **Pinpoint Test T** .
C1948	Front Driver's Seat Track Position Switch Circuit Resistance Out of Range	RCM	Go to **Pinpoint Test U** .
C1981	Front Driver's Seat Track Position Switch Circuit Fault	RCM	Go to **Pinpoint Test V** .

VEHICLE DYNAMIC SYSTEMS DTCS

ABS MODULE

ABS MODULE DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTCs	Description	Source	Perform Test
B1483	Brake Pedal Input Open Circuit	ABS Module	Go to **Pinpoint Test A** .
B1676	Battery Pack Voltage Out of Range	ABS Module	Go to **Pinpoint Test B** .
C1095	ABS Hydraulic Pump Motor Circuit Failure	ABS Module	Go to **Pinpoint Test E** .
C1145	Wheel Speed Sensor RF Input Circuit Failure	ABS Module	Go to **Pinpoint Test C** .
C1155	Wheel Speed Sensor LF Input Circuit Failure	ABS Module	Go to **Pinpoint Test C** .
C1165	Wheel Speed Sensor RR Input Circuit Failure	ABS Module	Go to **Pinpoint Test C** .
C1175	Wheel Speed Sensor LR Input Circuit Failure	ABS Module	Go to **Pinpoint Test C** .
C1233	Wheel Speed LF Signal Fault	ABS Module	Go to **Pinpoint Test D** .
C1234	Wheel Speed RF Signal Fault	ABS Module	Go to **Pinpoint Test D** .
C1235	Wheel Speed RR Signal Fault	ABS Module	Go to **Pinpoint Test D** .
C1236	Wheel Speed LR Signal Fault	ABS Module	Go to **Pinpoint Test D** .

INSTRUMENT CLUSTER (IC)

INSTRUMENT CLUSTER DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Source	Perform Test
C1093	Traction Control Disable Switch Circuit Failure	Instrument Cluster	Go to **Pinpoint Test G** .

WHEELS & TIRES DTCS

TIRE PRESSURE MONITORING SYSTEM (TPMS) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Source	Perform Test
B106A	Pressure Sensor Range Bit Incorrect State	Smart Junction Box (SJB)	Go to **Pinpoint Test G** .
B106B	Tire Pressure Sensor Low Battery	SJB	DTC B106B can be set during SJB configuration. Go to **Pinpoint Test H** .
B287A	Tire Pressure System Fault	SJB	Go to **Pinpoint Test F** .

WIPERS & WASHERS DTCS

SMART JUNCTION BOX (SJB) DIAGNOSTIC TROUBLE CODE (DTC) LIST

DTC	Description	Perform Test
B1432	Wiper Brake/Run Relay Circuit Short to Battery	Go to **Pinpoint Test A** .
B1433	Wiper Brake/Run Relay Circuit Short to Ground	Go to **Pinpoint Test B** .
B1447	Wiper Park Sense Circuit Open	Go to **Pinpoint Test F** .
B2179	Front Wiper Select Switch "A" Short to Ground	Go to **Pinpoint Test B** .
B2180	Front Wiper Select Switch "B" Short to Ground	Go to **Pinpoint Test B** .
B2181	Front Wiper Select Switch "C" Short to Ground	Go to **Pinpoint Test B** .
B2183	Front Wiper Select Switch "H" Short to Ground	Go to **Pinpoint Test C** .
B2184	Front Wiper Select Switch "W" Short to Ground	Go to **Pinpoint Test E** .

2008 FORD MOTOR CO.

Fusion, Milan & MKZ

BUZZERS, RELAYS & TIMERS

BUZZERS, RELAYS & TIMERS LOCATION

Component	Location
A/C Clutch Relay (Early Production)	In battery junction box (BJB). See **Fig. 2**.
A/C Clutch Relay (Late Production)	In battery junction box (BJB). See **Fig. 36**.
Blower Motor Relay (Early Production)	In battery junction box (BJB). See **Fig. 2**.
Blower Motor Relay (Late Production)	In battery junction box (BJB). See **Fig. 36**.
FNR5 Relay (Early Production)	In battery junction box (BJB). See **Fig. 2**.
FNR5 Relay (Late Production)	In battery junction box (BJB). See **Fig. 36**.
Fog Lamp Relay (Early Production)	In battery junction box (BJB). See **Fig. 2**.
Fog Lamp Relay (Late Production)	In battery junction box (BJB). See **Fig. 36**.
Fuel Pump Relay (Early Production)	In battery junction box (BJB). See **Fig. 2**.
Fuel Pump Relay (Late Production)	In battery junction box (BJB). See **Fig. 36**.
High Current PETA Pump Relay (Early Production)	In battery junction box (BJB). See **Fig. 2**.
High Current PETA Pump Relay (Late Production)	In battery junction box (BJB). See **Fig. 36**.
High Intensity Discharge Headlamp Relay (Left) (Early Production)	In battery junction box (BJB). See **Fig. 2**.
High Intensity Discharge Headlamp Relay (Left) (Late Production)	In battery junction box (BJB). See **Fig. 36**.
High Intensity Discharge Headlamp Relay (Right) (Early Production)	In battery junction box (BJB). See **Fig. 2**.
High Intensity Discharge Headlamp Relay (Right) (Late Production)	In battery junction box (BJB). See **Fig. 36**.
PCM Power Relay (Early Production)	In battery junction box (BJB). See **Fig. 2**.
PCM Power Relay (Late Production)	In battery junction box (BJB). See **Fig. 36**.
Wiper Park Relay (Early Production)	In battery junction box (BJB). See **Fig. 2**.
Wiper Park Relay (Late Production)	In battery junction box (BJB). See **Fig. 36**.
Wiper Run/Park Relay (Early Production)	In battery junction box (BJB). See **Fig. 2**.
Wiper Run/Park Relay (Late Production)	In battery junction box (BJB). See **Fig. 36**.

CIRCUIT PROTECTION DEVICES

CIRCUIT PROTECTION DEVICES LOCATION

Component	Location
A/C Evaporative Thermistor	Right side of dash. See **Fig. 20**.
Battery Junction Box (BJB) (2.3L)	Left side of engine compartment. See **Fig. 31**.
Battery Junction Box (BJB) (3.0L)	Left front of engine compartment. See **Fig. 29**.

Circuit Breaker	In smart junction box (SJB). See **Fig. 1**.
Fusible Link A (2.3L)	Right side of engine. See **Fig. 30**.
Fusible Link A (3.0L)	Center front of engine compartment. See **Fig. 28**.
Fusible Link A (3.5L)	Top of engine. See **Fig. 35**.
Fusible Link B (2.3L)	Right side of engine. See **Fig. 30**.
Fusible Link B (3.0L)	Center front of engine compartment. See **Fig. 28**.
Fusible Link B (3.5L)	Top of engine. See **Fig. 35**.
PCM Power Diode	In battery junction box (BJB). See **Fig. 2**.
Smart Junction Box (SJB)	Base of left "A" pillar. See **Fig. 16**.

CONTROL UNITS

CONTROL UNITS LOCATION

Component	Location
ABS Control Module (2.3L)	Right front of engine compartment. See **Fig. 31**.
ABS Control Module (3.0L)	Right front of engine compartment. See **Fig. 29**.
ABS Control Module (3.5L)	Right front of engine compartment. See **Fig. 34**.
All Wheel Drive Control Module	Left kick panel. See **Fig. 16**.
Antenna Module (MKZ)	Right rear of trunk. See **Fig. 5**.
Blower Motor Speed Controller (Front)	Right side of dash. See **Fig. 20**.
Compass Module	Front center of roof. See **Fig. 3**.
Compass Module (W/ Moonroof)	In roof harness. See **Fig. 4**.
Digital Signal Processing (DSP) Module	Right rear of trunk compartment. See **Fig. 5**.
Driver's Door Module	Front of driver's door. See **Fig. 12**.
Dual Automatic Temperature Control (DATC) Module	Center of dash. See **Fig. 19**.
Electronic Automatic Temperature Control (EATC) Module	Center of dash. See **Fig. 19**.
Electronic Throttle Control (EATC) Module (3.5L)	Right side of engine. See **Fig. 32**.
Heated/Cooled Seat Module	Under seat bottom. See **Fig. 13**.
Heated Seat Module	Under seat bottom. See **Fig. 13**.
Intake Manifold Runner Control (IMRC) Module	Top of intake manifold. See **Fig. 27**.
Manual Climate Control Module	Center of dash. See **Fig. 19**.
Memory Module	Under driver's seat. See **Fig. 14**.
Passive Anti-Theft Transceiver Module	Left side of dash. See **Fig. 19**.
Powertrain Control Module (PCM) (2.3L)	Left rear of engine compartment. See **Fig. 30**.
Powertrain Control Module (PCM) (3.0L)	Left rear of engine compartment. See **Fig. 28**.
Powertrain Control Module (PCM) (3.5L)	Left rear of engine compartment. See **Fig. 34**.
Restraints Control Module (RCM)	Under center console. See **Fig. 17**.
Roof Opening Panel Module	In roof harness. See **Fig. 4**.
Side Air Curtain Module (Driver's) (Fusion)	Base of left "C" pillar. See **Fig. 7**.

Side Air Curtain Module (Driver's) (Milan)	Base of left "C" pillar. See **Fig. 6**.
Side Air Curtain Module (Driver's) (MKZ)	Base of left "C" pillar. See **Fig. 5**.
Side Air Curtain Module (Passenger's) (Fusion)	Base of right "C" pillar. See **Fig. 7**.
Side Air Curtain Module (Passenger's) (Milan)	Base of right "C" pillar. See **Fig. 6**.
Side Air Curtain Module (Passenger's) (MKZ)	Base of right "C" pillar. See **Fig. 5**.
Transaxle Control Module (AW21)	On transaxle. See **Fig. 46**.
Transmission Control Module (FNR5)	Under instrument panel, LH side. See **Fig. 47**.

MOTORS

MOTORS LOCATION

Component	Location
Blower Motor	Right side of dash. See **Fig. 20**.
Door Lock Actuator (Driver's)	In driver's door. See **Fig. 12**.
Door Lock Actuator (Left Rear)	In left rear door. See **Fig. 10**.
Door Lock Actuator (Right Front)	In right front door. See **Fig. 11**.
Door Lock Actuator (Right Rear)	In right rear door. See **Fig. 9**.
Electronic Throttle Control (ETC) Motor	Left rear of engine. See **Fig. 27**.
Engine Cooling Fan Motor (2.3L)	Left front of engine compartment. See **Fig. 30**.
Engine Cooling Fan Motor (3.0L)	Left front of engine compartment. See **Fig. 28**.
Engine Cooling Fan Motor (3.5L)	Front of engine compartment. See **Fig. 34**.
Fresh/Recirculation Door Actuator	Right side of dash. See **Fig. 20**.
Lumbar Motor (Driver Seat)	In driver's seat back. See **Fig. 14**.
Lumbar Motor (Front Passenger's Seat)	Right side of seat. See **Fig. 13**.
Mode Door Actuator	Center of dash. See **Fig. 20**.
PETA Pump Motor	Lower left side of engine block. See **Fig. 27**.
Power Seat Motor Assembly (Left)	Under seat bottom. See **Fig. 14**.
Power Seat Motor Assembly (Right)	Under seat bottom. See **Fig. 13**.
Power Window Motor (Left Front)	In driver's door. See **Fig. 12**.
Power Window Motor (Left Rear)	In left rear door. See **Fig. 10**.
Power Window Motor (Right Front)	In right front door. See **Fig. 11**.
Power Window Motor (Right Rear)	In right rear door. See **Fig. 9**.
Recliner Motor (Driver's Seat)	In seat back. See **Fig. 14**.
Recliner Motor (Front Passenger's Seat)	Right side of seat. See **Fig. 13**.
Starter Motor (2.3L)	Lower left side of engine block. See **Fig. 27**.
Starter Motor (3.0L)	Right rear of engine. See **Fig. 28**.
Starter Motor (3.5L)	Left side of engine compartment, near battery. See **Fig. 35**.
Temperature Blend Door Actuator (Driver)	Center of dash. See **Fig. 20**.
Temperature Blend Door Actuator (Passenger)	Right side of dash. See **Fig. 20**.
Windshield Washer Pump Motor (2.3L)	Behind right front headlight. See **Fig. 31**.

Windshield Washer Pump Motor (3.0L)	Right front of engine compartment. See **Fig. 29**.
Windshield Washer Pump Motor (3.5L)	Right front of engine compartment. See **Fig. 34**.
Windshield Wiper Motor (2.3L)	Left rear of engine compartment. See **Fig. 30**.
Windshield Wiper Motor (3.0L)	Left rear of engine compartment. See **Fig. 28**.
Windshield Wiper Motor (3.5L)	Left rear of engine compartment. See **Fig. 34**.

SENDING UNITS & SENSORS

SENDING UNITS & SENSORS LOCATION

Component	Location
Accelerator Pedal Position Sensor	Left side of dash. See **Fig. 16**.
A/C Pressure Transducer Sensor	Right front of engine. See **Fig. 31**.
A/C Pressure Transducer Sensor (3.0L)	Center rear of engine compartment. See **Fig. 29**.
A/C Pressure Transducer Sensor (3.5L)	Center rear of engine compartment. See **Fig. 34**.
Ambient Air Temperature Sensor (2.3L)	Right side of radiator support. See **Fig. 31**.
Ambient Air Temperature Sensor (3.0L)	Behind front grille. See **Fig. 29**.
Camshaft Position Sensor 1 (3.0L)	Right front of engine. See **Fig. 25**.
Camshaft Position Sensor 1 (3.5L)	Right front of engine. See **Fig. 32**.
Camshaft Position Sensor (2.3L)	Top of engine. See **Fig. 38**.
Camshaft Position Sensor 2 (3.0L)	Left front of engine. See **Fig. 25**.
Camshaft Position Sensor 2 (3.5L)	Rear of left cylinder head. See **Fig. 25**.
Crankshaft Position Sensor (2.3L)	Lower right front of engine block. See **Fig. 26**.
Crankshaft Position Sensor (3.0L)	Lower right front of engine block. See **Fig. 25**.
Crankshaft Position Sensor (3.5L)	Lower left rear of engine block. See **Fig. 32**.
Cylinder Head Temp Sensor	Front of left cyl. head. See **Fig. 40**.
Cylinder Identification Sensor (2.3L)	Top rear of engine. See **Fig. 27**.
Dual Knock Sensor (3.5L)	Top rear of engine.
Engine Coolant Temperature (ECT) Sensor (2.3L)	Right rear of engine. See **Fig. 26**.
Engine Coolant Temperature (ECT) Sensor (3.0L)	Left rear of engine. See **Fig. 24**.
Engine Coolant Temperature (ECT) Sensor (3.5L)	Front of engine. See **Fig. 33**.
Front Impact Severity Sensor (2.3L)	At front radiator support. See **Fig. 30**.
Front Impact Severity Sensor (3.0L)	At front radiator support. See **Fig. 28**.
Fuel Injector 1 (3.0L)	Top right of intake manifold. See **Fig. 25**.
Fuel Injector 2 (3.0L)	Top right of intake manifold. See **Fig. 25**.
Fuel Tank Pressure Transducer Sensor (Fusion)	In fuel tank assembly. See **Fig. 7**.
Fuel Tank Pressure Transducer Sensor (Milan)	In fuel tank assembly. See **Fig. 6**.
Fuel Tank Pressure Transducer Sensor (MKZ)	In fuel tank assembly. See **Fig. 5**.
Heated Oxygen Sensor (HO2S) #11 (2.3L)	In exhaust manifold. See **Fig. 27**.
Heated Oxygen Sensor (HO2S) #11 (3.0L)	In right exhaust manifold. See **Fig. 25**.
Heated Oxygen Sensor (HO2S) #11 (3.5L)	Right side exhaust manifold. See **Fig. 33**.
Heated Oxygen Sensor (HO2S) #12 (2.3L)	In exhaust manifold. See **Fig. 27**.

Heated Oxygen Sensor (HO2S) #12 (3.0L)	In right exhaust manifold. See **Fig. 25**.
Heated Oxygen Sensor (HO2S) #12 (3.5L)	In right exhaust manifold. See **Fig. 33**.
Heated Oxygen Sensor (HO2S) #13 (2.3L)	In exhaust system. See **Fig. 23**.
Heated Oxygen Sensor (HO2S) #21 (3.0L)	In left exhaust manifold. See **Fig. 24**.
Heated Oxygen Sensor (HO2S) #21 (3.5L)	In left exhaust manifold. See **Fig. 32**.
Heated Oxygen Sensor (HO2S) #22 (3.0L)	In exhaust system. See **Fig. 22**.
Heated Oxygen Sensor (HO2S) #22 (3.5L)	In exhaust system. See **Fig. 32**.
In-Vehicle Temperature Sensor	Left side of dash. See **Fig. 19**.
Knock Sensor (2.3L)	Front of engine. See **Fig. 26**.
Knock Sensor (3.0L)	Right side of engine. See **Fig. 25**.
Manifold Absolute Pressure (MAP) Sensor	Top rear of engine. See **Fig. 25**.
Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor (2.3L)	Left front of engine compartment. See **Fig. 31**.
Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor (3.0L)	Left front of engine compartment. See **Fig. 29**.
Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor (3.5L)	Left side of engine compartment, on air intake. See **Fig. 34**.
Occupant Classification Sensor (OCS)	In seat cushion. See **Fig. 13**.
Output Shaft Speed (OSS) Sensor	Rear of transmission. See **Fig. 23**.
Output Shaft Speed (OSS) Sensor	Top of transmission. See **Fig. 21**.
Rail Sensor (Left)	Lower left side of seat. See **Fig. 13**.
Rail Sensor (Right)	Right side of seat track. See **Fig. 13**.
Seat Track Position Sensor (Left)	Front of seat track. See **Fig. 14**.
Secondary Fuel Sender	Top of fuel tank. See **Fig. 15**.
Side Air Curtain Sensor (Left 2) (Fusion)	Base of left "C" pillar. See **Fig. 7**.
Side Air Curtain Sensor (Left 2) (Milan)	Base of left "C" pillar. See **Fig. 6**.
Side Air Curtain Sensor (Left 2) (MKZ)	Base of left "C" pillar. See **Fig. 5**.
Side Air Curtain Sensor (Right 2) (Fusion)	Base of right "C" pillar. See **Fig. 7**.
Side Air Curtain Sensor (Right 2) (Milan)	Base of right "C" pillar. See **Fig. 6**.
Side Air Curtain Sensor (Right 2) (MKZ)	Base of right "C" pillar. See **Fig. 5**.
Sunload Sensor	Right side of dash. See **Fig. 20**.
Temperature Manifold Absolute Pressure (TMAP) Sensor	Lower left side of engine block. See **Fig. 27**.
Transmission Range Sensor	Left side of dash. See **Fig. 23**.
Turbine Shaft Speed (TSS) Sensor	Left side of transmission. See **Fig. 23**.
Vehicle Speed Sensor (VSS)	Right side of transmission. See **Fig. 23**.
Wheel Speed Sensor (Left Front) (3.5L)	At left front hub assembly. See **Fig. 34**.
Wheel Speed Sensor (Left Rear) (Milan)	On left rear hub assembly. See **Fig. 6**.
Wheel Speed Sensor (Left Rear) (MKZ)	On left rear hub assembly. See **Fig. 5**.
Wheel Speed Sensor (Right Front) (3.5L)	At right front hub assembly. See **Fig. 34**.
Wheel Speed Sensor (Right Rear) (Fusion)	On right rear hub assembly. See **Fig. 7**.
Wheel Speed Sensor (Right Rear) (Milan)	Base of right "C" pillar. See **Fig. 6**.

Wheel Speed Sensor (Right Rear) (MKZ)	On right rear hub assembly. See **Fig. 5**.

SOLENOIDS & SOLENOID VALVES

SOLENOIDS & SOLENOID VALVES LOCATION

Component	**Location**
A/C Clutch Field Coil (2.3L)	Front of A/C compressor. See **Fig. 26**.
A/C Clutch Field Coil (3.0L)	Front of A/C compressor. See **Fig. 24**.
Active Torque Control Coupling Solenoid (Fusion)	Vehicle underbody, near fuel tank. See **Fig. 7**.
Active Torque Control Coupling Solenoid (Milan)	Vehicle underbody, near fuel tank. See **Fig. 6**.
Active Torque Control Coupling Solenoid (MKZ)	Vehicle underbody, near fuel tank. See **Fig. 5**.
EVAP Canister Vent Control Solenoid (Fusion)	Rear of vehicle chassis. See **Fig. 7**.
EVAP Canister Vent Control Solenoid (Milan)	Rear of vehicle chassis. See **Fig. 6**.
EVAP Canister Vent Control Solenoid (MKZ)	Rear of vehicle chassis. See **Fig. 5**.
Evaporative Emission (EVAP) Canister Purge Valve (2.3L)	Lower right strut tower. See **Fig. 30**.
Evaporative Emission (EVAP) Canister Purge Valve (3.0L)	Lower right strut tower. See **Fig. 28**.
Evaporative Emission EVAP Canister Purge Valve (3.5L)	Right rear of engine compartment. See **Fig. 34**.
Fuel Injector 1 (2.3L)	Top of intake manifold. See **Fig. 26**.
Fuel Injector 1 (3.0L)	Top right of intake manifold. See **Fig. 25**.
Fuel Injector 1 (3.5L)	Top right of intake manifold. See **Fig. 32**.
Fuel Injector 2 (2.3L)	Top of intake manifold. See **Fig. 26**.
Fuel Injector 2 (3.0L)	Top right of intake manifold. See **Fig. 25**.
Fuel Injector 2 (3.5L)	Top right of intake manifold. See **Fig. 32**.
Fuel Injector 3 (2.3L)	Top of intake manifold. See **Fig. 26**.
Fuel Injector 3 (3.0L)	Top right of intake manifold. See **Fig. 25**.
Fuel Injector 3 (3.5L)	Top right of intake manifold. See **Fig. 32**.
Fuel Injector 4 (2.3L)	Top of intake manifold. See **Fig. 26**.
Fuel Injector 4 (3.0L)	Top left of intake manifold. See **Fig. 24**.
Fuel Injector 4 (3.5L)	Top left of intake manifold. See **Fig. 32**.
Fuel Injector 5 (3.0L)	Left side of intake manifold. See **Fig. 24**.
Fuel Injector 5 (3.5L)	Left side of intake manifold. See **Fig. 32**.
Fuel Injector 6 (3.0L)	Left side of intake manifold. See **Fig. 24**.
Fuel Injector 6 (3.5L)	Left side of intake manifold. See **Fig. 32**.
Heated Positive Crankcase Ventilation (PCV) Fitting (3.5L)	Top right rear of engine. See **Fig. 33**.
Heated Positive Crankcase Ventilation (PCV) Valve (3.0L)	Top rear of right cylinder head. See **Fig. 25**.
PETA Solenoid	Top rear of engine. See **Fig. 27**.
Stepper Motor EGR Valve (2.3L)	Right rear of engine. See **Fig. 27**.

Stepper Motor EGR Valve (3.0L)	Top rear of engine. See **Fig. 25**.
Swirl Control Valve Solenoid (2.3L)	Top left of engine. See **Fig. 27**.
Variable Camshaft Timing (VCT) Valve	Top rear of engine. See **Fig. 27**.
Variable Camshaft Timing (VCT) Valve 1 (3.0L)	Top front of right valve cover. See **Fig. 25**.
Variable Camshaft Timing (VCT) Valve 1 (3.5L)	Top front of right valve cover. See **Fig. 32**.
Variable Camshaft Timing (VCT) Valve 2 (3.0L)	Top front of left valve cover. See **Fig. 25**.
Variable Camshaft Timing (VCT) Valve 2 (3.5L)	Top front of left valve cover. See **Fig. 32**.

SWITCHES

SWITCHES LOCATION

Component	Location
Anti-Theft Hood Switch	Left front radiator support. See **Fig. 31**.
Anti-Theft Hood Switch (3.0L)	Left front radiator support. See **Fig. 29**.
Anti-Theft Hood Switch (3.5L)	Left front of engine compartment. See **Fig. 34**.
Brake Fluid Level Switch (2.3L)	Left rear of engine compartment. See **Fig. 31**.
Brake Fluid Level Switch (3.0L)	Left rear of engine compartment. See **Fig. 29**.
Brake Fluid Level Switch (3.5L)	Left rear of engine compartment. See **Fig. 34**.
Brake Pedal Position Switch	Left side of dash. See **Fig. 16**.
Clutch Pedal Position (CPP) Switch	Left side of dash. See **Fig. 16**.
Clutch Pedal Speed Control Deactivator Switch	Left side of dash. See **Fig. 16**.
Decklid Release Solenoid/Ajar Switch (Fusion)	Center rear of trunk. See **Fig. 8**.
Decklid Release Solenoid/Ajar Switch (Milan)	Center rear of trunk. See **Fig. 6**.
Ignition Switch	Base of steering column. See **Fig. 19**.
Inertia Fuel Shutoff (IFS) Switch	Base of right "A" pillar. See **Fig. 15**.
Luggage Compartment Disarm Switch (Fusion)	Center rear of luggage compartment. See **Fig. 7**.
Luggage Compartment Disarm Switch (Milan)	Center rear of luggage compartment. See **Fig. 6**.
Multifunction Switch	Left side of dash. See **Fig. 19**.
Oil Pressure Switch (2.3L)	On oil filter housing. See **Fig. 27**.
Oil Pressure Switch (3.0L)	Left side of engine block. See **Fig. 24**.
Oil Pressure Switch (3.5L)	Left side of engine block. See **Fig. 32**.
Park Brake Switch	Under center console. See **Fig. 17**.
Power Steering Pressure Switch (2.3L)	Front of engine. See **Fig. 27**.
Power Steering Pressure Switch (3.0L)	Lower right front of engine. See **Fig. 25**.
Power Steering Pressure Switch (3.5L)	Right rear of engine compartment. See **Fig. 35**.
Reversing Lamps Switch	Top of transmission. See **Fig. 21**.
Safety Belt Buckle Switch (Driver)	Under right side of seat. See **Fig. 14**.
Safety Belt Buckle Switch (Passenger)	Lower left side of seat track. See **Fig. 13**.
Transmission Fluid Pressure Switch	Left side of transmission. See **Fig. 23**.

MISCELLANEOUS

MISCELLANEOUS LOCATION

Component	**Location**
A/C Clutch Field Coil (3.5L)	Left front of engine, on front of A/C compressor. See **Fig. 32**.
Air Bag Sliding Contact	Behind steering wheel assembly. See **Fig. 18**.
Amplifier (Left Side)	Base of left "C" pillar. See **Fig. 5**.
Amplifier (Right Side)	Base of right "C" pillar. See **Fig. 5**.
Antenna (Fusion)	Base of right "C" pillar. See **Fig. 7**.
Antenna (Milan)	Base of right "C" pillar. See **Fig. 6**.
Antenna (MKZ)	Base of right "C" pillar. See **Fig. 5**.
Audio Jack	In center console. See **Fig. 17**.
Audio Unit	Center of dash. See **Fig. 19**.
Blower Motor Resistor Assembly (Front)	Right side of dash. See **Fig. 20**.
Coil On Plug (COP) 1 (2.3L)	Top rear of left valve cover. See **Fig. 26**.
Coil On Plug (COP) 1 (3.0L)	Top front of right valve cover. See **Fig. 25**.
Coil On Plug (COP) 1 (3.5L)	Top front of right valve cover. See **Fig. 33**.
Coil On Plug (COP) 2 (2.3L)	Top rear of left valve cover. See **Fig. 26**.
Coil On Plug (COP) 2 (3.0L)	Top of right valve cover. See **Fig. 25**.
Coil On Plug (COP) 2 (3.5L)	Top rear of right cylinder head. See **Fig. 33**.
Coil On Plug (COP) 3 (2.3L)	Top rear of left valve cover. See **Fig. 26**.
Coil On Plug (COP) 3 (3.0L)	Top rear of right valve cover. See **Fig. 25**.
Coil On Plug (COP) 3 (3.5L)	Top rear of right valve cover. See **Fig. 33**.
Coil On Plug (COP) 4 (2.3L)	Top rear of left valve cover. See **Fig. 26**.
Coil On Plug (COP) 4 (3.0L)	Top of left valve cover. See **Fig. 24**.
Coil On Plug (COP) 4 (3.5L)	Top of left valve cover. See **Fig. 32**.
Coil On Plug (COP) 5 (3.0L)	Top of left valve cover. See **Fig. 24**.
Coil On Plug (COP) 5 (3.5L)	Top of left valve cover. See **Fig. 32**.
Coil On Plug (COP) 6 (3.0L)	Top rear of left valve cover. See **Fig. 24**.
Coil On Plug (COP) 6 (3.5L)	Top rear of left valve cover. See **Fig. 32**.
Data Link Connector (DLC)	Left side of dash. See **Fig. 19**.
Driver Safety Belt Retractor Pretensioner	Base of "B" pillar. See **Fig. 16**.
Electrochromatic Inside Mirror Unit	In roof harness. See **Fig. 3**.
Generator (2.3L)	Right front of engine. See **Fig. 26**.
Generator (3.0L)	Left front of engine. See **Fig. 24**.
Generator (3.5L)	Left front of engine. See **Fig. 32**.
Horn (2.3L)	Behind right front of headlight. See **Fig. 31**.
Horn (3.0L)	Right front of engine compartment. See **Fig. 29**.
Horn (3.5L)	Right side of engine compartment. See **Fig. 34**.
Ignition Transformer Capacitor 1 (3.5L)	Top rear of right cylinder head. See **Fig. 32**.
Ignition Transformer Capacitor (2.3L)	Top front of intake manifold. See **Fig. 26**.
Ignition Transformer Capacitor 2 (3.5L)	Top rear of left cylinder head. See **Fig. 32**.

Ignition Transformer Capacitor (3.0L)	Top front of intake manifold. See **Fig. 25**.
Passenger Safety Belt Retractor Pretensioner	Base of right "B" pillar. See **Fig. 15**.
Power Point	Under center console. See **Fig. 17**.
RKE Antenna	Left "A" pillar. See **Fig. 16**.
Satellite Radio Receiver	Right rear of trunk. See **Fig. 7**.
Satellite Radio Receiver (MKZ)	Right rear of trunk. See **Fig. 5**.
Seat Back Heater (Left Front)	In driver's seat back. See **Fig. 14**.
Seat Back Heater (Right Front)	Right side of front passenger's seat back. See **Fig. 13**.
Seat Cushion Heater (Right Front)	Right side of front passenger's seat bottom. See **Fig. 13**.
Seat Cushion Heater (Left Front)	In seat cushion. See **Fig. 14**.
Subwoofer Amplifier (Fusion)	Right side of luggage compartment. See **Fig. 7**.
Subwoofer Amplifier (Milan)	Right side of luggage compartment. See **Fig. 6**.
Switch Control Monitor (2.3L)	Left rear of engine block. See **Fig. 27**.
THX Amplifier (MKZ)	Right rear of trunk. See **Fig. 5**.

CONNECTORS

CONNECTORS LOCATION

Component	Location
C110 (3.5L) (Neutral, 2 Pin)	Rear of engine, near thermostat housing. See **Fig. 40**.
C133 (2.3L) (Black, 16 Pin)	Left front of engine compartment. See **Fig. 45**.
C133 (3.0L) (Black, 16 Pin)	Left front of engine compartment. See **Fig. 41**.
C133 (3.5L) (Black, 16 Pin)	Left front of engine compartment. See **Fig. 41**.
C134 (2.3L) (Black, 34 Pin)	Left front of engine compartment. See **Fig. 30**.
C134 (3.0L) (Black, 34 Pin)	Left front of engine compartment. See **Fig. 28**.
C139 (3.0L) (Neutral, 4 Pin)	Left side of engine compartment. See **Fig. 24**.
C140 (3.5L) (Neutral, 2 Pin)	Left front of engine compartment. See **Fig. 35**.
C144 (3.5L) (Neutral, 16 Pin)	Top of engine. See **Fig. 39**.
C145 (3.5L) (Neutral, 70 Pin)	Top of engine. See **Fig. 39**.
C210 (Gray, 4 Pin)	Right side of dash. See **Fig. 20**.
C211 (Blue, 16 Pin)	Right side of dash. See **Fig. 20**.
C212 (Gray, 2 Pin)	Right side of dash. See **Fig. 19**.
C213 (Blue, 16 Pin)	Right side of dash. See **Fig. 19**.
C214 (2.3L) (Gray, 2 Pin)	Left rear of engine compartment. See **Fig. 31**.
C214 (3.0L) (Gray, 2 Pin)	Left rear of engine compartment. See **Fig. 29**.
C214 (3.0L) (Gray, 2 Pin)	Left rear of engine compartment. See **Fig. 34**.
C219 (2.3L) (White, 57 Pin)	Left rear of engine compartment. See **Fig. 31**.
C219 (3.0L) (White, 57 Pin)	Left rear of engine compartment. See **Fig. 29**.
C219 (3.5L) (White, 57 Pin)	Left rear of engine compartment. See **Fig. 35**.

C237 (White, 57 Pin)	Base of right "A" pillar. See **Fig. 15**.
C238 (16 Pin)	Below dash panel.
C240 (Gray, 24 Pin)	Center of dash. See **Fig. 19**.
C311 (34 Pin)	Lower front of seat assembly. See **Fig. 13**.
C312 (White, 57 Pin)	Lower front of seat assembly. See **Fig. 13**.
C313 (Yellow, 2 Pin)	Under seat bottom. See **Fig. 13**.
C314 (Yellow, 2 Pin)	Under rear of seat bottom. See **Fig. 13**.
C315 (34 Pin)	In seat bottom. See **Fig. 14**.
C316 (White, 57 Pin)	Under seat bottom. See **Fig. 14**.
C327 (2 Pin)	Under drivers seat.
C328 (Yellow, 2 Pin)	Under seat bottom. See **Fig. 14**.
C339 (Gray, 4 Pin)	Behind lower seat back. See **Fig. 13**.
C340 (Gray, 10 Pin)	Under seat bottom. See **Fig. 14**.
C406 (40 Pin)	Right side of cargo area. See **Fig. 44**.
C408 (8 Pin)	Center of rear bumper. See **Fig. 42**.
C510 (White, 34 Pin)	Base of left "A" pillar. See **Fig. 16**.
C510 (White, 34 Pin)	Front of driver's door. See **Fig. 12**.
C610 (White, 34 Pin)	In right front door jamb. See **Fig. 11**.
C710 (Gray, 14 Pin)	Center of left "B" pillar. See **Fig. 10**.
C810 (Gray, 14 Pin)	At right rear door jamb. See **Fig. 9**.
C913 (W/ Moonroof) (Gray, 12 Pin)	Front of roof. See **Fig. 4**.
C913 (W/O Moonroof) (Gray, 12 Pin)	Right "A" pillar. See **Fig. 3**.
C919 (W/Moonroof) (Gray, 10 Pin)	Front of roof. See **Fig. 4**.
C919 (W/O Moonroof) (Gray, 10 Pin)	Right "A" pillar. See **Fig. 3**.
C3007 (Gray, 10 Pin)	Under rear of seat bottom. See **Fig. 13**.
C3047 (Black, 16 Pin)	Under center console. See **Fig. 37**.
C3049 (Gray, 4 Pin)	Under seat bottom. See **Fig. 14**.
C3050 (Fusion) (Neutral, 12 Pin)	Left side of vehicle rear end. See **Fig. 44**.
C3050 (Milan) (Neutral, 12 Pin)	Left side of vehicle rear end. See **Fig. 44**.
C3051	Bottom of left rear passenger compartment. See **Fig. 42**.
C3052	Under center console. See **Fig. 37**.
C3133	In rear of center console. See **Fig. 37**.
C3134	Under center console. See **Fig. 37**.

GROUNDS

GROUNDS LOCATION

Component	Location
G100 (2.3L)	Left front strut tower. See **Fig. 31**.
G100 (3.0L)	Left front strut tower. See **Fig. 29**.

G100 (3.5L)	Left side of engine compartment, near battery junction box (BJB). See **Fig. 35**.
G101 (2.3L)	Rear of engine. See **Fig. 31**.
G101 (3.0L)	In front of battery. See **Fig. 29**.
G101 (3.5L)	Under battery. See **Fig. 35**.
G102 (2.3L)	Left rear of engine compartment. See **Fig. 45**.
G102 (3.0L)	Left rear of engine compartment. See **Fig. 45**.
G102 (3.5L)	Left rear of engine compartment. See **Fig. 45**.
G103 (2.3L)	Left front of engine compartment. See **Fig. 31**.
G103 (3.0L)	Left front of engine compartment. See **Fig. 29**.
G103 (3.5L)	Left side of engine compartment. See **Fig. 35**.
G104 (2.3L)	In front of right strut tower. See **Fig. 31**.
G104 (3.0L)	Right front of engine compartment. See **Fig. 29**.
G104 (3.5L)	Right side of engine compartment. See **Fig. 34**.
G200	Center of dash. See **Fig. 19**.
G201	Center of dash. See **Fig. 19**.
G202	Left side of dash. See **Fig. 19**.
G203	Base of right "A" pillar. See **Fig. 15**.
G204	Behind air bag, in steering wheel. See **Fig. 18**.
G300	Center of left floor pan. See **Fig. 16**.
G301	On right floor support pillar. See **Fig. 15**.
G400 (Fusion)	Center rear of trunk compartment. See **Fig. 42**.
G400 (MKZ)	Center rear of trunk compartment. See **Fig. 42**.
G401	Center of rear floor pan. See **Fig. 15**.
G402 (Fusion)	Base of right "C" pillar. See **Fig. 41**.
G402 (Milan)	Base of right "C" pillar. See **Fig. 41**.
G402 (MKZ)	Base of right "C" pillar. See **Fig. 41**.
G405	Left side of rear window. See **Fig. 43**.

SPLICES

SPLICES LOCATION

Component	Location
S100 (2.3L)	In starter motor relay and battery ground harness, near breakout to generator. See **Fig. 44**.
S100 (3.0L)	In starter motor relay and battery ground harness, near breakout to generator. See **Fig. 44**.
S101 (2.3L)	In starter motor relay and battery ground harness, near breakout to generator. See **Fig. 30**.
S101 (3.0L)	In starter motor relay and battery ground harness, near breakout to generator. See **Fig. 28**.
	In engine control sensor and fuel charge harness,

S102 (2.3L)	near breakout to powertrain control module. See **Fig. 26**.
S102 (3.0L)	In engine control sensor and fuel charge harness, near breakout to stepper motor EGR valve. See **Fig. 25**.
S102 (3.5L)	In dash panel to headlamp junction harness, near breakout to powertrain control module. See **Fig. 35**.
S103 (3.0L)	In engine control sensor and fuel charge harness, near breakout to powertrain control module. See **Fig. 25**.
S103 (3.5L)	In dash panel to headlamp junction harness, near breakout to powertrain control module. See **Fig. 35**.
S104 (3.5L)	In dash panel to headlamp junction harness, near breakout to C145. See **Fig. 35**.
S105	In engine control sensor and fuel charge harness, near breakout to heated oxygen sensor (HO2S) #22. See **Fig. 24**.
S106	In engine control sensor and fuel charge harness, near breakout to heated oxygen sensor (HO2S) #22. See **Fig. 24**.
S107 (2.3L)	In engine control sensor and fuel charge harness, near breakout to IMRC module. See **Fig. 38**.
S108 (2.3L)	In engine control sensor and fuel charge harness, near breakout to ETC module. See **Fig. 26**.
S108 (3.0L)	In engine control sensor and fuel charge harness, near breakout to fuel injector 1. See **Fig. 24**.
S109 (2.3L)	In engine control sensor and fuel charge harness, near breakout to IMTV. See **Fig. 38**.
S109 (3.0L)	In engine control sensor and fuel charge harness, near breakout to ETC module. See **Fig. 24**.
S110	In engine control sensor and fuel charge harness, near breakout to OSS sensor. See **Fig. 21**.
S111	In engine control sensor and fuel charge harness, near breakout to PETA solenoid. See **Fig. 38**.
S112	In engine control sensor and fuel charge harness, near breakout to transmission fluid pressure switch. See **Fig. 38**.
S113	In engine control sensor and fuel charge harness, near breakout to cylinder identification sensor. See **Fig. 38**.
S114	In engine control sensor and fuel charge harness, near breakout to C134. See **Fig. 23**.
S115 (2.3L)	In engine control sensor and fuel charge harness, near breakout to crankshaft position sensor. See **Fig. 26**.

S115 (3.0L)	In engine control sensor and fuel charge harness, near breakout to crankshaft position sensor. See **Fig. 40**.
S115 (3.5L)	In engine control sensor and fuel charge harness, near breakout to C145. See **Fig. 33**.
S116 (3.5L)	In dash panel to headlamp junction harness, near breakout to C145. See **Fig. 35**.
S117 (3.5L)	In dash panel to headlamp junction harness, near breakout to C145. See **Fig. 35**.
S118	In dash panel to headlamp junction harness, near breakout to powertrain control module. See **Fig. 35**.
S119 (2.3L)	In dash panel to headlamp junction harness, near breakout to battery junction box. See **Fig. 31**.
S119 (3.5L)	In dash panel to headlamp junction harness, near breakout to powertrain control module. See **Fig. 35**.
S120 (2.3L)	In dash panel to headlamp junction harness, near engine bulkhead grommet. See **Fig. 31**.
S120 (3.0L)	In dash panel to headlamp junction harness, near engine bulkhead grommet. See **Fig. 29**.
S121 (2.3L)	In dash panel to headlamp junction harness, near engine bulkhead grommet. See **Fig. 31**.
S121 (3.0L)	In dash panel to headlamp junction harness, near engine bulkhead grommet. See **Fig. 29**.
S121 (3.5)	In dash panel to headlamp junction harness, near breakout to powertrain control module. See **Fig. 35**.
S122 (2.3L)	In dash panel to headlamp junction harness, near engine bulkhead grommet. See **Fig. 31**.
S122 (3.0L)	In dash panel to headlamp junction harness, near engine bulkhead grommet. See **Fig. 29**.
S123 (2.3L)	In dash panel to headlamp junction harness, near breakout to powertrain control module (PCM). See **Fig. 31**.
S123 (3.0L)	In dash panel to headlamp junction harness, near breakout to powertrain control module (PCM). See **Fig. 29**.
S124 (2.3L)	In dash panel to headlamp junction harness, near breakout to powertrain control module (PCM). See **Fig. 31**.
S124 (3.0L)	In dash panel to headlamp junction harness, near breakout to powertrain control module (PCM). See **Fig. 29**.
S124 (3.5L)	In dash panel to headlamp junction harness, near breakout to anti-theft hood switch. See **Fig. 35**.
S125 (2.3L)	In dash panel to headlamp junction harness, near breakout to G102. See **Fig. 31**.

S125 (3.0L)	In dash panel to headlamp junction harness, near breakout to G102.
S125 (3.5L)	In dash panel to headlamp junction harness, near breakout to powertrain control module. See **Fig. 35**.
S126 (2.3L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 31**.
S126 (3.0L)	In dash panel to headlamp junction harness, near breakout to powertrain control module (PCM). See **Fig. 29**.
S126 (3.5L)	In dash panel to headlamp junction harness, near breakout to powertrain control module. See **Fig. 35**.
S127 (3.0L)	In dash panel to headlamp junction harness, near breakout to powertrain control module (PCM). See **Fig. 29**.
S128 (2.3L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 31**.
S128 (3.0L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 29**.
S128 (3.5L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 35**.
S129 (2.3L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 30**.
S129 (3.0L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 45**.
S130 (2.3L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 45**.
S130 (3.0L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 45**.
S130 (3.5L)	In dash panel to headlamp junction harness, near breakout to powertrain control module. See **Fig. 45**.
S131 (2.3L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 45**.
S131 (3.0L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 45**.
S131 (3.5L)	In dash panel to headlamp junction harness, near breakout to engine cooling fan motor. See **Fig. 45**.
S132 (2.3L)	In dash panel to headlamp junction harness, near breakout to G103. See **Fig. 45**.
S132 (3.0L)	In dash panel to headlamp junction harness, near breakout to G103. See **Fig. 45**.
S133 (2.3L)	In dash panel to headlamp junction harness, near breakout to battery junction box. See **Fig. 45**.
S133 (3.0L)	In dash panel to headlamp junction harness, near breakout to G103. See **Fig. 45**.

S133 (3.5L)	In dash panel to headlamp junction harness, near breakout to powertrain control module. See **Fig. 45**.
S134 (2.3L)	In dash panel to headlamp junction harness, near breakout to anti-theft hood switch. See **Fig. 45**.
S134 (3.0L)	In dash panel to headlamp junction harness, near breakout to anti-theft hood switch. See **Fig. 45**.
S134 (3.5L)	In dash panel to headlamp junction harness, near breakout to anti-theft hood switch. See **Fig. 45**.
S135 (2.3L)	In dash panel to headlamp junction harness, near breakout to anti-theft hood switch. See **Fig. 45**.
S135 (3.0L)	In dash panel to headlamp junction harness, near breakout to anti-theft hood switch. See **Fig. 45**.
S135 (3.5L)	In dash panel to headlamp junction harness, near breakout to engine cooling fan motor. See **Fig. 45**.
S136 (2.3L)	In dash panel to headlamp junction harness, near breakout to front impact severity sensor. See **Fig. 31**.
S136 (3.0L)	In dash panel to headlamp junction harness, near breakout to front impact severity sensor. See **Fig. 29**.
S136 (3.5L)	In dash panel to headlamp junction harness, near breakout to left headlight. See **Fig. 35**.
S137 (2.3L)	In dash panel to headlamp junction harness, near breakout to front impact severity sensor. See **Fig. 45**.
S137 (3.0L)	In dash panel to headlamp junction harness, near breakout to front impact severity sensor. See **Fig. 45**.
S137 (3.5L)	In dash panel to headlamp junction harness, near breakout to ABS control module. See **Fig. 45**.
S138 (2.3L)	In dash panel to headlamp junction harness, near breakout to front impact severity sensor. See **Fig. 45**.
S138 (3.0L)	In dash panel to headlamp junction harness, near breakout to front impact severity sensor. See **Fig. 45**.
S138 (3.5L)	In dash panel to headlamp junction harness, near breakout to ambient air temperature sensor. See **Fig. 45**.
S139 (2.3L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 45**.
S139 (3.0L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 45**.
S140 (2.3L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 45**.

S140 (3.0L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 45**.
S141 (2.3L)	In dash panel to headlamp junction harness, near breakout to G103. See **Fig. 45**.
S141 (3.0L)	In dash panel to headlamp junction harness, near breakout to G103. See **Fig. 45**.
S142 (2.3L)	In dash panel to headlamp junction harness, near breakout to battery junction box. See **Fig. 45**.
S142 (3.5L)	In dash panel to headlamp junction harness, near breakout to engine cooling fan motor. See **Fig. 45**.
S143 (2.3L)	In dash panel to headlamp junction harness, near breakout to battery junction box. See **Fig. 45**.
S143 (3.0L)	In dash panel to headlamp junction harness, near breakout to battery junction box. See **Fig. 45**.
S143 (3.5L)	In dash panel to headlamp junction harness, near breakout to battery junction box (BJB). See **Fig. 45**.
S144 (2.3L)	In dash panel to headlamp junction harness, near breakout to G103. See **Fig. 45**.
S144 (3.0L)	In dash panel to headlamp junction harness, near breakout to G103. See **Fig. 45**.
S144 (3.5L)	In dash panel to headlamp junction harness, near breakout to G103. See **Fig. 45**.
S145 (3.5L)	In dash panel to headlamp junction harness, near breakout to C144. See **Fig. 35**.
S149 (3.0L)	In engine control sensor and fuel sensor harness, near breakout to heated oxygen sensor (HO2S) #22. See **Fig. 24**.
S153 (3.5L)	In engine control sensor and fuel charge harness, near breakout to C144. See **Fig. 40**.
S154 (3.5L)	In engine control sensor and fuel charge harness, near breakout to camshaft position sensor 1. See **Fig. 32**.
S155 (3.5L)	In engine control sensor and fuel charge harness, near breakout to C144. See **Fig. 40**.
S156 (3.5L)	In engine control sensor and fuel charge harness, near breakout to camshaft position sensor 1. See **Fig. 32**.
S157 (3.5L)	In engine control sensor and fuel charge harness, near breakout to ignition transformer capacitor 2. See **Fig. 39**.
S158 (3.5L)	In engine control sensor and fuel charge harness, near breakout to fuel injector 3. See **Fig. 39**.
S159 (3.5L)	In engine control sensor and fuel charge harness, near breakout to C144. See **Fig. 40**.
	In engine control sensor and fuel charge harness,

S160 (3.5L)	near breakout to fuel injector 3. See **Fig. 39**.
S200	In steering wheel jumper harness, near breakout to right steering wheel switch.
S201	In steering wheel jumper harness, near breakout to right steering wheel switch.
S202	In steering wheel jumper harness, near breakout to left steering wheel switch. See **Fig. 18**.
S203	In steering wheel jumper harness, near breakout to left steering wheel switch. See **Fig. 18**.
S204	In A/C jumper, near breakout to air conditioner evaporative thermistor. See **Fig. 20**.
S205	In A/C jumper, near breakout to C298. See **Fig. 20**.
S206	In A/C jumper, near breakout to air conditioner evaporative thermistor. See **Fig. 20**.
S210 (2.3L)	In dash panel to headlamp junction harness, near breakout to smart junction box (SJB). See **Fig. 31**.
S210 (3.0L)	In dash panel to headlamp junction harness, near breakout to smart junction box (SJB). See **Fig. 29**.
S220	In main harness, near breakout to C212. See **Fig. 19**.
S221	In main harness, near breakout to C212. See **Fig. 19**.
S222	In main harness, near breakout to clock. See **Fig. 20**.
S223	In main harness, near breakout to clock. See **Fig. 20**.
S224	In main harness, near breakout to G200. See **Fig. 19**.
S225	In main harness, near breakout to clock. See **Fig. 20**.
S226	In main harness, near breakout to data link connector. See **Fig. 20**.
S227	In main harness, near breakout to data link connector. See **Fig. 20**.
S228	In main harness, near breakout to data link connector. See **Fig. 19**.
S229	In main harness, near breakout to G201. See **Fig. 19**.
S230	In main harness, near breakout to smart junction box (SJB). See **Fig. 20**.
S231	In main harness, near breakout to main light switch. See **Fig. 19**.
S232	In main harness, near breakout to smart junction box (SJB). See **Fig. 19**.
S233	In main harness, near breakout to G201. See **Fig. 19**.
S240	In body main harness, near breakout to C237. See **Fig. 15**.
	In body main harness, near breakout to C237. See

S241	**Fig. 15**.
S242	In body main harness, near breakout to C237. See **Fig. 15**.
S300	In power seat motor assembly harness, near breakout to C313. See **Fig. 13**.
S301	In power seat motor assembly harness, near breakout to OCSM module. See **Fig. 13**.
S302	In power seat motor assembly harness, near breakout to OCSM module. See **Fig. 13**.
S303	In power seat motor assembly harness, near breakout to C313. See **Fig. 13**.
S304	In power seats harness, near breakout to C339. See **Fig. 14**.
S305	In power seats harness, near breakout to C339. See **Fig. 14**.
S306	In power seats harness, near breakout to C339. See **Fig. 14**.
S309	In power seats harness, near breakout to C339. See **Fig. 14**.
S310	In power seats harness, near breakout to C339. See **Fig. 14**.
S318	Behind left kick panel. See **Fig. 16**.
S320	In power seats harness, near breakout to Smart Junction Box (SJB). See **Fig. 15**.
S321	In power seats harness, near breakout to Smart Junction Box (SJB). See **Fig. 16**.
S322	In power seats harness, near breakout to Smart Junction Box (SJB). See **Fig. 16**.
S323	In power seats harness, near breakout to Smart Junction Box (SJB). See **Fig. 16**.
S324	In power seats harness, near breakout to Smart Junction Box (SJB). See **Fig. 16**.
S325	In power seats harness, near breakout to Smart Junction Box (SJB). See **Fig. 15**.
S326	In body main harness, near breakout to C510. See **Fig. 16**.
S327	In body main harness, near breakout to C510. See **Fig. 16**.
S328	In body main harness, near breakout to G300. See **Fig. 16**.
S329	In body main harness, near breakout to G300. See **Fig. 15**.
S330	In body main harness, near breakout to power point. See **Fig. 15**.

S331	In body main harness, near breakout to power point. See **Fig. 15**.
S332	In body main harness, near breakout to power point. See **Fig. 15**.
S333	In body main harness, near breakout to C312. See **Fig. 15**.
S334	In body main harness, near breakout to G301. See **Fig. 15**.
S335	In body main harness, near breakout to antenna module. See **Fig. 41**.
S336	In body main harness, near breakout to left reversing lamp. See **Fig. 42**.
S337	In body main harness, near breakout to left reversing lamp. See **Fig. 41**.
S338	In body main harness, near breakout to smart junction box (SJB). See **Fig. 15**.
S339	In body main harness, near breakout to smart junction box (SJB). See **Fig. 15**.
S340	In body main harness, near breakout to park brake switch. See **Fig. 37**.
S341	In body main harness, near breakout to C510. See **Fig. 16**.
S342	In body main harness, near breakout to smart junction box (SJB). See **Fig. 16**.
S343	In body main harness, near breakout to smart junction box (SJB). See **Fig. 15**.
S344	In body main harness, near breakout to G300. See **Fig. 16**.
S345	In body main harness, near breakout to G301. See **Fig. 15**.
S346	In body main harness, near breakout to G301. See **Fig. 15**.
S347	In body main harness, near breakout to smart junction box (SJB). See **Fig. 16**.
S348	In body main harness, near breakout to G300. See **Fig. 16**.
S350	In body main harness, at breakout to 4x4 control module. See **Fig. 16**.
S351	In body main harness, at breakout to 4x4 control module. See **Fig. 16**.
S352	In body main harness, at breakout to C510.
S353	In body main harness, at breakout to C510.
S355	In bottom of center console. See **Fig. 37**.
S360	In ambient lighting main harness, near breakout to

	C3134. See **Fig. 37**.
S362	In ambient lighting main harness, near breakout to C3134. See **Fig. 37**.
S363	In ambient lighting main harness, near breakout to C3134.
S364	Near ambient lighting module. See **Fig. 37**.
S365	Near ambient lighting module. See **Fig. 37**.
S366	Near ambient lighting module. See **Fig. 37**.
S367	Near ambient lighting module. See **Fig. 37**.
S368	Near ambient lighting module. See **Fig. 37**.
S369	Near ambient lighting module. See **Fig. 37**.
S400	In license jumper harness, in breakout to C405. See **Fig. 8**.
S401	In license jumper harness, in breakout to C405. See **Fig. 8**.
S402	In radio speaker harness, near breakout to amplifier. See **Fig. 41**.
S403	In radio speaker harness, near breakout to amplifier. See **Fig. 41**.
S404	In radio speaker harness, near breakout to digital signal processing (DSP) module. See **Fig. 5**.
S405	In radio speaker harness, near breakout to digital signal processing (DSP) module. See **Fig. 5**.
S406	Near left rear wheel speed sensor.
S407	Near left rear wheel speed sensor.
S409	Near left turn signal. See **Fig. 44**.
S410	Near drivers safety belt retractor. See **Fig. 42**.
S410 (Fusion)	In body main harness, near breakout to left rear turn lamp. See **Fig. 42**.
S410 (Milan)	In body main harness, near breakout to left rear turn lamp. See **Fig. 42**.
S410 (MKZ)	In body main harness, near breakout to left rear turn lamp. See **Fig. 42**.
S411	In body main harness, near breakout to G400. See **Fig. 42**.
S412 (Fusion)	In body main harness, near breakout to left rear turn signal. See **Fig. 7**.
S412 (Milan)	In body main harness, near breakout to left rear turn signal. See **Fig. 6**.
S413	In body main harness, near breakout to digital signal processing (DSP) module. See **Fig. 5**.
S414	In body main harness, near breakout to digital signal processing (DSP) module. See **Fig. 5**.

S415	In body main harness, near breakout to fuel tank unit. See **Fig. 15**.
S416	In body main harness, near breakout to left rear turn signal lamp. See **Fig. 44**.
S416 (Fusion)	In body main harness, near breakout to left rear turn signal lamp. See **Fig. 44**.
S420	Wiring harness jumper to C408. See **Fig. 41**.
S421	In wiring harness jumper, near breakout to C408. See **Fig. 43**.
S422	In wiring harness jumper, near breakout to C408.
S423	Behind center of rear bumper.
S430	In body main harness, near breakout to SDARS module.
S430 (Fusion)	In body main harness, near breakout to satellite radio receiver. See **Fig. 41**.
S430 (Milan)	In body main harness, near breakout to satellite radio receiver. See **Fig. 41**.
S430 (MKZ)	In body main harness, near breakout to satellite radio receiver. See **Fig. 41**.
S431 (Fusion)	In body main harness, near breakout to satellite radio receiver. See **Fig. 41**.
S431 (Milan)	In body main harness, near breakout to satellite radio receiver. See **Fig. 41**.
S431 (MKZ)	In body main harness, near breakout to satellite radio receiver. See **Fig. 41**.
S500	In window regulator harness. See **Fig. 12**.
S501	In window regulator harness. See **Fig. 12**.
S502	At driver's door lock switch.
S503	In window regulator harness, near breakout to master window adjust switch. See **Fig. 12**.
S503	In window regulator harness, near breakout to master window adjust switch. See **Fig. 12**.
S504	In window regulator harness, near breakout to driver door module. See **Fig. 12**.
S505	In window regulator harness, near breakout to driver door module. See **Fig. 12**.
S601	In window regulator harness, near breakout to right front speaker. See **Fig. 11**.
S602	In window regulator harness, near breakout to passenger side window adjust switch. See **Fig. 11**.
S603	In window regulator harness, near breakout to passenger side window adjust switch. See **Fig. 11**.
S604	In window regulator harness, near breakout to passenger side door lock switch. See **Fig. 11**.

S605	In window regulator harness, near breakout to passenger side door lock switch. See **Fig. 11**.
S900	In interior lamp feed harness, near breakout to C901. See **Fig. 4**.
S901 (W/ Moonroof)	In interior lamp feed harness, near breakout to C906. See **Fig. 4**.
S901 (W/O Moonroof)	In interior lamp feed harness, near breakout to C906. See **Fig. 3**.
S902 (W/ Moonroof)	In interior lamp feed harness, near breakout to C906. See **Fig. 4**.
S902 (W/O Moonroof)	In interior lamp feed harness, near breakout to C906. See **Fig. 3**.
S903 (W/ Moonroof)	In interior lamp feed harness, near breakout to C906. See **Fig. 4**.
S903 (W/O Moonroof)	In interior lamp feed harness, near breakout to C906. See **Fig. 3**.

COMPONENT LOCATION GRAPHICS

NOTE: **Figures may show multiple component locations. Refer to appropriate table for proper figure references.**

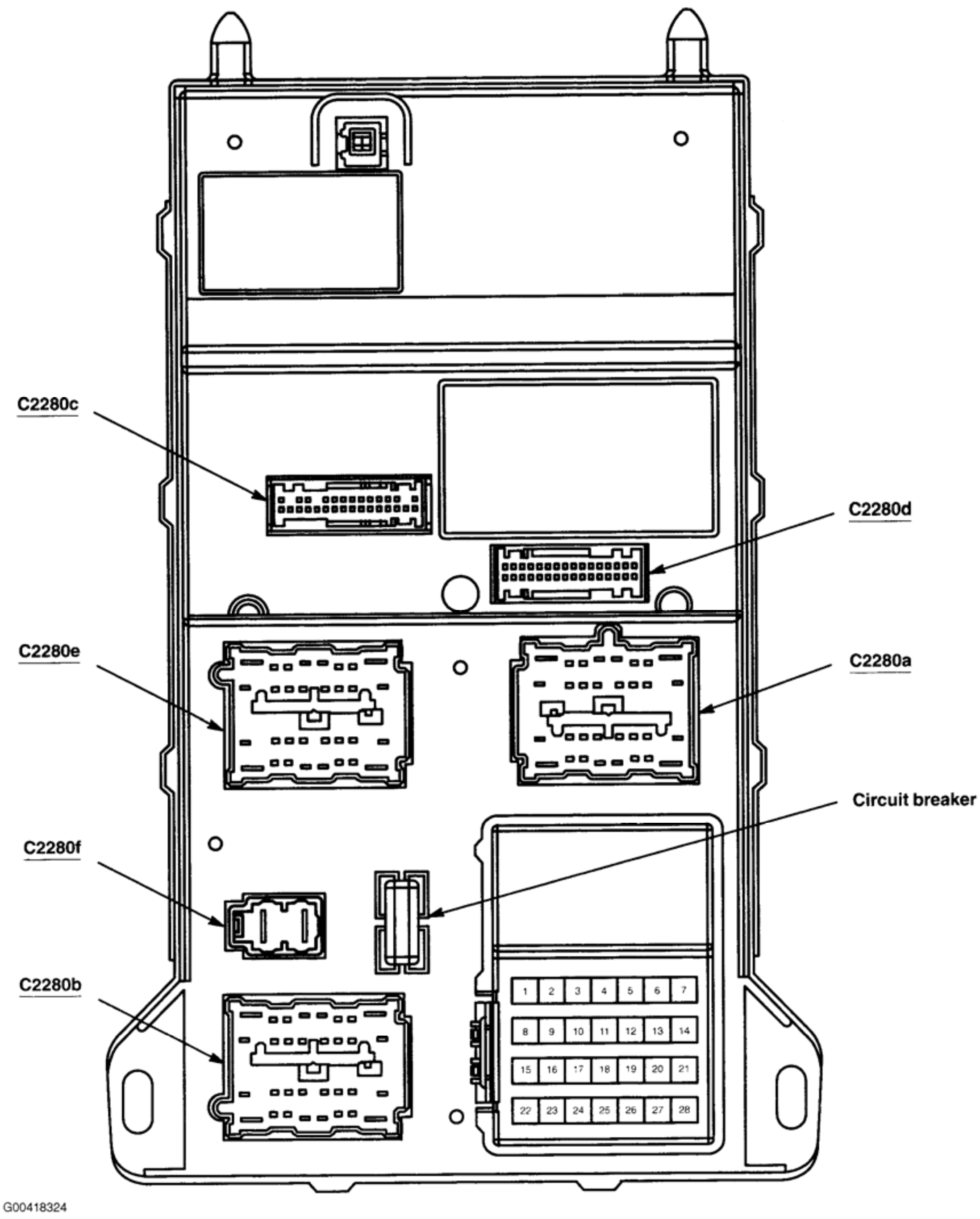


Fig. 1: Smart Junction Box (SJB)
Courtesy of FORD MOTOR CO.

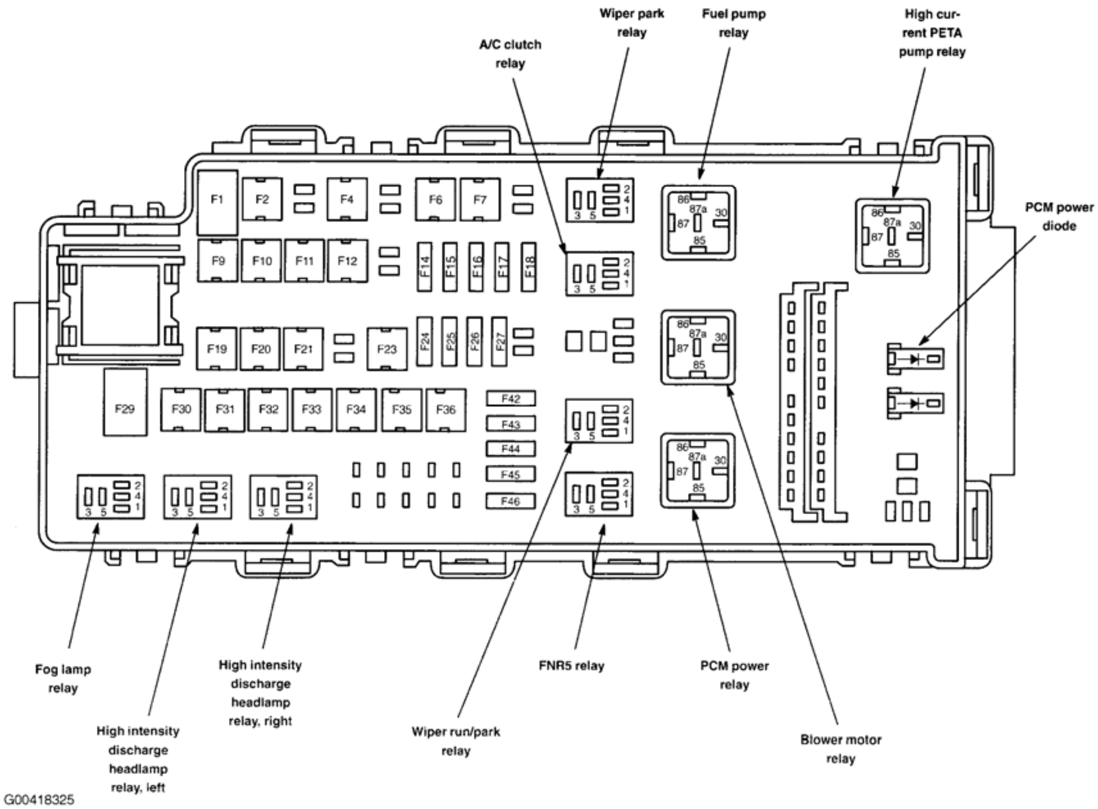


Fig. 2: Battery Junction Box (BJB) (Early Production)
Courtesy of FORD MOTOR CO.

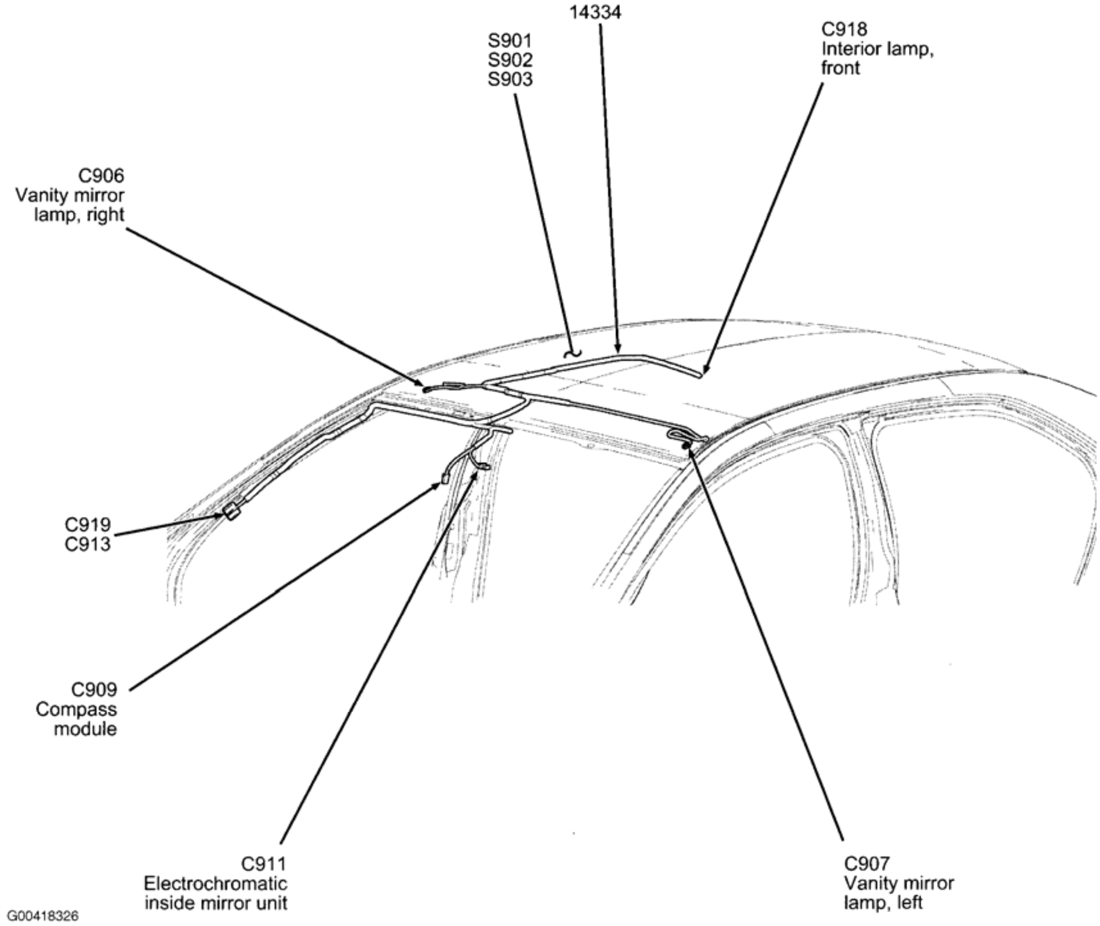


Fig. 3: Roof (W/O Moonroof)
Courtesy of FORD MOTOR CO.

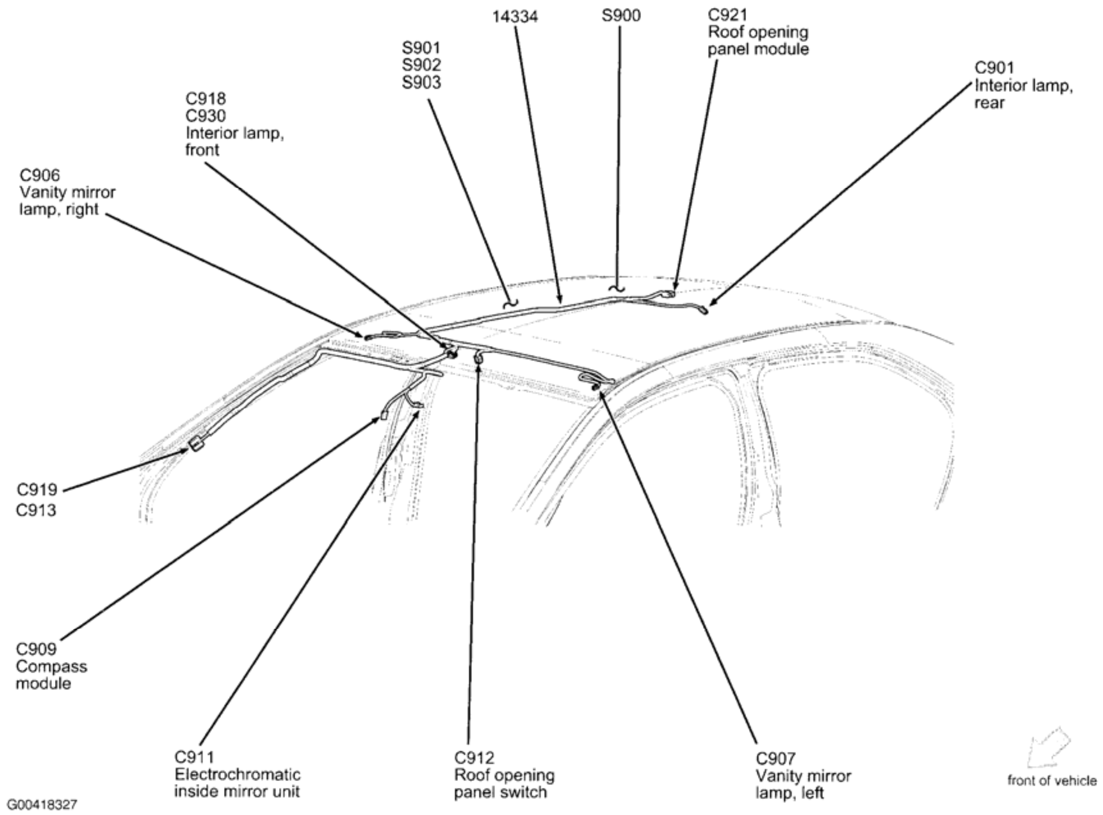


Fig. 4: Roof (W/ Moonroof)
Courtesy of FORD MOTOR CO.

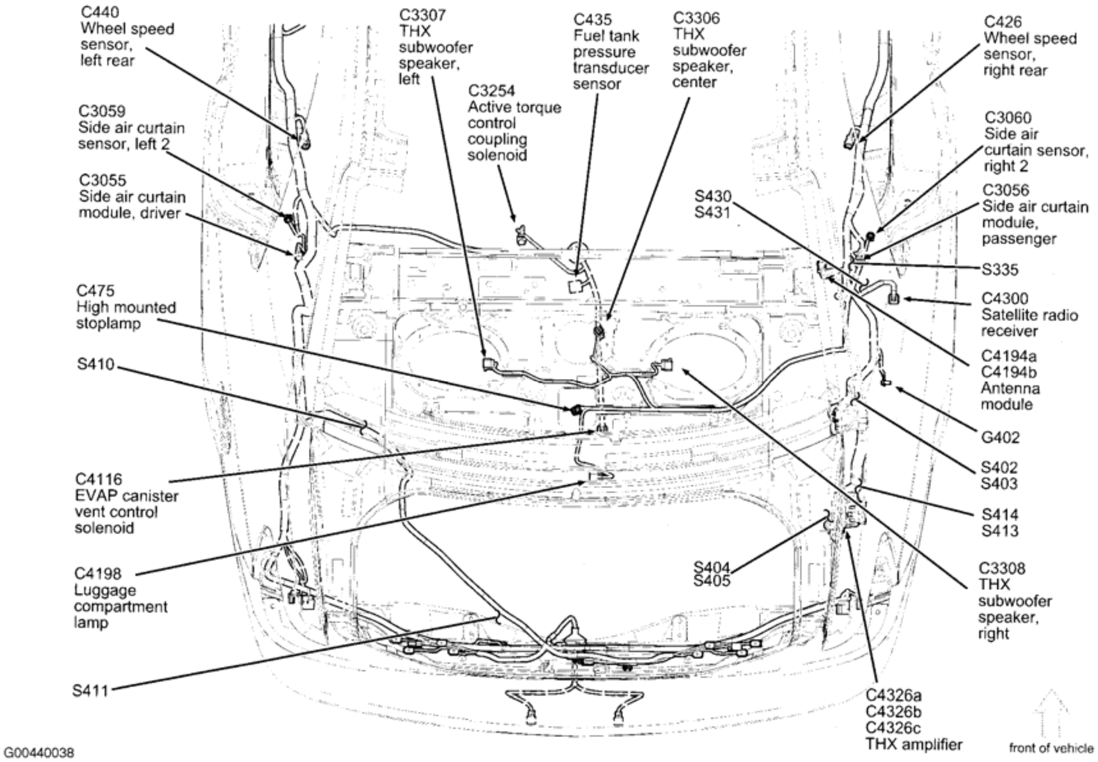


Fig. 5: Trunk (MKZ)
Courtesy of FORD MOTOR CO.

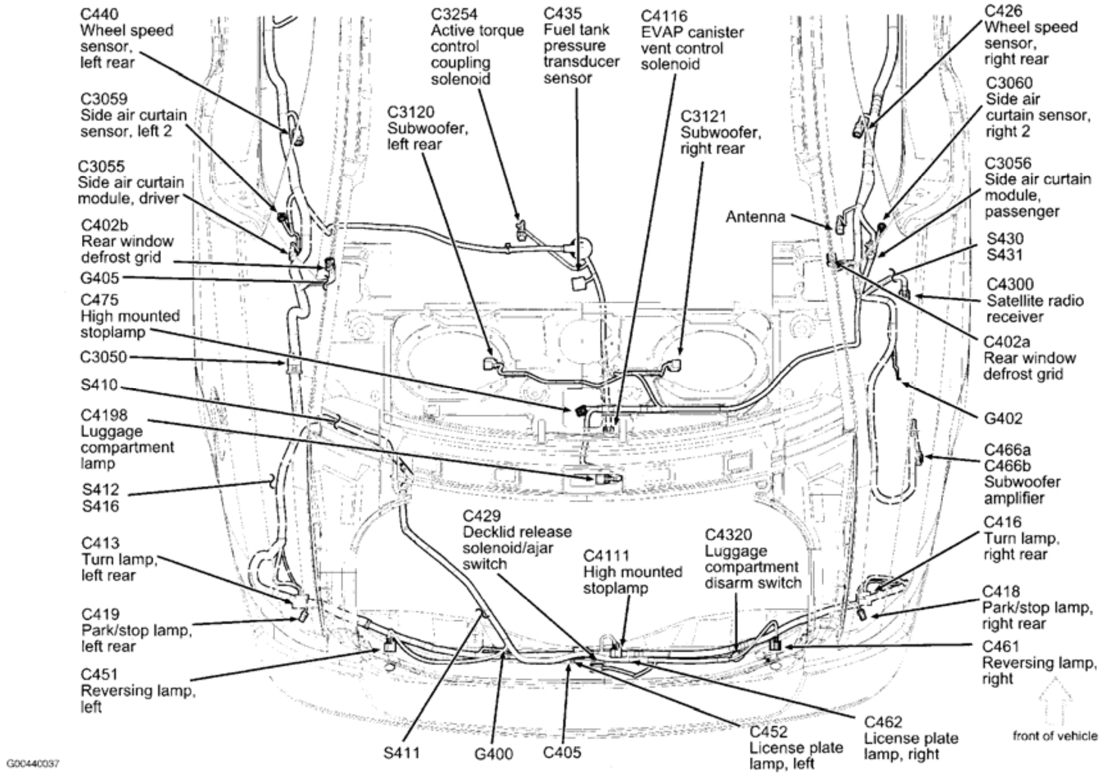


Fig. 6: Trunk (Milan)
Courtesy of FORD MOTOR CO.

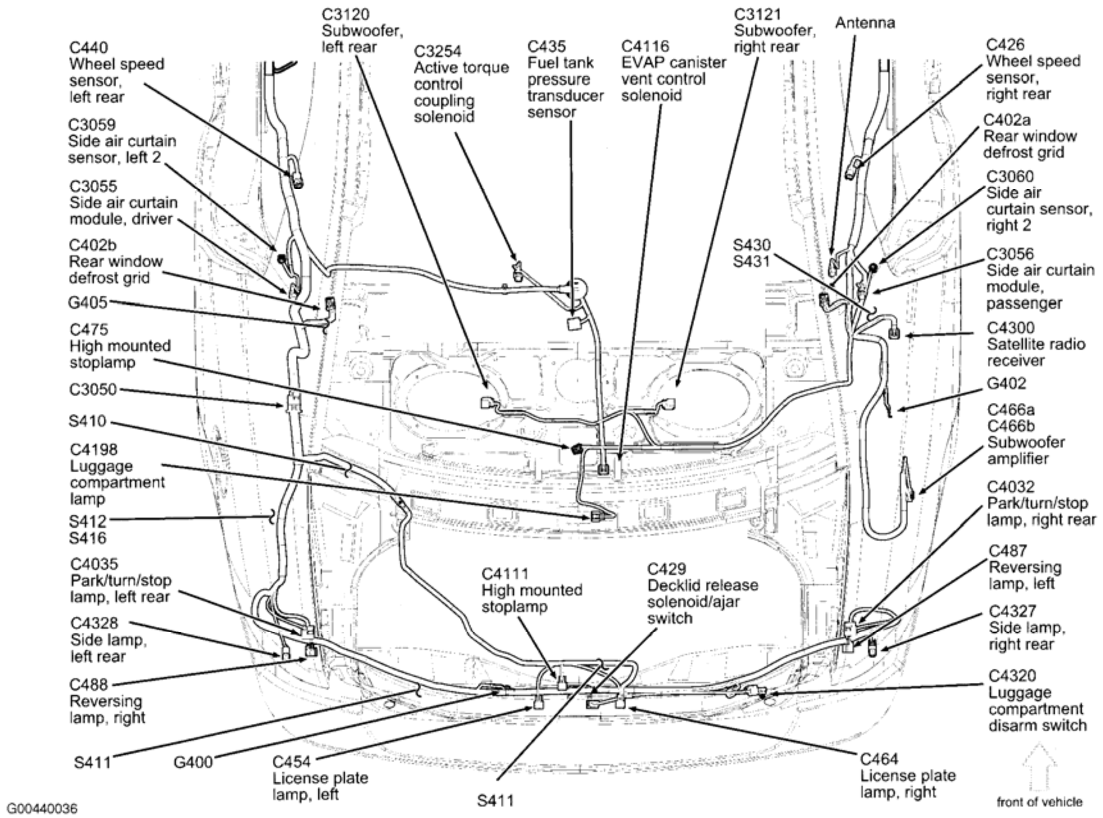


Fig. 7: Trunk (Fusion)
Courtesy of FORD MOTOR CO.

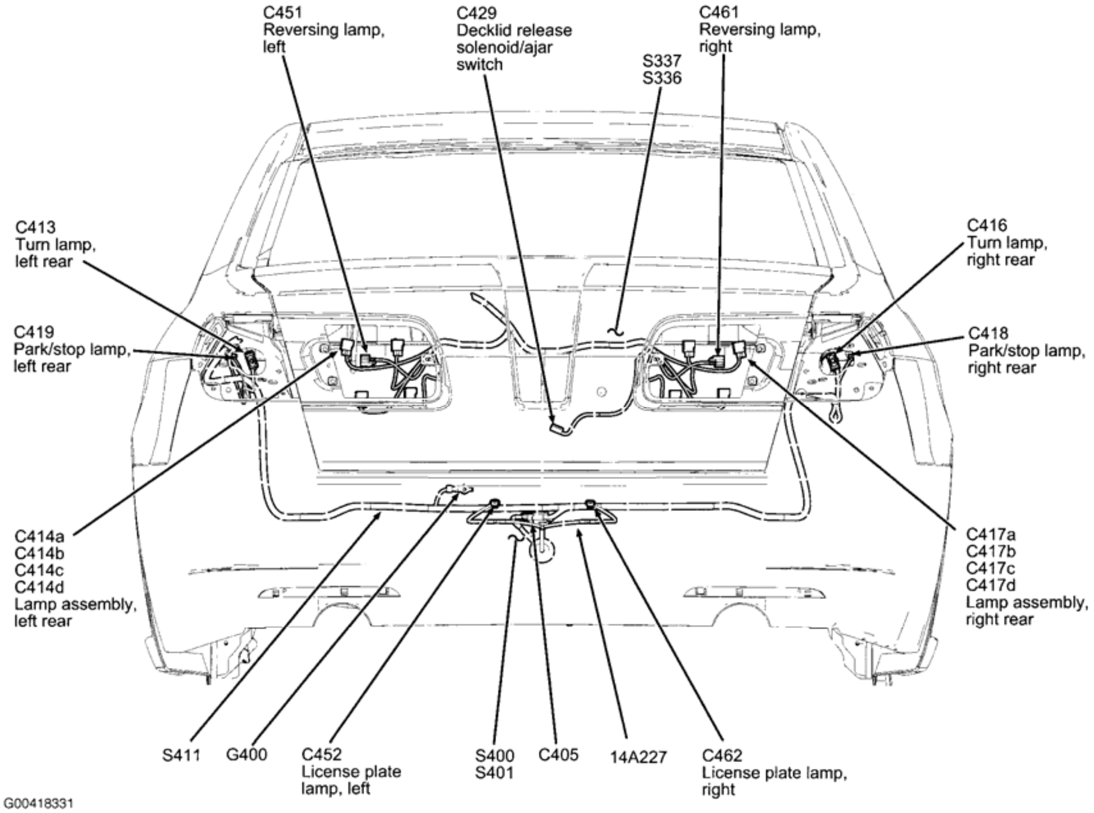


Fig. 8: Rear End (MKZ)
Courtesy of FORD MOTOR CO.

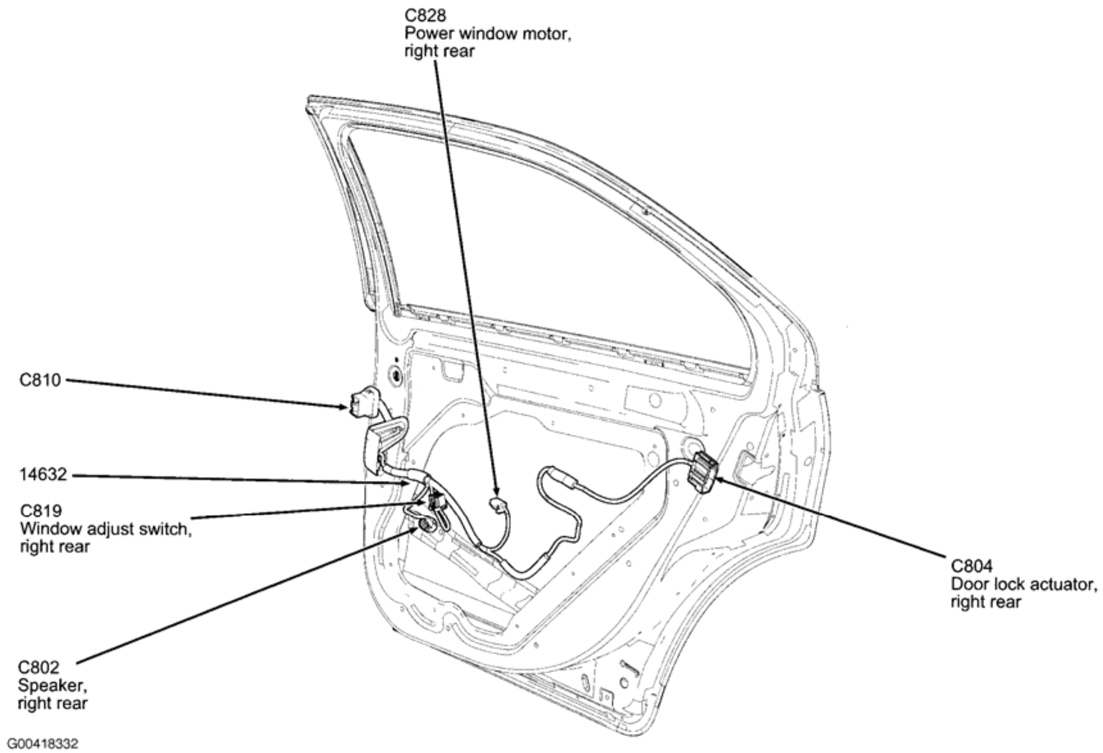


Fig. 9: Right Rear Door
Courtesy of FORD MOTOR CO.

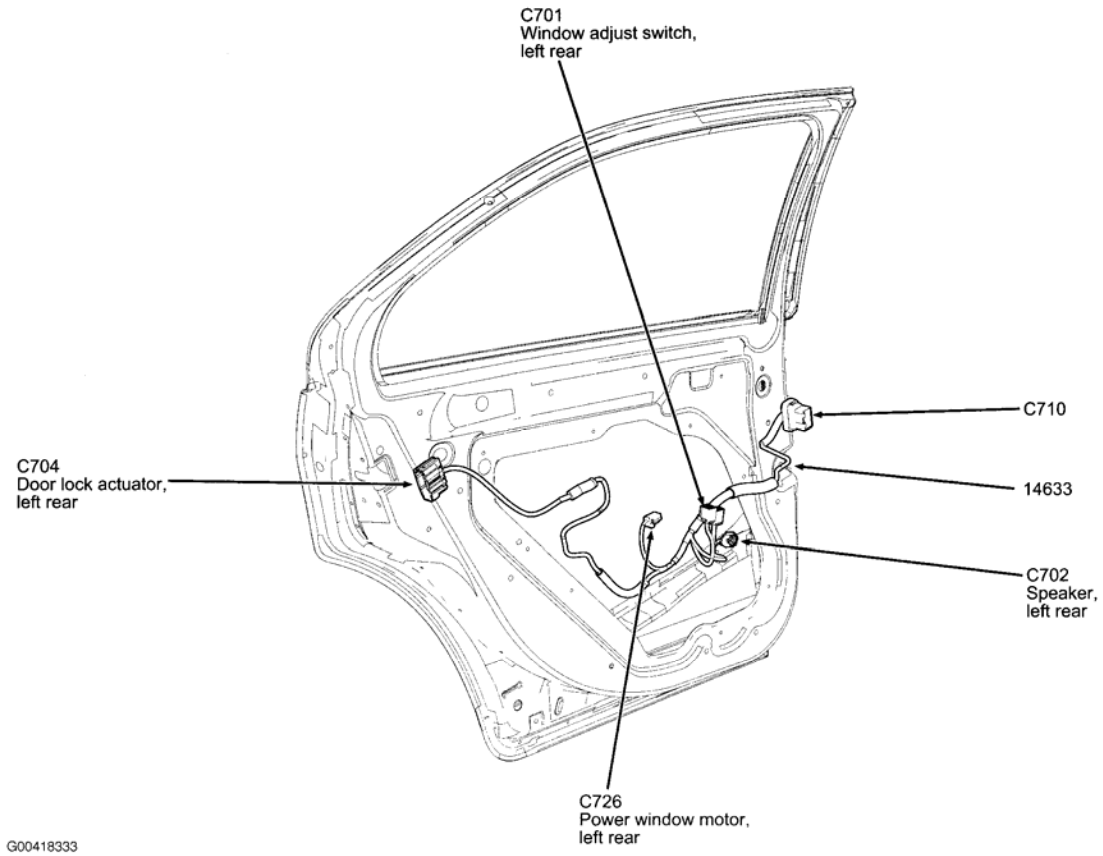


Fig. 10: Left Rear Door
Courtesy of FORD MOTOR CO.

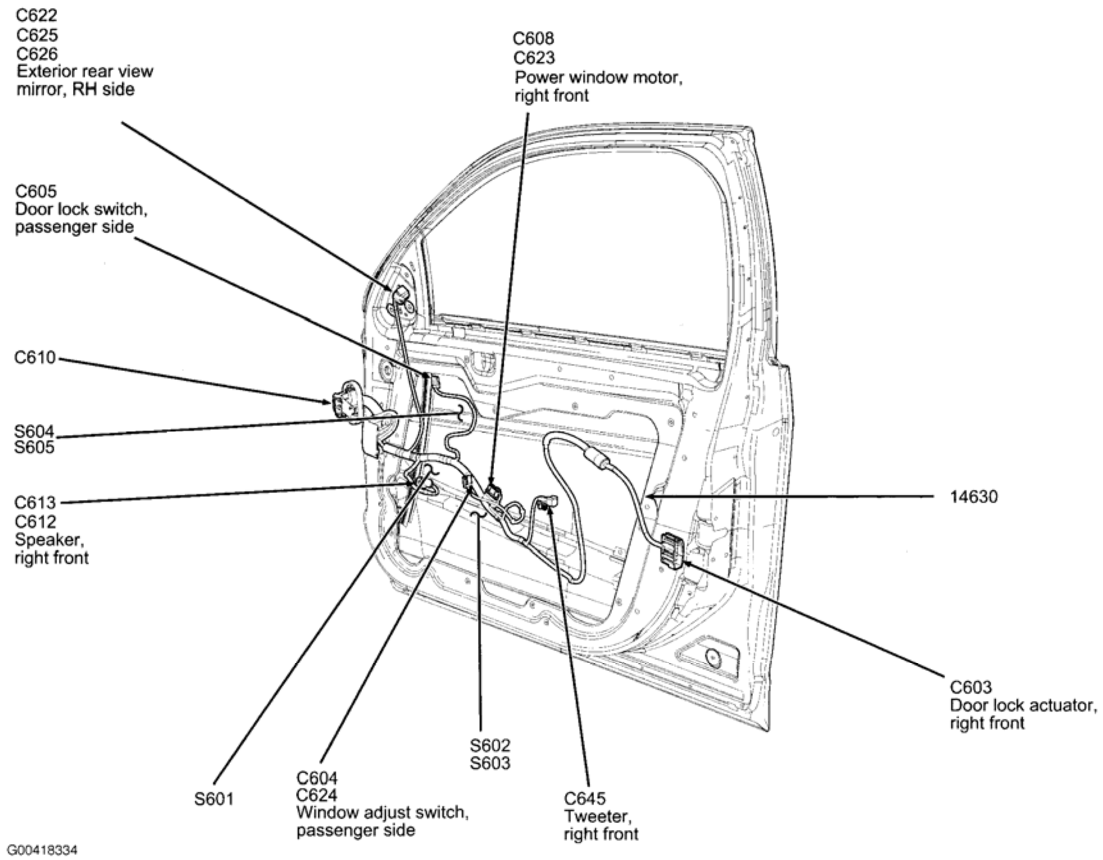


Fig. 11: Right Front Door
Courtesy of FORD MOTOR CO.

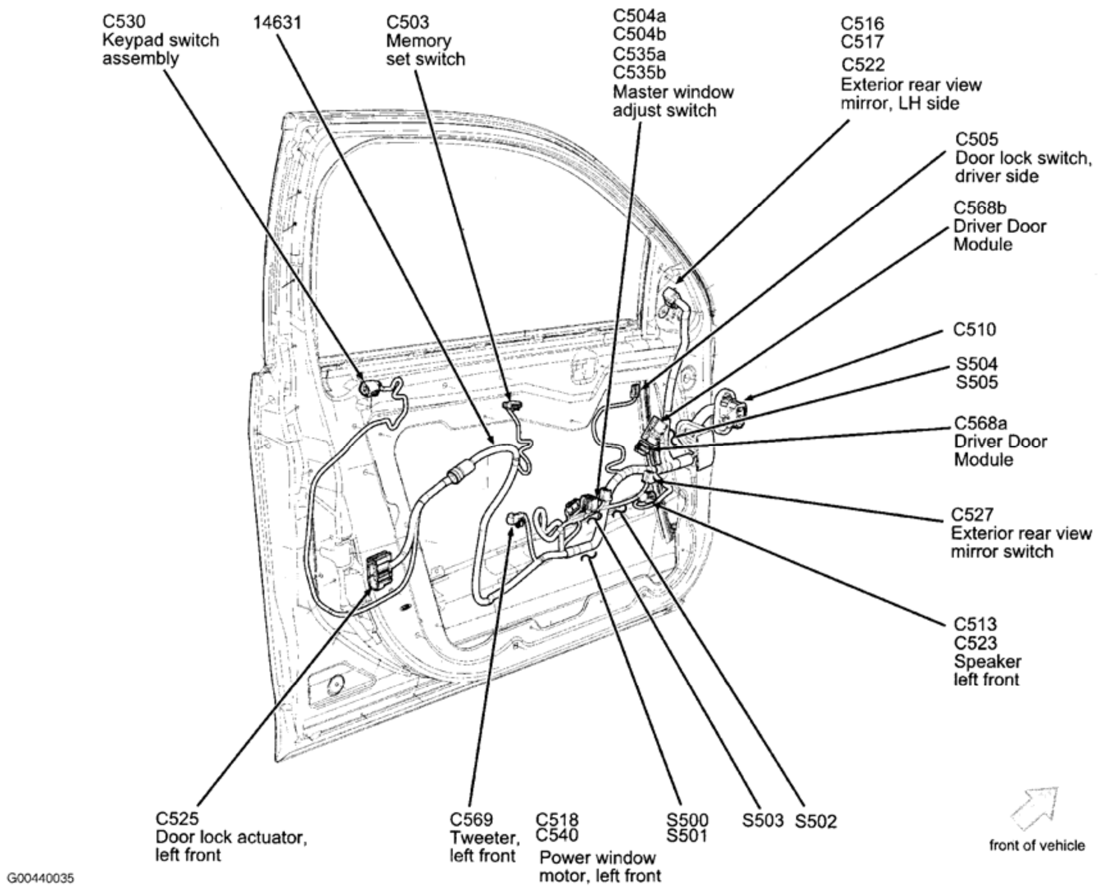


Fig. 12: Driver's Door
Courtesy of FORD MOTOR CO.

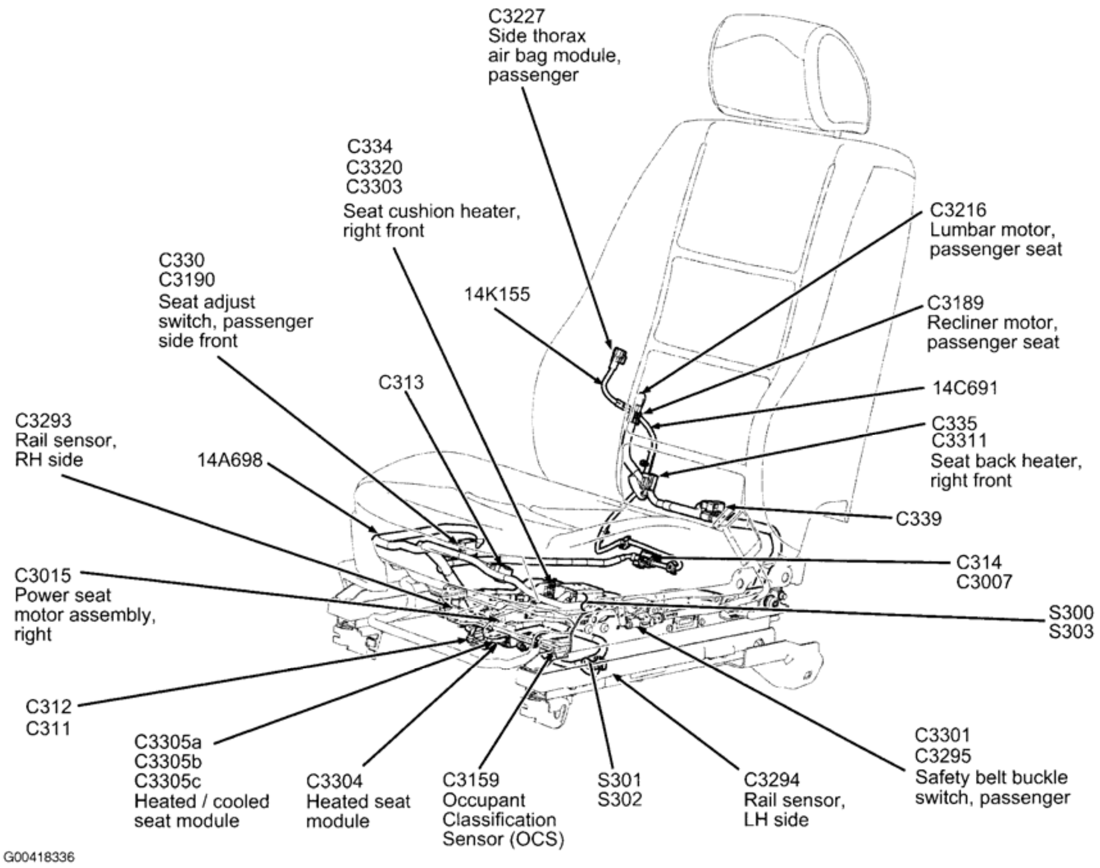


Fig. 13: Front Passenger's Seat
Courtesy of FORD MOTOR CO.

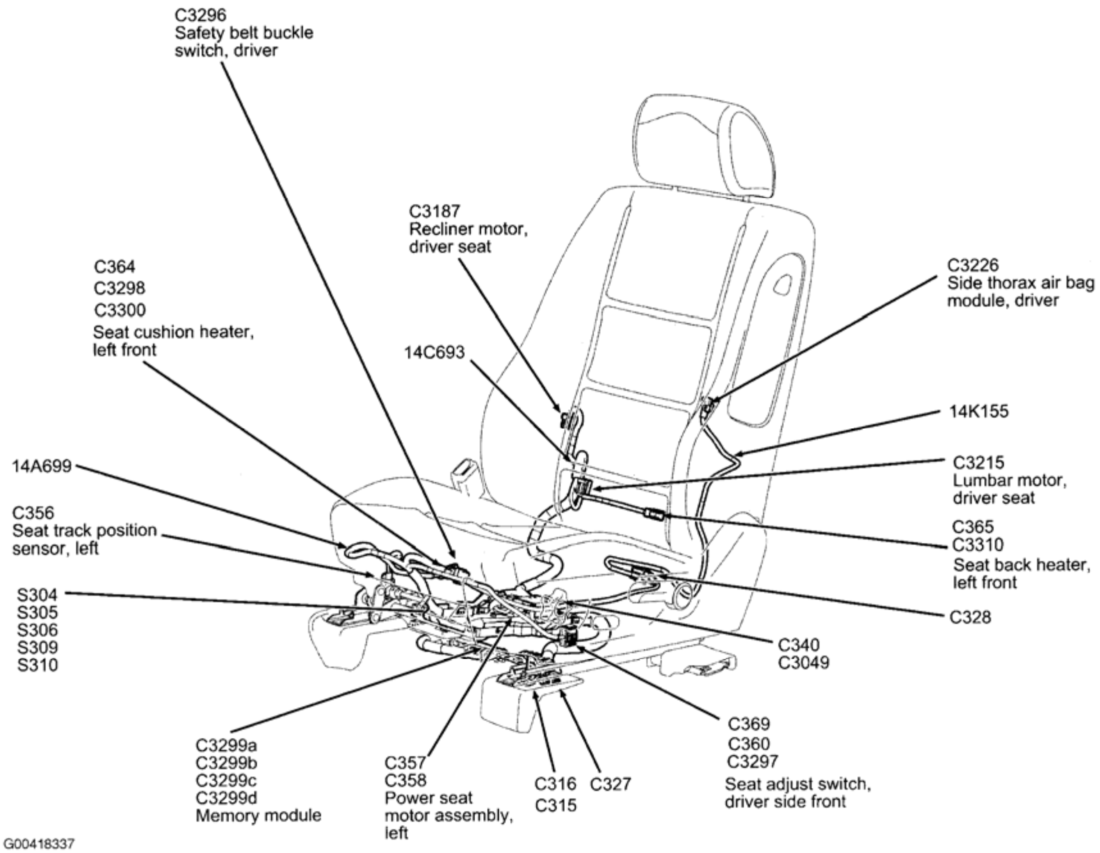


Fig. 14: Driver's Seat
Courtesy of FORD MOTOR CO.

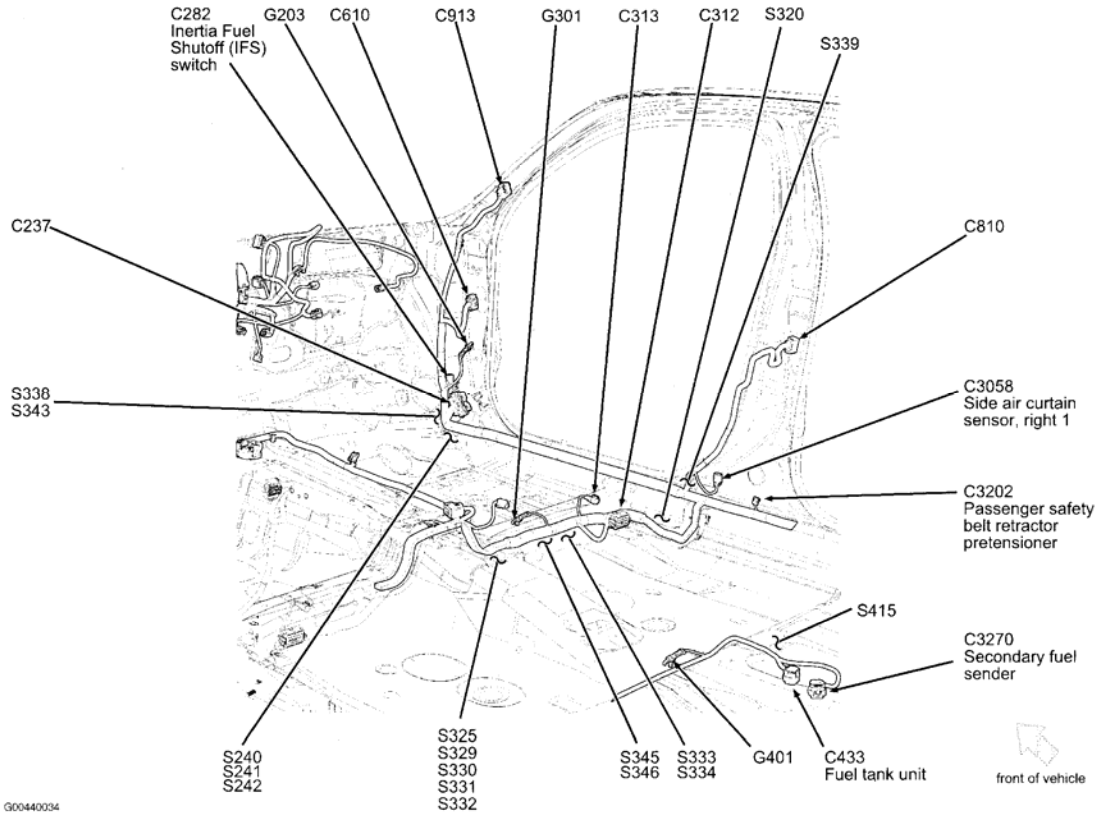


Fig. 15: Right Front Of Passenger Compartment
Courtesy of FORD MOTOR CO.

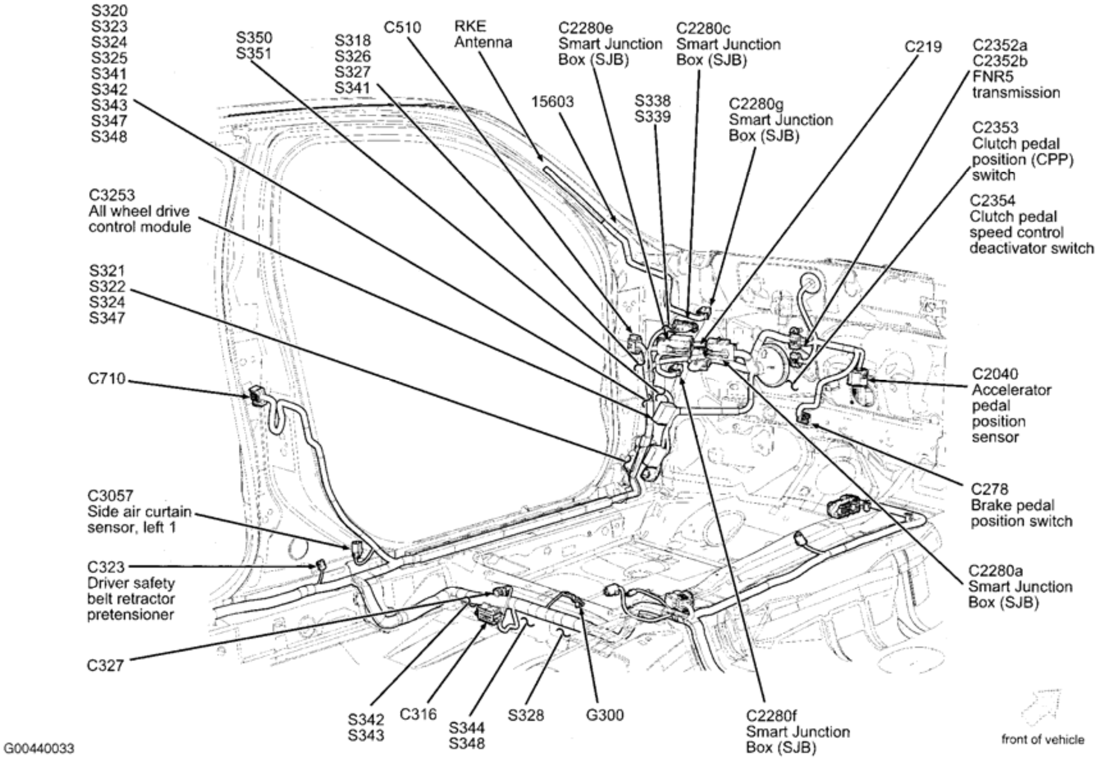


Fig. 16: Left Front Of Passenger Compartment
Courtesy of FORD MOTOR CO.

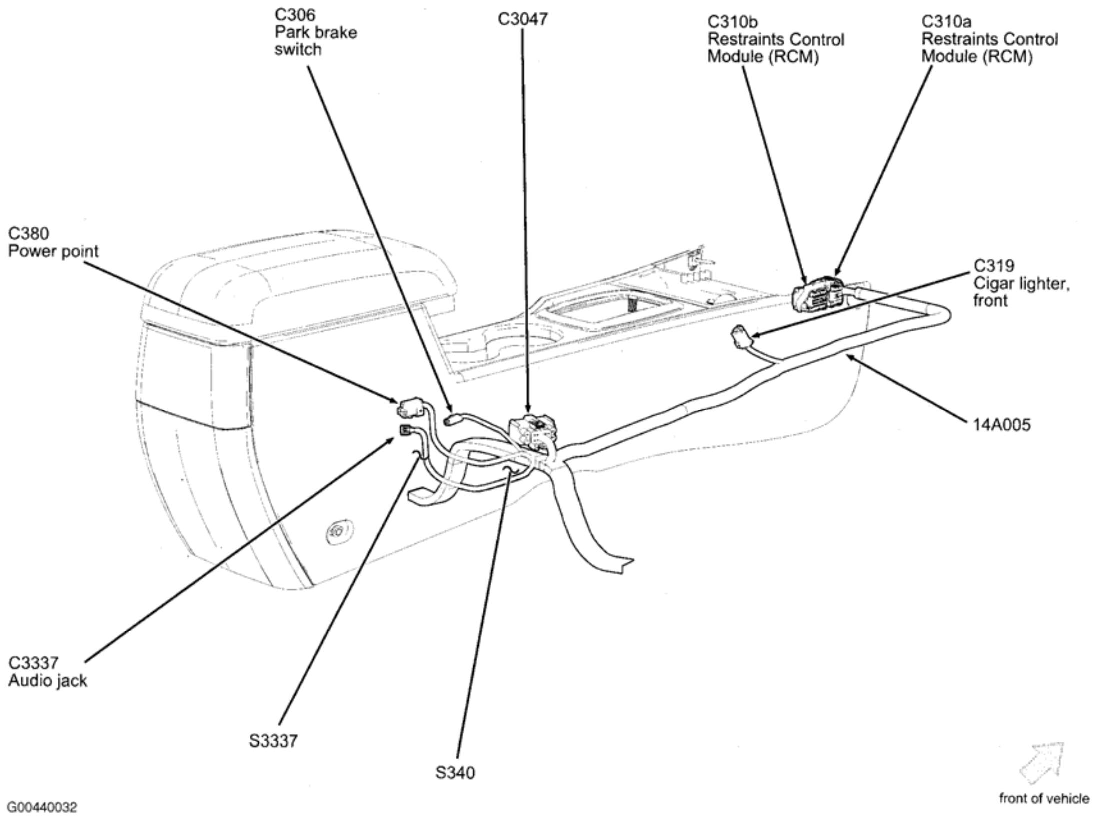


Fig. 17: Center Console
Courtesy of FORD MOTOR CO.

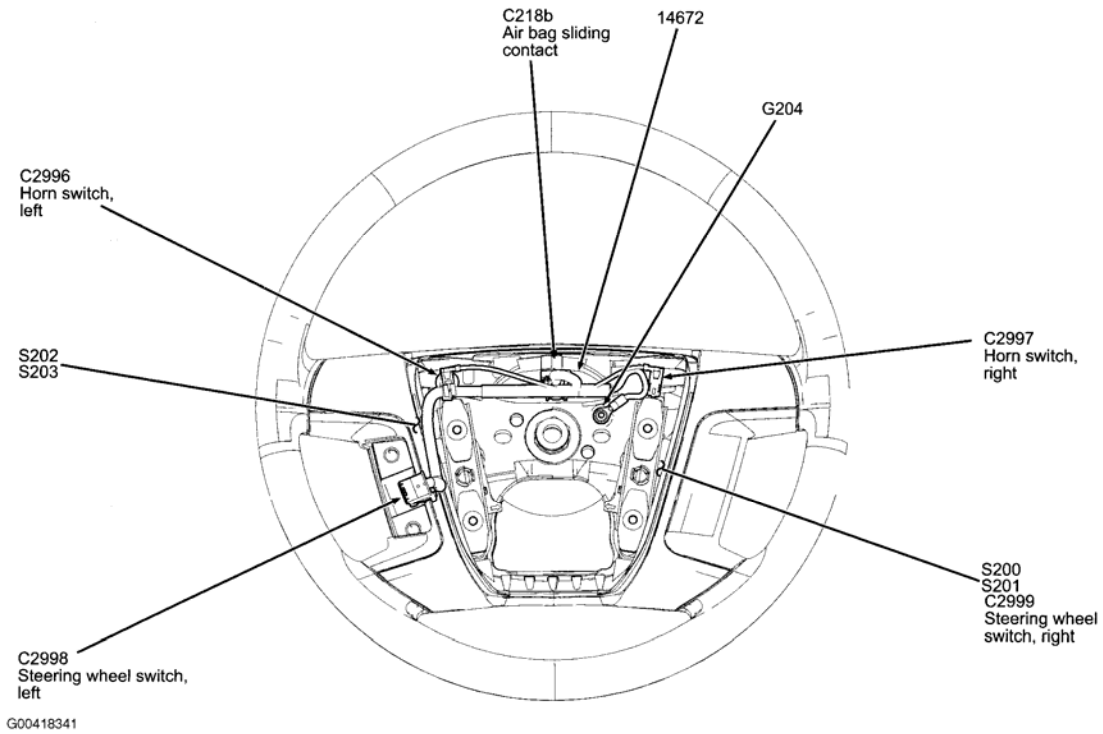


Fig. 18: Steering Wheel
Courtesy of FORD MOTOR CO.

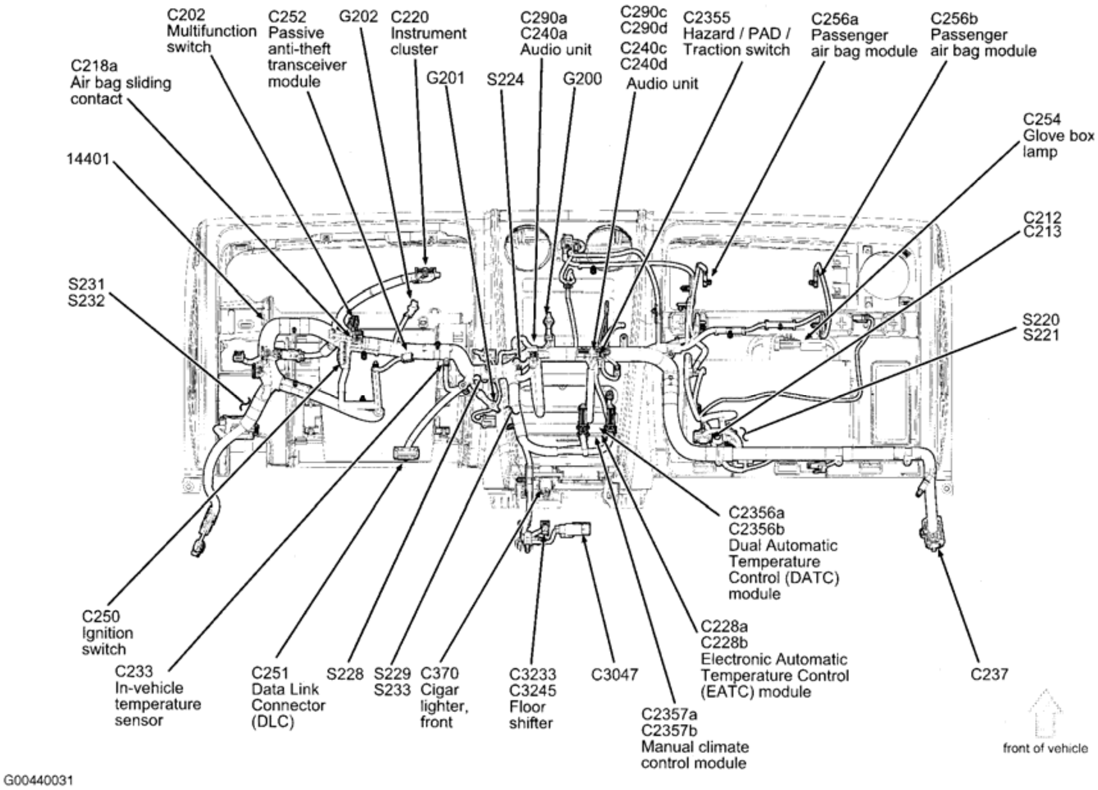


Fig. 19: Dash
Courtesy of FORD MOTOR CO.

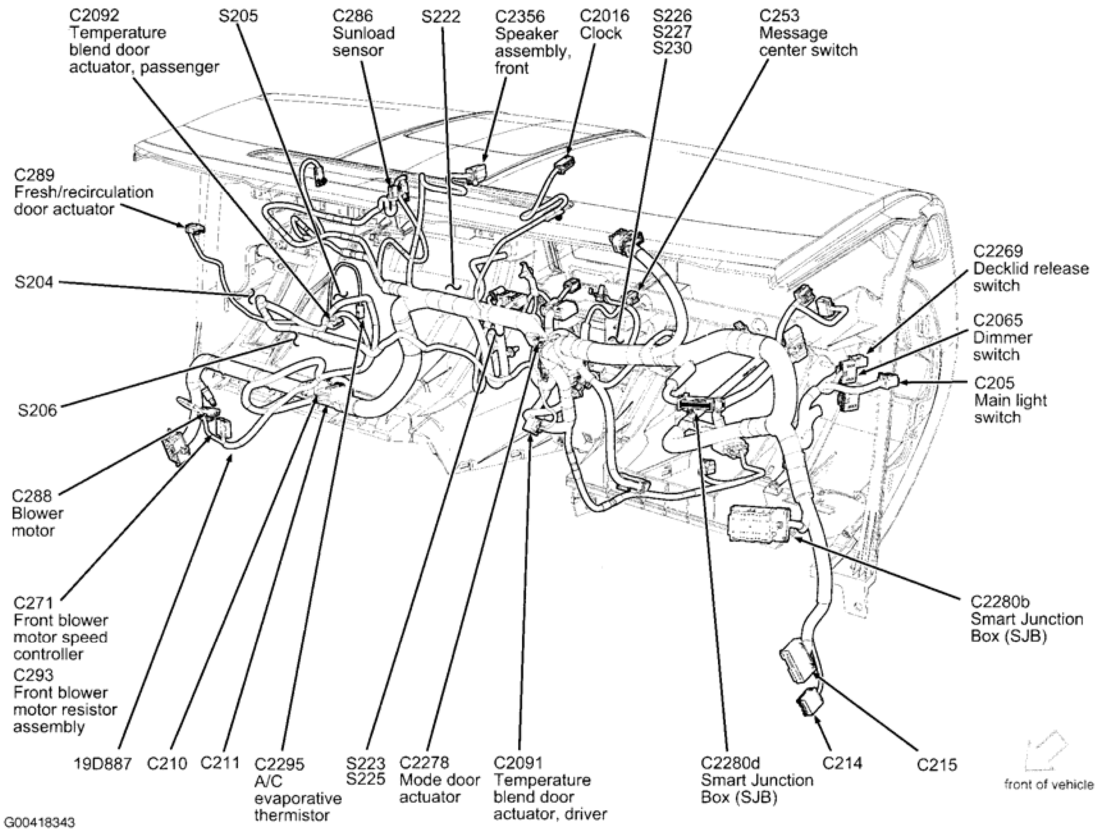


Fig. 20: Dash
Courtesy of FORD MOTOR CO.

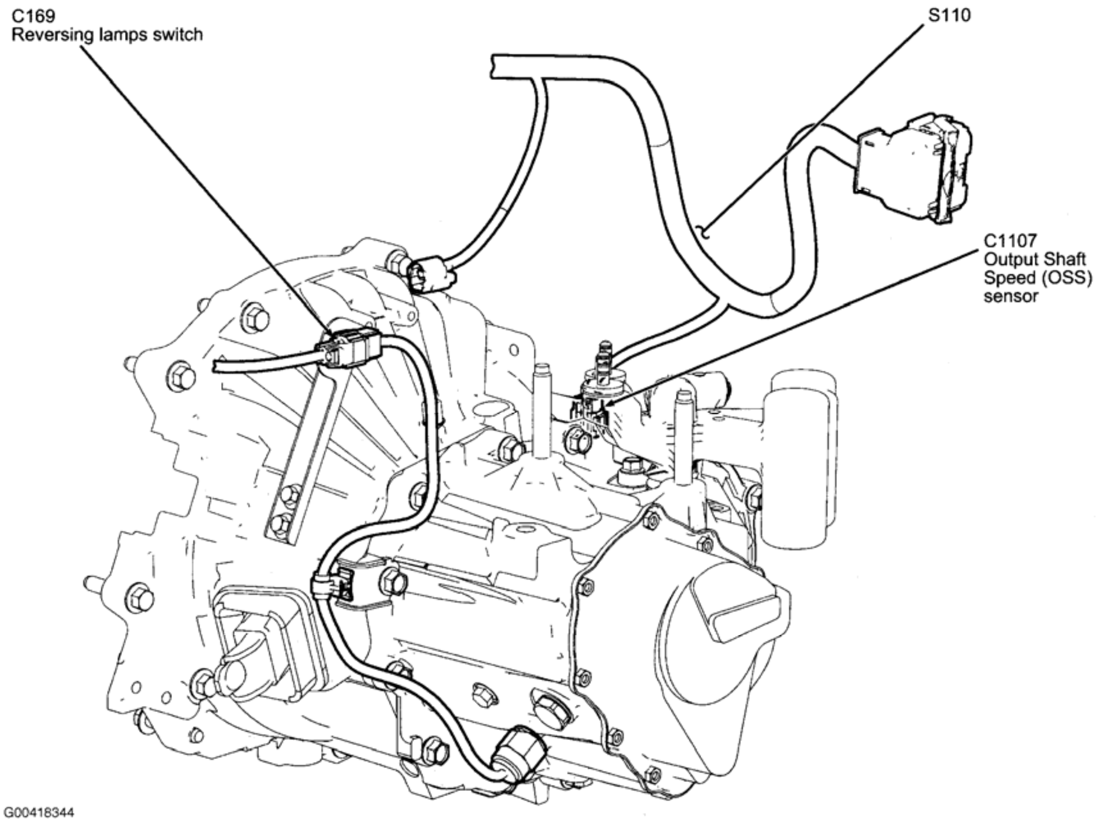


Fig. 21: Manual Transmission (2.3L)
Courtesy of FORD MOTOR CO.

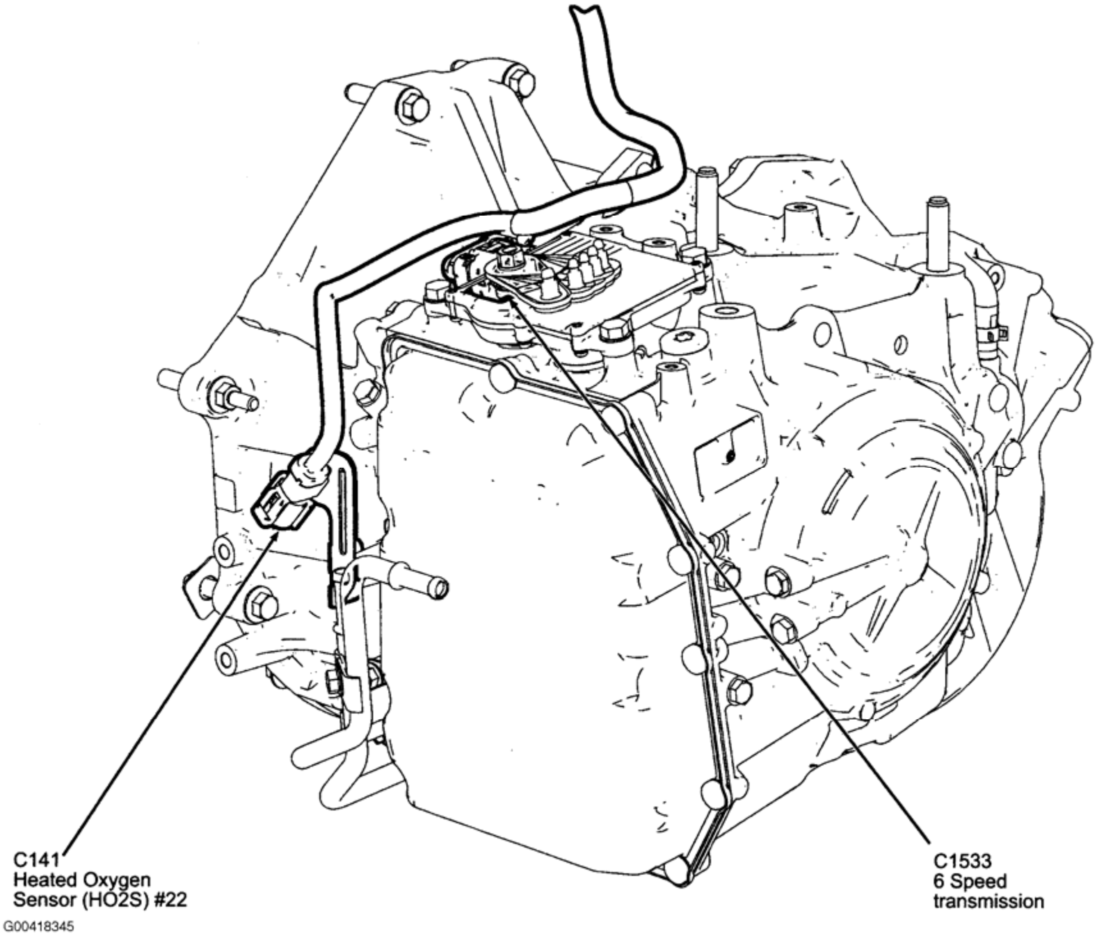


Fig. 22: Automatic Transmission (3.0L)
Courtesy of FORD MOTOR CO.

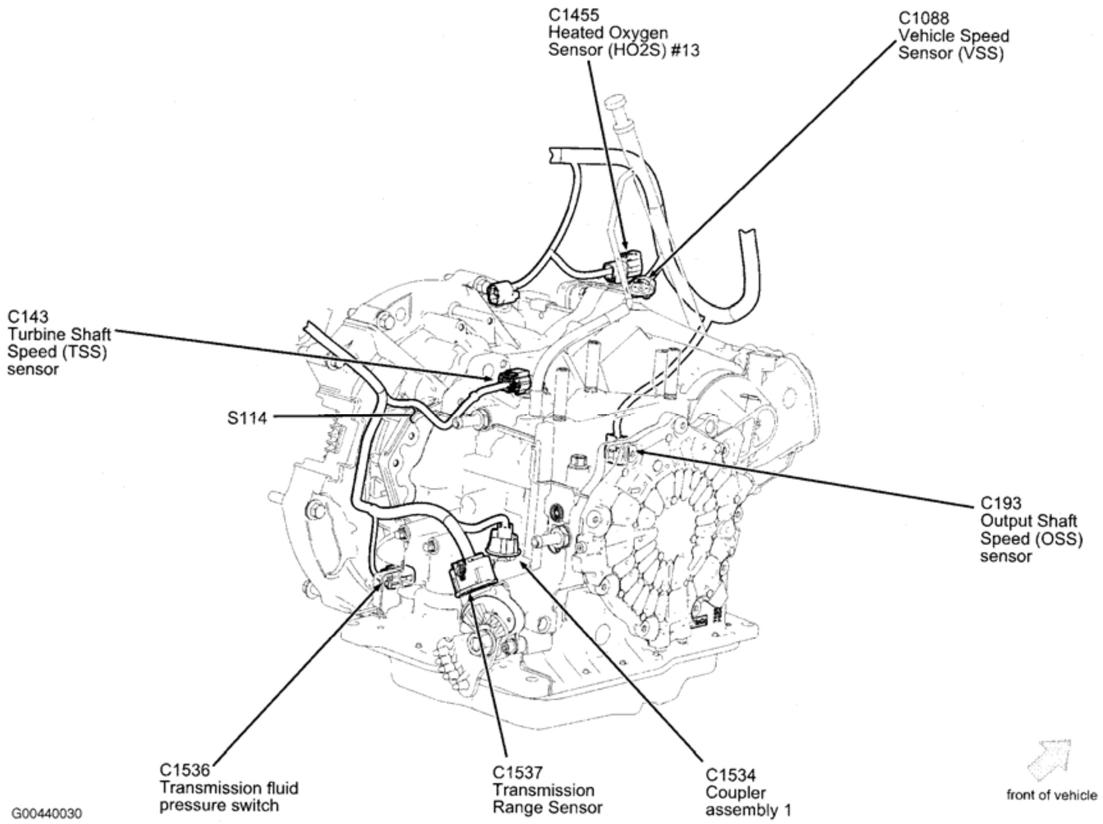


Fig. 23: Automatic Transmission (2.3L)
Courtesy of FORD MOTOR CO.

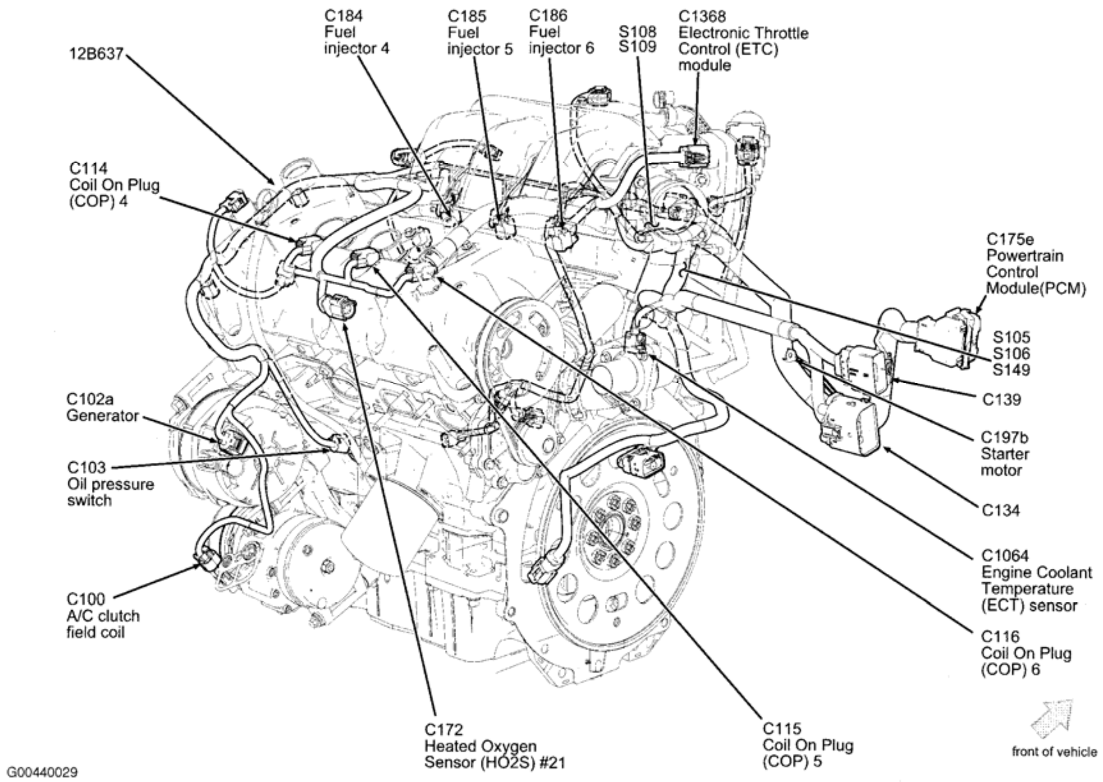


Fig. 24: Rear Of Engine (3.0L)
Courtesy of FORD MOTOR CO.

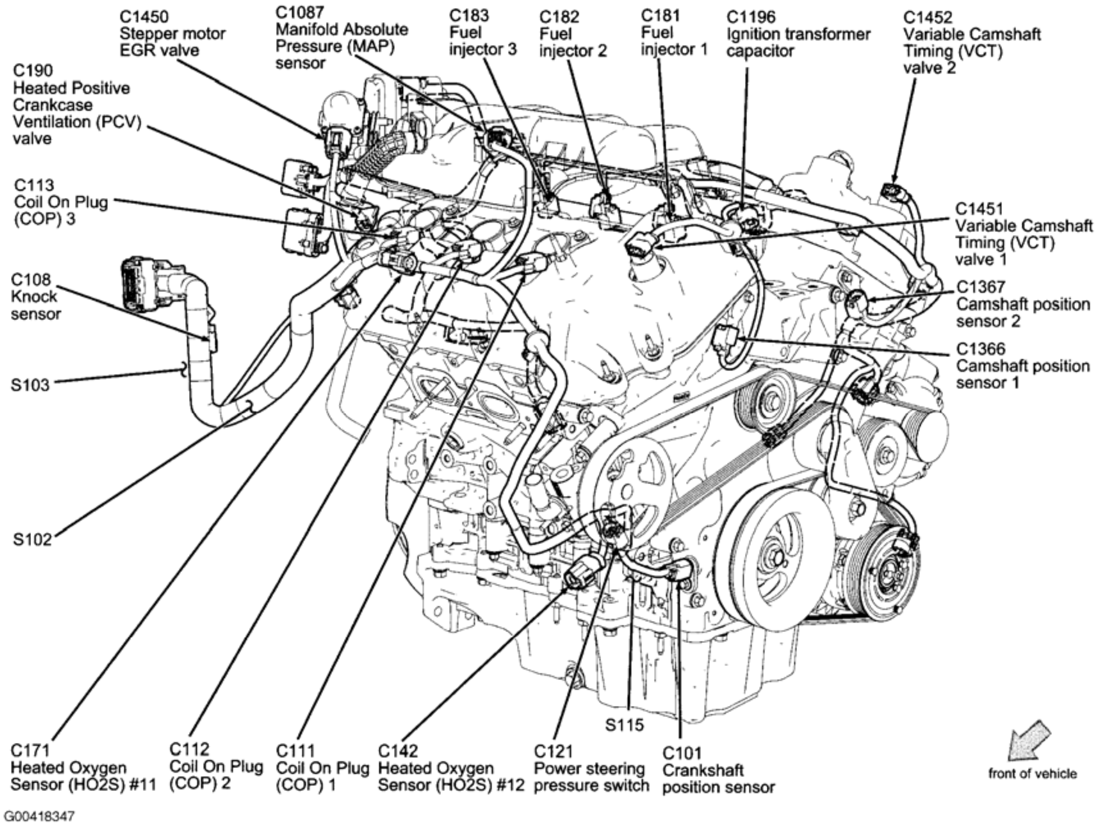


Fig. 25: Front Of Engine (3.0L)
Courtesy of FORD MOTOR CO.

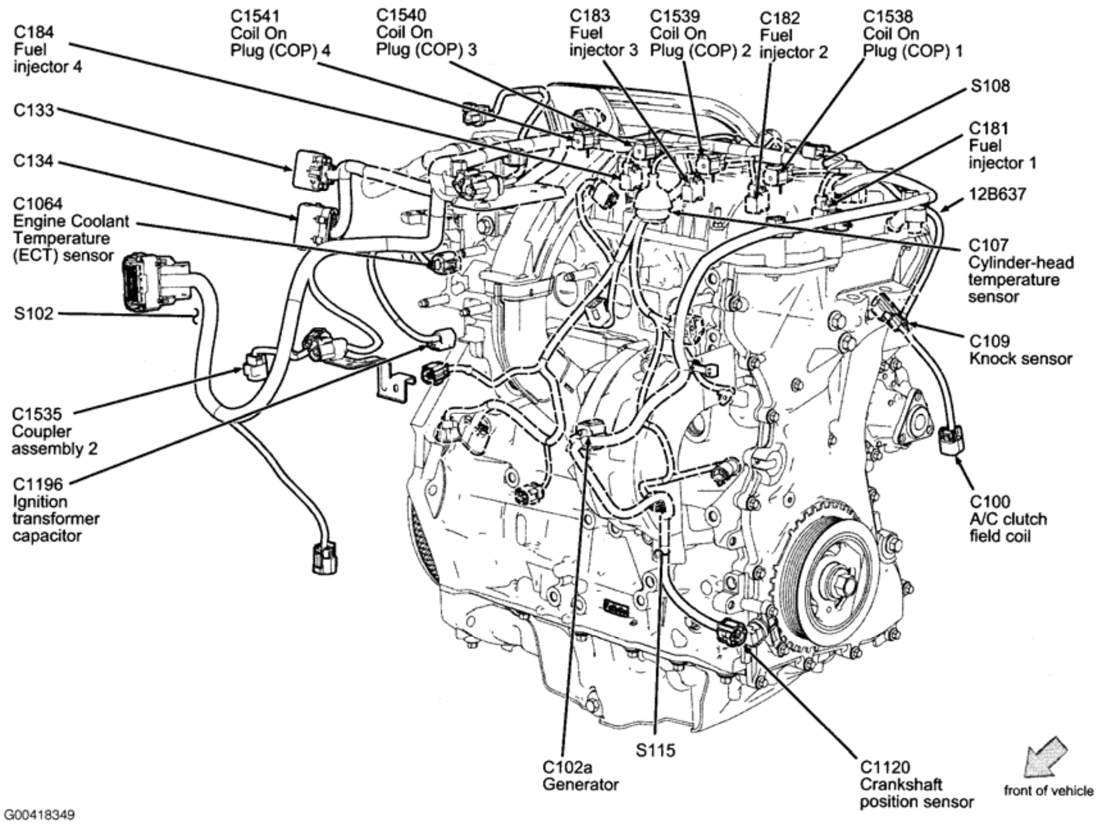


Fig. 26: Front Of Engine (2.3L)
Courtesy of FORD MOTOR CO.

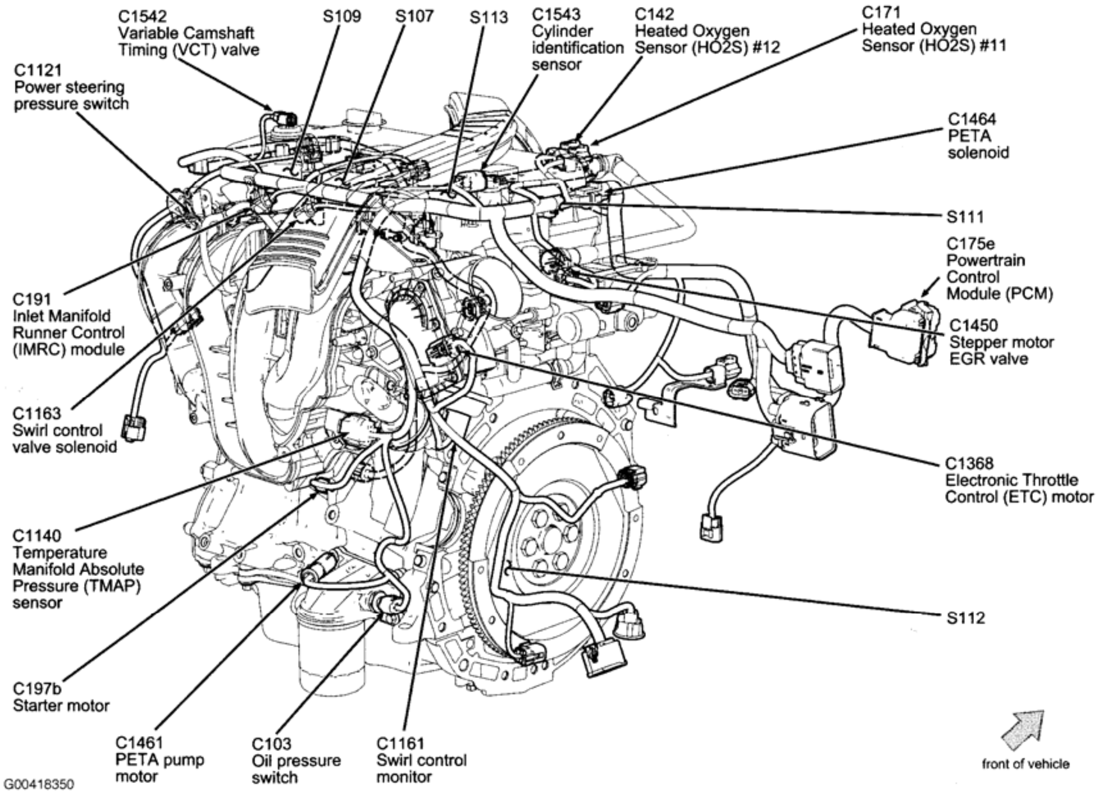


Fig. 27: Rear Of Engine (2.3L)
Courtesy of FORD MOTOR CO.

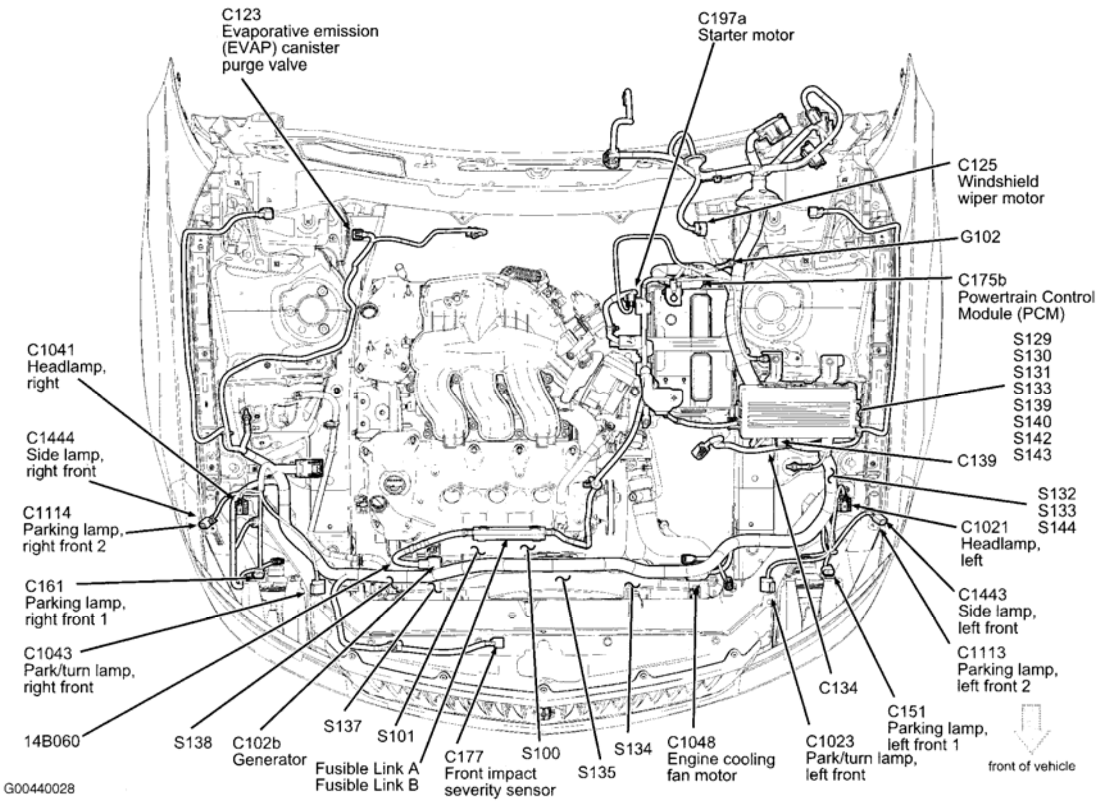


Fig. 28: Engine Compartment (3.0L)
Courtesy of FORD MOTOR CO.

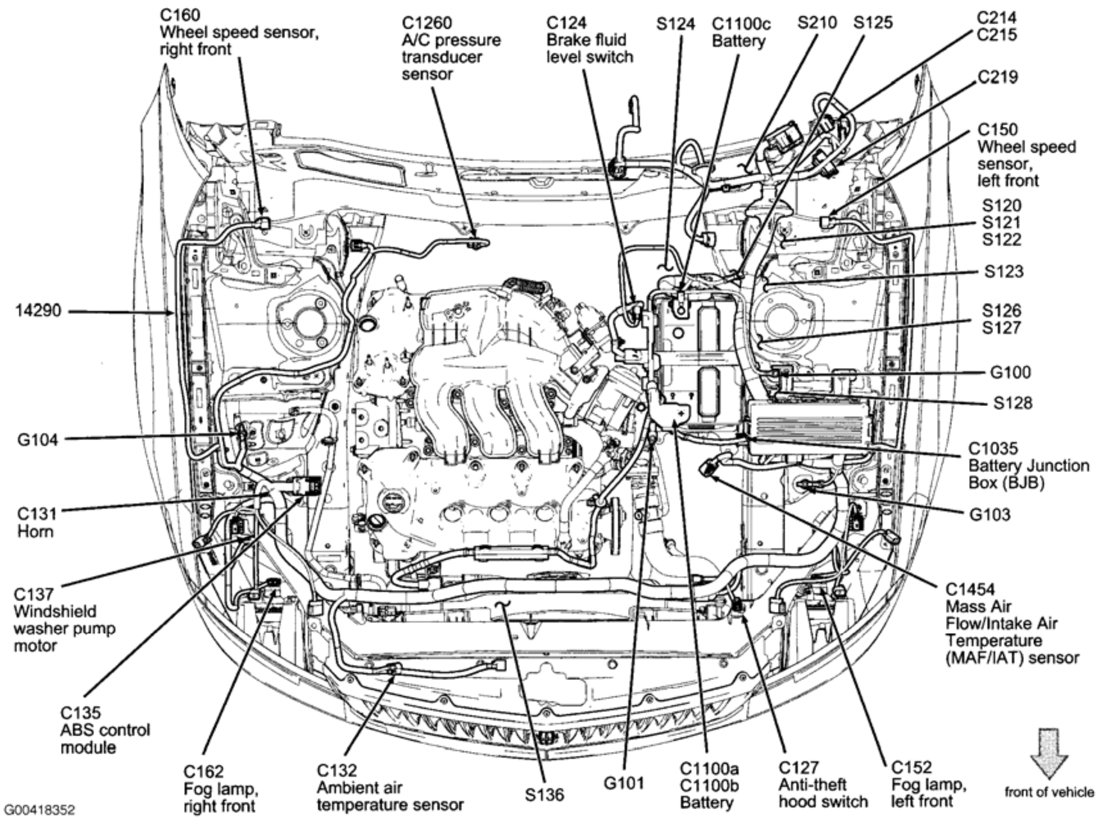


Fig. 29: Engine Compartment (3.0L)
Courtesy of FORD MOTOR CO.

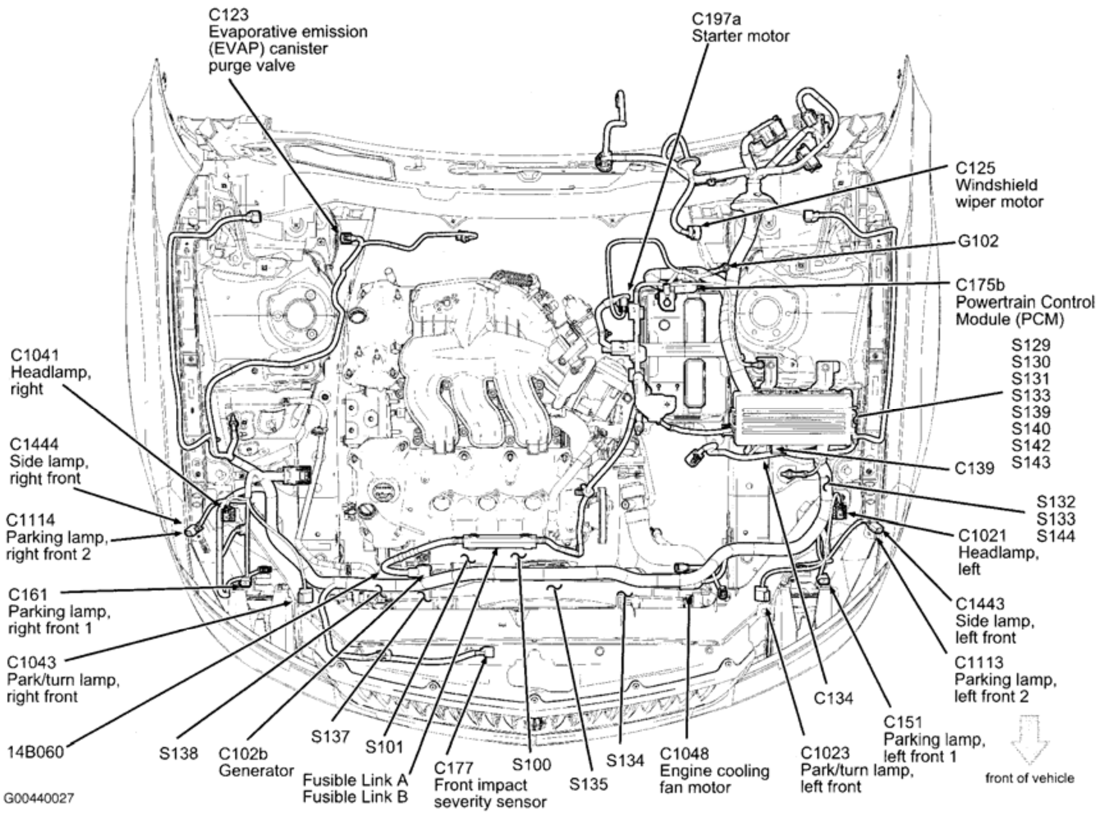


Fig. 30: Engine Compartment (2.3L)
Courtesy of FORD MOTOR CO.

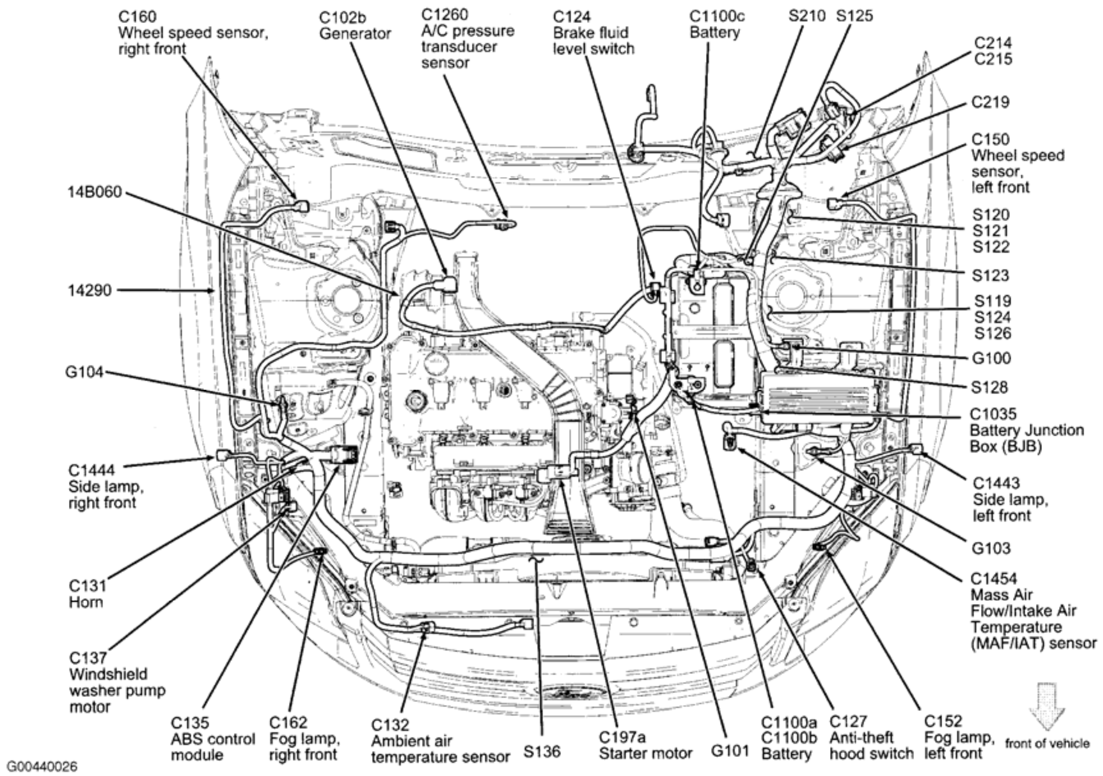


Fig. 31: Engine Compartment (2.3L)
Courtesy of FORD MOTOR CO.

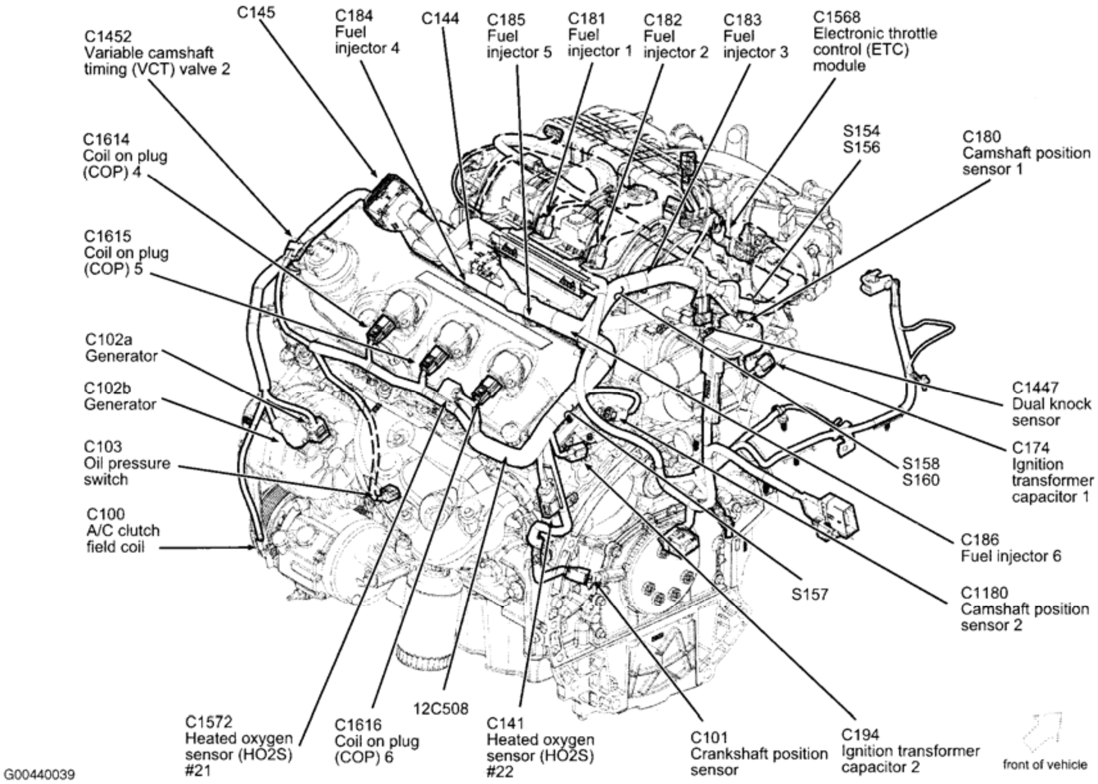


Fig. 32: Rear Of Engine (3.5L)
Courtesy of FORD MOTOR CO.

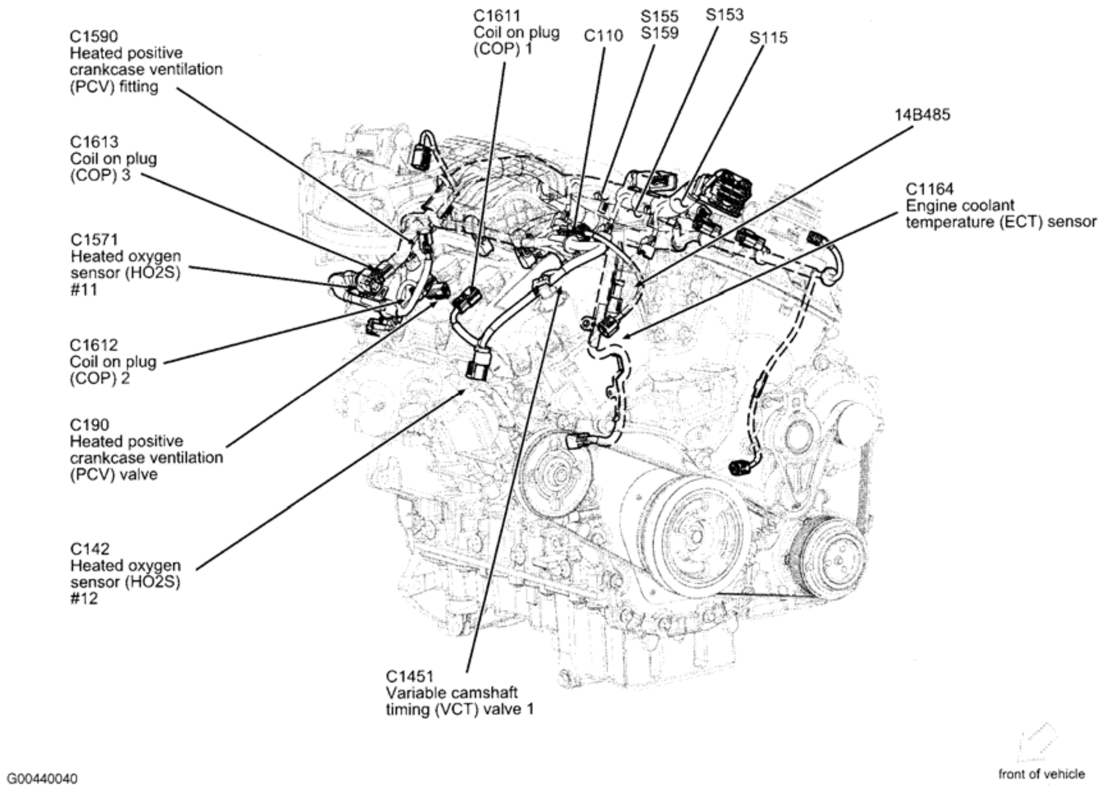


Fig. 33: Front Of Engine (3.5L)
Courtesy of FORD MOTOR CO.

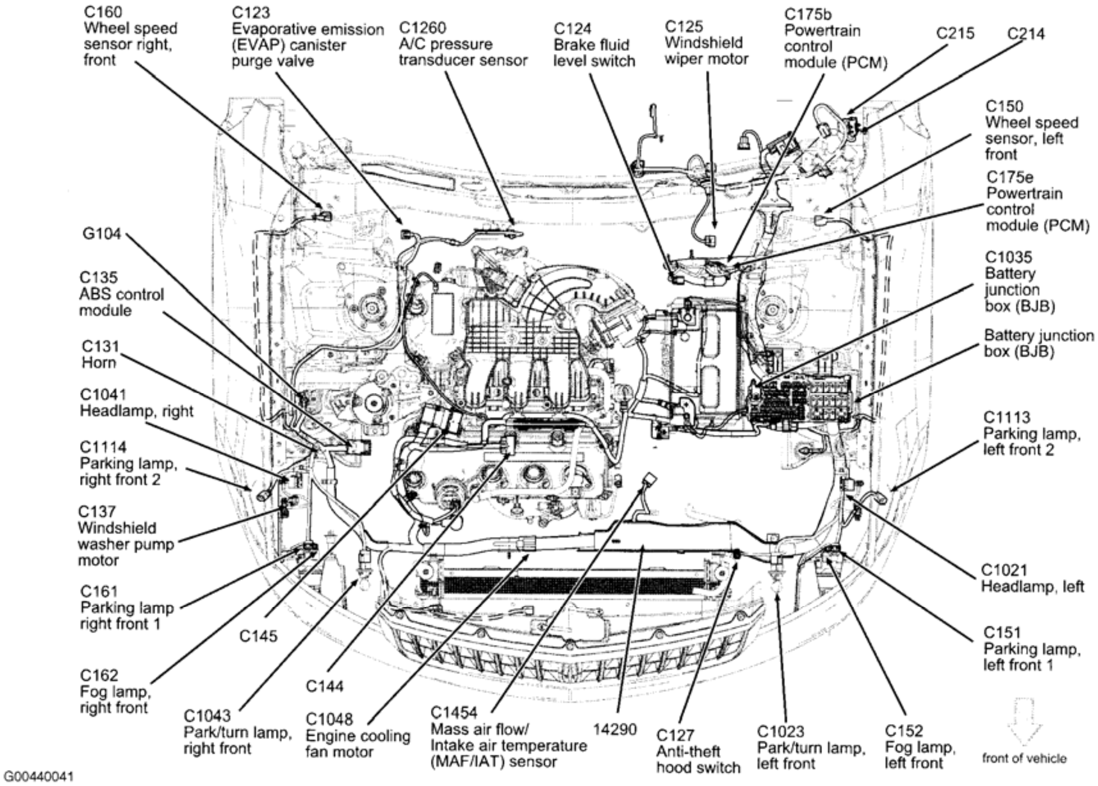


Fig. 34: Engine Compartment (3.5L)
Courtesy of FORD MOTOR CO.

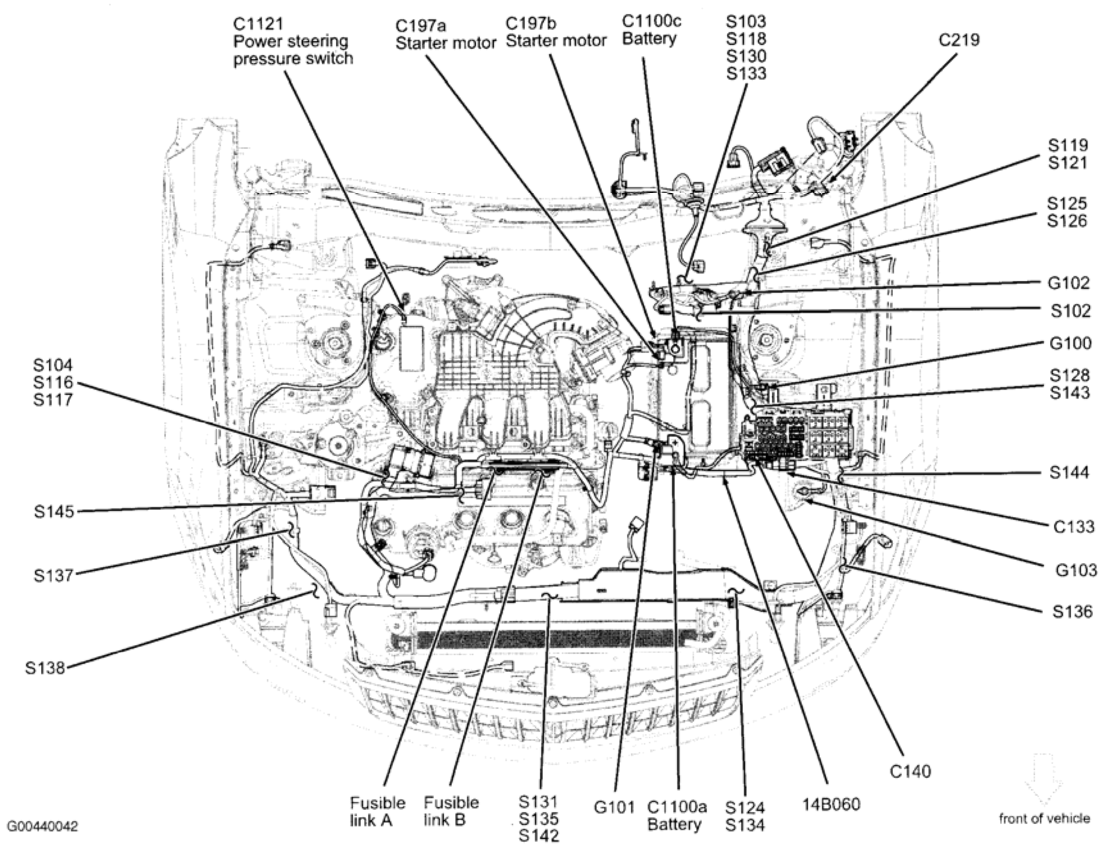


Fig. 35: Engine Compartment (3.5L)
Courtesy of FORD MOTOR CO.

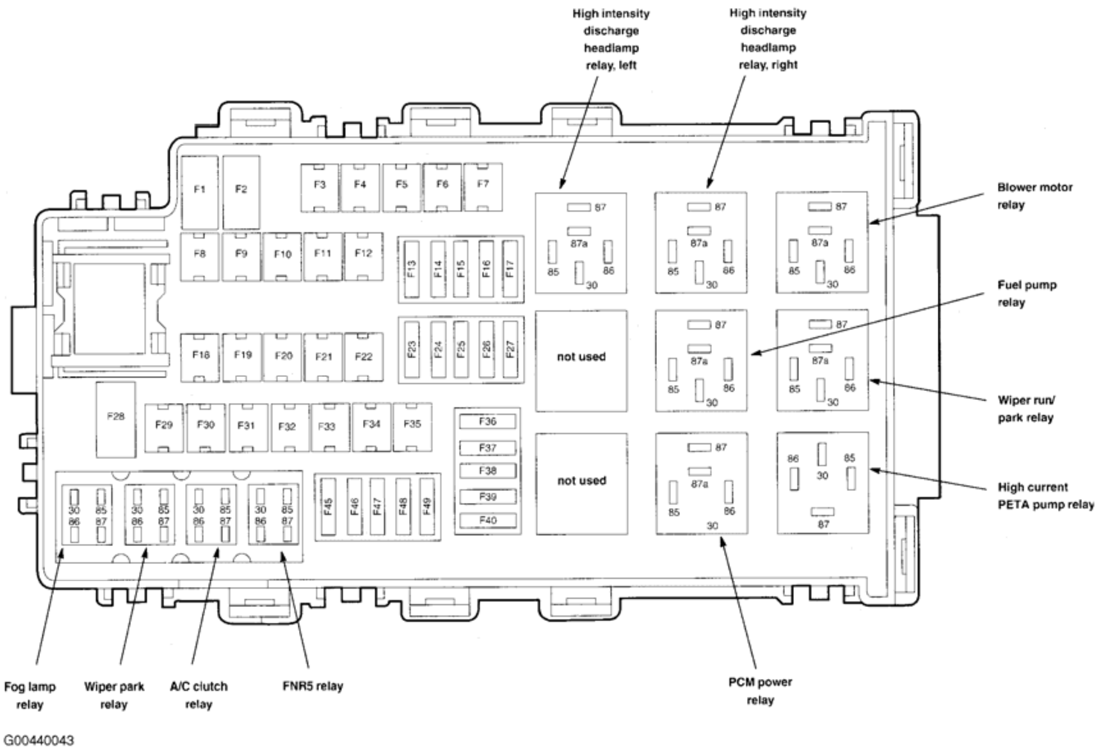


Fig. 36: Battery Junction Box (BJB) (Late Production)
Courtesy of FORD MOTOR CO.

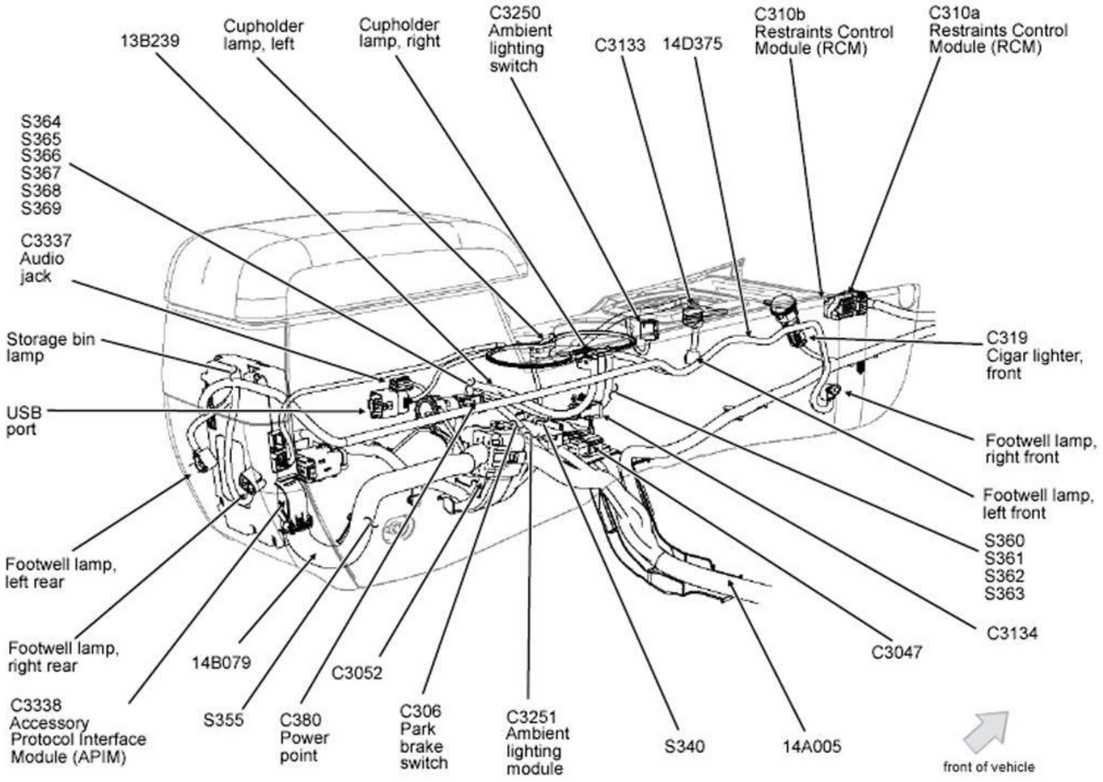


Fig. 37: API Module
Courtesy of FORD MOTOR CO.

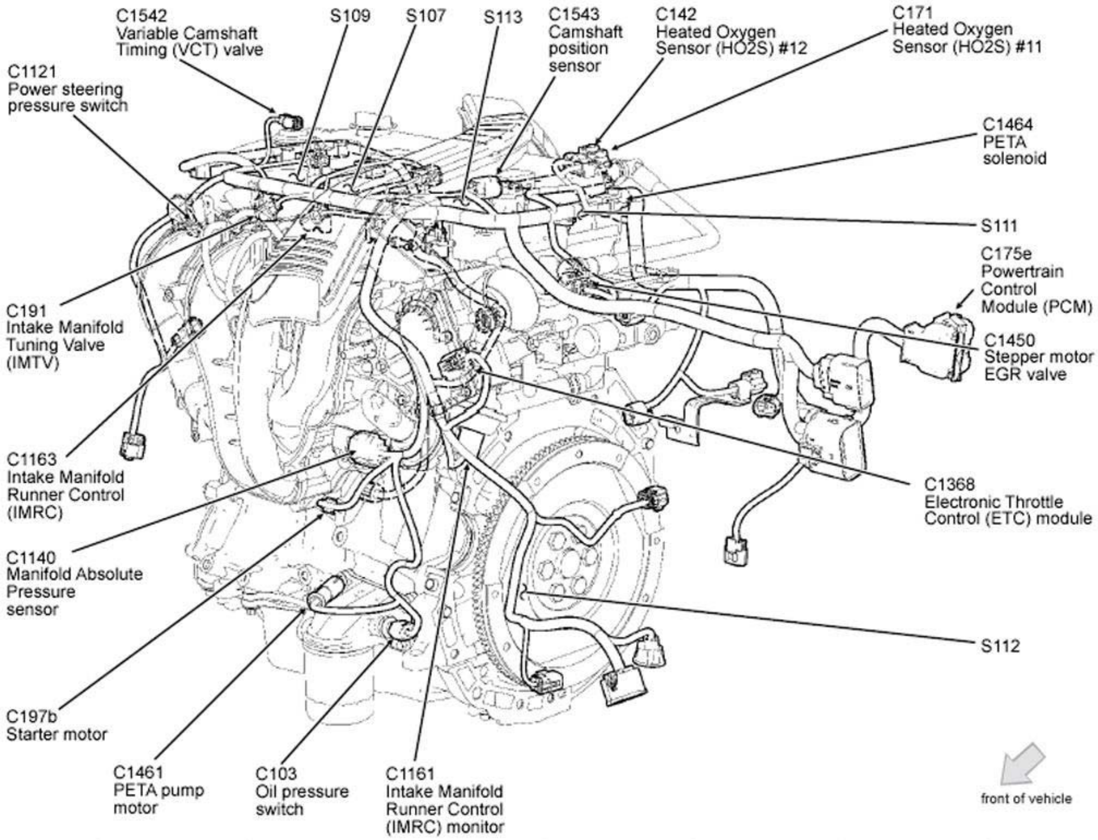


Fig. 38: Engine Overview
Courtesy of FORD MOTOR CO.

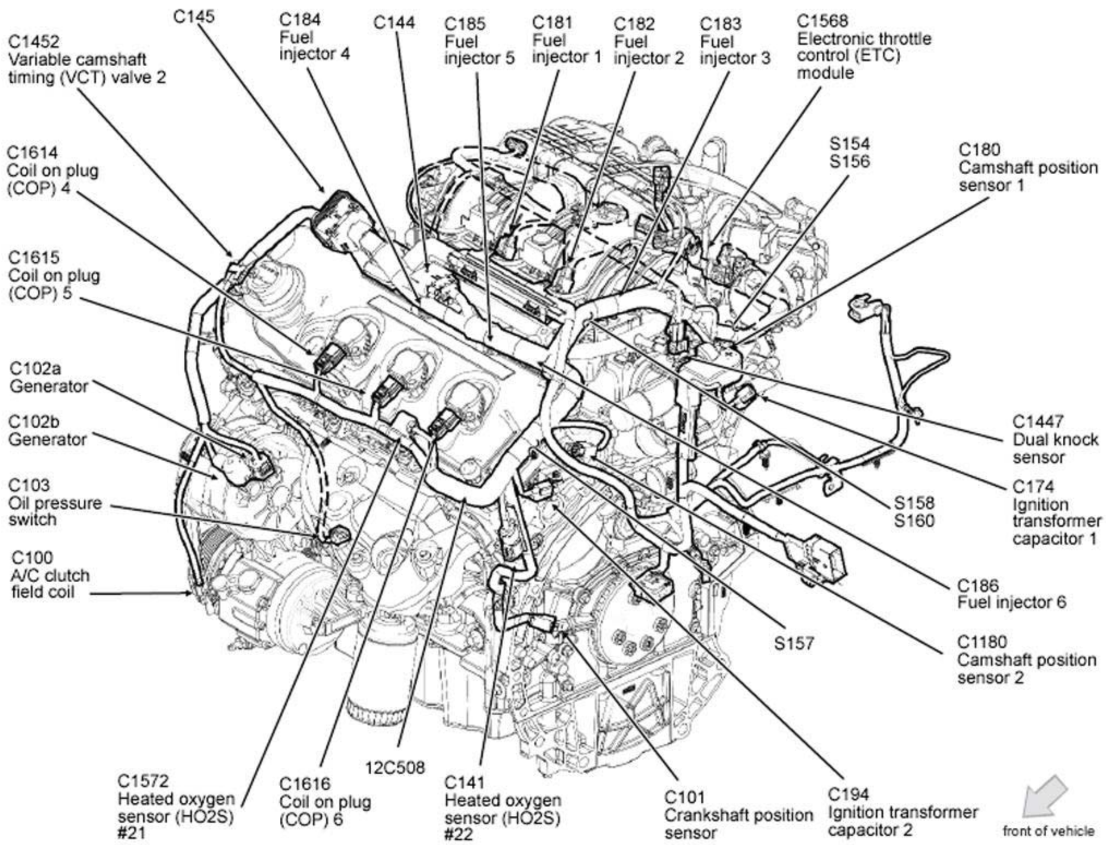


Fig. 39: Engine Overview
Courtesy of FORD MOTOR CO.

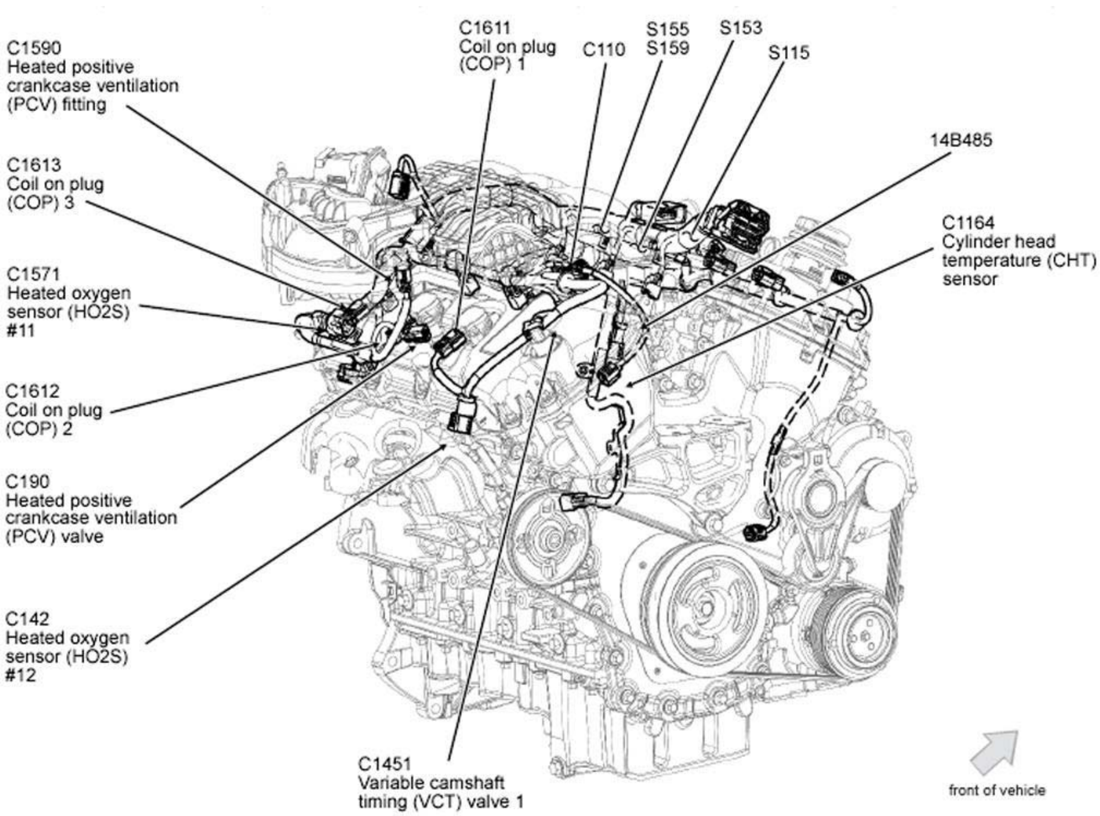


Fig. 40: Front Engine
Courtesy of FORD MOTOR CO.

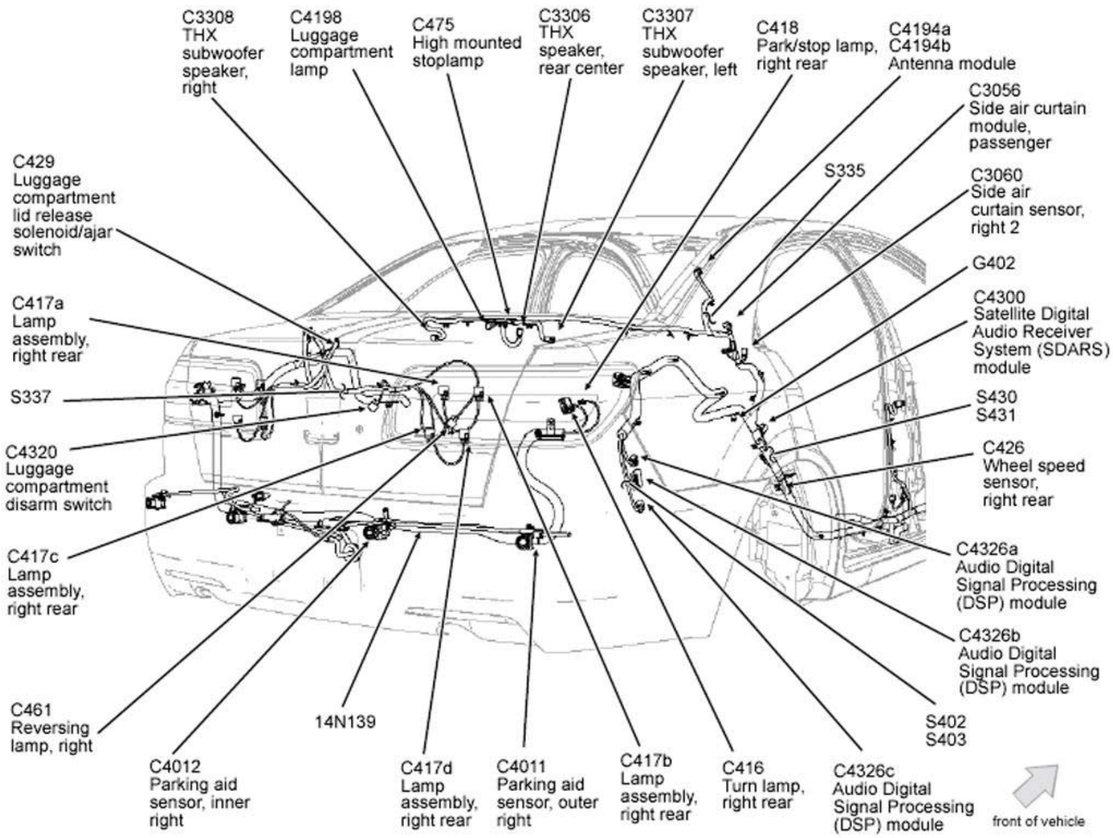


Fig. 41: Right Rear Of Vehicle
Courtesy of FORD MOTOR CO.

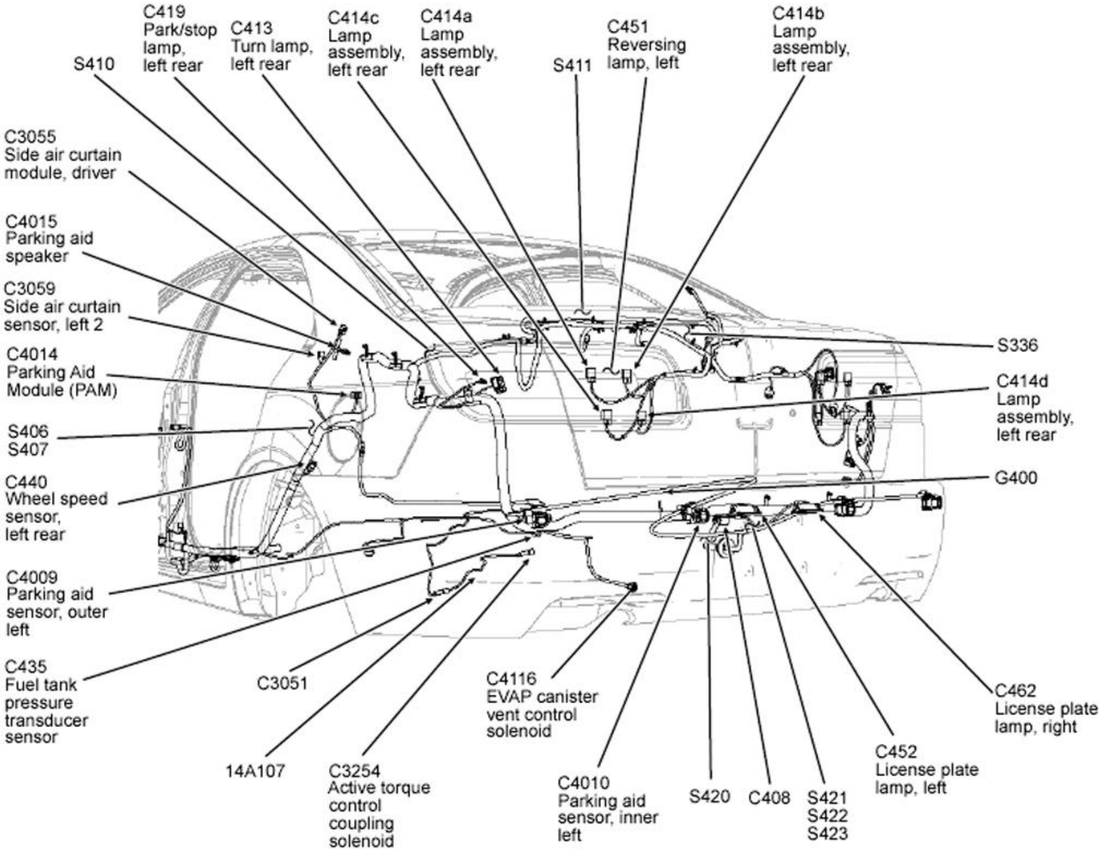


Fig. 42: Left Rear Of Vehicle
Courtesy of FORD MOTOR CO.

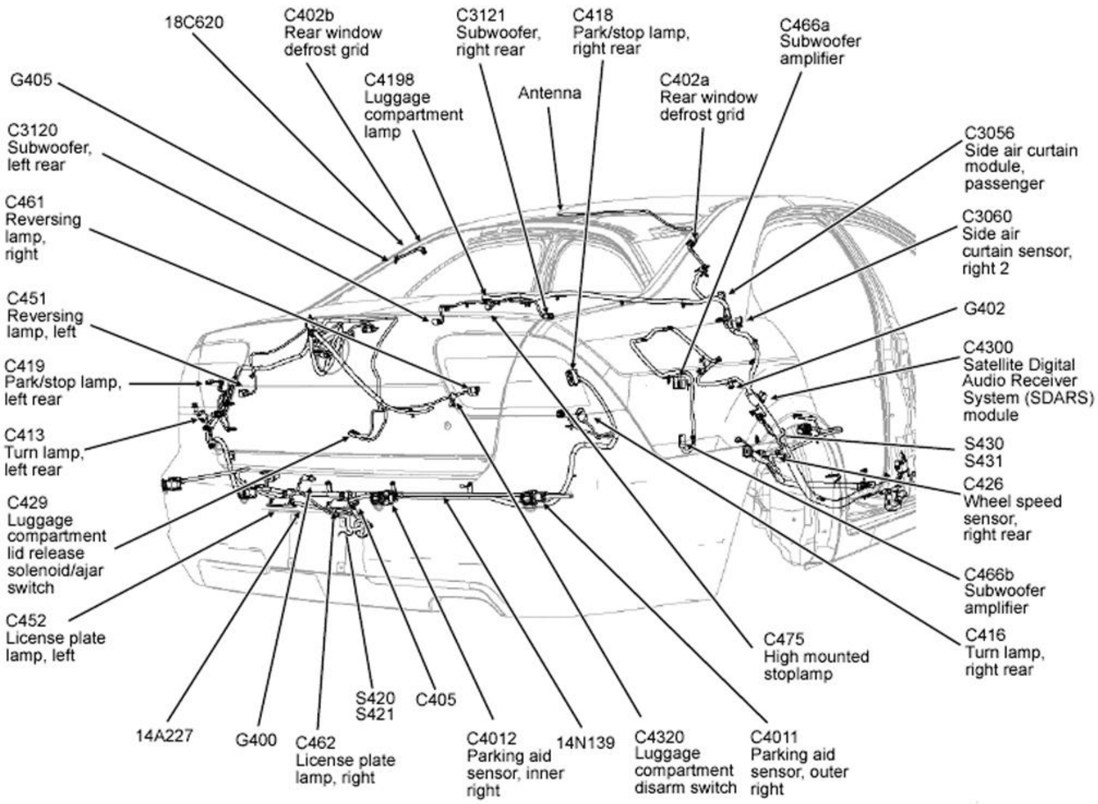


Fig. 43: Right Rear Of Vehicle
Courtesy of FORD MOTOR CO.

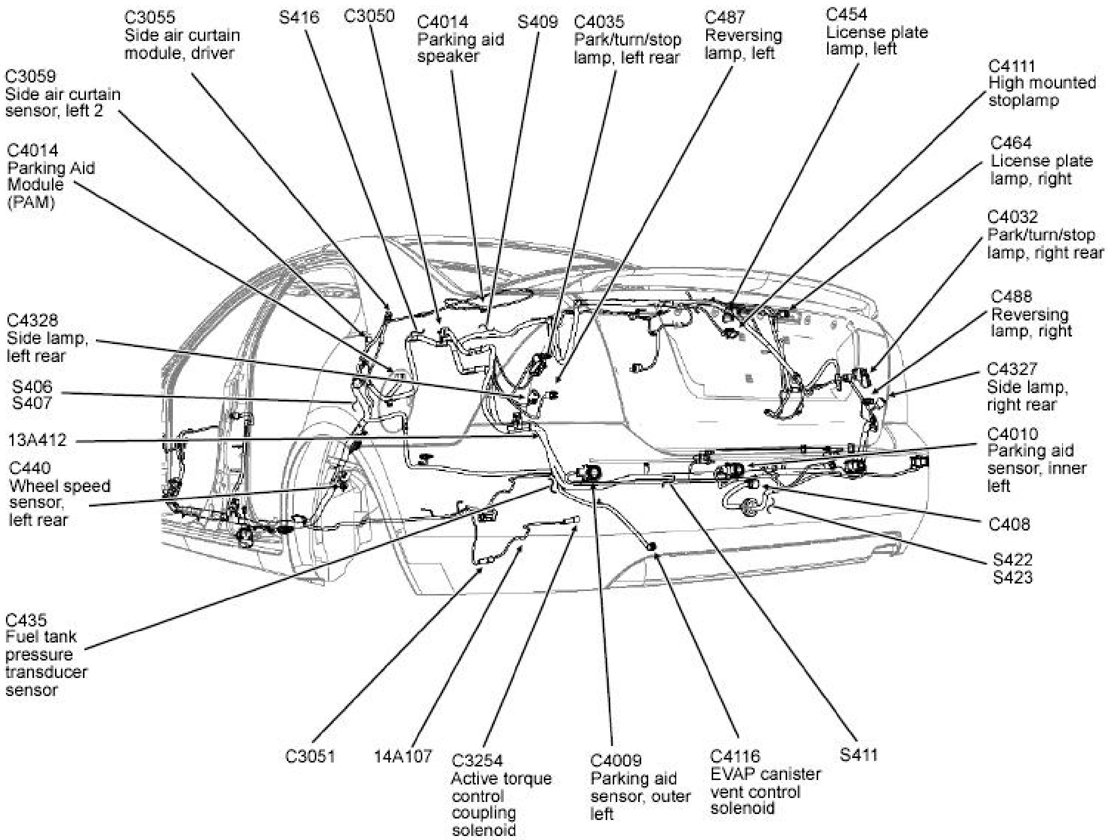


Fig. 44: Rear Vehicle Overview
Courtesy of FORD MOTOR CO.

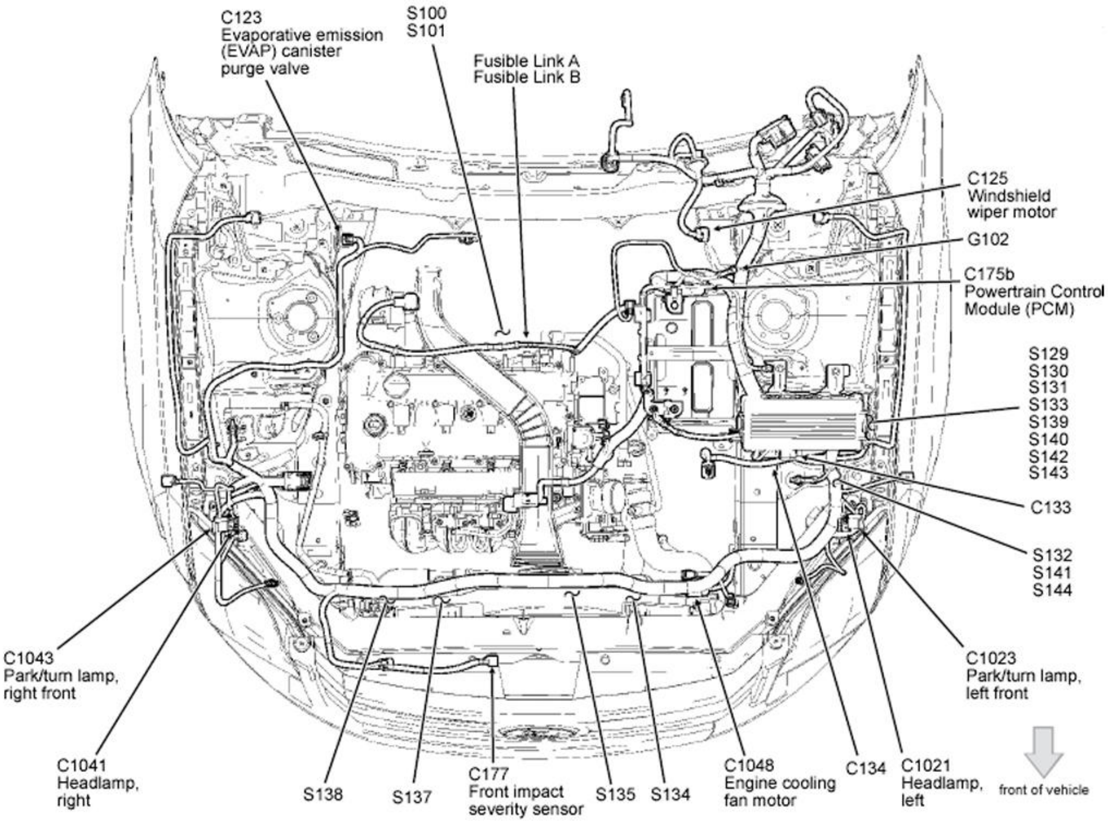


Fig. 45: Engine Overview
Courtesy of FORD MOTOR CO.

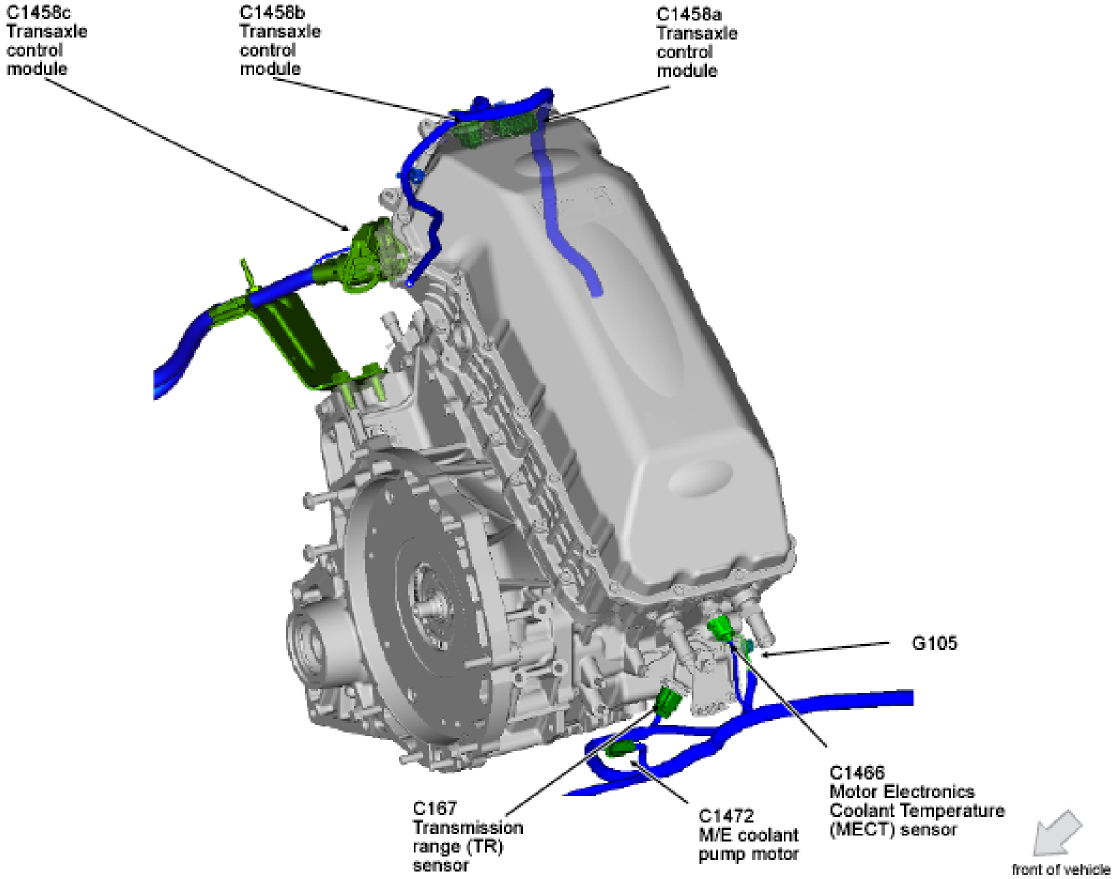
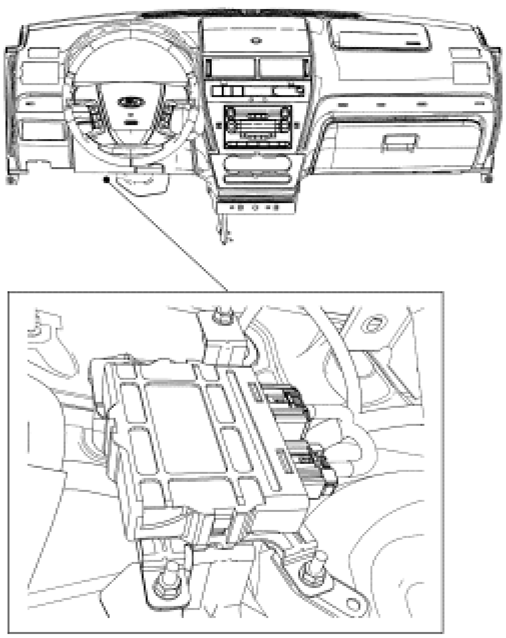


Fig. 46: Transaxle Assembly
Courtesy of FORD MOTOR CO.



N0041823

Fig. 47: Transmission Control Module (TCM)
Courtesy of FORD MOTOR CO.

2008 ENGINE PERFORMANCE

Electronic Engine Controls - 3.5L - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A	-
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-
Penetrating and Lock Lubricant XL-1 (US); CXC-51-A (Canada)	-	-

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Camshaft position (CMP) sensor bolts	10	-	89
Catalyst monitor sensor	48	35	-
Crankshaft position (CKP) sensor bolt	10	-	89
Cylinder head temperature (CHT) sensor	10	-	89
Heated oxygen sensor (HO2S)	48	35	-
Heat shield bolt and nut	10	-	89
Knock sensor (KS) bolt	20	15	-
Mass airflow (MAF) sensor screws	2	-	18
PCM bolts	8	-	71
Variable camshaft timing (VCT) oil control solenoid bolts	10	-	89

DESCRIPTION AND OPERATION

ELECTRONIC ENGINE CONTROLS

The electronic engine controls consist of the:

- PCM.

- cylinder head temperature (CHT) sensor.
- camshaft position (CMP) sensor.
- crankshaft position (CKP) sensor.
- mass air flow (MAF) sensor.
- heated oxygen sensor (HO2S).
- catalyst monitor sensor.
- variable camshaft timing (VCT) oil control solenoid.
- knock sensor (KS).

The PCM carries out the following functions:

- accepts input from various engine sensors to compute the fuel flow rate necessary to maintain a prescribed air/fuel ratio throughout the entire engine operational range.
- outputs a command to the fuel injectors to meter the appropriate quantity of fuel.

The CHT sensor:

- sends the PCM a signal indicating cylinder head temperature.
- resistance decreases as cylinder head temperature increases.

The CMP sensor:

- sends the PCM a signal indicating camshaft position used for fuel synchronization.

The CKP sensor:

- sends the PCM a signal indicating crankshaft position.
- is essential for calculating spark timing.

The MAF sensor:

- uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool.

The HO2S:

- creates a voltage signal dependent on exhaust oxygen content.
- provides feedback information to the PCM used to calculate fuel delivery.

The catalyst monitor sensor:

- monitors oxygen content after it flows through the catalytic converter.
- provides a voltage to the PCM used to calculate catalytic converter integrity.

The KS:

- is used to detect engine detonation.
- sends a voltage signal to the PCM.
- is able to provide a signal which retards the ignition timing, as necessary.

The VCT oil control solenoid:

- is an electrically controlled hydraulic valve that directs engine oil to the camshaft phaser. Once the PCM transmits a signal, the solenoid moves a valve spool, directing oil into the camshaft phaser cavity. This action changes valve timing by either inducing an advance or retard condition. The camshaft is, thereby repositioned in relation to crankshaft timing and allows for optimum engine performance and lower emissions.

DIAGNOSTIC TESTS

ELECTRONIC ENGINE CONTROLS

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

CAMSHAFT POSITION (CMP) SENSOR

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

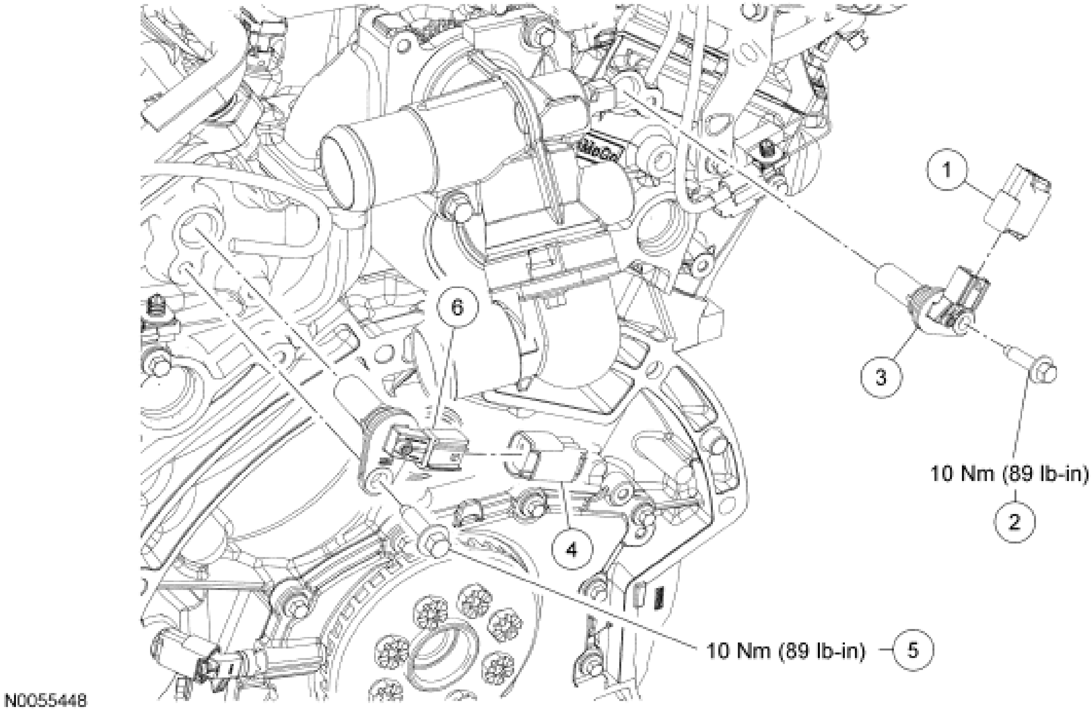


Fig. 1: Exploded View Of Camshaft Position (CMP) Sensor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	RH camshaft position (CMP) sensor electrical connector
2	W503279	RH CMP sensor bolt
3	6B288	RH CMP sensor
4	14A464	LH CMP sensor electrical connector
5	W503279	LH CMP sensor bolt
6	6B288	LH CMP sensor

REMOVAL AND INSTALLATION

1. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.
2. Disconnect the camshaft position (CMP) sensor electrical connector.
3. Remove the bolt and the CMP sensor.
   - To install, tighten to 10 Nm (89 lb-in).

NOTE: Lubricate the CMP sensor O-ring seal with clean engine oil.

4. To install, reverse the removal procedure.

CRANKSHAFT POSITION (CKP) SENSOR

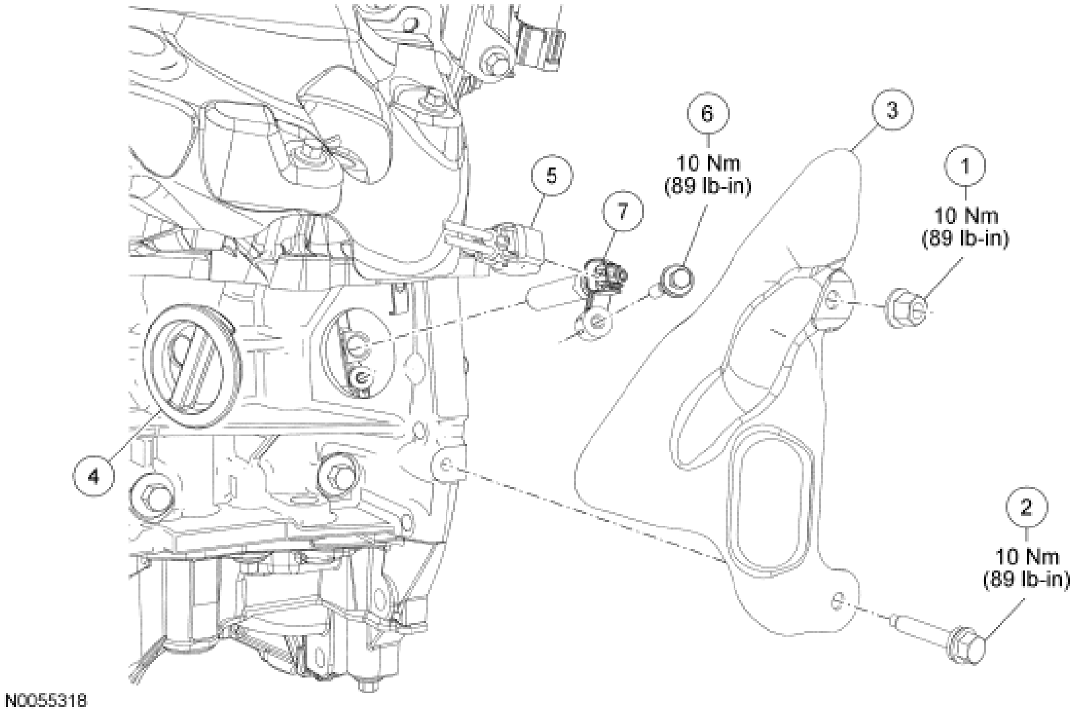


Fig. 2: Exploded View Of Crankshaft Position (CKP) Sensor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701542	Heat shield nut
2	W701669	Heat shield bolt
3	6K342	Heat shield
4	6C070	Rubber grommet cover
5	14A464	Crankshaft position (CKP) sensor electrical connector
6	6D327	CKP sensor bolt
7	6C315	CKP sensor

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the LH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.
3. Remove the bolt, nut and the heat shield.
   - To install, tighten to 10 Nm (89 lb-in).
4. Remove the rubber grommet cover.
5. Disconnect the crankshaft position (CKP) sensor electrical connector.
6. Remove the bolt and the CKP sensor.
   - To install, tighten to 10 Nm (89 lb-in).

7. To install, reverse the removal procedure.

POWERTRAIN CONTROL MODULE (PCM)

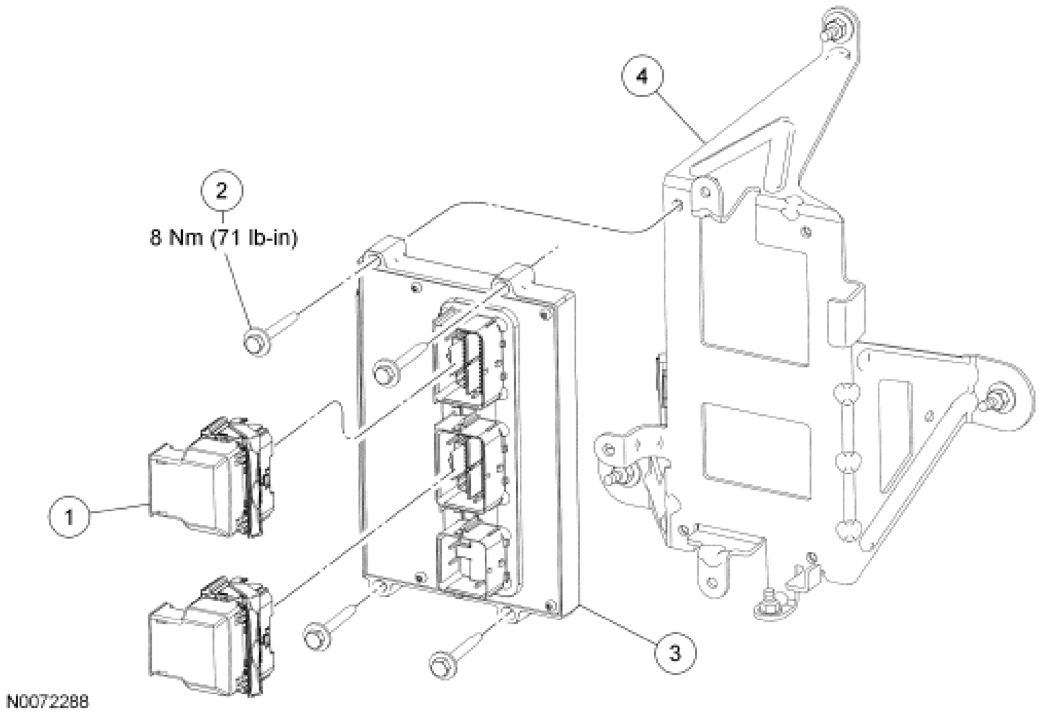


Fig. 3: Exploded View Of Powertrain Control Module (PCM) With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	PCM electrical connector (part of 12B637) (2 required)
2	W505428	PCM bolt (4 required)
3	12A650	PCM
4	12A659	PCM bracket

REMOVAL

NOTE: PCM replacement DOES NOT require new keys or programming of keys.

1. Retrieve the module configuration. Carry out the module configuration retrieval steps of the Programmable Module Installation procedure. For additional information, refer to **MODULE CONFIGURATION** article.
2. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Disconnect the 2 PCM electrical connectors.
4. Remove the 4 bolts and the PCM.

INSTALLATION

1. Install the PCM and the bolts.
    - Tighten to 8 Nm (71 lb-in).
2. Connect the 2 PCM electrical connectors.
3. Install the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
4. Restore the module configuration. Carry out the module configuration restore steps of the Programmable Module Installation procedure. For additional information, refer to **MODULE CONFIGURATION** article.
5. Reprogram the passive anti-theft system (PATS). Carry out the Parameter Reset procedure. For additional information, refer to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

MASS AIR FLOW (MAF) SENSOR

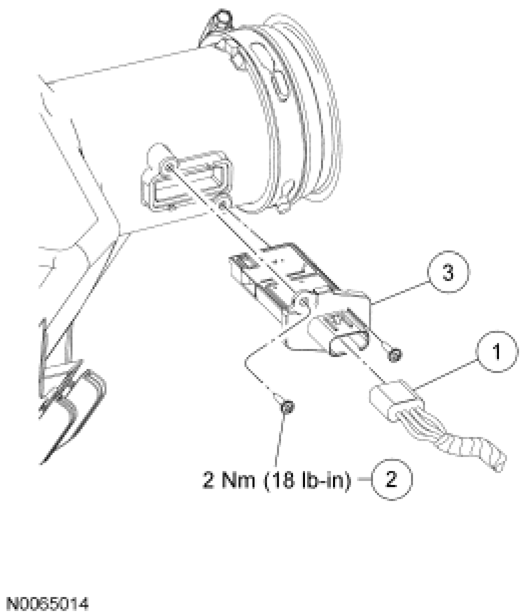


Fig. 4: Exploded View Of Mass Air Flow (MAF) Sensor With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Mass air flow (MAF) sensor electrical connector
2	W709287	MAF sensor screw (2 required)
3	12B579	MAF sensor

REMOVAL AND INSTALLATION

1. Disconnect the mass air flow (MAF) sensor electrical connector.
2. Remove the 2 screws and the MAF sensor.
    - To install, tighten to 2 Nm (18 lb-in).
3. To install, reverse the removal procedure.

CYLINDER HEAD TEMPERATURE (CHT) SENSOR

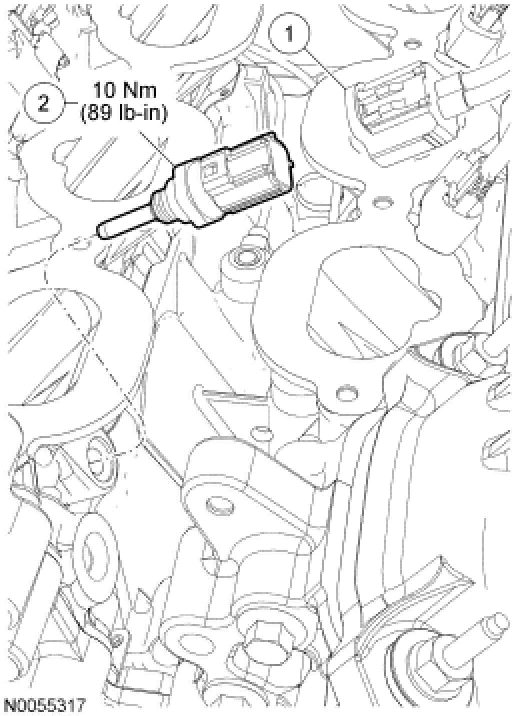


Fig. 5: Exploded View Of Cylinder Head Temperature (CHT) Sensor With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Cylinder head temperature (CHT) sensor electrical connector
2	6G004	CHT sensor

1. Remove the lower intake manifold. For additional information, refer to **ENGINE - 3.5L** article.
2. Disconnect the cylinder head temperature (CHT) sensor electrical connector.
3. Remove and discard the CHT sensor.
    - To install, tighten to 10 Nm (89 lb-in).
4. To install, reverse the removal procedure.
    - Do not reuse the CHT sensor, install a new sensor.

HEATED OXYGEN SENSOR (HO2S) AND CATALYST MONITOR SENSOR - EXPLODED VIEW

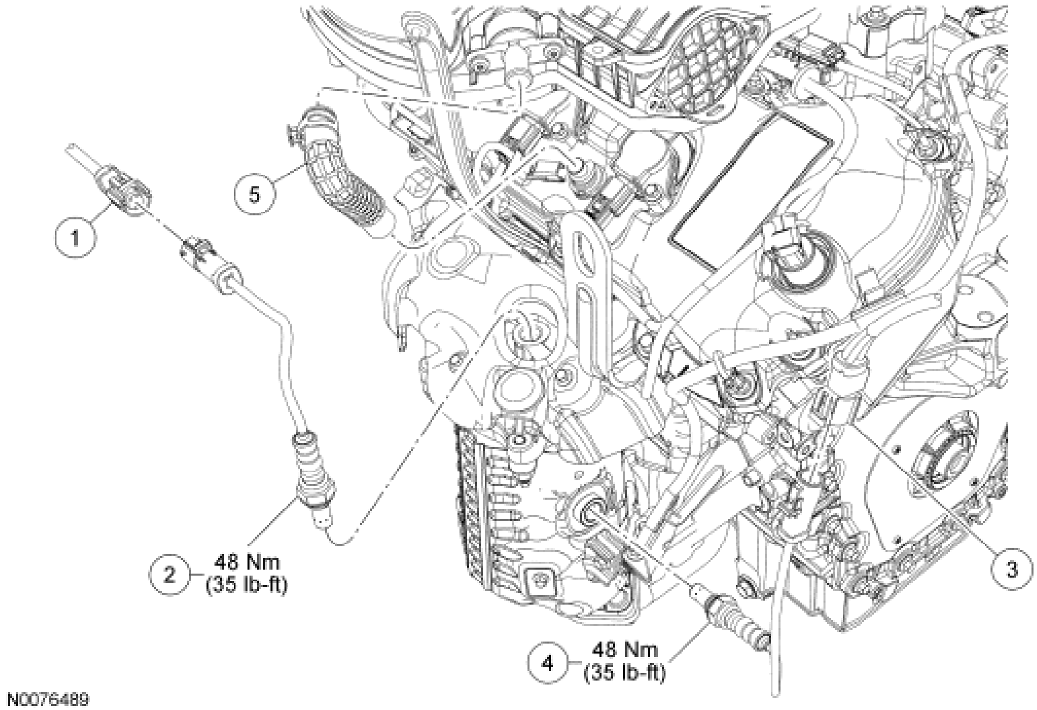


Fig. 6: Exploded View Of Heated Oxygen Sensor (HO2S) & Catalyst Monitor Sensor With Torque Specifications - RH Sensors
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Heated oxygen sensor (HO2S) electrical connector
2	9F472	HO2S
3	14A464	Catalyst monitor sensor electrical connector
4	9G444	Catalyst monitor sensor
5	6A664	PCV hose

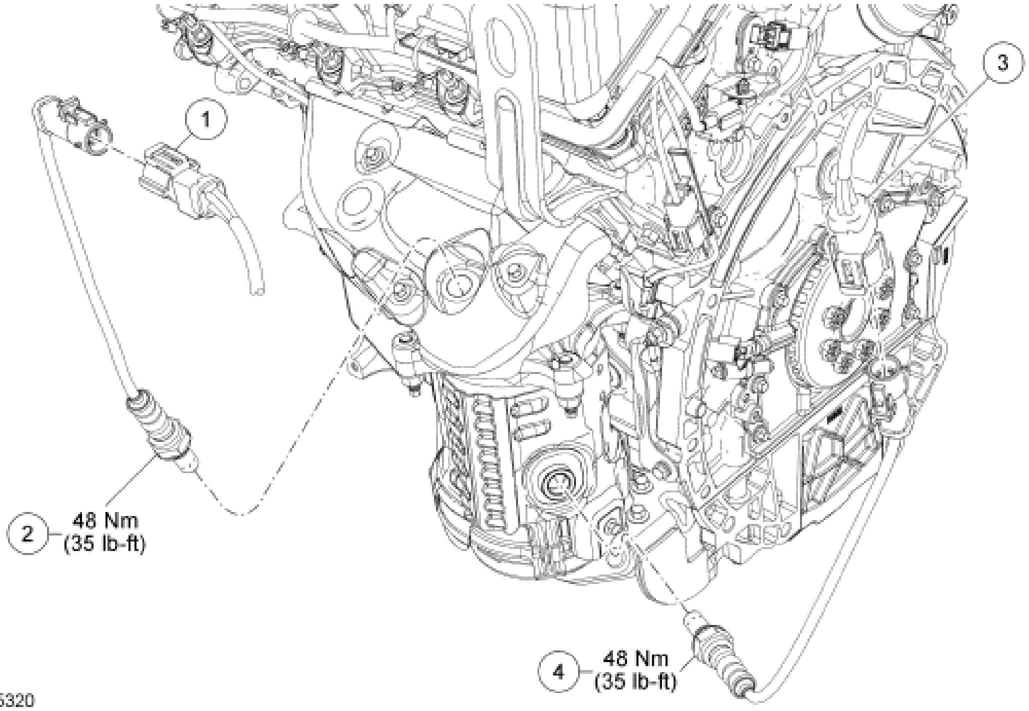


Fig. 7: Exploded View Of Heated Oxygen Sensor (HO2S) & Catalyst Monitor Sensor With Torque Specifications - LH Sensors
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Heated oxygen sensor (HO2S) electrical connector
2	9F472	HO2S
3	14A464	Catalyst monitor sensor electrical connector
4	9G444	Catalyst monitor sensor

1. For additional information, refer to the procedures.

HEATED OXYGEN SENSOR (HO2S)

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	Socket, Exhaust Gas Oxygen Sensor	303-476 (T94P-9472-A)

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Penetrating and Lock Lubricant XL-1 (US); CXC-51-A (Canada)	-

REMOVAL AND INSTALLATION

RH sensor

1. Remove the PCV hose.

   Both sensors

2. Disconnect the heated oxygen sensor (HO2S) electrical connector.

   NOTE: If necessary, lubricate the sensor threads with penetrating and lock lubricant to assist in removal.

3. Using the special tool, remove the HO2S.
   - To install, tighten to 48 Nm (35 lb-ft).

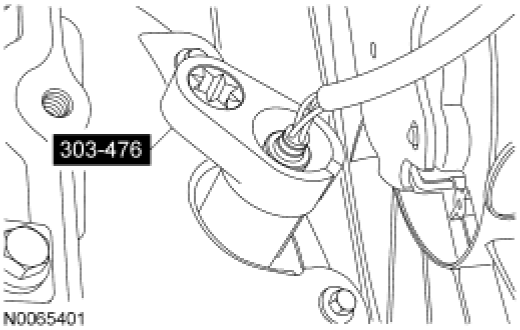


Fig. 8: Removing Heated Oxygen Sensor (HO2S) Using Special Tool (303-476)
Courtesy of FORD MOTOR CO.

NOTE: Apply a light coat of anti-seize lubricant to the threads of the HO2S.

4. To install, reverse the removal procedure.

CATALYST MONITOR SENSOR

Special Tools

Illustration	Tool Name	Tool Number
	Socket, Exhaust Gas Oxygen	

 ST1185-A	Sensor	303-476 (T94P-9472-A)

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Penetrating and Lock Lubricant XL-1 (US); CXC-51-A (Canada)	-

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the catalyst monitor sensor electrical connector.

NOTE: If necessary, lubricate the sensor threads with penetrating and lock lubricant to assist in removal.

3. Using the special tool, remove the catalyst monitor sensor.
   - To install, tighten to 48 Nm (35 lb-ft).

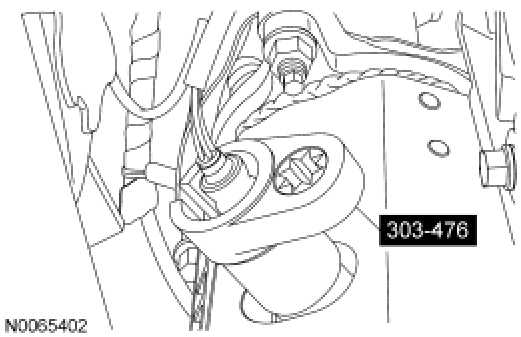


Fig. 9: Removing Catalyst Monitor Sensor Using Special Tool (303-476)
Courtesy of FORD MOTOR CO.

NOTE: Apply a light coat of anti-seize lubricant to the threads of the catalyst monitor sensor.

4. To install, reverse the removal procedure.

VARIABLE CAMSHAFT TIMING (VCT) OIL CONTROL SOLENOID

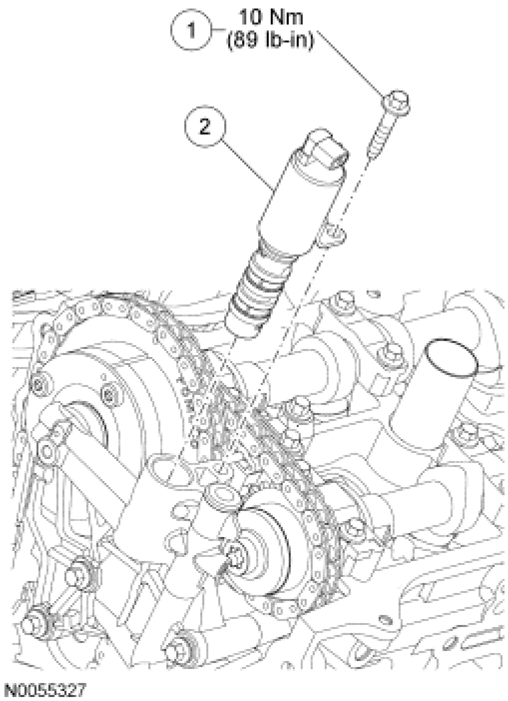


Fig. 10: Exploded View Of Variable Camshaft Timing (VCT) Oil Control Solenoid With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500215	Variable camshaft timing (VCT) oil control solenoid bolt
2	6B297	VCT oil control solenoid

REMOVAL AND INSTALLATION

1. Remove the LH or RH valve cover. For additional information, refer to **ENGINE - 3.5L** article.
2. Remove the bolt and the variable camshaft timing (VCT) oil control solenoid.
   - To install, tighten to 10 Nm (89 lb-in).
3. To install, reverse the removal procedure.

KNOCK SENSOR (KS)

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

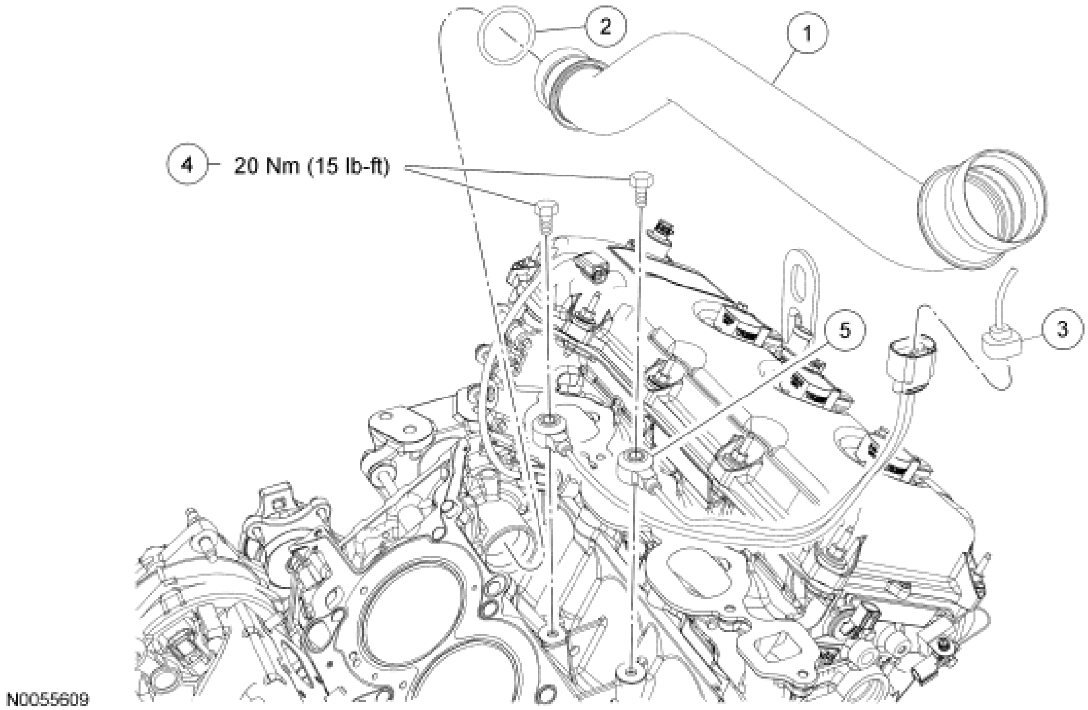


Fig. 11: Exploded View Of Knock Sensor (KS) With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9N271	Coolant tube
2	8565	O-ring seal
3	14A464	Knock sensor (KS) electrical connector
4	W704749	KS bolts (2 required)
5	12A699	KS

REMOVAL AND INSTALLATION

1. Remove the thermostat housing. For additional information, refer to **ENGINE COOLING** article.
2. Remove the lower intake manifold. For additional information, refer to **ENGINE - 3.5L** article.
3. Remove the coolant tube.
   - Discard the O-ring seal.
4. Disconnect the knock sensor (KS) electrical connector.
5. Remove the 2 bolts and the KS.
   - To install, tighten to 20 Nm (15 lb-ft).
6. To install, reverse the removal procedure.
   - Lubricate the new O-ring seal with clean engine coolant.

EMISSION APPLICATIONS

2008 Ford - Lincoln MKZ

EMISSION APPLICATIONS

2008 MKZ

Engine & Fuel System	(1) Emission Control Systems & Devices	EGR Test No.
3.5L (215") V6 SFI	**PCV, EVAP, TWC, FR, SPK, HO2S, CEC, (2) MIL** EVAP-CPV, EVAP-CVS, EVAP-FTPS, EVAP-FVCV, EVAP-VC, SPK-CC	...

(1) Major emission control systems and devices are listed in bold type. Components and other related devices are listed in light type.

(2) Computer controlled.

2008 ENGINE

Engine - 3.5L - MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6	-
Motorcraft Metal Surface Prep ZC-31-A	-	-
Motorcraft Premium Gold Engine Coolant with Bittering Agent (bittered in US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	5.2L (5.5 qt) includes filter change
Silicone Gasket Remover ZC-30	-	-
Thread Sealant with PTFE TA-24	WSK-M2G350-A2	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Engine	
Displacement	3.5L (4V) (214 CID)
No. cylinders	6
Bore/stroke	92.5/86.7 mm (3.641/3.413 in)
Fire order	1-4-2-5-3-6
Oil pressure	Minimum 30 psi @ 1,500 RPM with engine at normal operating temperature
Spark plug	AYSF-22FM Gap = 1.29-1.45 mm (0.051-0.057 in)
Compression ratio	10.3:1
Engine weight (without accessory drive components)	161 kg (355 lb)
Engine and transaxle weight (without accessory	260.8 kg (575 lb)

drive components)	
Cylinder Head and Valve Train	
Cylinder head gasket surface flatness[a]	-
Combustion chamber volume	55.84 cc (3.41 CI)
Valve tappet clearance intake	0.15-0.25 mm (0.006-0.01 in)
Valve tappet clearance - exhaust	0.300-0.400 mm (0.0118-0.0157 in)
Valve guide bore inner diameter	5.519-5.549 mm (0.217-0.218 in)
Valve stem diameter - intake	5.479-5.497 mm (0.2157-0.2164 in)
Valve stem diameter - exhaust	5.466-5.484 mm (0.2151-0.2159 in)
Valve stem-to-guide clearance - intake	0.022-0.070 mm (0.0008-0.0027 in)
Valve stem-to-guide clearance - exhaust	0.035-0.083 mm (0.0013-0.032 in)
Valve head diameter - intake	36.82-37.18 mm (1.44-1.46 in)
Valve head diameter - exhaust	30.82-31.18 mm (1.21-1.22 in)
Valve face runout	0.05 mm (0.0001 in)
Valve face angle	90.50-91.50 degrees
Valve seat width - intake	1.3-1.5 mm (0.051-0.059 in)
Valve seat width - exhaust	1.4-1.6 mm (0.055-0.062 in)
Valve seat runout	0.04 mm (0.0001 in) MAX
Valve seat angle	89.0-91.0 degrees
Valve spring free length (approx.)	48.4 mm (1.90 in)
Valve spring compression pressure (N @ spec. length)	510 N @ 27.32 mm (115 lbs @ 1.08 in)
Valve spring installed height	37.0 mm (1.45 in)
Valve spring installed height pressure (N @ spec. length)	235 N @ 37.0 mm (53 lbs @ 1.45 in)
Valve spring installed pressure - service limit	10% force loss @ specified height
Camshaft	
Theoretical valve lift @ 0 lash	9.6798 mm (0.38 in)
Lobe lift - intake	9.6798 mm (0.38 in)
Lobe lift - exhaust	9.6798 mm (0.38 in)
Allowable lobe lift loss	0.062 mm (0.0024 in)

Camshaft journal bore inside diameter - 1st journal	31.0375-31.0625 mm (1.221-1.222 in)
Camshaft journal bore inside diameter - intermediate journals	25.9875-26.0125 mm (1.023-1.024 in)
Camshaft bearing outside diameter - 1st journal	30.993-31.013 mm (1.2202-1.2209 in)
Camshaft bearing outside diameter - intermediate journals	25.937-25.963 mm (1.021-1.022 in)
Camshaft journal-to-bearing clearance, 1st journal - service limit	0.070 mm (0.0027 in) MAX
Camshaft journal-to-bearing clearance, intermediate journals - service limit	0.0755 mm (0.0029 in) MAX
Runout	0.040 mm (0.0015 in) MAX
End play - standard	0.032-0.170 mm (0.0012-0.0066 in)
End play - service limit	0.190 mm (0.00748 in) MAX
Cylinder Block	
Cylinder bore diameter - grade 1	-
Cylinder bore diameter - grade 2	-
Cylinder bore diameter - grade 3	-
Cylinder bore maximum taper	-
Cylinder bore maximum out-of-round - limit	-
Cylinder bore maximum out-of-round - service limit	-
Main bearing bore inside diameter	72.400-72.424 mm (2.8503-2.8513 in)
Head gasket surface flatness	-
Head gasket surface finish	-
Crankshaft	
Main bearing journal diameter	67.5 mm (2.657 in)
Main bearing journal maximum taper	0.004 mm (0.00015 in)
Main bearing journal maximum out-of-round	0.006 mm (0.00023 in)
Main bearing journal-to-cylinder block clearance	-
Connecting rod journal diameter	55.983-56.003 mm (2.204-2.205 in)
Connecting rod journal maximum taper	0.004 mm (0.00015 in)
Connecting rod journal maximum out-of-round	0.006 mm (0.00023 in)
Crankshaft maximum end play	0.101-0.291 mm (0.0039-0.0114 in)
Piston and Connecting Rod	
Piston diameter - single grade	92.476-92.490 mm (3.6407-3.6413 in)
Piston-to-cylinder bore clearance	0.010 to 0.044 mm (0.0003-0.0017 in)
Piston ring end gap - compression (top, gauge diameter)	0.15-0.25 mm (0.0059-0.0098 in)
Piston ring end gap - compression (bottom, gauge	0.30-0.55 mm (0.0118-0.0216 in)

diameter)	
Piston ring end gap - oil ring (steel rail, gauge diameter)	0.15-0.45 mm (0.0059-0.0177 in)
Piston ring groove width - compression (top)	1.230-1.25 mm (0.0484-0.0492 in)
Piston ring groove width - compression (bottom)	1.530-1.55 mm (0.0602-0.0610 in)
Piston ring groove width - oil ring	2.53-2.55 mm (0.0996-0.1003 in)
Piston ring width - upper comp ring	1.17-1.19 mm (0.0460-0.0468 in)
Piston ring width - lower comp ring	1.47-1.49 mm (0.0578-0.0586 in)
Piston ring-to-groove clearance (upper and lower compression rings)	0.040-0.080 mm (0.0015-0.0031 in)
Piston pin bore diameter	23.002-23.006 mm (0.9055-0.9057 in)
Piston pin diameter	22.998-23.000 mm (0.9054-0.9055 in)
Piston pin length	55.975 mm (2.203 in)
Piston pin-to-piston fit	0.002 to 0.008 mm (0.00007-0.0003 in)
Piston-to-connecting rod clearance	2.7 mm (0.1 in)
Connecting rod-to-pin clearance - standard	0.007-0.021 mm (0.0002-0.0008 in)
Connecting rod-to-pin clearance - service limit	-
Connecting rod pin bore diameter	23.007-23.019 mm (0.905-0.906 in)
Connecting rod length (center-to-center)	152.68 mm (6.01 in)
Connecting rod maximum allowed bend	0.038 mm (0.0014 in)
Connecting rod maximum allowed twist	0.050 mm (0.0019 in)
Connecting rod bearing bore diameter - grade 1	59.866-59.872 mm (2.3569-2.3571 in)
Connecting rod bearing bore diameter - grade 2	59.873-59.879 mm (2.3572-2.3574 in)
Connecting rod bearing bore diameter - grade 3	59.880-59.886 mm (2.3574-2.3577 in)
Connecting rod bearing-to-crankshaft clearance	-
Connecting rod side clearance (assembled to crank) - standard	0.175-0.425 mm (0.0068-0.0167 in)
Connecting rod side clearance (assembled to crank) - service limit	-

[a] Refer to the procedure.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
A/C compressor bolts and nut	25	18	-
A/C compressor stud	9	-	80
A/C manifold bolt	25	18	-
A/C tube fitting bolts	8	-	71
A/C tube retaining clamp bolts and nut	10	-	89
Accessory drive belt tensioner bolts	10	-	89
Battery cable power feed cable nut	6	-	53
Block drain plug (large)	40	30	-
Block drain plug (small)[a]	-	-	-
Block heater	40	30	-
Camshaft cap bolts[b]	-	-	-
Camshaft position (CMP) sensor bolts	10	-	89
Camshaft sprocket bolts[b]	-	-	-
Catalytic converter nuts	40	30	-
Catalytic converter bracket-to-engine bolts and nuts	40	30	-
Catalytic converter bracket-to-converter bolts	20	15	-
Catalytic converter-to-exhaust manifold studs	25	18	-
Coolant pump bolts[b]	-	-	-
Crankshaft position (CKP) sensor bolt	10	-	89
Crankshaft pulley bolt[b]	-	-	-
Crankcase rear seal retainer plate bolts[b]	-	-	-
Cylinder head bolts[b]	-	-	-
Cylinder head temperature (CHT) sensor	10	-	89
Engine coolant degas bottle nut and bolt	9	-	80
Engine front cover bolts[b]	-	-	-
Engine lifting eye bolts	24	18	-
Engine mount brace bolts	25	18	-
Engine mount bracket bolts	24	18	-
Engine mount studs	18	13	-
Engine mount-to-engine nuts	63	46	-
Engine mount-to-frame bolts	55	41	-
Engine mount-to-frame nut	63	46	-
Engine oil filter[c]	-	-	-
Engine oil pressure (EOP) switch	18	13	-
Engine roll-restrictor bolt	90	66	-
Exhaust manifold heat shield bolts	14	10	-

Exhaust manifold nuts[b]	-	-	-
Exhaust manifold studs	12	9	-
Exhaust Y-pipe nuts	40	30	-
Flexplate bolts	80	59	-
Fuel rail bolts	10	-	89
Generator bolts	48	35	-
Generator B+ terminal nut	6	-	53
Ground wire-to-body bolt	12	9	-
Ground wire-to-engine mount bolt	10	-	89
Ground wire-to-transaxle bolt	12	9	-
Halfshaft carrier bearing bracket bolts - all wheel drive (AWD)	23	17	-
Halfshaft carrier bearing bracket bolts and stud bolt - front wheel drive (FWD)	55	41	-
Heated oxygen sensor (HO2S)	48	-	35
Ignition coil-on-plug bolts	7	-	62
Intermediate steering shaft bolt	23	17	-
Knock sensor (KS) bolts	20	15	-
Lower ball joint nuts	200	148	-
Lower control arm-to-strut through bolt	103	76	-
Lower intake manifold bolts[b]	-	-	-
Oil filter adapter large bolt	57	42	-
Oil filter adapter small bolt	10	-	89
Oil pan bolts[b]	-	-	-
Oil pan-to-transaxle bolts	48	35	-
Oil pan drain plug	27	20	-
Oil pump bolts	10	-	89
Oil pump screen and pickup tube bolts	10	-	89
Power steering pressure (PSP) hose bracket and nut	9	-	80
PSP tube banjo bolt	37	27	-
PSP tube bracket-to-cylinder head bolt	10	-	89
Power steering pump bolts	25	18	-
Power transfer unit (PTU)	90	66	-
PTU bracket bolts	70	52	-
Rear drive shaft-to-PTU flange bolts	70	52	-
Stabilizer bar link nuts	40	30	-
Starter bolts	26	19	-
Starter B+ terminal nut	12	9	-
Starter S terminal nut	5	-	44
Subframe bracket bolts	103	76	-
Subframe nuts	150	111	-
Thermostat housing bolts	10	-	89

Tie-rod end nuts	48	35	-
Timing chain guide bolts	10	-	89
Timing chain tensioner bolts	10	-	89
Torque converter-to-flexplate nuts	36	27	-
Transaxle control cable bracket bolts and nut	12	9	-
Transaxle mount bracket bolt and nut	80	59	-
Transaxle mount through bolt and nut	90	66	-
Transaxle-to-engine bolts	48	35	-
Upper intake manifold bolts[b]	-	-	-
Upper intake manifold bracket-to-engine bolt - long bracket (early build engines)	24	18	-
Upper intake manifold bracket-to-engine bolt - short bracket	10	-	89
Upper intake manifold-to-bracket bolt - long bracket (early build engines)	10	-	89
Upper intake manifold-to-bracket bolt - short bracket	10	-	89
Variable camshaft timing (VCT) assembly bolts[b]	-	-	-
VCT housing bolts[b]	-	-	-
Valve cover bolts and stud bolts[b]	-	-	-
Wiring harness retainer bolt and stud bolt	10	-	89
Wiring harness retainer nuts	9	-	80

[a] Tighten to 20 Nm (15 lb-ft) plus an additional 180 degrees.

[b] Refer to the procedure.

[c] Tighten to 5 Nm (44 lb-in) plus an additional 180 degrees.

DESCRIPTION AND OPERATION

ENGINE

The 3.5L (4V) is a V-6 engine with the following features:

- Dual overhead camshafts
- Four valves per cylinder
- Sequential multi-port fuel injection Sequential Multi-Port Fuel Injection (SFI)
- An aluminum lower intake manifold and a composite upper intake manifold
- Aluminum cylinder heads
- An aluminum, 60-degree V-cylinder block
- Timing chain driven coolant pump
- Variable Camshaft Timing (VCT) system
- The electronic ignition system with 6 ignition coils

Identification

For quick identification, refer to the safety certification decal.

- The decal is located on the LH front door lock face panel.
- An engine identification label is also attached to the engine.
- The symbol code on the identification tag identifies each engine for determining parts usage; for instance, engine displacement in liters or cubic inch displacement and model year.

Exhaust Emission Control System

Operation and required maintenance of the exhaust emission control devices used on this engine is covered in the **Introduction - Gasoline Engines** article.

Induction System

The SFI provides the fuel/air mixture needed for combustion in the cylinders. The 6 solenoid-operated fuel injectors:

- are mounted between the fuel rail and the intake manifold.
- meter fuel into the air intake stream in accordance with engine demand.
- are positioned so that their tips direct fuel just ahead of the engine intake valves.

Valve Train

The valve train uses direct acting mechanical buckets (DAMB). The camshaft lobes are positioned directly above mechanical buckets which are positioned on top of the valves.

Variable Camshaft Timing (VCT) System

The VCT system changes intake camshaft timing dependent on engine speed, load and oil temperature. Oil pressure advances and retards camshaft timing to improve low-speed and high-speed engine performance, engine idle quality and exhaust emissions.

PCV System

All engines are equipped with a closed-type PCV system recycling the crankcase vapors to the upper intake manifold.

Lubrication System

The engine lubrication system is of the force-feed type in which oil is supplied under full pressure to the crankshaft, connecting rod bearings, timing chain tensioners and VCT solenoids. The flow of oil to the valve tappets and valve train is controlled by a restricting orifice located in the head gaskets.

Oil Pump

The lubrication system is designed to provide optimum oil flow to critical components of the engine through its entire operating range.

The heart of the system is a positive displacement internal gear oil pump.

Generically, this design is known as a gerotor pump, which operates as follows:

- The oil pump is mounted on the front face of the cylinder block.
- The inner rotor is piloted on the crankshaft post and is driven through flats on the crankshaft.
- System pressure is limited by an integral, internally-vented relief valve which directs the bypassed oil back to the inlet side of the oil pump.
- Oil pump displacement has been selected to provide adequate volume to make sure of correct oil pressure both at hot idle and maximum speed.
- The relief valve calibration protects the system from excessive pressure during high-viscosity conditions.
- The relief valve is designed to provide adequate connecting rod bearing lubrication under high-temperature and high-speed conditions.

Cooling System

The engine cooling system includes the following:

- Radiator
- Timing chain driven coolant pump
- Electric fan assembly(s)
- Degas bottle (aids in maintaining the correct volume of engine coolant)
- Coolant thermostat
- Coolant hoses

Engine Cylinder Identification

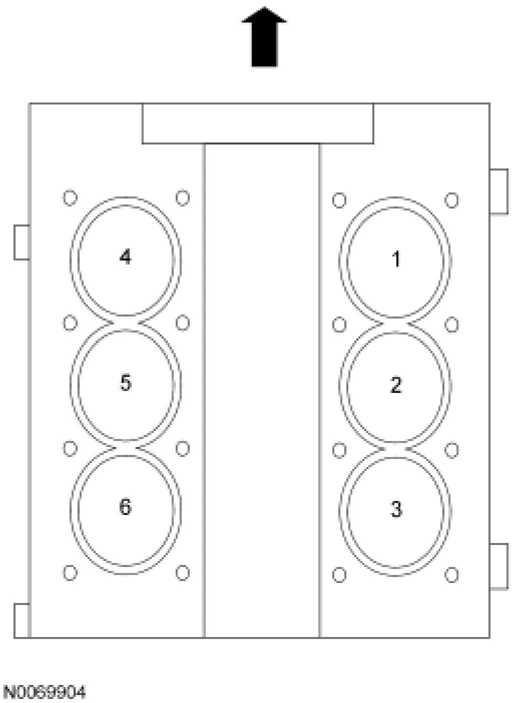


Fig. 1: Engine Cylinder Identification
Courtesy of FORD MOTOR CO.

DIAGNOSTIC TESTS

ENGINE

For basic engine mechanical concerns, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article. For driveability concerns, refer to the **Introduction - Gasoline Engines** article.

GENERAL PROCEDURES

VALVE CLEARANCE CHECK

1. Remove the valve covers. For additional information, refer to **Valve Cover - LH** and **Valve Cover - RH**.

   NOTE: The valve clearance must be measured with the camshaft at base circle. The engine will have to be rotated with the crankshaft pulley bolt to bring each valve to base circle.

2. Use a feeler gauge to measure the clearance of each valve and record its location. A mid-range clearance is the most desirable:
   - Intake: 0.15-0.25 mm (0.006-0.01 in)
   - Exhaust: 0.300-0.400 mm (0.0118-0.0157 in)

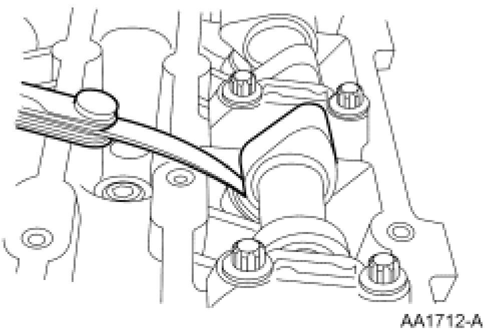


Fig. 2: Measuring Each Valve's Clearance Using A Feeler Gauge
Courtesy of FORD MOTOR CO.

NOTE: The number on the valve tappet reflects the thickness of the valve tappet. For example, a tappet with the number 3.310 has the thickness of 3.31 mm (0.13 in).

3. If any of the valve clearances are out of specification, select new tappets using this formula: tappet thickness = measured clearance + the base tappet thickness - most desirable thickness.

   Select the tappets and mark the installation location.

4. If required, install the new selected valve tappets in the marked locations. For additional information, refer to **Valve Tappets**.

IN-VEHICLE SERVICING

UPPER INTAKE MANIFOLD

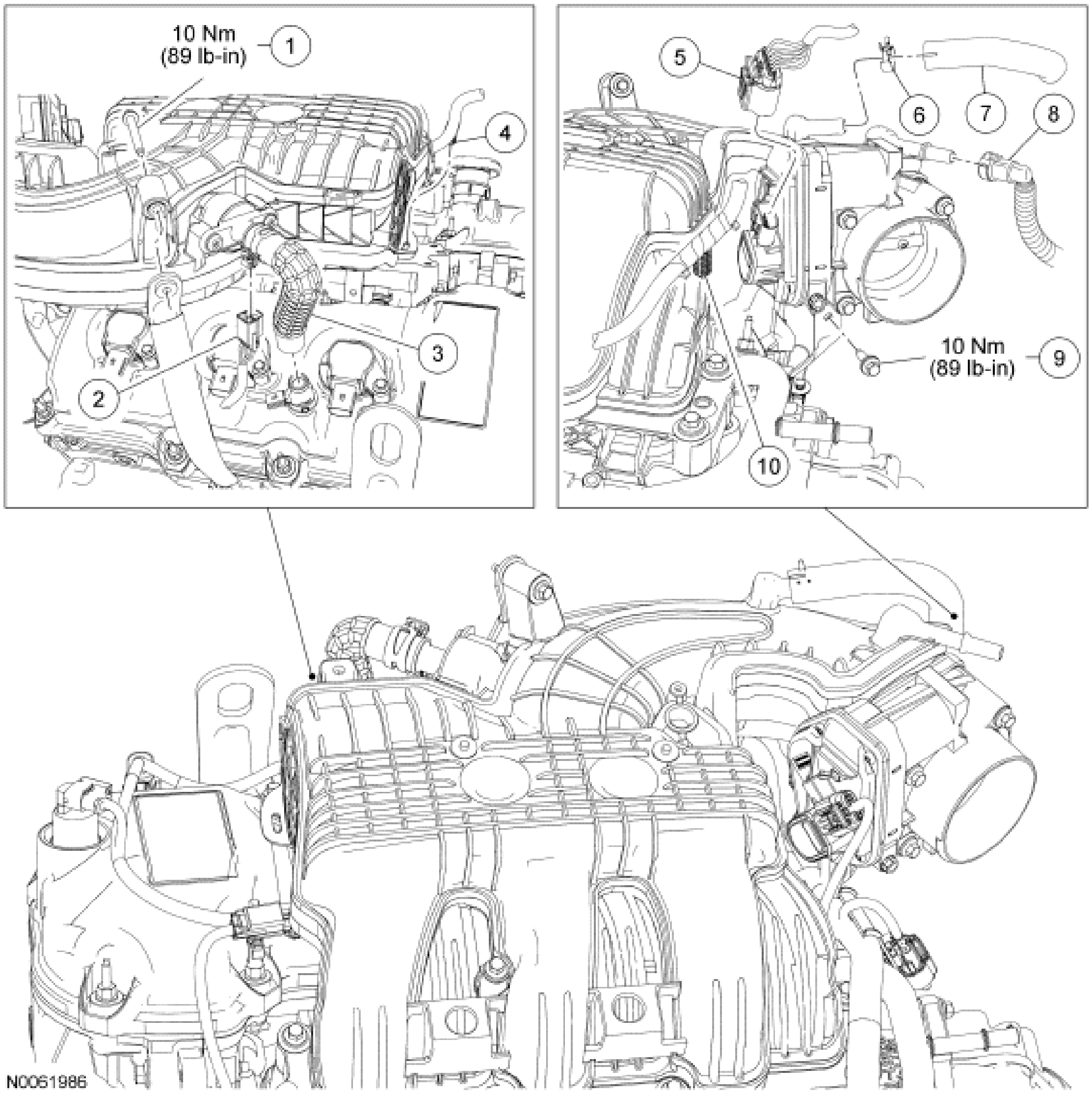


Fig. 3: Exploded View Of Upper Intake Manifold With Torque Specifications (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W503274	Upper intake manifold long support bracket bolt (early build engines)
2	14A464	Heated PCV electrical connector (part of 12C508) (early build engines)
3	6K817	PCV hose
4	13A506	Block heater wiring harness retainer (part of 6B018)
5	14A464	Throttle body (TB) electrical connector (part of 12C508)
6	CS16140	Brake booster-to-intake manifold vacuum hose clamp
7	6K817	Brake booster-to-intake manifold vacuum hose
8	9D661	Evaporative emissions (EVAP)-to-intake manifold tube

9	W503274	Upper intake manifold short support bracket bolt
10	-	Engine control wiring harness retainer (part of 12C508)

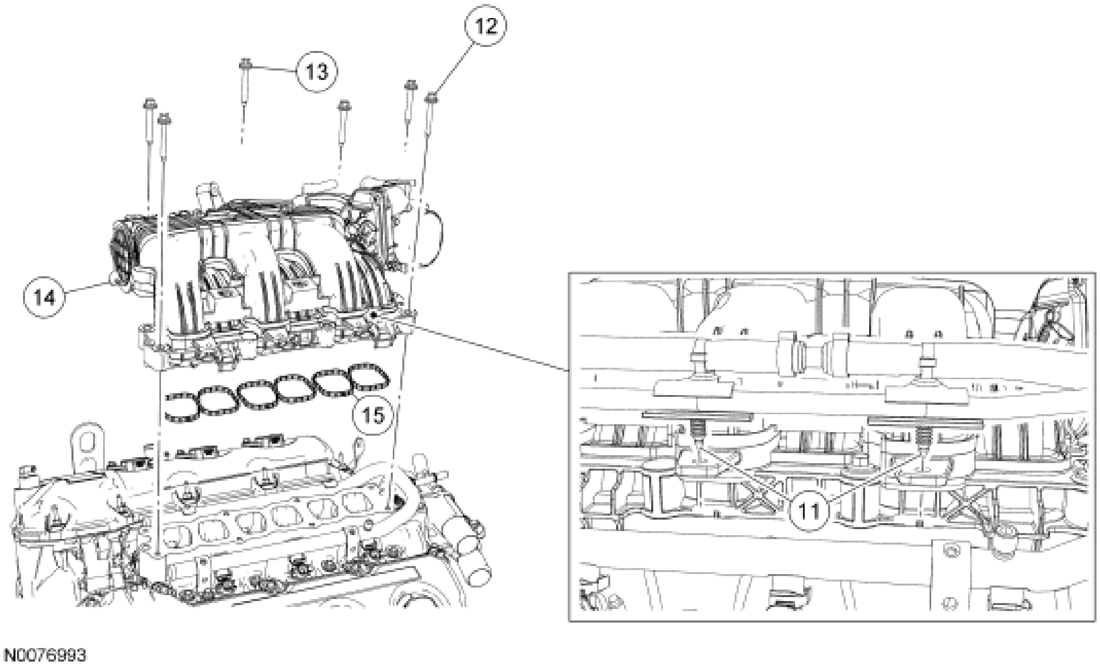


Fig. 4: Exploded View Of Upper Intake Manifold With Torque Specifications (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
11	13A506	Wire harness pin-type retainers (part of 14B060)
12	W503282	Upper intake manifold bolt (5 required)
13	W707083	Upper intake manifold bolt
14	9S455	Upper intake manifold
15	9H486	Upper intake manifold gasket (3 required)

REMOVAL

All engines

1. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.
2. Disconnect the throttle body (TB) electrical connector.
3. Disconnect the evaporative emissions (EVAP) tube from the intake manifold. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
4. Disconnect the brake booster vacuum hose from the intake manifold.

5. Disconnect the PCV tube from the PCV valve.

Early build engines

6. Remove the upper intake manifold long support bracket bolt.
7. Disconnect the heated PCV electrical connector.

All engines

8. Detach all the wiring harness retainers from the upper intake manifold.
9. If equipped, detach the cylinder block heater wiring harness retainer from the upper intake manifold.
10. Remove the upper intake manifold short support bracket bolt.
11. Remove the 6 bolts and the upper intake manifold.
    - Remove and discard the gaskets.
    - Clean and inspect all of the sealing surfaces of the upper and lower intake manifold.

INSTALLATION

All engines

1. Using new gaskets, install the upper intake manifold and the 6 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

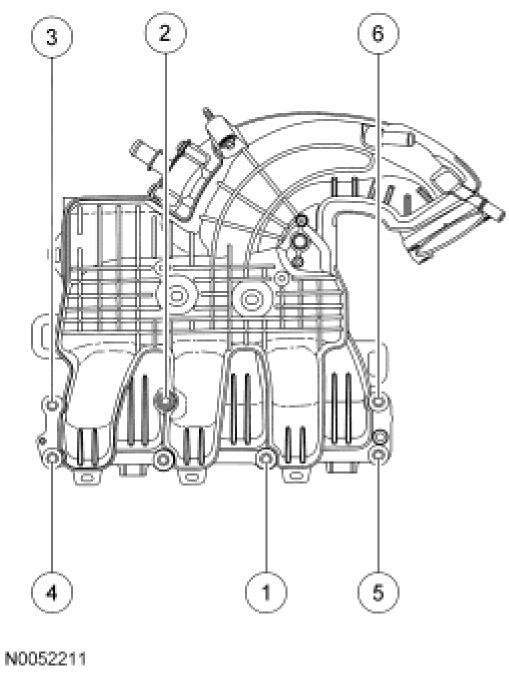


Fig. 5: Installing Upper Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

2. Install the upper intake manifold short support bracket bolt.
   - Tighten to 10 Nm (89 lb-in).
3. If equipped, attach the cylinder block heater wiring harness retainer to the upper intake manifold.
4. Attach all the wiring harness retainers to the upper intake manifold.
5. Connect the PCV tube to the PCV valve.

   Early build engines

6. Connect the heated PCV electrical connector.
7. Install the upper intake manifold long support bracket bolt.
   - Tighten to 10 Nm (89 lb-in).

   All engines

8. Connect the brake booster vacuum hose to the intake manifold.
9. Connect the EVAP tube to the intake manifold. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
10. Connect the TB electrical connector.
11. Install the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.

LOWER INTAKE MANIFOLD

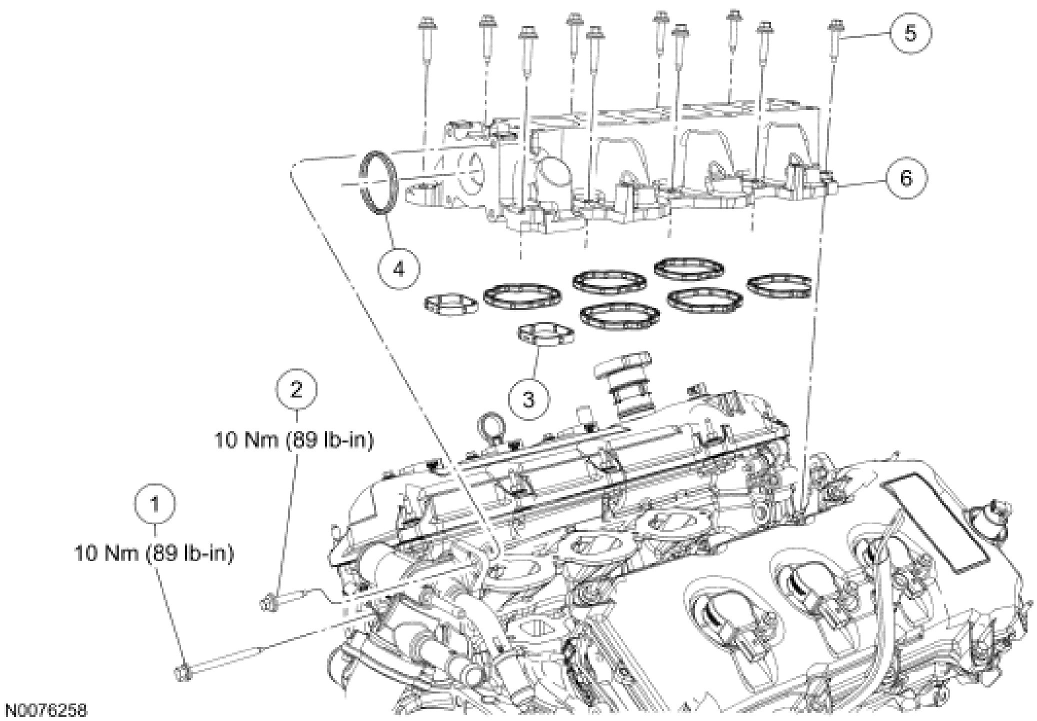


Fig. 6: Exploded View Of Lower Intake Manifold With Torque Specifications

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W708607	Thermostat housing-to-lower intake manifold bolt
2	W503279	Thermostat housing-to-lower intake manifold bolt
3	9439	Lower intake manifold gasket (8 required)
4	8A571	Thermostat housing gasket
5	W503279	Lower intake manifold bolt (10 required)
6	9K461	Lower intake manifold

REMOVAL

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Drain the cooling system. For additional information, refer to **ENGINE COOLING** article.
3. Remove the fuel rail. For additional information, refer to **FUEL CHARGING AND CONTROLS - 3.5L** article.
4. Remove the 2 thermostat housing-to-lower intake manifold bolts.
5. Remove the 10 bolts and the lower intake manifold.
    - Remove and discard the intake manifold and thermostat housing gaskets.
    - Clean and inspect all sealing surfaces.

INSTALLATION

1. Using new intake manifold and thermostat housing gaskets, install the lower intake manifold and the 10 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

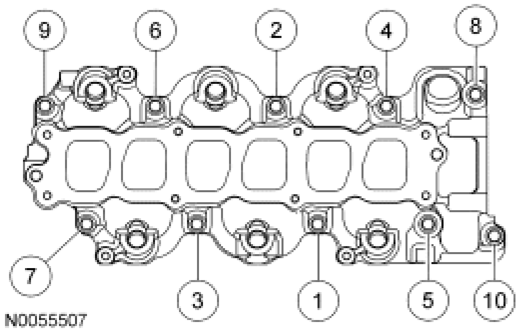
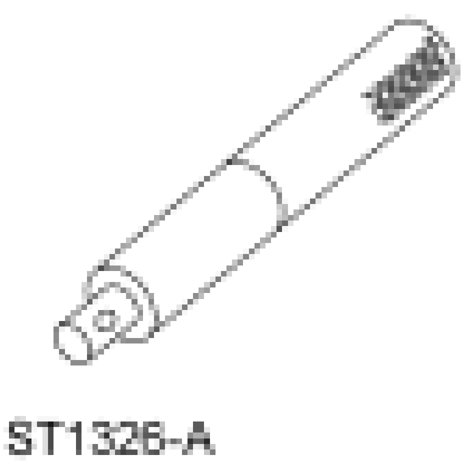


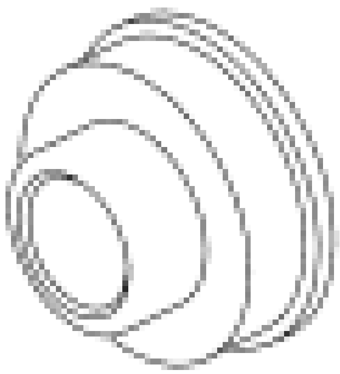
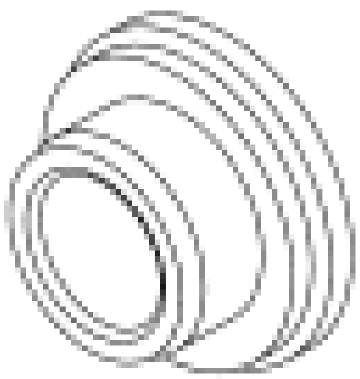
Fig. 7: Installing Lower Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

2. Install the 2 thermostat housing-to-lower intake manifold bolts.
    - Tighten to 10 Nm (89 lb-in).
3. Install the fuel rail. For additional information, refer to **FUEL CHARGING AND CONTROLS - 3.5L** article.
4. Fill and bleed the cooling system. For additional information, refer to **ENGINE COOLING** article.

VALVE COVER - LH

Special Tools

Illustration	Tool Name	Tool Number
	Handle	205-153 (T80T-4000-W)
	Installer, Seal	303-1247/2

 ST2983-A		
 ST2982-A	Remover, Seal	303-1247/1

Material

Item	Specification
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft Metal Surface Prep ZC-31	-
Silicone Gasket Remover ZC-30	-

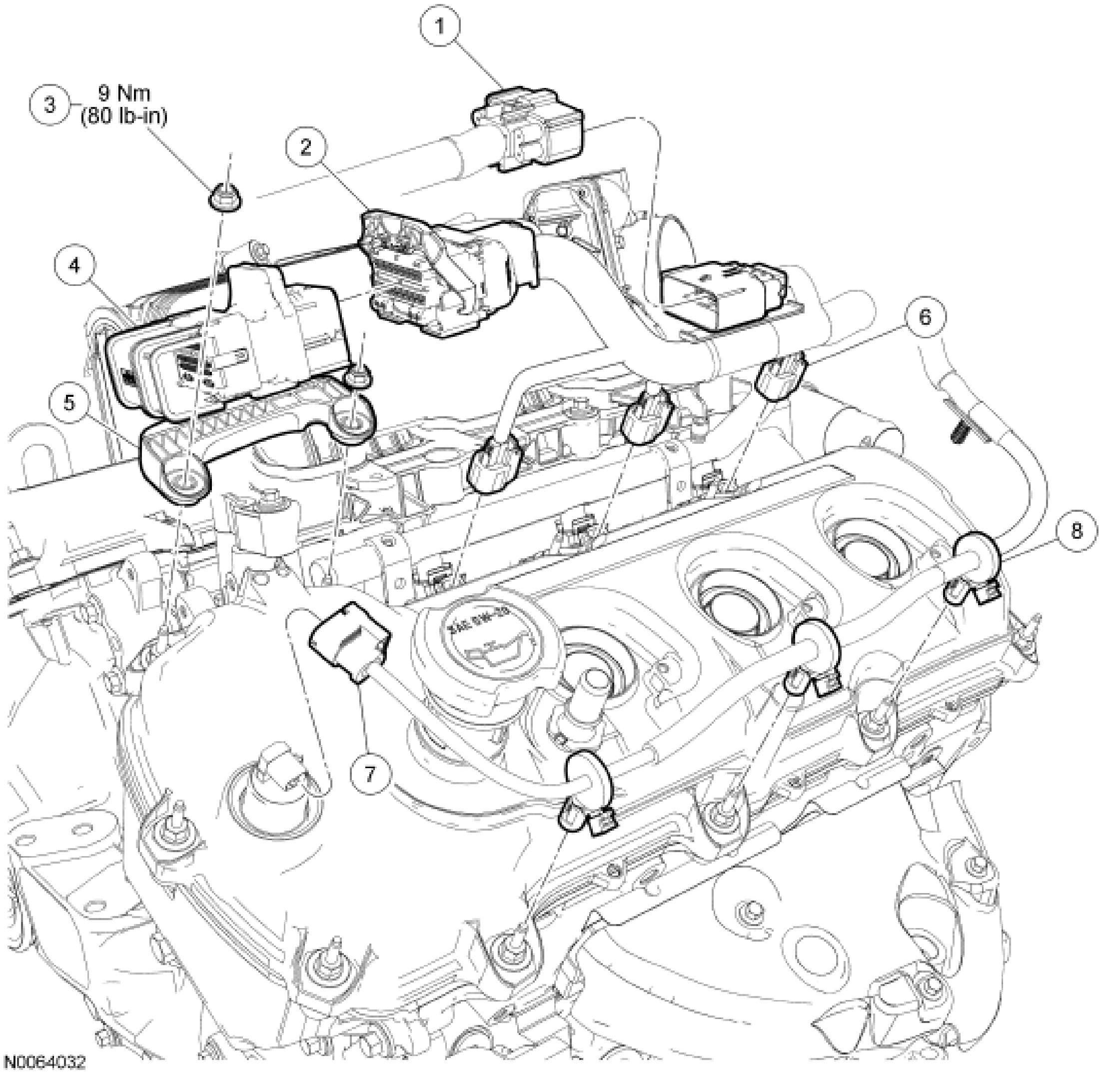


Fig. 8: Exploded View Of LH Valve Cover With Torque Specification (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Engine control wiring harness electrical connector (part of 12C508)
2	14A464	Engine control wiring harness electrical connector (part of 12C508)
3	W520100	Wiring harness retaining bracket nut (2 required)
4	14A464	Engine control wiring harness electrical connector (part of 12C508)
5	-	Wiring harness retaining bracket (part of 12C508)
6	14A464	LH fuel injector electrical connector (3 required) (part of 12C508)
7	14A464	LH variable camshaft timing (VCT) electrical connector

		(part of 12C508)
8	W700497	Engine control wiring harness retainer (part of 12C508)

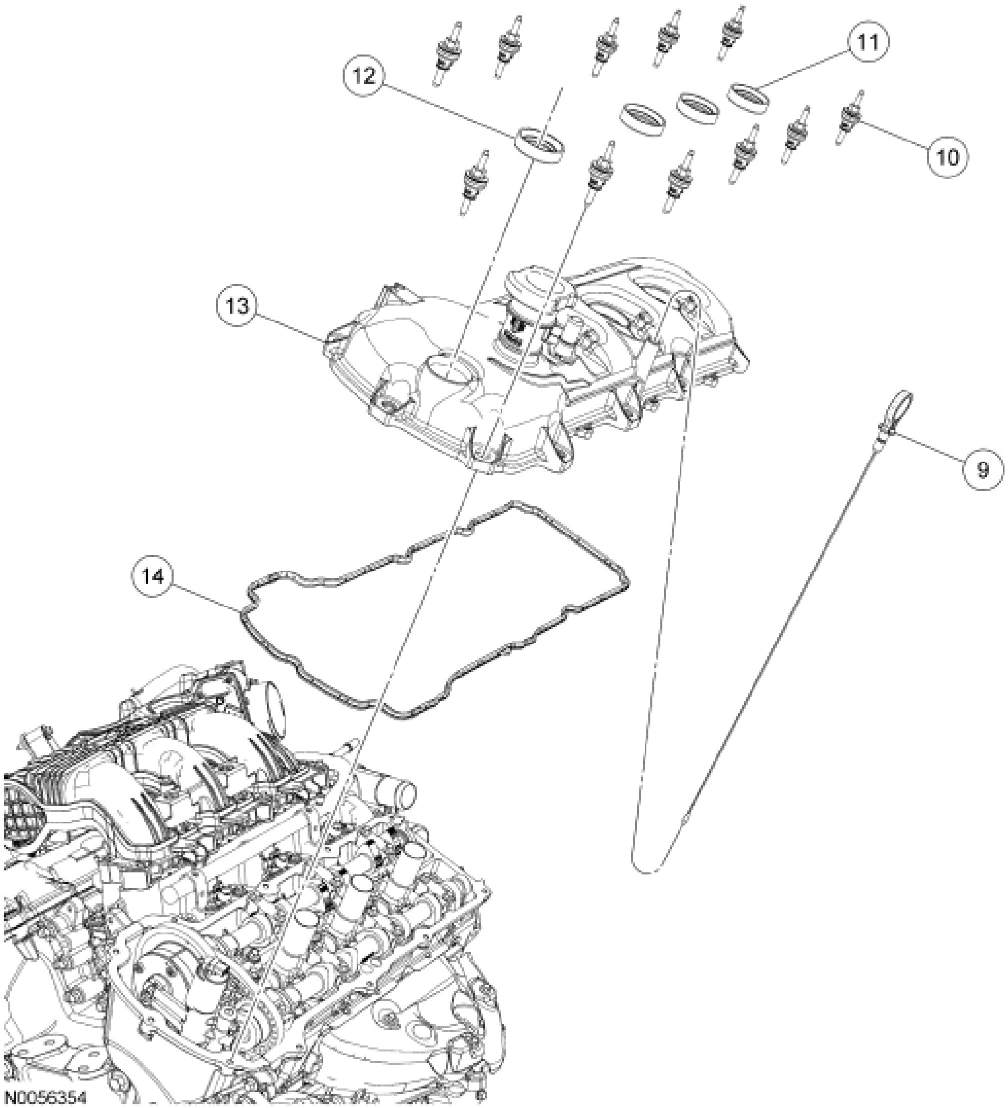


Fig. 9: Exploded View Of LH Valve Cover (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
9	6750	Oil level indicator
10	6C519	Valve cover stud bolt (11 required)
11	6C535	Spark plug tube seal (3 required)
12	6C535	Variable camshaft timing (VCT) seal
13	6A505	LH valve cover
14	6A559	LH valve cover gasket

REMOVAL

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

1. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.
2. Remove the LH ignition coils. For additional information, refer to **ENGINE IGNITION - 3.5L** article.
3. Remove the oil level indicator.
4. Disconnect the LH variable camshaft timing (VCT) solenoid electrical connector.
5. Detach the 2 wiring harness retainers.

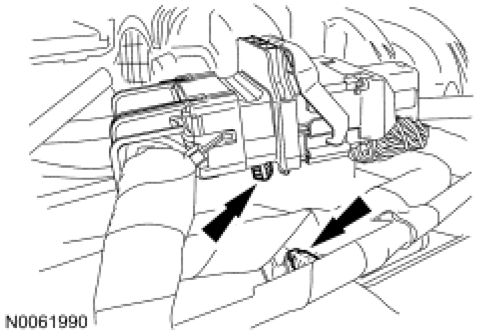


Fig. 10: Identifying Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

6. Disconnect the 2 engine control wiring harness electrical connectors.

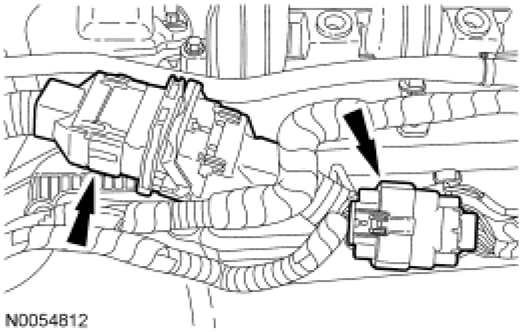


Fig. 11: Identifying Engine Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

7. Remove the 2 nuts and the wiring harness retaining bracket.

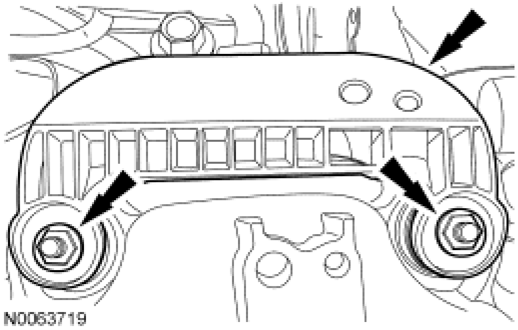


Fig. 12: Identifying Wiring Harness Retaining Bracket & Nuts
Courtesy of FORD MOTOR CO.

8. Detach all of the wiring harness retainers from the valve cover and the stud bolts.
9. Disconnect the 3 LH fuel injector electrical connectors.
10. Remove the 11 stud bolts and the LH valve cover.
    - Discard the gasket.

NOTE: VCT solenoid seal removal shown, spark plug tube seal removal similar.

11. Inspect the VCT solenoid seals and the spark plug tube seals. Remove any damaged seals.
    - Using the special tools, remove the seal(s).

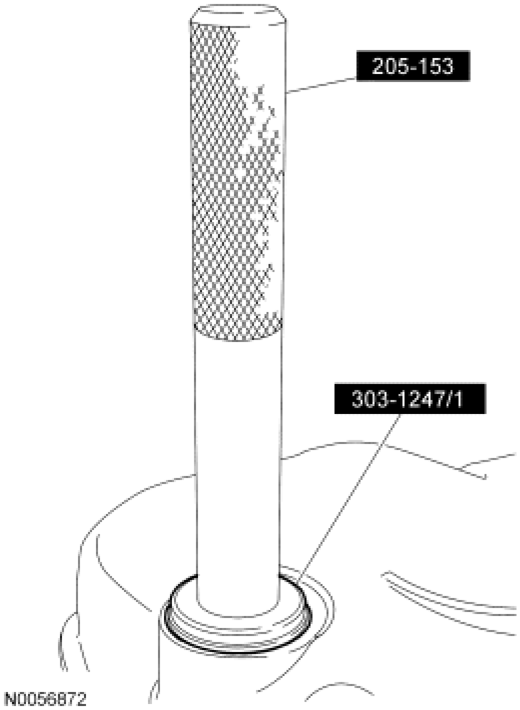


Fig. 13: Removing Seals Using Special Tools (205-153) & (303-1247/1)
Courtesy of FORD MOTOR CO.

12. Clean the valve cover, cylinder head and engine front cover sealing surfaces with metal surface prep.

INSTALLATION

NOTE: **Installation of new seals is only required if damaged seals were removed during disassembly of the engine.**

NOTE: **Spark plug tube seal installation shown, VCT seal installation similar.**

1. Using the special tools, install new VCT solenoid and/or spark plug tube seals.

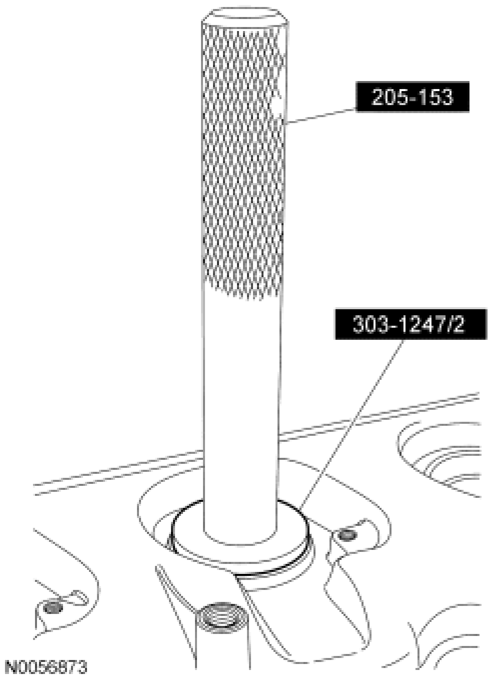


Fig. 14: Installing VCT Solenoid And/Or Spark Plug Tube Seals Using Special Tools (205-153) & (303-1247/2)
Courtesy of FORD MOTOR CO.

CAUTION: **Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.**

NOTE: **If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.**

2. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front

cover-to-LH cylinder head joints.

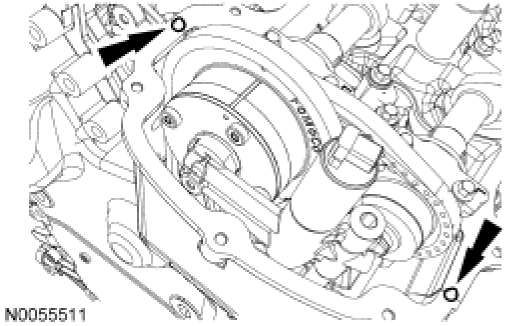


Fig. 15: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-LH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

3. Using a new gasket, install the LH valve cover and 11 stud bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

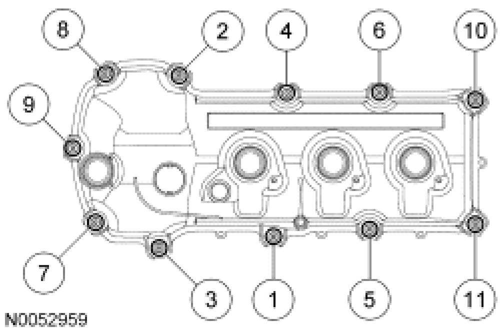
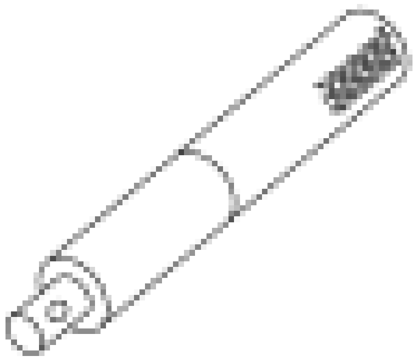
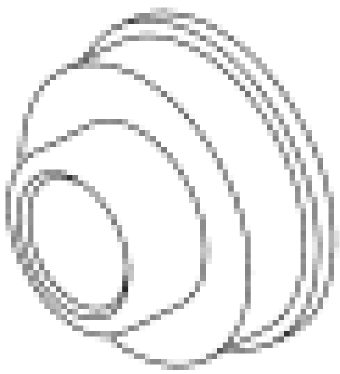


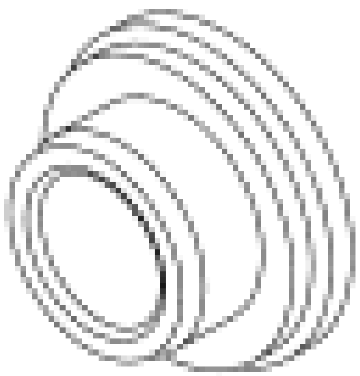
Fig. 16: Installing LH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

4. Connect the 3 LH fuel injector electrical connectors.
5. Attach all of the wiring harness retainers to the valve cover and the stud bolts.
6. Install the wiring harness retaining bracket and the 2 nuts.
   - Tighten to 9 Nm (80 lb-in).
7. Connect the 2 engine control wiring harness electrical connectors.
8. Attach the 2 wiring harness retainers.
9. Connect the LH VCT solenoid electrical connector.
10. Install the oil level indicator.
11. Install the LH ignition coils. For additional information, refer to **ENGINE IGNITION - 3.5L** article.
12. Install the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.

VALVE COVER - RH

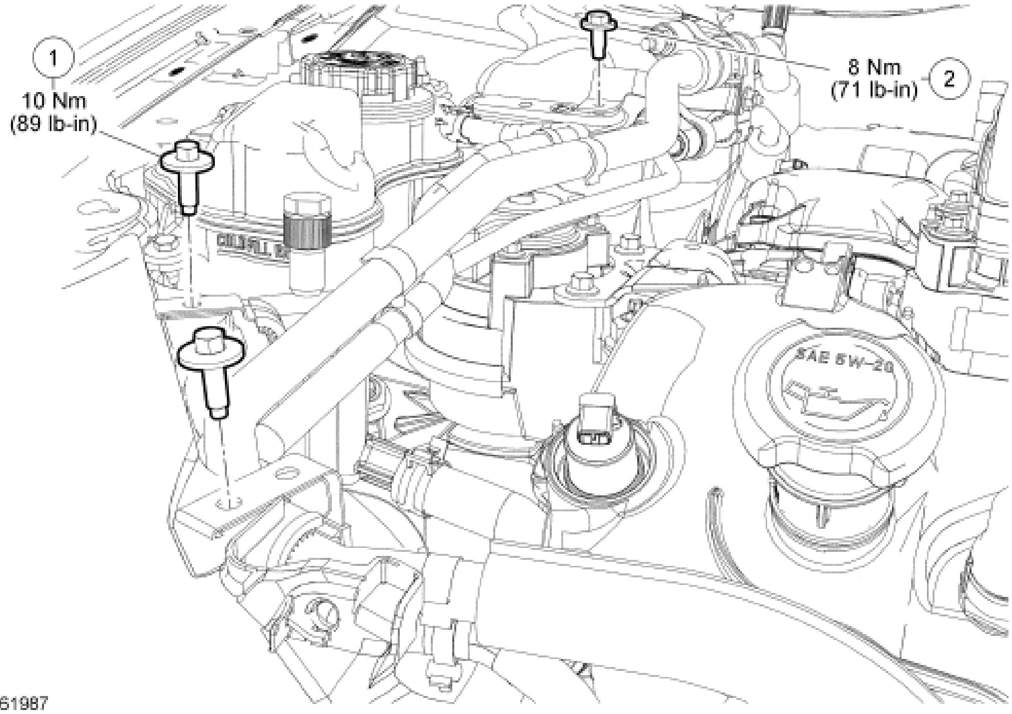
Special Tools

Illustration	**Tool Name**	**Tool Number**
 ST1326-A	Handle	205-153 (T80T-4000-W)
 ST2983-A	Installer, Seal	303-1247/2
	Remover, Seal	303-1247/1

 ST2982-A		

Material

Item	Specification
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft Metal Surface Prep ZC-31	-
Silicone Gasket Remover ZC-30	-



N0061987

Fig. 17: Exploded View Of A/C Tube Retaining Clamp Bolt With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W503924	A/C tube retaining clamp bolt (2 required)
2	W505422	A/C tube retaining clamp bolt

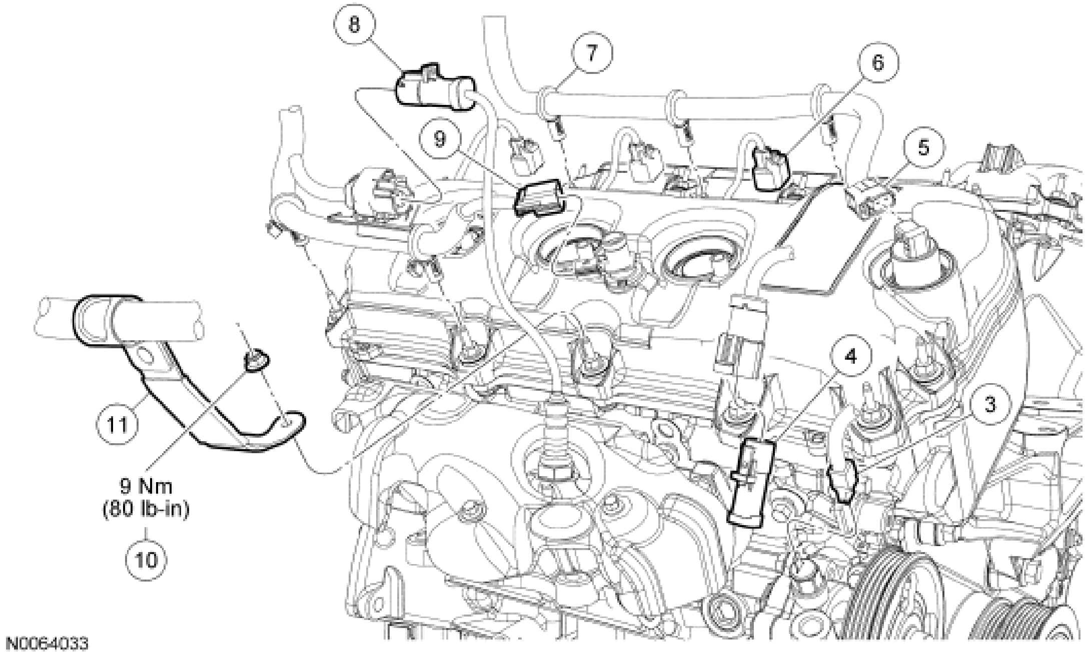


Fig. 18: Exploded View Of RH Valve Cover With Torque Specification (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
3	14A464	Power steering pressure (PSP) switch electrical connector (part of 12C508)
4	14A464	RH catalyst monitor sensor electrical connector (part of 12C508)
5	14A464	RH variable camshaft timing (VCT) electrical connector (part of 12C508)
6	14A464	RH fuel injector electrical connector (3 required) (part of 12C508)
7	W700497	Engine control wiring harness retainer (part of 12C508)
8	14A464	RH heated oxygen sensor (HO2S) electrical connector (part of 12C508)
9	14A464	Heated PCV valve electrical connector (part of 12C508) (early build engines)
10	W520100	PSP hose bracket nut

11	3A719	PSP hose bracket

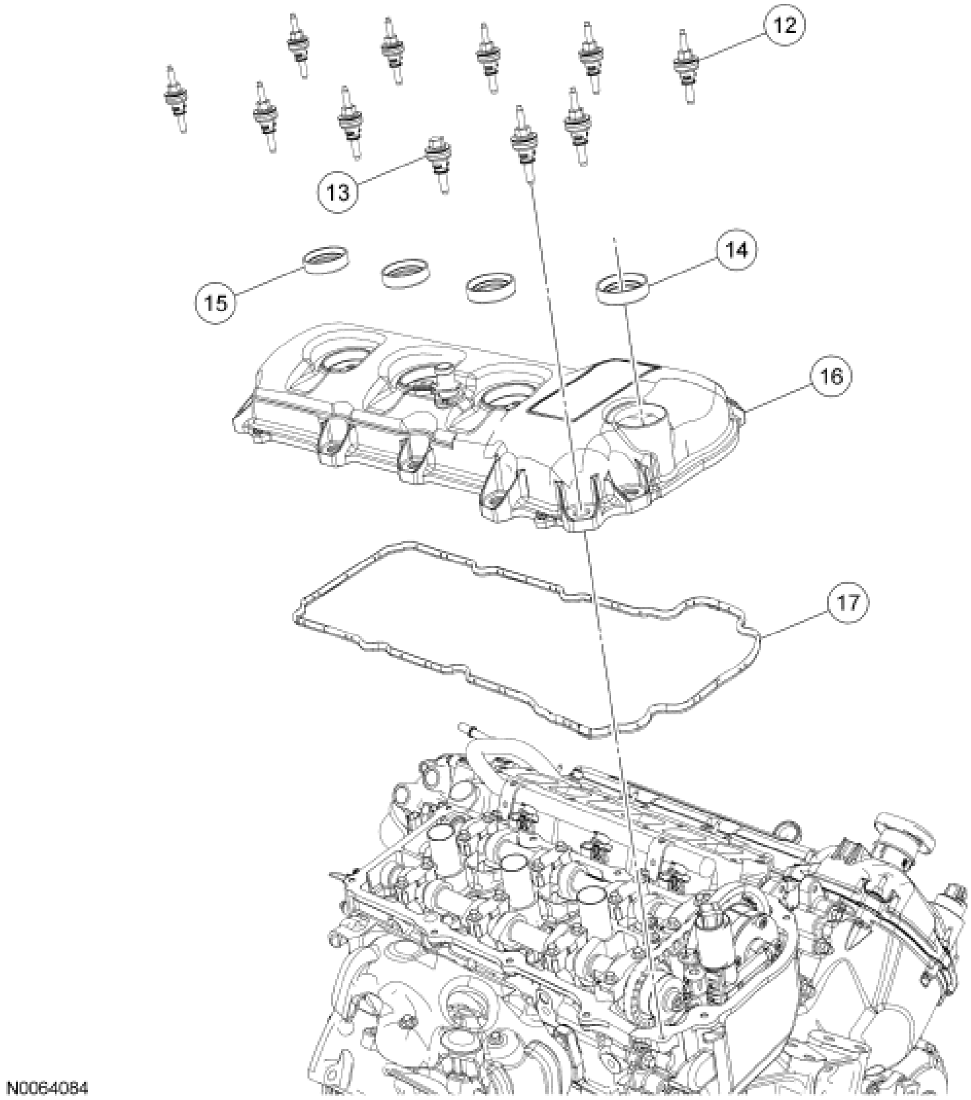


Fig. 19: Exploded View Of RH Valve Cover (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
12	6C519	Valve cover stud bolt (10 required)
13	6C520	Valve cover bolt
14	6C535	Variable camshaft timing (VCT) seal
15	6C535	Spark plug tube seal (3 required)
16	6582	RH valve cover
17	6584	RH valve cover gasket

REMOVAL

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

All engines

1. Remove the RH ignition coils. For additional information, refer to **ENGINE IGNITION - 3.5L** article.
2. Remove the power steering fluid reservoir. For additional information, refer to **POWER STEERING** article.
3. Disconnect the power steering pressure (PSP) switch electrical connector.
4. Disconnect the RH catalyst monitor sensor electrical connector and retainer.
5. Remove the PSP hose bracket nut from the valve cover stud bolt and position the bracket aside.

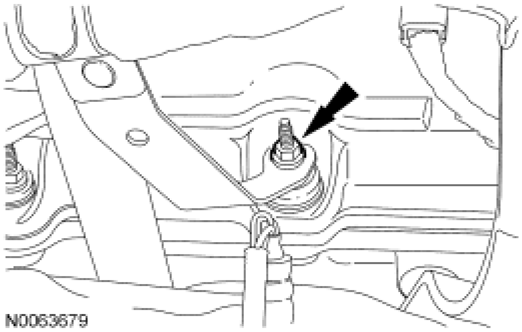


Fig. 20: Identifying PSP Hose Bracket Nut
Courtesy of FORD MOTOR CO.

6. Disconnect the RH heated oxygen sensor (HO2S) electrical connector.
7. Disconnect the RH variable camshaft timing (VCT) electrical connector.
8. Disconnect the 3 RH fuel injector electrical connectors.

Early build engines

9. Disconnect the heated PCV valve electrical connector.

All engines

10. Detach all of the wiring harness retainers from the valve cover and the stud bolts.
11. Remove the A/C tube retaining clamp bolt.
12. Remove the 2 A/C tube retaining clamp bolts.

NOTE: It is necessary to reposition the A/C tubes to remove the valve cover.

13. Remove the bolt, the 10 stud bolts and the RH valve cover.

- Discard the gasket.

NOTE: VCT solenoid seal removal shown, spark plug tube seal removal similar.

14. Inspect the VCT solenoid seals and the spark plug tube seals. Remove any damaged seals.
    - Using the special tools, remove the seal(s).

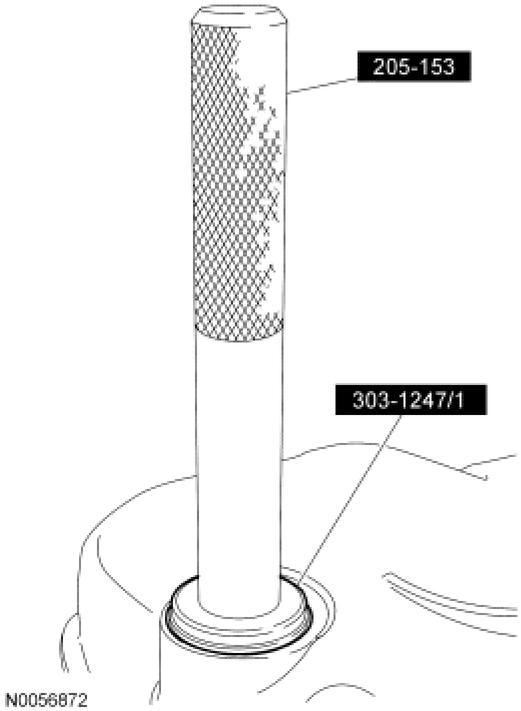


Fig. 21: Removing Seals Using Special Tools (205-153) & (303-1247/1)
Courtesy of FORD MOTOR CO.

15. Clean the valve cover, cylinder head and engine front cover sealing surfaces with metal surface prep.

INSTALLATION

All engines

NOTE: Installation of new seals is only required if damaged seals were removed during disassembly of the engine.

NOTE: Spark plug tube seal installation shown, VCT seal installation similar.

1. Using the special tools, install new VCT solenoid and/or spark plug tube seals.

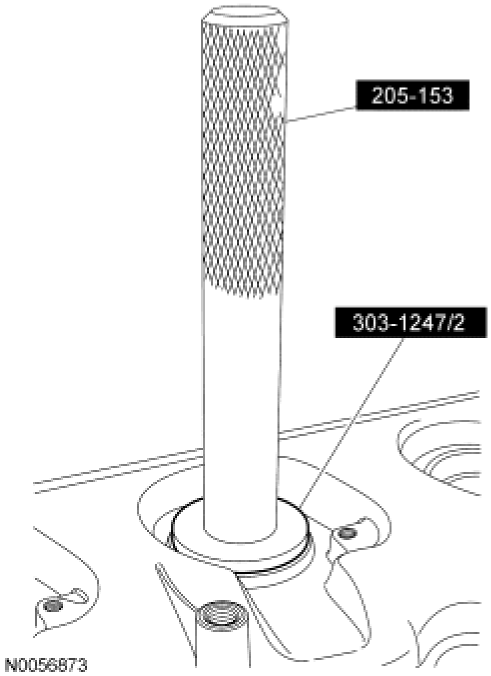


Fig. 22: Installing VCT Solenoid And/Or Spark Plug Tube Seals Using Special Tools (205-153) & (303-1247/2)
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

2. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-RH cylinder head joints.

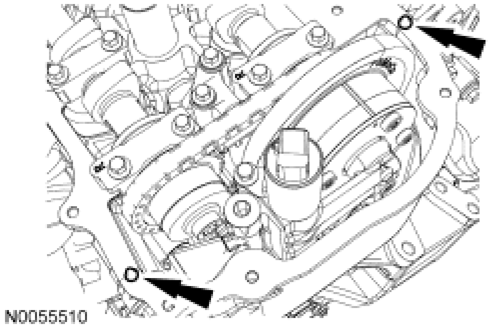


Fig. 23: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-RH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

3. Using a new gasket, install the RH valve cover, bolt and the 10 stud bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

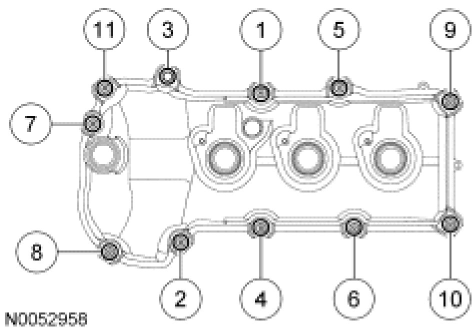


Fig. 24: Installing RH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

4. Position the A/C tubes and install the 2 retaining clamp bolts.
   - Tighten to 10 Nm (89 lb-in).
5. Install the A/C tube retaining clamp bolt.
   - Tighten to 8 Nm (71 lb-in).
6. Attach all of the wiring harness retainers to the valve cover and the stud bolts.

Early build engines

7. Connect the heated PCV valve electrical connector.

All engines

8. Connect the 3 LH fuel injector electrical connectors.
9. Connect the LH VCT electrical connector.
10. Connect the RH HO2S electrical connector.
11. Install the PSP hose bracket and nut.
    - Tighten to 9 Nm (80 lb-in).
12. Connect the RH catalyst monitor sensor electrical connector and retainer.
13. Connect the PSP switch electrical connector.
14. Install the power steering fluid reservoir. For additional information, refer to **POWER STEERING** article.
15. Install the RH ignition coils. For additional information, refer to **ENGINE IGNITION - 3.5L** article.

LOWER END COMPONENTS - EXPLODED VIEW, CRANKSHAFT PULLEY AND CRANKSHAFT

FRONT SEAL

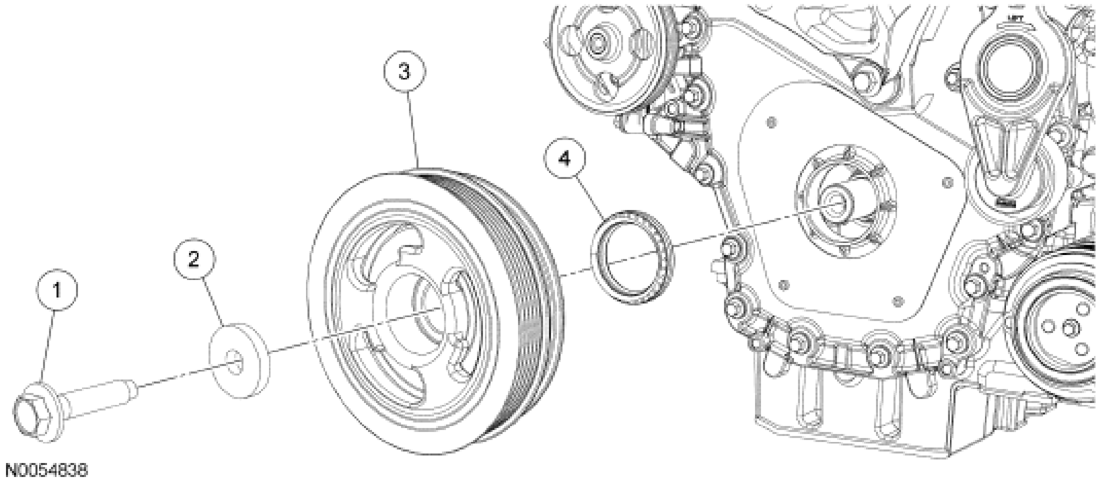


Fig. 25: Exploded View Of Crankshaft Pulley & Crankshaft Front Seal
Courtesy of FORD MOTOR CO.

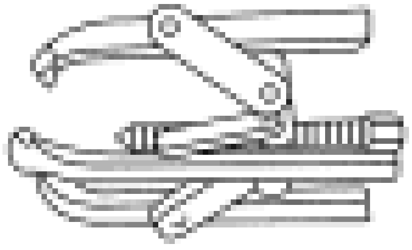
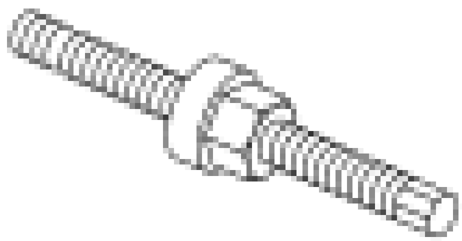
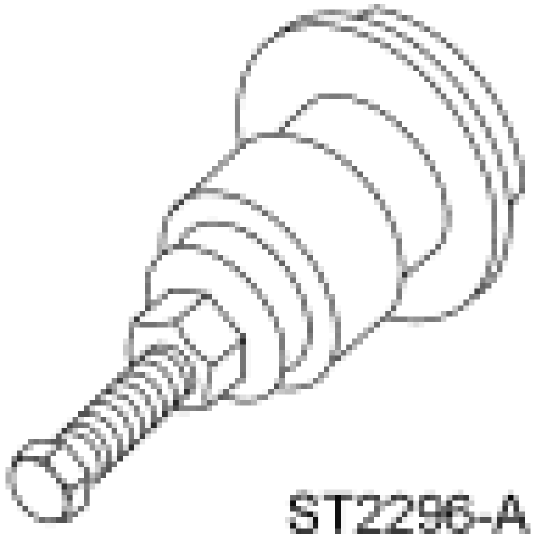
Item	Part Number	Description
1	W701512	Crankshaft pulley bolt
2	N806165	Washer
3	6316	Crankshaft pulley
4	6700	Crankshaft front seal

1. For additional information, refer to the procedures.

CRANKSHAFT PULLEY

Special Tools

Illustration	Tool Name	Tool Number
	3-Jaw Puller	303-D121

 ST1184-A		
 ST1287-A	Installer, Crankshaft Vibration Damper	303-102 (T74P-6316-B)
 ST2296-A	Installer, Front Cover Oil Seal	303-335
	Strap Wrench	303-D055 (D85L-6000-A)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the accessory drive belt and the power steering belt. For additional information, refer to **ACCESSORY DRIVE - 3.5L** article.
3. Using the Strap Wrench, remove the crankshaft bolt and washer.
   - Discard the bolt.

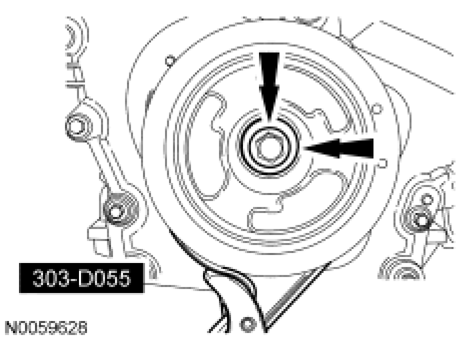


Fig. 26: Removing Crankshaft Bolt & Washer Using Special Tool (303-D055)
Courtesy of FORD MOTOR CO.

4. Using the 3-Jaw Puller, remove the crankshaft pulley.

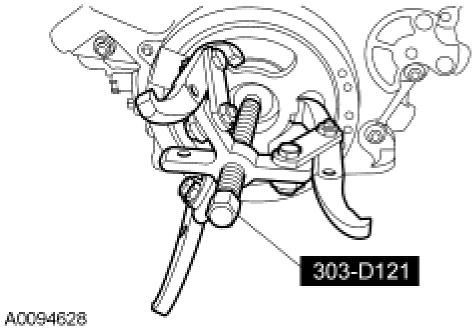


Fig. 27: Identifying Special Tools (303-D121) And Crankshaft Pulley
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Lubricate the crankshaft front seal inner lip with clean engine oil.

NOTE: Lubricate the outside diameter sealing surfaces with clean engine oil.

2. Using the Front Cover Oil Seal Installer and Crankshaft Vibration Damper Installer, install the crankshaft pulley.

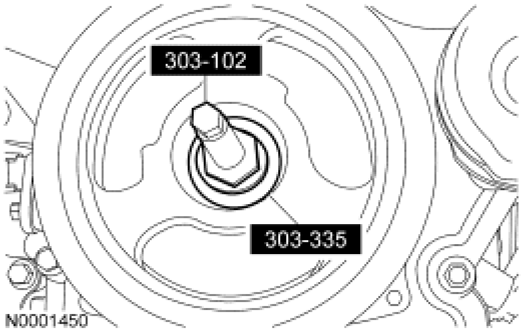


Fig. 28: Installing Crankshaft Pulley
Courtesy of FORD MOTOR CO.

3. Using the Strap Wrench, install the crankshaft pulley washer and new bolt and tighten in 4 stages.
   - Stage 1: Tighten to 120 Nm (89 lb-ft).
   - Stage 2: Loosen one full turn.
   - Stage 3: Tighten to 50 Nm (37 lb-ft).
   - Stage 4: Tighten an additional 90 degrees.

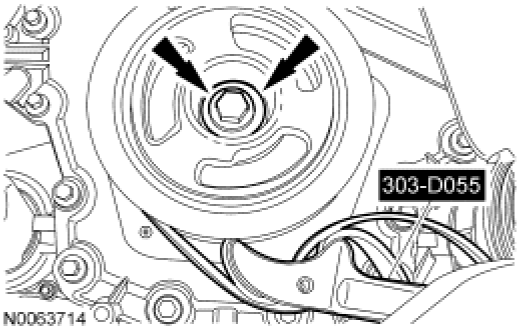
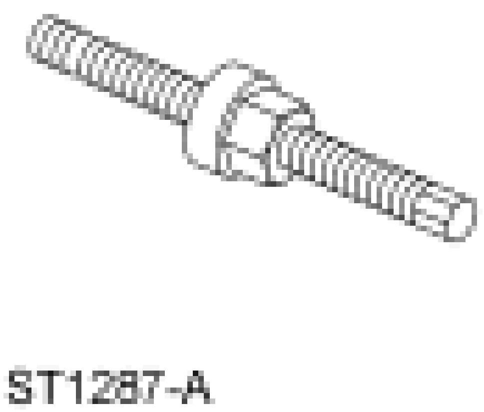


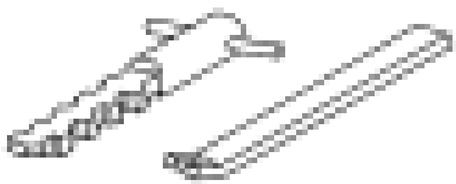
Fig. 29: Installing Crankshaft Pulley Washer & Bolt Using Special Tools (303-D055)
Courtesy of FORD MOTOR CO.

4. Install the accessory drive belt and the power steering belt. For additional information, refer to **ACCESSORY DRIVE - 3.5L** article.

CRANKSHAFT FRONT SEAL

Special Tools

Illustration	Tool Name	Tool Number
	Installer, Crankshaft Vibration Damper	303-102 (T74P-6316-B)
	Installer, Front Crankshaft Seal	303-1251

 ST2981-A		
 ST1385-A	Remover, Oil Seal	303-409 (T92C-6700CH)

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the crankshaft pulley. For additional information, refer to **Crankshaft Pulley**.

3. Using the Oil Seal Remover, remove and discard the crankshaft front seal.
    - Clean all sealing surfaces with metal surface prep.

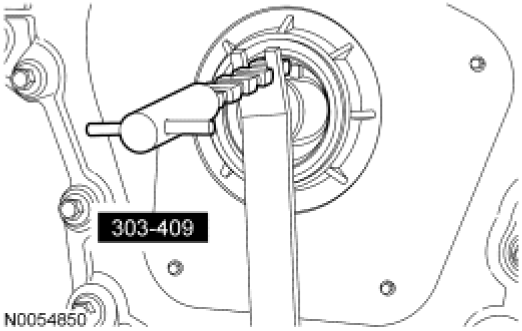


Fig. 30: Removing Crankshaft Front Seal Using Special Tool (303-409)
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: **Apply clean engine oil to the crankshaft front seal bore in the engine front cover.**

1. Using the Front Crankshaft Seal Installer and Crankshaft Vibration Damper Installer, install a new crankshaft front seal.

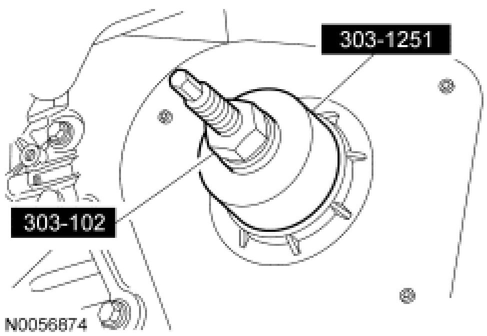


Fig. 31: Installing Crankshaft Front Seal Using Special Tools (303-102) & (303-1251)
Courtesy of FORD MOTOR CO.

2. Install the crankshaft pulley. For additional information, refer to **Crankshaft Pulley**.

LOWER END COMPONENTS - EXPLODED VIEW, FLEXPLATE AND CRANKSHAFT REAR SEAL

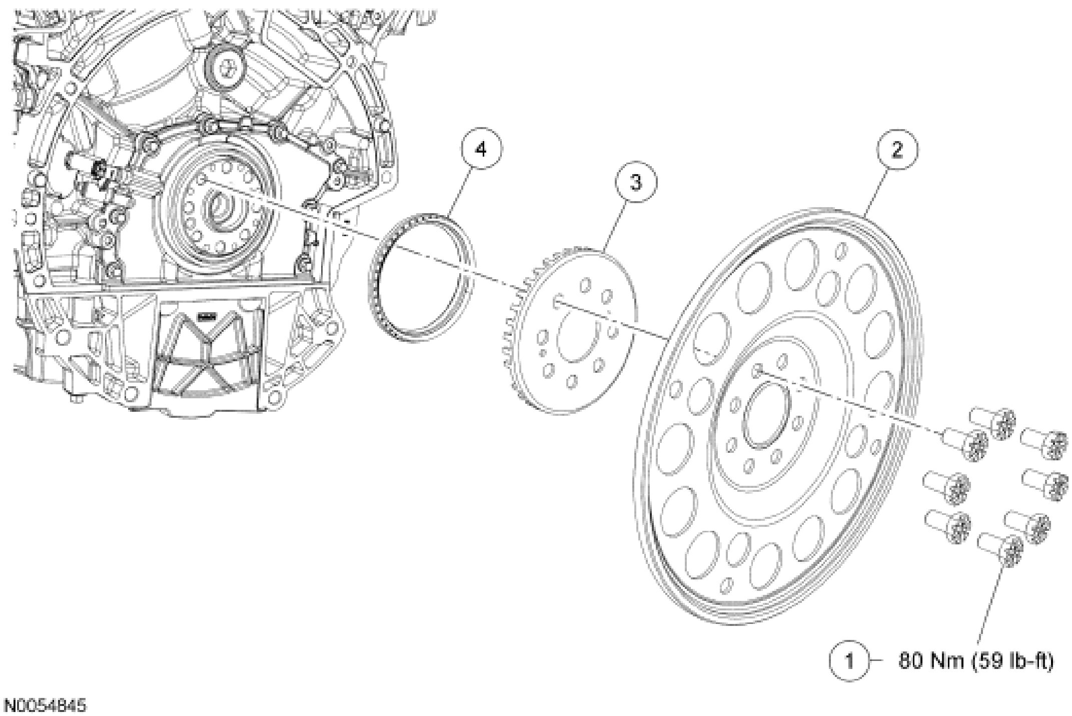


Fig. 32: Exploded View Of Flexplate & Crankshaft Rear Seal With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701559	Flexplate bolt (8 required)
2	6375	Flexplate
3	12A227	Crankshaft sensor ring
4	6701	Crankshaft rear seal

1. For additional information, refer to the procedures.

FLEXPLATE

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the transaxle. For additional information, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.

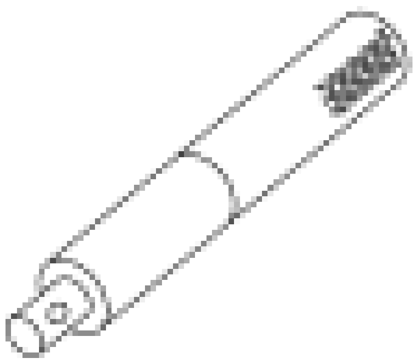
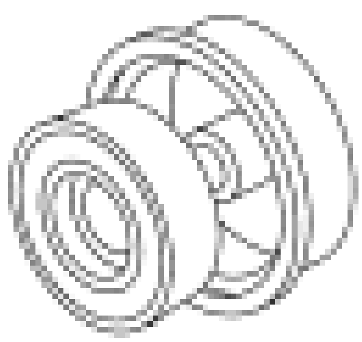
NOTE: One of the 8 flexplate holes are offset so the flexplate can only be installed in one position.

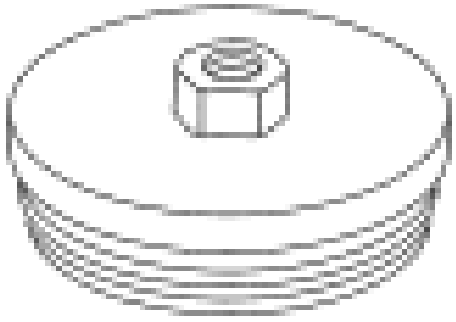
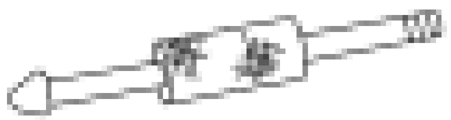
3. Remove the bolts and the flexplate.
   - To install, tighten to 80 Nm (59 lb-ft).

4. To install, reverse the removal procedure.

CRANKSHAFT REAR SEAL

Special Tools

Illustration	**Tool Name**	**Tool Number**
 ST1326-A	Handle	205-153 (T80T-4000-W)
 ST2980-A	Installer, Rear Main Seal	303-1250
	Remover, Crankshaft Rear Oil Seal	303-519 (T95P-6701-EH)

		
	Slide Hammer	307-005 (T59L-100-B)

Material

Item	**Specification**
Motorcraft Metal Surface Prep ZC-31-A	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the flexplate. For additional information, refer to **Flexplate**.

3. Remove the crankshaft sensor ring.
4. Using the Crankshaft Rear Oil Seal Remover and Slide Hammer, remove and discard the crankshaft rear seal.
   - Clean all sealing surfaces with metal surface prep.

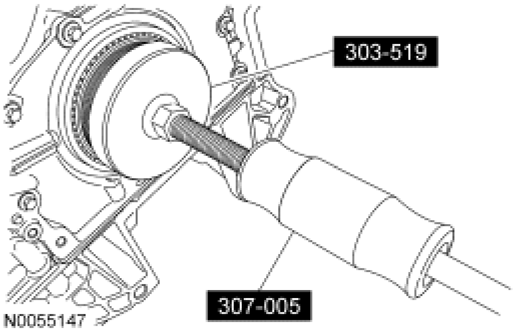


Fig. 33: Removing Crankshaft Rear Seal Using Special Tools (303-519) & (307-005)
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: Lubricate the seal lips and bore with clean engine oil prior to installation.

1. Position the Rear Main Seal Installer onto the end of the crankshaft and slide a new crankshaft rear seal onto the tool.

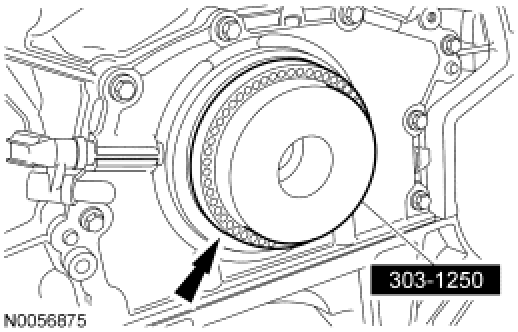


Fig. 34: Positioning Special Tool (303-1250) Onto End Of Crankshaft
Courtesy of FORD MOTOR CO.

2. Using the Rear Main Seal Installer and Handle, install the new crankshaft rear seal.

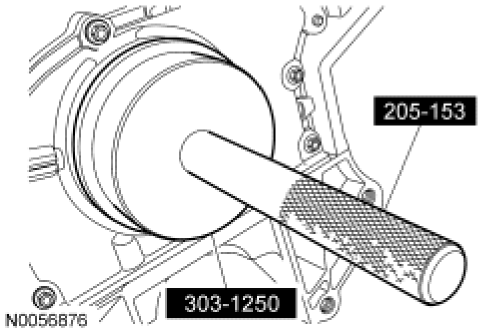


Fig. 35: Installing New Crankshaft Rear Seal Using Special Tools (303-1250) & (205-153)
Courtesy of FORD MOTOR CO.

3. Install the crankshaft sensor ring.
4. Install the flexplate. For additional information, refer to **Flexplate**.

OIL FILTER ADAPTER

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

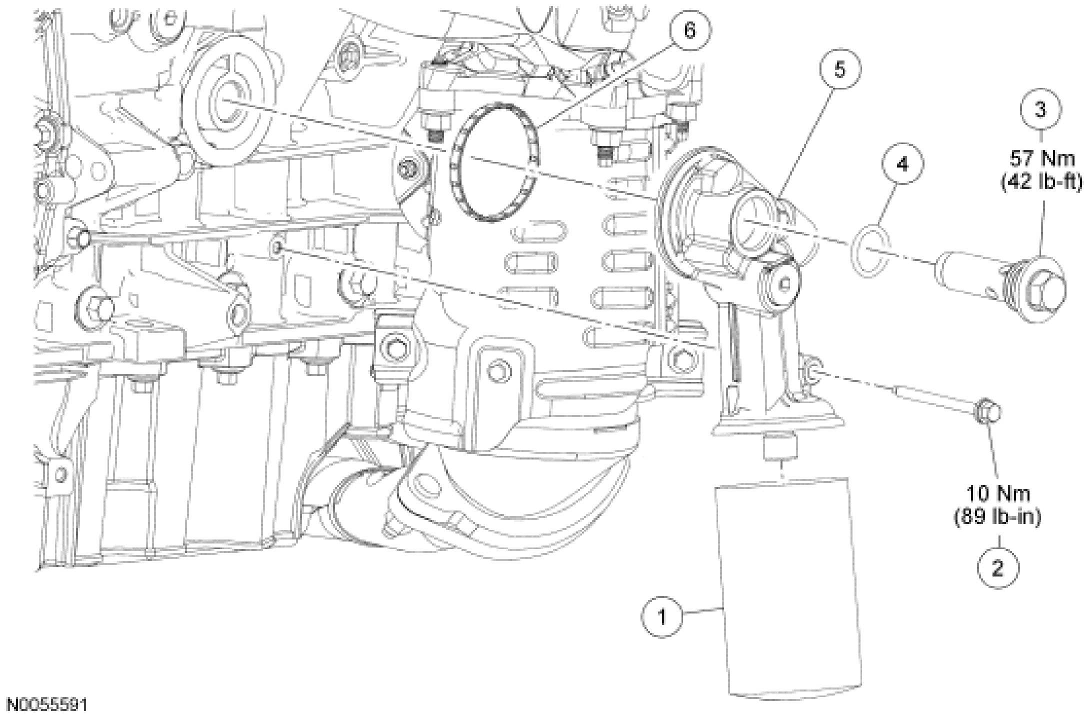


Fig. 36: Exploded View Of Oil Filter Adapter With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6714	Engine oil filter
2	W708607	Oil filter adapter bolt
3	6895	Oil filter adapter bolt
4	6K649	O-ring seal
5	6831	Oil filter adapter
6	6A636	Oil filter adapter gasket

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. If equipped, remove the 6 screws and the underbody shield.

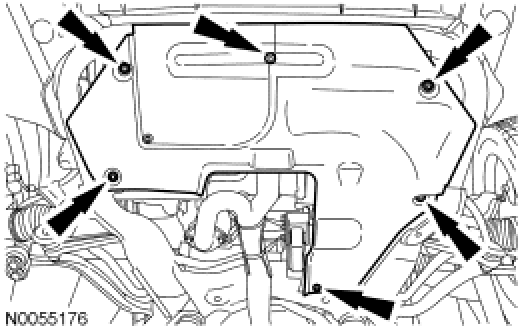


Fig. 37: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

3. Remove and discard the engine oil filter.
4. Remove the 2 bolts and the oil filter adapter.
    - Discard the gasket and O-ring seal.
    - Clean and inspect all sealing surfaces.

INSTALLATION

1. Using a new gasket and O-ring seal, install the oil filter adapter.
    - Tighten the large bolt to 57 Nm (42 lb-ft).
    - Tighten the small bolt to 10 Nm (89 lb-in).

NOTE: Lubricate the engine oil filter gasket with clean engine oil prior to installing the oil filter.

2. Install a new engine oil filter.

- Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.

3. If equipped, install the 6 screws and the underbody shield.

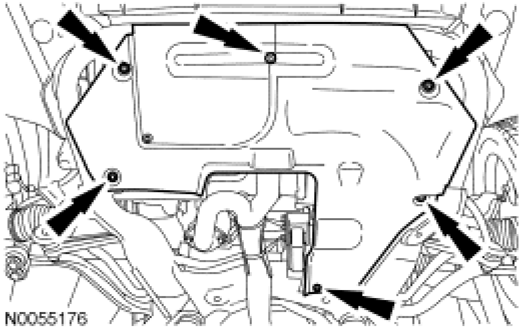


Fig. 38: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

ENGINE OIL PRESSURE (EOP) SWITCH

Material

Item	Specification
Thread Sealant with PTFE TA-24	WSK-M2G350-A2

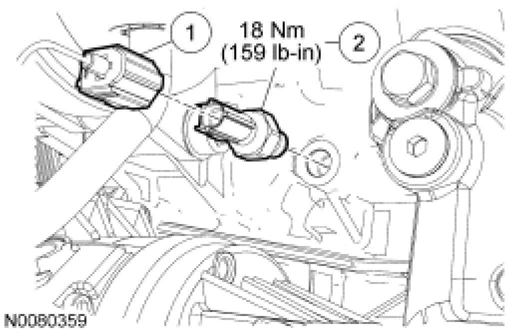


Fig. 39: Exploded View Of Engine Oil Pressure (EOP) Switch With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Engine Oil Pressure (EOP) switch electrical connector (part of 12C508)
2	9278	EOP switch

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. If equipped, remove the 6 screws and the underbody shield.

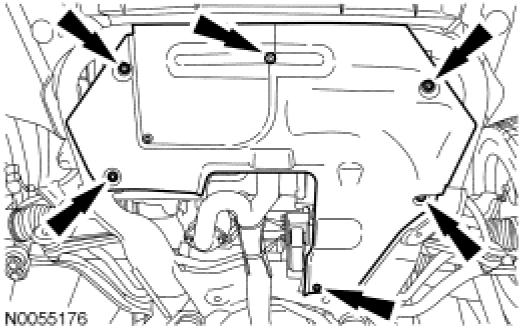


Fig. 40: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

3. Disconnect the Engine Oil Pressure (EOP) switch electrical connector.
4. Remove the EOP switch.
   - To install, tighten to 18 Nm (159 lb-in).
5. To install, reverse the removal procedure.
   - Apply thread sealant with PTFE to the EOP switch threads prior to installation.

EXHAUST MANIFOLD - LH

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-

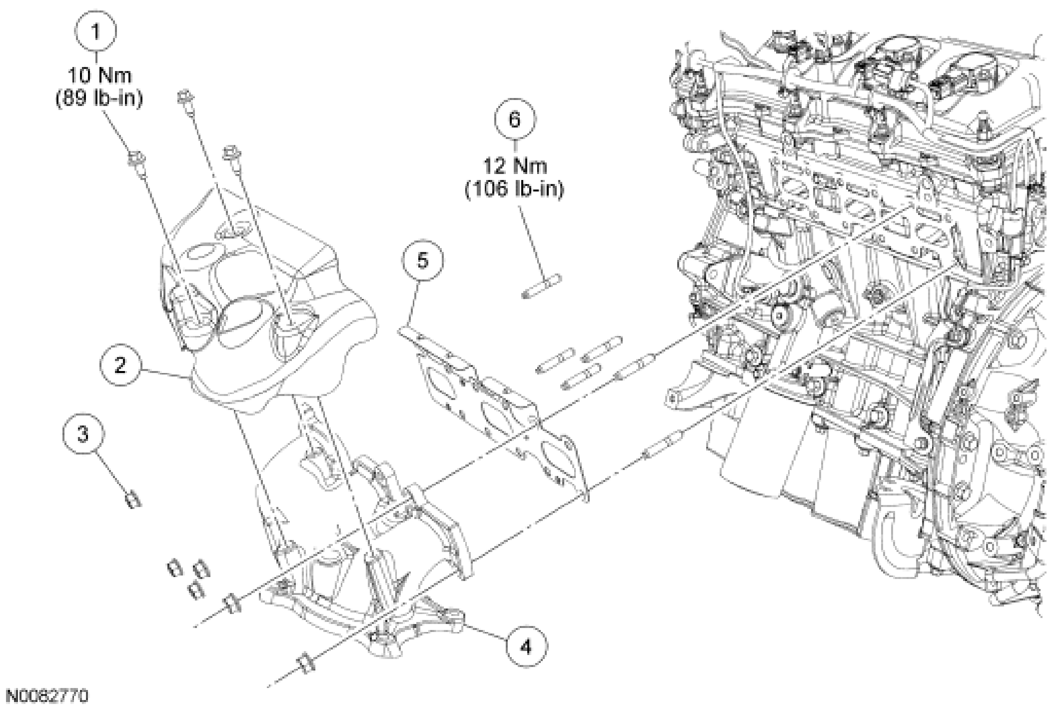


Fig. 41: Exploded View Of LH Exhaust Manifold With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W713299	LH exhaust manifold heat shield bolt (3 required)
2	9Y427	LH exhaust manifold heat shield
3	W701706	LH exhaust manifold nut (6 required)
4	9431	LH exhaust manifold
5	9448	LH exhaust manifold gasket
6	W701732	LH exhaust manifold stud (6 required)

REMOVAL

1. Remove the LH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.
2. Remove the LH Heated Oxygen Sensor (HO2S). For additional information, refer to **ELECTRONIC ENGINE CONTROLS - 3.5L** article.
3. Remove the 3 bolts and the LH exhaust manifold heat shield.
4. Remove the 6 nuts and the LH exhaust manifold.
   - Discard the nuts and gasket.
5. Clean and inspect the LH exhaust manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
6. Remove and discard the 6 LH exhaust manifold studs.

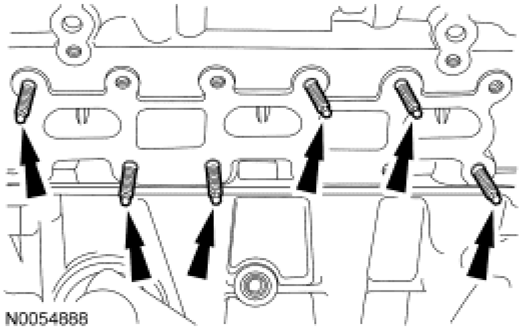


Fig. 42: Locating LH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

NOTE: **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These may cause scratches and gouges resulting in leak paths. Use a plastic scraper to clean the sealing surfaces.**

7. Clean the exhaust manifold mating surface of the cylinder head with metal surface prep. Follow the directions on the packaging.

INSTALLATION

1. Install 6 new LH exhaust manifold studs.
   - Tighten to 12 Nm (106 lb-in).

NOTE: Failure to tighten the exhaust manifold nuts to specification a second time will cause the exhaust manifold to develop an exhaust leak.

2. Using a new gasket, install the LH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown:
   - Stage 1: Tighten to 20 Nm (177 lb-in).
   - Stage 2: Tighten to 25 Nm (18 lb-ft).

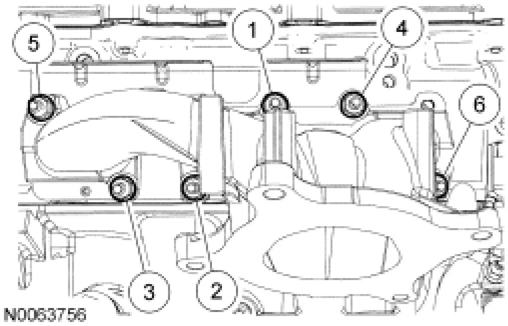


Fig. 43: Installing LH Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

3. Install the LH exhaust manifold heat shield and the 3 bolts.
   - Tighten to 10 Nm (89 lb-in).
4. Install the LH HO2S. For additional information, refer to **ELECTRONIC ENGINE CONTROLS - 3.5L** article.
5. Install the LH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.

EXHAUST MANIFOLD - RH

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	-

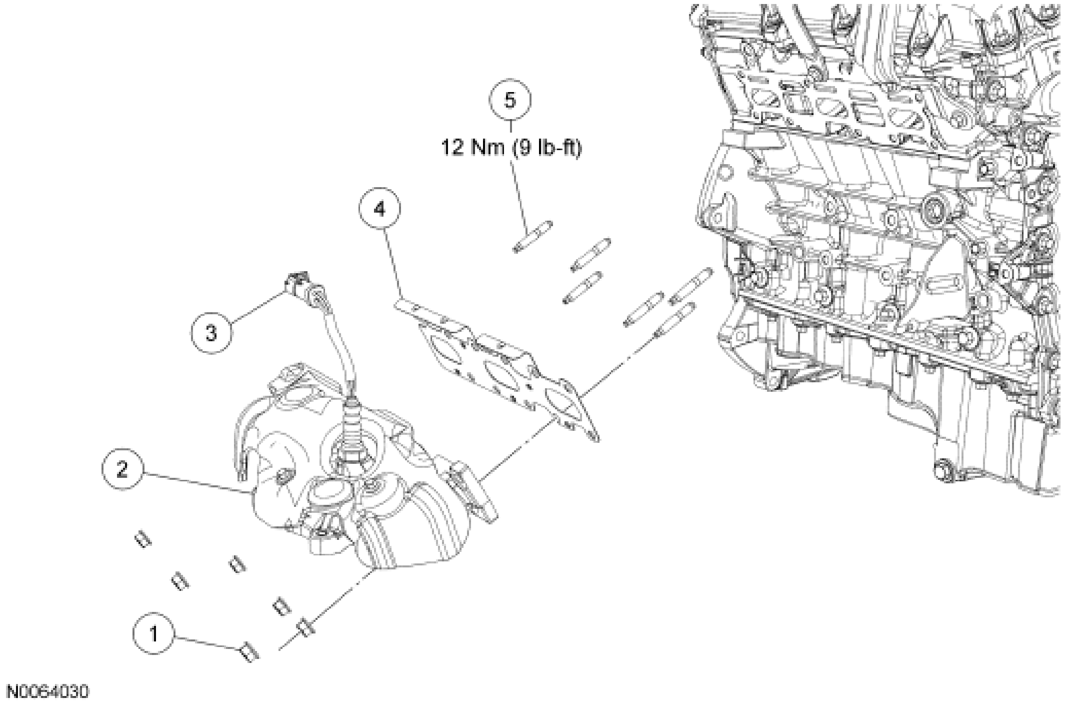


Fig. 44: Exploded View Of RH Exhaust Manifold With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701706	RH exhaust manifold nut (6 required)
2	9430	RH exhaust manifold
3	14A464	RH heated oxygen sensor (H02S) electrical connector
4	9448	RH exhaust manifold gasket
5	W701732	RH exhaust manifold stud (6 required)

REMOVAL

1. Remove the RH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.
2. Disconnect the RH heated oxygen sensor (HO2S) electrical connector.
3. Remove the 6 nuts and the RH exhaust manifold.
    - Discard the nuts and gasket.
4. Clean and inspect the RH exhaust manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
5. Remove and discard the 6 RH exhaust manifold studs.

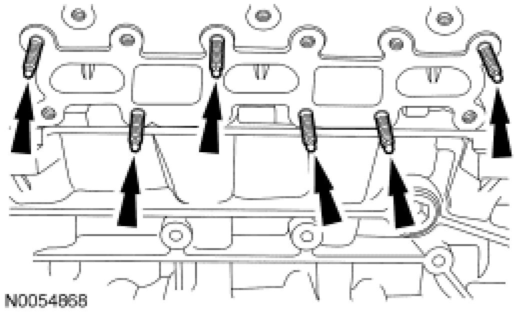


Fig. 45: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These may cause scratches and gouges resulting in leak paths. Use a plastic scraper to clean the sealing surfaces.

6. Clean the exhaust manifold mating surface of the cylinder head with metal surface prep. Follow the directions on the packaging.

INSTALLATION

1. Install 6 new RH exhaust manifold studs.
    - Tighten to 12 Nm (9 lb-ft).

CAUTION: Failure to tighten the exhaust manifold nuts to specification a second time will cause the exhaust manifold to develop an exhaust leak.

2. Using a new gasket, install the RH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten to 20 Nm (15 lb-ft).

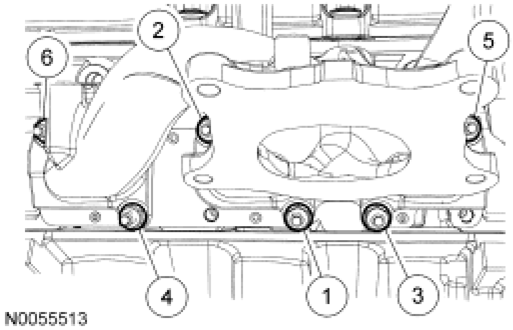
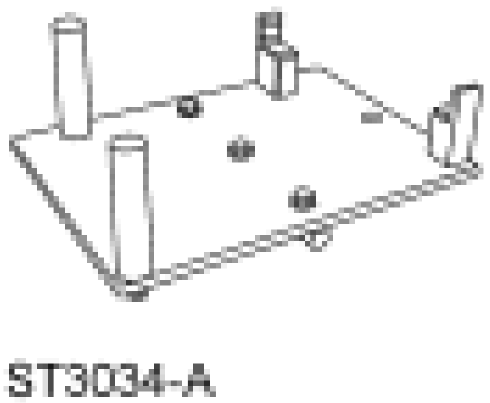


Fig. 46: Installing RH Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

3. Connect the RH HO2S electrical connector.
4. Install the RH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.

ENGINE MOUNT

Special Tools

Illustration	Tool Name	Tool Number
	Oil Pan Holding Fixture	303-1295

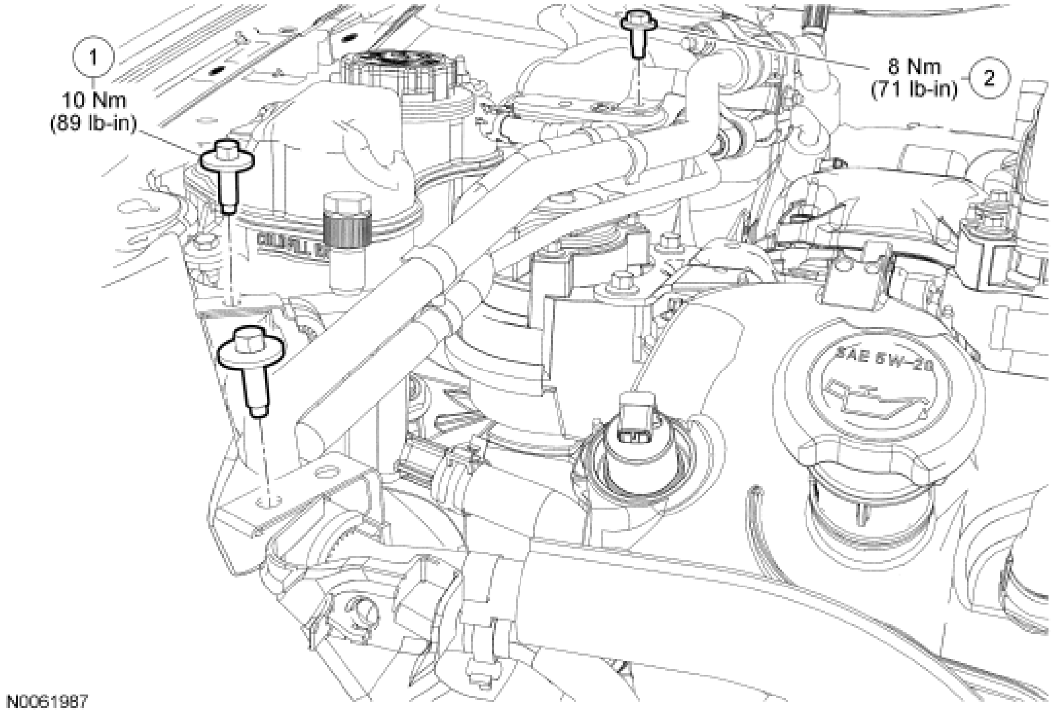


Fig. 47: Exploded View Of A/C Tube Retaining Clamp Bolt With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W503924	A/C tube retaining clamp bolt (2 required)
2	W505422	A/C tube retaining clamp bolt

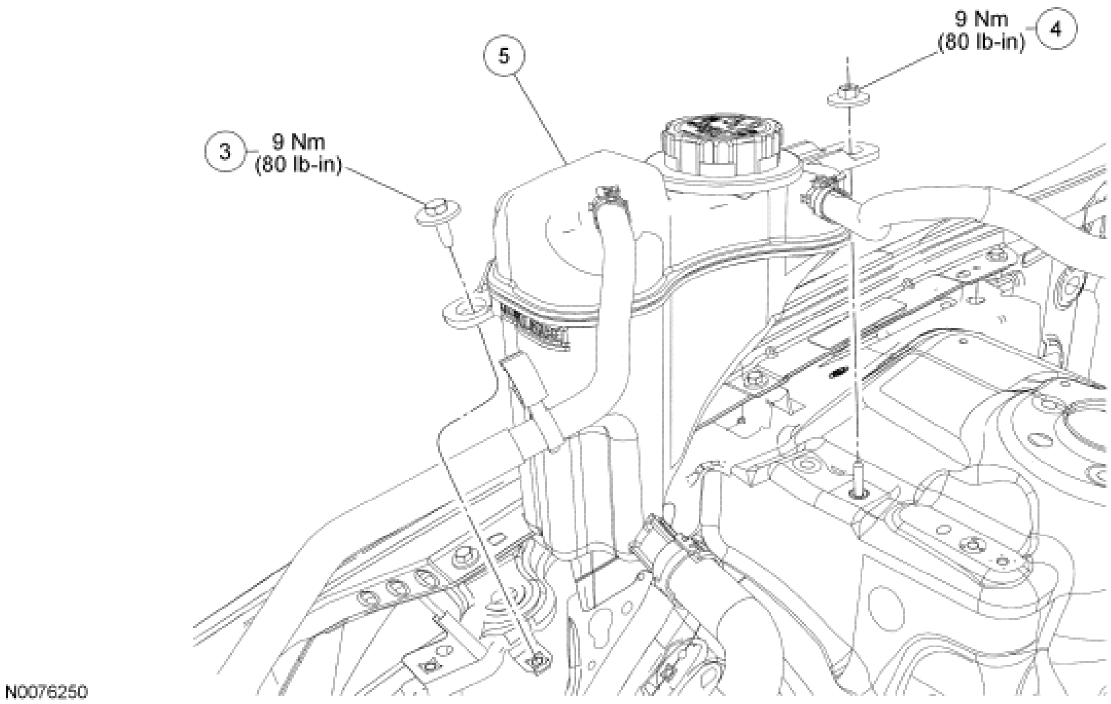


Fig. 48: Exploded View Of Engine Mount Components With Torque Specifications (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
3	W707398	Engine coolant degas bottle-to-fender bolt
4	W709603	Engine coolant degas bottle-to-fender nut
5	8A080	Engine coolant degas bottle

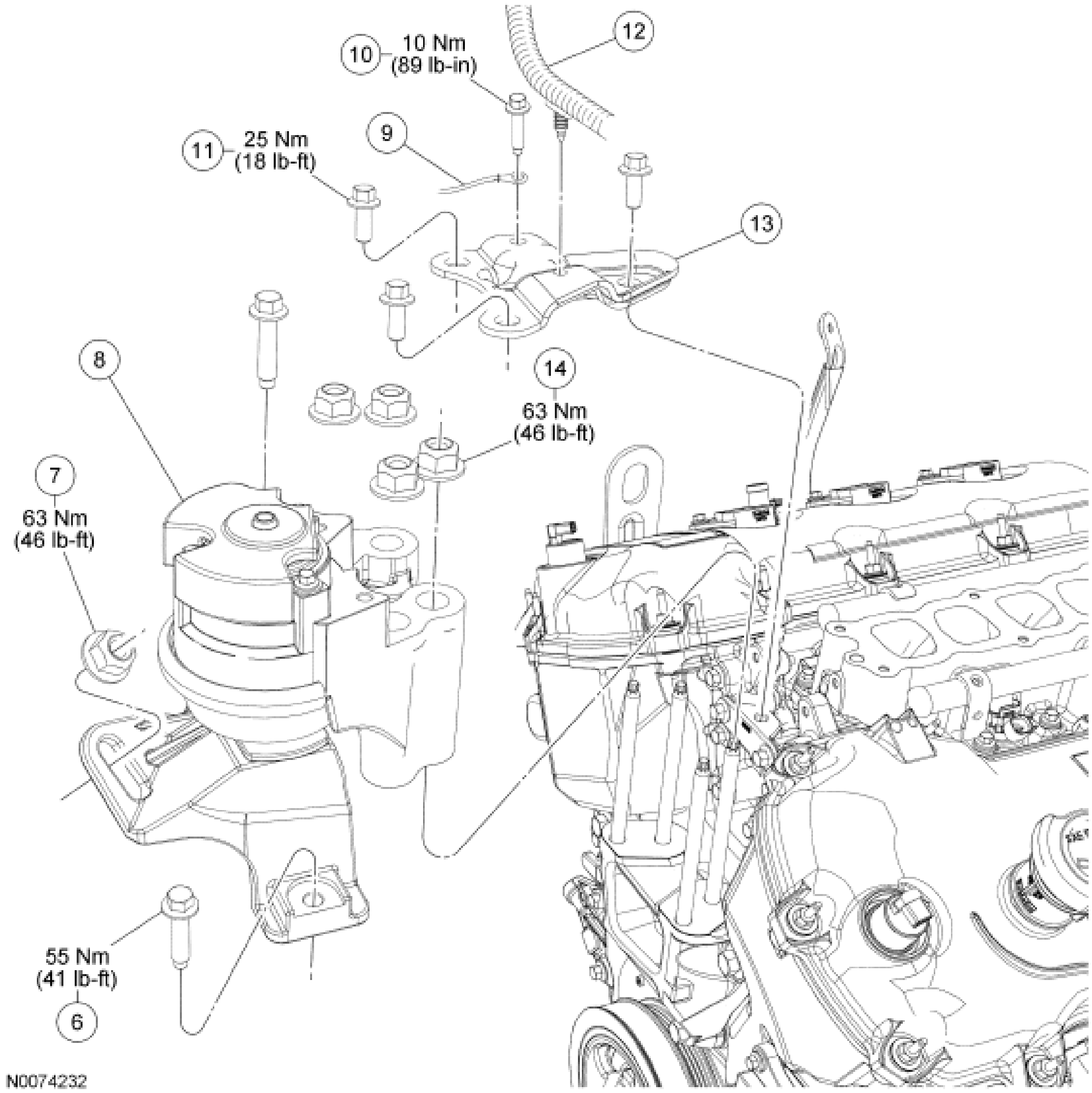


Fig. 49: Exploded View Of Engine Mount Components With Torque Specifications (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
6	W500720	Engine mount-to-frame bolt (2 required)
7	W705891	Engine mount-to-frame nut
8	6F012	Engine mount
9	19A905	Ground wire
10	W705936	Ground wire bolt
11	W708764	Engine mount brace bolt (3 required)
12	3493	Power steering hose retainer
13	6K075	Engine mount brace
14	W705891	Engine mount-to-engine nut (4 required)

REMOVAL AND INSTALLATION

1. Remove the exhaust flexible pipe. For additional information, refer to **EXHAUST SYSTEM** article.

CAUTION: The special tool must be carefully aligned to the mounting bosses on the oil pan. Failure to follow these instructions may result in damage to the oil pan.

2. Position a floor jack and the special tool under the oil pan.

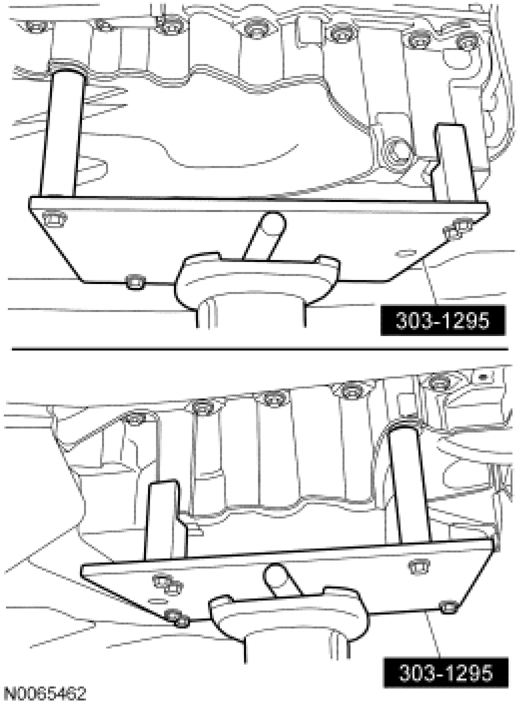


Fig. 50: Positioning Floor Jack & Special Tool (303-1295) Under Oil Pan
Courtesy of FORD MOTOR CO.

3. Remove the A/C tube retaining clamp bolt.
   - To install, tighten to 8 Nm (71 lb-in).
4. Remove the 2 A/C tube retaining clamp bolts.
   - To install, tighten to 10 Nm (89 lb-in).
5. Remove the nut, bolt and position the engine coolant degas bottle aside.
   - To install, tighten to 9 Nm (80 lb-in).
6. Detach the power steering hose retainer from the engine mount brace.
7. Remove the bolt and the ground wire from the engine mount brace.
   - To install, tighten to 10 Nm (89 lb-in).
8. Remove the 3 bolts and the engine mount brace.
   - To install, tighten to 25 Nm (18 lb-ft).

9. Remove the 4 engine mount-to-engine nuts.
   - To install, tighten the bolts to 55 Nm (41 lb-ft) and the nut to 63 Nm (46 lb-ft).
10. Using the special tool, lower the engine 25 mm (1 in).

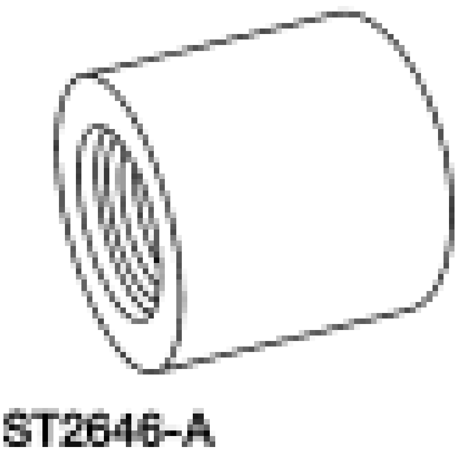
NOTE: It is necessary to reposition the A/C tubes to remove the engine mount.

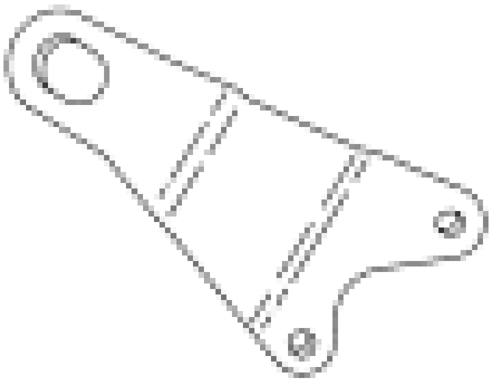
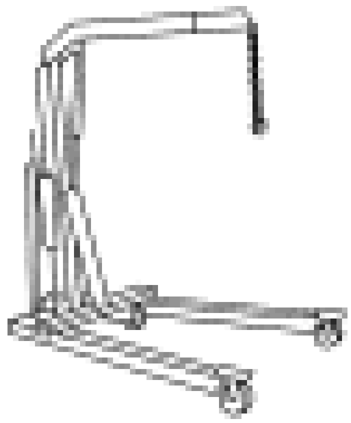
11. Remove the nut, the 2 bolts and the engine mount.
   - To install, tighten the bolts to 55 Nm (41 lb-ft) and the nut to 63 Nm (46 lb-ft).
12. To install, reverse the removal procedure.

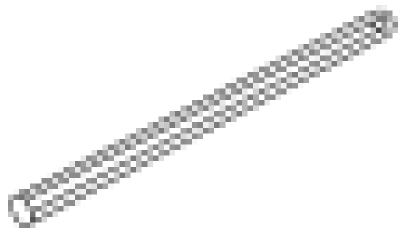
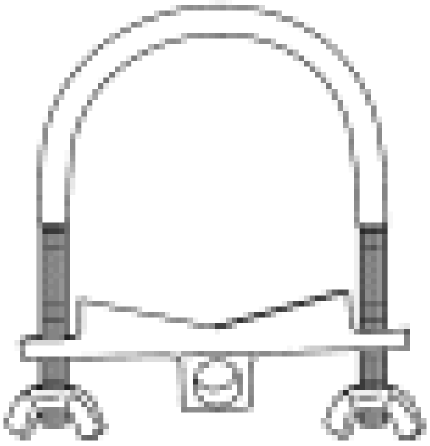
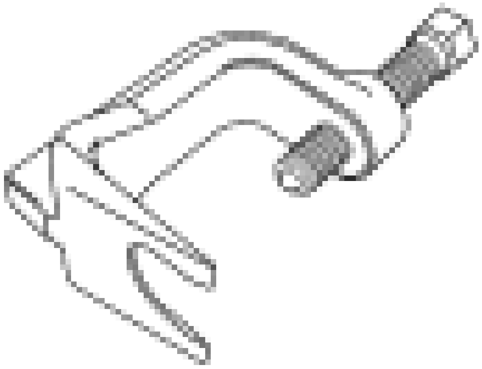
REMOVAL

ENGINE

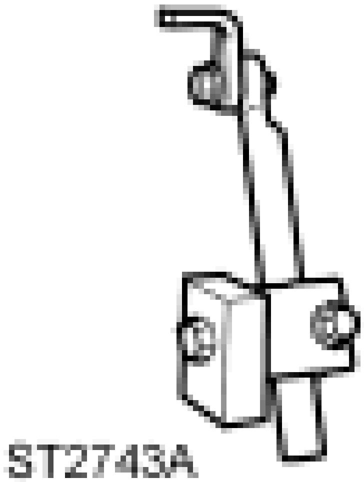
Special Tools

Illustration	Tool Name	Tool Number
	Adapter for 204-592	204-592/1
	Engine Lifting Bracket	303-1245

 ST2976A		
 ST1341-A	Heavy Duty Floor Crane	014-00071 or equivalent
 ST1293-A	Powertrain Lift	014-00765
	Remover, Halfshaft	205-243

 ST2939-A		
 ST2934-A	Remover, Halfshaft	205-832
 ST2945-A	Separator, Ball Joint	204-592
	Slide Hammer	100-001

 ST1185-A		
 ST1602-A	Spreader Bar	303-D089 (D93P-6001-A3) or equivalent
 ST1408-A	Tie-Rod End Remover	211-105
	Universal Adapter Brackets	014-0001

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Recover the A/C system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
4. Remove the accessory drive belt and the power steering belt. For additional information, refer to **ACCESSORY DRIVE - 3.5L** article.
5. If equipped, remove the 6 screws and the underbody shield.

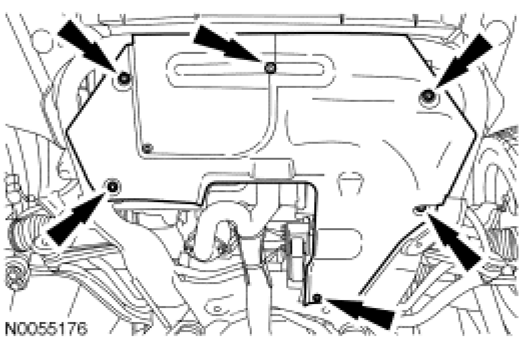


Fig. 51: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

6. Disconnect the power steering cooler tube and drain the power steering fluid into a suitable drain pan.

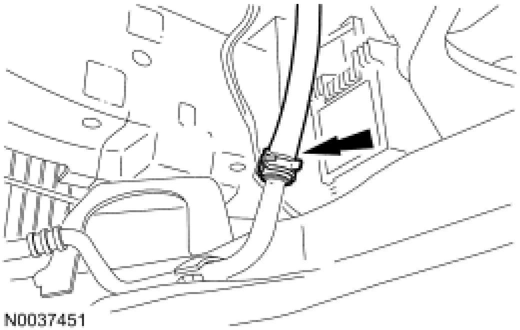


Fig. 52: Locating Power Steering Cooler Tube
Courtesy of FORD MOTOR CO.

7. Drain the cooling system. For additional information, refer to **ENGINE COOLING** article.
8. Remove the degas bottle. For additional information, refer to **ENGINE COOLING** article.
9. Remove the engine air cleaner and air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.
10. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
11. Disconnect the 2 engine wiring harness electrical connectors.

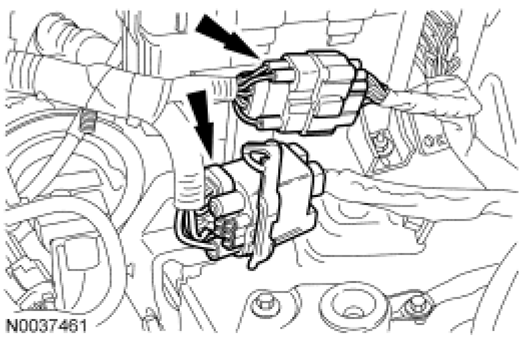


Fig. 53: Locating Engine Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

12. Detach the 2 wiring harness retainers from the transmission mount and the battery tray bracket.

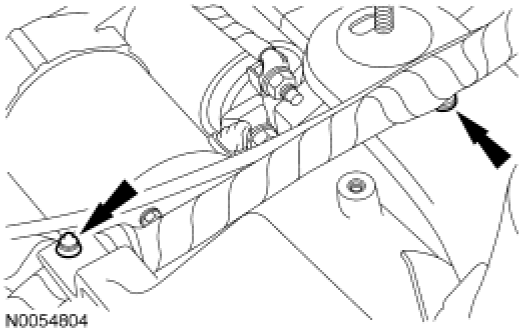


Fig. 54: Locating Wiring Harness Retainers From Transmission Mount & Battery Tray Bracket
Courtesy of FORD MOTOR CO.

13. Remove the nut and disconnect the power feed wire from the battery terminal.

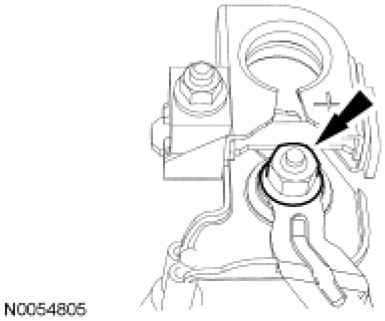


Fig. 55: Locating Power Feed To Battery Terminal And Nut
Courtesy of FORD MOTOR CO.

14. Remove the bolt and position aside the ground wire.

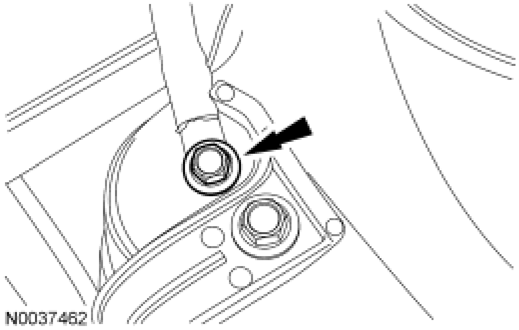


Fig. 56: Locating Ground Wire And Bolt
Courtesy of FORD MOTOR CO.

15. Disconnect the vacuum hose and the evaporative emissions (EVAP) tube from the upper intake manifold.

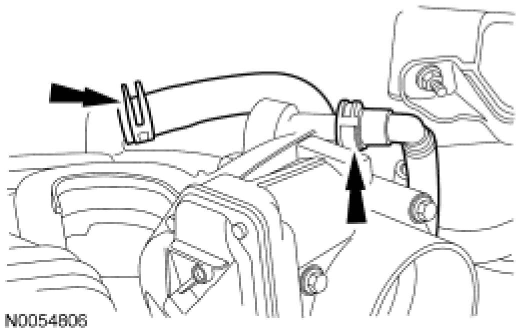


Fig. 57: Locating Vacuum Hose & Evaporative Emissions (EVAP) Tube From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

16. Disconnect the upper radiator hose, lower radiator hose and 2 heater hoses from the thermostat housing.

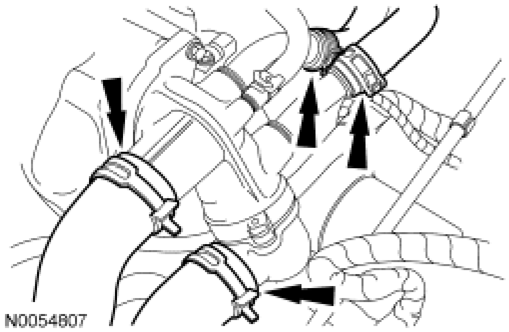


Fig. 58: Locating Upper Radiator Hose, Lower Radiator Hose & Heater Hoses From Thermostat Housing
Courtesy of FORD MOTOR CO.

17. Disconnect the transaxle control cable from the control lever.

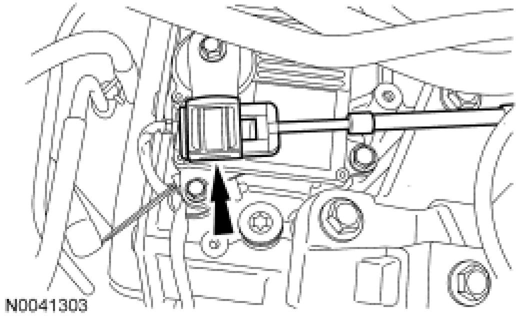


Fig. 59: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

18. Remove the 3 nuts and position the transaxle control cable bracket aside.

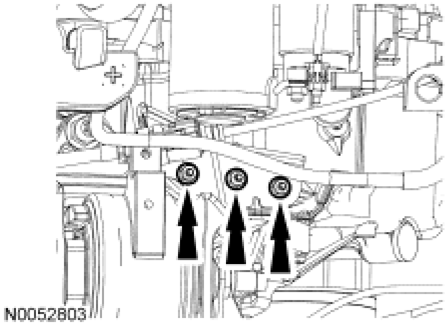


Fig. 60: Identifying Selector Lever Cable Bracket Bolts & Nuts
Courtesy of FORD MOTOR CO.

19. Remove the bolt and position the ground wire aside.

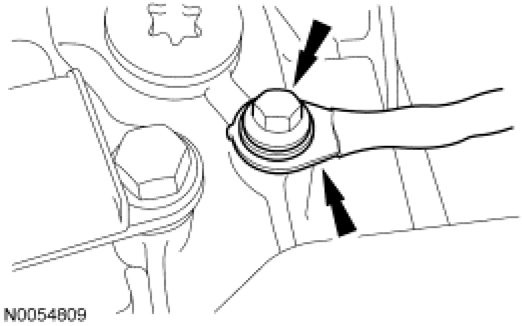


Fig. 61: Locating Ground Wire And Bolt
Courtesy of FORD MOTOR CO.

20. If equipped, detach the engine block heater harness from the radiator support, power steering hose, A/C tube and the engine wiring harness.
21. Detach the coolant tube retainer clips from the A/C tube.

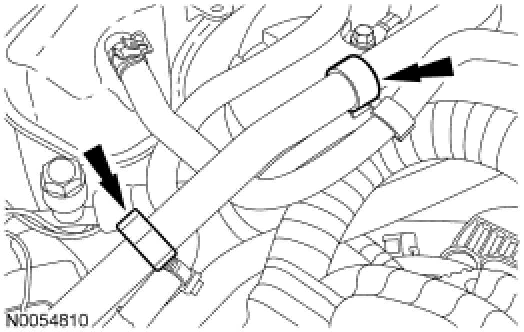


Fig. 62: Identifying Coolant Tube Retainer Clips
Courtesy of FORD MOTOR CO.

22. Remove the nut and disconnect the A/C tube from the condenser.
    - Discard the O-ring seal.

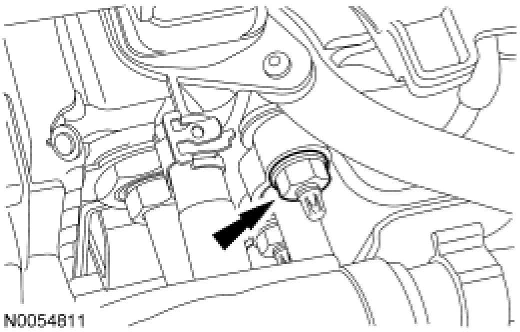


Fig. 63: Locating A/C Tube From Condenser
Courtesy of FORD MOTOR CO.

23. Remove the 2 A/C tube bracket bolts.

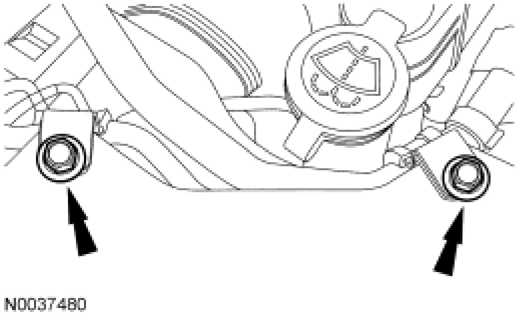


Fig. 64: Locating A/C Tube Bracket Bolts
Courtesy of FORD MOTOR CO.

24. Remove the A/C tube bracket bolt.

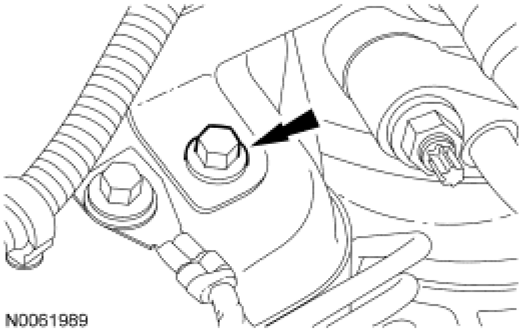


Fig. 65: Locating A/C Tube Bracket Bolt
Courtesy of FORD MOTOR CO.

25. Remove the 2 nuts and disconnect the A/C tubes.
    - Discard the O-ring seal.

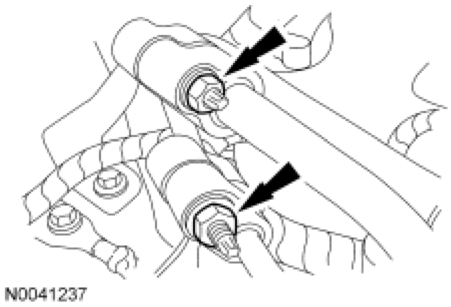


Fig. 66: Locating A/C Tubes And Nuts
Courtesy of FORD MOTOR CO.

26. Detach the 2 wiring harness retainers.

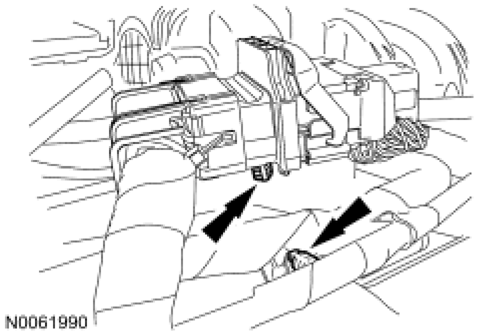


Fig. 67: Identifying Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

27. Disconnect the 2 engine wiring harness electrical connectors.

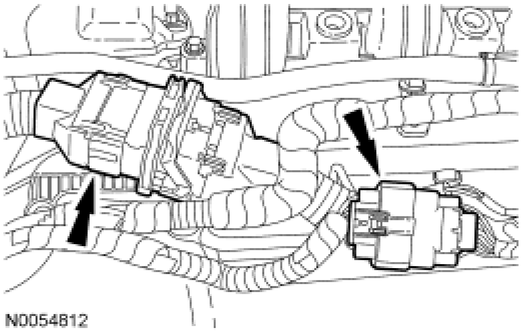


Fig. 68: Identifying Engine Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

28. Remove the 2 wiring harness retainers from the LH valve cover stud bolts and position the wiring harness aside.

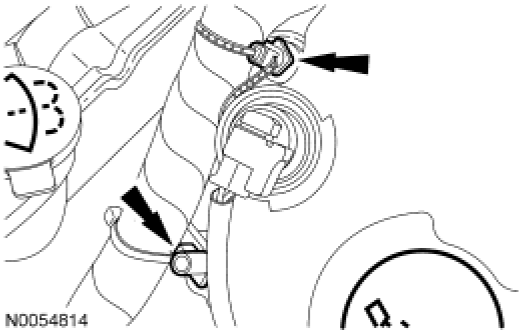


Fig. 69: Identifying Wiring Harness Retainers From LH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

29. Remove the oil level indicator.

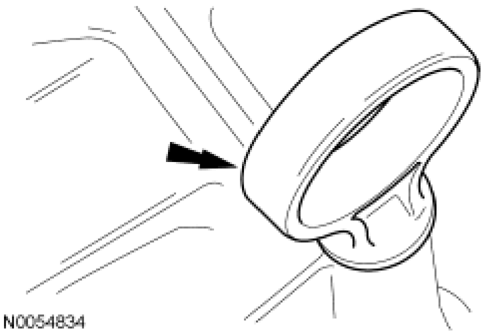


Fig. 70: Identifying Oil Level Indicator
Courtesy of FORD MOTOR CO.

30. Disconnect the hose from the power steering reservoir.
    - Detach the pin-type retainer from the engine mount brace.

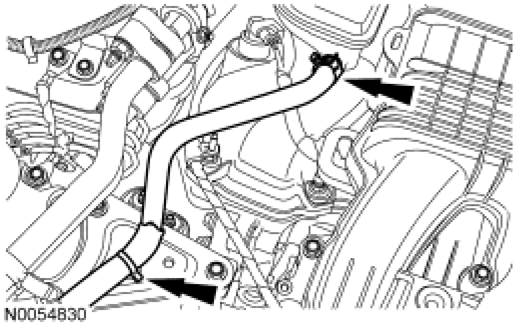


Fig. 71: Identifying Pin-Type Retainer From Engine Mount Brace
Courtesy of FORD MOTOR CO.

31. Using a small screwdriver, release the retaining clip and detach the power steering reservoir from the cowl.

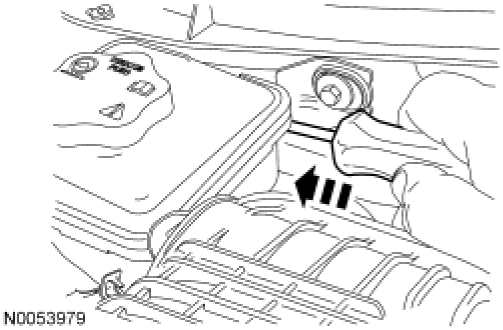


Fig. 72: Detaching Power Steering Reservoir From Bracket
Courtesy of FORD MOTOR CO.

32. Disconnect the fuel supply tube from the fuel rail. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

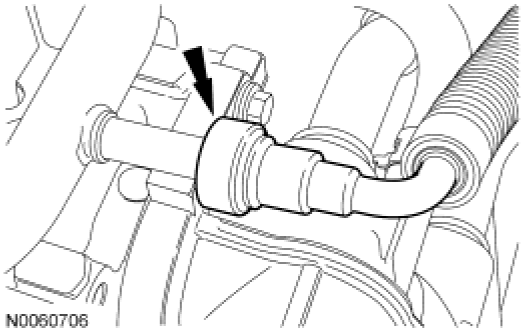


Fig. 73: Identifying Fuel Supply Tube From Fuel Rail
Courtesy of FORD MOTOR CO.

33. Remove the bolt and the ground wire from the engine mount brace.

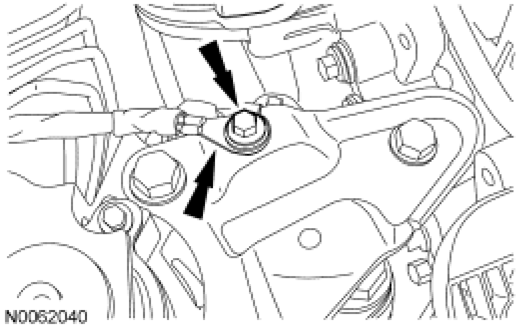


Fig. 74: Identifying Ground Wire Bolt From Engine Mount Brace
Courtesy of FORD MOTOR CO.

34. Remove the 3 bolts and the engine mount brace.

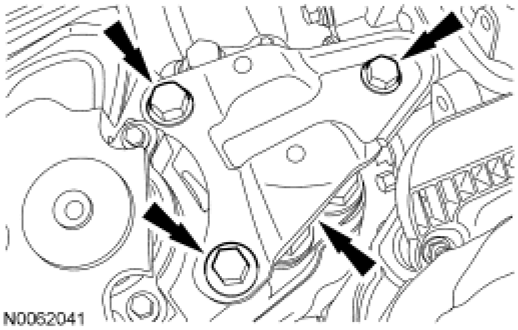


Fig. 75: Locating Engine Mount Brace Bolts
Courtesy of FORD MOTOR CO.

35. Disconnect the PCM electrical connectors and pin-type retainers.

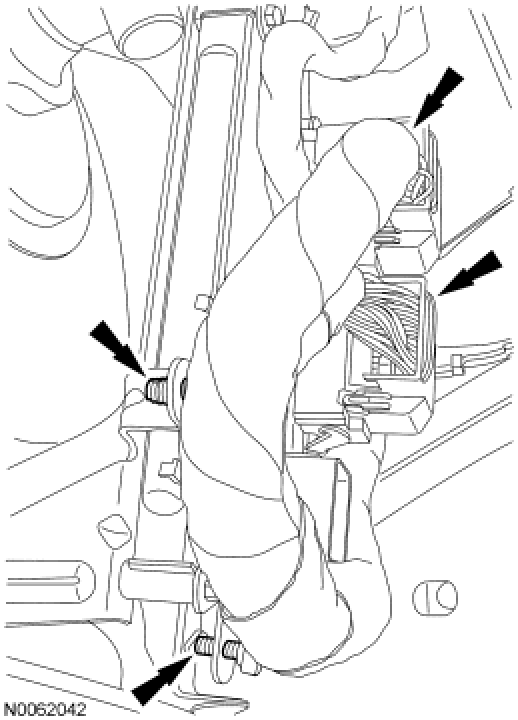


Fig. 76: Locating PCM Electrical Connectors & Pin-Type Retainers
Courtesy of FORD MOTOR CO.

36. Remove the power steering pressure (PSP) hose bracket bolt.

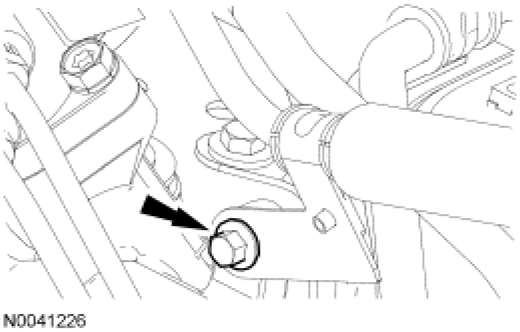


Fig. 77: Locating Power Steering Pressure (PSP) Hose Bracket Bolt
Courtesy of FORD MOTOR CO.

37. Remove and discard the PSP hose banjo bolt and the 2 seals from the steering gear.

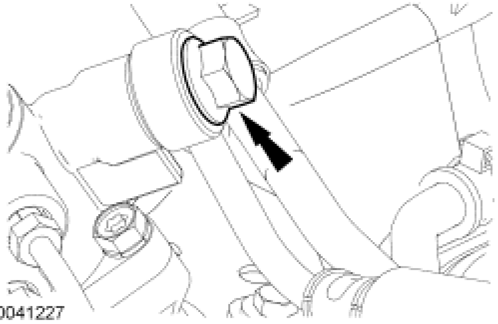


Fig. 78: Locating PSP Hose Banjo Bolt
Courtesy of FORD MOTOR CO.

38. Place the steering wheel in the straight-ahead position and the ignition key in the OFF position.
39. Remove the 2 nuts and the steering joint cover.

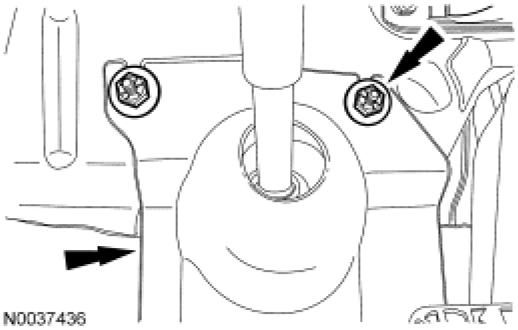


Fig. 79: Locating Steering Joint Cover And Nuts
Courtesy of FORD MOTOR CO.

CAUTION: Do not allow the intermediate shaft to rotate while it is disconnected from the gear or damage to the clockspring can occur. If there is evidence that the intermediate shaft has rotated, the clockspring

must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.

NOTE: **Index-mark the steering column shaft position to the steering gear for reference during installation.**

40. Remove the bolt and disconnect the steering column shaft from the steering gear.
    - Discard the bolt.

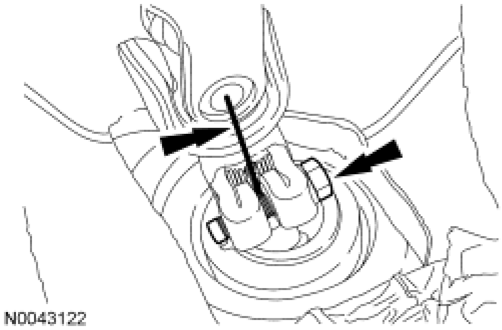


Fig. 80: Locating Steering Column Shaft Index Mark And Bolt
Courtesy of FORD MOTOR CO.

41. Remove the 4 screws and position the LH fender splash shield aside.

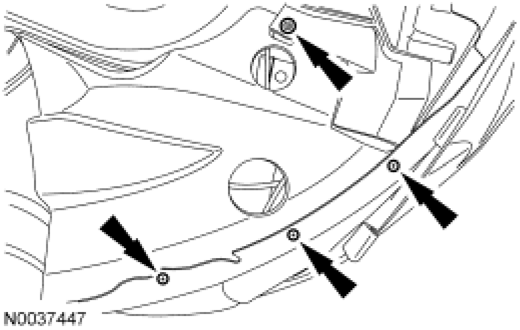


Fig. 81: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

42. Remove the 6 pin-type retainers (4 shown) and the LH splash shield.

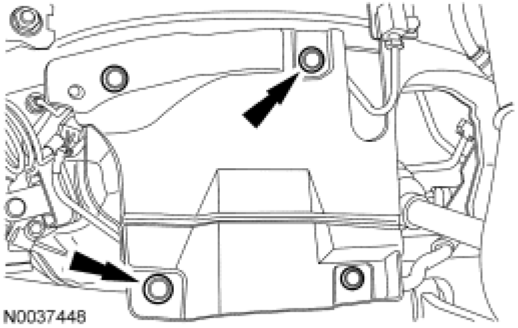


Fig. 82: Locating LH Splash Shield And Pin-Type Retainers
Courtesy of FORD MOTOR CO.

CAUTION: The steering gear-to-dash seal must be removed or it will be damaged when lowering the subframe.

43. Release the 4 clips and slide the steering gear-to-dash seal off of the steering gear and into the passenger compartment.

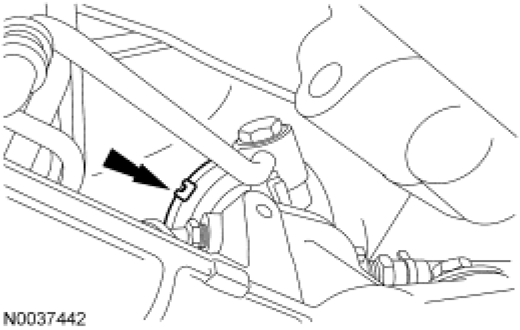


Fig. 83: Locating Steering Gear-To-Dash Seal Clips
Courtesy of FORD MOTOR CO.

44. Disconnect the transaxle cooler hoses.

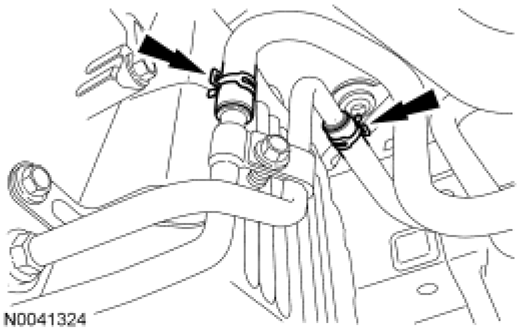


Fig. 84: Locating Transmission Fluid Cooler Hoses
Courtesy of FORD MOTOR CO.

45. Remove the drain plug and drain the engine oil.
    - Install the drain plug and tighten to 27 Nm (20 lb-ft).

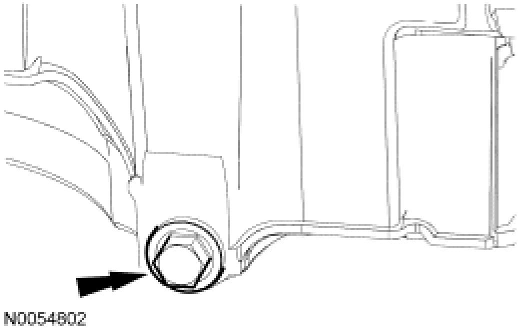


Fig. 85: Locating Drain Plug
Courtesy of FORD MOTOR CO.

46. Remove and discard the engine oil filter.

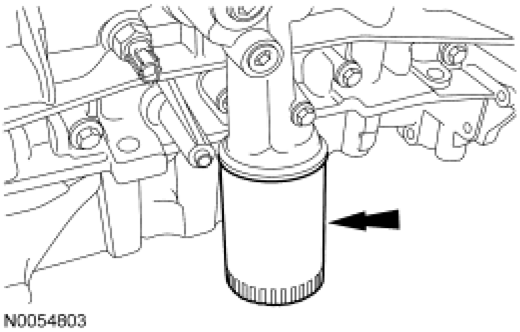


Fig. 86: Identifying Engine Oil Filter
Courtesy of FORD MOTOR CO.

47. Remove the 6 nuts and the Y-pipe assembly.
    - Discard the gaskets and nuts.

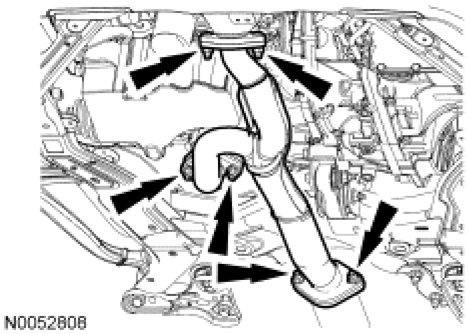


Fig. 87: Locating Y-Pipe Nuts & Y-Pipe Assembly
Courtesy of FORD MOTOR CO.

48. Remove the 4 oil pan-to-transaxle bolts.

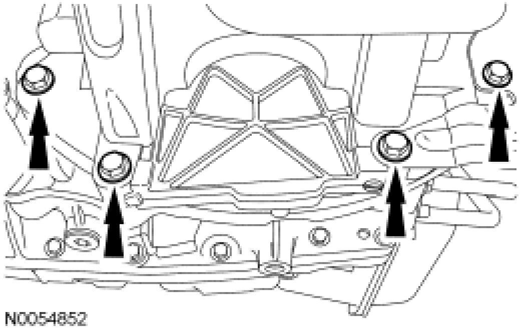


Fig. 88: Locating Oil Pan-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

49. Remove the 2 fasteners and the inspection cover.

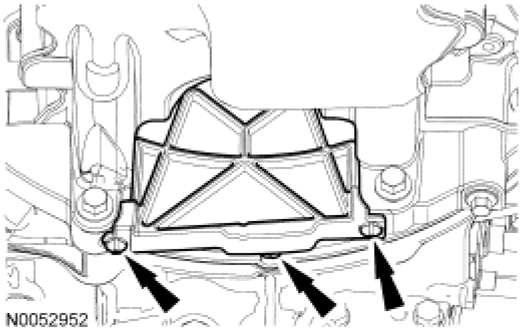


Fig. 89: Identifying Inspection Cover & Fasteners
Courtesy of FORD MOTOR CO.

50. Remove and discard the 4 torque converter nuts.

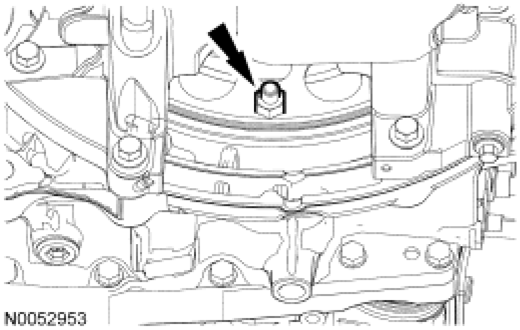


Fig. 90: Identifying Torque Converter Nuts
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

NOTE: Index-mark the driveshaft for installation.

51. Remove the 4 bolts (3 shown) and support the driveshaft with a length of mechanic's wire.

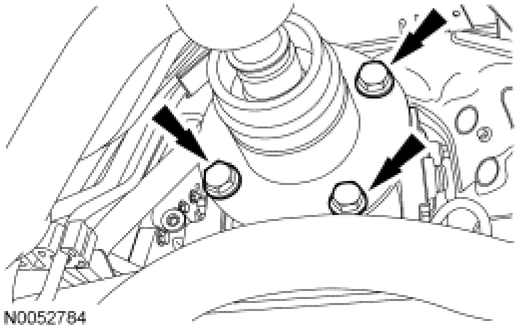


Fig. 91: Identifying Drive Shaft Bolts
Courtesy of FORD MOTOR CO.

All vehicles

52. Remove the engine roll restrictor-to-subframe through bolt.

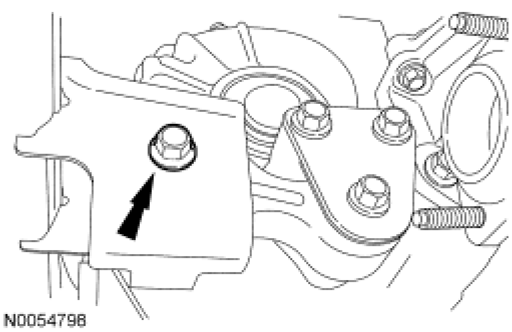


Fig. 92: Locating Roll Restrictor Bolt
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

53. Remove the cotter pins and nuts from the tie-rod ends.

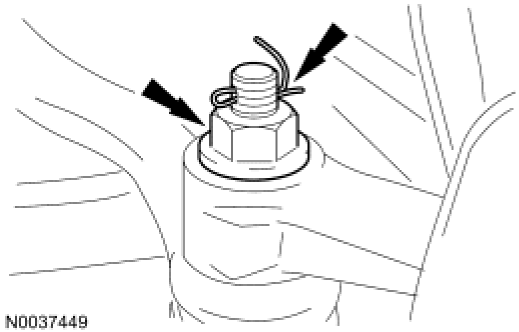


Fig. 93: Locating Tie-Rod Ends Nuts And Cotter Pin
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

54. Using the special tool, separate the tie-rod ends from the steering knuckles.

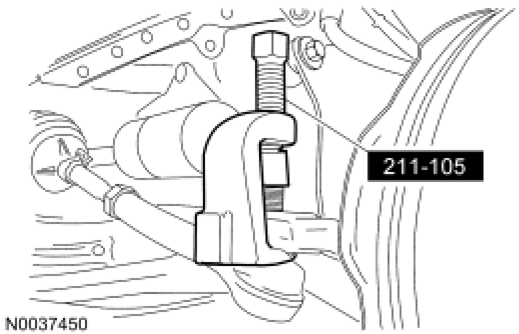


Fig. 94: Separating Tie-Rod Ends From Wheel Knuckles Using Special Tool (211-105)
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

55. Remove the nuts and separate the stabilizer bar links from the struts.

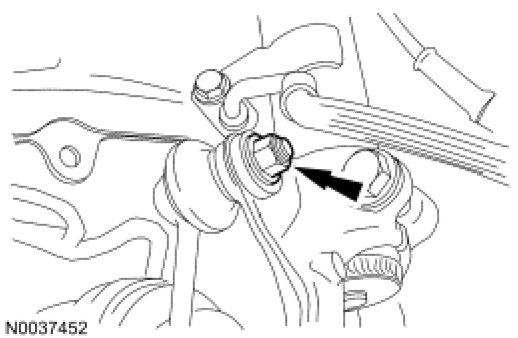


Fig. 95: Locating Stabilizer Bar Links Nut
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

56. Remove the 4 lower ball joint nuts.

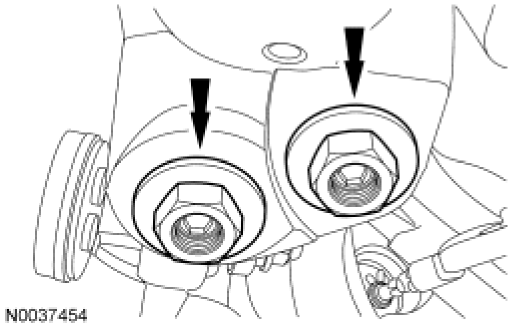


Fig. 96: Locating Lower Ball Joint Nuts
Courtesy of FORD MOTOR CO.

CAUTION: **When the lower ball joint is separated from the wheel knuckle, the lower arm may strike the outer constant velocity (CV) joint boot with enough force to damage the boot clamp. This will result in a loss of grease from the outer CV joint. Place a block of wood, or similar item, between the lower arm and the outer CV joint to prevent the lower arm from striking the outer CV joint.**

NOTE: **Once pressure is applied to the ball joint with the special tool, it may be necessary to tap the wheel knuckle at the ball joint area to separate the ball joint from the wheel knuckle.**

NOTE: **LH shown, RH similar.**

57. Using the special tools, separate the lower ball joints from the lower control arms.

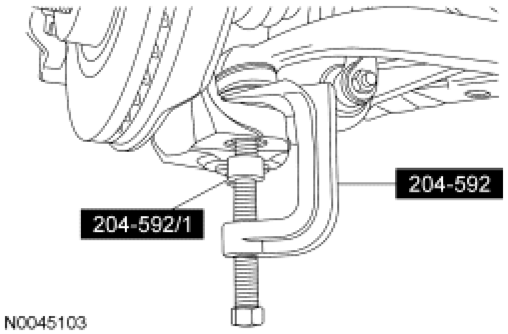


Fig. 97: Identifying Special Tools (204-592/1, 204-592)
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

58. Remove the through bolts from the lower control arms.

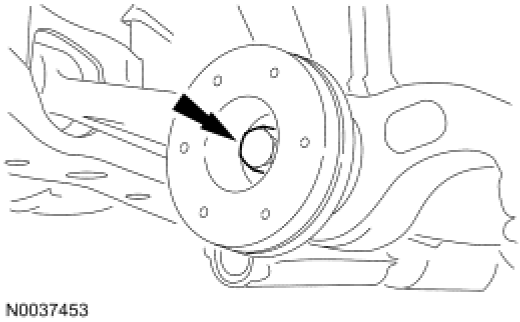


Fig. 98: Locating Lower Control Arms Through Bolt
Courtesy of FORD MOTOR CO.

59. Position the special tool under the subframe assembly.

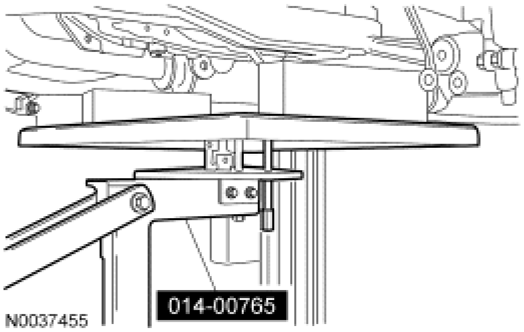


Fig. 99: Positioning Special Tool (014-00765) Under Subframe Assembly
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

60. Remove the 4 subframe bracket-to-body bolts.

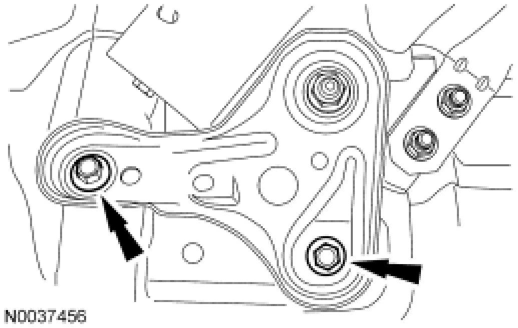


Fig. 100: Locating Subframe Bracket-To-Body Bolts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

61. Remove the 2 rear subframe nuts and the 2 subframe brackets.

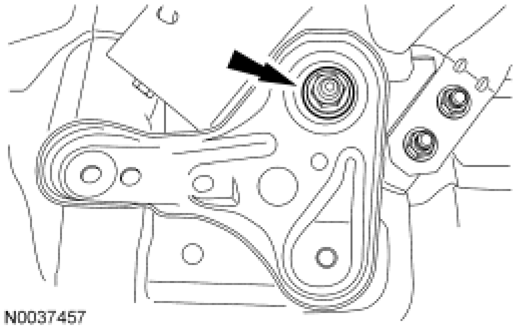


Fig. 101: Locating Subframe Nuts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

62. Remove the 2 front subframe nuts.

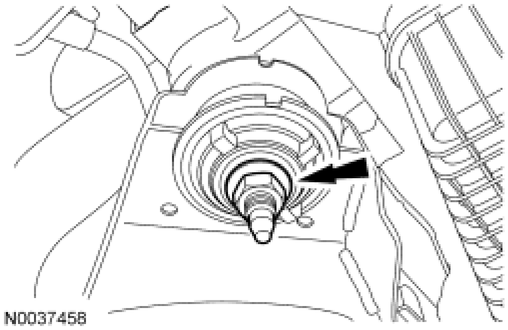


Fig. 102: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

63. Lower the subframe assembly from the vehicle.
64. Using the special tools, separate the LH halfshaft from the transaxle and support the halfshaft with a length of mechanic's wire.

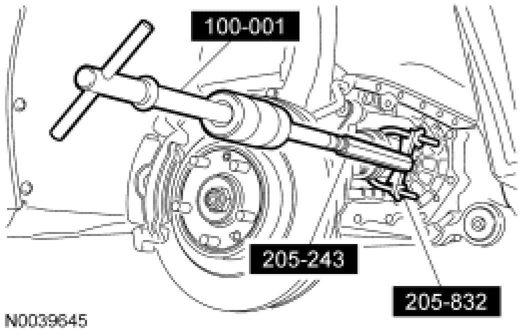


Fig. 103: Identifying Special Tools (100-001, 205-243 And 205-832)
Courtesy of FORD MOTOR CO.

65. Remove the 2 RH catalytic converter bracket bolts.

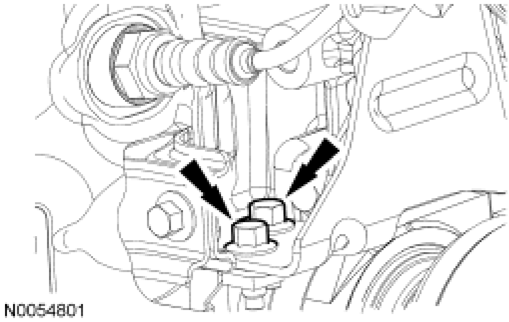


Fig. 104: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

66. Remove the 2 nuts and remove the RH catalytic converter bracket.

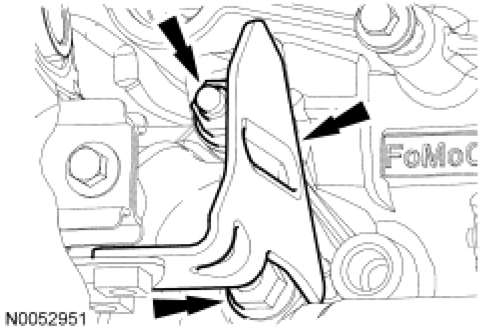


Fig. 105: Identifying Catalytic Converter Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

67. Remove the RH halfshaft carrier bearing bolt and 2 stud bolts.
    - Separate the RH halfshaft from the transaxle and support the halfshaft with a length of mechanic's wire.

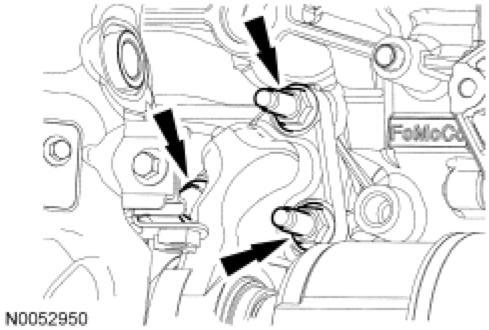


Fig. 106: Identifying Intermediate Shaft Bearing Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

AWD vehicles

68. Remove the 2 RH halfshaft carrier bearing bolts.
    - Separate the RH halfshaft from the transaxle and support the halfshaft with a length of mechanic's wire.

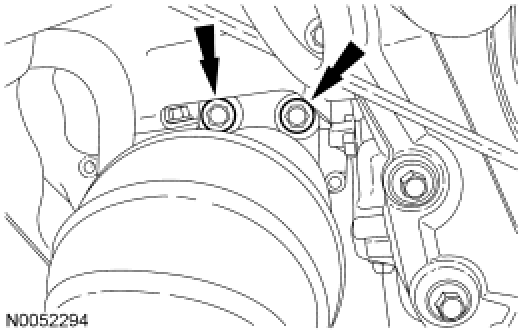


Fig. 107: Locating RH Halfshaft Bearing Support Bracket Bolts
Courtesy of FORD MOTOR CO.

69. Disconnect the RH catalyst monitor electrical connector.

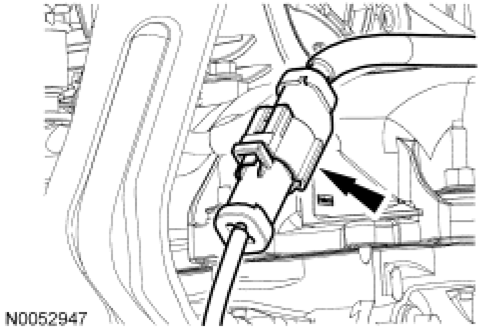


Fig. 108: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

70. Remove the 4 nuts and the RH catalytic converter.

- Discard the gasket.

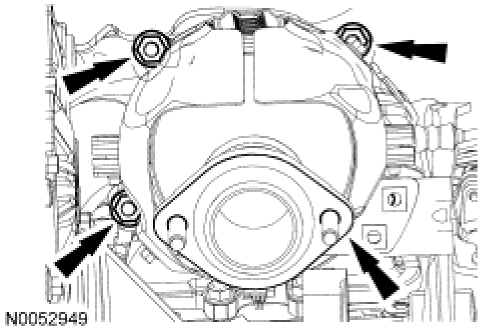


Fig. 109: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

71. Remove the 5 bolts and the power transfer unit (PTU) support bracket.

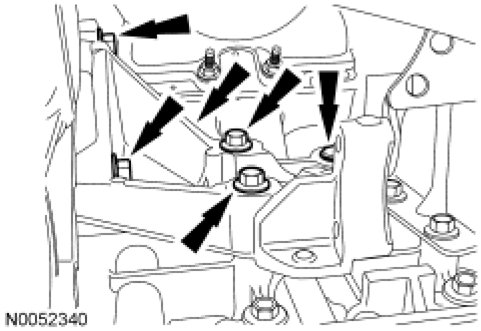


Fig. 110: Locating Power Transfer Unit (PTU) Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

72. Remove the 5 bolts and the PTU.

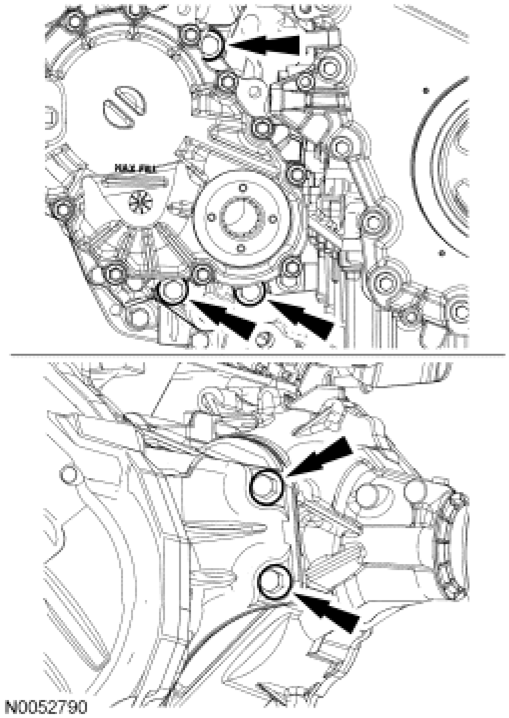


Fig. 111: Locating PTU Bolts
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: Position a block of wood under the transaxle.

73. Install the special tools.

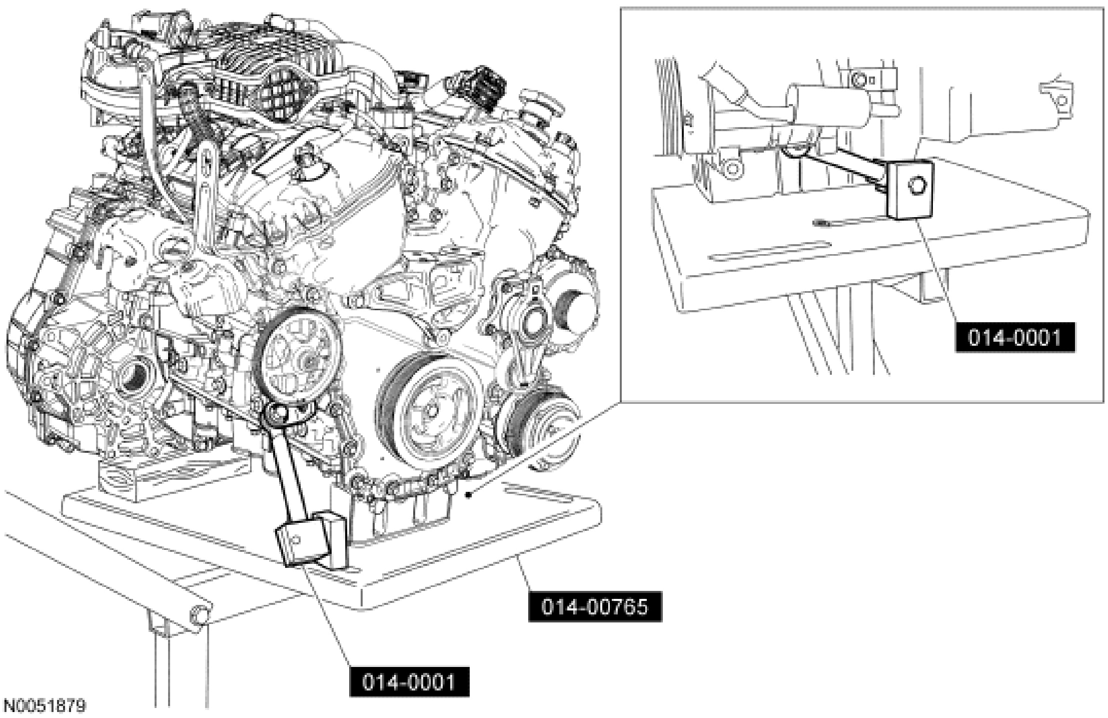


Fig. 112: Positioning Block Of Wood Under Transaxle Using Special Tools (014-0001) & (014-00765)
Courtesy of FORD MOTOR CO.

74. Remove the transaxle mount through bolt and nut.

Fig. 113: Identifying Transaxle Support Insulator Through Bolt
Courtesy of FORD MOTOR CO.

75. Remove the transaxle mount bracket bolt and the 2 nuts.

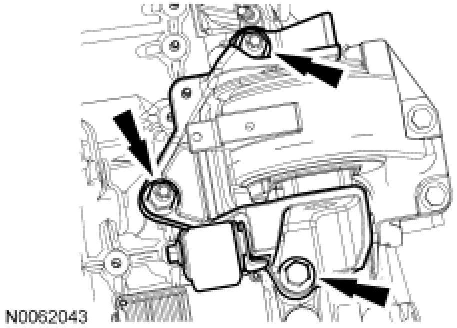


Fig. 114: Identifying Transaxle Mount Bracket Bolt
Courtesy of FORD MOTOR CO.

76. Remove the 4 engine mount nuts.

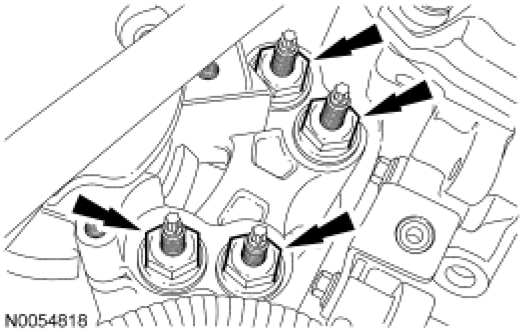


Fig. 115: Identifying Engine Mount Nuts
Courtesy of FORD MOTOR CO.

77. Remove the nut, 2 bolts and the engine mount.

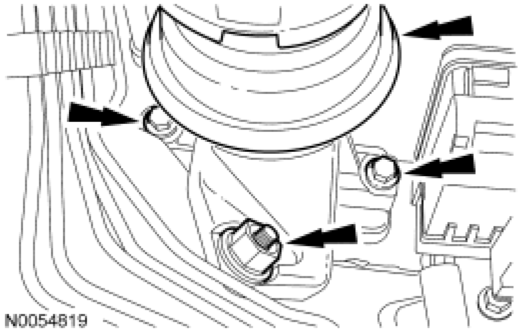


Fig. 116: Identifying Nut, Bolts & Engine Mount
Courtesy of FORD MOTOR CO.

78. Lower the engine and transaxle assembly from the vehicle.
79. Disconnect the wiring harness fasteners from the transaxle-to-engine stud bolt and the starter.

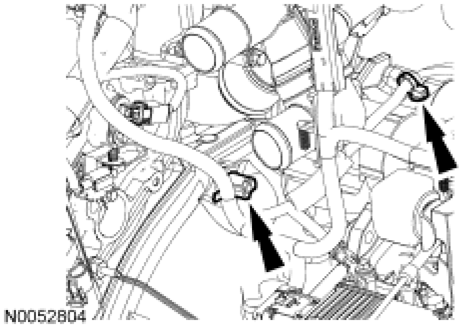


Fig. 117: Identifying Wiring Harness Fasteners & Torque Converter Housing Stud Bolt
Courtesy of FORD MOTOR CO.

80. Remove the bolt and ground wire.

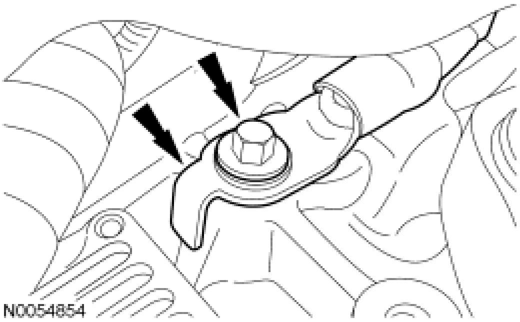


Fig. 118: Identifying Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

81. Disconnect the transmission control module (TCM) electrical connector.

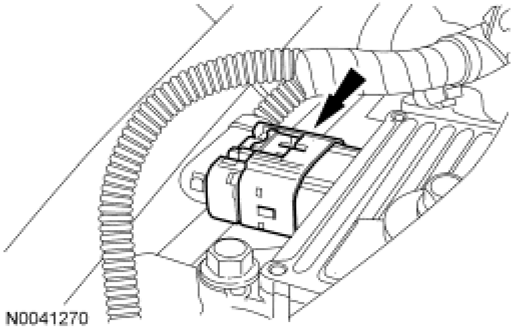


Fig. 119: Locating Transmission Control Module (TCM) Electrical Connector
Courtesy of FORD MOTOR CO.

82. Remove the 2 nuts and the starter motor wiring.

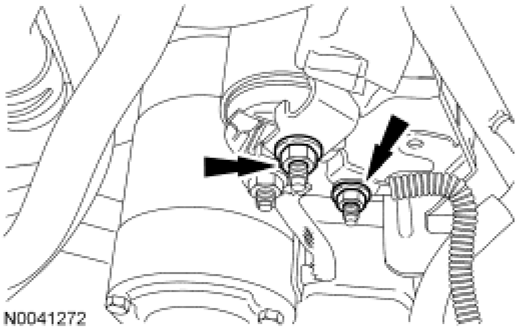


Fig. 120: Locating Starter Motor Wiring Nuts
Courtesy of FORD MOTOR CO.

83. Remove the 2 bolts and the starter.

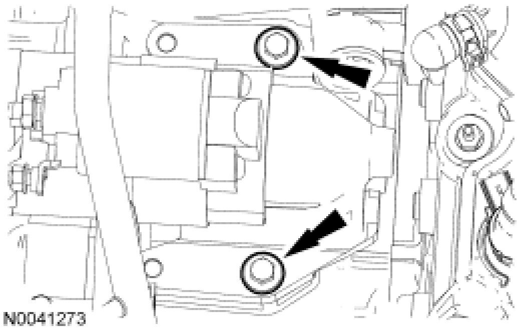


Fig. 121: Locating Starter Motor Bolts
Courtesy of FORD MOTOR CO.

84. Install the special tool on the LH cylinder head.

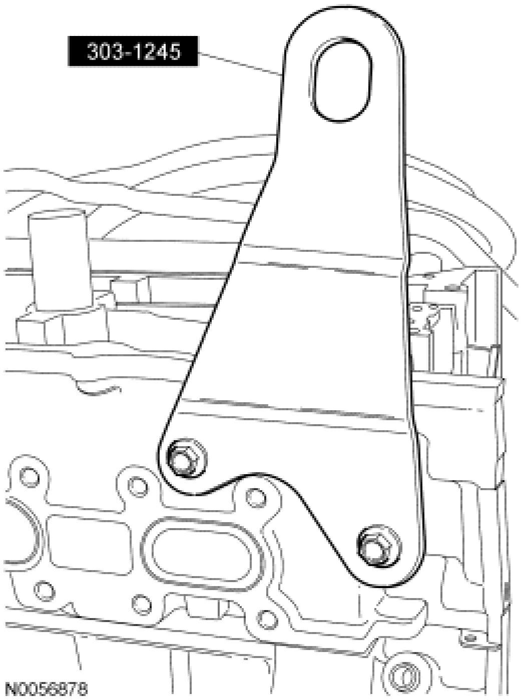


Fig. 122: Installing Special Tool (303-1245) On LH Cylinder Head
Courtesy of FORD MOTOR CO.

85. Using the special tools and a suitable engine crane, remove the engine and transaxle from the lift table.

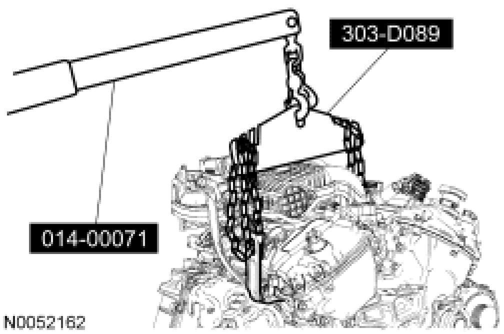


Fig. 123: Removing Engine & Transaxle From Lift Table Using Special Tools (303-D089, 014-00071) & Suitable Engine Crane
Courtesy of FORD MOTOR CO.

86. Remove the 2 engine-to-transaxle bolts.

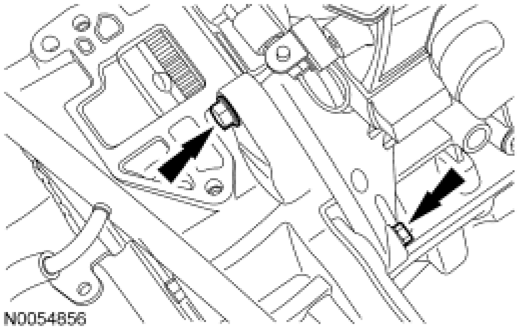


Fig. 124: Locating Engine-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

87. Remove the transaxle-to-engine stud bolt and the 4 transaxle-to-engine bolts.
    - Separate the transaxle from the engine.

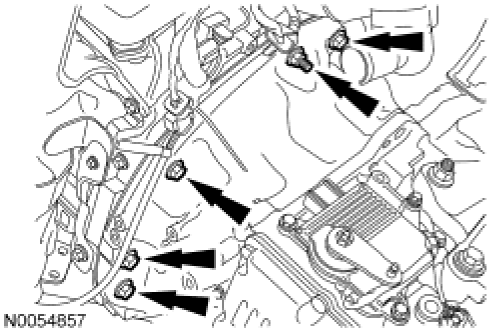
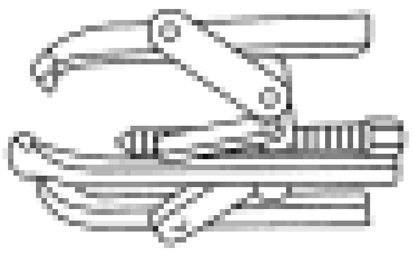
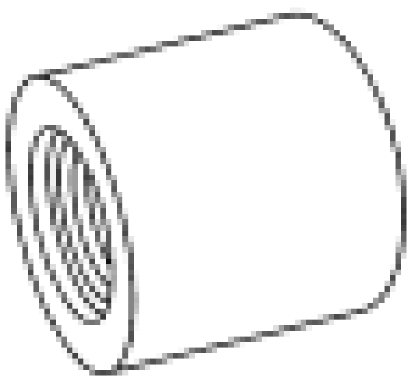
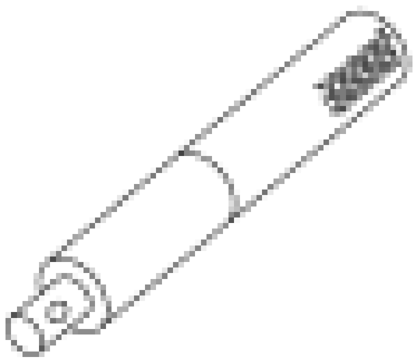


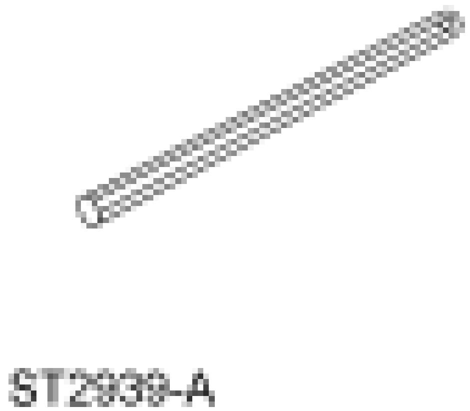
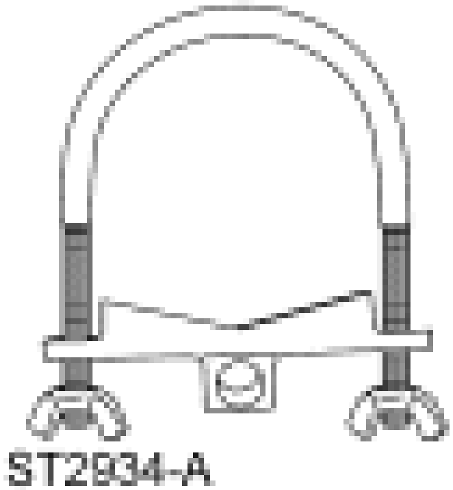
Fig. 125: Locating Transaxle-To-Engine Stud Bolt & Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

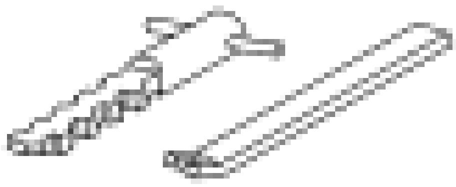
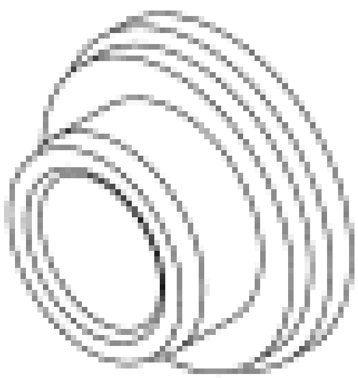
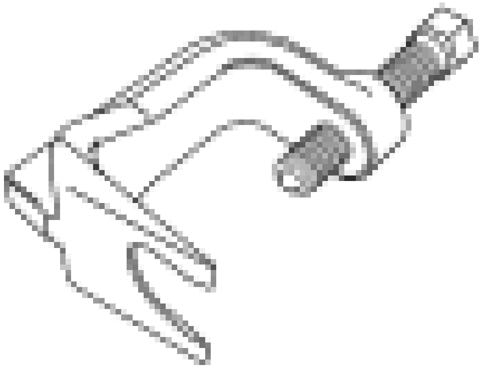
ENGINE FRONT COVER

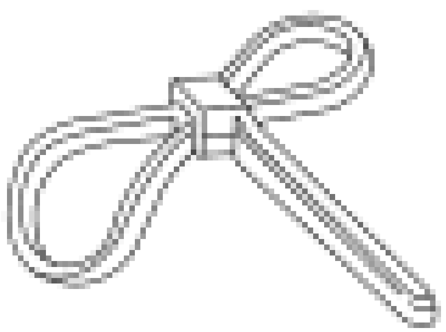
Special Tools

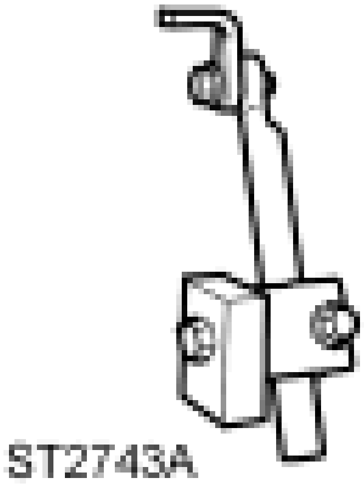
Illustration	Tool Name	Tool Number
	3-Jaw Puller	303-D121

 ST1184-A		
 ST2646-A	Adapter for 204-592	204-592/1
 ST1326-A	Handle	205-153 (T80T-4000-W)
	Powertrain Lift	014-00765

		
	Remover, Halfshaft	205-243
	Remover, Halfshaft	205-832
	Remover, Oil Seal	303-409 (T92C-6700CH)

 ST1385-A		
 ST2982-A	Remover, Seal	303-1247/1
 ST2945-A	Separator, Ball Joint	204-592
	Slide Hammer	100-001

 ST1185-A		
 ST1438-A	Strap Wrench	303-D055 (D85L-6000-A)
 ST1408-A	Tie-Rod End Remover	211-105
	Universal Adapter Brackets	014-0001

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Silicone Gasket Remover ZC-30	-

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

CAUTION: **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.**

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Recover the A/C system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
4. Remove the accessory drive belt and the power steering belt. For additional information, refer to **ACCESSORY DRIVE - 3.5L** article.
5. If equipped, remove the 6 screws and the underbody shield.

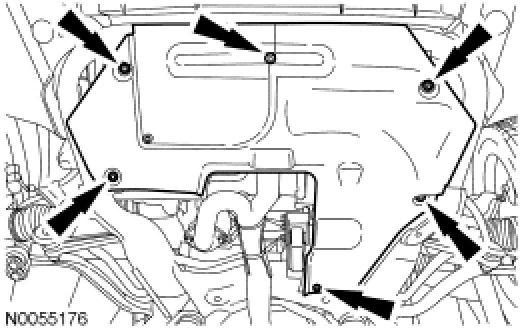


Fig. 126: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

6. Disconnect the power steering cooler tube and drain the power steering fluid into a suitable drain pan.

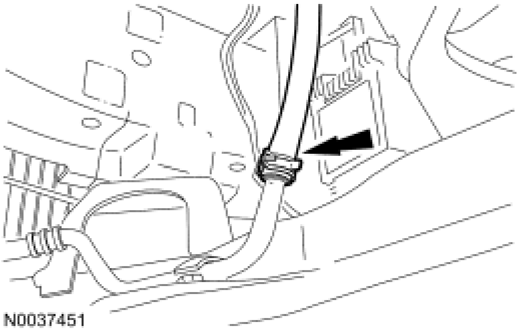


Fig. 127: Locating Power Steering Cooler Tube
Courtesy of FORD MOTOR CO.

7. Drain the cooling system. For additional information, refer to **ENGINE COOLING** article.
8. Remove the degas bottle. For additional information, refer to **ENGINE COOLING** article.
9. Remove the engine air cleaner and air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.
10. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
11. Disconnect the 2 engine wiring harness electrical connectors.

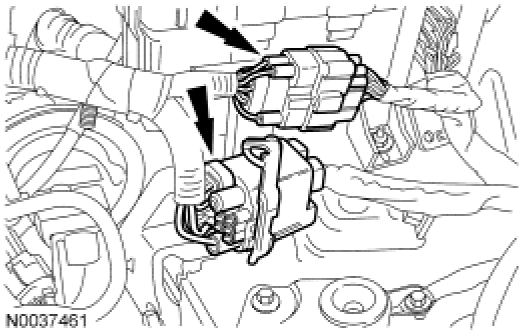


Fig. 128: Locating Engine Wiring Harness Electrical Connectors

Courtesy of FORD MOTOR CO.

12. Detach the 2 wiring harness retainers from transmission mount and the battery tray bracket.

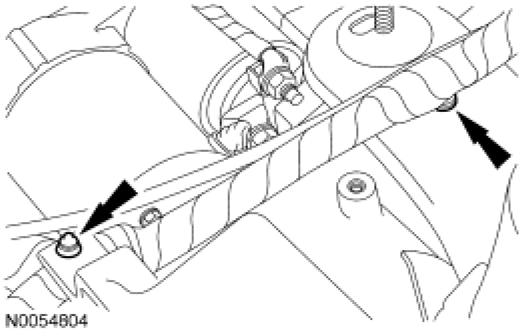


Fig. 129: Locating Wiring Harness Retainers From Transmission Mount & Battery Tray Bracket
Courtesy of FORD MOTOR CO.

13. Remove the nut and disconnect the power feed wire from the battery terminal.

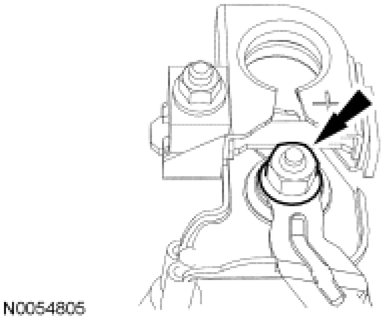


Fig. 130: Locating Power Feed To Battery Terminal And Nut
Courtesy of FORD MOTOR CO.

14. Remove the bolt and position aside the ground wire.

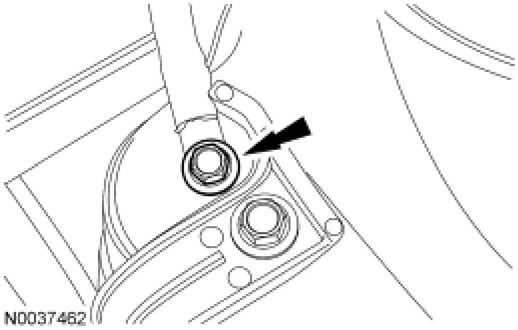


Fig. 131: Locating Ground Wire And Bolt
Courtesy of FORD MOTOR CO.

15. Disconnect the vacuum hose and the evaporative emissions (EVAP) tube from the upper intake manifold.

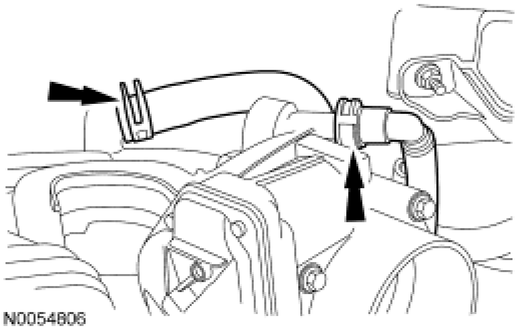


Fig. 132: Locating Vacuum Hose & Evaporative Emissions (EVAP) Tube From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

16. Disconnect the upper radiator hose, lower radiator hose and 2 heater hoses from the thermostat housing.

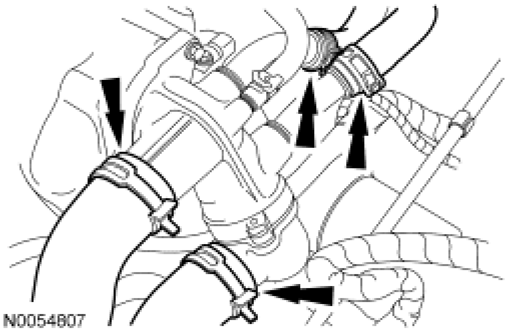


Fig. 133: Locating Upper Radiator Hose, Lower Radiator Hose & Heater Hoses From Thermostat Housing
Courtesy of FORD MOTOR CO.

17. Disconnect the transaxle control cable from the control lever.

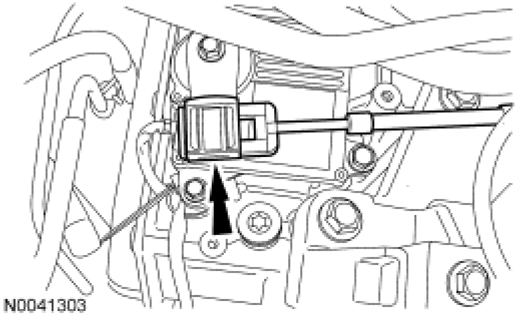


Fig. 134: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

18. Remove the 3 nuts and position the transaxle control cable bracket aside.

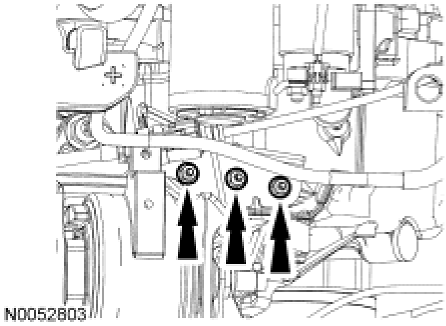


Fig. 135: Identifying Selector Lever Cable Bracket Bolts & Nuts
Courtesy of FORD MOTOR CO.

19. Remove the bolt and position the ground wire aside.

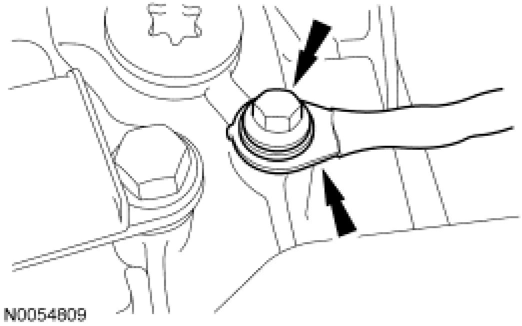


Fig. 136: Locating Ground Wire And Bolt
Courtesy of FORD MOTOR CO.

20. If equipped, detach the engine block heater harness from the radiator support, power steering hose, A/C tube and the engine wiring harness.
21. Detach the coolant tube retainer clips from the A/C tube.

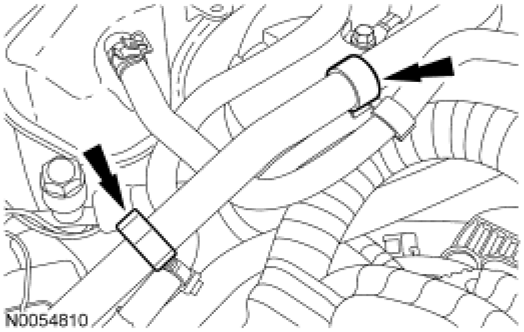


Fig. 137: Identifying Coolant Tube Retainer Clips
Courtesy of FORD MOTOR CO.

22. Remove the nut and disconnect the A/C tube from the condenser.
    - Discard the O-ring seals.

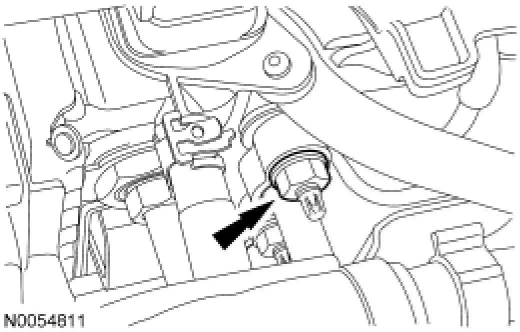


Fig. 138: Locating A/C Tube From Condenser
Courtesy of FORD MOTOR CO.

23. Remove the 2 A/C tube bracket bolts.

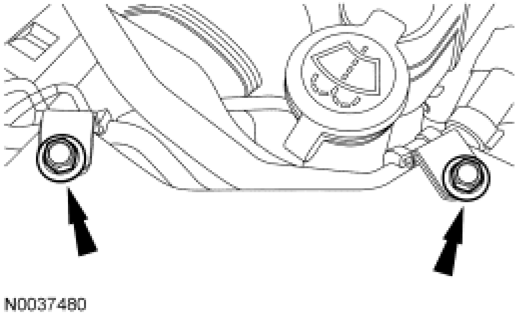


Fig. 139: Locating A/C Tube Bracket Bolts
Courtesy of FORD MOTOR CO.

24. Remove the A/C tube bracket bolt.

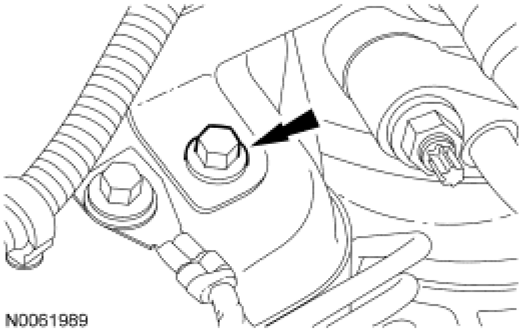


Fig. 140: Locating A/C Tube Bracket Bolt
Courtesy of FORD MOTOR CO.

25. Remove the 2 nuts and disconnect the A/C tubes.
    - Discard the O-ring seals.

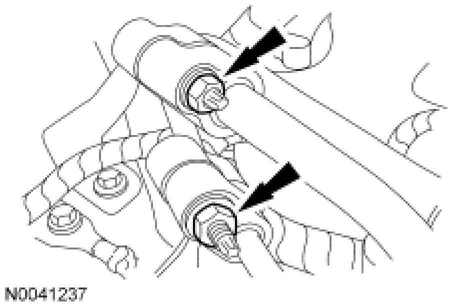


Fig. 141: Locating A/C Tubes And Nuts
Courtesy of FORD MOTOR CO.

26. Detach the 2 wiring harness retainers.

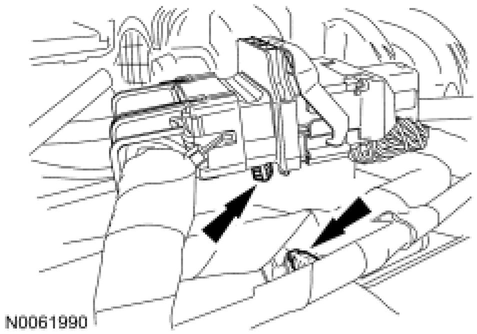


Fig. 142: Identifying Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

27. Disconnect the 2 engine wiring harness electrical connectors.

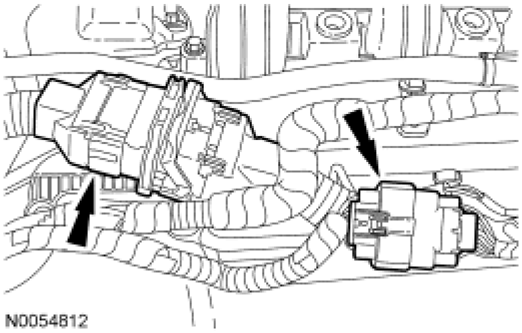


Fig. 143: Identifying Engine Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

28. Remove the 2 wiring harness retainers from the LH valve cover stud bolts and position the wiring harness aside.

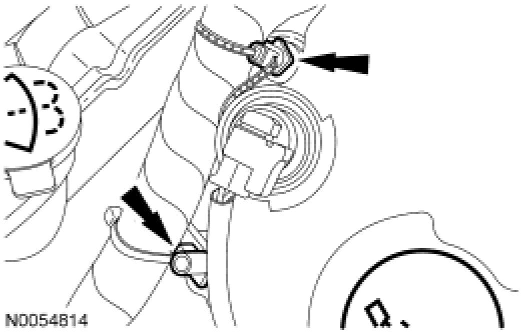


Fig. 144: Identifying Wiring Harness Retainers From LH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

29. Remove the oil level indicator.

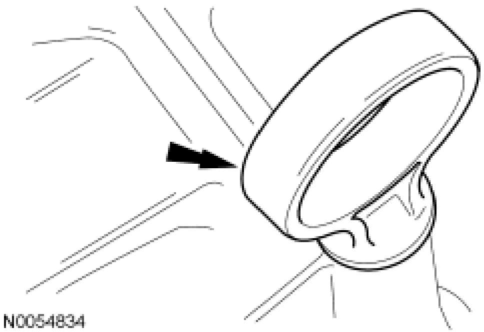


Fig. 145: Identifying Oil Level Indicator
Courtesy of FORD MOTOR CO.

30. Disconnect the hose from the power steering reservoir.
    - Detach the pin-type retainer from the engine mount brace.

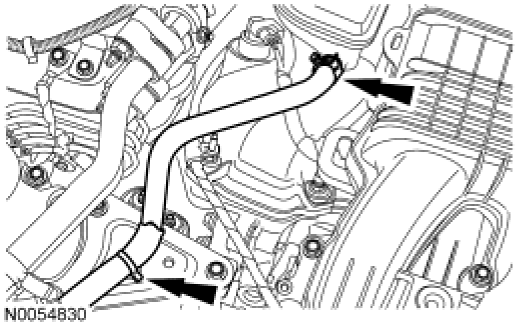


Fig. 146: Identifying Pin-Type Retainer From Engine Mount Brace
Courtesy of FORD MOTOR CO.

31. Using a small screwdriver, release the retaining clip and detach the power steering reservoir from the cowl.

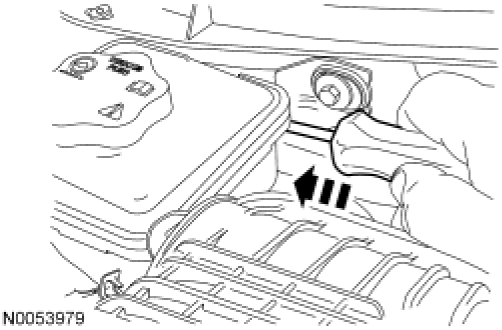


Fig. 147: Detaching Power Steering Reservoir From Bracket
Courtesy of FORD MOTOR CO.

32. Disconnect the fuel supply tube from the fuel rail. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

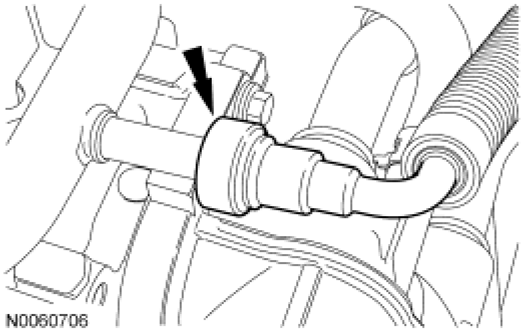


Fig. 148: Identifying Fuel Supply Tube From Fuel Rail
Courtesy of FORD MOTOR CO.

33. Remove the bolt and the ground wire from the engine mount brace.

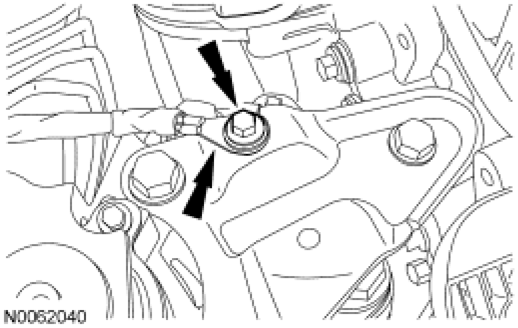


Fig. 149: Identifying Ground Wire Bolt From Engine Mount Brace
Courtesy of FORD MOTOR CO.

34. Remove the 3 bolts and the engine mount brace.

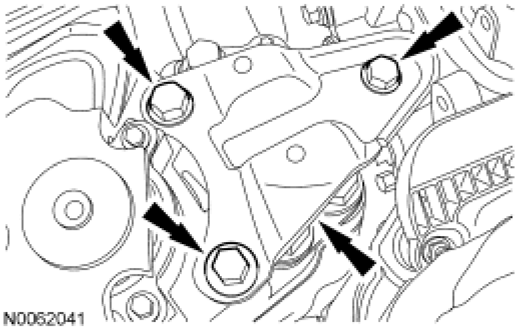


Fig. 150: Locating Engine Mount Brace Bolts
Courtesy of FORD MOTOR CO.

35. Disconnect the PCM electrical connectors and pin-type retainers.

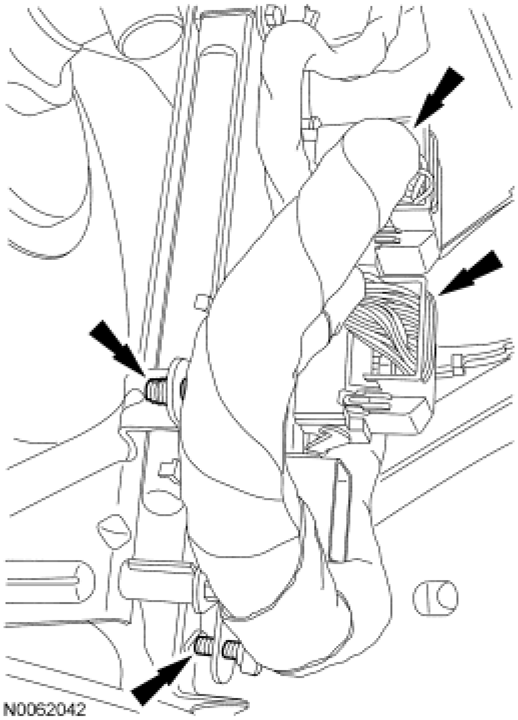


Fig. 151: Locating PCM Electrical Connectors & Pin-Type Retainers
Courtesy of FORD MOTOR CO.

36. Remove the power steering pressure (PSP) hose bracket bolt.

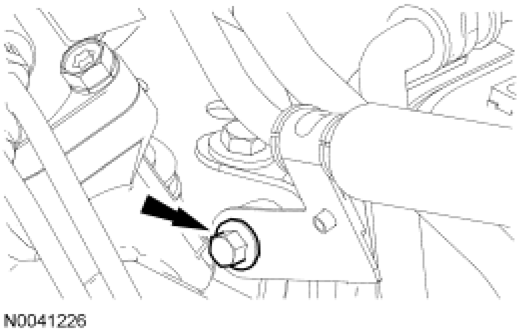


Fig. 152: Locating Power Steering Pressure (PSP) Hose Bracket Bolt
Courtesy of FORD MOTOR CO.

37. Remove and discard the PSP banjo bolt and the 2 seals from the steering gear.

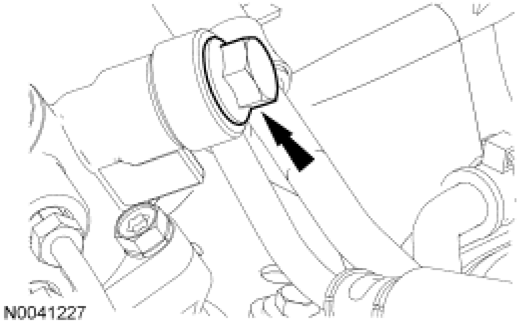


Fig. 153: Locating PSP Hose Banjo Bolt
Courtesy of FORD MOTOR CO.

38. Place the steering wheel in the straight-ahead position and the ignition key in the OFF position.
39. Remove the 2 nuts and the steering joint cover.

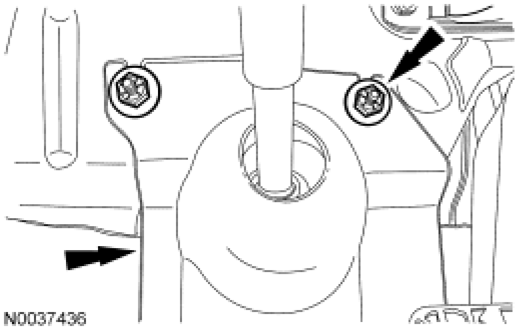


Fig. 154: Locating Steering Joint Cover And Nuts
Courtesy of FORD MOTOR CO.

CAUTION: Do not allow the intermediate shaft to rotate while it is disconnected from the gear or damage to the clockspring may occur. If there is evidence that the intermediate shaft has rotated, the clockspring

must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.

NOTE: **Index-mark the steering column shaft position to the steering gear for reference during installation.**

40. Remove the bolt and disconnect the steering column shaft from the steering gear.
    - Discard the bolt.

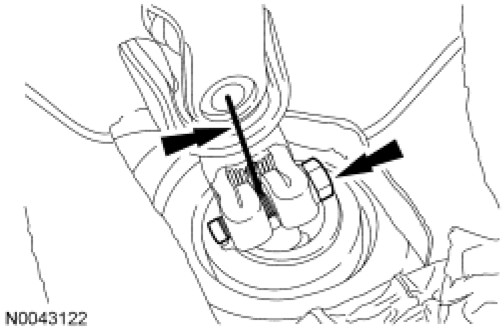


Fig. 155: Locating Steering Column Shaft Index Mark And Bolt
Courtesy of FORD MOTOR CO.

41. Remove the 4 screws and position the LH fender splash shield aside.

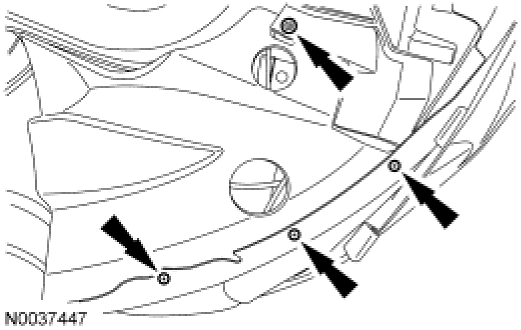


Fig. 156: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

42. Remove the 6 pin-type retainers (4 shown) and the LH splash shield.

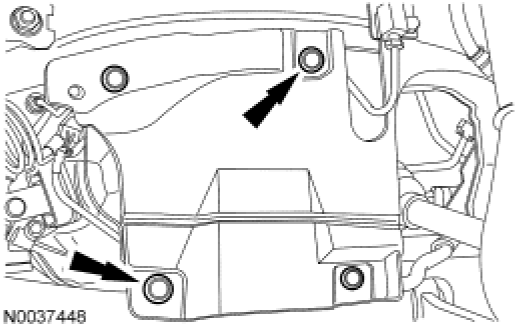


Fig. 157: Locating LH Splash Shield And Pin-Type Retainers
Courtesy of FORD MOTOR CO.

CAUTION: The steering gear-to-dash seal must be removed or it will be damaged when lowering the subframe.

43. Release the 4 clips and slide the steering gear-to-dash seal off of the steering gear and into the passenger compartment.

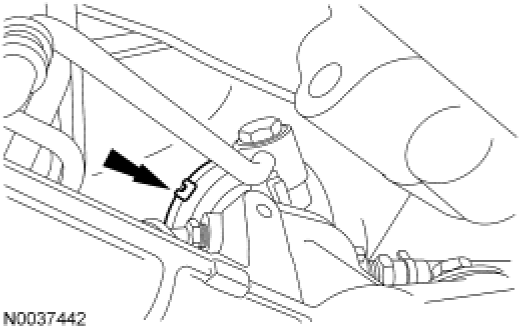


Fig. 158: Locating Steering Gear-To-Dash Seal Clips
Courtesy of FORD MOTOR CO.

44. Disconnect the transaxle cooler hoses.

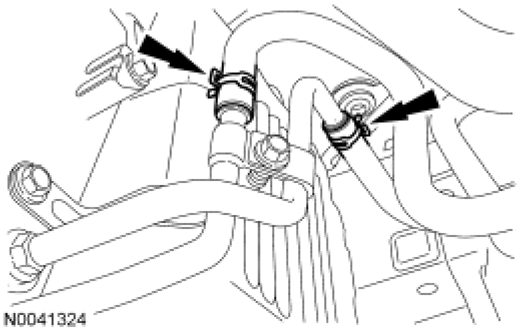


Fig. 159: Locating Transmission Fluid Cooler Hoses
Courtesy of FORD MOTOR CO.

45. Remove the drain plug and drain the engine oil.
    - Install the drain plug and tighten to 27 Nm (20 lb-ft).

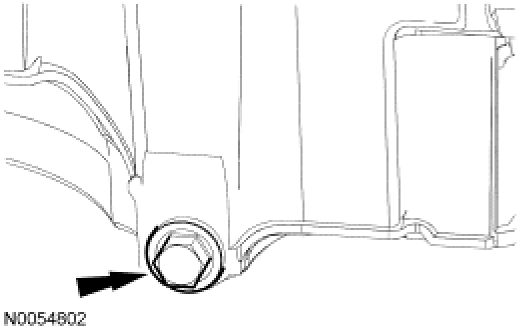


Fig. 160: Locating Drain Plug
Courtesy of FORD MOTOR CO.

46. Remove and discard the engine oil filter.

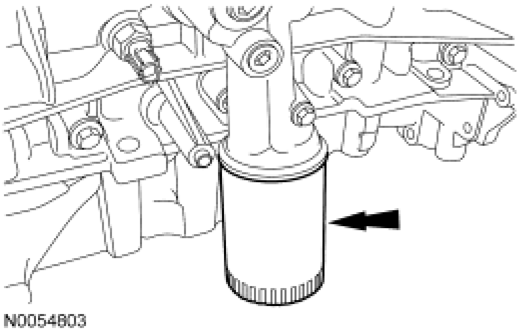


Fig. 161: Identifying Engine Oil Filter
Courtesy of FORD MOTOR CO.

47. Remove the 6 nuts and the Y-pipe assembly.
    - Discard the gaskets and nuts.

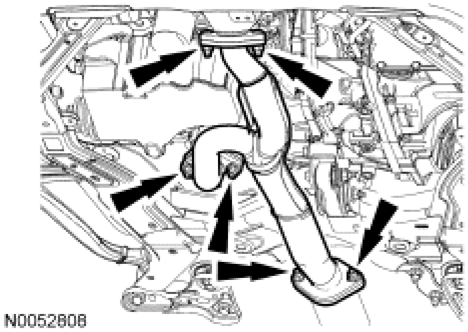


Fig. 162: Locating Y-Pipe Nuts & Y-Pipe Assembly
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

NOTE: Index-mark the driveshaft for installation.

48. Remove the 4 bolts (3 shown) and support the driveshaft with a length of mechanic's wire.

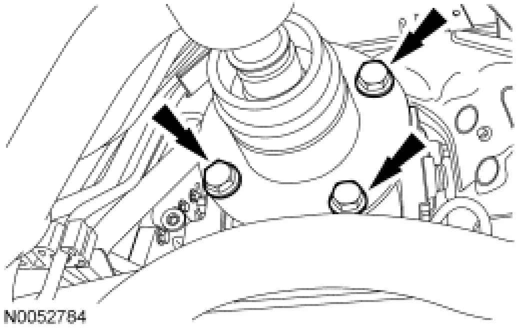


Fig. 163: Identifying Drive Shaft Bolts
Courtesy of FORD MOTOR CO.

All vehicles

49. Remove the engine roll restrictor-to-subframe through bolt.

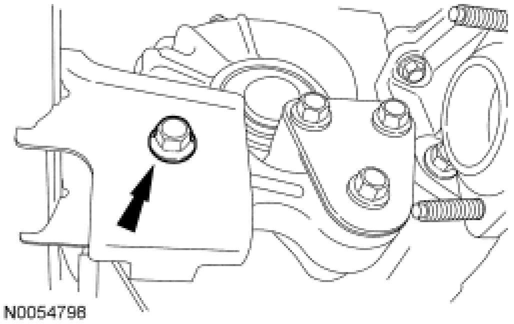


Fig. 164: Locating Roll Restrictor Bolt
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

50. Remove the cotter pins and nuts from the tie-rod ends.

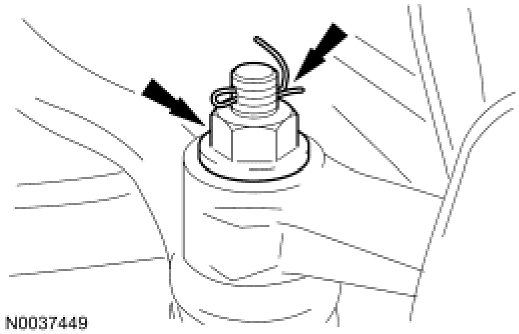


Fig. 165: Locating Tie-Rod Ends Nuts And Cotter Pin
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

51. Using the special tool, separate the tie-rod ends from the steering knuckles.

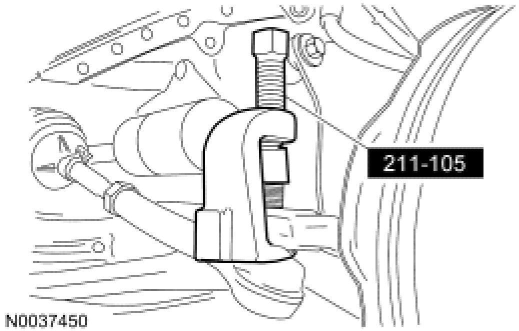


Fig. 166: Separating Tie-Rod Ends From Wheel Knuckles Using Special Tool (211-105)
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

52. Remove the nuts and separate the stabilizer bar links from the struts.

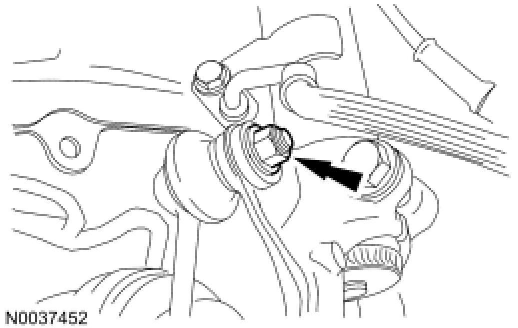


Fig. 167: Locating Stabilizer Bar Links Nut
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

53. Remove the 4 lower ball joint nuts.

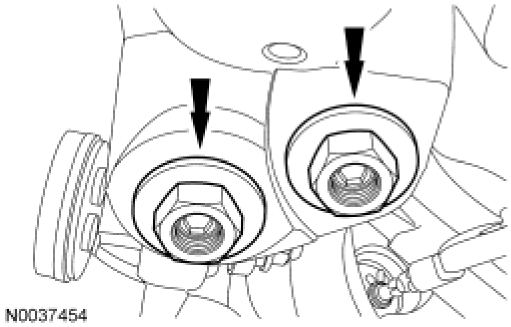


Fig. 168: Locating Lower Ball Joint Nuts
Courtesy of FORD MOTOR CO.

CAUTION: **When the lower ball joint is separated from the wheel knuckle, the lower arm may strike the outer constant velocity (CV) joint boot with enough force to damage the boot clamp. This will result in a loss of grease from the outer CV joint. Place a block of wood, or similar item, between the lower arm and the outer CV joint to prevent the lower arm from striking the outer CV joint.**

NOTE: **Once pressure is applied to the ball joint with the special tool, it may be necessary to tap the wheel knuckle at the ball joint area to separate the ball joint from the wheel knuckle.**

NOTE: **LH shown, RH similar.**

54. Using the special tools, separate the lower ball joints from the lower control arms.

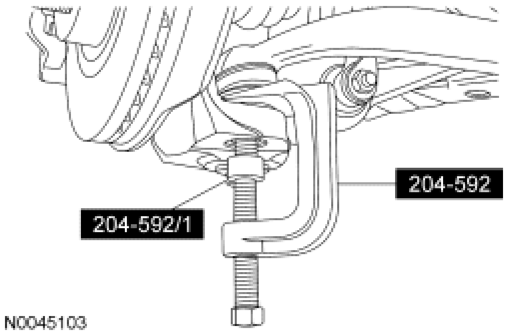


Fig. 169: Identifying Special Tools (204-592/1, 204-592)
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

55. Remove the through bolts from the lower control arms.

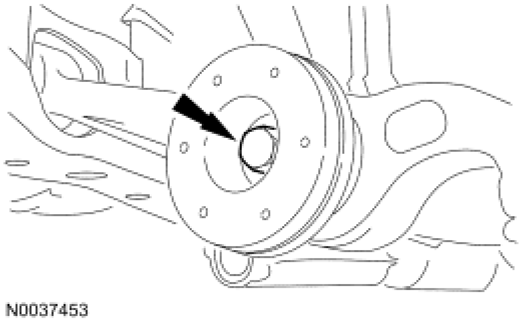


Fig. 170: Locating Lower Control Arms Through Bolt
Courtesy of FORD MOTOR CO.

56. Position the special tool under the subframe assembly.

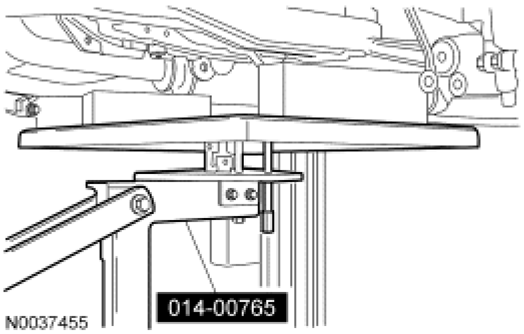


Fig. 171: Positioning Special Tool (014-00765) Under Subframe Assembly
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

57. Remove the 4 subframe bracket-to-body bolts.

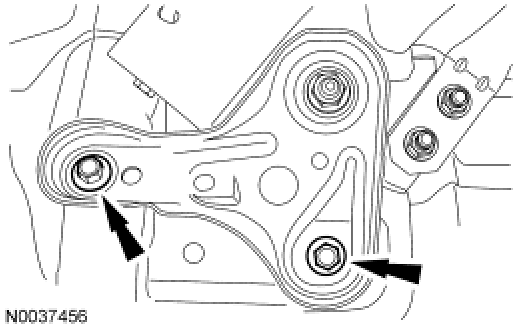


Fig. 172: Locating Subframe Bracket-To-Body Bolts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

58. Remove the 2 subframe nuts and the 2 subframe brackets.

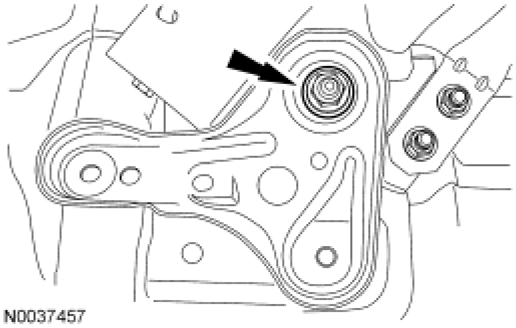


Fig. 173: Locating Subframe Nuts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

59. Remove the 2 front subframe nuts.

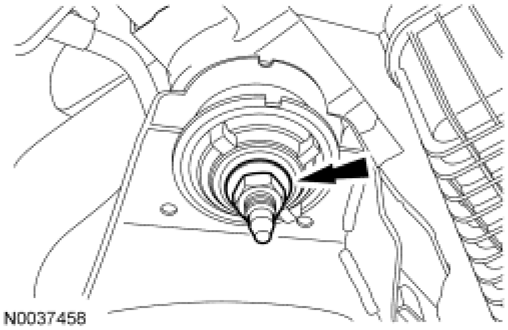


Fig. 174: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

60. Using the special tool, lower the subframe assembly from the vehicle.

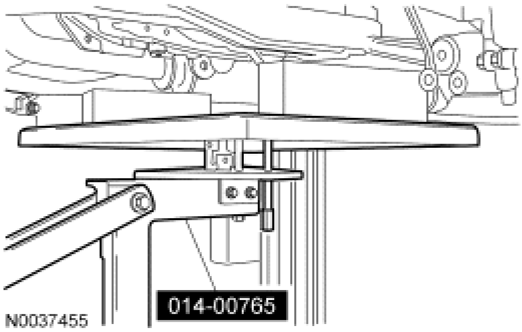


Fig. 175: Positioning Special Tool (014-00765) Under Subframe Assembly

Courtesy of FORD MOTOR CO.

61. Using the special tools, separate the LH halfshaft from the transaxle and support the halfshaft with a length of mechanic's wire.

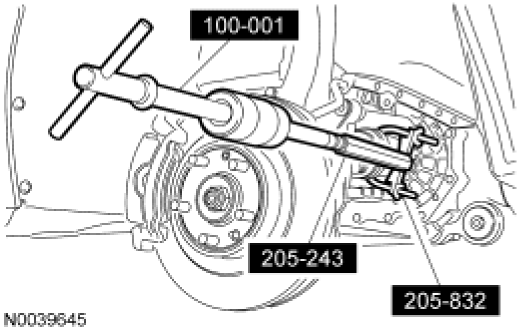


Fig. 176: Identifying Special Tools (100-001, 205-243 And 205-832)
Courtesy of FORD MOTOR CO.

AWD vehicles

62. Remove the 2 RH halfshaft carrier bearing bolts.
    - Separate the RH halfshaft from the transaxle and support the halfshaft with a length of mechanic's wire.

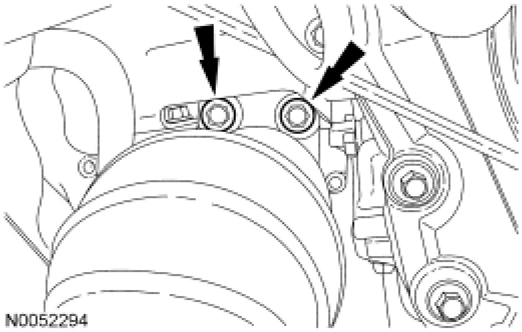


Fig. 177: Locating RH Halfshaft Bearing Support Bracket Bolts
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

63. Remove the 2 RH catalytic converter bracket bolts.

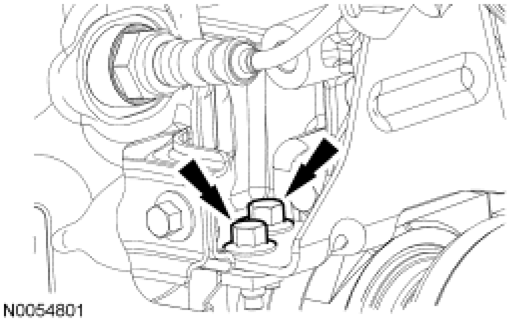


Fig. 178: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

64. Remove the 2 nuts and remove the RH catalytic converter bracket.

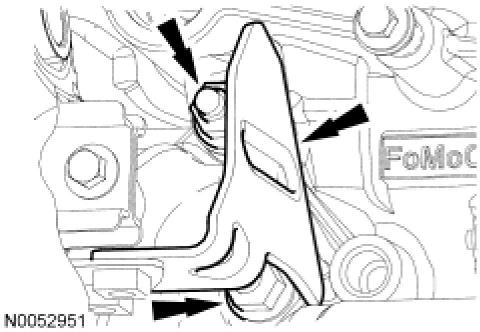


Fig. 179: Identifying Catalytic Converter Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

65. Remove the RH halfshaft carrier bearing bolt and the 2 stud bolts.
    - Separate the RH halfshaft from the transaxle and support the halfshaft with a length of mechanic's wire.

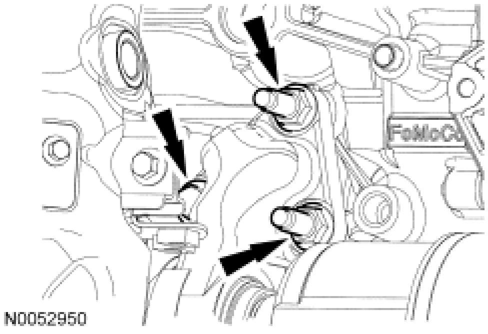


Fig. 180: Identifying Intermediate Shaft Bearing Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: Position a block of wood under the transaxle.

66. Install the special tools.

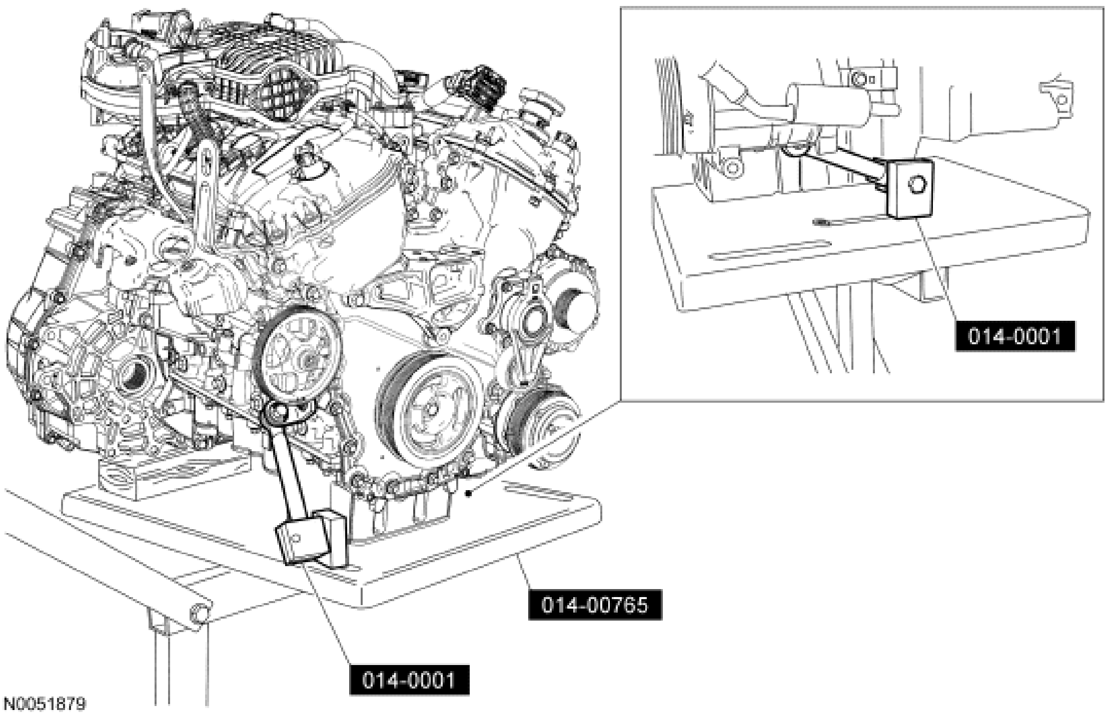


Fig. 181: Positioning Block Of Wood Under Transaxle Using Special Tools (014-0001) & (014-00765)
Courtesy of FORD MOTOR CO.

67. Remove the transaxle mount through bolt.

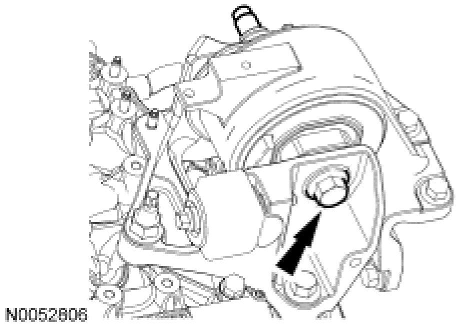


Fig. 182: Identifying Transaxle Support Insulator Through Bolt
Courtesy of FORD MOTOR CO.

68. Remove the transaxle mount bracket bolt and the 2 nuts.

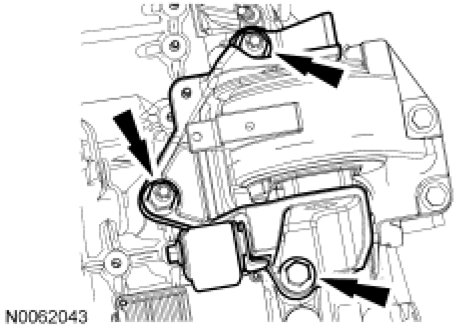


Fig. 183: Identifying Transaxle Mount Bracket Bolt
Courtesy of FORD MOTOR CO.

69. Remove the 4 engine mount nuts.

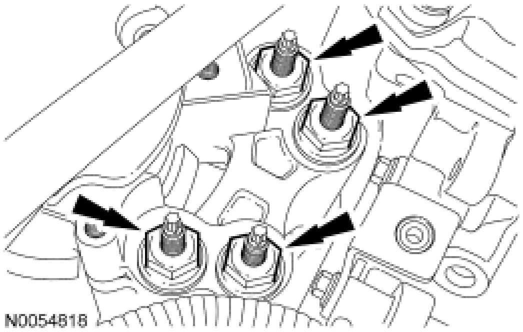


Fig. 184: Identifying Engine Mount Nuts
Courtesy of FORD MOTOR CO.

70. Remove the nut, 2 bolts and the engine mount.

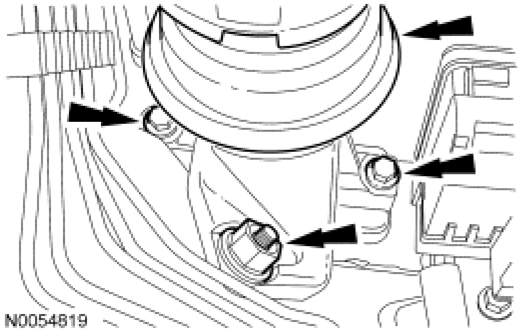


Fig. 185: Identifying Nut, Bolts & Engine Mount
Courtesy of FORD MOTOR CO.

71. Lower the engine and transaxle assembly from the vehicle.
72. If equipped, detach the block heater wiring harness retainer from the upper intake manifold.

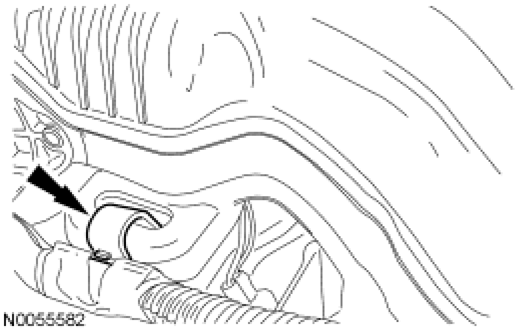


Fig. 186: Identifying Block Heater Wiring Harness Retainer From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

73. If equipped, detach the block heater wiring harness retainers from the PSP hose and the power steering reservoir hose.

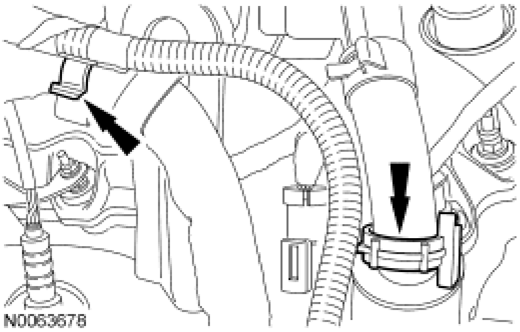


Fig. 187: Identifying Block Heater Wiring Harness From Engine
Courtesy of FORD MOTOR CO.

74. If equipped, disconnect the heated PCV electrical connector.

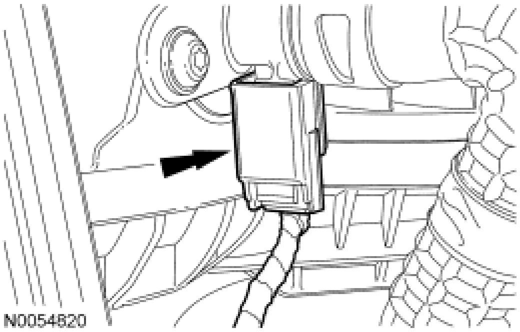


Fig. 188: Identifying Positive Crankcase Ventilation (PCV) Fitting Electrical Connector
Courtesy of FORD MOTOR CO.

75. Disconnect the PCV hose from the PCV valve.

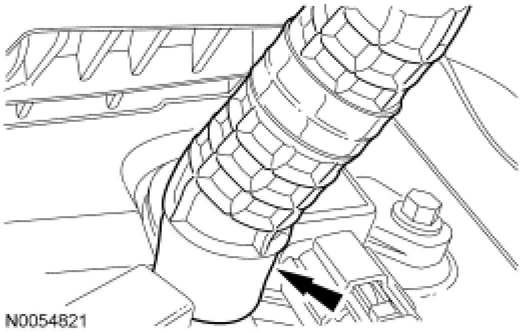


Fig. 189: Identifying PCV Hose From PCV Valve
Courtesy of FORD MOTOR CO.

76. Disconnect the throttle body (TB) electrical connector.

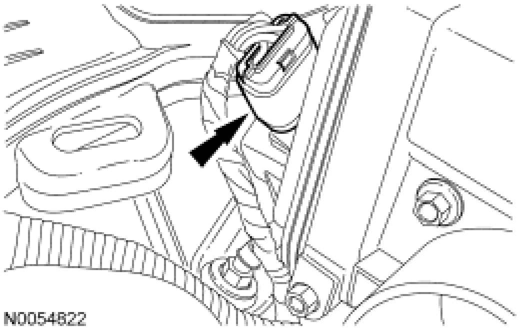


Fig. 190: Locating Throttle Body Electrical Connector
Courtesy of FORD MOTOR CO.

77. Detach the wiring harness retainers from the upper intake manifold.

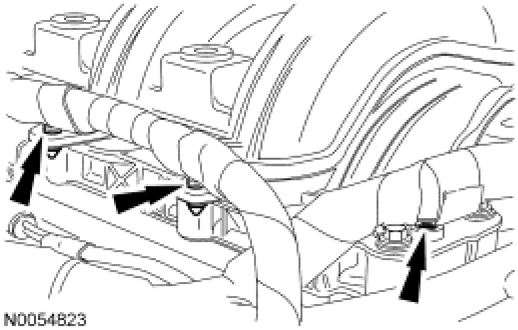


Fig. 191: Locating Wiring Harness Retainers From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

78. If equipped, remove the upper intake manifold long support bracket bolt.

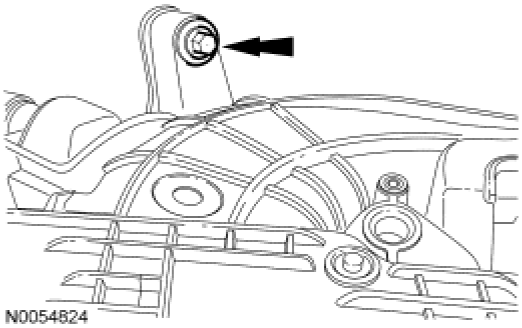


Fig. 192: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

79. Remove the upper intake manifold short support bracket bolt.

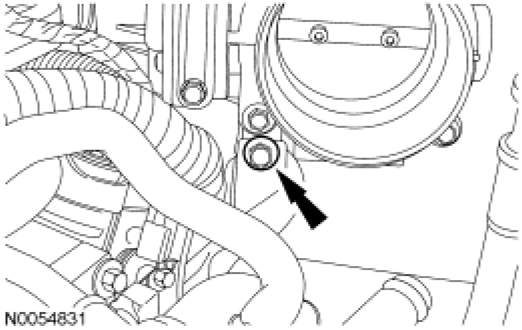


Fig. 193: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

80. Remove the 6 bolts and the upper intake manifold.
    - Discard the gaskets.

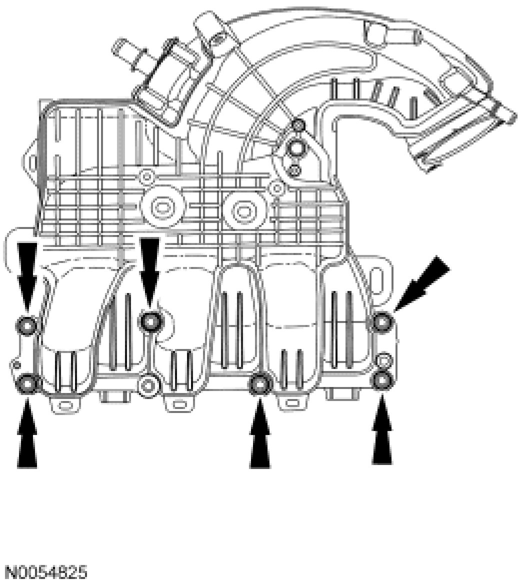


Fig. 194: Identifying Upper Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

81. Disconnect the RH catalyst monitor electrical connector.

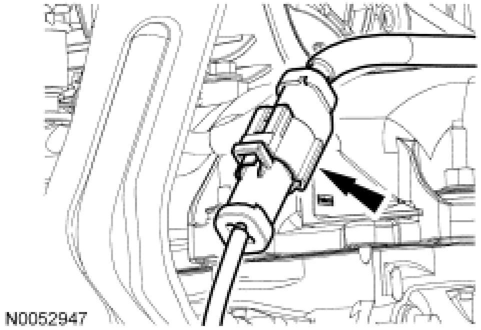


Fig. 195: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

82. Disconnect the PSP switch electrical connector.

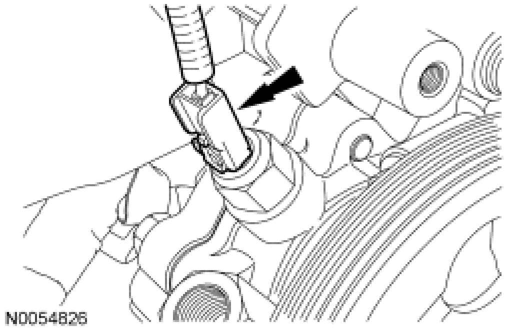


Fig. 196: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

83. Disconnect the RH variable camshaft timing (VCT) solenoid electrical connector.

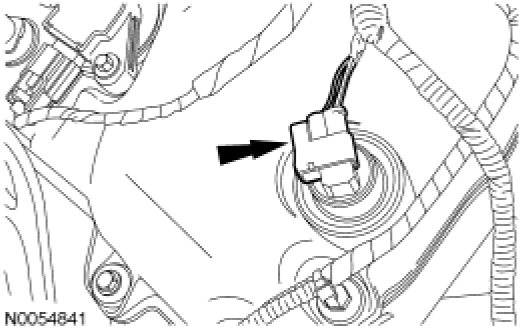


Fig. 197: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

84. Disconnect the 3 RH coil-on-plug electrical connectors.

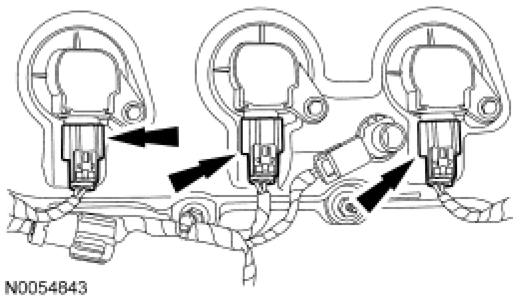


Fig. 198: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

85. If equipped, disconnect the heated PCV valve electrical connector.

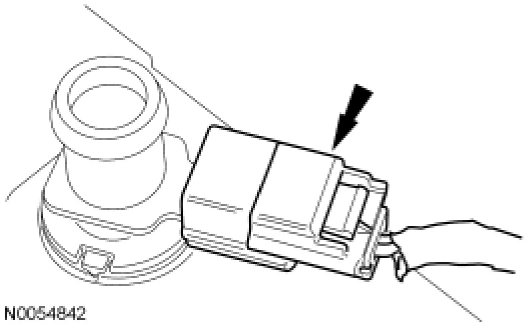


Fig. 199: Locating Heated PCV Valve Electrical Connector
Courtesy of FORD MOTOR CO.

86. Detach all of the wiring harness retainers from the RH valve cover and stud bolts.
87. Disconnect the LH VCT solenoid electrical connector.

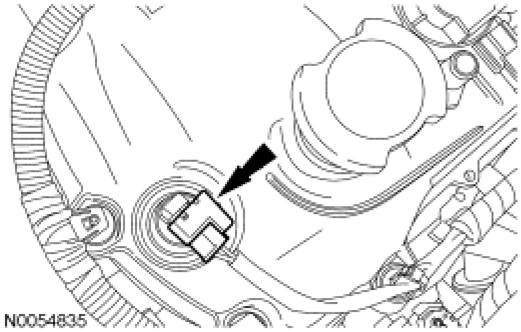


Fig. 200: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

88. Disconnect the 3 LH coil-on-plug electrical connectors.

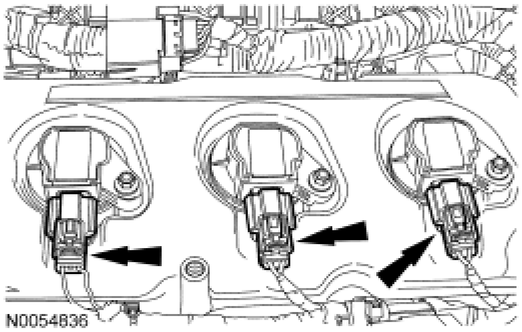


Fig. 201: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

89. Detach all of the wiring harness retainers from the LH valve cover and stud bolts.

NOTE: **LH shown, RH similar.**

90. Remove the 6 bolts and the 6 coil-on-plugs.

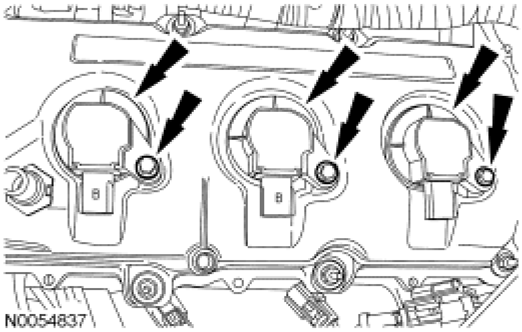


Fig. 202: Locating Coil-On-Plugs & Bolts
Courtesy of FORD MOTOR CO.

91. Detach the PSP hose retainer from the engine lifting eye.

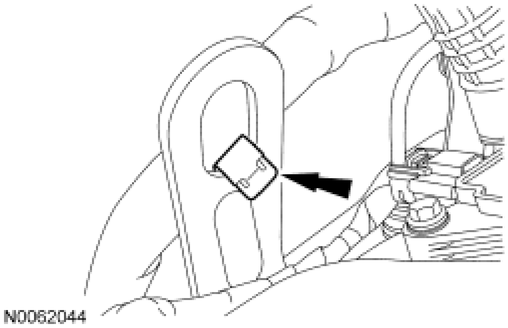


Fig. 203: Locating PSP Hose Retainer From Engine Lifting Eye
Courtesy of FORD MOTOR CO.

92. Remove the PSP hose bracket nut and position the PSP hose aside.

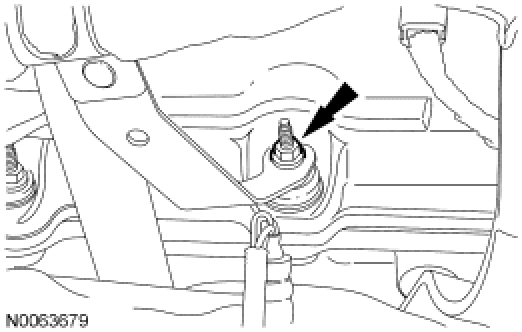


Fig. 204: Identifying PSP Hose Bracket Nut
Courtesy of FORD MOTOR CO.

93. Remove the 2 nuts and the wiring harness retaining bracket.

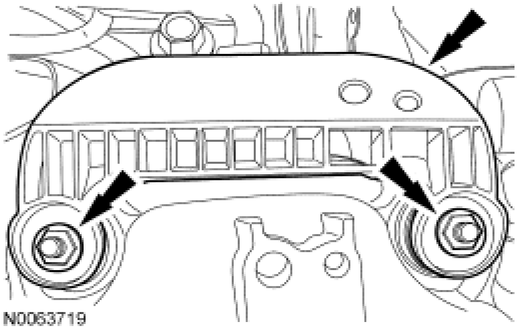


Fig. 205: Identifying Wiring Harness Retaining Bracket & Nuts
Courtesy of FORD MOTOR CO.

94. Remove the 11 stud bolts and the LH valve cover.
    - Discard the gasket.

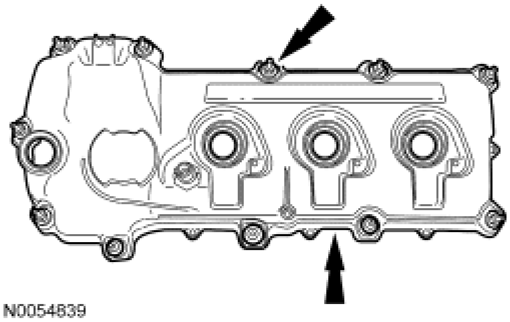


Fig. 206: Locating LH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

95. Remove the bolt, the 10 stud bolts and the RH valve cover.
    - Discard the gasket.

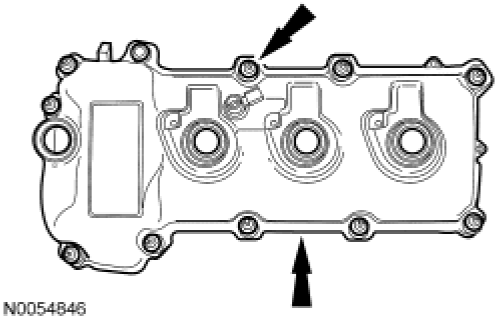


Fig. 207: Locating RH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

NOTE: **VCT solenoid seal removal shown, spark plug tube seal removal similar.**

96. Inspect the VCT solenoid seals and the spark plug tube seals. Install new seals if damaged.
    - Using the special tools, remove the seal(s).

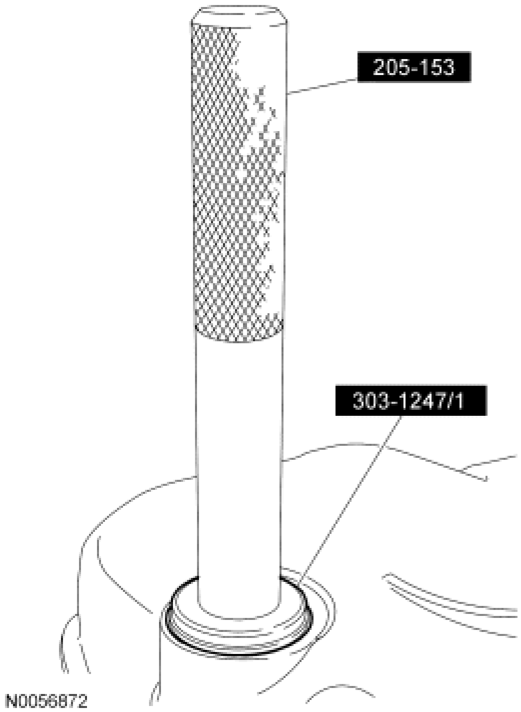


Fig. 208: Removing Seals Using Special Tools (205-153) & (303-1247/1)
Courtesy of FORD MOTOR CO.

97. Remove the 3 bolts and position the power steering pump aside.

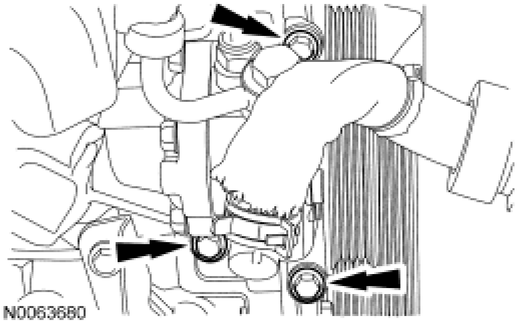


Fig. 209: Locating Power Steering Pump Bolts
Courtesy of FORD MOTOR CO.

98. Remove the 3 bolts and the accessory drive belt tensioner.

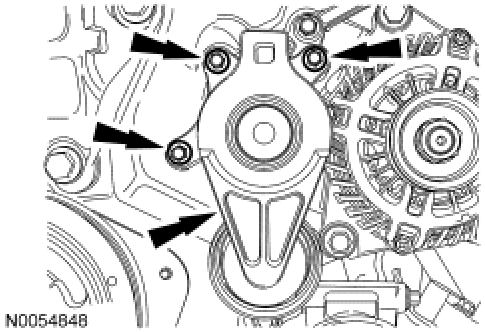


Fig. 210: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

99. Using the special tool, remove the crankshaft bolt and washer.
    - Discard the bolt.

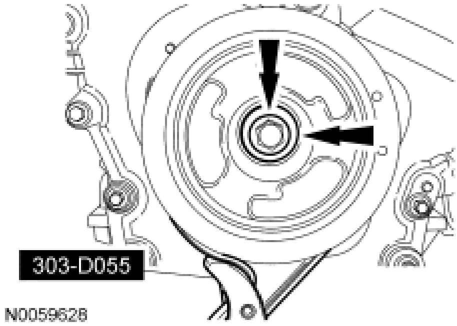


Fig. 211: Removing Crankshaft Bolt & Washer Using Special Tool (303-D055)
Courtesy of FORD MOTOR CO.

100. Using the special tool, remove the crankshaft pulley.

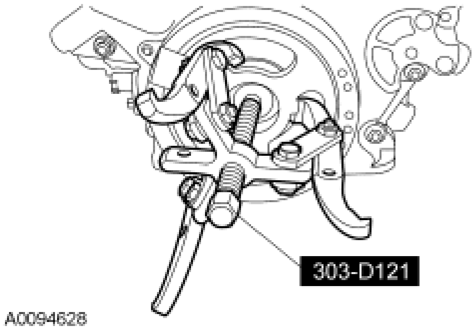


Fig. 212: Identifying Special Tools (303-D121) And Crankshaft Pulley
Courtesy of FORD MOTOR CO.

101. Using the special tool, remove and discard the crankshaft front seal.

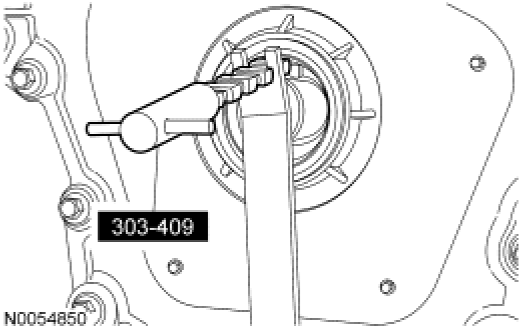


Fig. 213: Removing Crankshaft Front Seal Using Special Tool (303-409)
Courtesy of FORD MOTOR CO.

102. Remove the 2 bolts and the engine mount bracket.

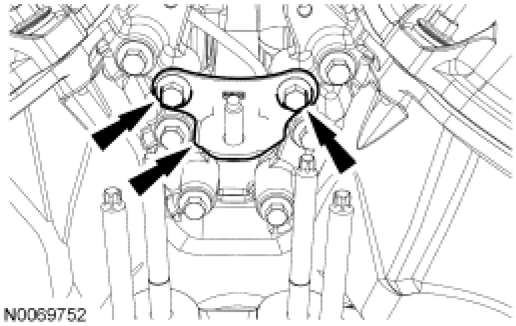


Fig. 214: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

103. Remove the 2 engine mount studs.

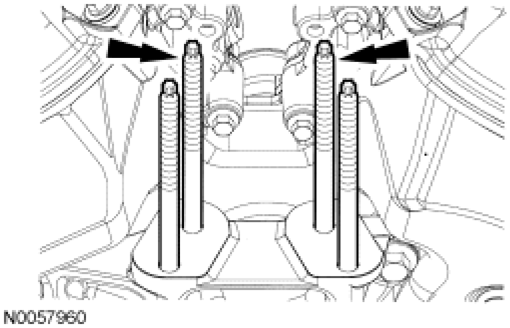


Fig. 215: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

104. Remove the 3 bolts and the engine mount bracket.

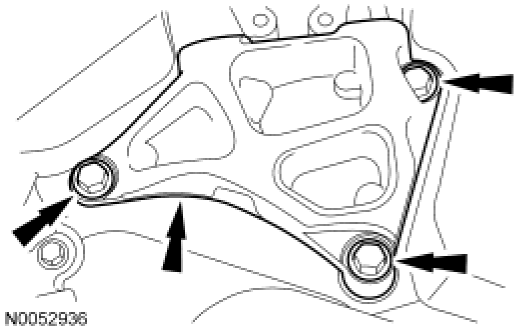


Fig. 216: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

105. Remove the 22 engine front cover bolts.

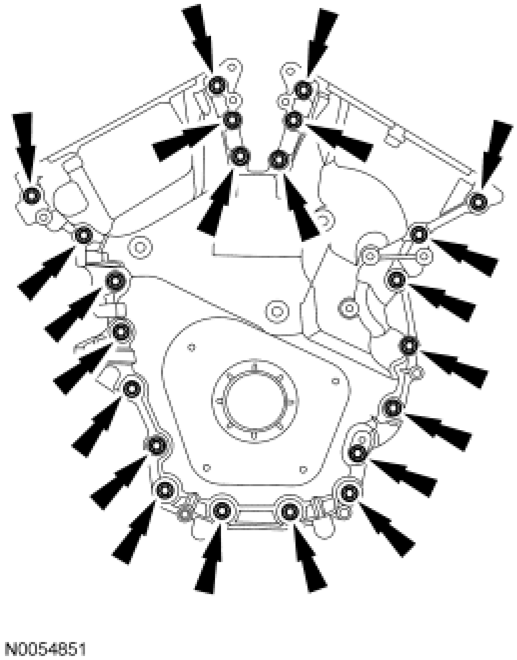


Fig. 217: Identifying Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

106. Install 6 of the engine front cover bolts (finger tight) into the 6 threaded holes in the engine front cover in the following sequence.
    1. Tighten the bolts one turn at a time in a criss-cross pattern until the engine front cover-to-cylinder block seal is released.
    2. Remove the engine front cover.

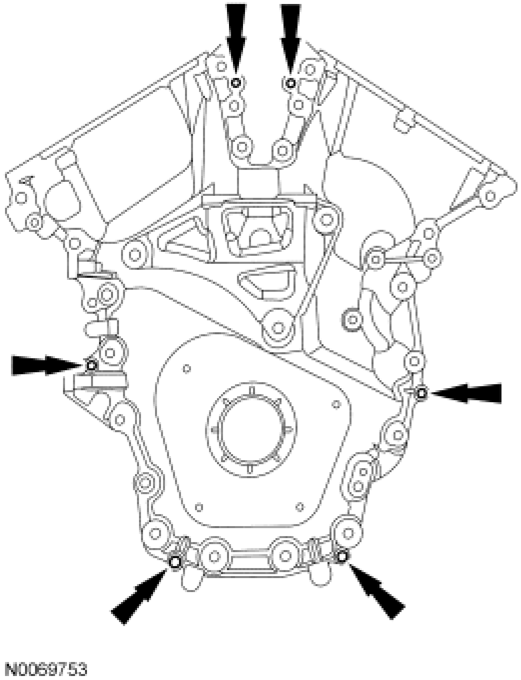


Fig. 218: Identifying Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Only use a 3M Roloc® Bristle Disk (2-in white, part number 07528) to clean the engine front cover. Do not use metal scrapers, wire brushes or any other power abrasive disk to clean the engine front cover. These tools cause scratches and gouges that make leak paths.

107. Clean the engine front cover using a 3M Roloc® Bristle Disk (2-in white, part number 07528) in a suitable tool turning at the recommended speed of 15,000 RPM.
    - Thoroughly wash the engine front cover to remove any foreign material, including any abrasive particles created during the cleaning process.

CAUTION: Place clean, lint-free shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

CAUTION: Do not use wire brushes, power abrasive discs or 3M Roloc® Bristle Disk (2-in white part number 07528) to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. They also cause contamination that will cause premature engine failure. Remove all traces of the gasket.

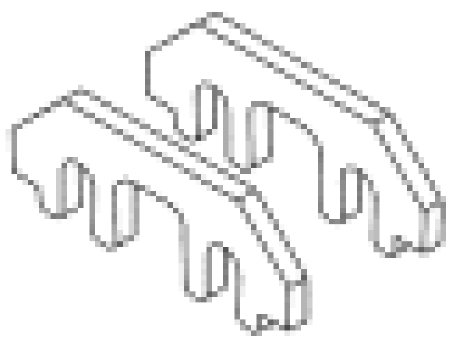
108. Clean all engine sealing surfaces, including the cylinder heads, the oil pan and cylinder block in the

following sequence.

1. Remove any large deposits of silicone or gasket material.
2. Apply silicone gasket remover and allow to set for several minutes.
3. Remove the silicone gasket remover. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
4. Apply metal surface prep to remove any remaining traces of oil or coolant and to prepare the surfaces to bond. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.
5. Make sure the 2 locating dowel pins are seated correctly in the cylinder block.

TIMING DRIVE COMPONENTS

Special Tools

Illustration	Tool Name	Tool Number
 ST2979-A	Tool, Camshaft Holding	303-1248

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan can cause engine failure.

1. Remove the engine front cover. For additional information, refer to **Engine Front Cover**.
2. Rotate the crankshaft clockwise and align the timing marks on the Variable Camshaft Timing (VCT) assemblies as shown.

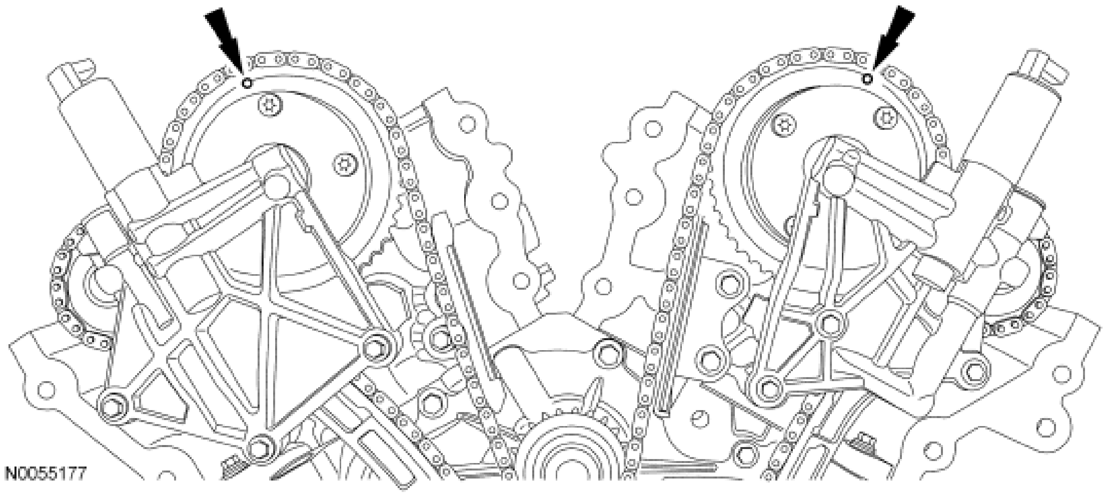


Fig. 219: Aligning Timing Marks On Variable Camshaft Timing (VCT) Assemblies
Courtesy of FORD MOTOR CO.

NOTE: The Camshaft Holding Tool will hold the camshafts in the Top Dead Center (TDC) position.

3. Install the Camshaft Holding Tool onto the flats of the LH camshafts.

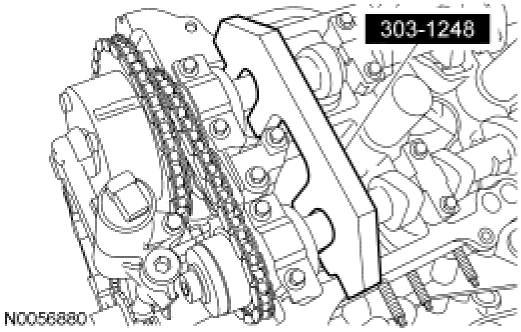


Fig. 220: Installing Special Tool (303-1248) Onto Flats Of LH Camshafts
Courtesy of FORD MOTOR CO.

NOTE: The Camshaft Holding Tool will hold the camshafts in the TDC position.

4. Install the Camshaft Holding Tool onto the flats of the RH camshafts.

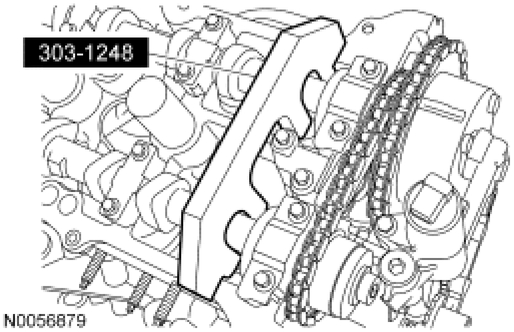


Fig. 221: Installing Special Tool (303-1248) Onto Flats Of RH Camshafts
Courtesy of FORD MOTOR CO.

5. Remove the 3 bolts and the RH VCT housing.

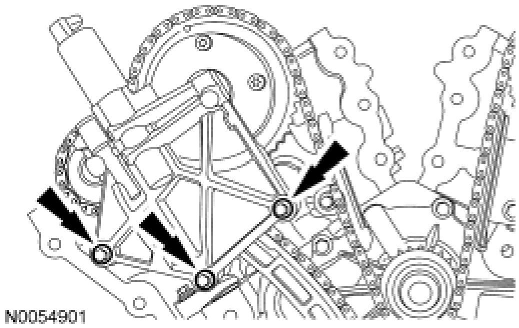


Fig. 222: Locating RH VCT Housing
Courtesy of FORD MOTOR CO.

6. Remove the 3 bolts and the LH VCT housing.

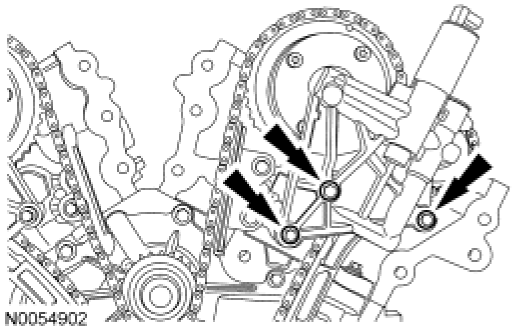


Fig. 223: Locating LH VCT Housing
Courtesy of FORD MOTOR CO.

7. Remove and discard the VCT housing seals.

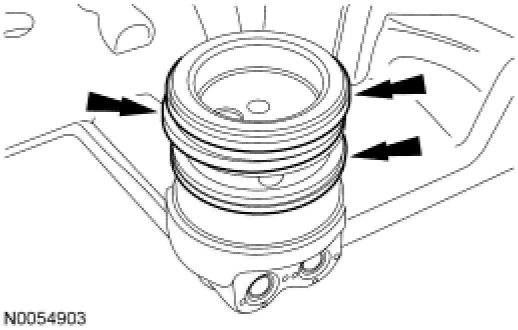


Fig. 224: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

8. Remove the 2 bolts and the primary timing chain tensioner.

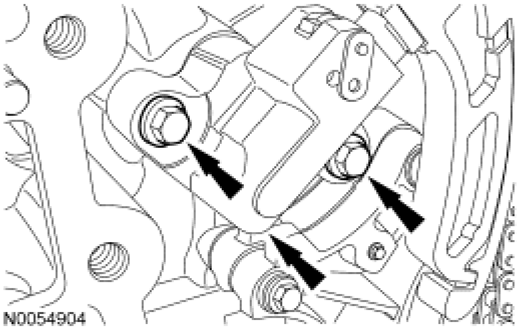


Fig. 225: Locating Primary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

9. Remove the primary timing chain tensioner arm.

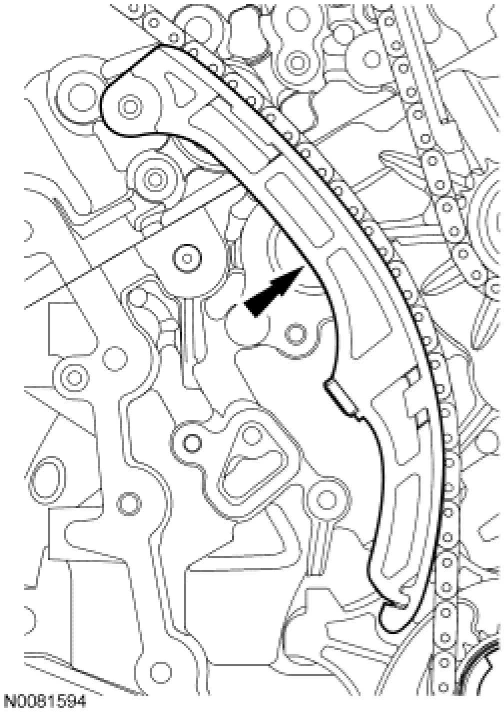


Fig. 226: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

10. Remove the 2 bolts and the lower LH primary timing chain guide.

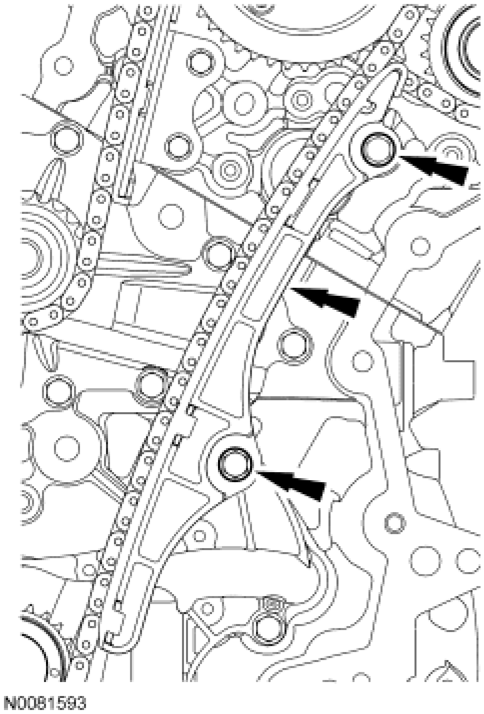


Fig. 227: Locating Lower LH Primary Timing Chain Guide & Bolts

Courtesy of FORD MOTOR CO.

11. Remove the primary timing chain.

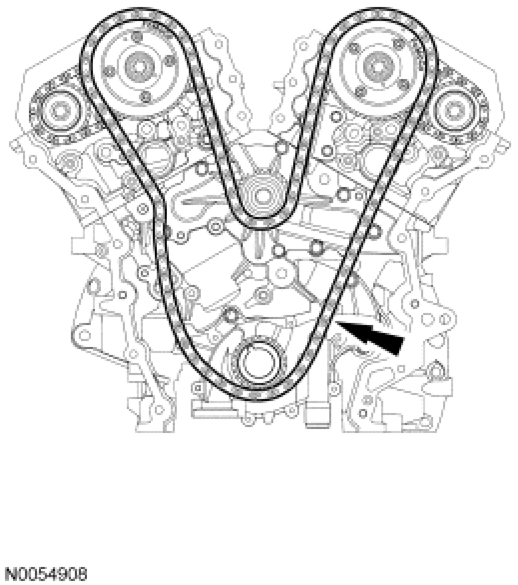


Fig. 228: Locating Primary Timing Chain
Courtesy of FORD MOTOR CO.

12. Remove the crankshaft timing chain sprocket.

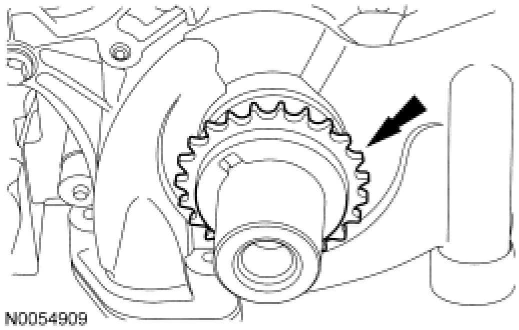


Fig. 229: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

13. Remove the 2 bolts and the upper LH primary timing chain guide.

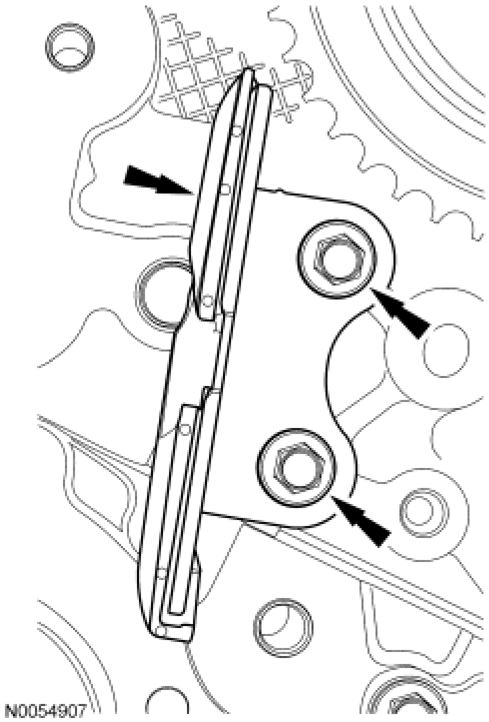


Fig. 230: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

14. Compress the LH secondary timing chain tensioner and install a suitable lock pin to retain the tensioner in the collapsed position.

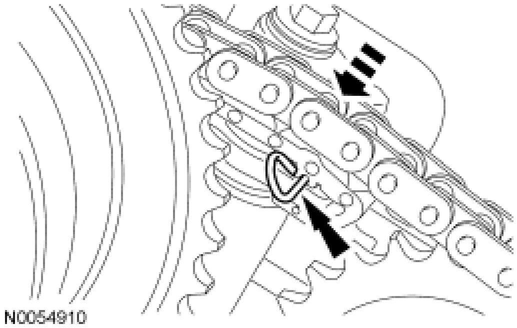


Fig. 231: Compressing LH Secondary Timing Chain Tensioner & Installing Suitable Lock Pin To Retain Tensioner In Collapsed Position
Courtesy of FORD MOTOR CO.

NOTE:	**The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.**

15. Remove and discard the LH VCT assembly bolt and the LH exhaust camshaft sprocket bolt.
    - Remove the LH VCT assembly, secondary timing chain and the LH exhaust camshaft sprocket as an assembly.

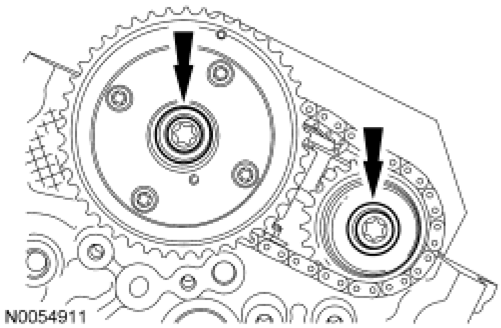


Fig. 232: Locating LH VCT Assembly Bolt & LH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

NOTE: It is necessary to tilt the Camshaft Holding Tool toward the rear of the engine to access the rearmost secondary timing chain tensioner bolt.

16. Remove the 2 bolts and the LH secondary timing chain tensioner.

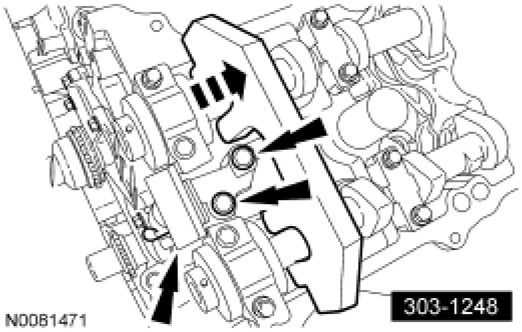


Fig. 233: Locating LH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

17. Compress the RH secondary timing chain tensioner and install a suitable lock pin to retain the tensioner in the collapsed position.

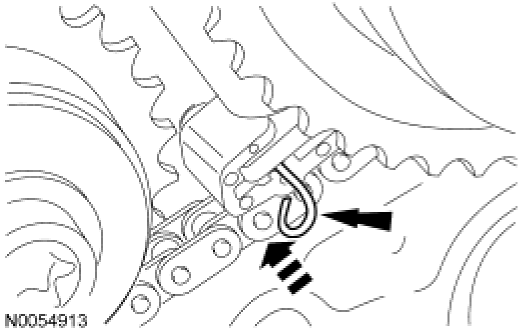


Fig. 234: Compressing RH Secondary Timing Chain Tensioner & Installing Suitable Lock Pin To Retain Tensioner In Collapsed Position
Courtesy of FORD MOTOR CO.

NOTE: The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.

18. Remove and discard the RH VCT assembly bolt and the RH exhaust camshaft sprocket bolt.
    - Remove the RH VCT assembly, secondary timing chain and the RH exhaust camshaft sprocket as an assembly.

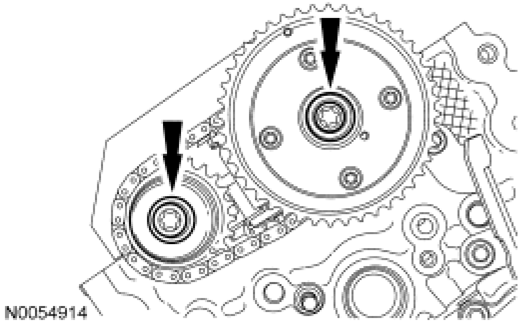


Fig. 235: Locating RH VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

NOTE: It is necessary to tilt the Camshaft Holding Tool toward the rear of the engine to access the rearmost secondary timing chain tensioner bolt.

19. Remove the 2 bolts and the RH secondary timing chain tensioner.

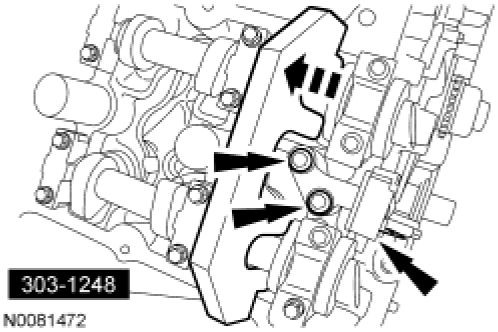


Fig. 236: Locating RH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

20. Remove the 2 bolts and the RH primary timing chain guide.

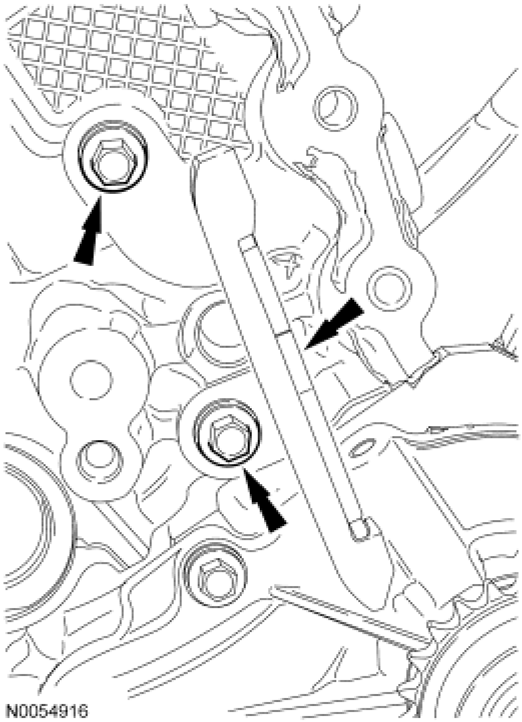
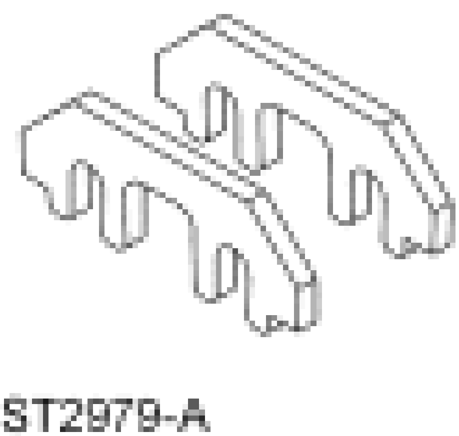


Fig. 237: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

CAMSHAFT

Special Tools

Illustration	Tool Name	Tool Number
	Tool, Camshaft Holding	303-1248

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan can cause engine

failure.

All camshafts

1. Remove the engine front cover. For additional information, refer to **Engine Front Cover**.
2. Rotate the crankshaft clockwise and align the timing marks on the Variable Camshaft Timing (VCT) assemblies as shown.

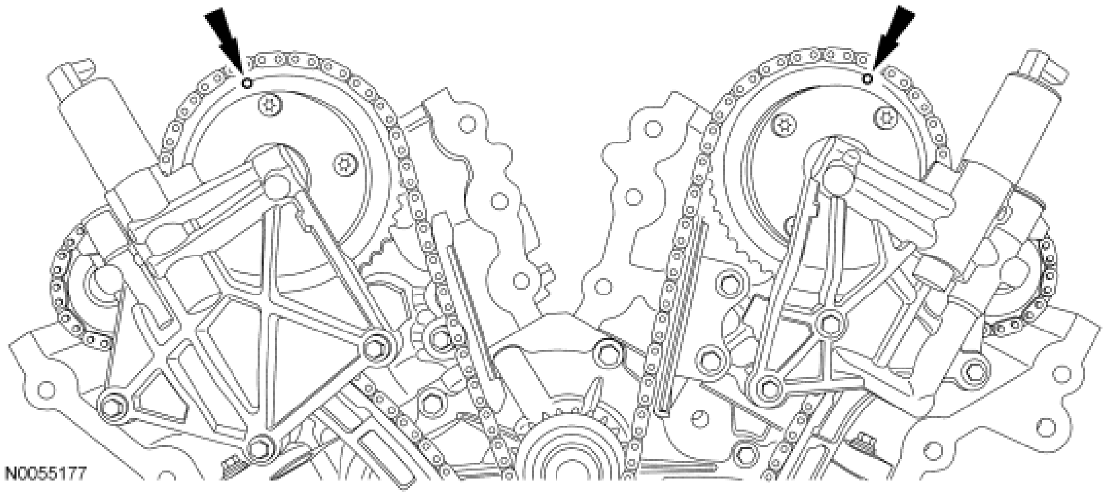


Fig. 238: Aligning Timing Marks On Variable Camshaft Timing (VCT) Assemblies
Courtesy of FORD MOTOR CO.

NOTE: The Camshaft Holding Tool will hold the camshafts in the Top Dead Center (TDC) position.

3. Install the Camshaft Holding Tool onto the flats of the LH camshafts.

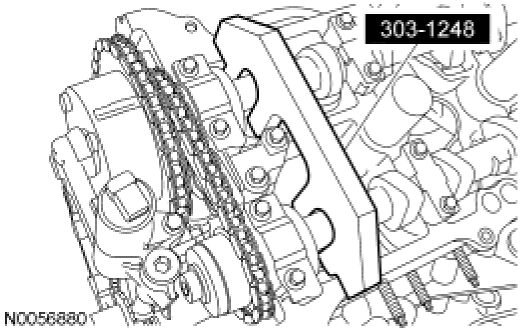


Fig. 239: Installing Special Tool (303-1248) Onto Flats Of LH Camshafts
Courtesy of FORD MOTOR CO.

NOTE: The Camshaft Holding Tool will hold the camshafts in the TDC position.

4. Install the Camshaft Holding Tool onto the flats of the RH camshafts.

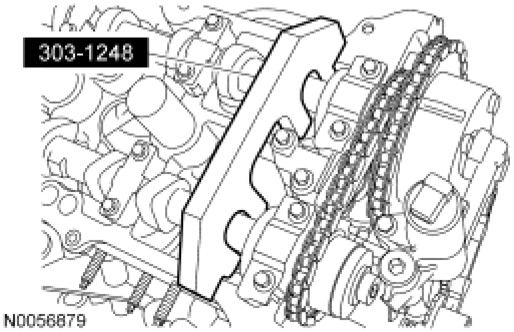


Fig. 240: Installing Special Tool (303-1248) Onto Flats Of RH Camshafts
Courtesy of FORD MOTOR CO.

5. Remove the 3 bolts and the RH VCT housing.

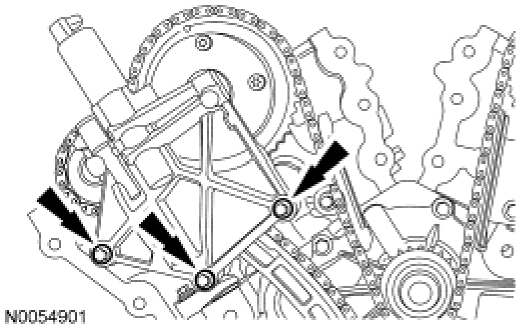


Fig. 241: Locating RH VCT Housing
Courtesy of FORD MOTOR CO.

6. Remove the 3 bolts and the LH VCT housing.

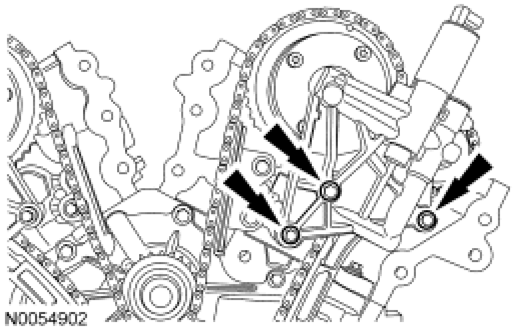


Fig. 242: Locating LH VCT Housing
Courtesy of FORD MOTOR CO.

7. Remove and discard the VCT housing seals.

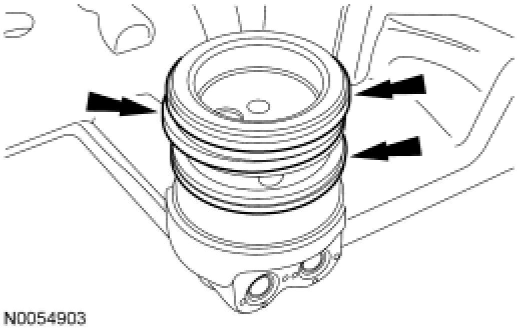


Fig. 243: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

8. Remove the 2 bolts and the primary timing chain tensioner.

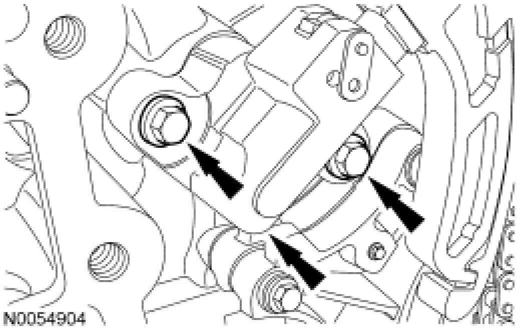


Fig. 244: Locating Primary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

9. Remove the primary timing chain tensioner arm.

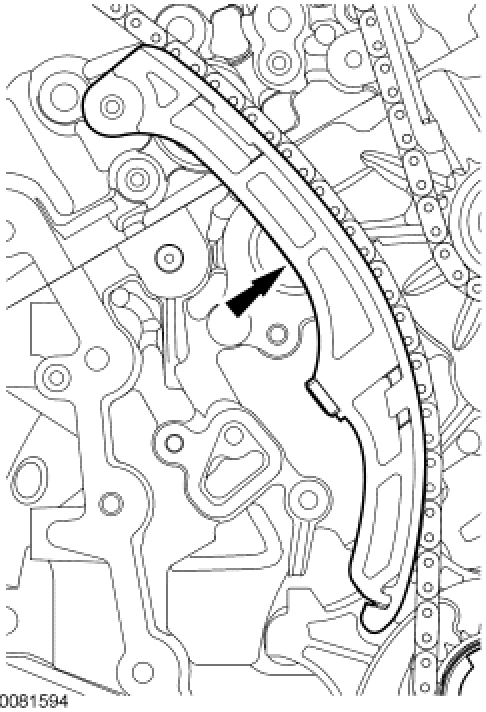


Fig. 245: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

10. Remove the 2 bolts and the lower LH primary timing chain guide.

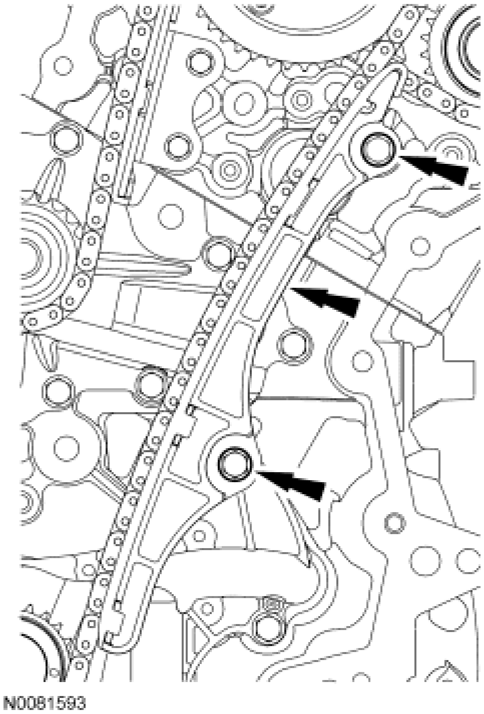
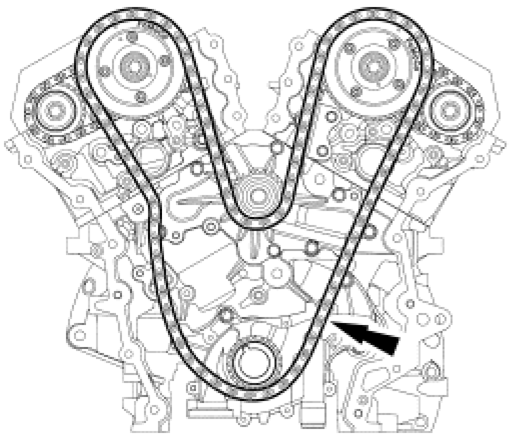


Fig. 246: Locating Lower LH Primary Timing Chain Guide & Bolts

Courtesy of FORD MOTOR CO.

11. Remove the primary timing chain.

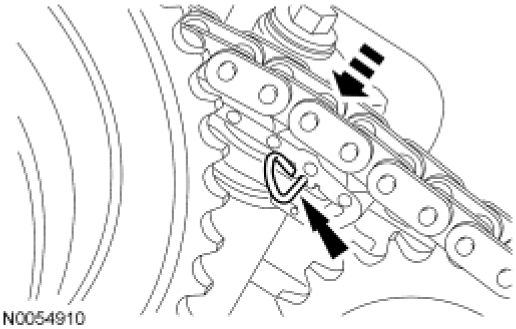


N0054908

Fig. 247: Locating Primary Timing Chain
Courtesy of FORD MOTOR CO.

LH camshafts

12. Compress the LH secondary timing chain tensioner and install a suitable lock pin to retain the tensioner in the collapsed position.



N0054910

Fig. 248: Compressing LH Secondary Timing Chain Tensioner & Installing Suitable Lock Pin To Retain Tensioner In Collapsed Position
Courtesy of FORD MOTOR CO.

NOTE: The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.

13. Remove and discard the LH VCT assembly bolt and the LH exhaust camshaft sprocket bolt.
    - Remove the LH VCT assembly, secondary timing chain and the LH exhaust camshaft sprocket as an assembly.

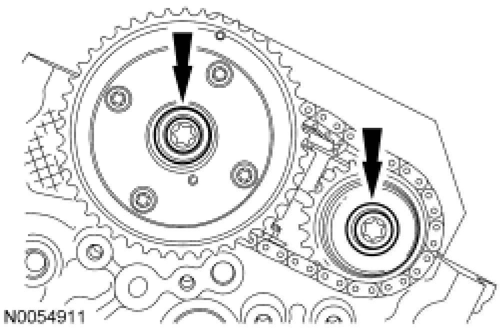


Fig. 249: Locating LH VCT Assembly Bolt & LH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

NOTE: When the Camshaft Holding Tool is removed, valve spring pressure will rotate the LH camshafts approximately 3 degrees to a neutral position.

14. Remove the Camshaft Holding Tool from the LH camshafts.

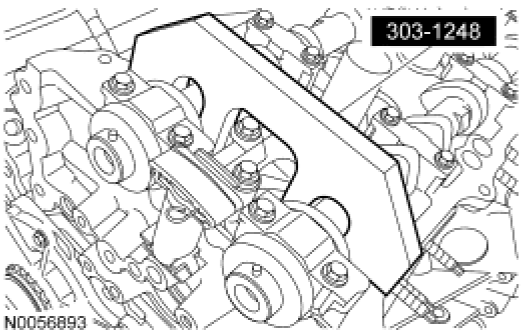


Fig. 250: Removing Special Tool (303-1248) From LH Camshafts
Courtesy of FORD MOTOR CO.

NOTE: The camshafts must remain in the neutral position during removal or engine damage may occur.

15. Verify the LH camshafts are in the neutral position.

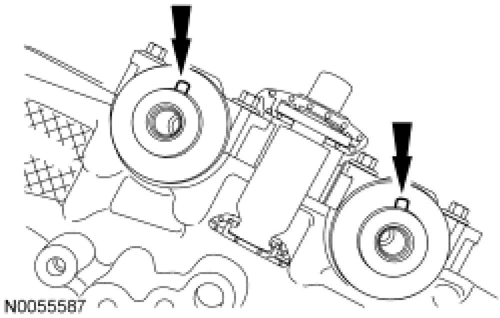


Fig. 251: Verifying LH Camshafts Are In Neutral Position
Courtesy of FORD MOTOR CO.

NOTE: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.

16. Remove the bolts and the LH camshaft bearing caps.
    - Remove the LH camshafts.

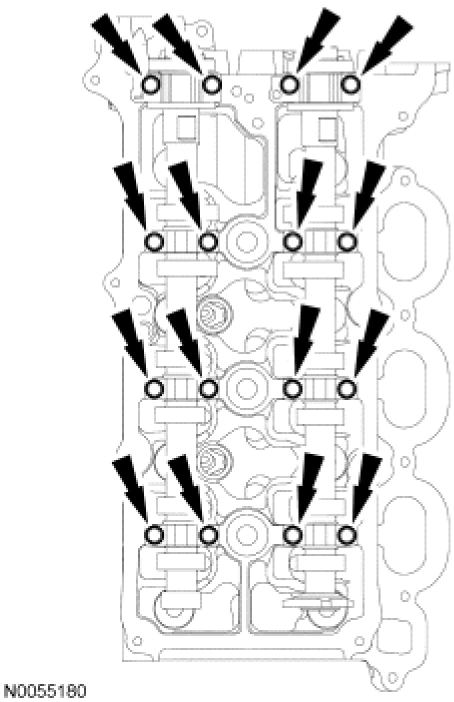


Fig. 252: Identifying LH Camshafts Bolts
Courtesy of FORD MOTOR CO.

RH camshafts

17. Compress the RH secondary timing chain tensioner and install a suitable lock pin to retain the tensioner in the collapsed position.

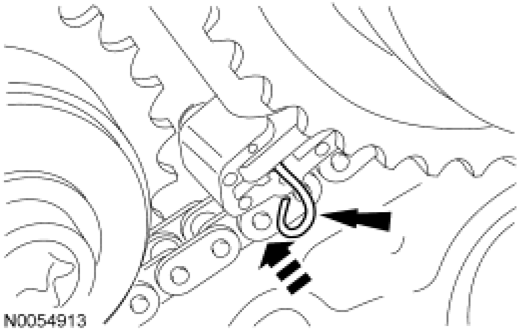


Fig. 253: Compressing RH Secondary Timing Chain Tensioner & Installing Suitable Lock Pin To Retain Tensioner In Collapsed Position
Courtesy of FORD MOTOR CO.

NOTE:	**The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.**

18. Remove and discard the RH VCT assembly bolt and the RH exhaust camshaft sprocket bolt.
    - Remove the RH VCT assembly, secondary timing chain and the RH exhaust camshaft sprocket as an assembly.

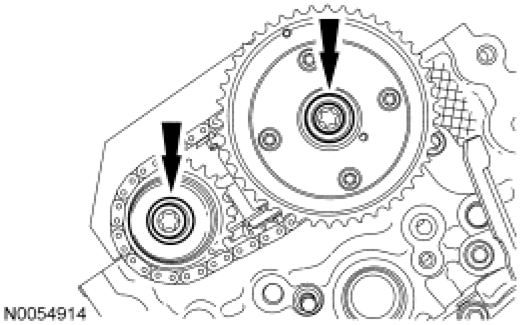


Fig. 254: Locating RH VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

19. Remove the Camshaft Holding Tool from the RH camshafts.

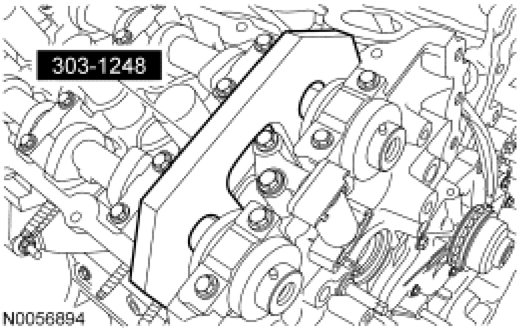


Fig. 255: Removing Special Tool (303-1248) From RH Camshafts

Courtesy of FORD MOTOR CO.

NOTE: The camshafts must remain in the neutral position during removal or engine damage may occur.

20. Rotate the RH camshafts counterclockwise to the neutral position.

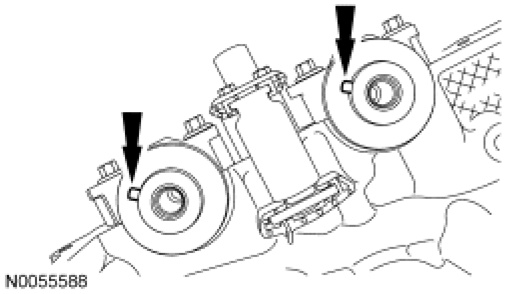


Fig. 256: Rotating RH Camshafts Counterclockwise To Neutral Position
Courtesy of FORD MOTOR CO.

NOTE: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.

21. Remove the bolts and the RH camshaft bearing caps.
    - Remove the RH camshafts.

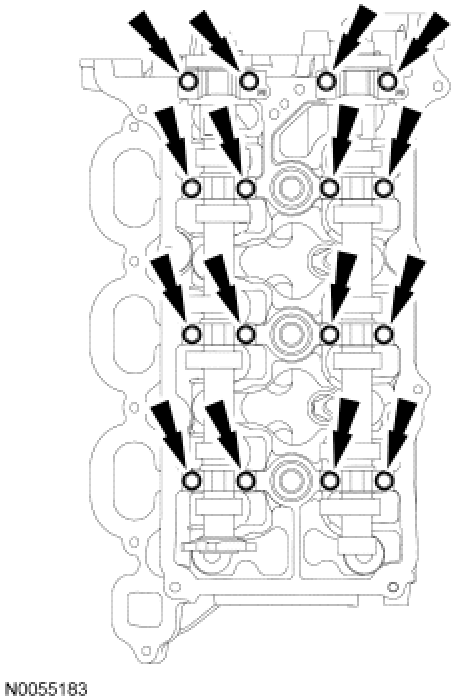


Fig. 257: Identifying RH Camshafts Bolts
Courtesy of FORD MOTOR CO.

VALVE TAPPETS

NOTE:	**During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.**

1. Depending on the valve tappets being serviced, remove the LH and/or the RH camshafts. For additional information, refer to **Camshaft**.

NOTE:	**If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.**

2. Remove the valve tappets from the cylinder head.

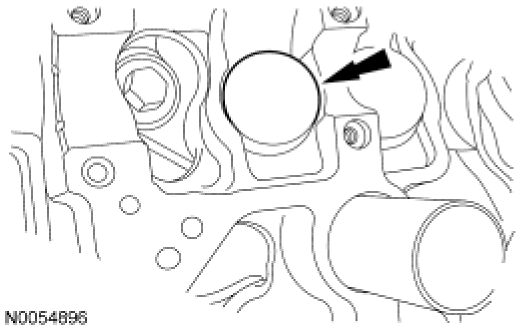
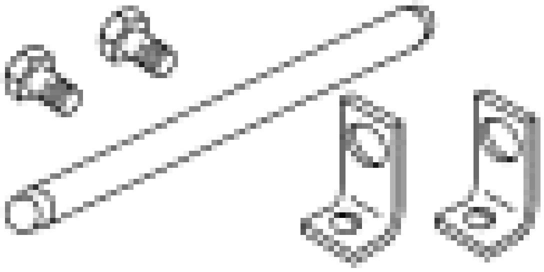
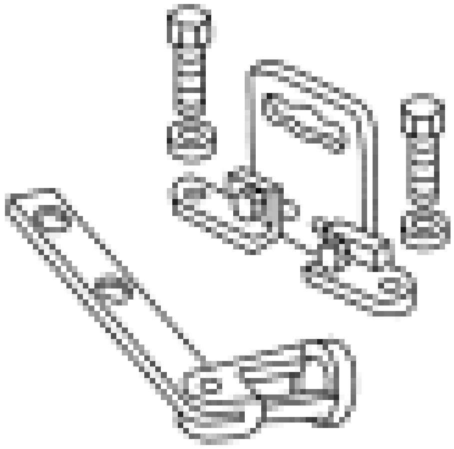
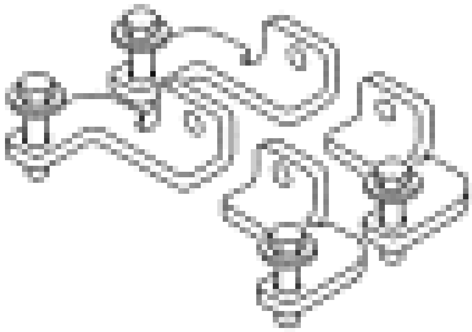


Fig. 258: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

VALVE SPRING, RETAINER AND SEAL

Special Tools

Illustration	Tool Name	Tool Number
	Compressor, Valve Spring	303-300 (T87C-6565-A)

 ST1981-A		
 ST1907-A	Compressor, Valve Spring	303-350 (T89P-6565-A)
 ST3028-A	Compressor, Valve Spring	303-1249

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

1. Remove the valve tappets from the cylinder being serviced. For additional information, refer to **Valve Tappets**.
2. Rotate the crankshaft until the piston for the valve being serviced is at the top of its stroke.

   NOTE: If air pressure has forced the piston to the bottom of the cylinder, any loss of air pressure will allow the valve to fall into the cylinder. If air pressure must be removed, support the valve prior to removal or engine damage may occur.

   NOTE: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

   NOTE: If a valve drops into the cylinder, remove the cylinder head. For additional information, refer to Cylinder Head - RH or Cylinder Head - LH.

3. Pressurize the cylinder using compressed air.
4. Using the Valve Spring Compressors, remove the keys, retainer and spring.

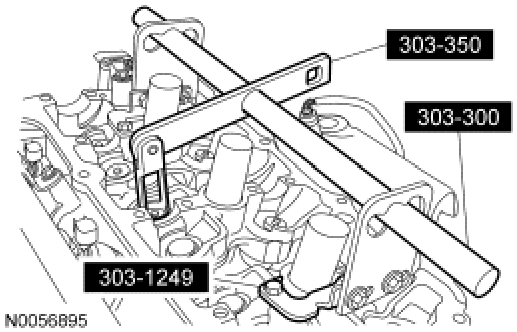


Fig. 259: Removing Keys, Retainer & Spring Using Special Tools (303-1249, 303-350, 303-300)
Courtesy of FORD MOTOR CO.

5. Remove and discard the valve stem seal.

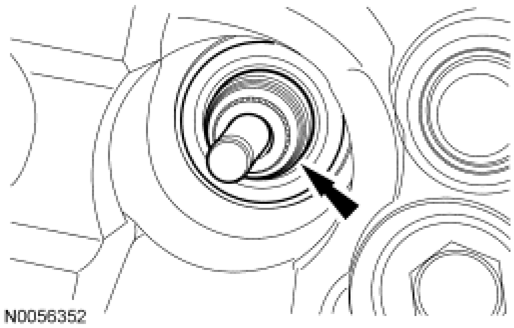


Fig. 260: Identifying Valve Stem Seal
Courtesy of FORD MOTOR CO.

CYLINDER HEAD - RH

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Silicone Gasket Remover ZC-30	-

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

All vehicles

1. Remove the RH camshafts. For additional information, refer to **Camshaft**.
2. If equipped, remove the heat shield and disconnect the block heater electrical connector.
   - Remove the block heater wiring harness from the engine.

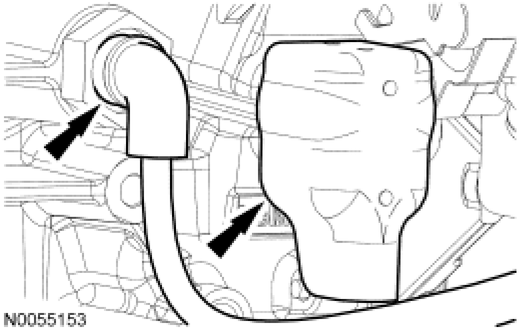


Fig. 261: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

3. Disconnect the RH heated oxygen sensor (HO2S) electrical connector.

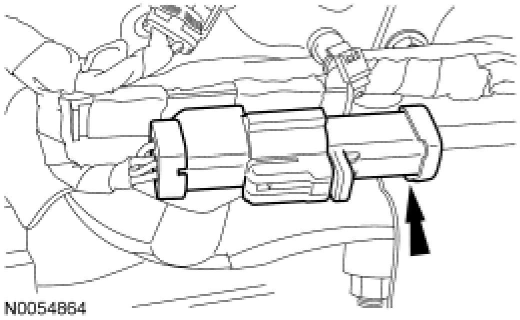


Fig. 262: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

4. Disconnect the RH camshaft position (CMP) sensor electrical connector.

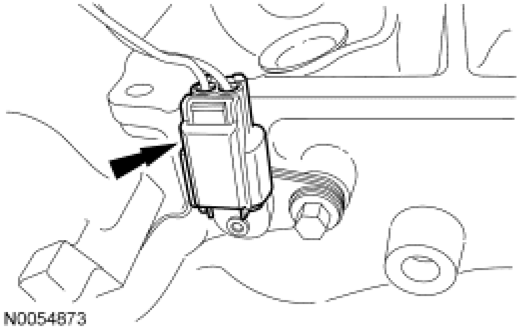


Fig. 263: Locating RH Camshaft Position (CMP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

5. Remove the bolt and the power steering pressure (PSP) tube and bracket assembly.

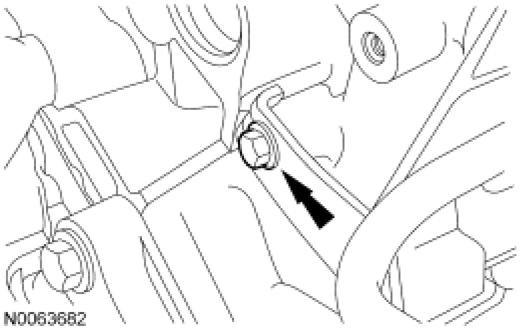


Fig. 264: Identifying Power Steering Pressure (PSP) Tube & Bracket Assembly
Courtesy of FORD MOTOR CO.

6. Disconnect the 6 fuel injector electrical connectors (3 shown).

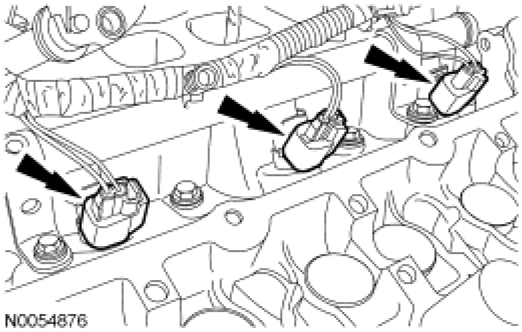


Fig. 265: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

7. Disconnect the cylinder head temperature (CHT) sensor electrical connector.

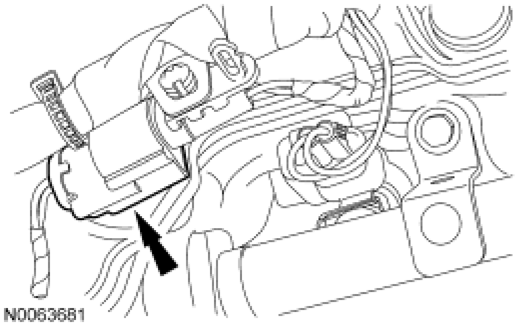


Fig. 266: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

8. Disconnect the LH catalyst monitor sensor electrical connector.

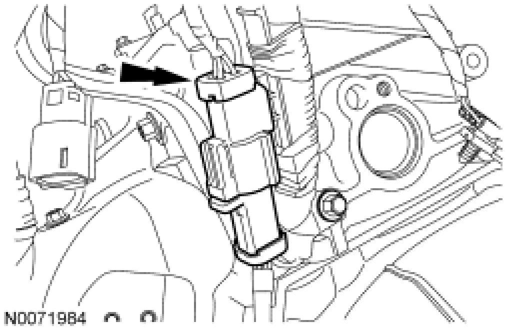


Fig. 267: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

9. Remove the 2 LH catalytic converter bracket bolts.

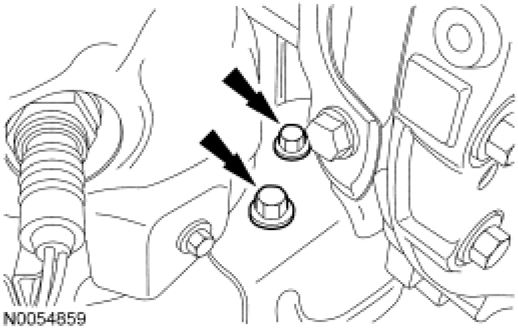


Fig. 268: Locating LH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

10. Remove the 4 nuts (3 shown) and the LH catalytic converter.
    - Discard the nuts and the gasket.

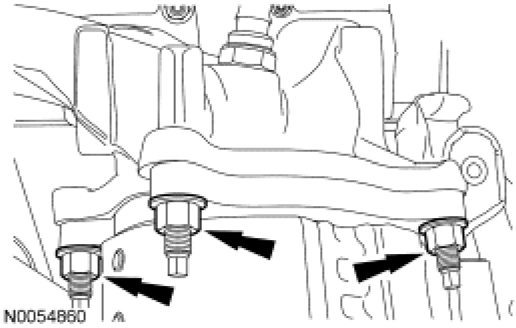


Fig. 269: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

11. Remove the LH cylinder block drain plug.
    - Allow coolant to drain from the cylinder block.

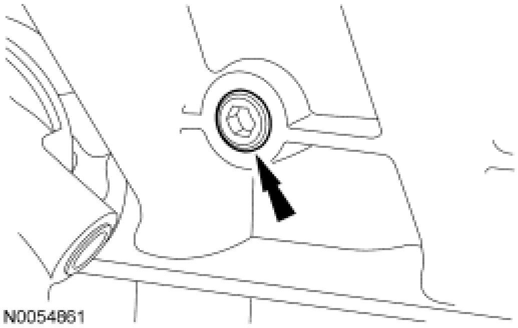


Fig. 270: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

12. Remove the 2 RH catalytic converter bracket bolts.

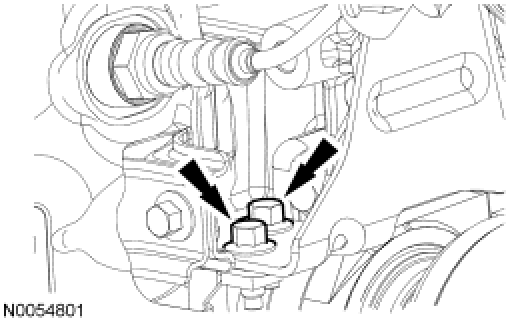


Fig. 271: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

All vehicles

13. Remove the 4 nuts and the RH catalytic converter.
    - Discard the nuts and the gasket.

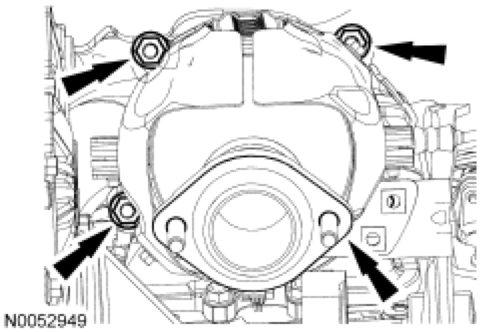


Fig. 272: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

14. Remove the RH cylinder block drain plug or, if equipped, the block heater.
    - Allow coolant to drain from the cylinder block.

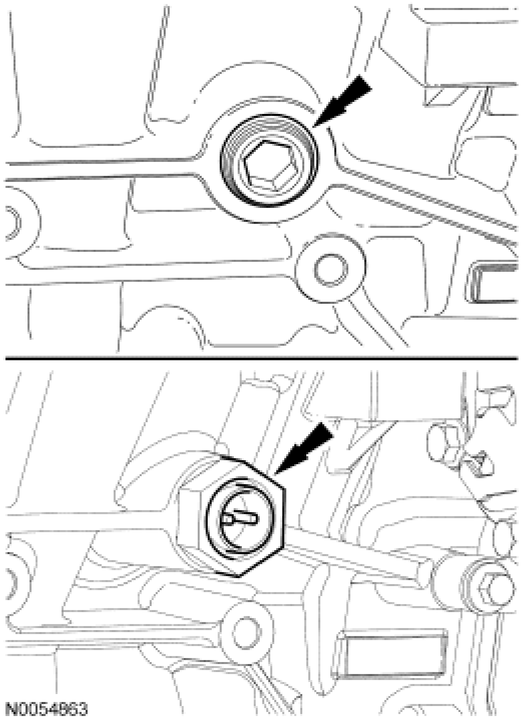


Fig. 273: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

15. Remove the 3 bolts and the RH exhaust manifold heat shield.

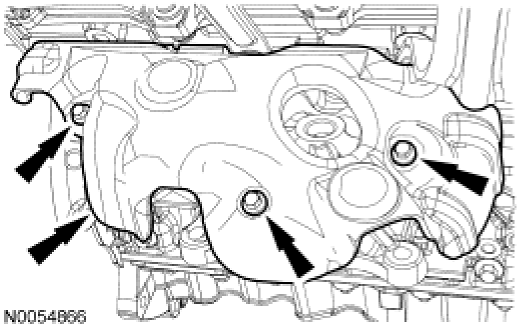


Fig. 274: Locating RH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

16. Remove the 6 nuts and the RH exhaust manifold.
    - Discard the nuts and exhaust manifold gaskets.

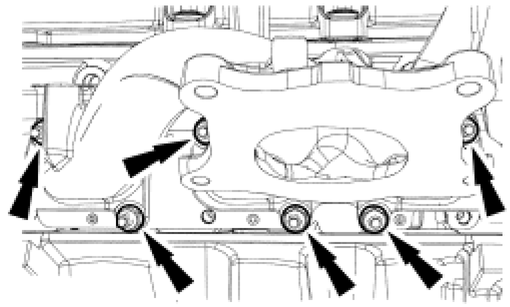


Fig. 275: Locating RH Exhaust Manifold & Nuts
Courtesy of FORD MOTOR CO.

17. Clean and inspect the RH exhaust manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
18. Remove and discard the 6 RH exhaust manifold studs.

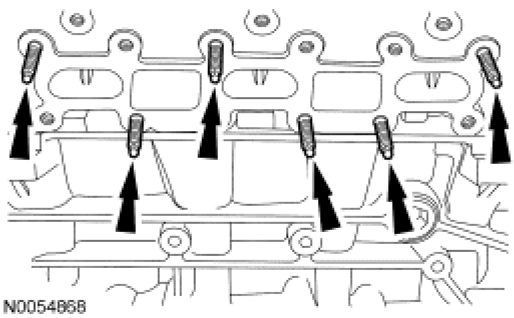


Fig. 276: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

19. Remove the 2 bolts and the RH primary timing chain guide.

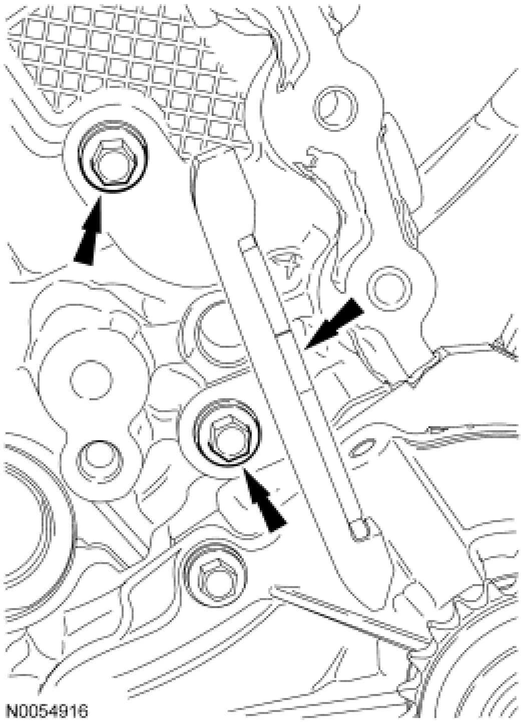


Fig. 277: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

20. Remove the 2 bolts and the RH secondary timing chain tensioner.

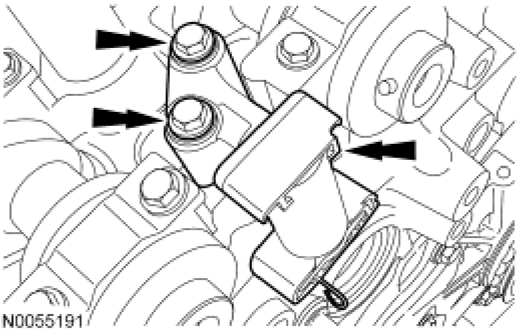


Fig. 278: Locating RH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

21. Remove the 2 bolts and the engine lifting eye.

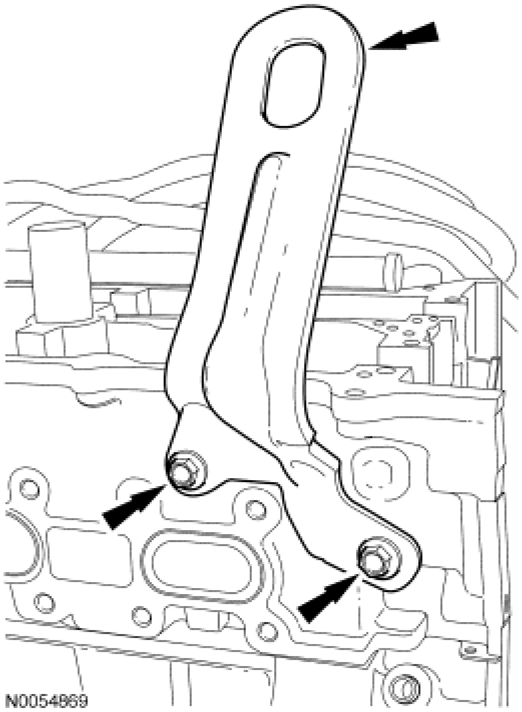


Fig. 279: Locating Engine Lifting Eye & Bolts
Courtesy of FORD MOTOR CO.

NOTE: Index-mark the location of the bracket on the cylinder head for installation.

22. If equipped, remove the bolt and the upper intake manifold long support bracket.

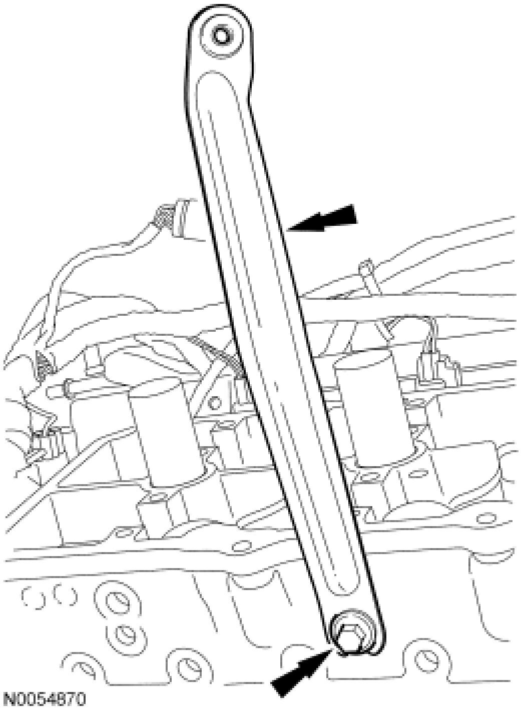


Fig. 280: Locating Upper Intake Manifold Bracket & Bolt
Courtesy of FORD MOTOR CO.

NOTE: Index-mark the location of the bracket on the cylinder head for installation.

23. Remove the bolt and the upper intake manifold short support bracket.

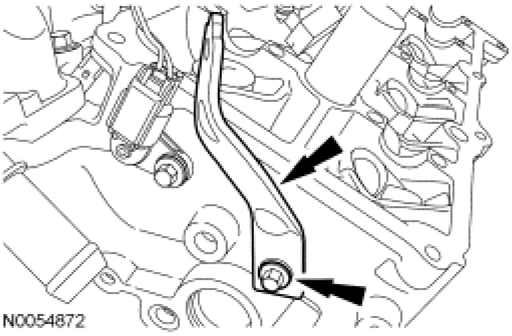


Fig. 281: Locating Upper Intake Manifold Bracket & Bolt
Courtesy of FORD MOTOR CO.

24. Remove the bolt and the RH CMP sensor.

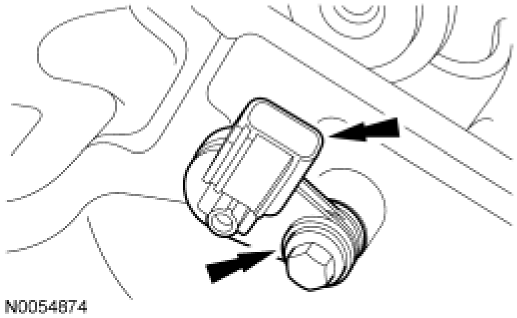


Fig. 282: Locating RH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

25. Remove the 4 bolts and the fuel rail and injectors as an assembly.

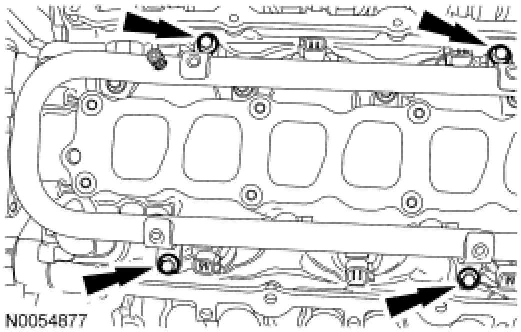


Fig. 283: Locating Fuel Rail And Injectors & Bolts
Courtesy of FORD MOTOR CO.

26. Disconnect the coolant bypass hose from the thermostat housing.

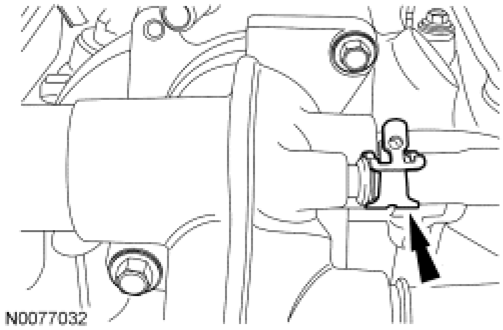


Fig. 284: Identifying Coolant Bypass Hose From Thermostat Housing
Courtesy of FORD MOTOR CO.

27. Remove the 2 thermostat housing-to-lower intake manifold bolts.
    - Remove the thermostat housing and discard the gasket and O-ring seal.

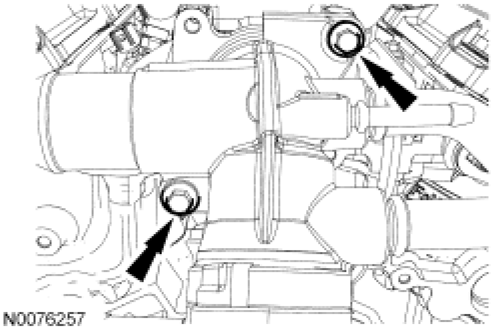


Fig. 285: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

28. Remove the 10 bolts and the lower intake manifold.
    - Discard the gaskets.

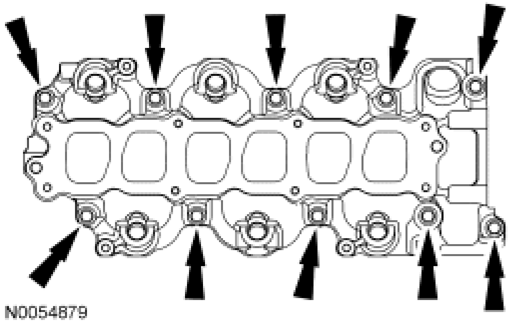


Fig. 286: Locating Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

29. Disconnect and remove the CHT sensor jumper harness.

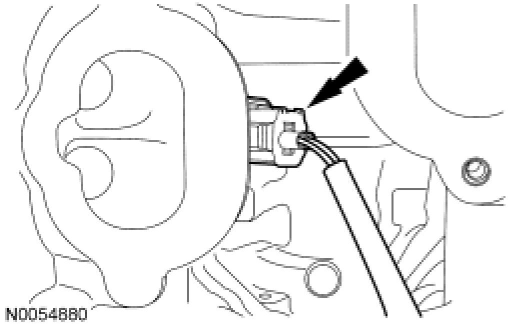


Fig. 287: Identifying CHT Sensor Jumper Harness
Courtesy of FORD MOTOR CO.

NOTE: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

30. Remove the valve tappets from the cylinder head.

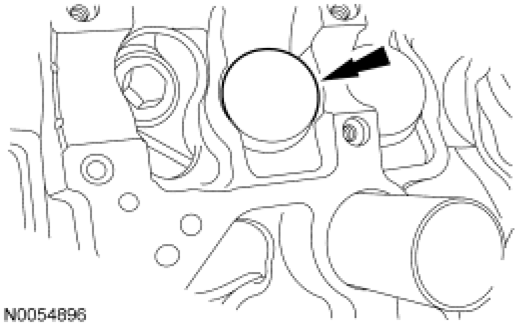


Fig. 288: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

31. Remove and discard the M6 bolt.

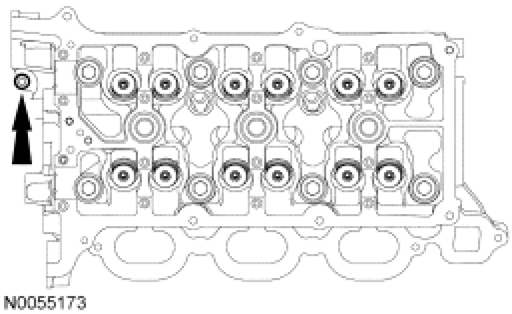


Fig. 289: Identifying M6 Bolt
Courtesy of FORD MOTOR CO.

CAUTION: Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

CAUTION: Aluminum surfaces are soft and may be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.

NOTE: The cylinder head bolts must be discarded and new bolts must be installed. They are tighten-to-yield design and cannot be reused.

32. Remove and discard the 8 bolts from the cylinder head.
    - Remove the cylinder head.
    - Discard the cylinder head gasket.

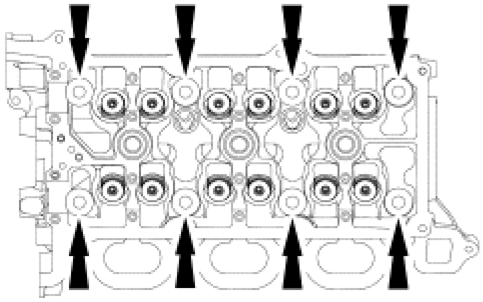

N0057856

Fig. 290: Identifying Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.

NOTE: Observe all warnings or cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.

NOTE: If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.

33. Clean the cylinder head-to-cylinder block mating surfaces of both the cylinder heads and the cylinder block in the following sequence.
    1. Remove any large deposits of silicone or gasket material with a plastic scraper.
    2. Apply silicone gasket remover, following package directions, and allow to set for several minutes.
    3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep, following package directions, to remove any remaining traces of oil or coolant and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.
34. Support the cylinder head on a bench with the head gasket side up.

NOTE: The straightedge used must be flat within 0.0051 mm (0.0002 in) per foot of tool length.

35. Inspect all areas of the deck face with a straightedge and feeler gauge. The cylinder head must not have depressions deeper than 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area, or scratches more than 0.0254 mm (0.001 in).

CYLINDER HEAD - LH

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Silicone Gasket Remover ZC-30	-

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

All vehicles

1. Remove the LH camshafts. For additional information, refer to **Camshaft**.
2. If equipped, remove the heat shield and disconnect the block heater electrical connector.
    - Remove the block heater wiring harness from the engine.

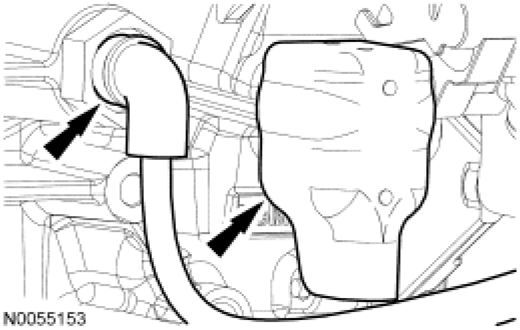


Fig. 291: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

3. Disconnect the A/C compressor electrical connector.

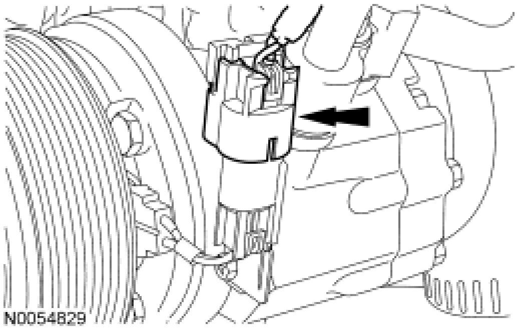


Fig. 292: Identifying A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

4. Remove the nut and disconnect the generator B+ cable.

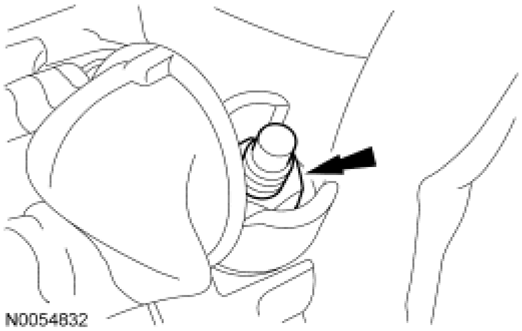


Fig. 293: Identifying Generator B+ Cable & Nut
Courtesy of FORD MOTOR CO.

5. Disconnect the generator electrical connector.

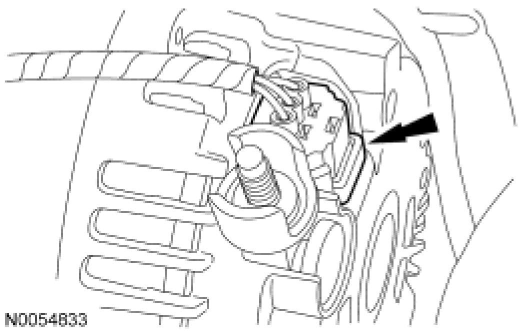


Fig. 294: Identifying Generator Electrical Connector
Courtesy of FORD MOTOR CO.

6. Detach the wiring harness retainer from the generator.

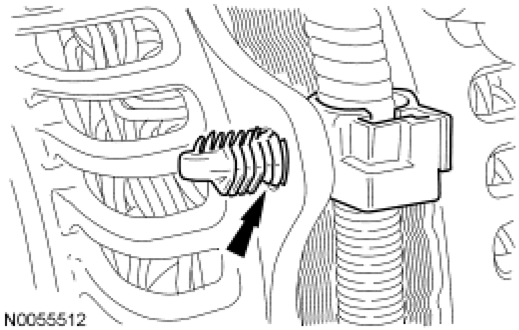


Fig. 295: Identifying Wiring Harness Retainer From Generator
Courtesy of FORD MOTOR CO.

7. Remove the nut, bolt and the generator.

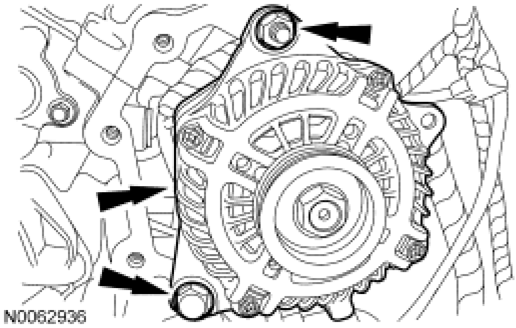


Fig. 296: Locating Generator, Bolts & Nuts
Courtesy of FORD MOTOR CO.

8. Detach the wiring harness pin-type retainer.

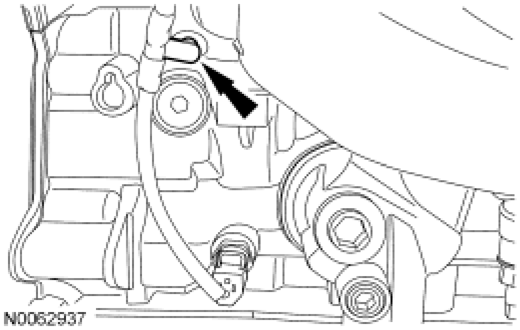


Fig. 297: Identifying Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

9. Disconnect the 6 fuel injector electrical connectors (3 shown).

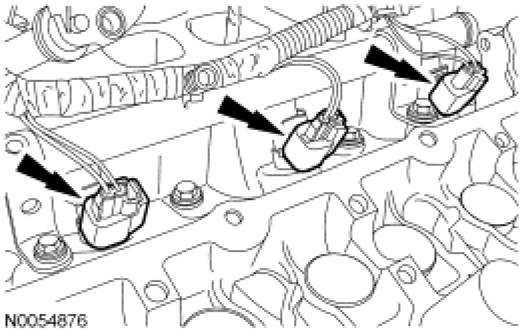


Fig. 298: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

10. Disconnect the Cylinder Head Temperature (CHT) sensor electrical connector.

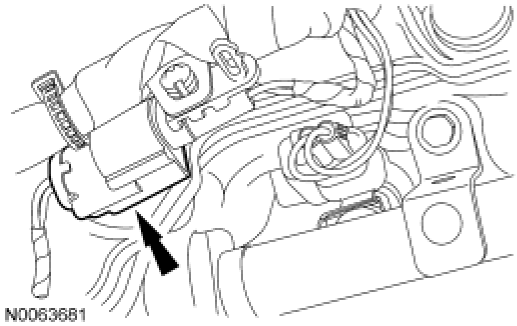


Fig. 299: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

11. Disconnect the LH Camshaft Position (CMP) sensor electrical connector.

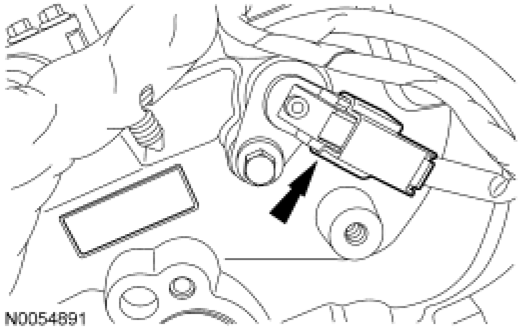


Fig. 300: Locating LH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

12. Disconnect the LH heated oxygen sensor (HO2S) electrical connector.

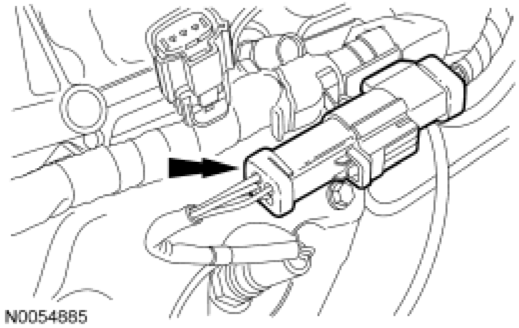


Fig. 301: Locating LH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

13. Disconnect the LH catalyst monitor sensor electrical connector.

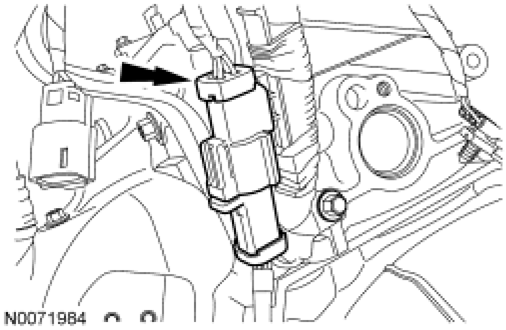


Fig. 302: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

14. Remove the wiring harness retainer bolt from the rear of the LH cylinder head.

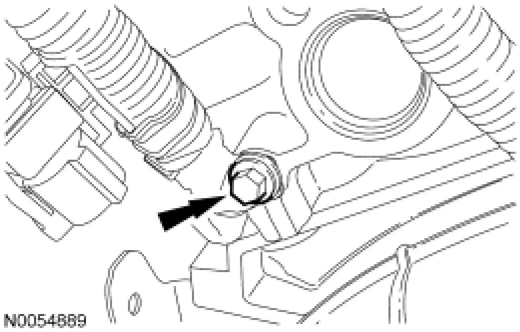


Fig. 303: Identifying Wiring Harness Retainer Bolt From Rear Of LH Cylinder Head
Courtesy of FORD MOTOR CO.

15. Remove the 2 LH catalytic converter bracket bolts.

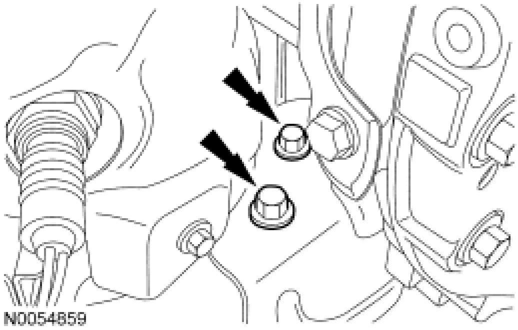


Fig. 304: Locating LH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

16. Remove the 4 nuts (3 shown) and the LH catalytic converter.
    - Discard the nuts and the gasket.

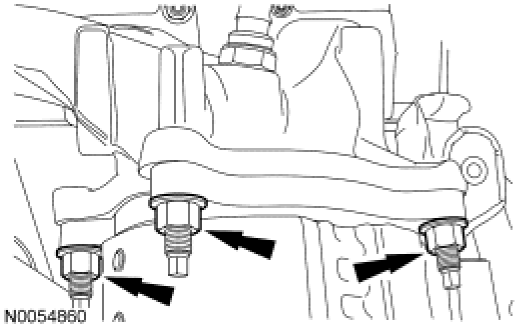


Fig. 305: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

17. Remove the 3 bolts and the LH exhaust manifold heat shield.

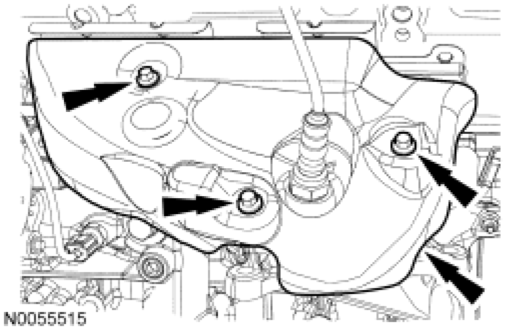


Fig. 306: Locating LH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

18. Remove the 6 nuts and the LH exhaust manifold.
    - Discard the nuts and the exhaust manifold gasket.

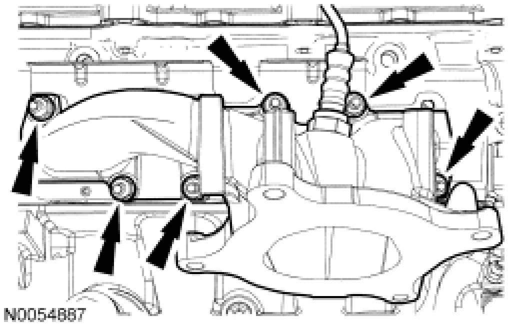


Fig. 307: Locating LH Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

19. Clean and inspect the LH exhaust manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
20. Remove and discard the 6 LH exhaust manifold studs.

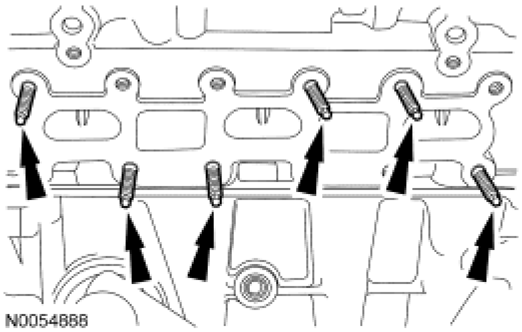


Fig. 308: Locating LH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

21. Remove the LH cylinder block drain plug.
    - Allow coolant to drain from the cylinder block.

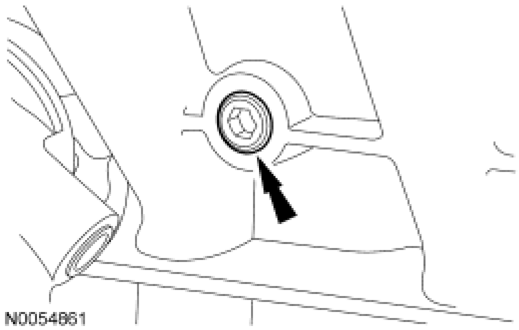


Fig. 309: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

22. Remove the 2 RH catalytic converter bracket bolts.

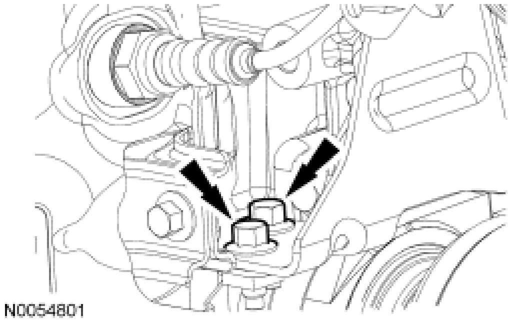


Fig. 310: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

All vehicles

23. Remove the 4 nuts and the RH catalytic converter.
    - Discard the nuts and the gasket.

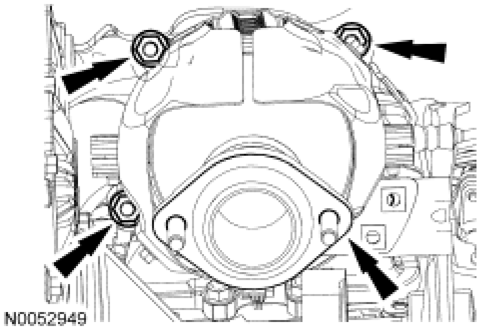


Fig. 311: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

24. Remove the RH cylinder block drain plug or, if equipped, the block heater.
    - Allow coolant to drain from the cylinder block.

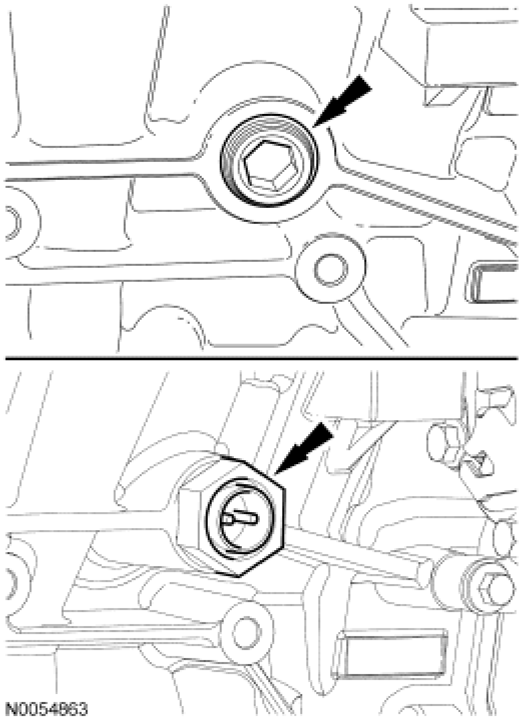


Fig. 312: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

25. Remove the 4 bolts and the fuel rail and injectors as an assembly.

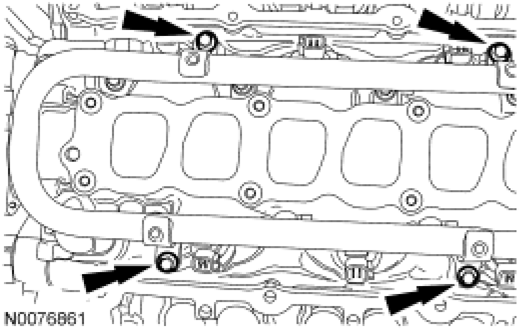


Fig. 313: Identifying Bolts & Fuel Rail
Courtesy of FORD MOTOR CO.

26. Disconnect the coolant bypass hose from the thermostat housing.

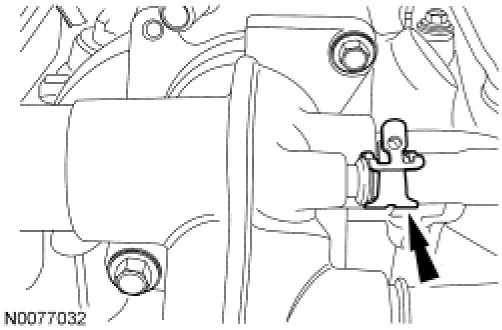


Fig. 314: Identifying Coolant Bypass Hose From Thermostat Housing
Courtesy of FORD MOTOR CO.

27. Remove the 2 thermostat housing-to-lower intake manifold bolts.
    - Remove the thermostat housing and discard the gasket and O-ring seal.

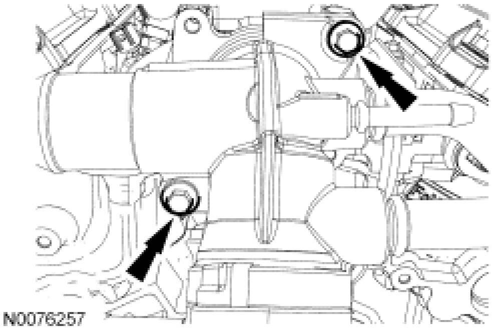


Fig. 315: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

28. Remove the 10 bolts and the lower intake manifold.
    - Discard the gaskets.

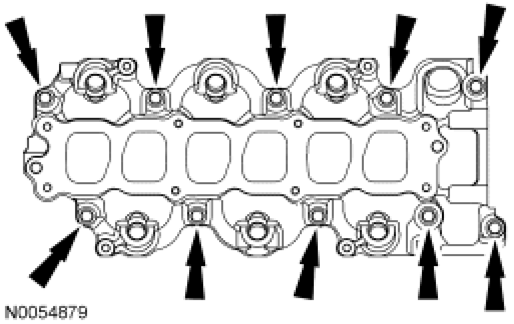


Fig. 316: Locating Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

29. Remove the bolt and the LH CMP sensor.

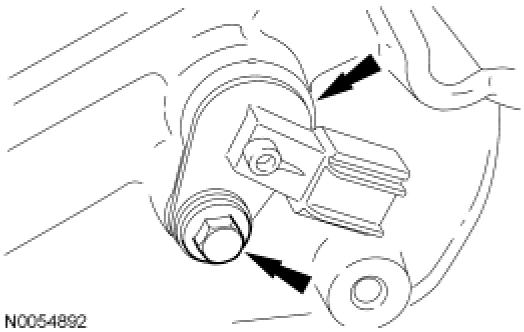


Fig. 317: Locating LH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

30. Remove the 2 bolts and the upper LH primary timing chain guide.

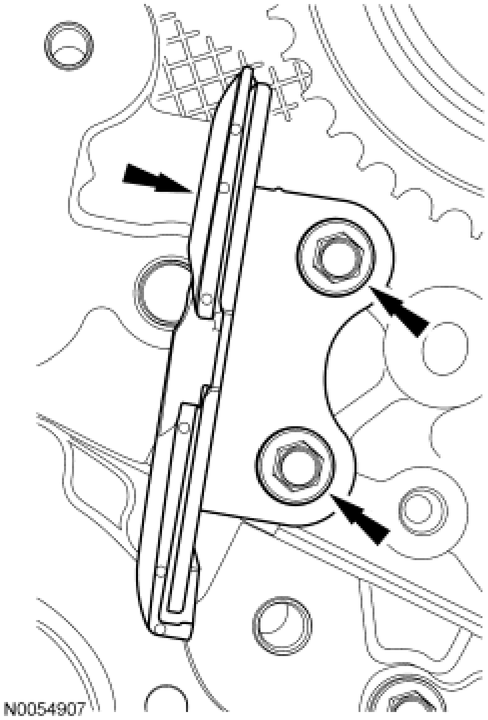


Fig. 318: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

31. Remove the 2 bolts and the LH secondary timing chain tensioner.

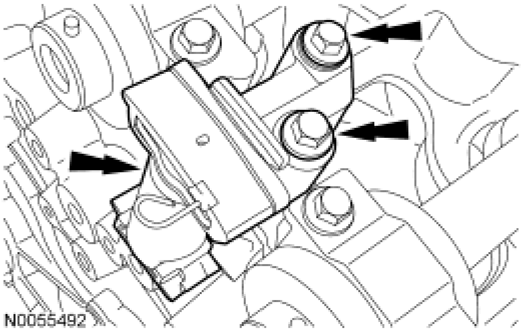


Fig. 319: Locating LH Secondary Timing Chain Tensioner & Bolt
Courtesy of FORD MOTOR CO.

NOTE: **If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.**

32. Remove the valve tappets from the cylinder head.

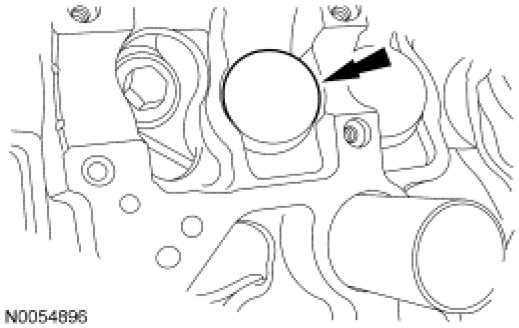


Fig. 320: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

33. Remove and discard the M6 bolt.

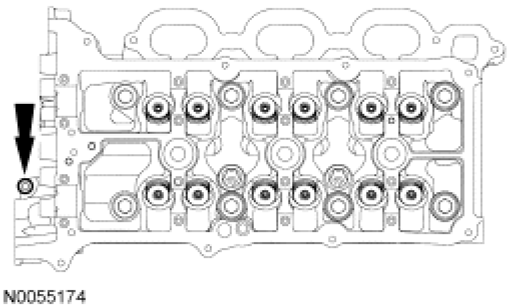


Fig. 321: Identifying M6 Bolt
Courtesy of FORD MOTOR CO.

NOTE:	**Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.**
NOTE:	**Aluminum surfaces are soft and may be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.**
NOTE:	**The cylinder head bolts must be discarded and new bolts must be installed. They are tighten-to-yield design and cannot be reused.**

34. Remove and discard the 8 bolts from the cylinder head.
    - Remove the cylinder head.
    - Discard the cylinder head gasket.

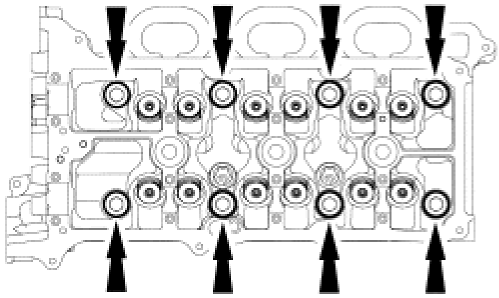


Fig. 322: Identifying Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

NOTE: **Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.**

NOTE: **Observe all warnings or cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.**

NOTE: **If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.**

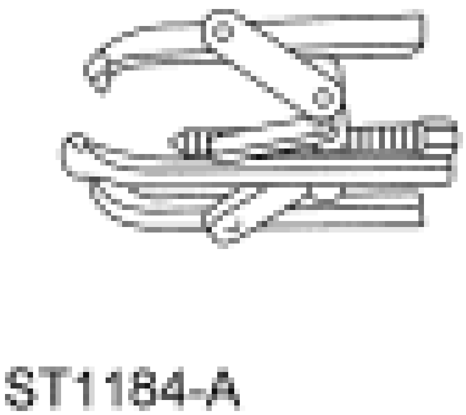
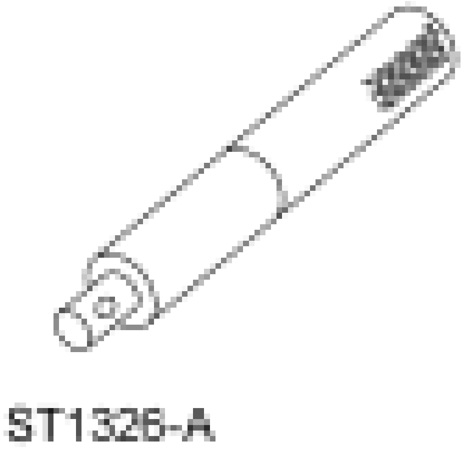
35. Clean the cylinder head-to-cylinder block mating surfaces of both the cylinder heads and the cylinder block in the following sequence.
    1. Remove any large deposits of silicone or gasket material with a plastic scraper.
    2. Apply silicone gasket remover, following package directions, and allow to set for several minutes.
    3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep, following package directions, to remove any remaining traces of oil or coolant and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.
36. Support the cylinder head on a bench with the head gasket side up.

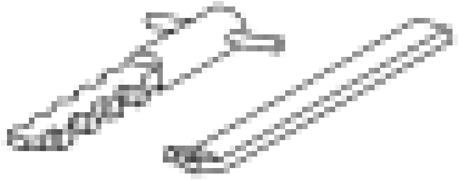
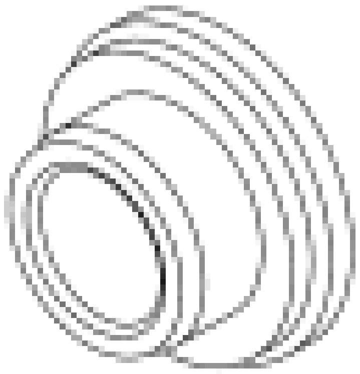
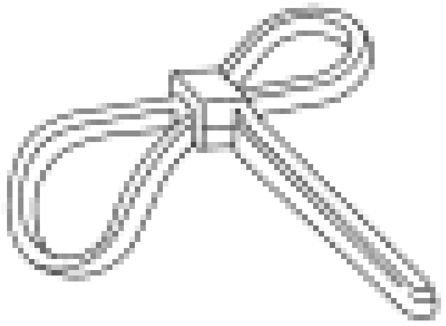
NOTE: **The straightedge used must be flat within 0.0051 mm (0.0002 in) per foot of tool length.**

37. Inspect all areas of the deck face with a straightedge and feeler gauge. The cylinder head must not have depressions deeper than 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area, or scratches more than 0.0254 mm (0.001 in).

OIL PAN

Special Tools

Illustration	Tool Name	Tool Number
	3-Jaw Puller	303-D121
	Handle	205-153 (T80T-4000-W)
	Remover, Oil Seal	303-409 (T92C-6700CH)

 ST1385-A		
 ST2982-A	Remover, VCT Spark Plug Tube Seal	303-1247/1
 ST1438-A	Strap Wrench	303-D055 (D85L-6000-A)

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Silicone Gasket Remover ZC-30	-

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

All vehicles

1. Remove the engine from the vehicle. For additional information, refer to **Engine**.
2. Remove the 8 bolts and the flywheel.

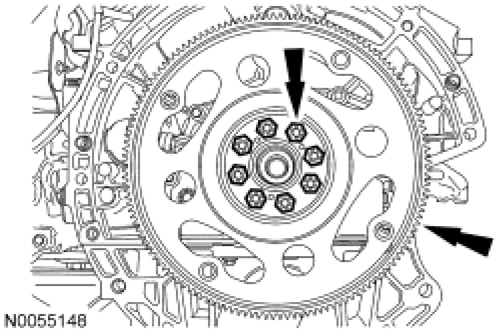


Fig. 323: Identifying Flexplate & Bolts
Courtesy of FORD MOTOR CO.

3. Remove the crankshaft sensor ring.

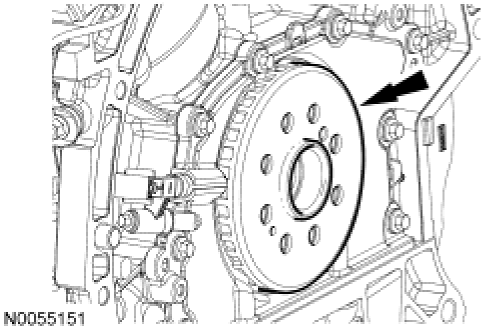


Fig. 324: Identifying Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

NOTE: Install the engine stand bolts into the cylinder block only. Do not install

the bolts into the oil pan.

4. Mount the engine on a suitable engine stand.
5. If equipped, detach the block heater wiring harness retainer from the upper intake manifold.

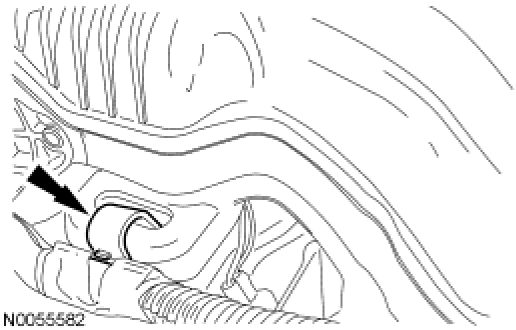


Fig. 325: Identifying Block Heater Wiring Harness Retainer From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

6. If equipped, remove the heat shield and disconnect the block heater electrical connector.

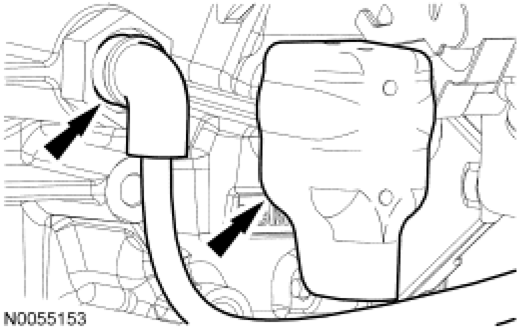


Fig. 326: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

7. If equipped, detach the block heater wiring harness retainer from the power steering reservoir hose and the Power Steering Pressure (PSP) hose.
   - Remove the block heater wiring harness from the engine.

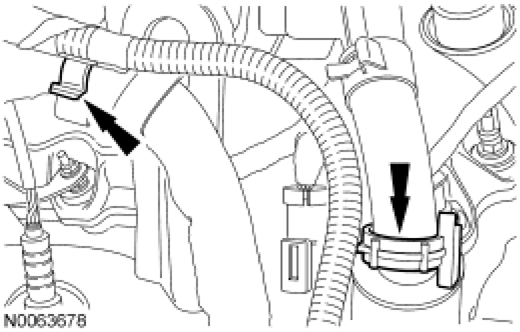


Fig. 327: Identifying Block Heater Wiring Harness From Engine
Courtesy of FORD MOTOR CO.

8. Disconnect the PCV hose from the PCV valve.

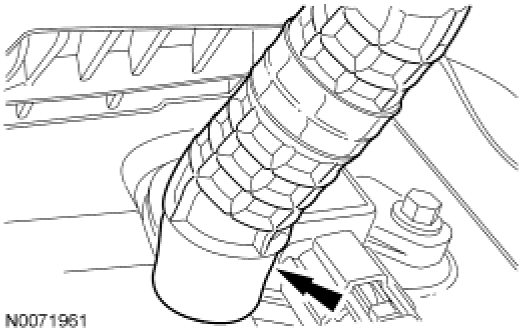


Fig. 328: Identifying PCV Hose
Courtesy of FORD MOTOR CO.

9. Disconnect the Throttle Body (TB) electrical connector.

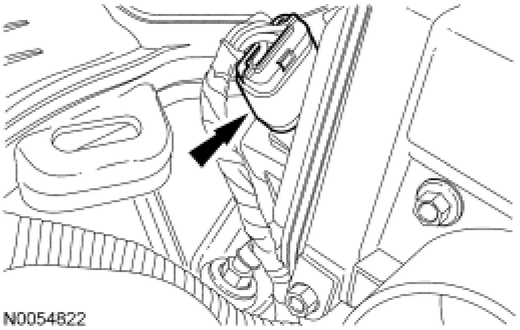


Fig. 329: Locating Throttle Body Electrical Connector
Courtesy of FORD MOTOR CO.

10. Detach the wiring harness retainers from the upper intake manifold.

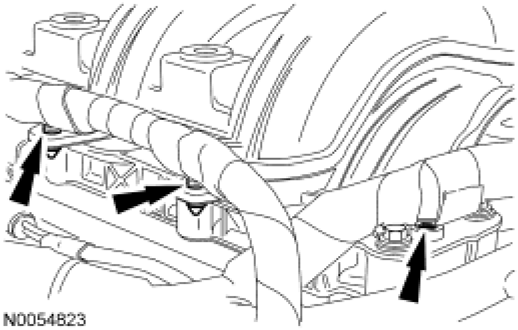


Fig. 330: Locating Wiring Harness Retainers From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

11. Remove the upper intake manifold support bracket bolt.

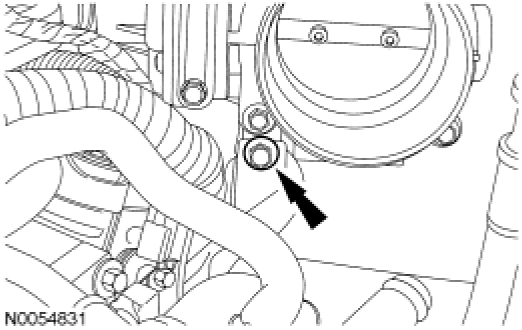


Fig. 331: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

12. Remove the 6 bolts and the upper intake manifold.
    - Discard the gaskets.

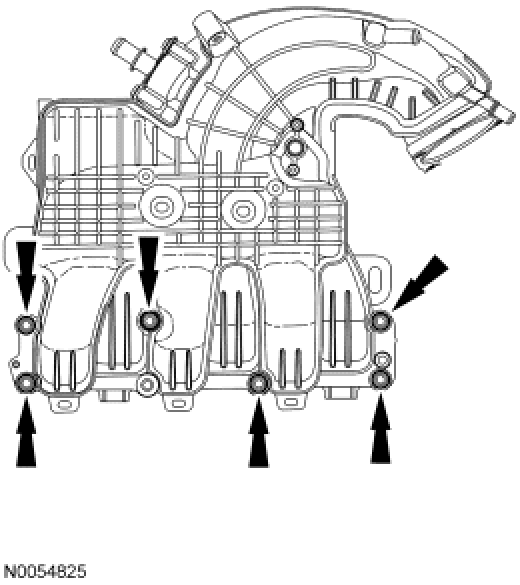


Fig. 332: Identifying Upper Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

13. Disconnect the PSP switch electrical connector.

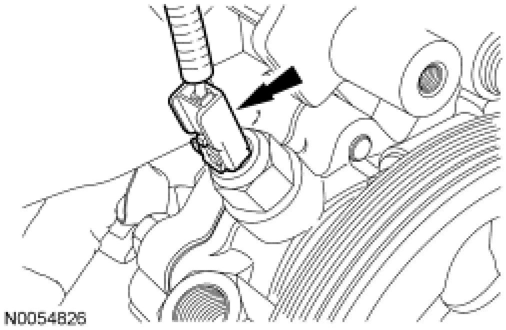


Fig. 333: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

14. Disconnect the RH catalyst monitor sensor electrical connector.

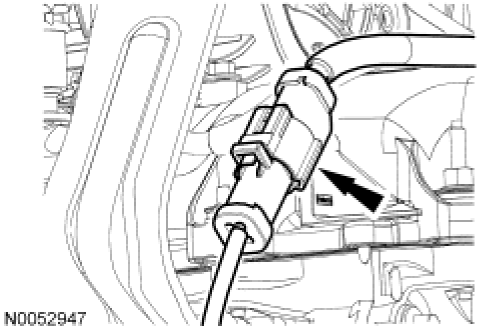


Fig. 334: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

15. Disconnect the RH Variable Camshaft Timing (VCT) solenoid electrical connector.

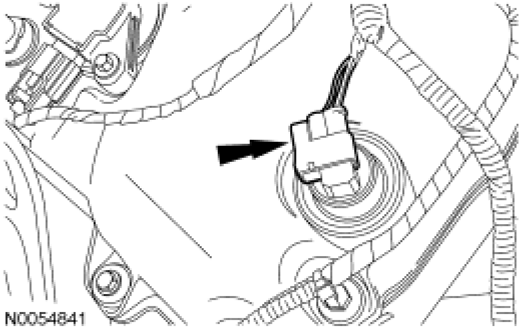


Fig. 335: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

16. Disconnect the 3 RH coil-on-plug electrical connectors.

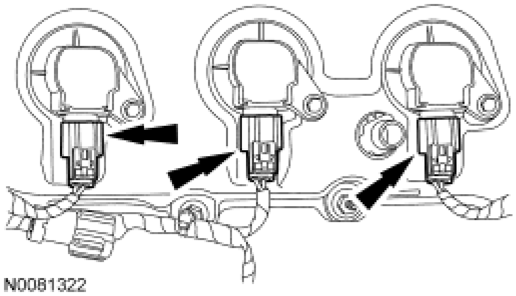


Fig. 336: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

17. Detach all of the wiring harness retainers from the RH valve cover and stud bolts.
18. Disconnect the LH catalyst monitor sensor electrical connector.

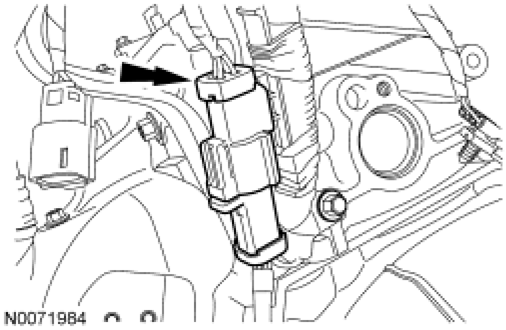


Fig. 337: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

19. Disconnect the LH VCT solenoid electrical connector.

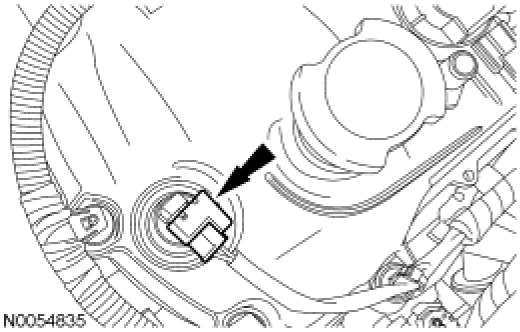


Fig. 338: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

20. Disconnect the 3 LH coil-on-plug electrical connectors.

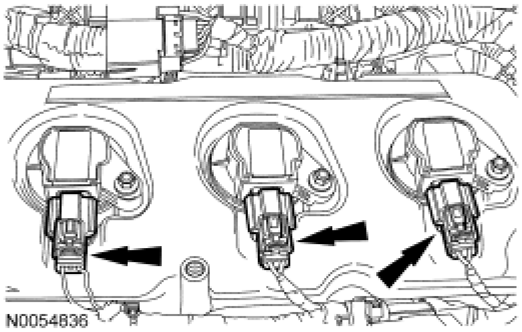


Fig. 339: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

21. Detach all of the wiring harness retainers from the LH valve cover and stud bolts.

NOTE: The A/C compressor must remain bolted to the cylinder block prior to installing the oil pan.

22. Remove the A/C compressor nut and stud.

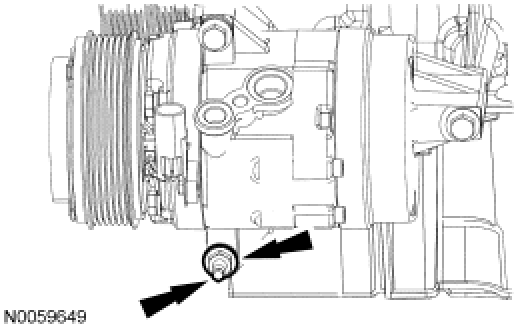


Fig. 340: Identifying A/C Compressor Nut & Stud
Courtesy of FORD MOTOR CO.

23. Detach the PSP hose retainer from the engine lifting eye.

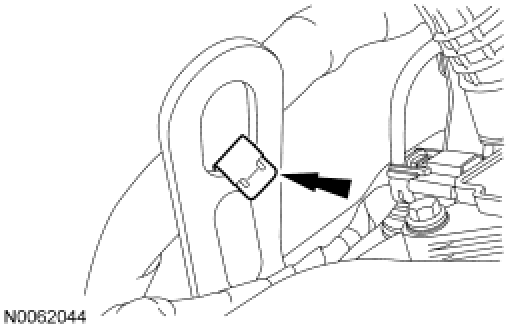


Fig. 341: Locating PSP Hose Retainer From Engine Lifting Eye
Courtesy of FORD MOTOR CO.

24. Remove the PSP hose bracket nut.

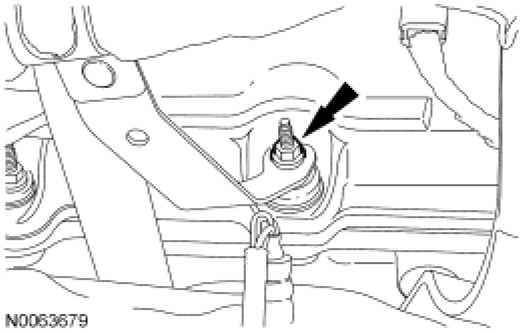


Fig. 342: Identifying PSP Hose Bracket Nut
Courtesy of FORD MOTOR CO.

25. Remove the 3 bolts and position the power steering pump aside.

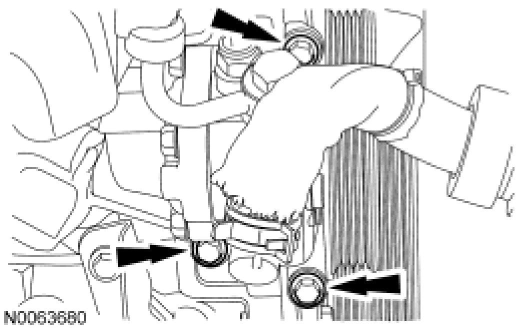


Fig. 343: Locating Power Steering Pump Bolts
Courtesy of FORD MOTOR CO.

26. Remove the 3 bolts and the accessory drive belt tensioner.

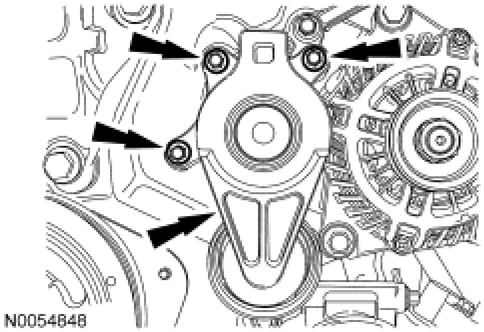


Fig. 344: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

27. Remove the 4 nuts (3 shown) and the LH catalytic converter.
    - Discard the nuts and the gasket.

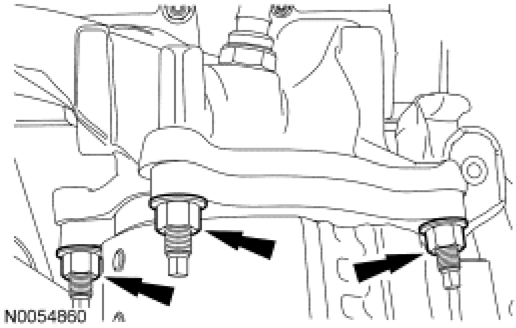


Fig. 345: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

FWD vehicles

28. Remove the 4 nuts and the RH catalytic converter.
    - Discard the nuts and the gasket.

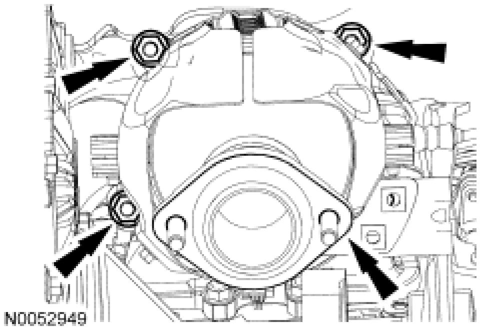


Fig. 346: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

All vehicles

29. Remove the RH cylinder block drain plug or, if equipped, the block heater.
    - Allow coolant to drain from the cylinder block.

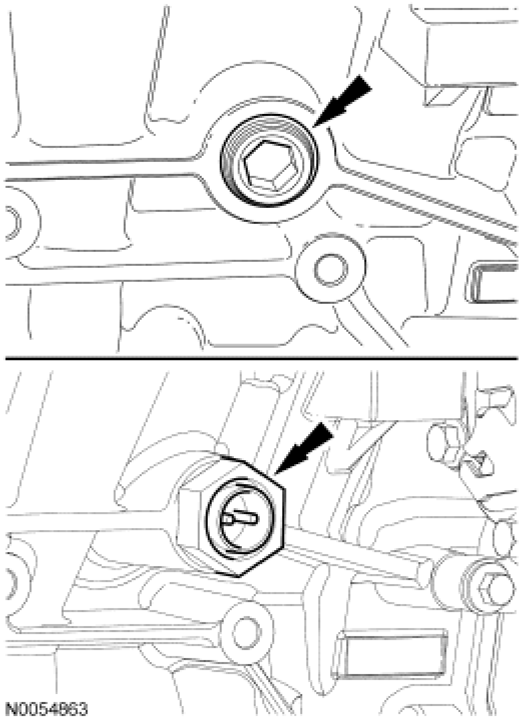


Fig. 347: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

30. Remove the LH cylinder block drain plug.
    - Allow coolant to drain from the cylinder block.

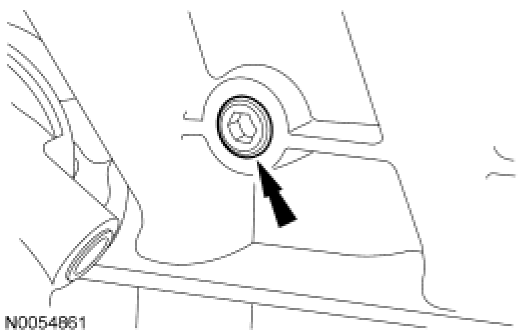


Fig. 348: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

31. Remove the 6 bolts and the 6 coil-on-plugs.

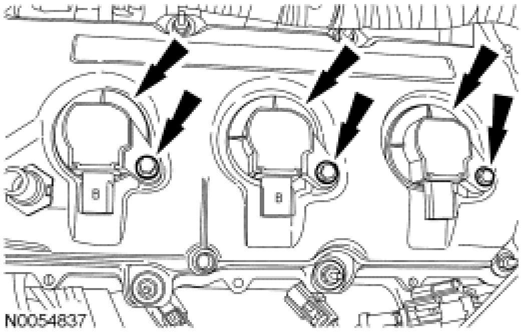


Fig. 349: Locating Coil-On-Plugs & Bolts
Courtesy of FORD MOTOR CO.

32. Remove the 2 nuts and the wiring harness retaining bracket.

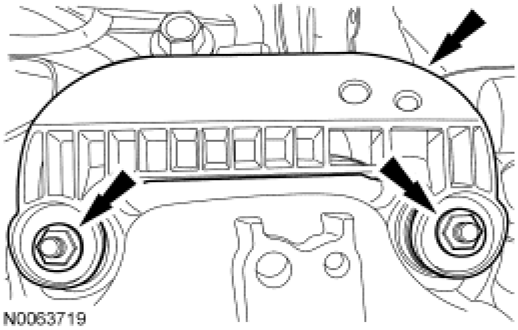


Fig. 350: Identifying Wiring Harness Retaining Bracket & Nuts
Courtesy of FORD MOTOR CO.

33. Loosen the 11 stud bolts and remove the LH valve cover.
    - Discard the gasket.

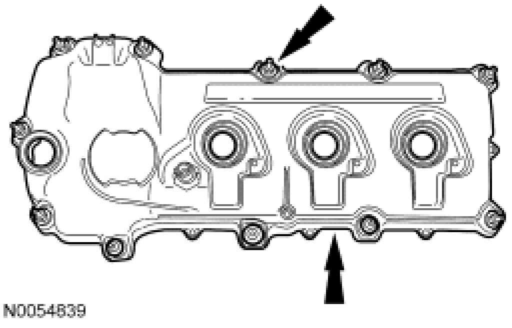


Fig. 351: Locating LH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

34. Loosen the bolt, the 10 stud bolts and remove the RH valve cover.
    - Discard the gasket.

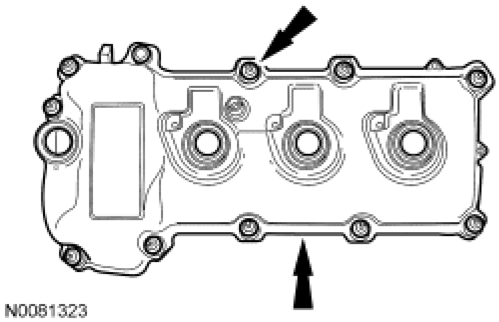


Fig. 352: Locating Stud Bolts On RH Valve Cover
Courtesy of FORD MOTOR CO.

NOTE: VCT solenoid seal removal shown, spark plug tube seal removal similar.

35. Inspect the VCT solenoid seals and the spark plug tube seals. Remove any damaged seals.
    - Using the VCT Spark Plug Tube Seal Remover and Handle, remove the seal(s).

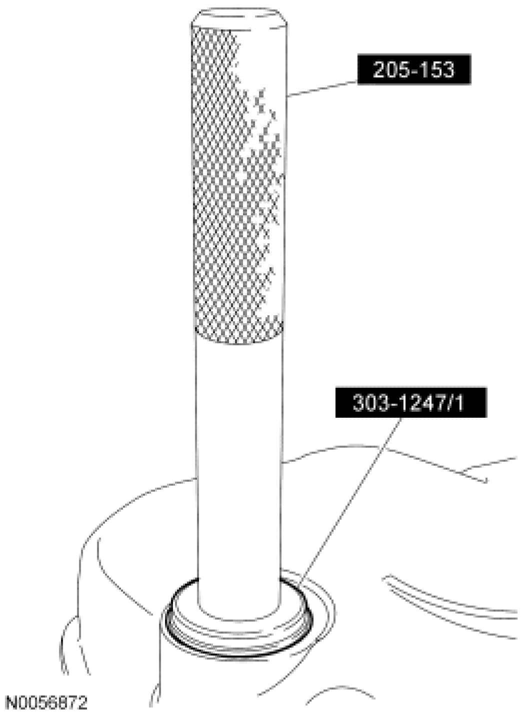


Fig. 353: Removing Seals Using Special Tools (205-153) & (303-1247/1)
Courtesy of FORD MOTOR CO.

36. Using the Strap Wrench, remove the crankshaft bolt and washer.
    - Discard the bolt.

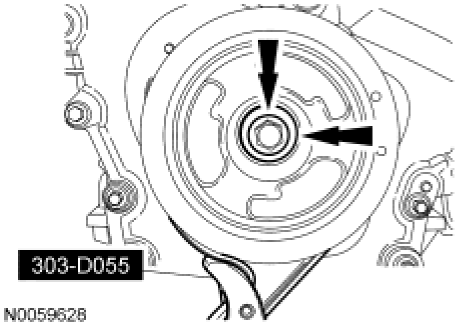


Fig. 354: Removing Crankshaft Bolt & Washer Using Special Tool (303-D055)
Courtesy of FORD MOTOR CO.

37. Using the 3-Jaw Puller, remove the crankshaft pulley.

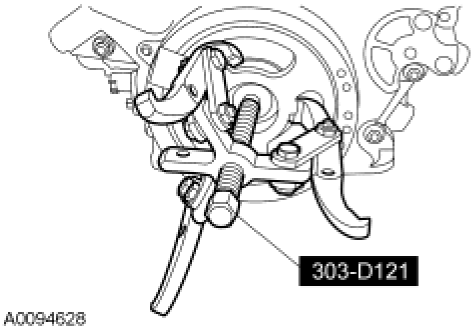


Fig. 355: Identifying Special Tools (303-D121) And Crankshaft Pulley
Courtesy of FORD MOTOR CO.

38. Using the Oil Seal Remover, remove and discard the crankshaft front seal.

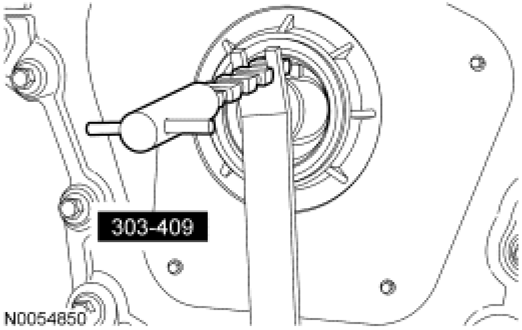


Fig. 356: Removing Crankshaft Front Seal Using Special Tool (303-409)
Courtesy of FORD MOTOR CO.

39. Remove the 2 bolts and the engine mount bracket.

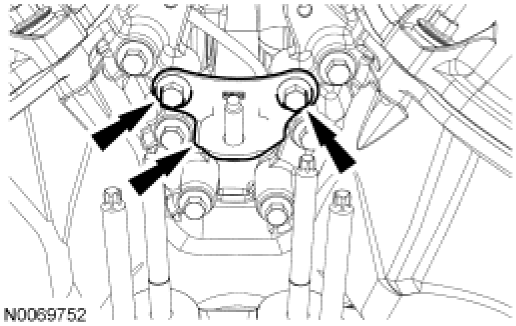


Fig. 357: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

NOTE: **Only use hand tools to remove the studs.**

40. Remove the 2 engine mount studs.

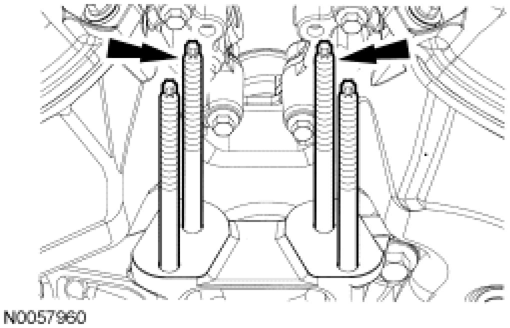


Fig. 358: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

41. Remove the 3 bolts and the engine mount bracket.

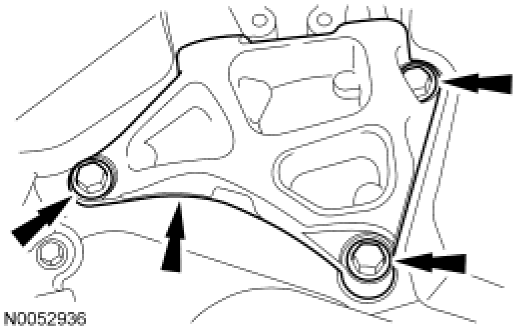


Fig. 359: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

42. Remove the 22 engine front cover bolts.

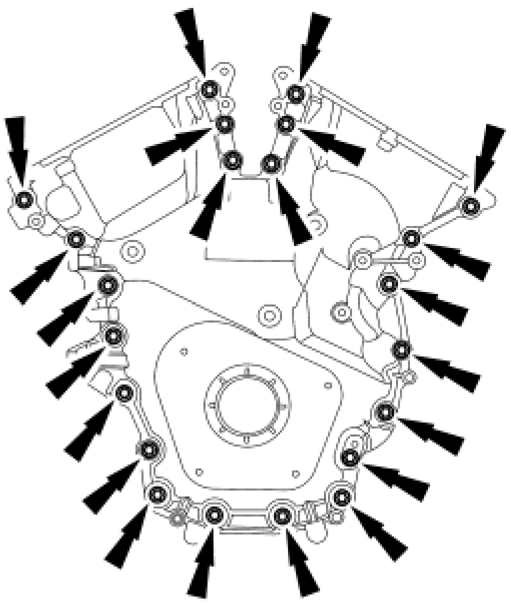
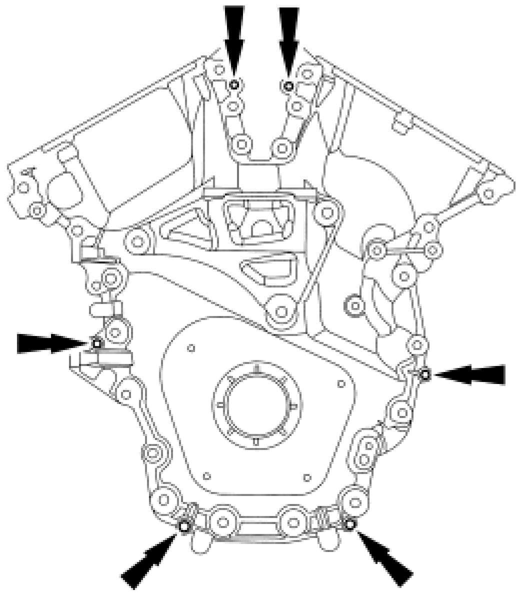


Fig. 360: Identifying Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

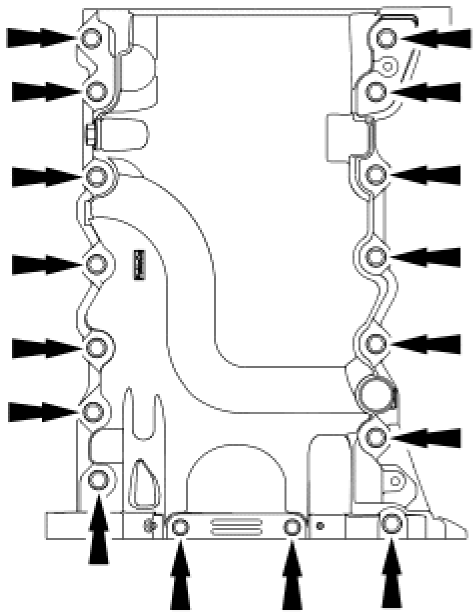
43. Install 6 of the engine front cover bolts (finger tight) into the 6 threaded holes in the engine front cover in the following sequence.
    1. Tighten the bolts one turn at a time in a criss-cross pattern until the engine front cover-to-cylinder block seal is released.
    2. Remove the engine front cover.



N0082530

Fig. 361: Tightening Bolts One Turn At A Time In A Criss-Cross Pattern Until Engine Front Cover-To-Cylinder Block Seal Is Released
Courtesy of FORD MOTOR CO.

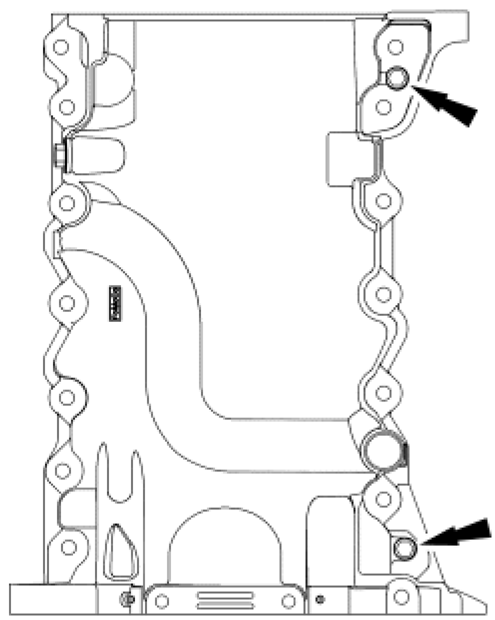
44. Remove the 16 oil pan bolts.



N0055163

Fig. 362: Identifying Oil Pan Bolts
Courtesy of FORD MOTOR CO.

45. Install 2 of the oil pan bolts (finger tight) into the 2 threaded holes in the oil pan in the following sequence.
    1. Alternately tighten the 2 bolts one turn at a time until the oil pan-to-cylinder block seal is released.
    2. Remove the oil pan.



N0055164

Fig. 363: Installing 2 Of Oil Pan Bolts (Finger Tight) Into 2 Threaded Holes In Oil Pan
Courtesy of FORD MOTOR CO.

NOTE:	**Only use a 3M Roloc® Bristle Disk (2-in white, part number 07528) to clean the engine front cover and oil pan. Do not use metal scrapers, wire brushes or any other power abrasive disk to clean the crankshaft rear seal retainer plate. These tools cause scratches and gouges that make leak paths.**

46. Clean the engine front cover and oil pan using a 3M Roloc® Bristle Disk (2-in white, part number 07528) in a suitable tool turning at the recommended speed of 15,000 RPM.
    - Thoroughly wash the engine front cover and oil pan to remove any foreign material, including any abrasive particles created during the cleaning process.

NOTE:	**Place clean, lint-free shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket**

surfaces) that enters the oil passages or the oil pan, can cause engine failure.

NOTE: Do not use wire brushes, power abrasive discs or 3M Roloc® Bristle Disk (2-in white, part number 07528) to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. They also cause contamination that will cause premature engine failure. Remove all traces of the gasket.

47. Clean all engine sealing surfaces of the cylinder block in the following sequence.
    1. Remove any large deposits of silicone or gasket material.
    2. Apply silicone gasket remover and allow to set for several minutes.
    3. Remove the silicone gasket remover. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep to remove any remaining traces of oil or coolant and to prepare the surfaces to bond. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.
    5. Make sure the 2 locating dowel pins are seated correctly in the cylinder block.

OIL PUMP SCREEN AND PICKUP TUBE

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

1. Remove the oil pan. For additional information, refer to **Oil Pan**.
2. Remove the 3 bolts and the oil pump screen and pickup tube.
    - Discard the O-ring seal.

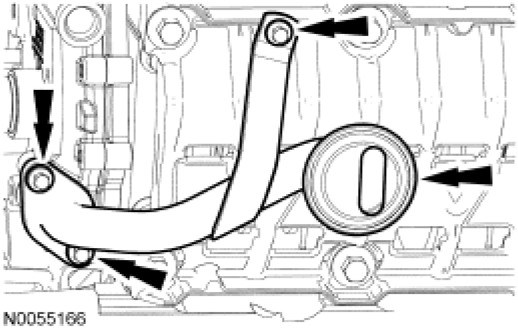
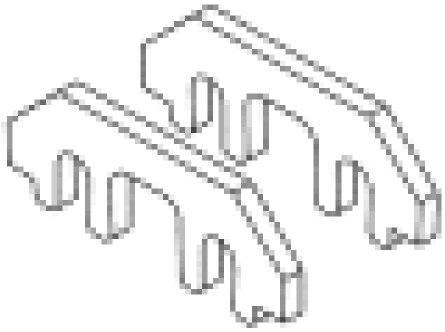


Fig. 364: Identifying Oil Pump Screen, Pickup Tube & Bolts
Courtesy of FORD MOTOR CO.

OIL PUMP

Special Tools

Illustration	Tool Name	Tool Number
 ST2979-A	Camshaft Alignment Tool	303-1248

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan can cause engine failure.

1. Remove the engine front cover. For additional information, refer to **Engine Front Cover**.
2. Rotate the crankshaft clockwise and align the timing marks on the variable camshaft timing (VCT) assemblies as shown.

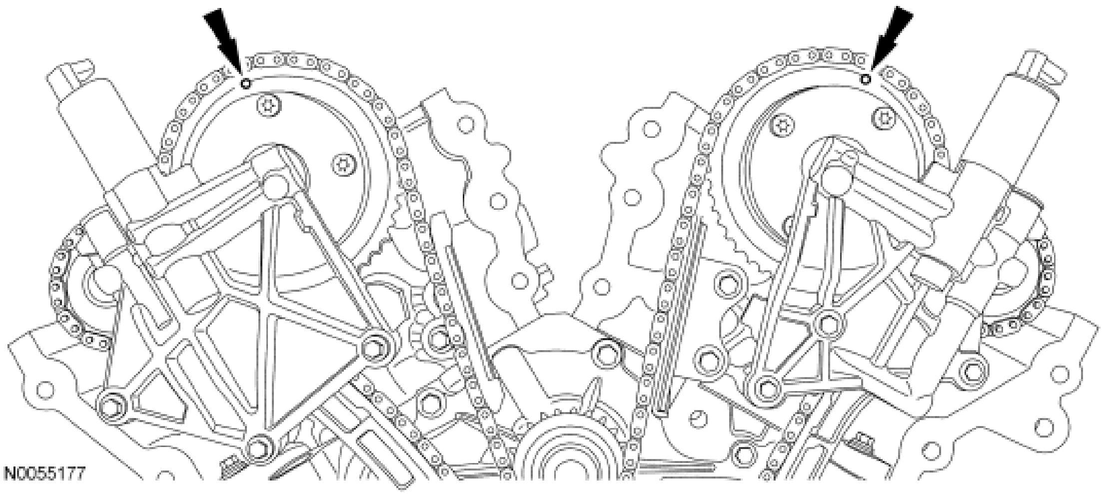


Fig. 365: Aligning Timing Marks On Variable Camshaft Timing (VCT) Assemblies
Courtesy of FORD MOTOR CO.

NOTE: The special tool will hold the camshafts in the top dead center (TDC)

position.

3. Install the special tool onto the flats of the LH camshafts.

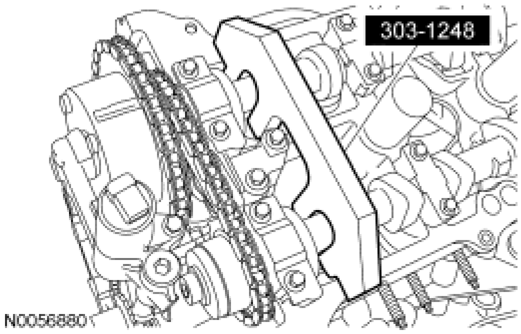


Fig. 366: Installing Special Tool (303-1248) Onto Flats Of LH Camshafts
Courtesy of FORD MOTOR CO.

NOTE: The special tool will hold the camshafts in the TDC position.

4. Install the special tool onto the flats of the RH camshafts.

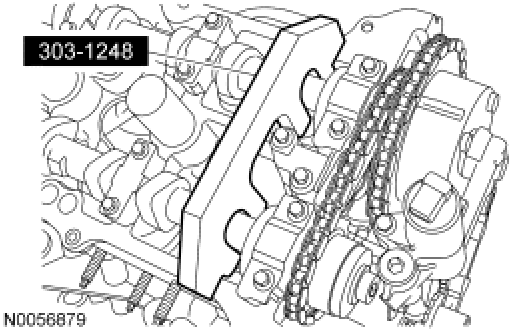


Fig. 367: Installing Special Tool (303-1248) Onto Flats Of RH Camshafts
Courtesy of FORD MOTOR CO.

5. Remove the 3 bolts and the RH VCT housing.

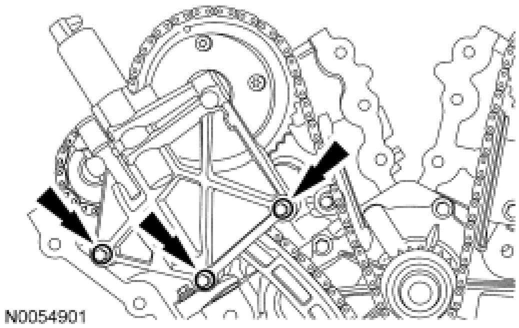


Fig. 368: Locating RH VCT Housing

Courtesy of FORD MOTOR CO.

6. Remove the 3 bolts and the LH VCT housing.

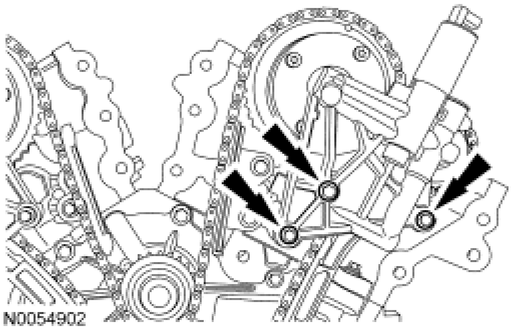


Fig. 369: Locating LH VCT Housing
Courtesy of FORD MOTOR CO.

7. Remove and discard the VCT housing seals.

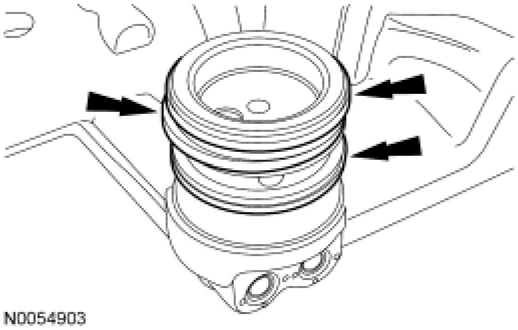


Fig. 370: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

8. Remove the 2 bolts and the primary timing chain tensioner.

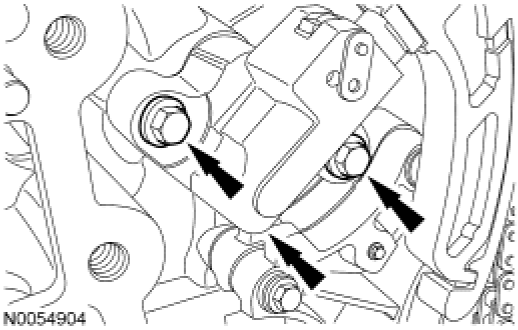


Fig. 371: Locating Primary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

9. Remove the primary timing chain tensioner arm.

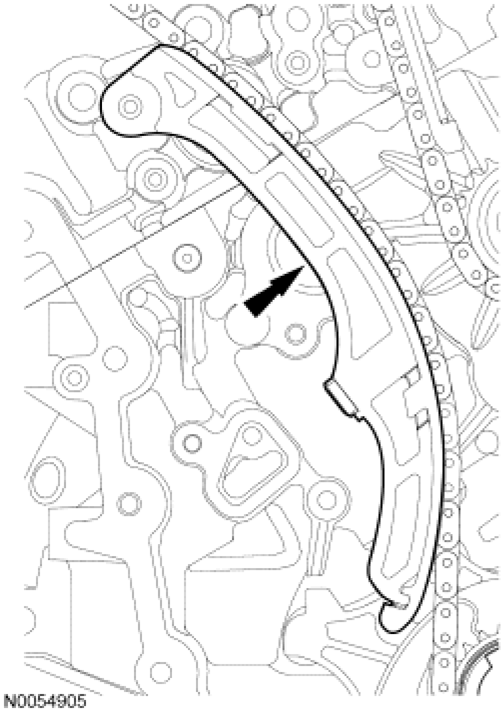


Fig. 372: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

10. Remove the 2 bolts and the lower LH primary timing chain guide.

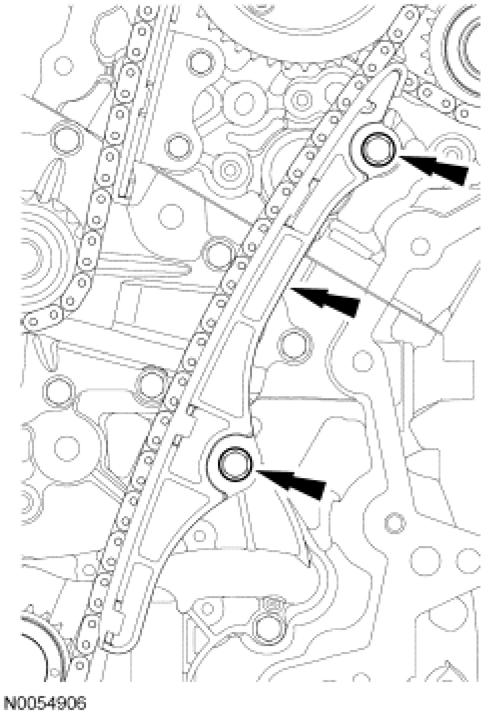


Fig. 373: Locating Lower LH Primary Timing Chain Guide Bolts

Courtesy of FORD MOTOR CO.

11. Remove the primary timing chain.

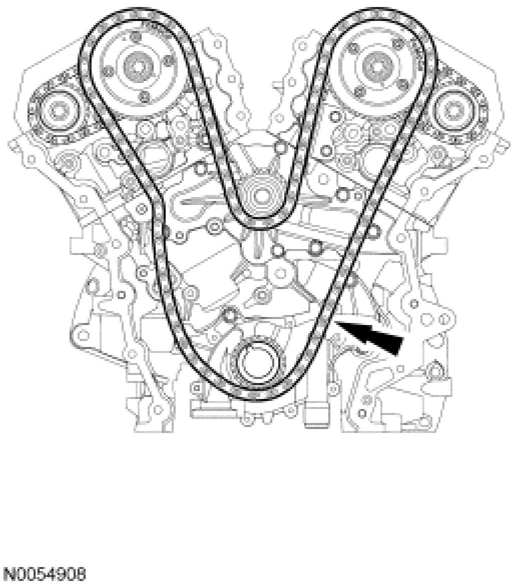


Fig. 374: Locating Primary Timing Chain
Courtesy of FORD MOTOR CO.

12. Remove the crankshaft timing chain sprocket.

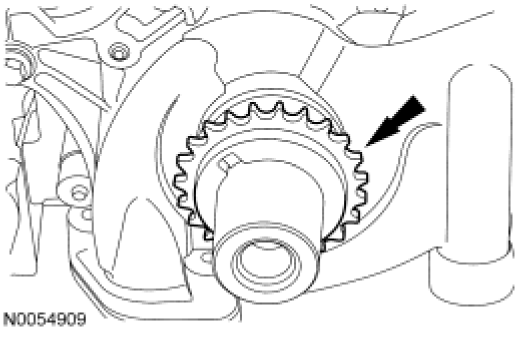


Fig. 375: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

13. Remove the 2 oil pump screen and pickup tube bolts.

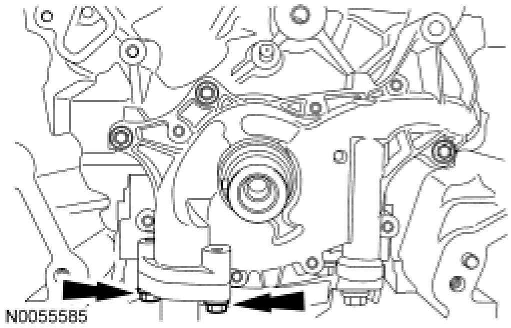


Fig. 376: Locating Oil Pump Bolts
Courtesy of FORD MOTOR CO.

14. Remove the 3 oil pump bolts.
    - Rotate the oil pump clockwise and separate the oil pump from the oil pump screen and pickup tube.
    - Remove the oil pump.
    - Discard the oil pump screen and pickup tube O-ring seal.

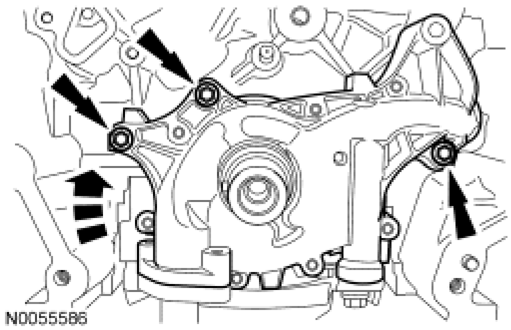
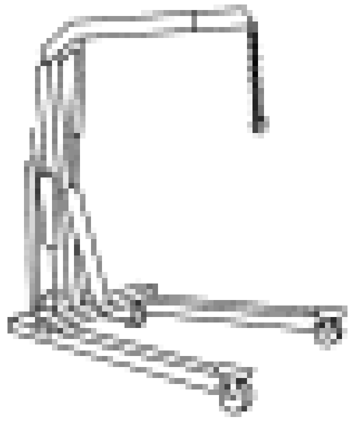
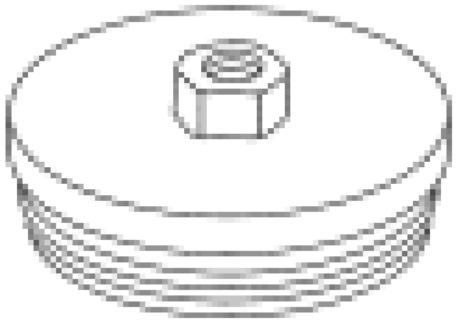
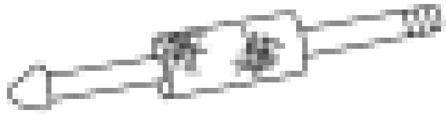


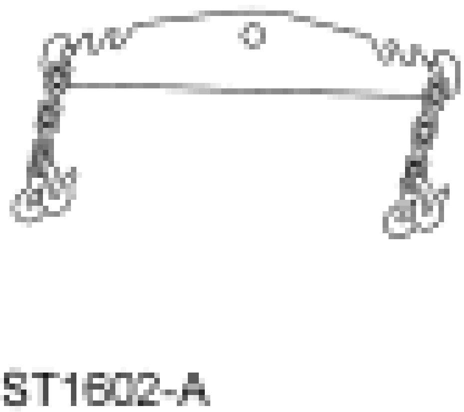
Fig. 377: Locating Oil Pump Bolts
Courtesy of FORD MOTOR CO.

CRANKSHAFT REAR SEAL WITH RETAINER PLATE

Special Tools

Illustration	Tool Name	Tool Number
	Heavy Duty Floor Crane	014-00071 or equivalent

 ST1341-A		
 ST1382-A	Remover, Crankshaft Rear Oil Seal	303-519 (T95P-6701-EH)
 ST1187-A	Slide Hammer	307-005 (T59L-100-B)
	Spreader Bar	303-D089 (D93P-6001-A3) or

		equivalent

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Silicone Gasket Remover ZC-30	-

NOTE: **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.**

NOTE: **This procedure is for removal of the crankshaft rear seal and retainer plate and requires removal of the oil pan. If only removing the crankshaft rear seal, refer to Crankshaft Rear Seal.**

1. Remove the oil pan. For additional information, refer to **Oil Pan**.
2. Using the Heavy Duty Floor Crane and Spreader Bar, remove the engine from the stand.

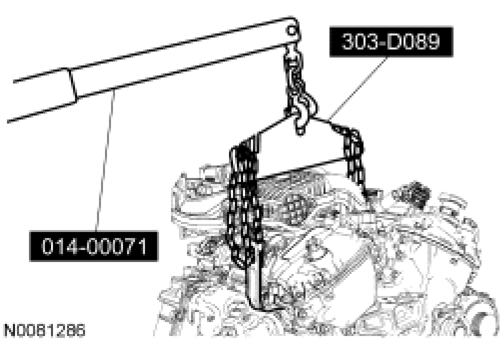


Fig. 378: Identifying Heavy Duty Floor Crane and Spreader Bar
Courtesy of FORD MOTOR CO.

3. Disconnect the Crankshaft Position (CKP) sensor electrical connector.

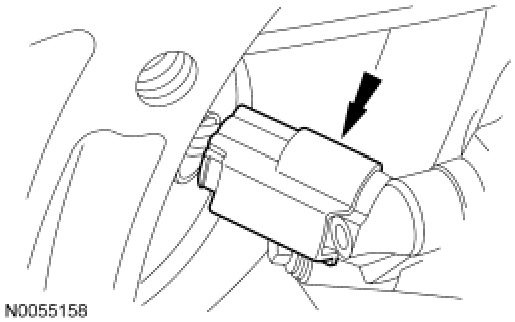


Fig. 379: Identifying Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

4. Remove the bolt and the CKP sensor.

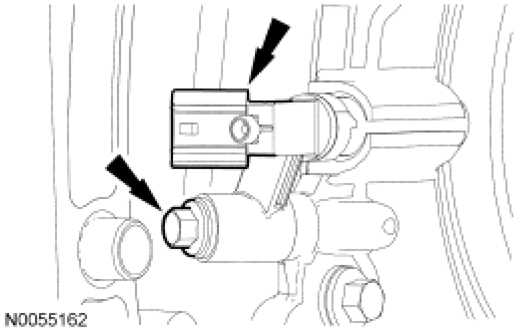


Fig. 380: Identifying CKP Sensor & Bolt
Courtesy of FORD MOTOR CO.

5. Using the Crankshaft Rear Oil Seal Remover and Slide Hammer, remove and discard the rear crankshaft seal.

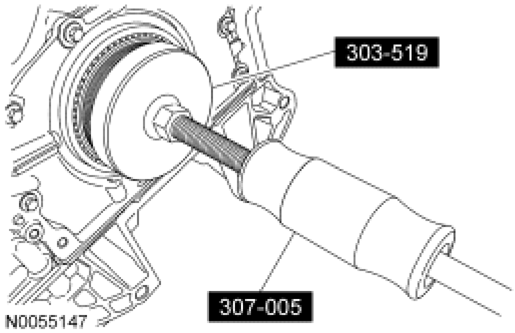


Fig. 381: Removing Crankshaft Rear Seal Using Special Tools (303-519) & (307-005)
Courtesy of FORD MOTOR CO.

6. Remove the 8 crankshaft rear seal retainer bolts.

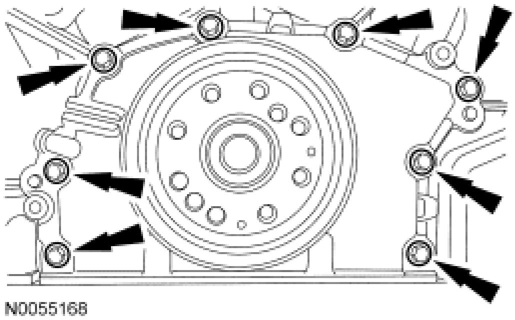


Fig. 382: Locating Crankshaft Rear Seal Retainer Bolts
Courtesy of FORD MOTOR CO.

7. Install the 2 M6 oil pan bolts (finger tight) into the 2 threaded holes in the crankshaft rear seal retainer.
   - Alternately tighten the 2 bolts one turn at a time until the crankshaft rear seal retainer-to-cylinder block seal is released.
     - Remove the crankshaft rear seal retainer.

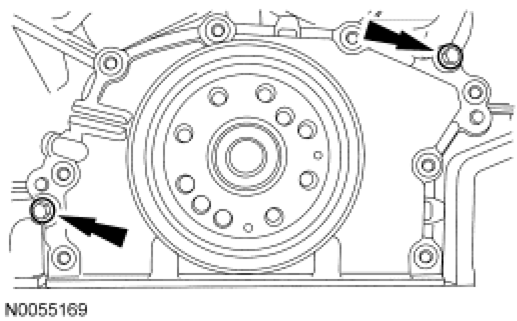


Fig. 383: Identifying M6 Oil Pan Bolts
Courtesy of FORD MOTOR CO.

NOTE: Only use a 3M Roloc® Bristle Disk, (2-in white, part number 07528) to clean the crankshaft rear seal retainer plate. Do not use metal scrapers, wire brushes or any other power abrasive disk to clean the crankshaft rear seal retainer plate. These tools cause scratches and gouges that make leak paths.

8. Clean the crankshaft rear seal retainer plate using a 3M Roloc® Bristle Disk, (2-in white, part number 07528) in a suitable tool turning at the recommended speed of 15,000 RPM.
   - Thoroughly wash the crankshaft rear seal retainer plate to remove any foreign material, including any abrasive particles created during the cleaning process.

NOTE: Place clean, lint-free shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any

foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

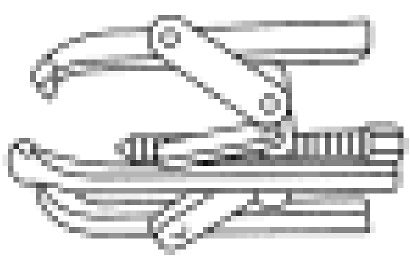
NOTE: **Do not use wire brushes, power abrasive discs or 3M Roloc® Bristle Disk (2-in white, part number 07528) to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. They also cause contamination that will cause premature engine failure. Remove all traces of the gasket.**

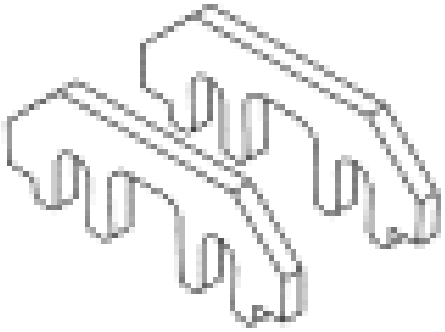
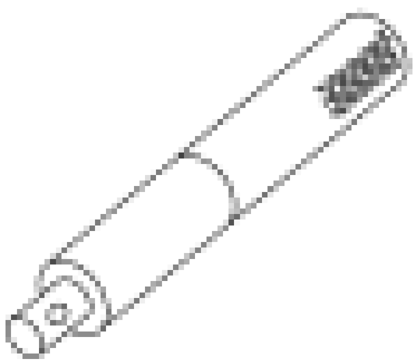
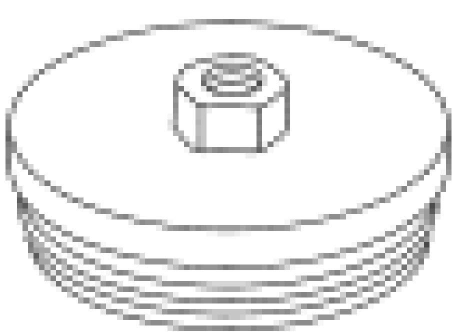
9. Clean the sealing surfaces of the cylinder block in the following sequence.
    1. Remove any large deposits of silicone or gasket material.
    2. Apply silicone gasket remover and allow to set for several minutes.
    3. Remove the silicone gasket remover. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep to remove any remaining traces of oil or coolant and to prepare the surfaces to bond. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

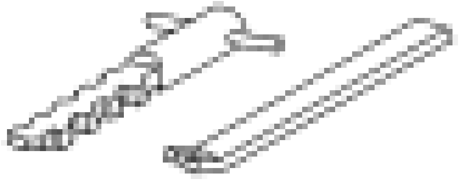
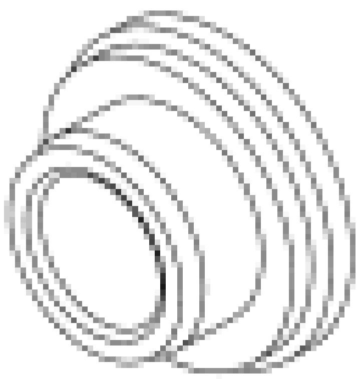
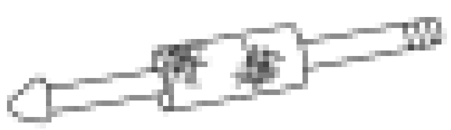
DISASSEMBLY

ENGINE

Special Tools

Illustration	Tool Name	Tool Number
 ST1184-A	3-Jaw Puller	303-D121
	Camshaft Alignment Tool	303-1248

 ST2979-A		
 ST1326-A	Handle	205-153 (T80T-4000-W)
 ST1382-A	Remover, Crankshaft Rear Oil Seal	303-519 (T95P-6701-EH)
	Remover, Oil Seal	303-409 (T92C-6700CH)

 ST1385-A		
 ST2982-A	Remover, Seal	303-1247/1
 ST1187-A	Slide Hammer	307-005 (T59L-100-B)
	Strap Wrench	303-D055 (D85L-6000-A)

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31-A	-
Silicone Gasket Remover ZC-30	-

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

NOTE: For additional information, refer to the exploded view under the Assembly procedure.

All vehicles

1. Remove the 8 bolts and the flexplate.

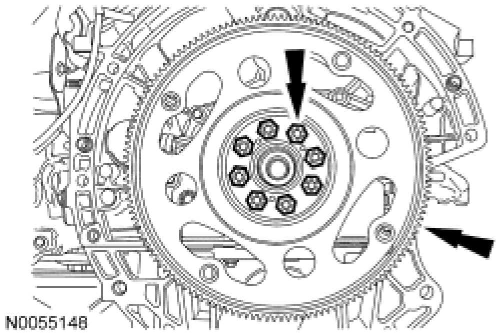


Fig. 384: Identifying Flexplate & Bolts

Courtesy of FORD MOTOR CO.

2. Remove the crankshaft sensor ring.

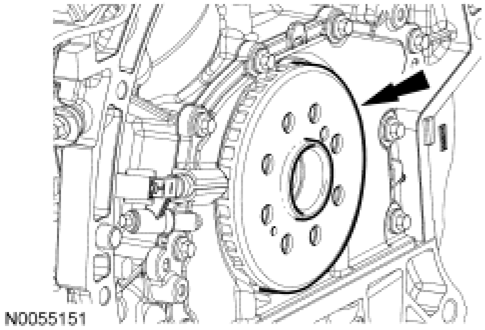


Fig. 385: Identifying Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

3. Using the special tools, remove and discard the rear crankshaft seal.

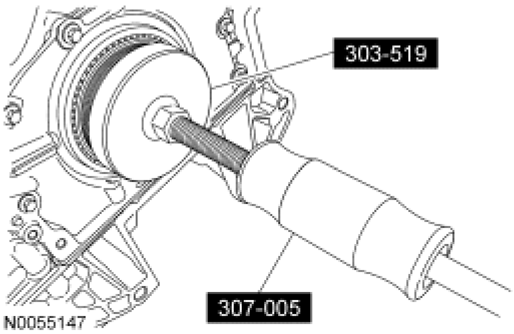
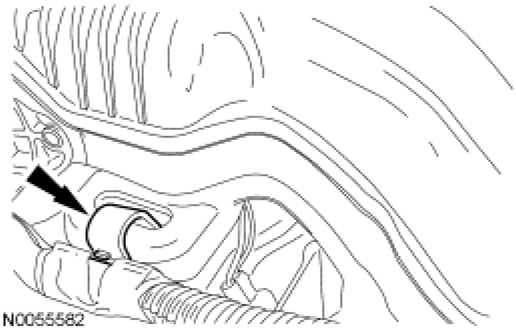


Fig. 386: Removing Crankshaft Rear Seal Using Special Tools (303-519) & (307-005)
Courtesy of FORD MOTOR CO.

NOTE: **Install the engine stand bolts into the cylinder block only. Do not install the bolts into the oil pan.**

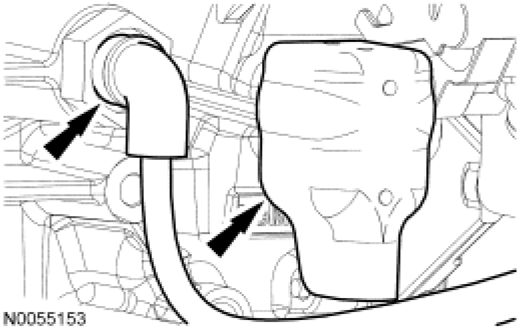
4. Mount the engine on a suitable engine stand.
5. If equipped, detach the block heater wiring harness retainer from the upper intake manifold.



N0055582

Fig. 387: Identifying Block Heater Wiring Harness Retainer From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

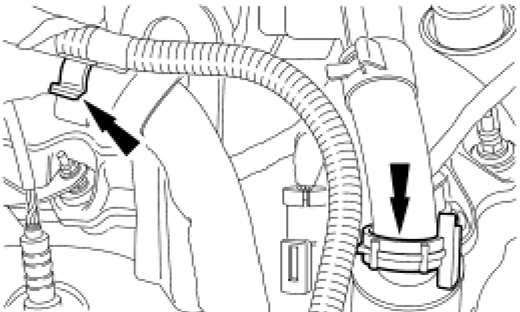
6. If equipped, remove the heat shield and disconnect the block heater electrical connector.



N0055153

Fig. 388: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

7. If equipped, detach the block heater wiring harness retainer from the power steering reservoir hose and the power steering pressure (PSP) hose.
   - Remove the block heater wiring harness from the engine.



N0063678

Fig. 389: Identifying Block Heater Wiring Harness From Engine
Courtesy of FORD MOTOR CO.

8. If equipped, disconnect the heated PCV electrical connector.

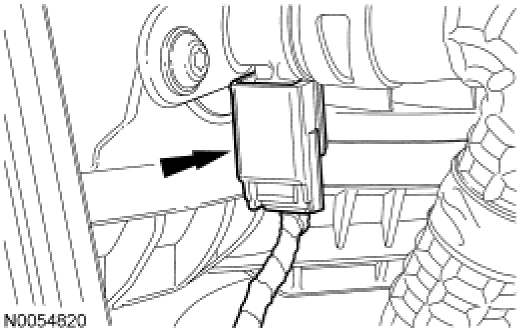


Fig. 390: Identifying Positive Crankcase Ventilation (PCV) Fitting Electrical Connector
Courtesy of FORD MOTOR CO.

9. Disconnect the PCV hose from the PCV valve.

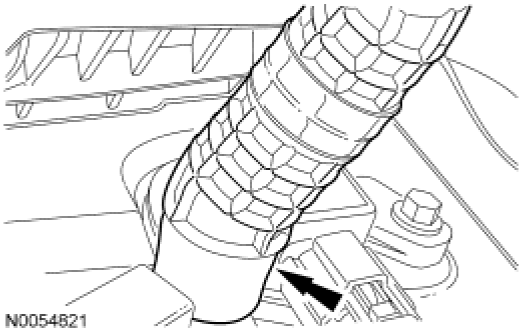


Fig. 391: Identifying PCV Hose From PCV Valve
Courtesy of FORD MOTOR CO.

10. Disconnect the throttle body (TB) electrical connector.

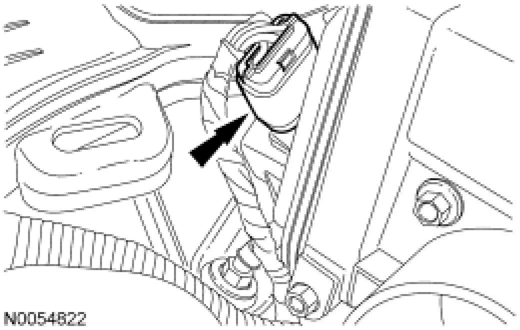


Fig. 392: Locating Throttle Body Electrical Connector
Courtesy of FORD MOTOR CO.

11. Detach the wiring harness retainers from the upper intake manifold.

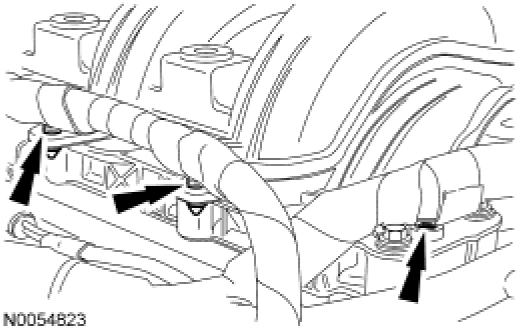


Fig. 393: Locating Wiring Harness Retainers From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

12. If equipped, remove the upper intake manifold long support bracket bolt.

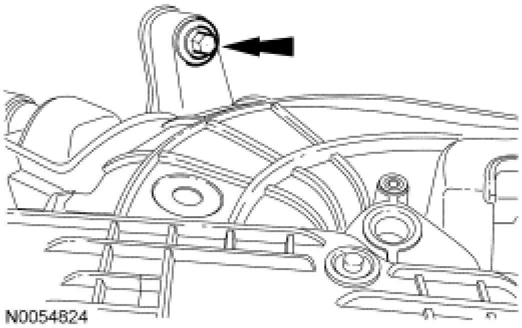


Fig. 394: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

13. Remove the upper intake manifold short support bracket bolt.

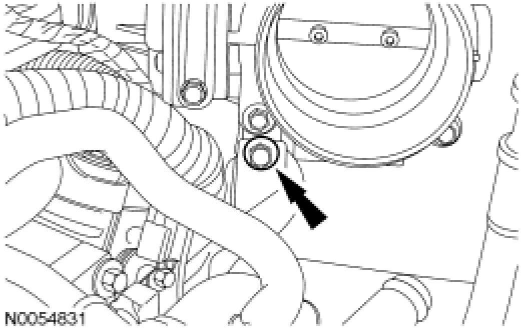


Fig. 395: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

14. Remove the 6 bolts and the upper intake manifold.
    - Discard the gaskets.

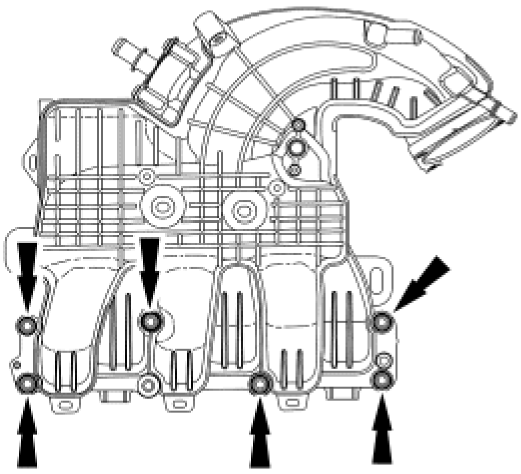


Fig. 396: Identifying Upper Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

15. Disconnect the PSP switch electrical connector.

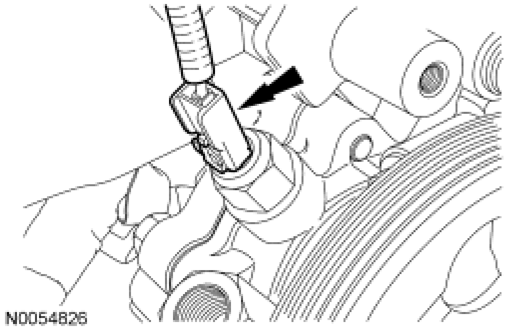


Fig. 397: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

16. Disconnect the RH catalyst monitor sensor electrical connector.

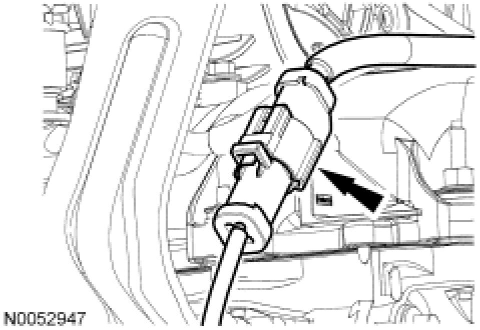


Fig. 398: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

17. Disconnect the RH heated oxygen sensor (HO2S) electrical connector.

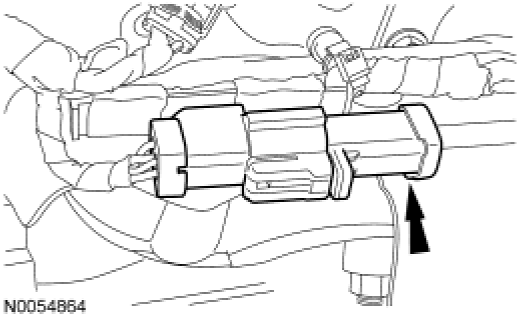


Fig. 399: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

18. Disconnect the RH variable camshaft timing (VCT) solenoid electrical connector.

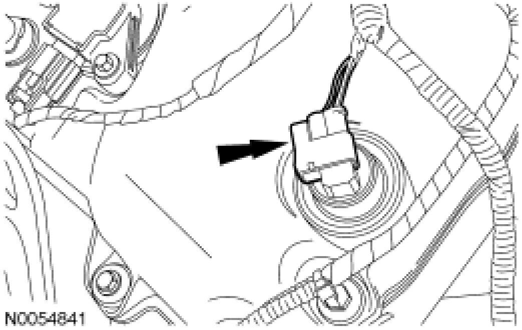


Fig. 400: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

19. Disconnect the 3 RH coil-on-plug electrical connectors.

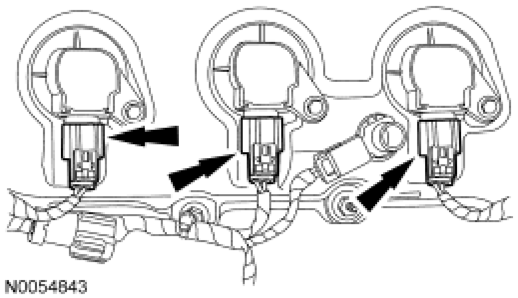


Fig. 401: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

20. If equipped, disconnect the heated PCV valve electrical connector.

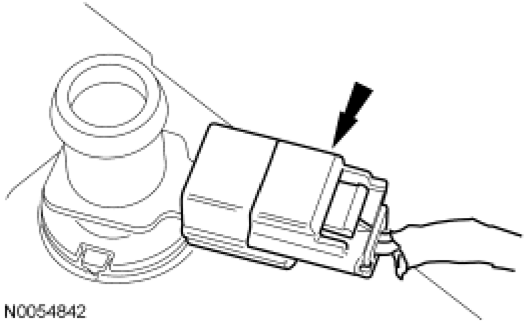


Fig. 402: Locating Heated PCV Valve Electrical Connector
Courtesy of FORD MOTOR CO.

21. Detach all of the wiring harness retainers from the RH valve cover and stud bolts.
22. Disconnect the coolant bypass hose from the thermostat housing.

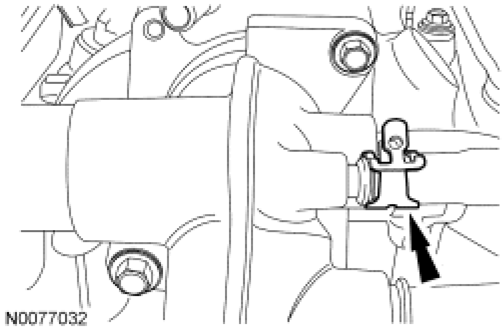


Fig. 403: Identifying Coolant Bypass Hose From Thermostat Housing
Courtesy of FORD MOTOR CO.

23. Disconnect the RH camshaft position (CMP) sensor electrical connector.

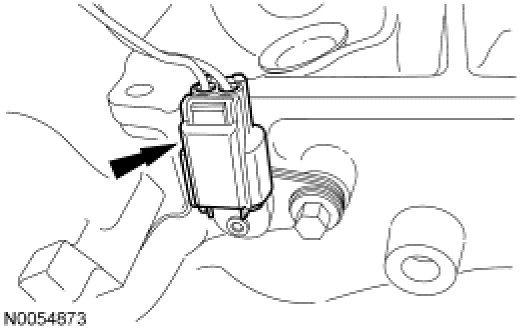


Fig. 404: Locating RH Camshaft Position (CMP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

24. Disconnect the knock sensor (KS) electrical connector.

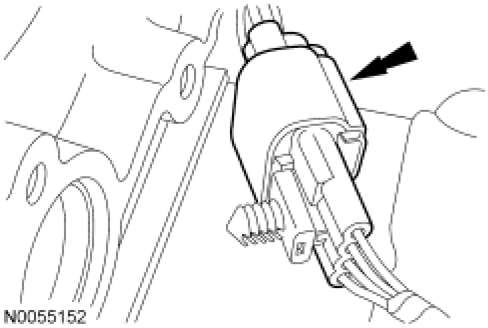


Fig. 405: Locating Knock Sensor (KS) Electrical Connector
Courtesy of FORD MOTOR CO.

25. Disconnect the 6 fuel injector electrical connectors (3 shown).

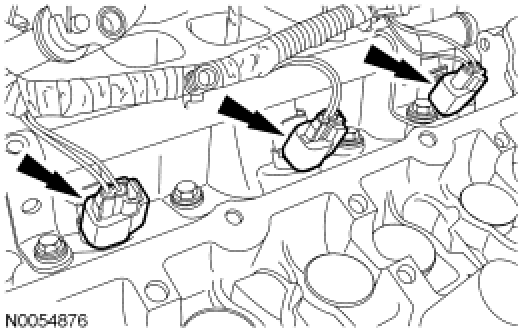


Fig. 406: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

26. Disconnect the cylinder head temperature (CHT) sensor electrical connector.

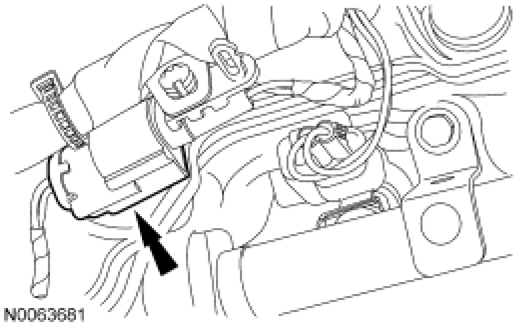


Fig. 407: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

27. Disconnect the LH CMP sensor electrical connector.

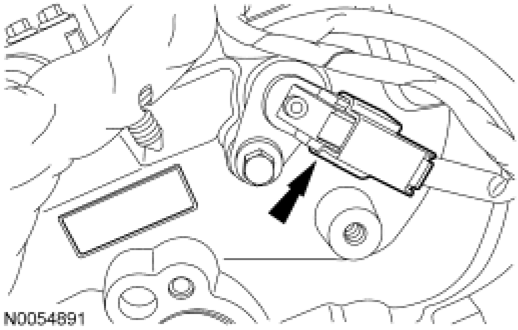


Fig. 408: Locating LH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

28. Disconnect the LH catalyst monitor sensor electrical connector.

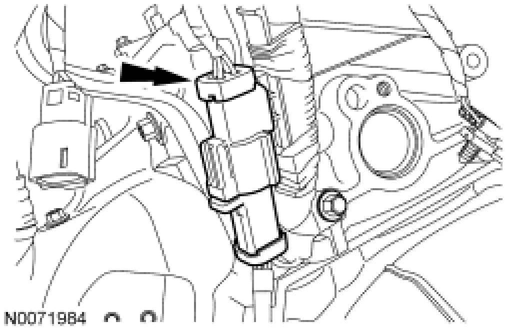


Fig. 409: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

29. Disconnect the LH HO2S electrical connector.

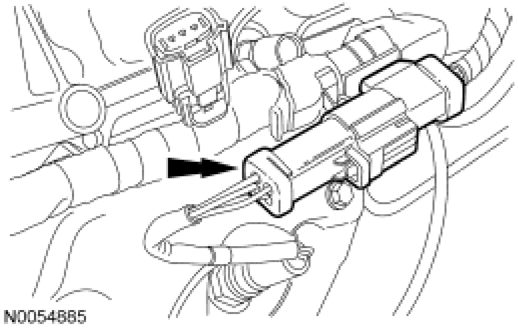


Fig. 410: Locating LH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

30. Disconnect the 3 LH coil-on-plug electrical connectors.

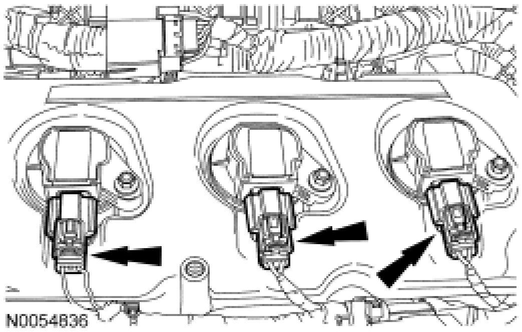


Fig. 411: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

31. Disconnect the LH VCT solenoid electrical connector.

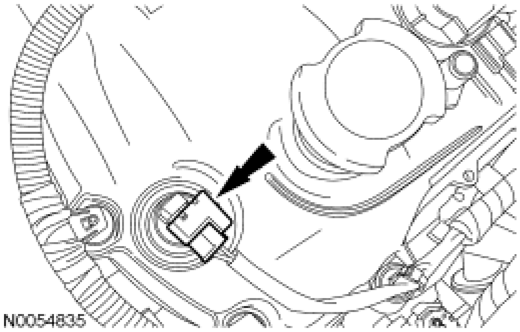


Fig. 412: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

32. Detach all of the wiring harness retainers from the LH valve cover and stud bolts.
33. Remove the wiring harness retainer bolt from the rear of the LH cylinder head.

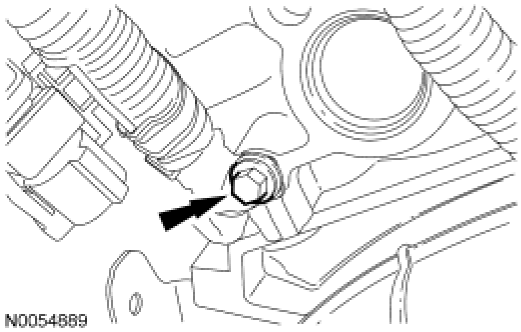


Fig. 413: Identifying Wiring Harness Retainer Bolt From Rear Of LH Cylinder Head
Courtesy of FORD MOTOR CO.

34. Remove the nut, the bolt and the heat shield.

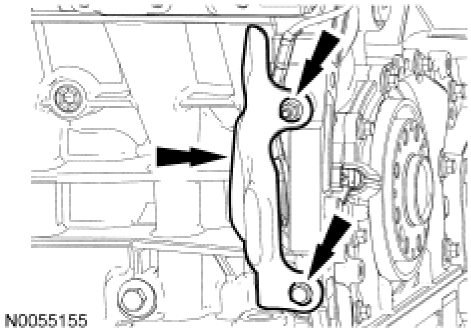


Fig. 414: Identifying Heat Shield, Nut & Bolt
Courtesy of FORD MOTOR CO.

35. Remove the wiring harness retainer stud bolt.

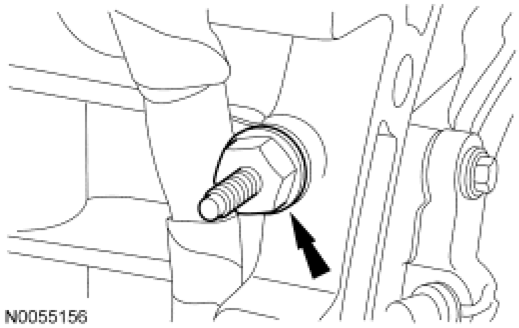


Fig. 415: Identifying Wiring Harness Retainer Stud Bolt
Courtesy of FORD MOTOR CO.

36. Remove the wiring harness grommet.

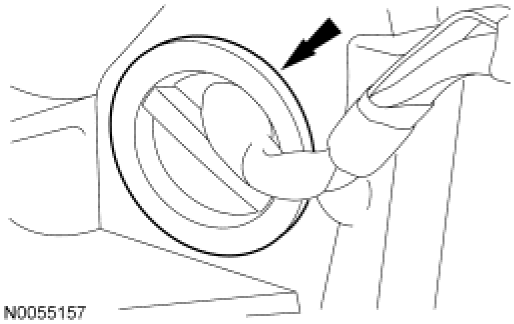


Fig. 416: Identifying Wiring Harness Grommet
Courtesy of FORD MOTOR CO.

37. Disconnect the crankshaft position (CKP) sensor electrical connector.

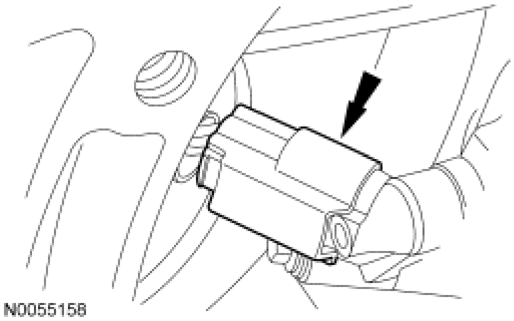


Fig. 417: Identifying Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

38. Disconnect the A/C compressor electrical connector.

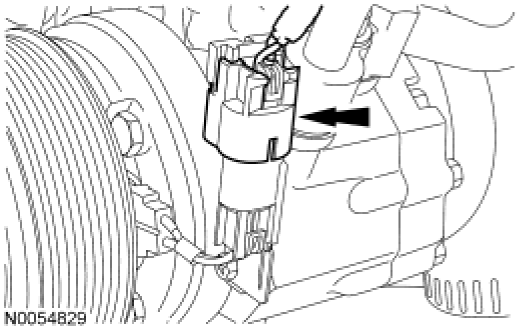


Fig. 418: Identifying A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

39. Remove the nut and disconnect the generator B+ cable.

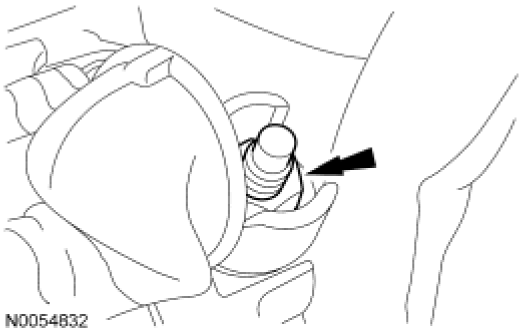


Fig. 419: Identifying Generator B+ Cable & Nut
Courtesy of FORD MOTOR CO.

40. Disconnect the generator electrical connector.

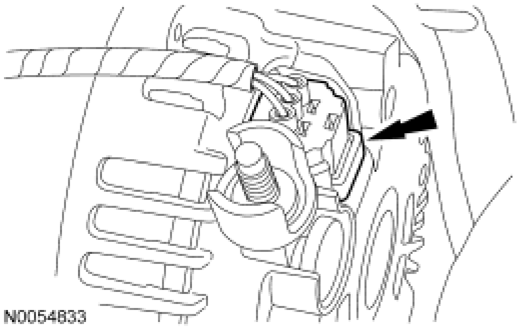


Fig. 420: Identifying Generator Electrical Connector
Courtesy of FORD MOTOR CO.

41. Detach the wiring harness retainer from the generator.

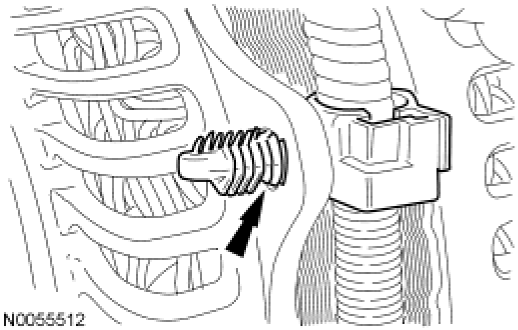


Fig. 421: Identifying Wiring Harness Retainer From Generator
Courtesy of FORD MOTOR CO.

42. Disconnect the engine oil pressure (EOP) switch electrical connector and the wiring harness pin-type retainer.
    - Remove the wiring harness from the engine.

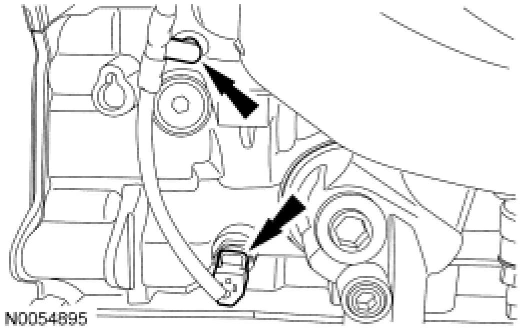


Fig. 422: Locating Engine Oil Pressure (EOP) Switch Electrical Connector & Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

43. Remove the bolt and the A/C manifold.
    - Discard the O-ring seals.

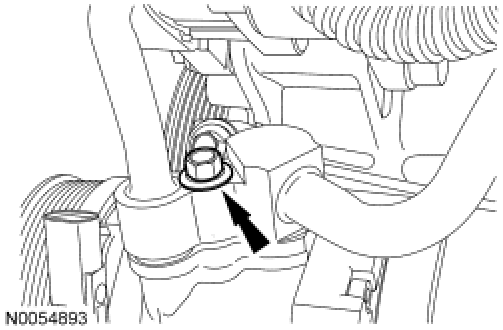


Fig. 423: Locating A/C Manifold Bolt
Courtesy of FORD MOTOR CO.

44. Remove the nut, 2 bolts and the A/C compressor.

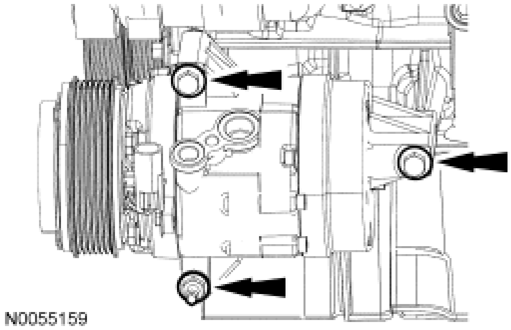


Fig. 424: Identifying A/C Compressor Nut & Bolts
Courtesy of FORD MOTOR CO.

45. Remove the A/C compressor mounting stud from the oil pan.

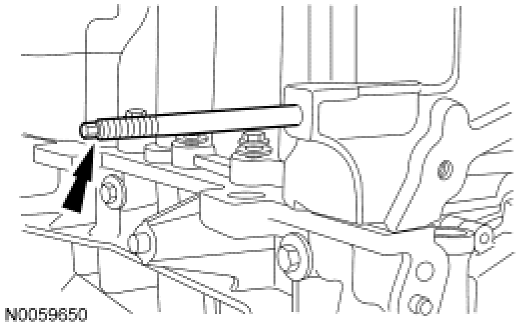


Fig. 425: Locating A/C Compressor Mounting Stud
Courtesy of FORD MOTOR CO.

46. Remove the bolt, nut and the generator.

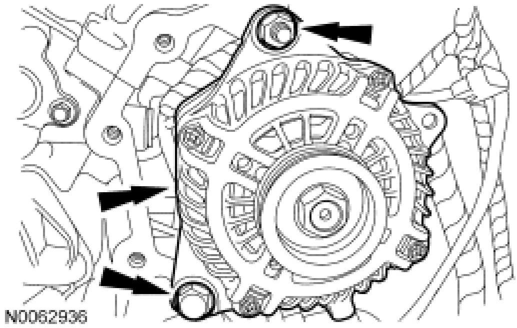


Fig. 426: Locating Generator, Bolts & Nuts
Courtesy of FORD MOTOR CO.

47. Detach the PSP hose retainer from the engine lifting eye.

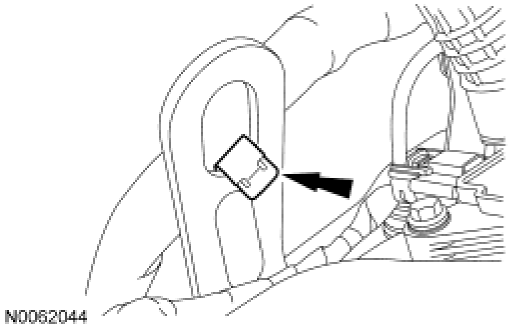


Fig. 427: Locating PSP Hose Retainer From Engine Lifting Eye
Courtesy of FORD MOTOR CO.

48. Remove the PSP hose bracket nut.

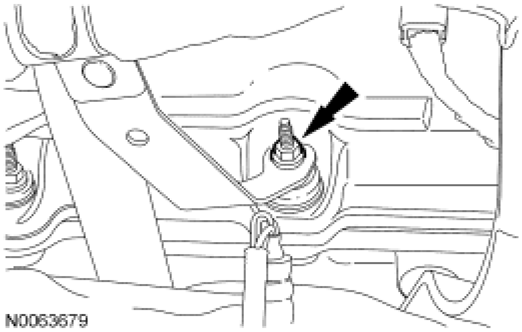


Fig. 428: Identifying PSP Hose Bracket Nut
Courtesy of FORD MOTOR CO.

49. Remove the PSP tube bracket bolt from the RH cylinder head.

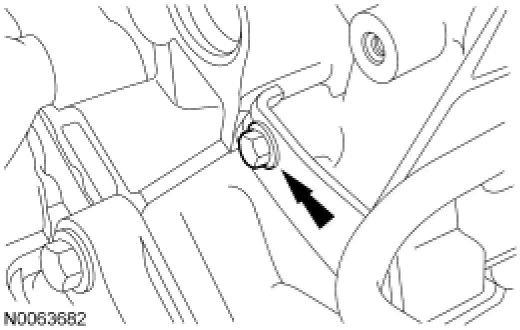


Fig. 429: Identifying Power Steering Pressure (PSP) Tube & Bracket Assembly
Courtesy of FORD MOTOR CO.

50. Remove the 3 bolts and the power steering pump.

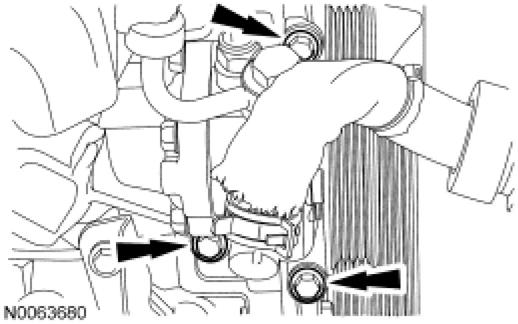


Fig. 430: Locating Power Steering Pump Bolts
Courtesy of FORD MOTOR CO.

51. Remove the 3 bolts and the accessory drive belt tensioner.

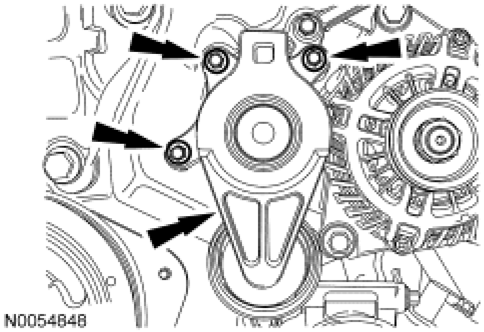


Fig. 431: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

52. Remove the 4 nuts (3 shown) and the LH catalytic converter.
    - Discard the nuts and the gasket.

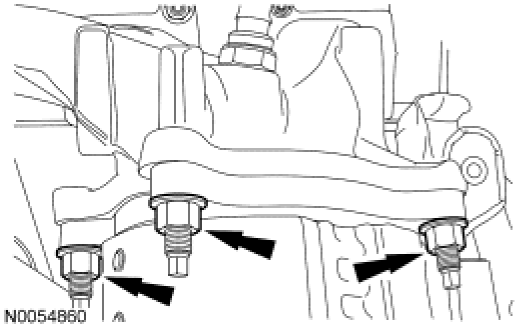


Fig. 432: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

53. Remove the 3 bolts and the LH exhaust manifold heat shield.

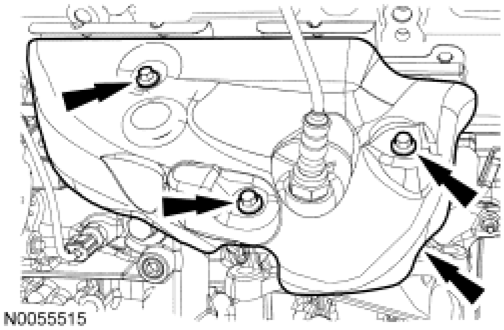


Fig. 433: Locating LH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

54. Remove the 6 nuts and the LH exhaust manifold.
    - Discard the nuts and the exhaust manifold gasket.

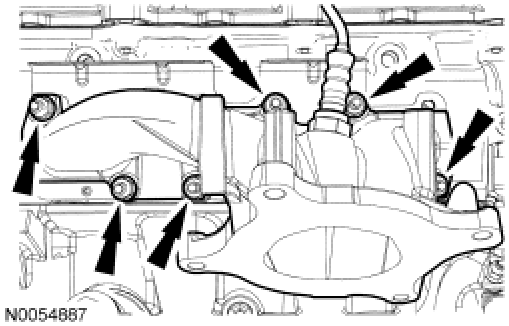


Fig. 434: Locating LH Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

55. Clean and inspect the LH exhaust manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
56. Remove and discard the 6 LH exhaust manifold studs.

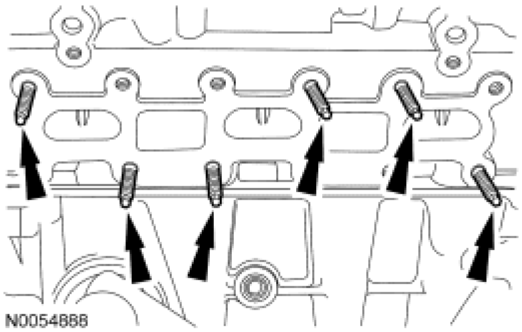


Fig. 435: Locating LH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

FWD vehicles

57. Remove the 4 nuts and the RH catalytic converter.
    - Discard the nuts and the gasket.

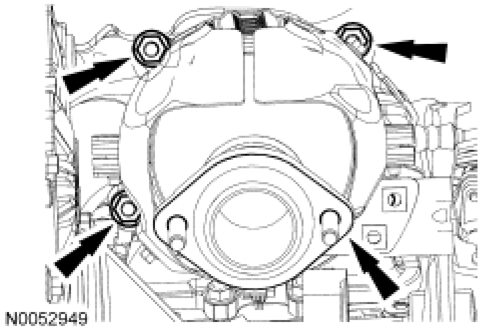


Fig. 436: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

All vehicles

58. Remove the 3 bolts and the RH exhaust manifold heat shield.

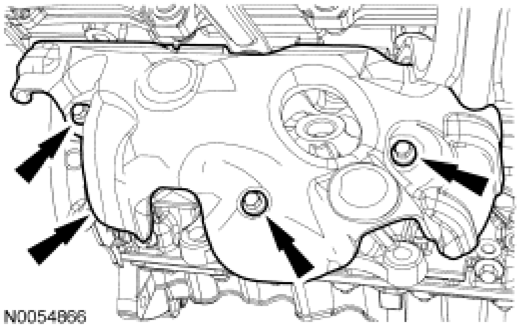


Fig. 437: Locating RH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

59. Remove the 6 nuts and the RH exhaust manifold.
    - Discard the nuts and the exhaust manifold gasket.

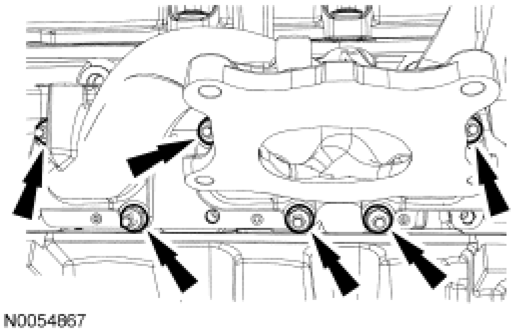


Fig. 438: Locating RH Exhaust Manifold & Nuts
Courtesy of FORD MOTOR CO.

60. Clean and inspect the RH exhaust manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
61. Remove and discard the 6 RH exhaust manifold studs.

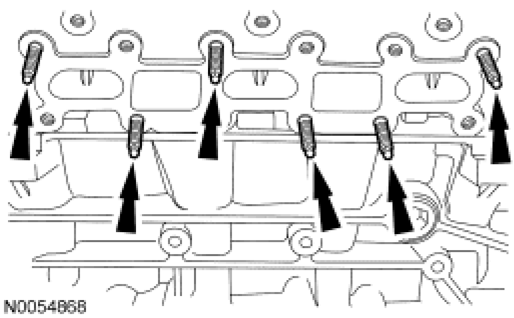


Fig. 439: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

62. Remove the RH cylinder block drain plug or, if equipped, the block heater.
    - Allow coolant to drain from the cylinder block.

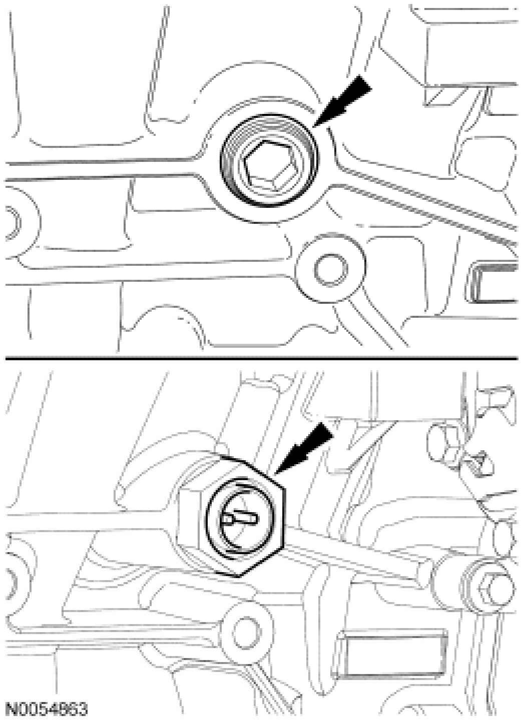


Fig. 440: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

63. Remove the LH cylinder block drain plug.
    - Allow coolant to drain from the cylinder block.

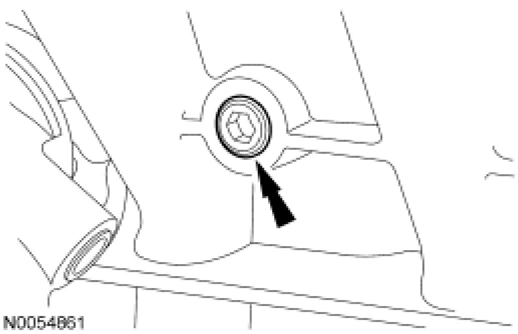


Fig. 441: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

64. Remove the pin-type retainer and the cover.

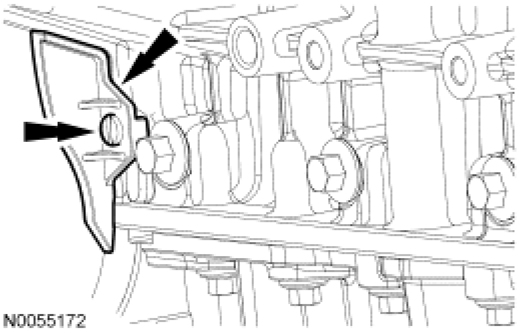


Fig. 442: Locating Pin-Type Retainer & Cover
Courtesy of FORD MOTOR CO.

65. Remove the 2 bolts and the engine lifting eye.

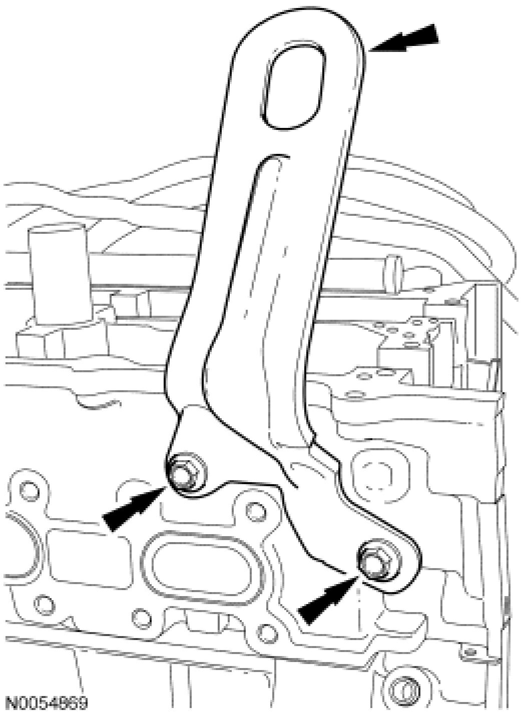


Fig. 443: Locating Engine Lifting Eye & Bolts
Courtesy of FORD MOTOR CO.

66. If equipped, remove the bolt and the upper intake manifold long support bracket.

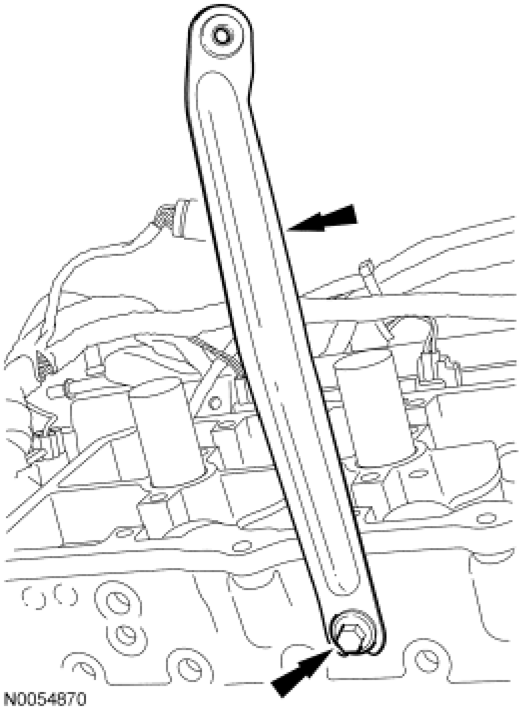


Fig. 444: Locating Upper Intake Manifold Bracket & Bolt
Courtesy of FORD MOTOR CO.

67. Remove the bolt and the upper intake manifold short support bracket.

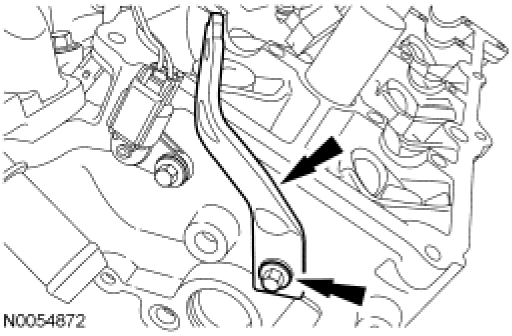


Fig. 445: Locating Upper Intake Manifold Bracket & Bolt
Courtesy of FORD MOTOR CO.

68. Remove the bolt and the RH CMP sensor.

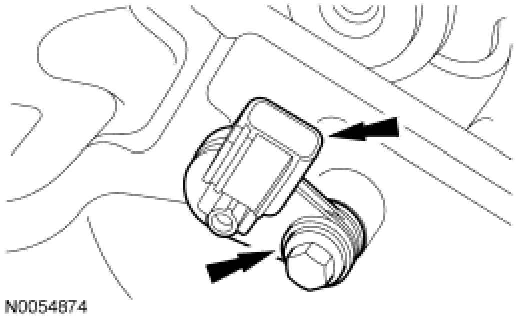


Fig. 446: Locating RH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

69. Remove the 2 bolts and the catalytic converter bracket.

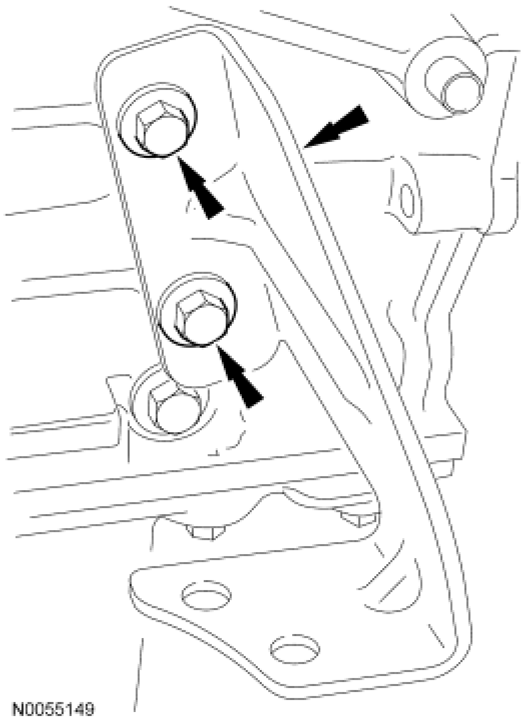


Fig. 447: Locating Catalytic Converter Bracket & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

70. Remove the 4 bolts and the fuel rail and injectors as an assembly.

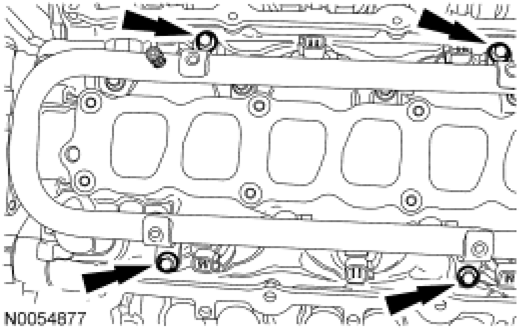


Fig. 448: Locating Fuel Rail And Injectors & Bolts
Courtesy of FORD MOTOR CO.

71. Remove the 2 thermostat housing-to-lower intake manifold bolts.
    - Remove the thermostat housing and discard the gasket.

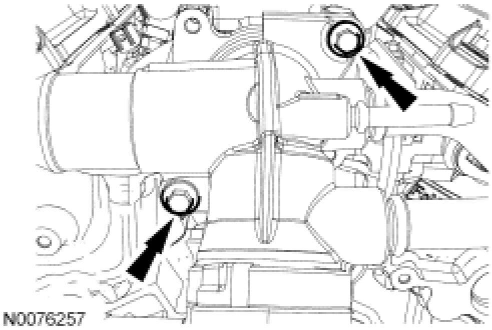


Fig. 449: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

72. Remove the 10 bolts and the lower intake manifold.
    - Discard the gaskets.

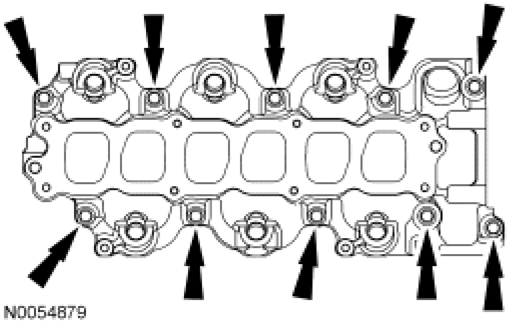


Fig. 450: Locating Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

73. Disconnect and remove the CHT sensor jumper harness.

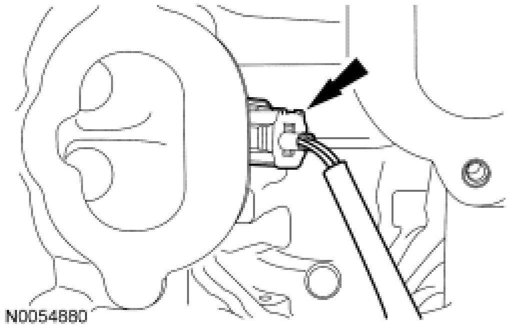


Fig. 451: Identifying CHT Sensor Jumper Harness
Courtesy of FORD MOTOR CO.

74. Remove the bolt and the LH CMP sensor.

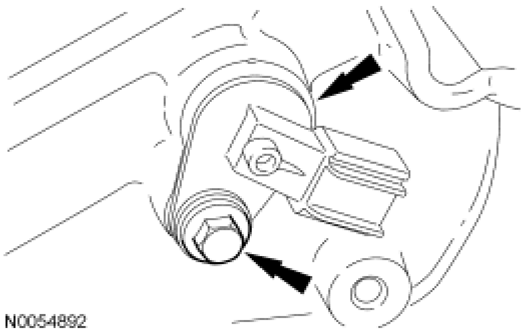


Fig. 452: Locating LH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

75. Remove the bolt and the CKP sensor.

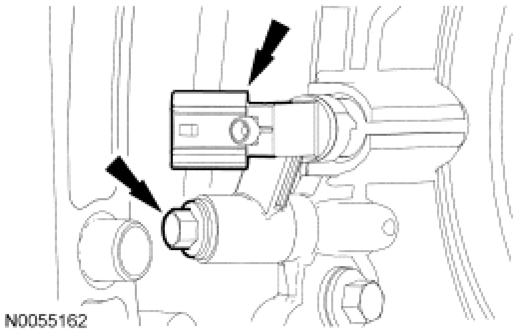


Fig. 453: Identifying CKP Sensor & Bolt
Courtesy of FORD MOTOR CO.

76. Remove the EOP switch.

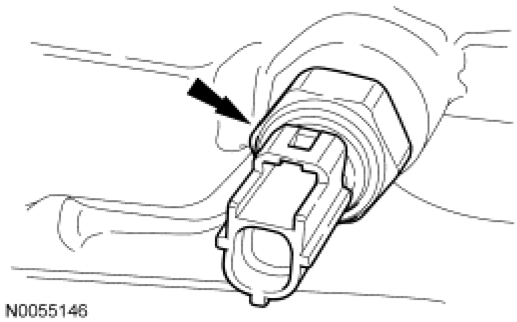


Fig. 454: Identifying EOP Switch
Courtesy of FORD MOTOR CO.

77. Remove the 2 bolts and the oil filter adapter.
    - Discard the gasket and the O-ring seal.

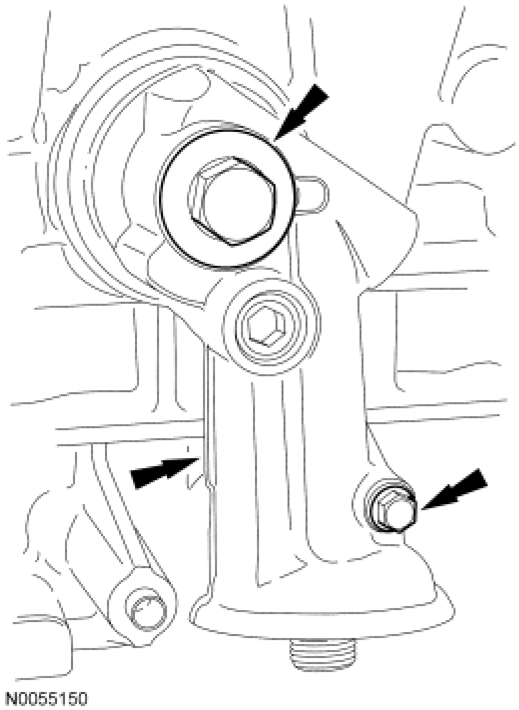


Fig. 455: Locating Oil Filter Adapter & Bolts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

78. Remove the 6 bolts and the 6 coil-on-plugs.

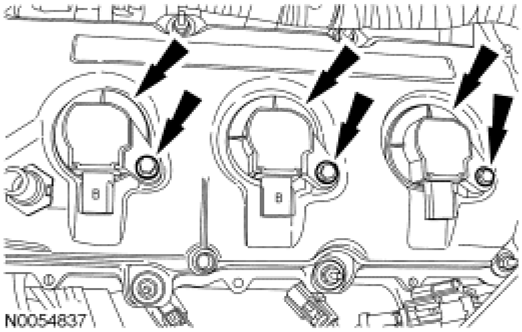


Fig. 456: Locating Coil-On-Plugs & Bolts
Courtesy of FORD MOTOR CO.

79. Remove the 2 nuts and the wiring harness retaining bracket.

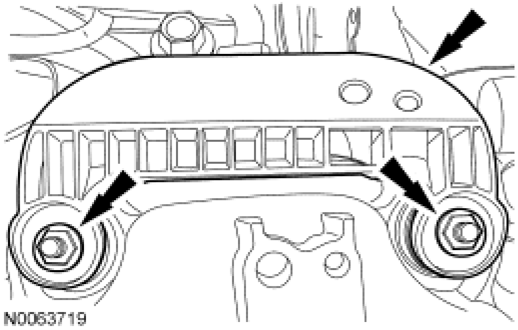


Fig. 457: Identifying Wiring Harness Retaining Bracket & Nuts
Courtesy of FORD MOTOR CO.

80. Remove the 11 stud bolts and the LH valve cover.
    - Discard the gasket.

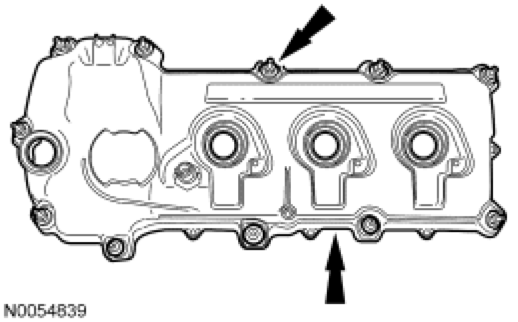


Fig. 458: Locating LH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

81. Remove the bolt, the 10 stud bolts and the RH valve cover.
    - Discard the gasket.

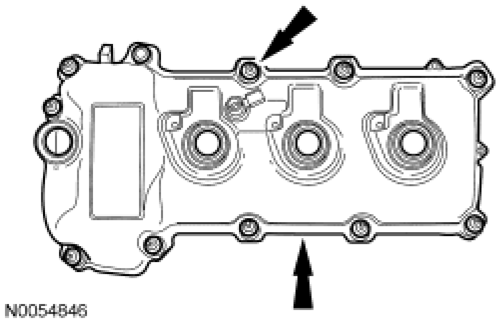


Fig. 459: Locating RH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

NOTE: VCT solenoid seal removal shown, spark plug tube seal removal similar.

82. Inspect the VCT solenoid seals and the spark plug tube seals. Remove any damaged seals.
    - Using the special tools, remove the seal(s).

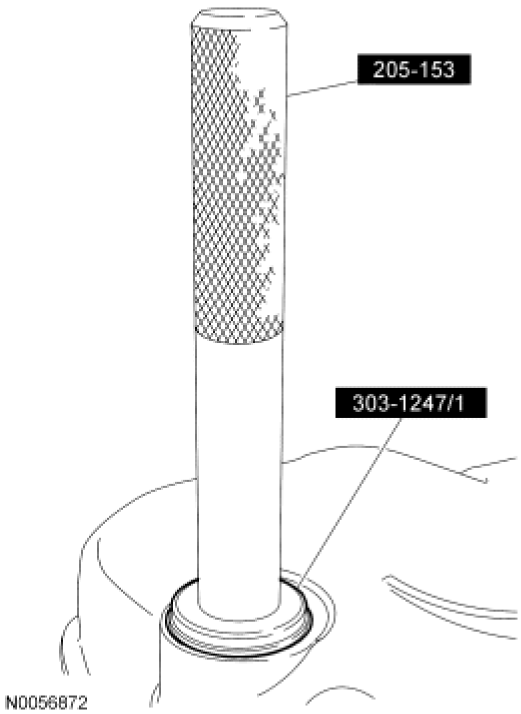
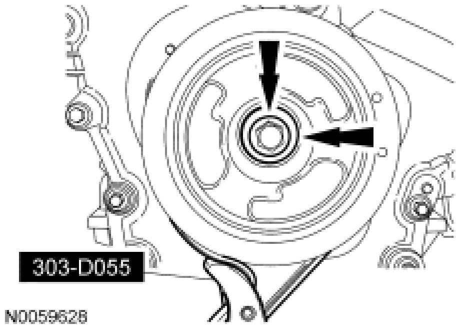


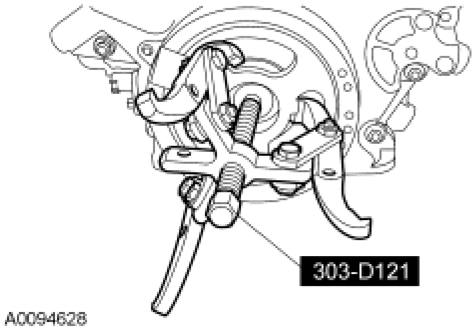
Fig. 460: Removing Seals Using Special Tools (205-153) & (303-1247/1)
Courtesy of FORD MOTOR CO.

83. Remove the crankshaft bolt and washer.
    - Discard the bolt.



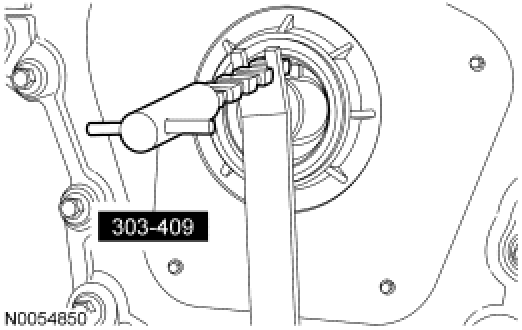
<u>Fig. 461: Removing Crankshaft Bolt & Washer Using Special Tool (303-D055)</u>
Courtesy of FORD MOTOR CO.

84. Using the special tool, remove the crankshaft pulley.



<u>Fig. 462: Identifying Special Tools (303-D121) And Crankshaft Pulley</u>
Courtesy of FORD MOTOR CO.

85. Using the special tool, remove and discard the crankshaft front seal.



<u>Fig. 463: Removing Crankshaft Front Seal Using Special Tool (303-409)</u>
Courtesy of FORD MOTOR CO.

86. Remove the 2 bolts and the engine mount bracket.

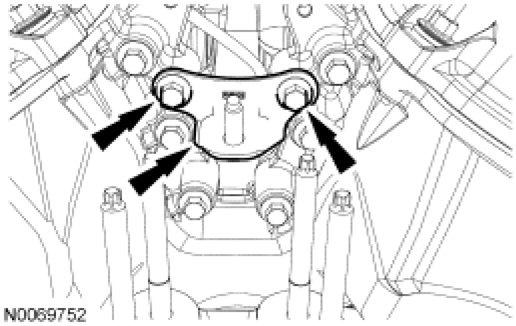


Fig. 464: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

87. Remove the 2 engine mount studs.

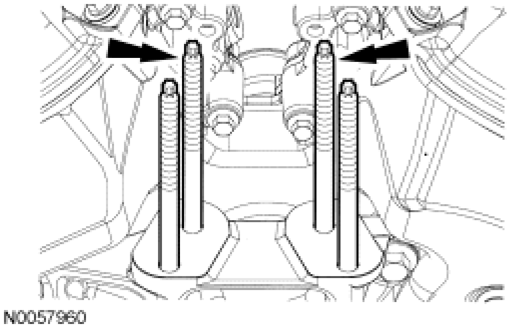


Fig. 465: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

88. Remove the 3 bolts and the engine mount bracket.

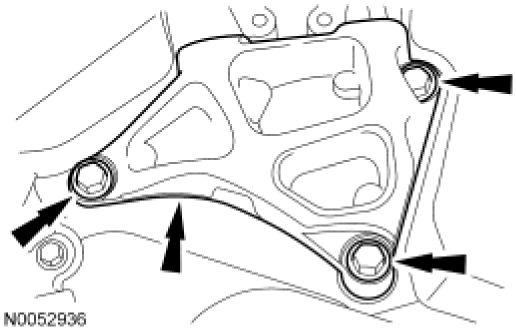


Fig. 466: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

89. Remove the 22 engine front cover bolts.

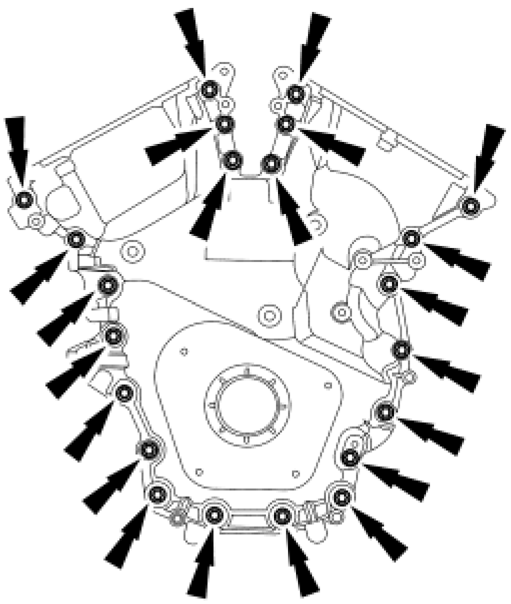


Fig. 467: Identifying Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

90. Install 6 of the engine front cover bolts (finger tight) into the 6 threaded holes in the engine front cover in the following sequence.
    1. Tighten the bolts one turn at a time in a criss-cross pattern until the engine front cover-to-cylinder block seal is released.
    2. Remove the engine front cover.

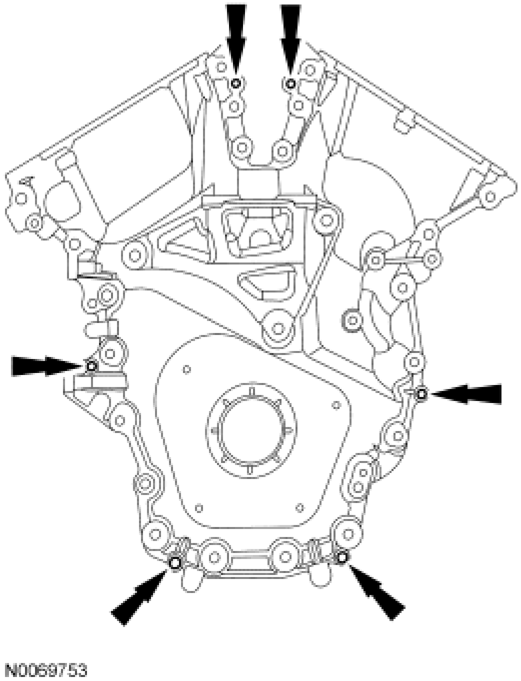


Fig. 468: Identifying Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

91. Rotate the crankshaft clockwise and align the timing marks on the VCT assemblies as shown.

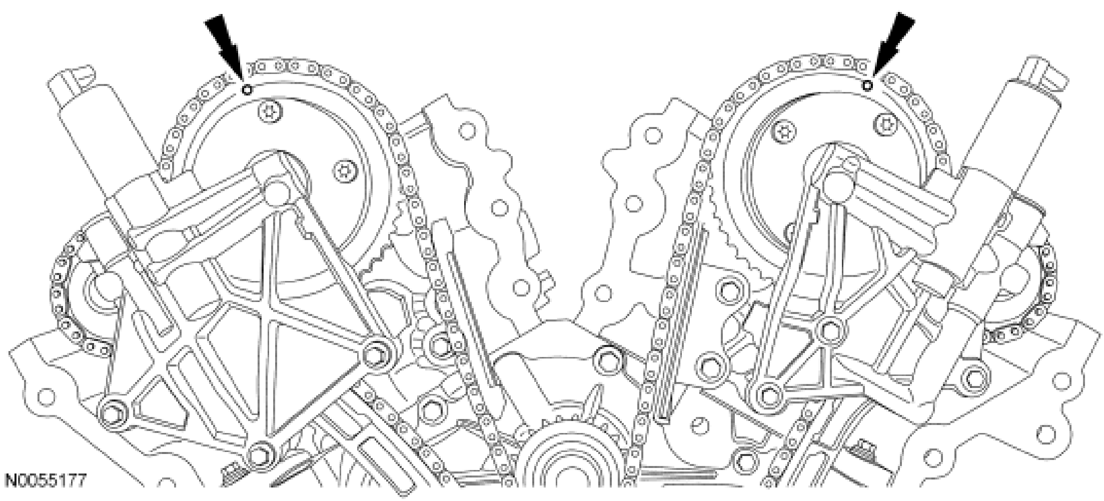


Fig. 469: Aligning Timing Marks On Variable Camshaft Timing (VCT) Assemblies
Courtesy of FORD MOTOR CO.

NOTE: The special tool will hold the camshafts in the top dead center (TDC) position.

92. Install the special tool onto the flats of the LH camshafts.

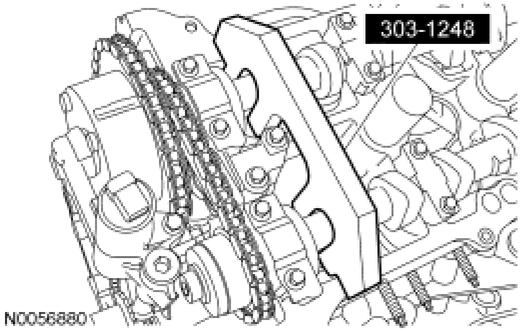


Fig. 470: Installing Special Tool (303-1248) Onto Flats Of LH Camshafts
Courtesy of FORD MOTOR CO.

NOTE: The special tool will hold the camshafts in the TDC position.

93. Install the special tool onto the flats of the RH camshafts.

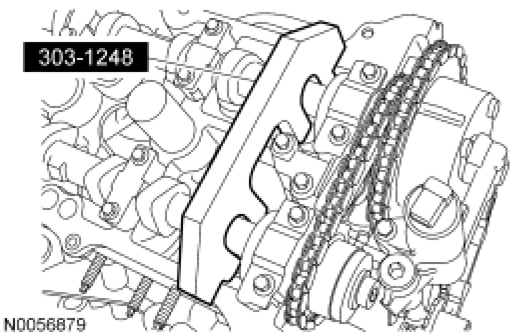


Fig. 471: Installing Special Tool (303-1248) Onto Flats Of RH Camshafts
Courtesy of FORD MOTOR CO.

94. Remove the 3 bolts and the RH VCT housing.

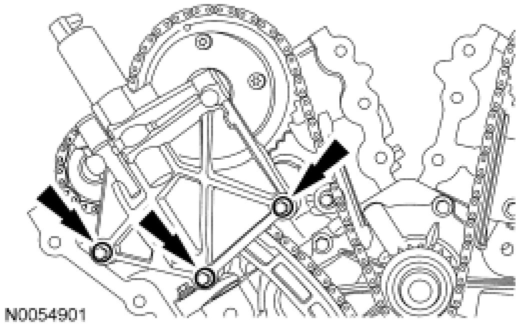


Fig. 472: Locating RH VCT Housing
Courtesy of FORD MOTOR CO.

95. Remove the 3 bolts and the LH VCT housing.

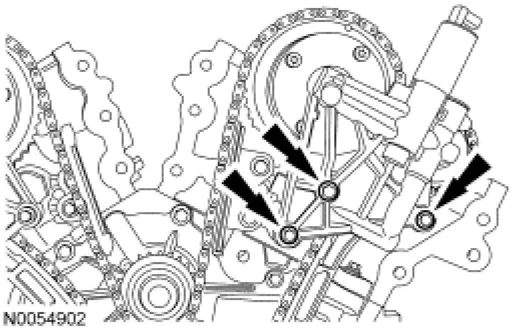


Fig. 473: Locating LH VCT Housing
Courtesy of FORD MOTOR CO.

96. Remove and discard the VCT housing seals.

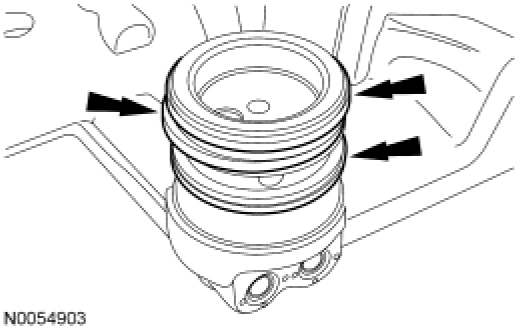


Fig. 474: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

97. Remove the 2 bolts and the primary timing chain tensioner.

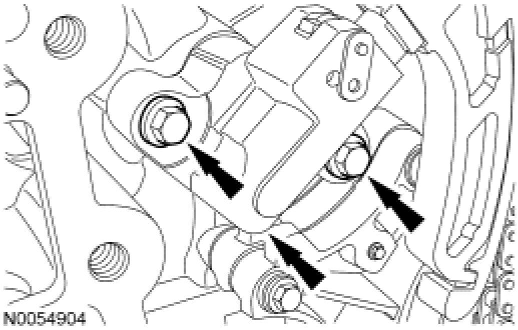
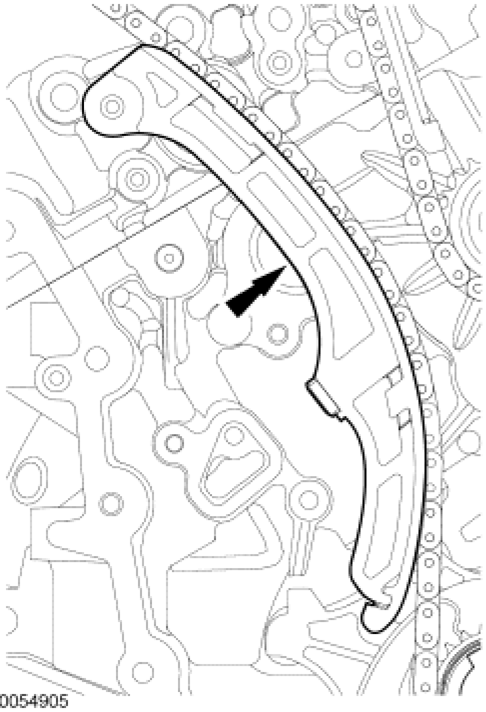


Fig. 475: Locating Primary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

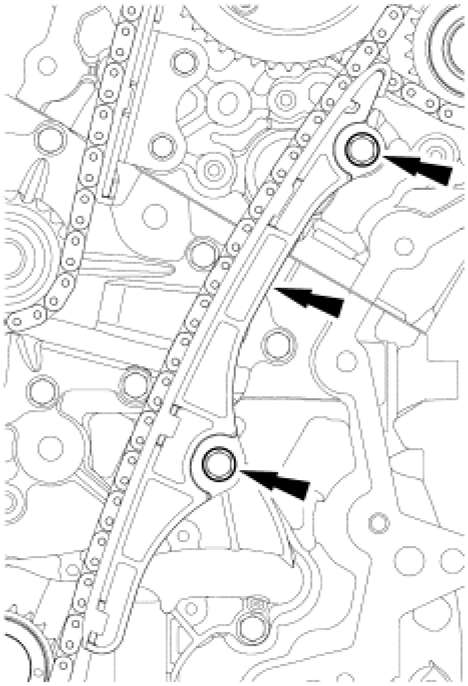
98. Remove the primary timing chain tensioner arm.



N0054905

Fig. 476: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

99. Remove the 2 bolts and the lower LH primary timing chain guide.

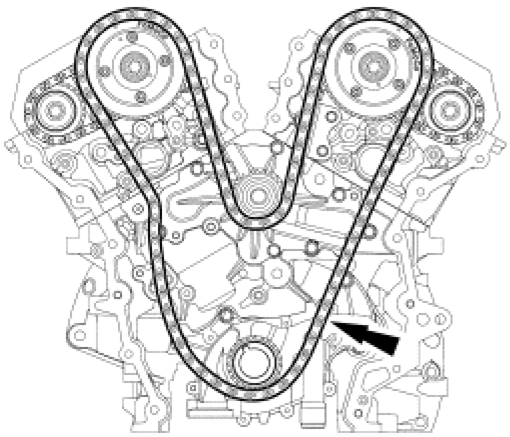


N0054906

Fig. 477: Locating Lower LH Primary Timing Chain Guide Bolts

Courtesy of FORD MOTOR CO.

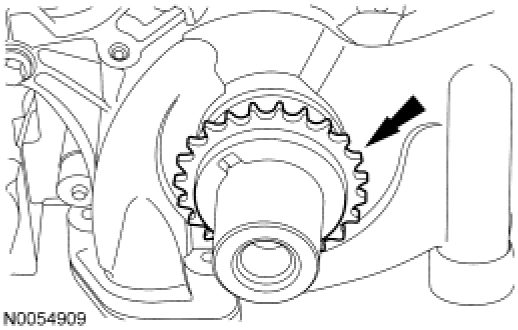
100. Remove the primary timing chain.



N0054908

Fig. 478: Locating Primary Timing Chain
Courtesy of FORD MOTOR CO.

101. Remove the crankshaft timing chain sprocket.



N0054909

Fig. 479: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

102. Remove the 2 bolts and the upper LH primary timing chain guide.

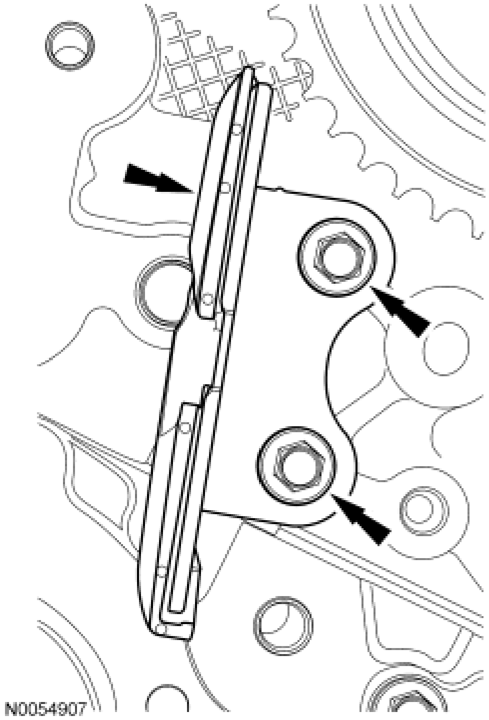


Fig. 480: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

103. Compress the LH secondary timing chain tensioner and install a suitable lock pin to retain the tensioner in the collapsed position.

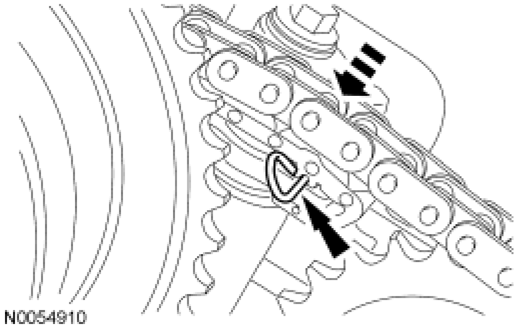


Fig. 481: Compressing LH Secondary Timing Chain Tensioner & Installing Suitable Lock Pin To Retain Tensioner In Collapsed Position
Courtesy of FORD MOTOR CO.

NOTE: The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.

104. Remove and discard the LH VCT assembly bolt and the LH exhaust camshaft sprocket bolt.
    - Remove the LH VCT assembly, secondary timing chain and the LH exhaust camshaft sprocket as an assembly.

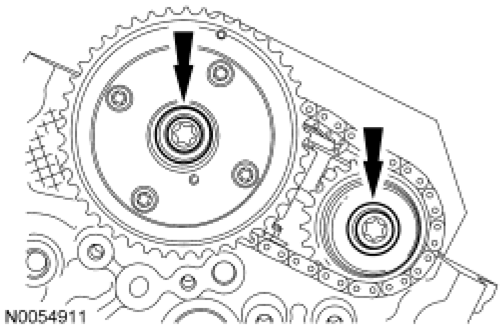


Fig. 482: Locating LH VCT Assembly Bolt & LH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

NOTE: **When the special tool is removed, valve spring pressure will rotate the LH camshafts approximately 3 degrees to a neutral position.**

105. Remove the special tool from the LH camshafts.

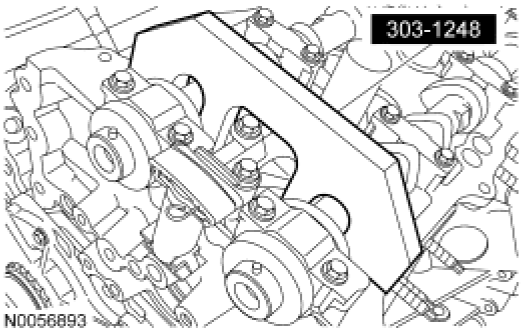


Fig. 483: Removing Special Tool (303-1248) From LH Camshafts
Courtesy of FORD MOTOR CO.

CAUTION: **The camshafts must remain in the neutral position during removal or engine damage may occur.**

106. Verify the LH camshafts are in the neutral position.

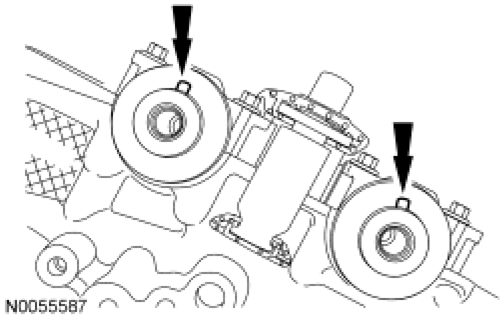


Fig. 484: Verifying LH Camshafts Are In Neutral Position

Courtesy of FORD MOTOR CO.

107. Remove the 2 bolts and the LH secondary timing chain tensioner.

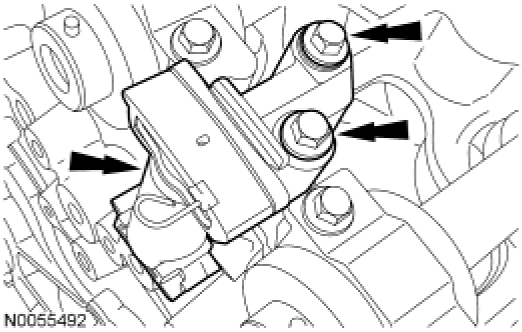


Fig. 485: Locating LH Secondary Timing Chain Tensioner & Bolt
Courtesy of FORD MOTOR CO.

NOTE: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.

108. Remove the bolts and the LH camshaft bearing caps.
   - Remove the LH camshafts.

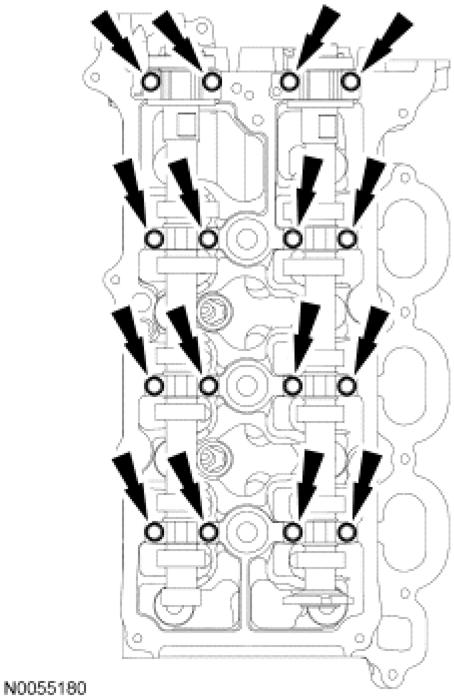


Fig. 486: Identifying LH Camshafts Bolts
Courtesy of FORD MOTOR CO.

109. Compress the RH secondary timing chain tensioner and install a suitable lock pin to retain the tensioner in the collapsed position.

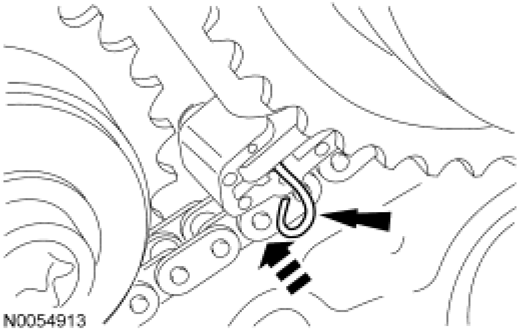


Fig. 487: Compressing RH Secondary Timing Chain Tensioner & Installing Suitable Lock Pin To Retain Tensioner In Collapsed Position
Courtesy of FORD MOTOR CO.

NOTE: **The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.**

110. Remove and discard the RH VCT assembly bolt and the RH exhaust camshaft sprocket bolt.
    - Remove the RH VCT assembly, secondary timing chain and the RH exhaust camshaft sprocket as an assembly.

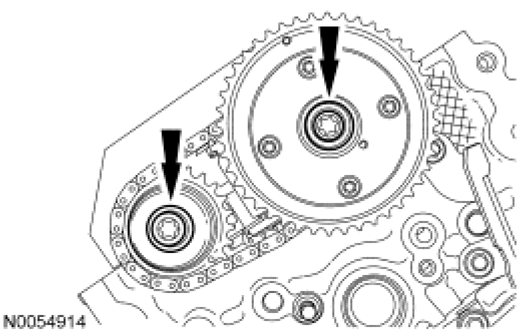


Fig. 488: Locating RH VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

111. Remove the special tool from the RH camshafts.

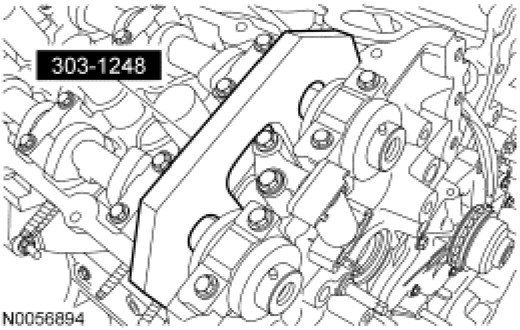


Fig. 489: Removing Special Tool (303-1248) From RH Camshafts
Courtesy of FORD MOTOR CO.

CAUTION: The camshafts must remain in the neutral position during removal or engine damage may occur.

112. Rotate the RH camshafts counterclockwise to the neutral position.

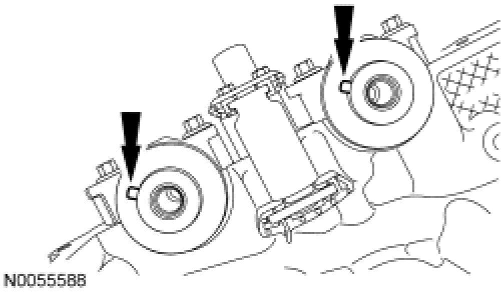


Fig. 490: Rotating RH Camshafts Counterclockwise To Neutral Position
Courtesy of FORD MOTOR CO.

113. Remove the 2 bolts and the RH secondary timing chain tensioner.

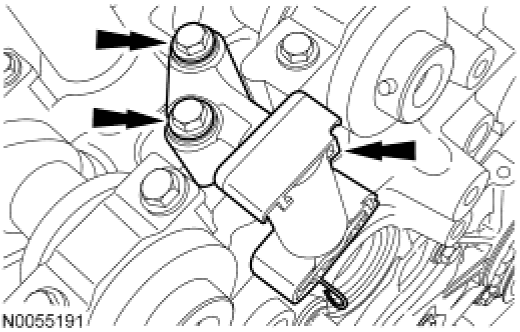


Fig. 491: Locating RH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

114. Remove the 2 bolts and the RH primary timing chain guide.

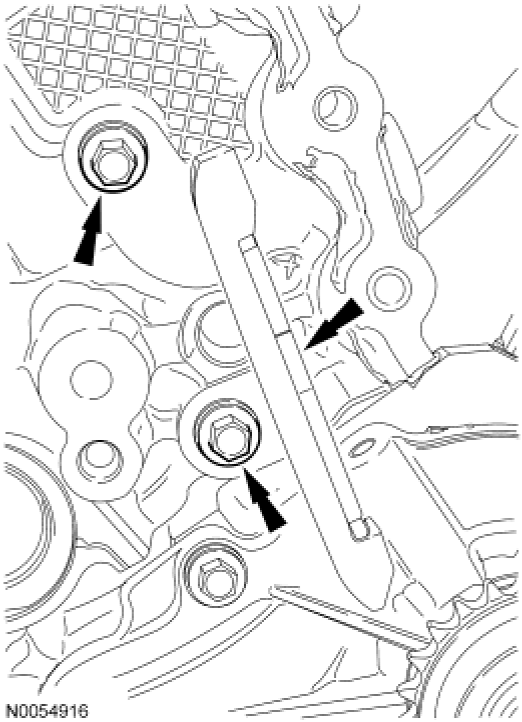


Fig. 492: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

NOTE:	**Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.**

115. Remove the bolts and the RH camshaft bearing caps.
    - Remove the RH camshafts.

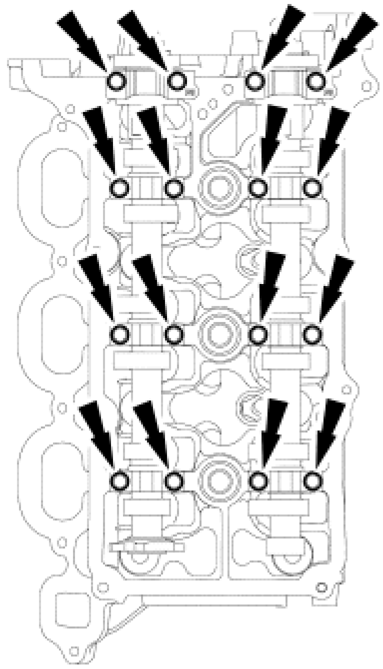


Fig. 493: Identifying RH Camshafts Bolts
Courtesy of FORD MOTOR CO.

NOTE: **If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.**

NOTE: **LH shown, RH similar.**

116. Remove the valve tappets from the cylinder heads.

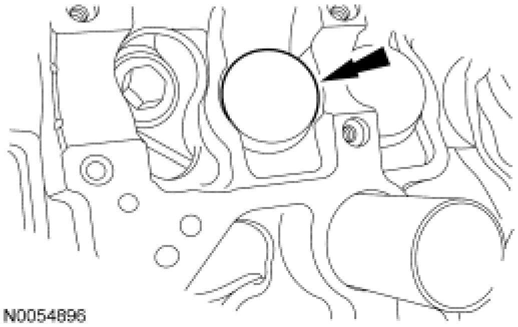


Fig. 494: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

117. Remove and discard the M6 bolt from each cylinder head.

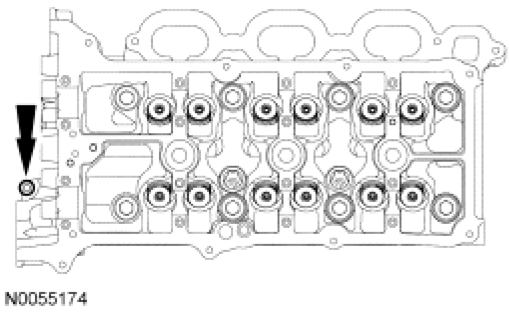


Fig. 495: Identifying M6 Bolt
Courtesy of FORD MOTOR CO.

CAUTION: Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

CAUTION: Aluminum surfaces are soft and may be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.

NOTE: The cylinder head bolts must be discarded and new bolts must be installed. They are tighten-to-yield design and cannot be reused.

NOTE: LH shown, RH similar.

118. Remove and discard the 8 bolts from each cylinder head.
- Remove the cylinder heads.
- Discard the cylinder head gaskets.

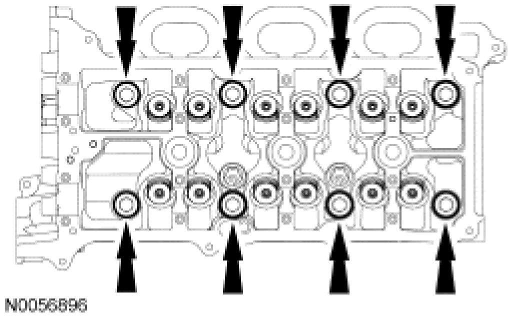


Fig. 496: Identifying Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the gasket.

NOTE: Observe all warnings or cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.

NOTE: If there is no residual gasket material present, metal surface prep can be used to clean and prepare the surfaces.

119. Clean the cylinder head-to-cylinder block mating surfaces of both the cylinder heads and the cylinder block.
    1. Remove any large deposits of silicone or gasket material with a plastic scraper.
    2. Apply silicone gasket remover, following package directions, and allow to set for several minutes.
    3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep, following package directions, to remove any remaining traces of oil or coolant and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.
120. Support the cylinder heads on a bench with the head gasket side up.

NOTE: The straightedge used must be flat within 0.0051 mm (0.0002 in) per foot of tool length.

121. Inspect all areas of the deck face with a straightedge and feeler gauge. The cylinder heads must not have depressions deeper than 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area, or scratches more than 0.0254 mm (0.001 in).
122. Remove the coolant tube.
    - Remove and discard the O-ring seals.

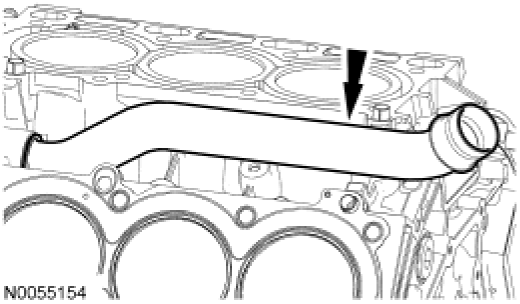


Fig. 497: Identifying Coolant Tube
Courtesy of FORD MOTOR CO.

123. Remove the 2 bolts and the knock sensor (KS).

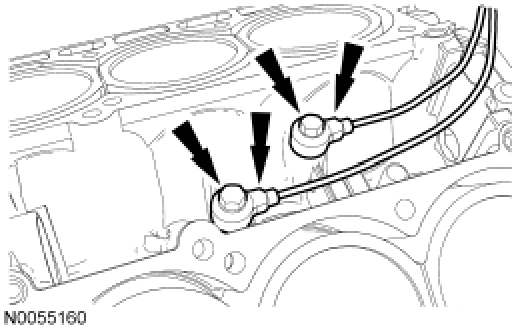


Fig. 498: Locating Knock Sensor (KS) Bolts
Courtesy of FORD MOTOR CO.

124. Remove the 8 bolts and the coolant pump.

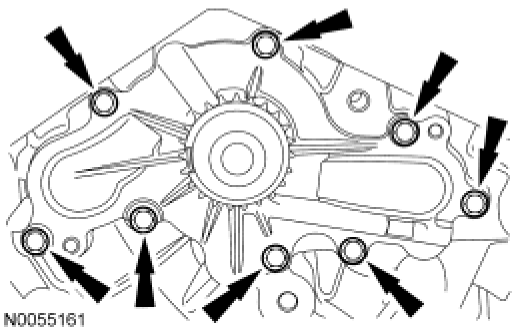


Fig. 499: Locating Coolant Pump Bolts
Courtesy of FORD MOTOR CO.

125. Remove the 16 oil pan bolts.

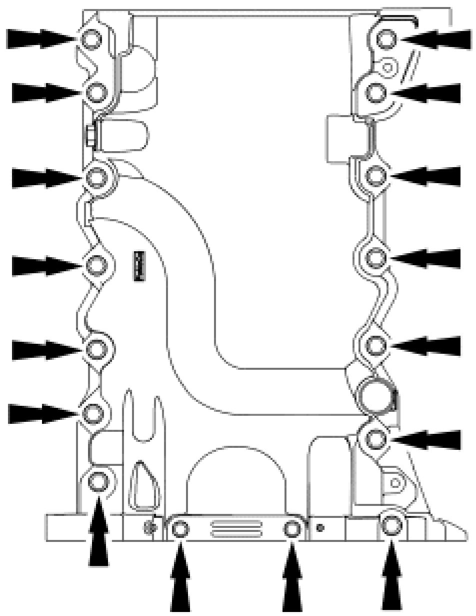
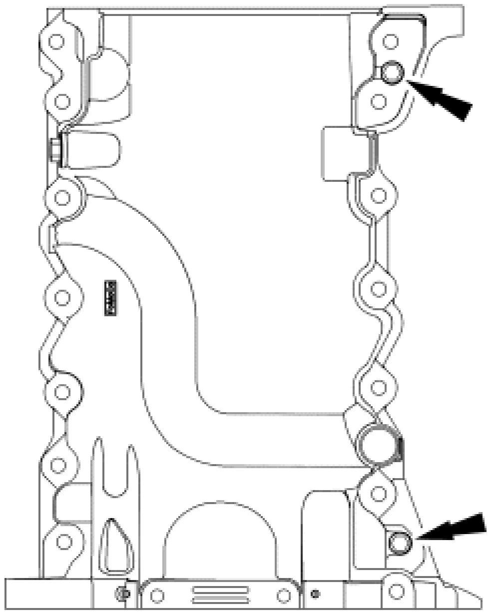


Fig. 500: Identifying Oil Pan Bolts
Courtesy of FORD MOTOR CO.

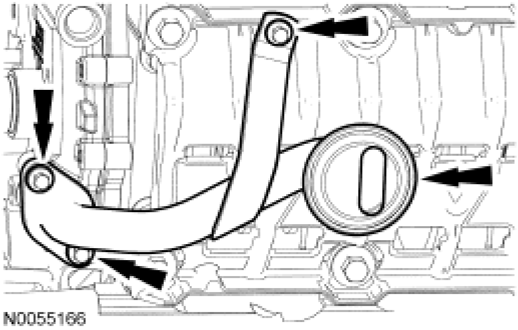
126. Install 2 of the oil pan bolts (finger tight) into the 2 threaded holes in the oil pan in the following sequence.
    1. Alternately tighten the 2 bolts one turn at a time until the oil pan-to-cylinder block seal is released.
    2. Remove the oil pan.



N0055164

Fig. 501: Installing 2 Of Oil Pan Bolts (Finger Tight) Into 2 Threaded Holes In Oil Pan
Courtesy of FORD MOTOR CO.

127. Remove the 3 bolts and the oil pump screen and pickup tube.
    - Discard the O-ring seal.



N0055166

Fig. 502: Identifying Oil Pump Screen, Pickup Tube & Bolts
Courtesy of FORD MOTOR CO.

128. Remove the 3 bolts and the oil pump.

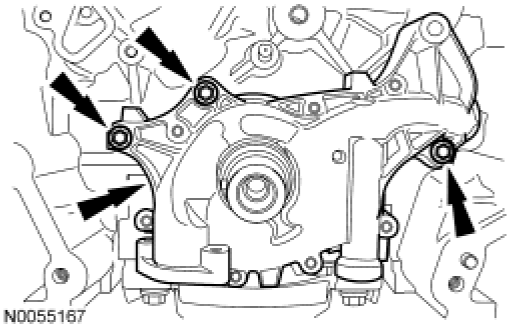


Fig. 503: Identifying Oil Pump & Bolts
Courtesy of FORD MOTOR CO.

129. Remove the 8 crankshaft rear seal retainer bolts.

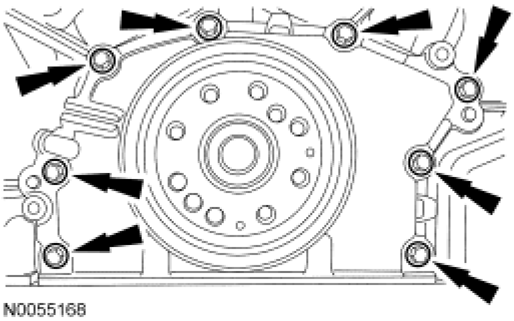


Fig. 504: Locating Crankshaft Rear Seal Retainer Bolts
Courtesy of FORD MOTOR CO.

130. Install the 2 M6 oil pan bolts (finger tight) into the 2 threaded holes in the crankshaft rear seal retainer in the following sequence.
    1. Alternately tighten the 2 bolts one turn at a time until the crankshaft rear seal retainer-to-cylinder block seal is released.
    2. Remove the crankshaft rear seal retainer.

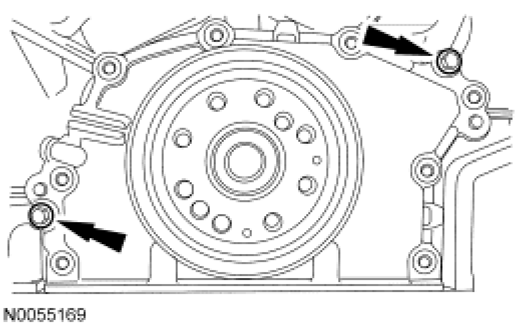


Fig. 505: Identifying M6 Oil Pan Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Only use a 3M Roloc® Bristle Disk (2-in white, part number 07528) to clean the engine front cover, oil pan and crankshaft rear seal retainer plate. Do not use metal scrapers, wire brushes or any other power abrasive disk to clean the engine front cover, oil pan and crankshaft rear seal retainer plate. These tools cause scratches and gouges that make leak paths.

131. Clean the engine front cover, oil pan and crankshaft rear seal retainer plate using a 3M Roloc® Bristle Disk (2-in white, part number 07528) in a suitable tool turning at the recommended speed of 15,000 RPM.
    - Thoroughly wash the engine front cover, oil pan and crankshaft rear seal retainer plate to remove any foreign material, including any abrasive particles created during the cleaning process.

CAUTION: Place clean, lint-free shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

CAUTION: Do not use wire brushes, power abrasive discs or 3M Roloc® Bristle Disk (2-in white, part number 07528) to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. They also cause contamination that will cause premature engine failure. Remove all traces of the gasket.

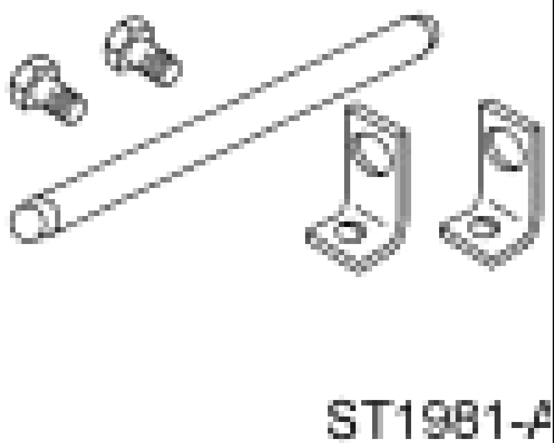
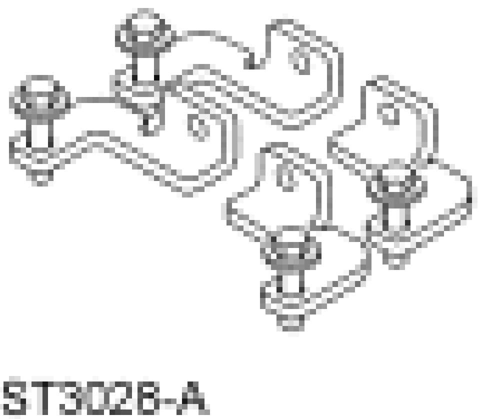
132. Clean all engine sealing surfaces of the cylinder block in the following sequence.
    1. Remove any large deposits of silicone or gasket material.
    2. Apply silicone gasket remover and allow to set for several minutes.
    3. Remove the silicone gasket remover. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep to remove any remaining traces of oil or coolant and to prepare the surfaces to bond. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.
    5. Make sure the 2 engine front cover locating dowel pins are seated correctly in the cylinder block.

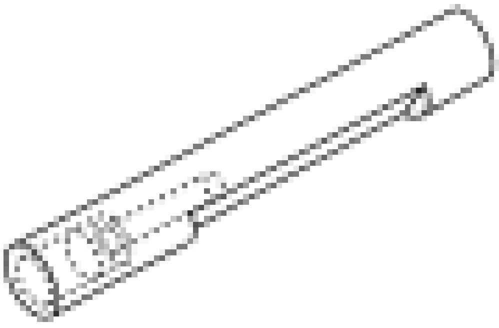
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

CYLINDER HEAD

Special Tools

Illustration	Tool Name	Tool Number
	Compressor, Valve Spring	303-300 (T87C-6565-A)

		
	Compressor, Valve Spring	303-350 (T89P-6565-A)
	Compressor, Valve Spring	303-1249
	Installer, Valve Stem Oil Seal	303-470 (T94P-6510-CH)

 ST1906-A		

Material

Item	**Specification**
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

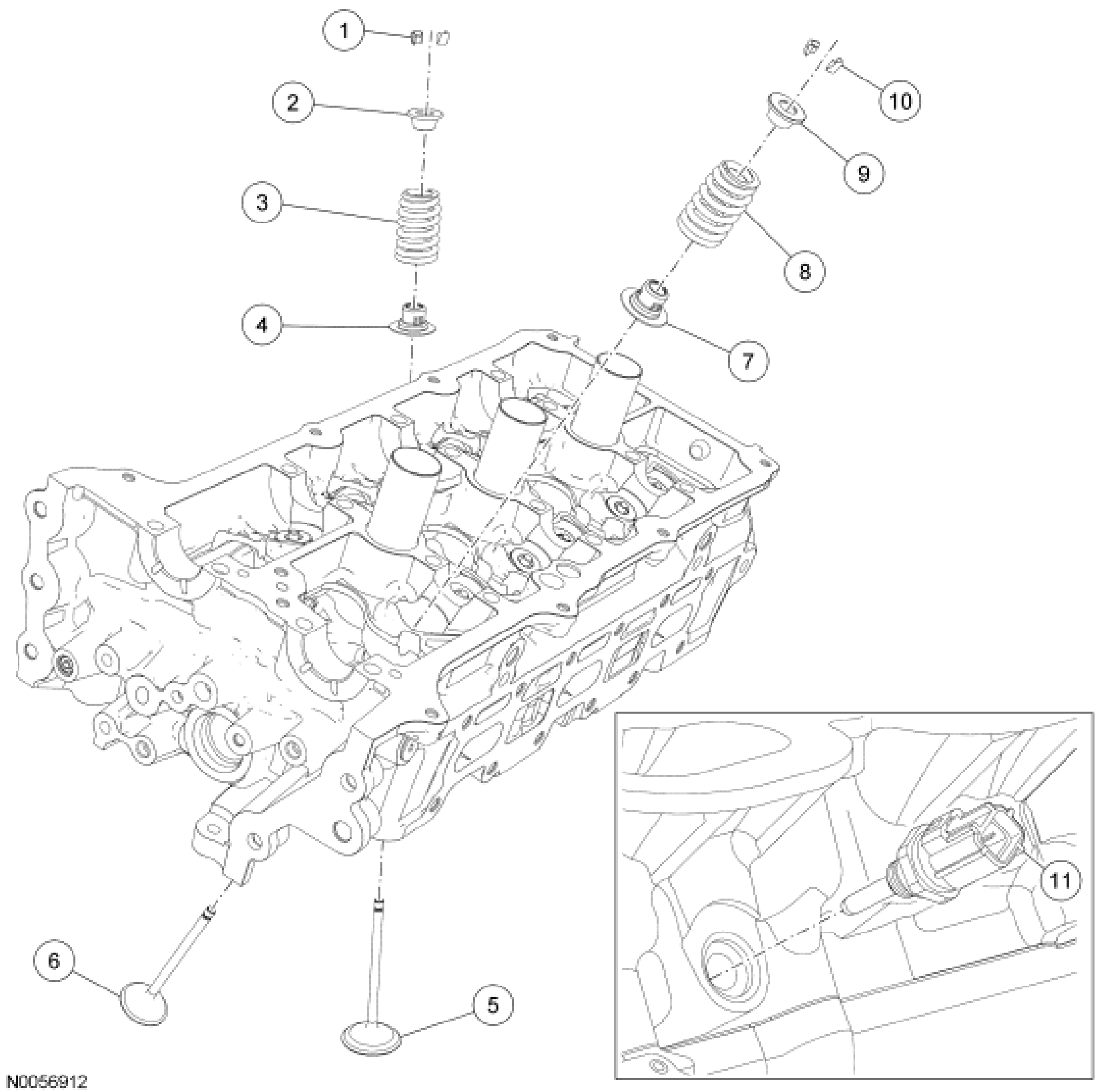


Fig. 506: Exploded View Of Cylinder Head
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6518	Intake valve spring retainer key (12 required)
2	6514	Intake valve spring retainer (6 required)
3	6513	Intake valve spring (6 required)
4	6A517	Intake valve stem seal (6 required)
5	6505	Intake valve (6 required)
6	6507	Exhaust valve (6 required)
7	6A517	Exhaust valve stem seal (6 required)
8	6513	Exhaust valve spring (6 required)
9	6514	Exhaust valve spring retainer (6 required)

10	6518	Exhaust valve spring retainer key (12 required)
11	6G004	Cylinder Head Temperature (CHT) sensor

DISASSEMBLY

All cylinder heads

NOTE: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

1. Using the Valve Spring Compressors, remove the keys, retainer and spring.

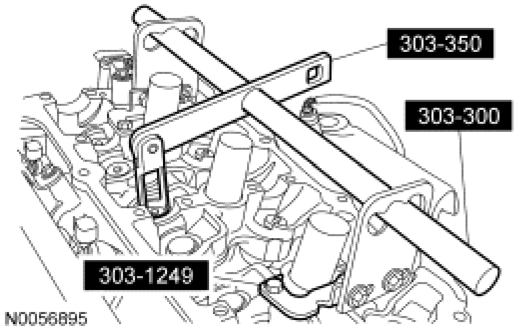


Fig. 507: Removing Keys, Retainer & Spring Using Special Tools (303-1249, 303-350, 303-300)
Courtesy of FORD MOTOR CO.

2. Remove the valve from the cylinder head.
3. Remove and discard the valve stem seal.
4. Repeat the above steps for each valve.

RH cylinder head

5. Remove and discard the Cylinder Head Temperature (CHT) sensor.

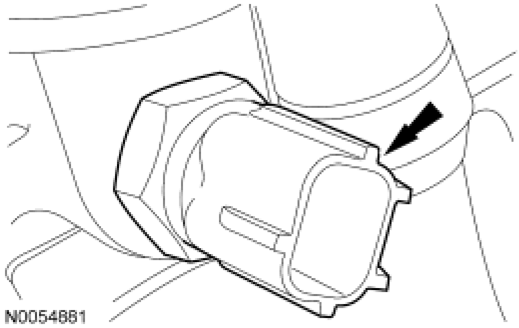


Fig. 508: Identifying Cylinder Head Temperature (CHT) Sensor
Courtesy of FORD MOTOR CO.

ASSEMBLY

All cylinder heads

NOTE: Lubricate the valve stem seal with clean engine oil prior to installation.

1. Using the Valve Stem Oil Seal Installer, install a new valve stem seal.

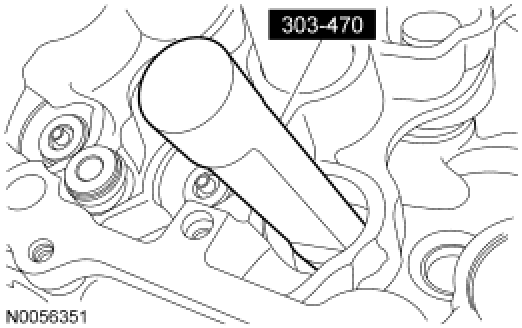


Fig. 509: Installing New Valve Stem Seal Using Special Tool (303-470)
Courtesy of FORD MOTOR CO.

2. Install the valve.
3. Using the Valve Spring Compressors, install the valve spring, retainer and key.

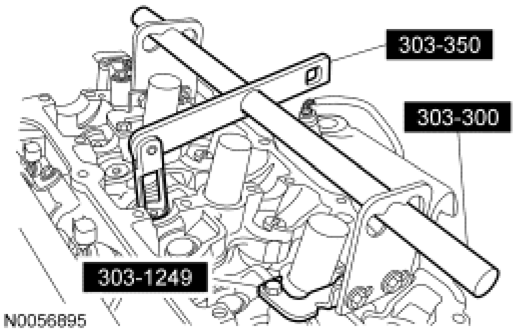


Fig. 510: Removing Keys, Retainer & Spring Using Special Tools (303-1249, 303-350, 303-300)
Courtesy of FORD MOTOR CO.

4. Repeat the above steps for each valve.

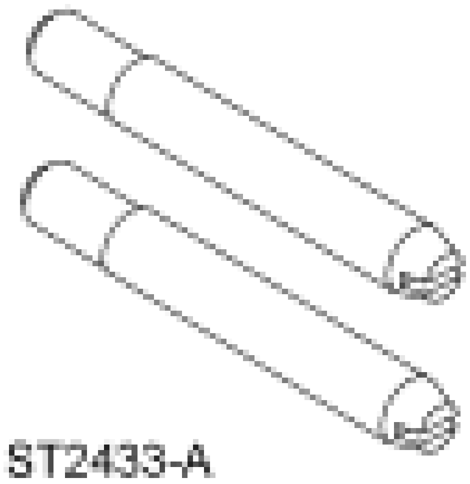
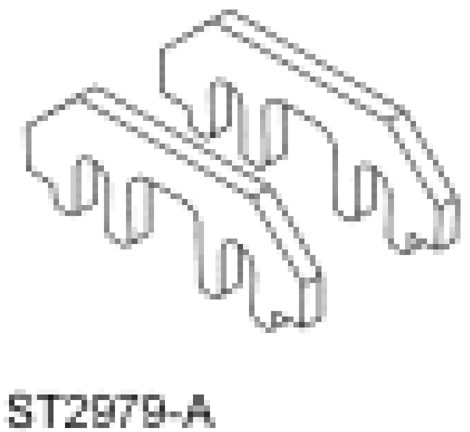
RH cylinder head

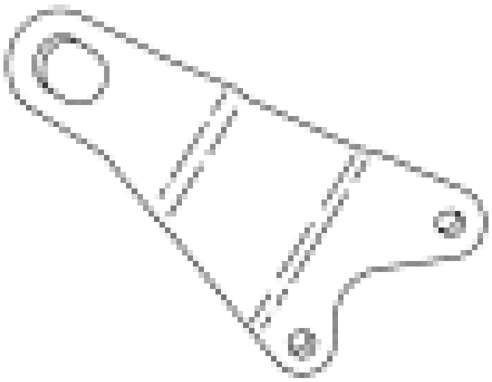
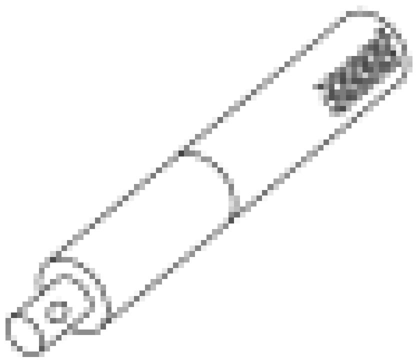
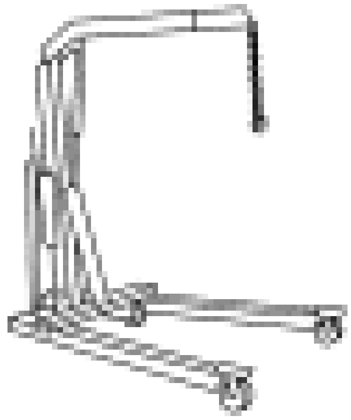
5. Install a new CHT sensor.
   - Tighten to 10 Nm (89 lb-in).

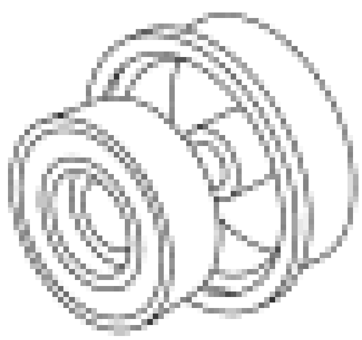
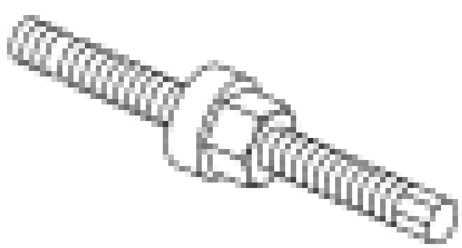
ASSEMBLY

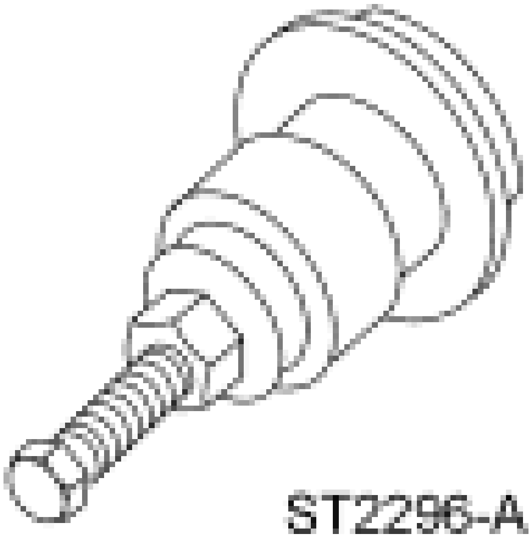
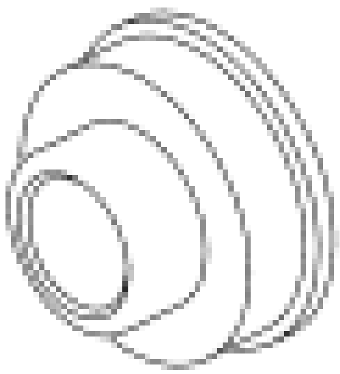
ENGINE

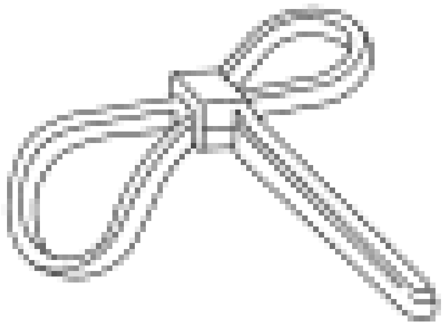
Special Tools

Illustration	Tool Name	Tool Number
	Alignment Pins	307-399
	Camshaft Alignment Tool	303-1248
	Engine Lifting Bracket	303-1245

 ST2976A		
 ST1326-A	Handle	205-153 (T80T-4000-W)
 ST1341-A	Heavy Duty Floor Crane	014-00071 or equivalent
	Installer, Crankshaft Front	303-1251

 ST2981-A	Seal	
 ST2980-A	Installer, Crankshaft Rear Seal	303-1250
 ST1287-A	Installer, Crankshaft Vibration Damper	303-102 (T74P-6316-B)
	Installer, Front Cover Oil Seal	303-335

 ST2296-A		
 ST2983-A	Installer, Seal	303-1247/2
 ST1602-A	Spreader Bar	303-D089 (D93P-6001-A3) or equivalent
	Strap Wrench	303-D055 (D85L-6000-A)

 ST1436-A		

Material

Item	Specification
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft Metal Surface Prep ZC-31-A	-
Motorcraft Premium Gold Engine Coolant with Bittering Agent (bittered in US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket Remover ZC-30	-
Thread Sealant with PTFE TA-24	WSK-M2G350-A2

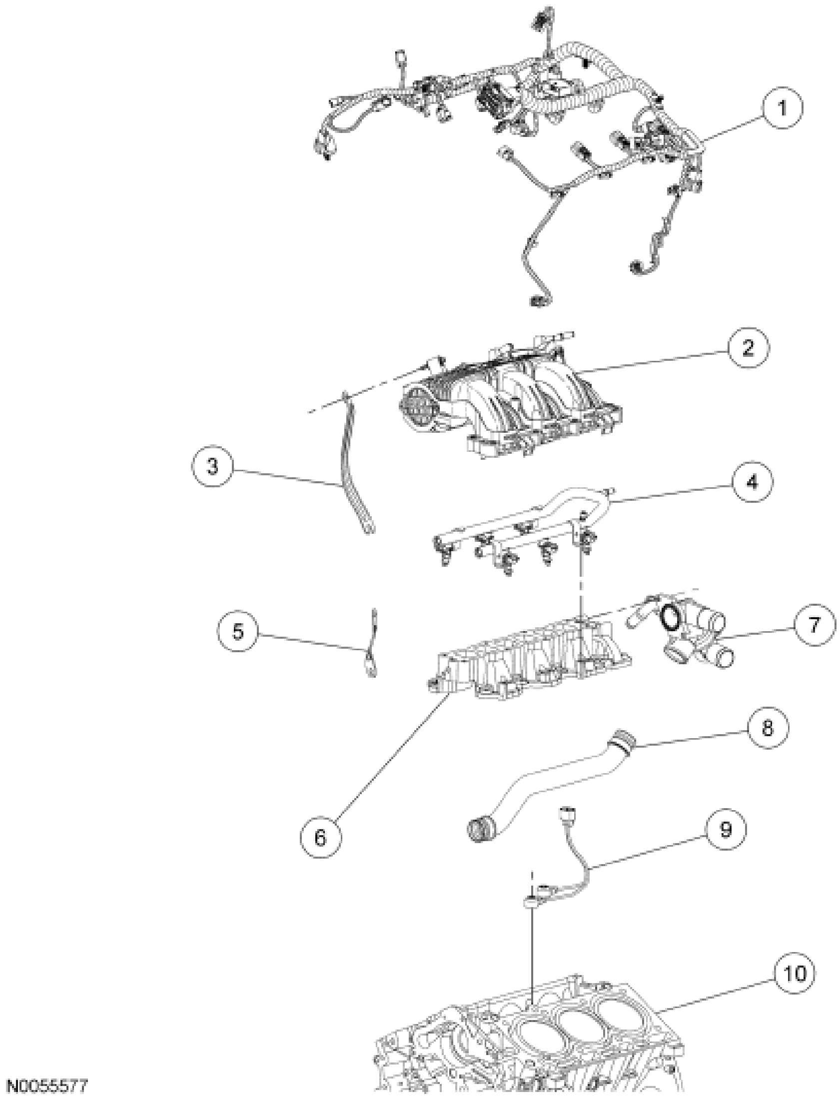


Fig. 511: Exploded View Of Engine Upper
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	12C508	Engine control harness
2	9S455	Upper intake manifold
3	9J444	Upper intake manifold long support bracket (early build vehicles)
4	9F797	Fuel rail
5	9J444	Upper intake manifold short support bracket
6	9K461	Lower intake manifold
7	8A856	Thermostat housing
8	9N271	Coolant tube
9	9N271	Knock sensor (KS)

10	6010	Cylinder block

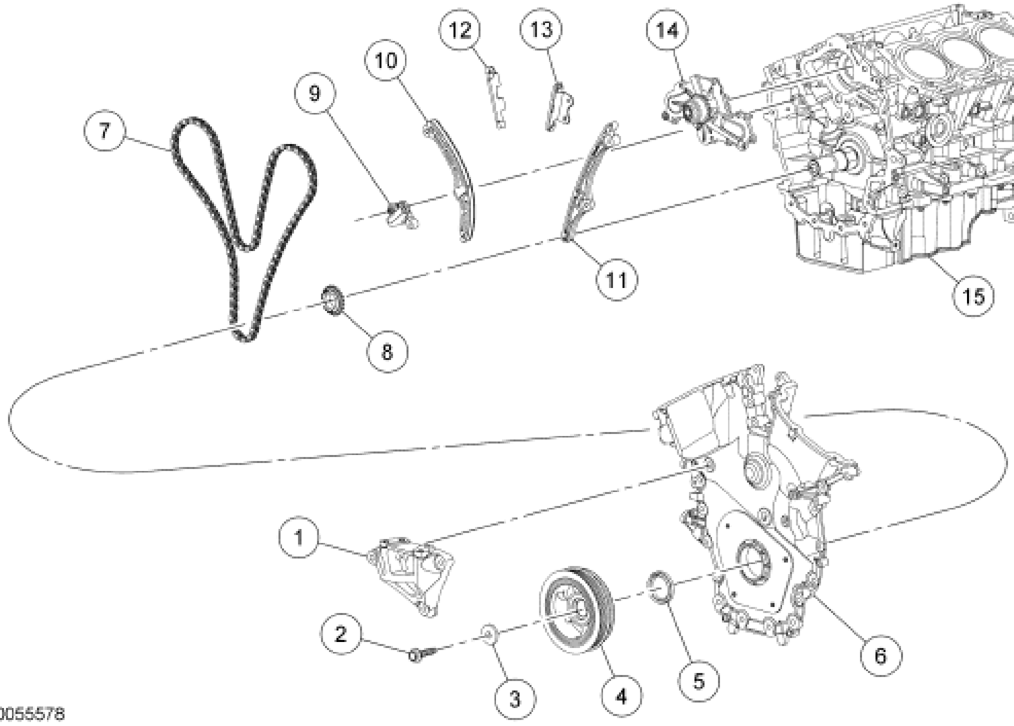


Fig. 512: Exploded View Of Engine Front
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6A0003	Engine mount bracket
2	W701512	Crankshaft pulley bolt
3	N806165	Crankshaft pulley washer
4	6316	Crankshaft pulley
5	6700	Crankshaft front seal
6	6C086	Engine front cover
7	6268	Timing chain
8	6306	Crankshaft timing sprocket
9	6K254	Primary timing chain tensioner
10	6K255	Primary timing chain tensioner arm
11	6B274	LH lower primary timing chain guide
12	6M256	RH primary timing chain guide
13	6K297	LH upper primary timing chain guide
14	8501	Coolant pump
15	6010	Cylinder block

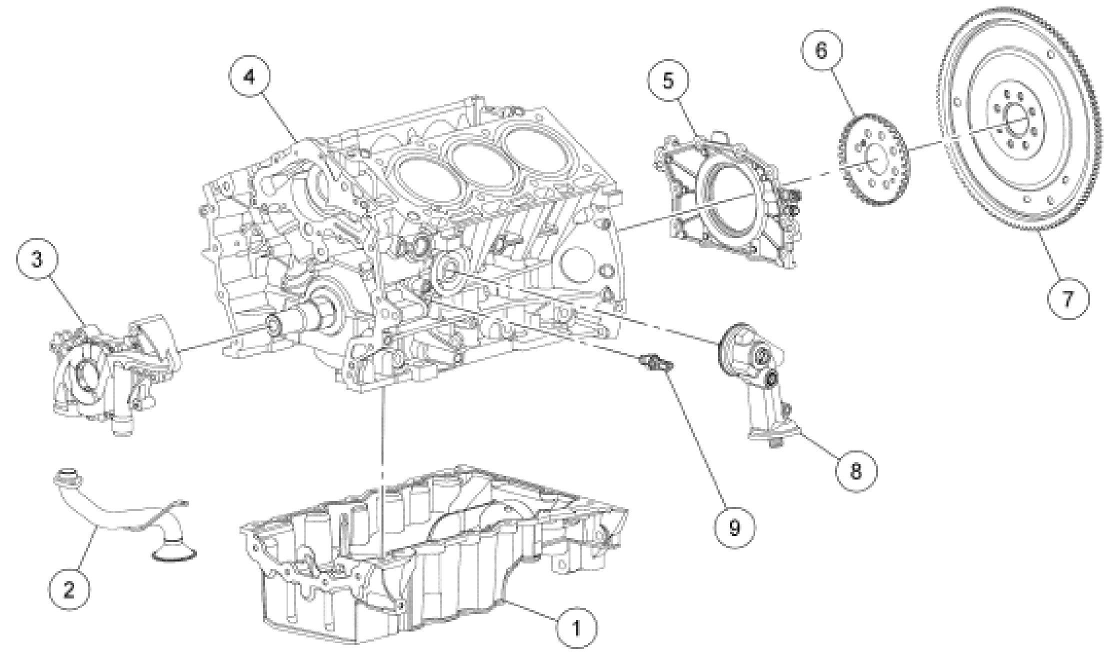


Fig. 513: Exploded View Of Engine Lower
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6675	Oil pan
2	6622	Oil pump screen and pickup tube
3	6621	Oil pump
4	6010	Cylinder block
5	6D327	Crankshaft rear seal retainer
6	12A227	Crankshaft sensor ring
7	6375	Flexplate
8	6881	Oil filter adapter
9	9278	Engine oil pressure (EOP) switch

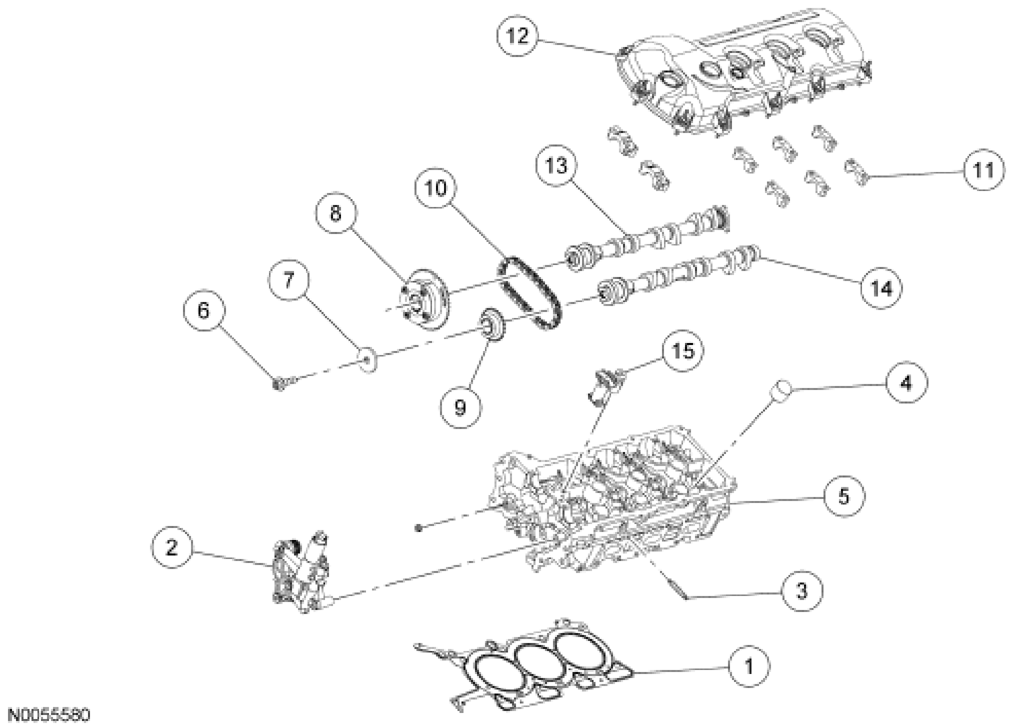


Fig. 514: Exploded View Of LH Cylinder Head
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6083	LH cylinder head gasket
2	6C261	LH variable camshaft timing (VCT) housing
3	W12244	LH exhaust manifold stud (6 required)
4	6500	Valve tappet (32 required)
5	6050	LH cylinder head
6	6279	LH camshaft bolt (2 required)
7	W710738	LH exhaust camshaft sprocket washer
8	6C524	LH VCT assembly
9	6256	LH exhaust camshaft sprocket
10	6C256	LH secondary timing chain
11	6A258	LH camshaft cap (8 required)
12	6A505	LH valve cover
13	6A267	LH intake camshaft
14	6A269	LH exhaust camshaft
15	6C271	LH secondary timing chain tensioner

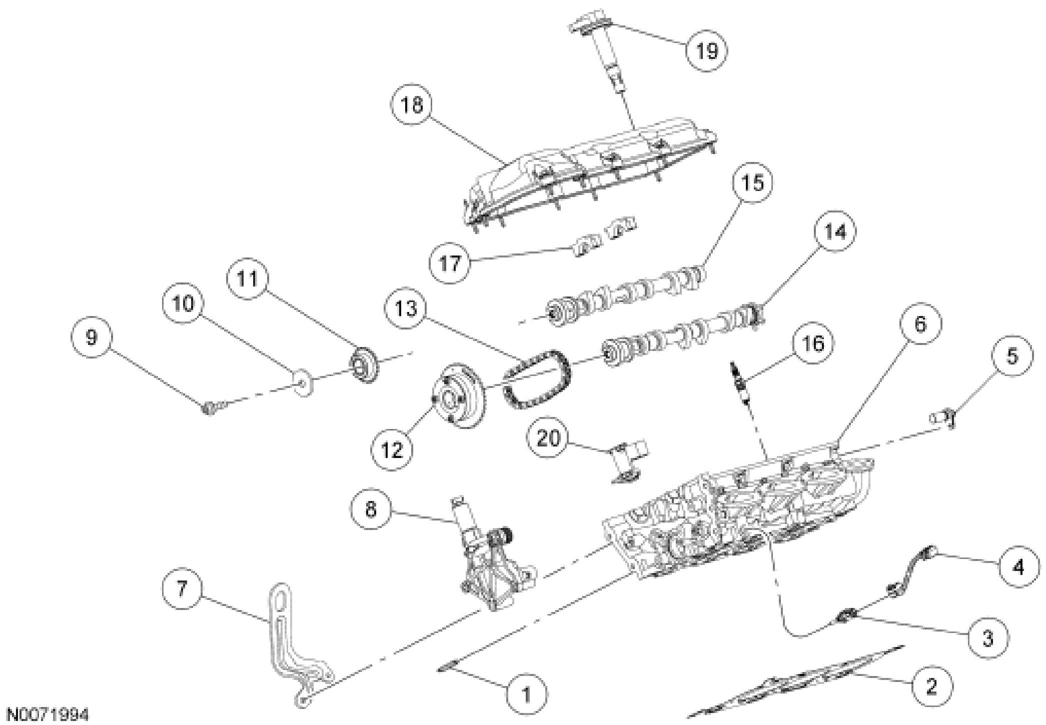


Fig. 515: Exploded View Of RH Cylinder Head
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712244	RH exhaust manifold stud (6 required)
2	6051	RH cylinder head gasket
3	6G004	Cylinder head temperature (CHT) sensor
4	14B485	CHT sensor jumper harness
5	6B288	Camshaft position sensor (2 required)
6	6049	RH cylinder head
7	17A084	Engine lift eye
8	6C260	RH variable camshaft timing (VCT) housing
9	6279	RH camshaft bolt (2 required)
10	W710738	RH exhaust camshaft sprocket washer
11	6256	RH exhaust camshaft sprocket
12	6C524	RH VCT assembly
13	6C256	RH secondary timing chain
14	6A266	RH intake camshaft
15	6A268	RH exhaust camshaft
16	12405	Spark plug (6 required)
17	6A258	RH camshaft cap (8 required)
18	6582	RH valve cover
19	12A375	Coil-on-plug (6 required)

20	6C270	RH secondary timing chain tensioner

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

All vehicles

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The crankshaft rear seal retainer must be installed and the bolts tightened within 4 minutes of sealant application.

1. Apply a 3 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the sealing surface of the crankshaft rear seal retainer.

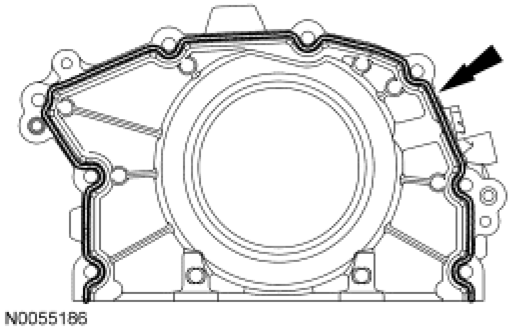


Fig. 516: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Sealing Surface Of Crankshaft Rear Seal Retainer
Courtesy of FORD MOTOR CO.

2. Install the rear seal retainer and the 8 bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

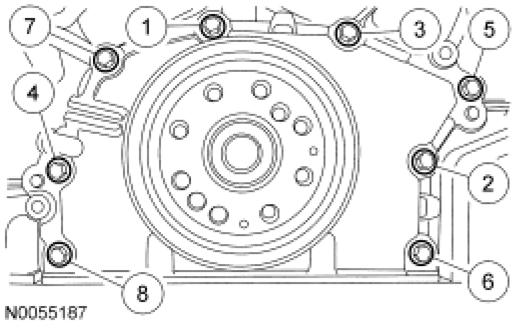


Fig. 517: Installing Crankshaft Rear Seal Retainer Bolts In Sequence
Courtesy of FORD MOTOR CO.

3. Install the oil pump and the 3 bolts.
   - Tighten to 10 Nm (89 lb-in).

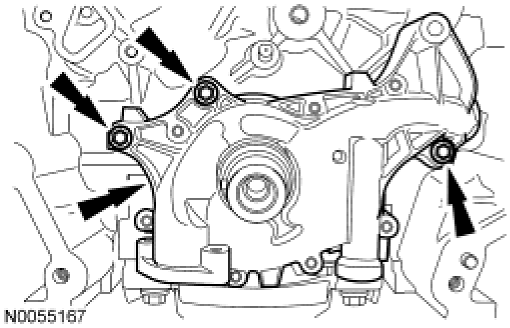


Fig. 518: Identifying Oil Pump & Bolts
Courtesy of FORD MOTOR CO.

4. Using a new O-ring seal, install the oil pump screen and pickup tube and the 3 bolts.
   - Tighten to 10 Nm (89 lb-in).

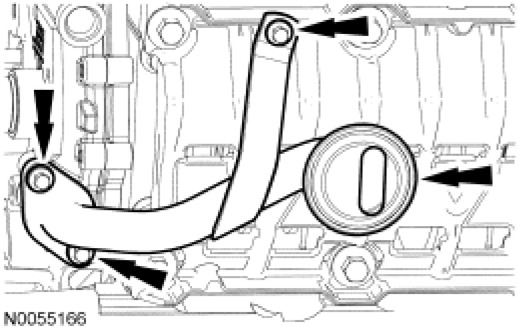


Fig. 519: Identifying Oil Pump Screen, Pickup Tube & Bolts
Courtesy of FORD MOTOR CO.

NOTE: **The A/C compressor must be installed on the cylinder block and the 2 bolts tightened prior to installing the oil pan.**

5. Install the A/C compressor and the 2 bolts.
   - Tighten to 25 Nm (18 lb-ft).

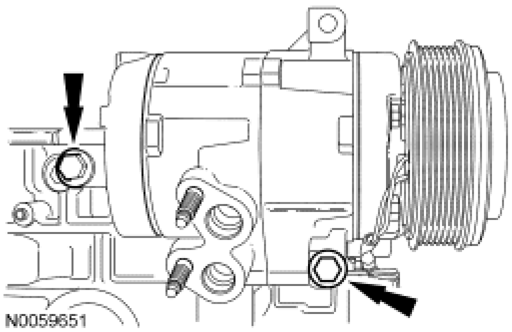


Fig. 520: Identifying A/C Compressor Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The oil pan and the 4 specified bolts must be installed and the oil pan aligned to the cylinder block and A/C compressor within 4 minutes of sealant application. Final tightening of the oil pan bolts must be carried out within 60 minutes of sealant application.

6. Apply a 3 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the sealing surface of the oil pan.
   - Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the 2 crankshaft seal retainer plate-to-cylinder block joint areas on the sealing surface of the oil pan.

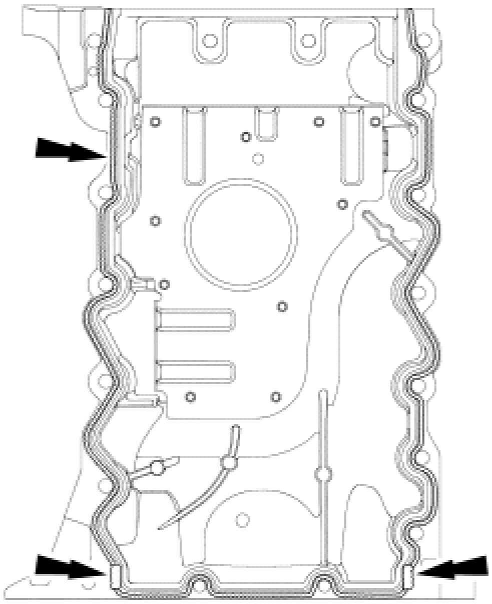


Fig. 521: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Crankshaft Seal Retainer Plate-To-Cylinder Block
Courtesy of FORD MOTOR CO.

NOTE: **The oil pan and the 4 specified bolts must be installed within 4 minutes of the start of sealant application.**

7. Install the oil pan and bolts 10, 11, 13 and 14.
    - Tighten the bolts in the sequence shown to 3 Nm (27 lb-in).
    - Loosen the bolts 180 degrees.

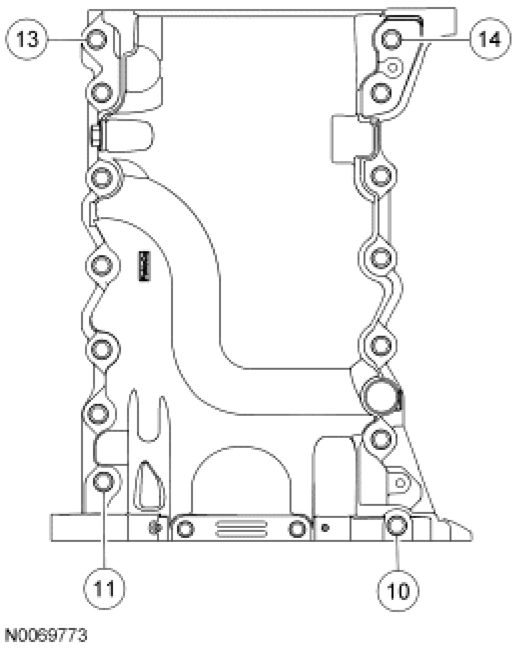


Fig. 522: Installing Oil Pan Bolts 10, 11, 13 & 14 In Sequence
Courtesy of FORD MOTOR CO.

8. Align the oil pan to the cylinder block and A/C compressor.
   - Position the oil pan so the mounting boss is against the A/C compressor and using a straightedge, align the oil pan flush with the rear of the cylinder block at the 2 areas shown.

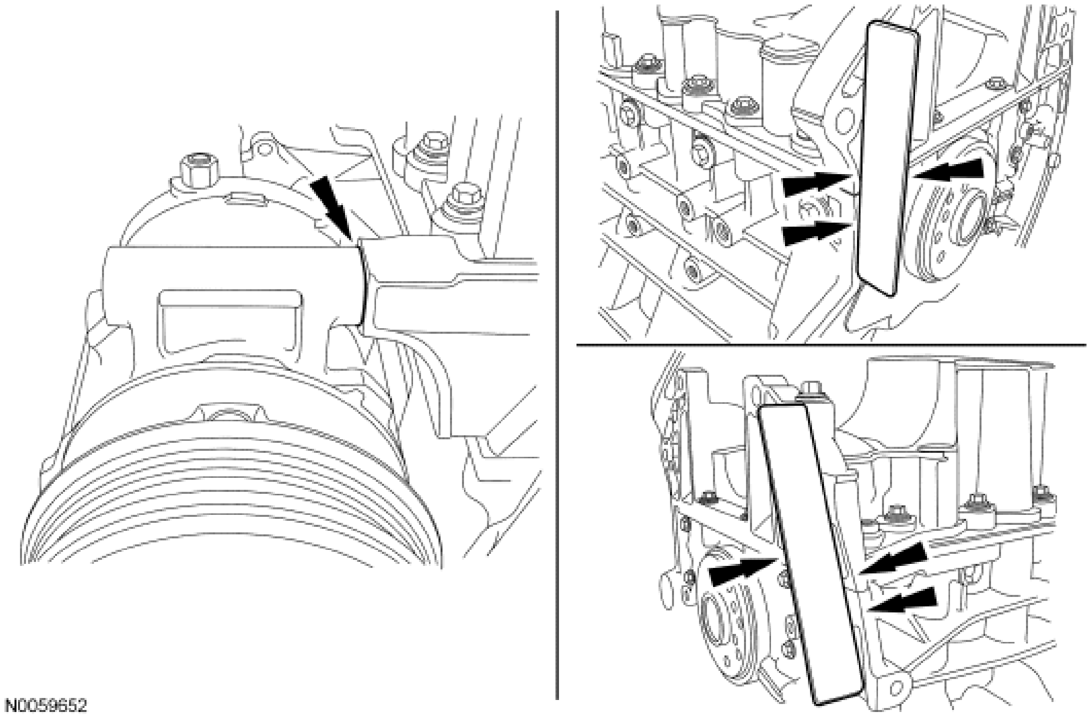


Fig. 523: Aligning Oil Pan Flush With Rear Of Cylinder Block
Courtesy of FORD MOTOR CO.

9. Tighten bolts 10, 11, 13 and 14 in the sequence shown, to 3 Nm (27 lb-in).

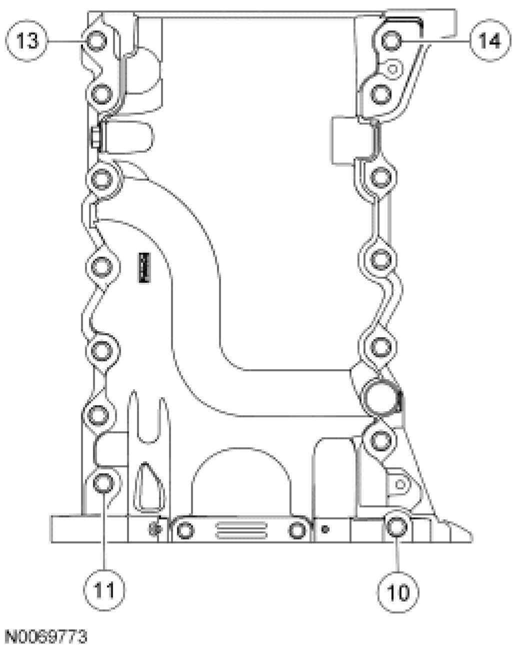


Fig. 524: Installing Oil Pan Bolts 10, 11, 13 & 14 In Sequence

Courtesy of FORD MOTOR CO.

10. Install the remaining oil pan bolts. Tighten all the oil pan bolts in the sequence shown.
    - Tighten the large bolts (1-14) to 24 Nm (18 lb-ft).
    - Tighten the small bolts (15 and 16) to 10 Nm (89 lb-in).

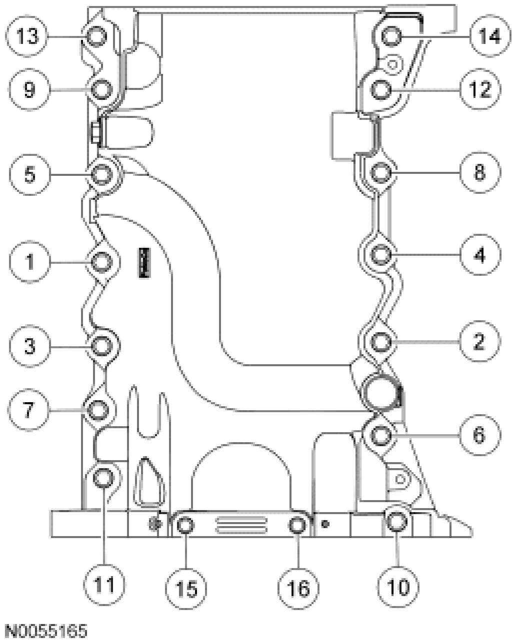


Fig. 525: Installing Remaining Oil Pan Bolts In Sequence
Courtesy of FORD MOTOR CO.

11. Install the A/C compressor mounting stud and nut.
    - Tighten the stud to 9 Nm (80 lb-in) and the nut to 25 Nm (18 lb-ft).

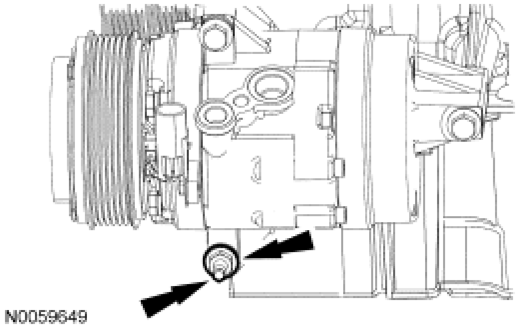


Fig. 526: Identifying A/C Compressor Nut & Stud
Courtesy of FORD MOTOR CO.

12. Install the coolant pump and the 8 bolts.

- Tighten in the sequence shown to 10 Nm (89 lb-in).

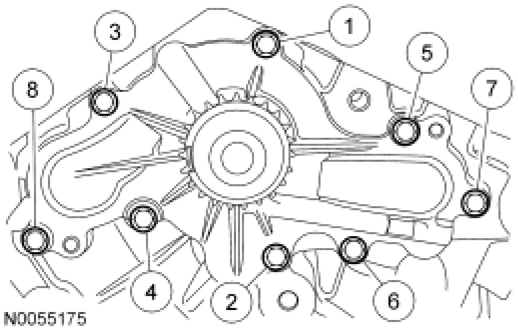


Fig. 527: Identifying Coolant Pump Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

13. Install the knock sensor (KS) and the 2 bolts.
    - Tighten to 20 Nm (15 lb-ft).

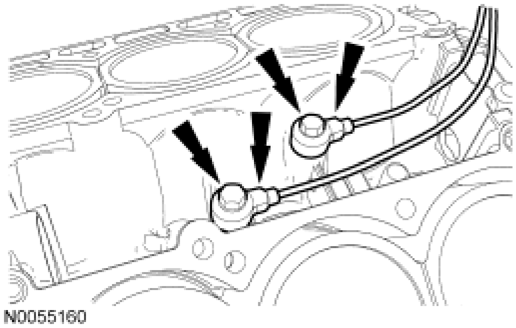


Fig. 528: Locating Knock Sensor (KS) Bolts
Courtesy of FORD MOTOR CO.

NOTE: Apply clean engine coolant to the O-ring seals prior to installation.

14. Using new O-ring seals, install the coolant tube.

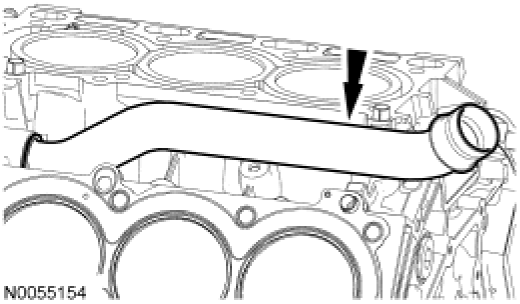


Fig. 529: Identifying Coolant Tube
Courtesy of FORD MOTOR CO.

15. Install a new gasket, the RH cylinder head and 8 new bolts. Tighten in the sequence shown in 5 stages:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten to 35 Nm (26 lb-ft).
    - Stage 3: Tighten 90 degrees.
    - Stage 4: Tighten 90 degrees.
    - Stage 5: Tighten 90 degrees.

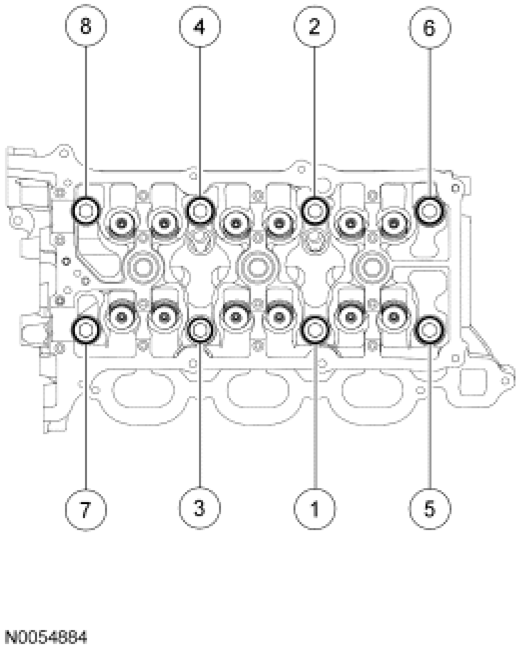


Fig. 530: Installing RH Cylinder Head Bolts In Sequence
Courtesy of FORD MOTOR CO.

16. Install the bolt.
    - Tighten to 10 Nm (89 lb-in).

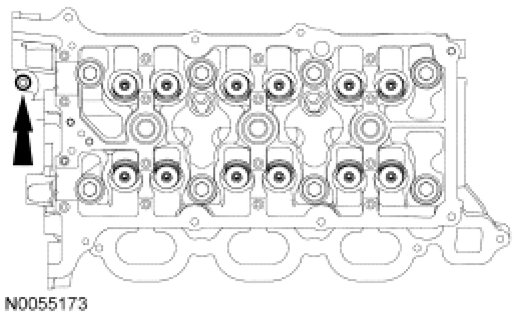


Fig. 531: Identifying M6 Bolt
Courtesy of FORD MOTOR CO.

17. Install a new gasket, the LH cylinder head and 8 new bolts. Tighten in the sequence shown in 5 stages:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten to 35 Nm (26 lb-ft).
    - Stage 3: Tighten 90 degrees.
    - Stage 4: Tighten 90 degrees.
    - Stage 5: Tighten 90 degrees.

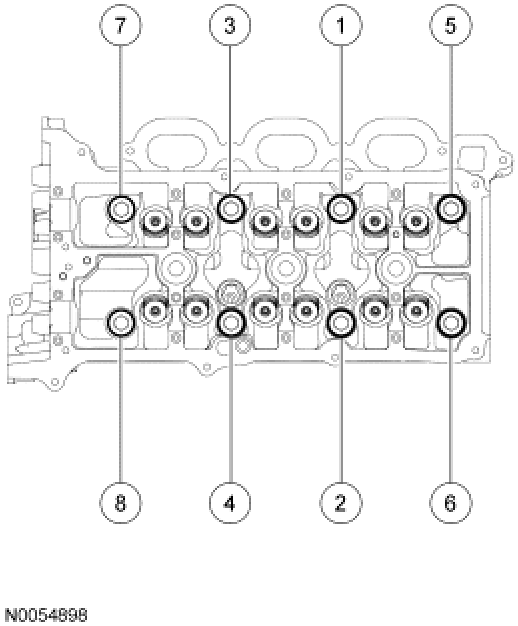


Fig. 532: Installing LH Cylinder Head Bolts In Sequence
Courtesy of FORD MOTOR CO.

18. Install the bolt.
    - Tighten to 10 Nm (89 lb-in).

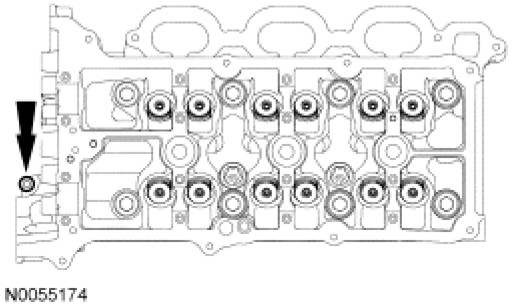


Fig. 533: Identifying M6 Bolt
Courtesy of FORD MOTOR CO.

CAUTION: The crankshaft must remain in the freewheeling position (crankshaft dowel pin at 9 o'clock) until after the camshafts are installed and the valve clearance is checked/adjusted. Do not turn the crankshaft until instructed to do so. Failure to follow this process will result in severe engine damage.

19. Position the crankshaft dowel pin in the 9 o'clock position.

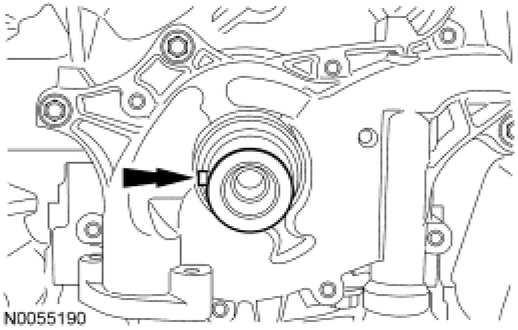


Fig. 534: Positioning Crankshaft Dowel Pin In 9 O'clock Position
Courtesy of FORD MOTOR CO.

NOTE: The valve tappets must be installed in their original positions.

NOTE: Coat the valve tappets with clean engine oil prior to installation.

NOTE: LH shown, RH similar.

20. Install the valve tappets.

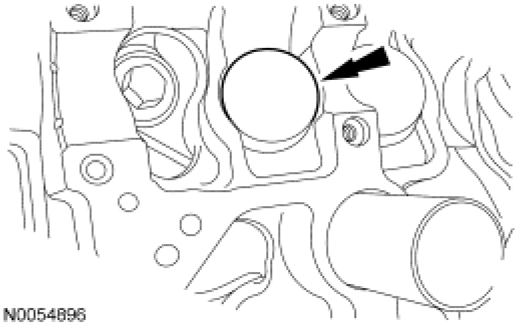


Fig. 535: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

CAUTION: The camshafts must remain in the neutral position during installation or engine damage may occur.

NOTE: **Coat the camshafts with clean engine oil prior to installation.**

21. Position the camshafts onto the RH cylinder head in the neutral position as shown.

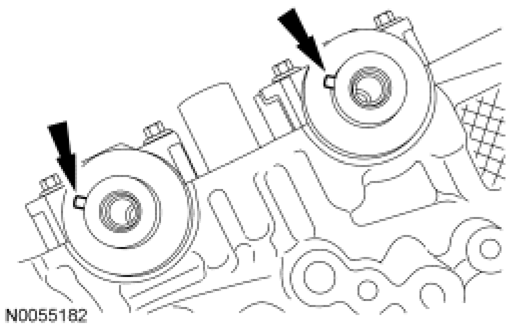


Fig. 536: Positioning Camshafts Onto RH Cylinder Head In Neutral Position
Courtesy of FORD MOTOR CO.

NOTE: **Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.**

22. Install the 8 camshaft caps and the 16 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

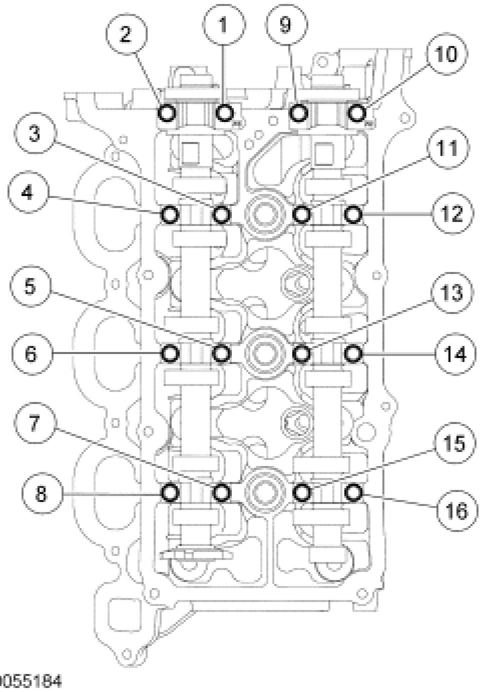


Fig. 537: Installing Camshaft Caps & Bolts In Sequence
Courtesy of FORD MOTOR CO.

CAUTION: The camshafts must remain in the neutral position during installation or engine damage may occur.

NOTE: Coat the camshafts with clean engine oil prior to installation.

23. Position the camshafts onto the LH cylinder head in the neutral position as shown.

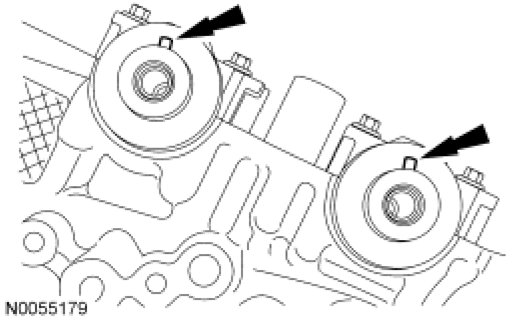


Fig. 538: Positioning Camshafts Onto LH Cylinder Head In Neutral Position
Courtesy of FORD MOTOR CO.

NOTE: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.

24. Install the 8 camshaft caps and the 16 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

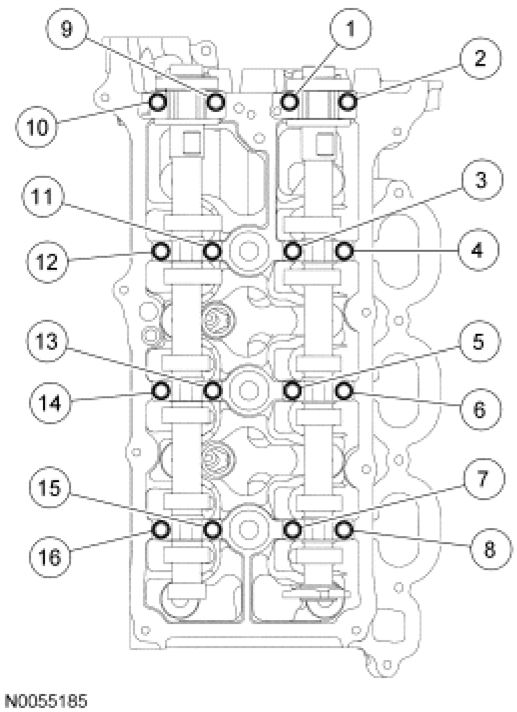


Fig. 539: Installing Camshaft Caps & Bolts In Sequence
Courtesy of FORD MOTOR CO.

CAUTION: If any components are installed new, the engine valve clearance must be checked/adjusted or engine damage may occur.

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

25. Using a feeler gauge, confirm that the valve tappet clearances are within specification. If valve tappet clearances are not within specification, the clearance must be adjusted by installing new valve tappet(s) of the correct size. For additional information, refer to **Valve Clearance Check**.

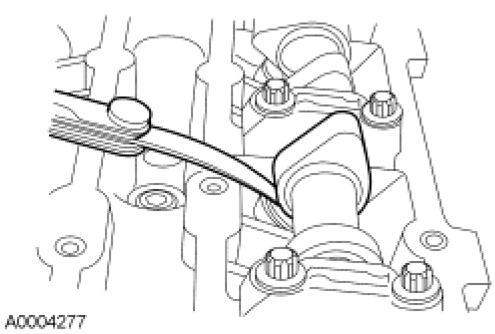


Fig. 540: Measuring Valve Clearance
Courtesy of FORD MOTOR CO.

26. Install the RH primary timing chain guide and the 2 bolts.

- Tighten to 10 Nm (89 lb-in).

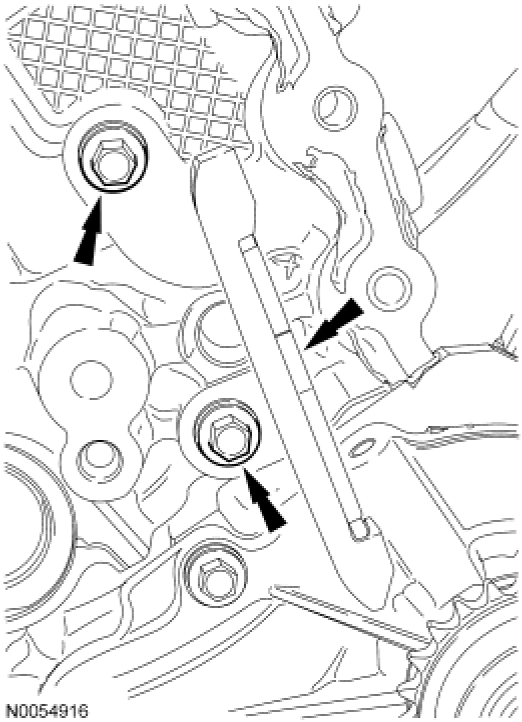


Fig. 541: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

27. Install the RH secondary timing chain tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

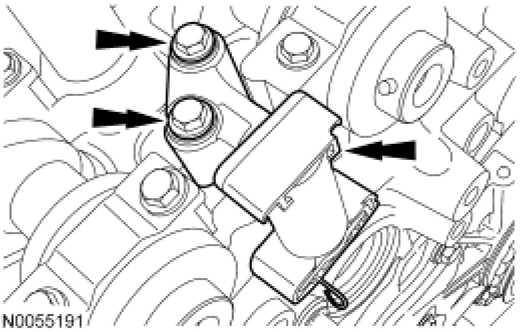


Fig. 542: Locating RH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

28. Rotate the RH camshafts to the top dead center (TDC) position and install the special tool on the flats of the camshafts.

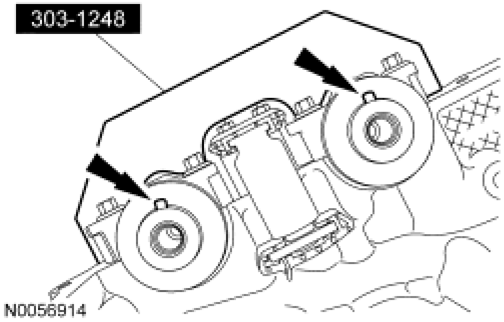


Fig. 543: Installing Special Tool (303-1248) On Flats Of Camshafts
Courtesy of FORD MOTOR CO.

29. Assemble the RH variable camshaft timing (VCT) assembly, the RH exhaust camshaft sprocket and the RH secondary timing chain.
    - Align the colored links with the timing marks.

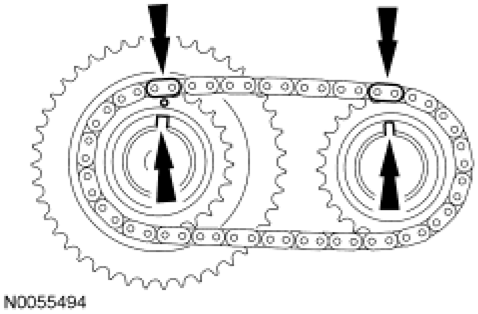


Fig. 544: Aligning RH Exhaust Camshaft Sprocket & RH Secondary Timing Chain Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

30. Position the RH secondary timing assembly onto the camshafts.

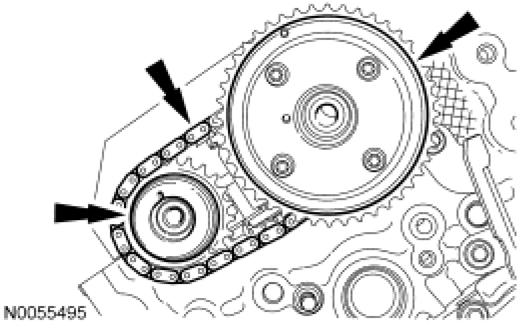


Fig. 545: Positioning RH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

31. Install 2 new bolts and the original washer. Tighten in 4 stages.

- Stage 1: Tighten to 40 Nm (30 lb-ft).
- Stage 2: Loosen one full turn.
- Stage 3: Tighten to 10 Nm (89 lb-in).
- Stage 4: Tighten 90 degrees.

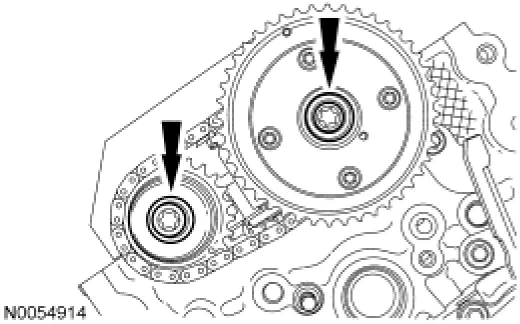


Fig. 546: Locating RH VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

32. Remove the lock pin from the RH secondary timing chain tensioner.

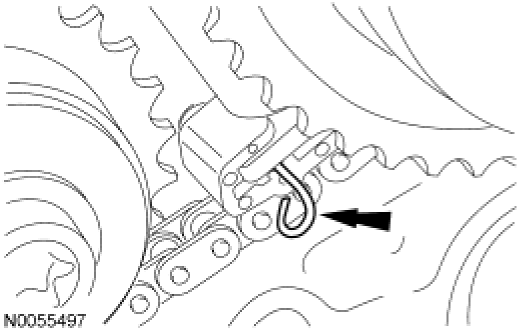


Fig. 547: Identifying Lock Pin On RH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

33. Install the LH secondary timing chain tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

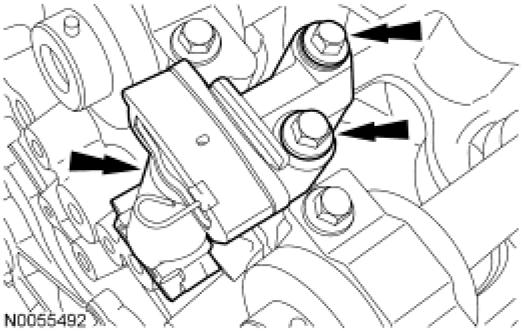


Fig. 548: Locating LH Secondary Timing Chain Tensioner & Bolt
Courtesy of FORD MOTOR CO.

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

34. Rotate the LH camshafts to the TDC position and install the special tool on the flats of the camshafts.

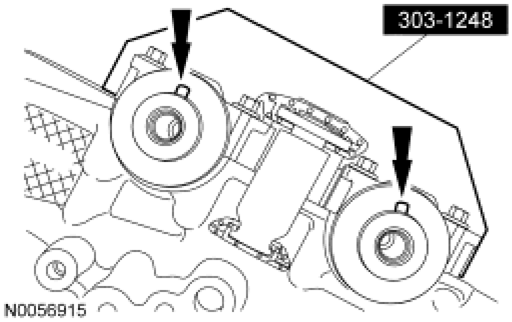


Fig. 549: Installing Special Tool (303-1248) On Flats Of Camshafts
Courtesy of FORD MOTOR CO.

35. Assemble the LH VCT assembly, the LH exhaust camshaft sprocket and the LH secondary timing chain.
    - Align the colored links with the timing marks.

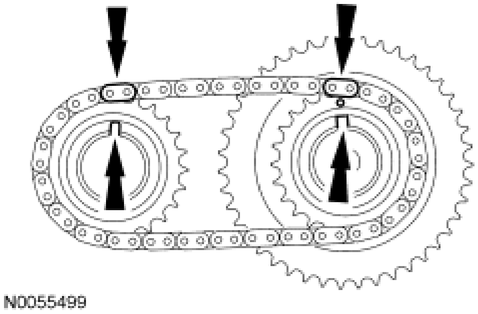


Fig. 550: Aligning LH Exhaust Camshaft Sprocket & LH Secondary Timing Chain Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

36. Position the LH secondary timing assembly onto the camshafts.

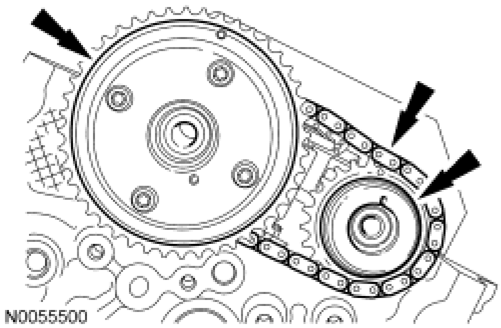


Fig. 551: Positioning LH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

37. Install 2 new bolts and the original washer. Tighten in 4 stages.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 10 Nm (89 lb-in).
    - Stage 4: Tighten 90 degrees.

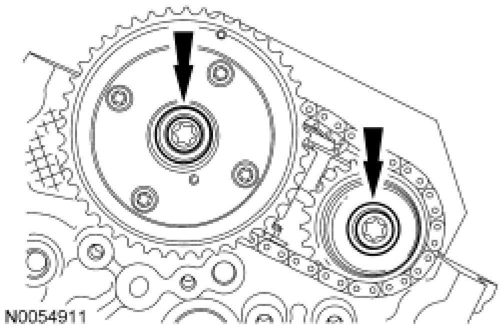


Fig. 552: Locating LH VCT Assembly Bolt & LH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

38. Remove the lock pin from the LH secondary timing chain tensioner.

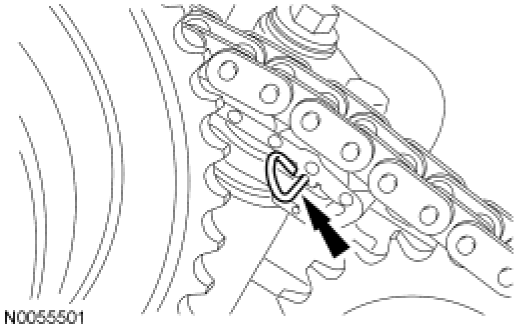


Fig. 553: Locating Lock Pin On LH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

39. Rotate the crankshaft clockwise 60 degrees to the TDC position (crankshaft dowel pin at 11 o'clock).

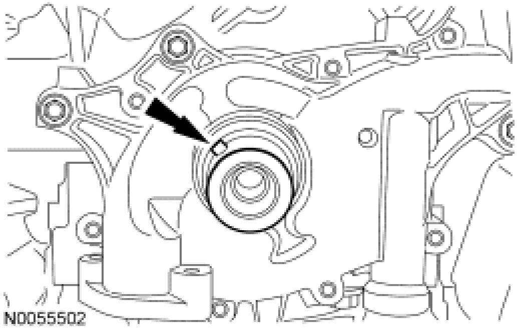


Fig. 554: Identifying Crankshaft Dowel Pin
Courtesy of FORD MOTOR CO.

40. Install the crankshaft timing chain sprocket.

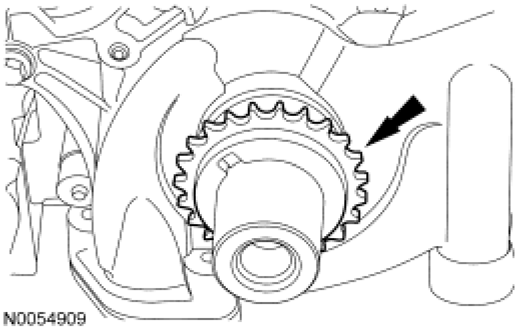


Fig. 555: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

41. Install the primary timing chain with the colored links aligned with the timing marks on the VCT assemblies and the crankshaft sprocket.

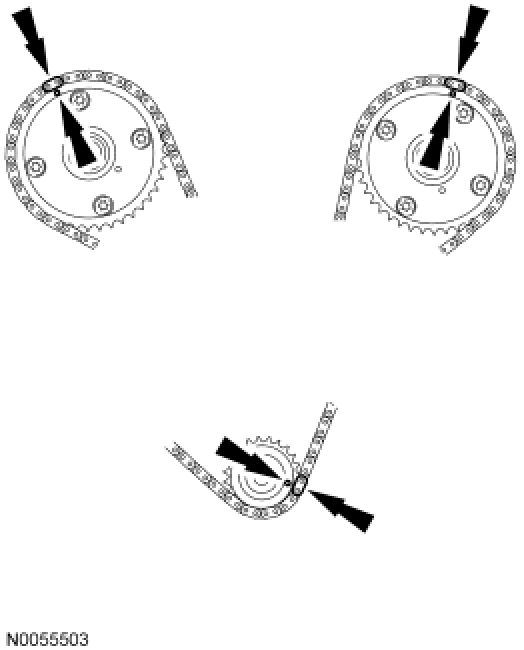


Fig. 556: Aligning Timing Marks On VCT Assemblies & Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

42. Install the upper LH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

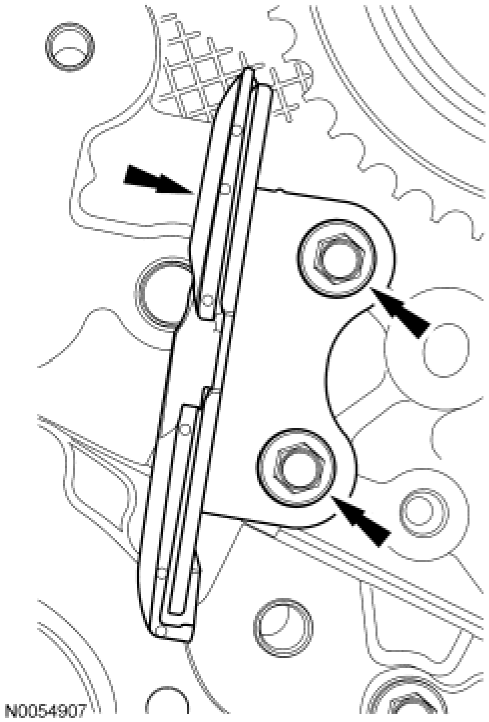


Fig. 557: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

43. Install the lower LH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

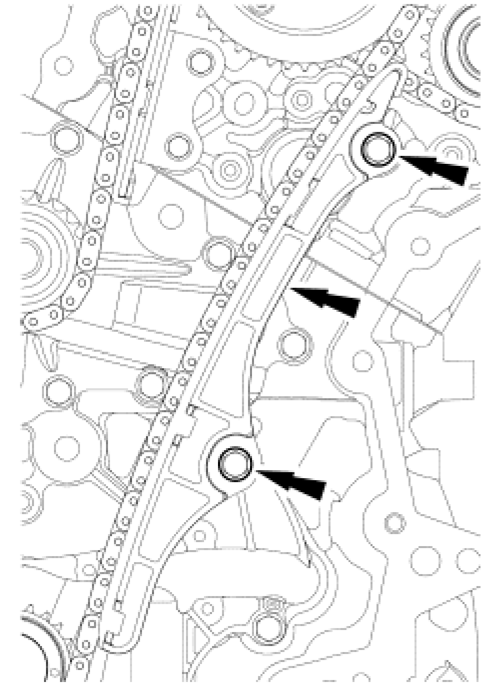


Fig. 558: Locating Lower LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

44. Install the primary timing chain tensioner arm.

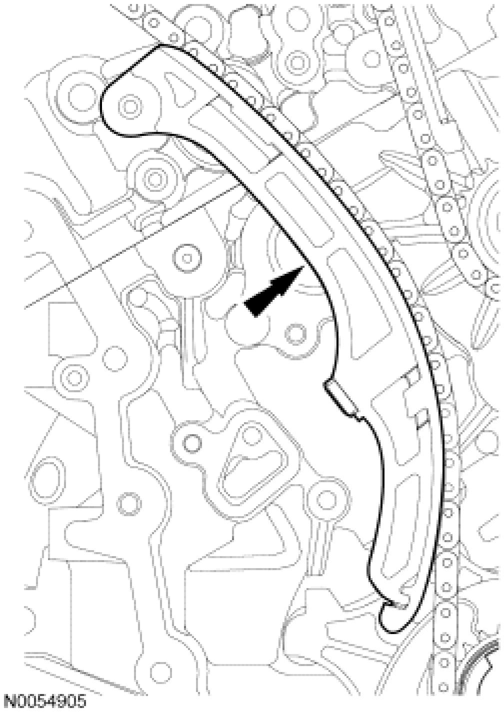


Fig. 559: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

45. Reset the primary timing chain tensioner.
    - Rotate the lever counterclockwise.
    - Using a soft-jawed vise, compress the plunger.
    - Align the hole in the lever with the hole in the tensioner housing.
    - Install a suitable lock pin.

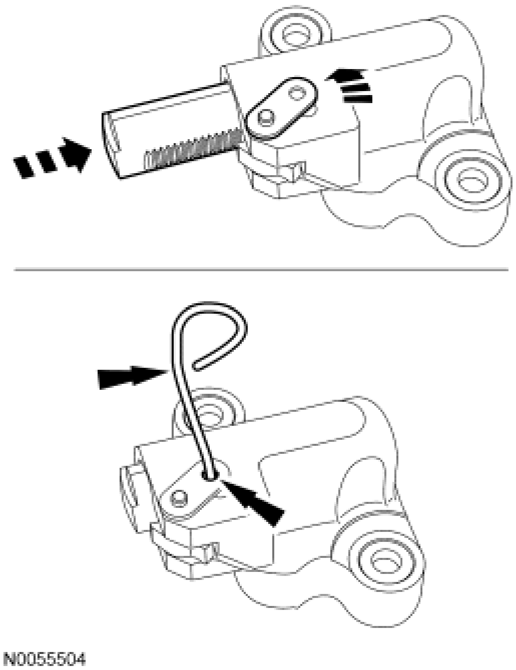


Fig. 560: Compressing Plunger Using A Soft-Jawed Vise
Courtesy of FORD MOTOR CO.

NOTE: It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.

46. Install the primary tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).
    - Remove the lock pin.

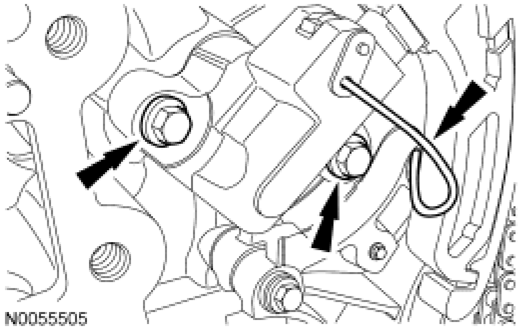


Fig. 561: Locating Primary Tensioner Bolts
Courtesy of FORD MOTOR CO.

47. As a post-check, verify correct alignment of all timing marks.

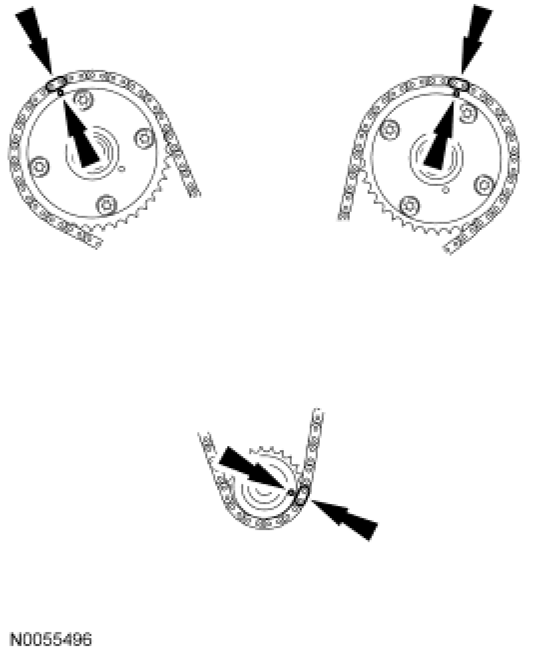


Fig. 562: Verifying Correct Alignment Of All Timing Marks
Courtesy of FORD MOTOR CO.

48. Install new VCT housing seals.

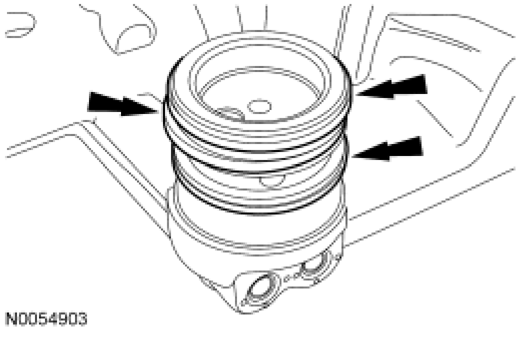


Fig. 563: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

CAUTION: Make sure the dowels on the variable camshaft timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

49. Install the LH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

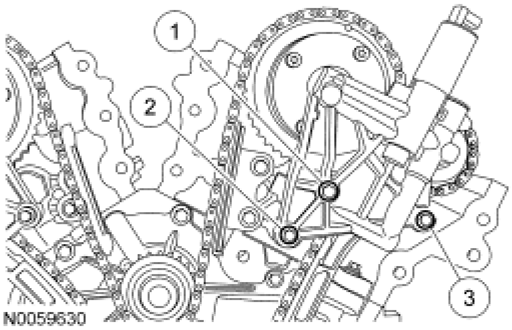


Fig. 564: Identifying LH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

CAUTION: Make sure the dowels on the variable camshaft timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

50. Install the RH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

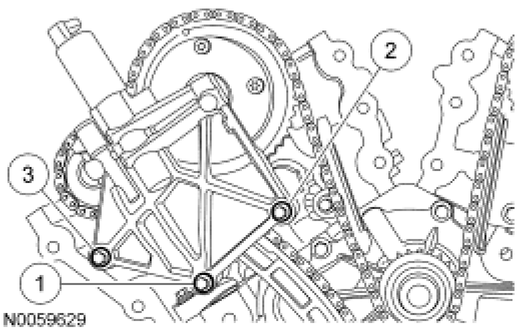


Fig. 565: Identifying RH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

51. Install the special tools.

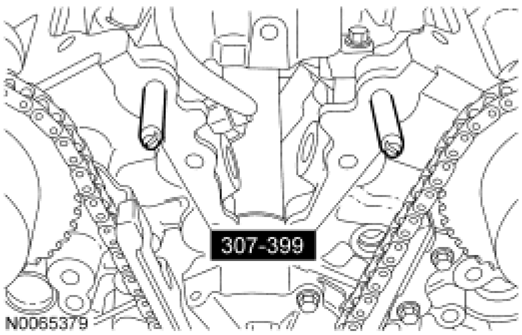


Fig. 566: Identifying Special Tool (307-399)
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The engine front cover and bolts 17, 18, 19 and 20 must be installed within 4 minutes of the initial sealant application. The remainder of the engine front cover bolts and the engine mount bracket bolts must be installed and tightened within 35 minutes of the initial sealant application. If the time limits are exceeded, the sealant must be removed, the sealing area cleaned and sealant reapplied. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

52. Apply a 3.0 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover sealing surfaces including the 3 engine mount bracket bosses.
    - Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the oil pan-to-cylinder block joint and the cylinder head-to-cylinder block joint areas of the engine front cover in 5 places as indicated.

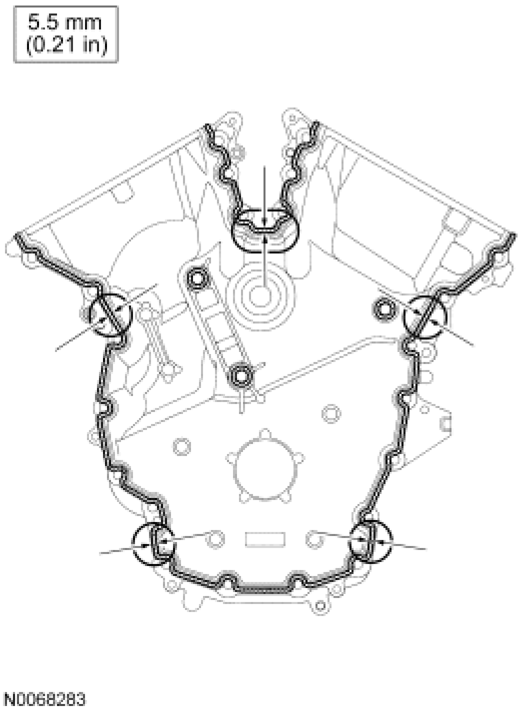


Fig. 567: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover Sealing Surfaces
Courtesy of FORD MOTOR CO.

NOTE: Make sure the 2 locating dowel pins are seated correctly in the cylinder block.

53. Install the engine front cover and bolts 17, 18, 19 and 20.
    - Tighten in sequence to 3 Nm (27 lb-in).

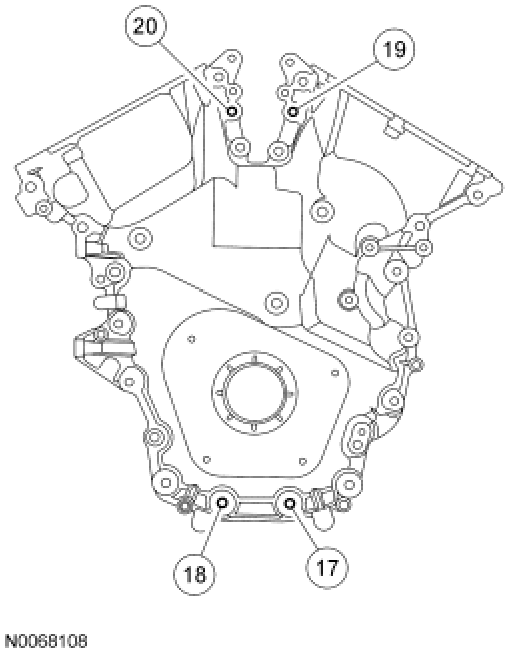


Fig. 568: Installing Engine Front Cover & Bolts In Sequence
Courtesy of FORD MOTOR CO.

54. Remove the special tools (alignment pins).

NOTE: **Do not tighten the bolts at this time.**

55. Install the engine mount bracket and the 3 bolts.

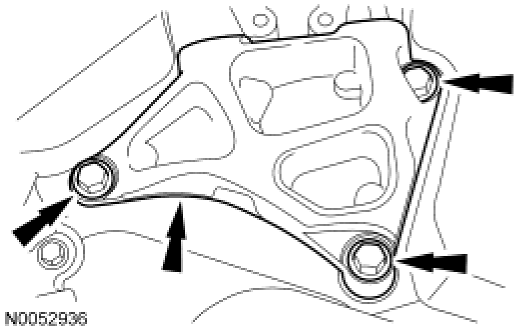
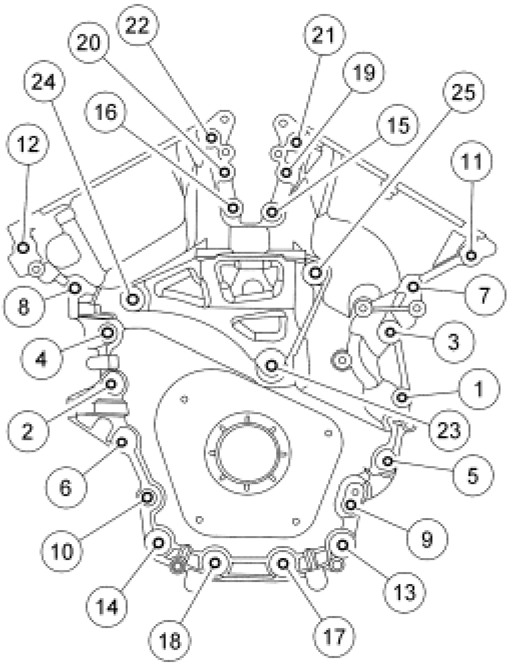


Fig. 569: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

CAUTION: **Do not expose the Motorcraft High Performance Engine RTV Silicone**

to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

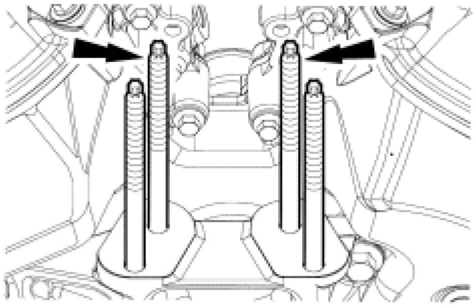
56. Install the remaining engine front cover bolts. Tighten all of the engine front cover bolts and engine mount bracket bolts in the sequence shown in 2 stages:
    - Stage 1: Tighten bolts 1 thru 22 to 10 Nm (89 lb-in) and bolts 23, 24 and 25 to 15 Nm (11 lb-ft).
    - Stage 2: Tighten bolts 1 thru 22 to 24 Nm (18 lb-ft) and bolts 23, 24 and 25 to 75 Nm (55 lb-ft).



N0068109

Fig. 570: Identifying Tightening Of Engine Front Cover Bolts & Engine Mount Bracket Bolts In Sequence
Courtesy of FORD MOTOR CO.

57. Install the 2 engine mount studs.
    - Tighten to 18 Nm (13 lb-ft).



N0057960

Fig. 571: Locating Engine Mount Studs

Courtesy of FORD MOTOR CO.

58. Install the engine mount bracket and the 2 bolts.
    - Tighten to 24 Nm (18 lb-ft).

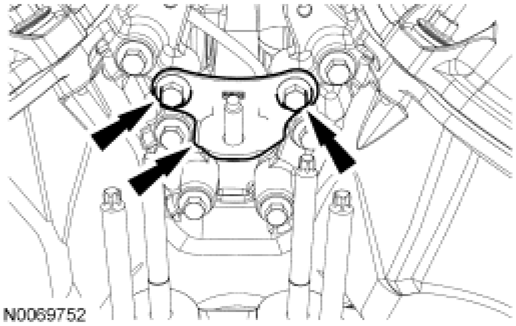


Fig. 572: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

NOTE: Apply clean engine oil to the crankshaft front seal bore in the engine front cover.

59. Using the special tools, install a new crankshaft front seal.

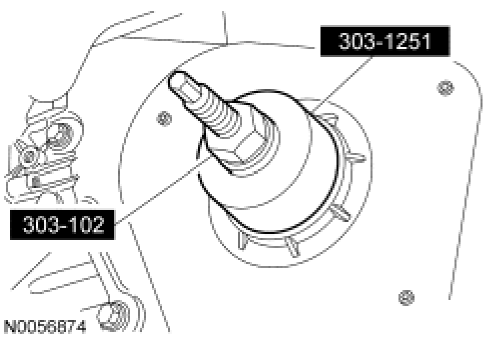


Fig. 573: Installing Crankshaft Front Seal Using Special Tools (303-102) & (303-1251)
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the outside diameter sealing surfaces with clean engine oil.

60. Using the special tools, install the crankshaft pulley.

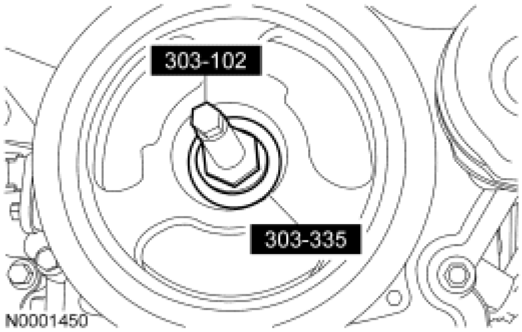


Fig. 574: Installing Crankshaft Pulley
Courtesy of FORD MOTOR CO.

61. Using the special tool, install the crankshaft pulley washer and new bolt and tighten in 4 stages.
    - Stage 1: Tighten to 120 Nm (89 (lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.

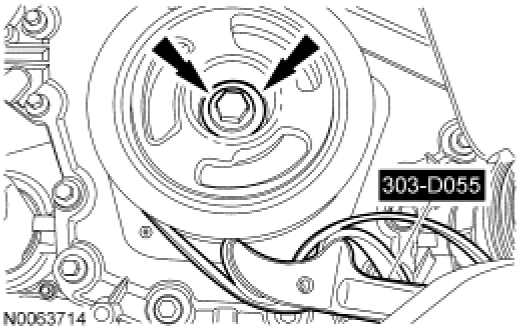


Fig. 575: Installing Crankshaft Pulley Washer & Bolt Using Special Tools (303-D055)
Courtesy of FORD MOTOR CO.

NOTE: Installation of new seals is only required if damaged seals were removed during disassembly of the engine.

NOTE: Spark plug tube seal installation shown, VCT seal installation similar.

62. Using the special tools, install new VCT solenoid and/or spark plug tube seals.

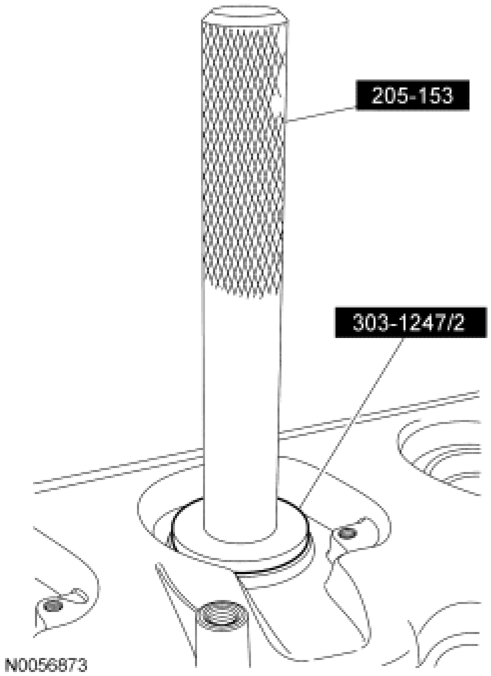


Fig. 576: Installing VCT Solenoid And/Or Spark Plug Tube Seals Using Special Tools (205-153) & (303-1247/2)
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

63. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-RH cylinder head joints.

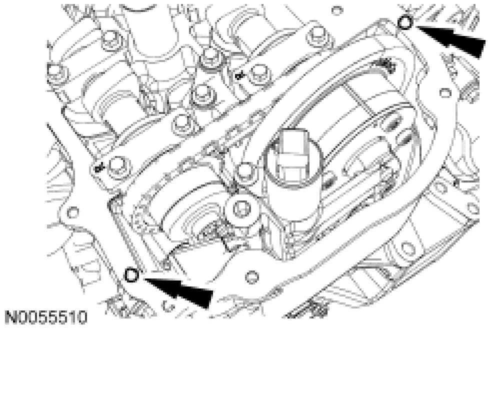


Fig. 577: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-RH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

64. Using a new gasket, install the RH valve cover, bolt and the 10 stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

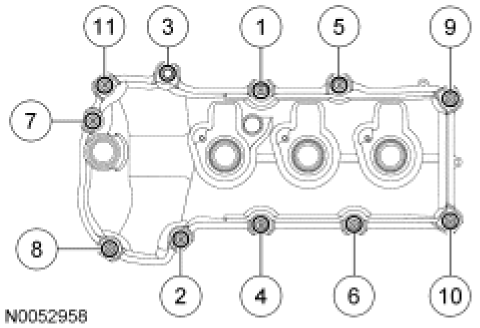


Fig. 578: Installing RH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

65. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-LH cylinder head joints.

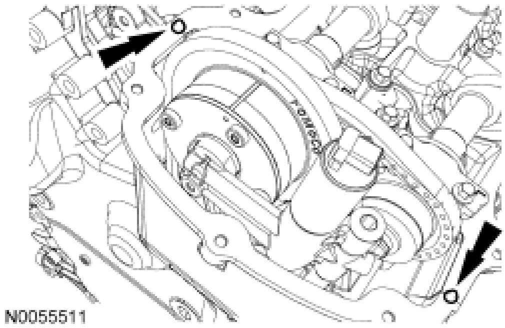


Fig. 579: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-LH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

66. Using a new gasket, install the LH valve cover and 11 stud bolts.

- Tighten in the sequence shown to 10 Nm (89 lb-in).

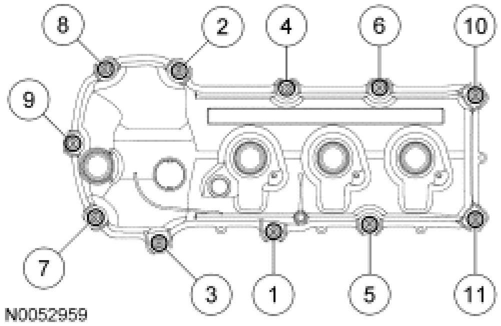


Fig. 580: Installing LH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

67. Install the wiring harness retaining bracket and the 2 nuts.
    - Tighten to 9 Nm (80 lb-in).

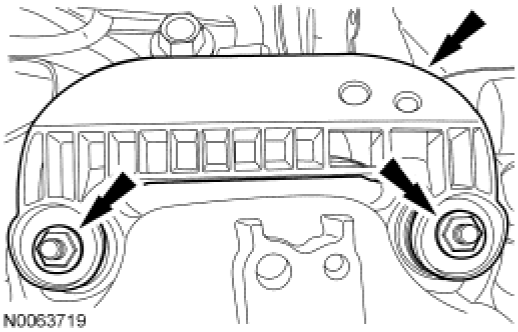


Fig. 581: Identifying Wiring Harness Retaining Bracket & Nuts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

68. Install the 6 coil-on-plug assemblies and the 6 bolts.
    - Tighten to 7 Nm (62 lb-in).

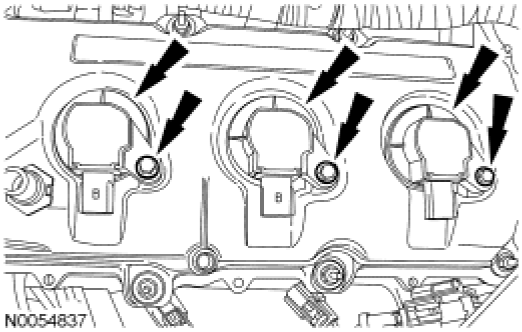


Fig. 582: Locating Coil-On-Plugs & Bolts

Courtesy of FORD MOTOR CO.

69. Using a new gasket and O-ring seal, install the oil filter adapter and the 2 bolts.
    - Tighten the large bolt to 57 Nm (42 lb-ft).
    - Tighten the small bolt to 10 Nm (89 lb-in).

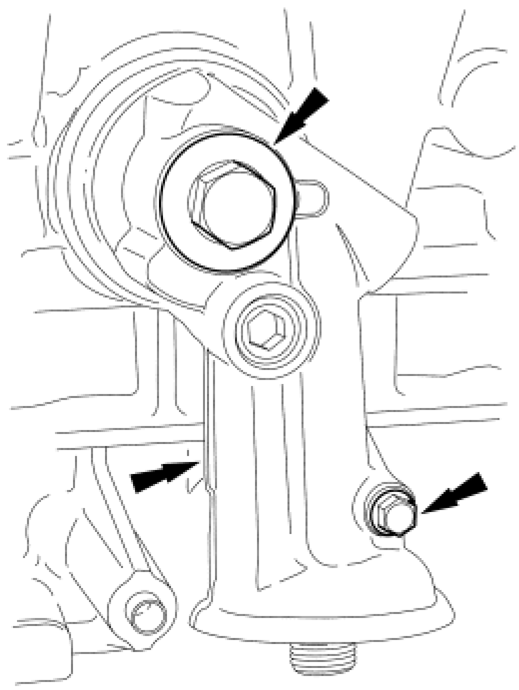


Fig. 583: Locating Oil Filter Adapter & Bolts
Courtesy of FORD MOTOR CO.

NOTE: **Apply pipe sealant with Teflon® to the engine oil pressure (EOP) switch threads.**

70. Install the EOP switch.
    - Tighten to 18 Nm (13 lb-ft).

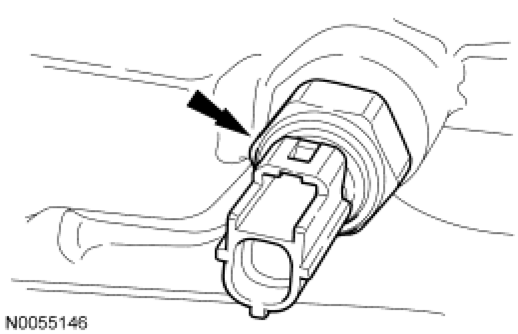


Fig. 584: Identifying EOP Switch

Courtesy of FORD MOTOR CO.

71. Install the crankshaft position (CKP) sensor and install the bolt.
    - Tighten to 10 Nm (89 lb-in).

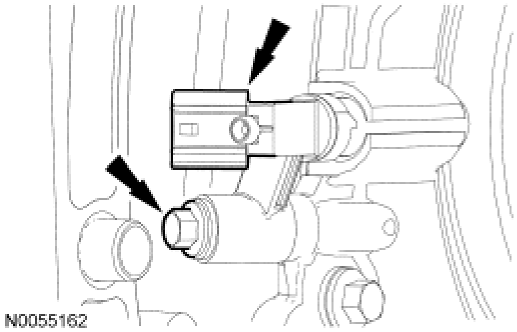


Fig. 585: Identifying CKP Sensor & Bolt
Courtesy of FORD MOTOR CO.

72. Install LH camshaft position (CMP) sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).

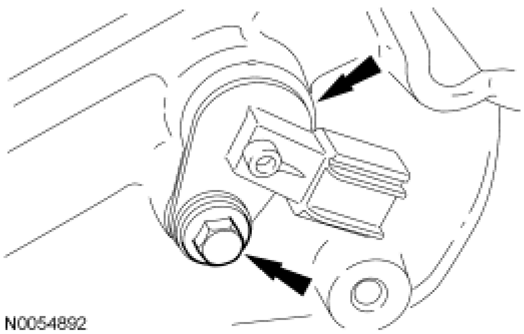


Fig. 586: Locating LH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

73. Install and connect the cylinder head temperature (CHT) sensor jumper harness.

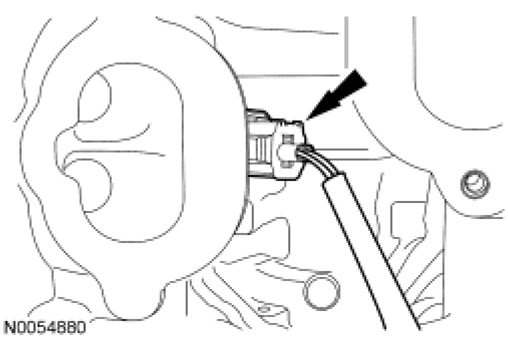


Fig. 587: Identifying CHT Sensor Jumper Harness

Courtesy of FORD MOTOR CO.

74. Using new gaskets, install the lower intake manifold and the 10 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

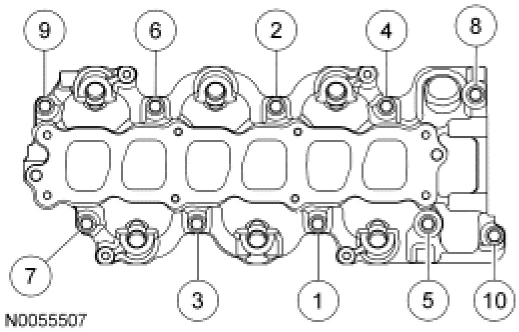


Fig. 588: Installing Lower Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

75. Using a new gasket, install the thermostat housing and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

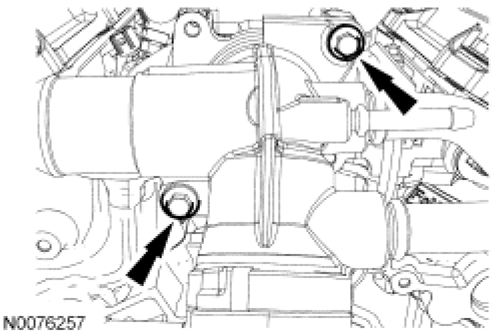


Fig. 589: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Use O-ring seals that are made of special fuel-resistant material. The use of ordinary O-rings may cause the fuel system to leak. Do not reuse the O-ring seals.

NOTE: The upper and lower O-ring seals are not interchangeable.

76. Install new fuel injector O-ring seals.
    - Remove the retaining clips and separate the fuel injectors from the fuel rail.
    - Remove and discard the O-ring seals.
    - Install new O-ring seals and lubricate with clean engine oil.
    - Install the fuel injectors and the retaining clips onto the fuel rail.

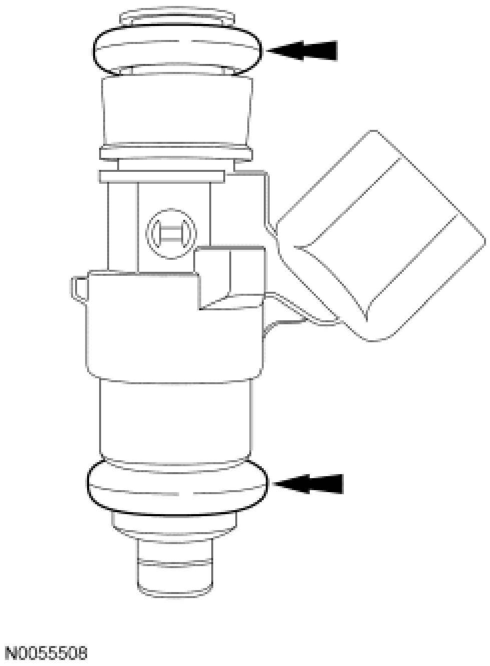


Fig. 590: Identifying Fuel Injector O-Ring Seals
Courtesy of FORD MOTOR CO.

77. Install the fuel rail and injectors as an assembly and install the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).

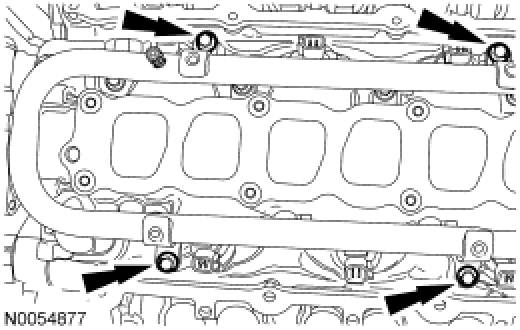


Fig. 591: Locating Fuel Rail And Injectors & Bolts
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

78. Install the catalytic converter bracket and the 2 bolts.
    - Tighten to 40 Nm (30 lb-ft).

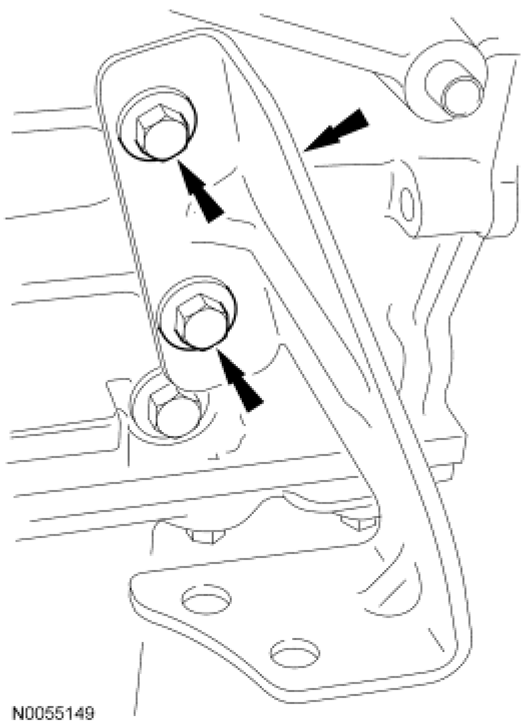


Fig. 592: Locating Catalytic Converter Bracket & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

79. Install the RH CMP sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).

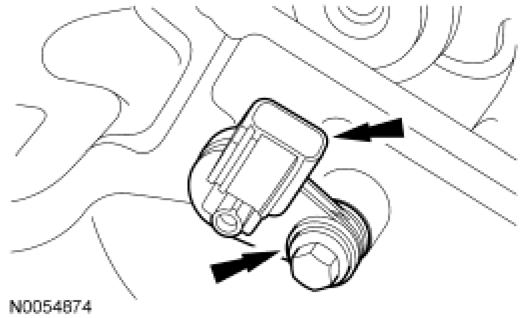


Fig. 593: Locating RH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

80. Install the engine lifting eye and the 2 bolts.
    - Tighten to 24 Nm (18 lb-ft).

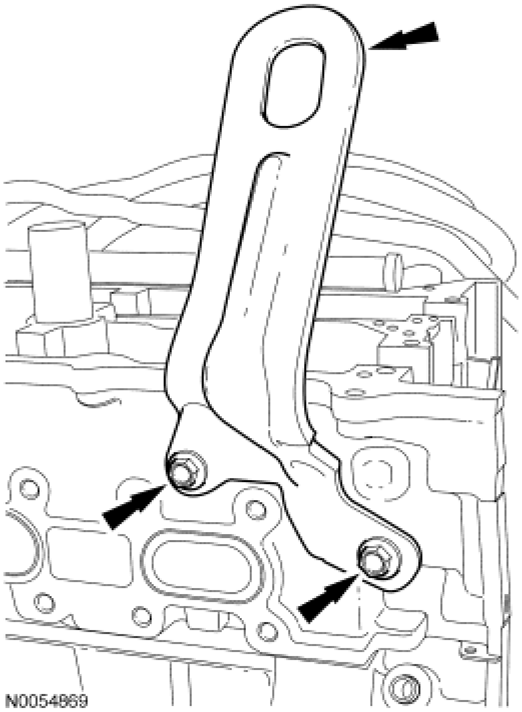


Fig. 594: Locating Engine Lifting Eye & Bolts
Courtesy of FORD MOTOR CO.

81. Install the cover and the pin-type retainer.

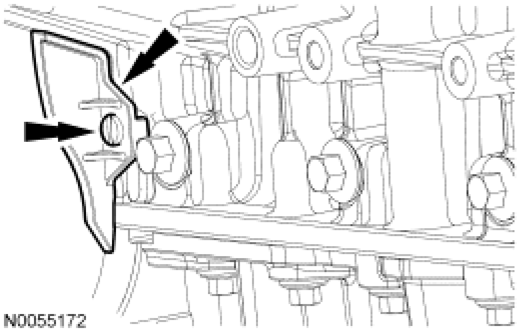


Fig. 595: Locating Pin-Type Retainer & Cover
Courtesy of FORD MOTOR CO.

82. Install the LH cylinder block drain plug.
    - Tighten to 20 Nm (15 lb-ft) plus an additional 180 degrees.

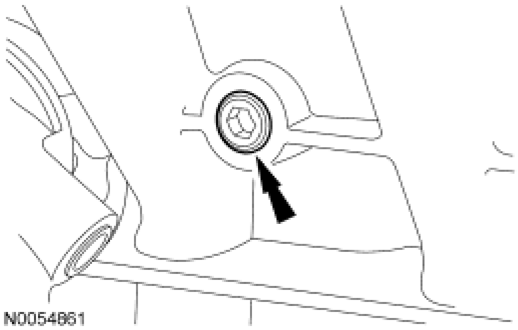


Fig. 596: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

83. Install the RH cylinder block drain plug or, if equipped, the block heater.
    - Tighten to 40 Nm (30 lb-ft).

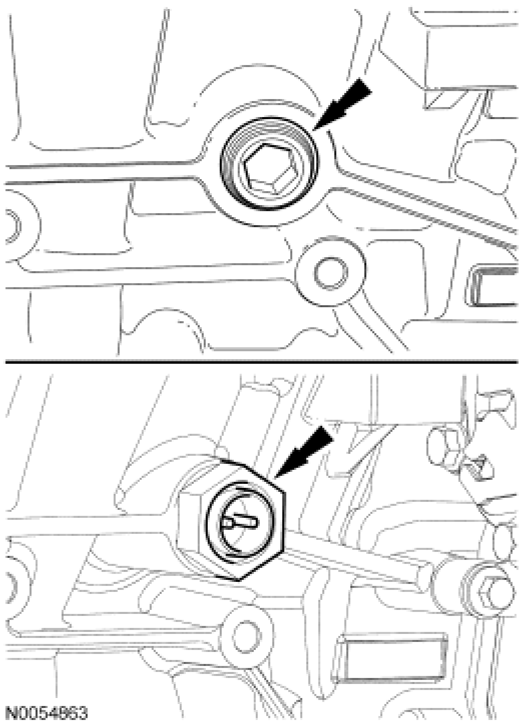


Fig. 597: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

84. Install 6 new RH exhaust manifold studs.
    - Tighten to 12 Nm (9 lb-ft).

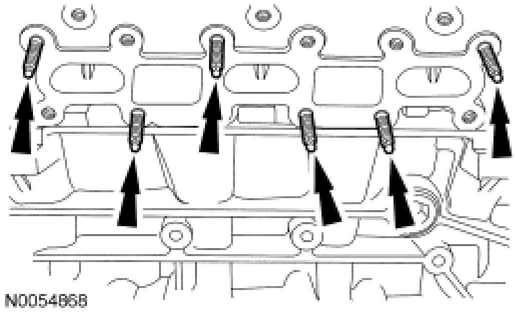


Fig. 598: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

CAUTION: Failure to tighten the exhaust manifold nuts to specification a second time will cause the exhaust manifold to develop an exhaust leak.

85. Using a new gasket, install the RH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten to 20 Nm (15 lb-ft).

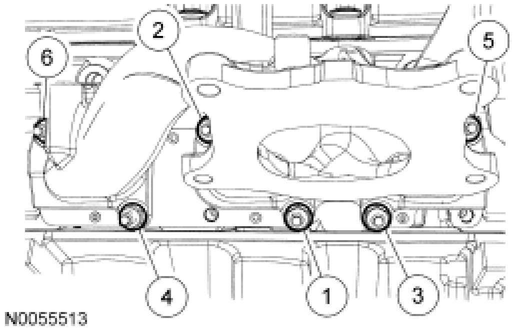


Fig. 599: Installing RH Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

86. Using a new gasket, install the RH catalytic converter and the 4 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

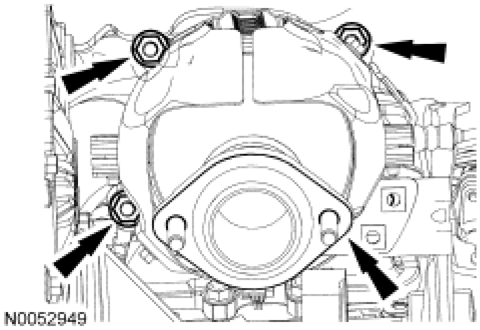


Fig. 600: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

All vehicles

87. Install 6 new LH exhaust manifold studs.
    - Tighten to 12 Nm (9 lb-ft).

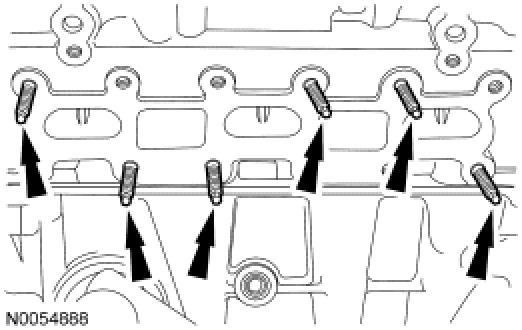


Fig. 601: Locating LH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

CAUTION: Failure to tighten the exhaust manifold nuts to specification a second time will cause the exhaust manifold to develop an exhaust leak.

88. Using a new gasket, install the LH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).
    - Stage 2: Tighten to 20 Nm (15 lb-ft).

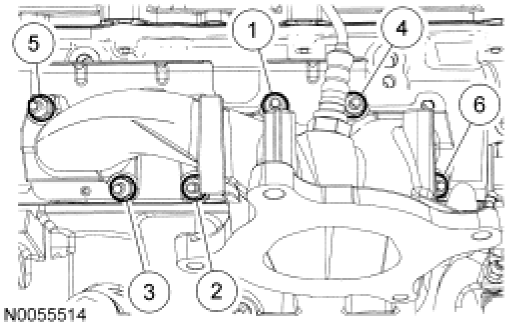


Fig. 602: Installing LH Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

89. Install the LH exhaust manifold heat shield and the 3 bolts.
    - Tighten to 14 Nm (10 lb-ft).

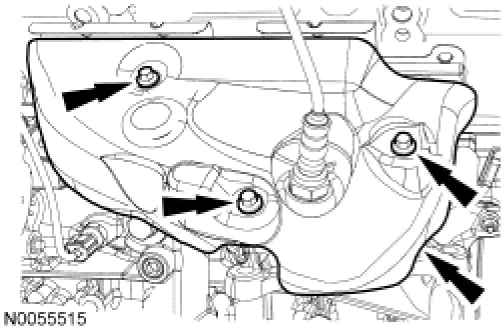


Fig. 603: Locating LH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

90. Using a new gasket, install the LH catalytic converter and the 4 new nuts (3 shown).
    - Tighten to 40 Nm (30 lb-ft).

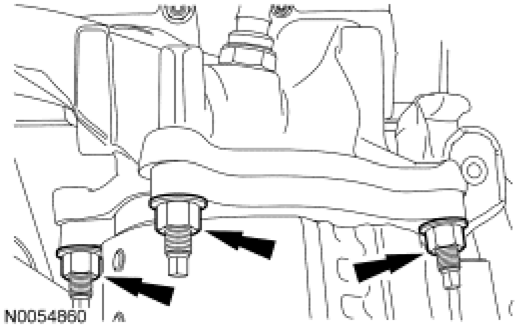


Fig. 604: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

91. Install the accessory drive belt tensioner and the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).

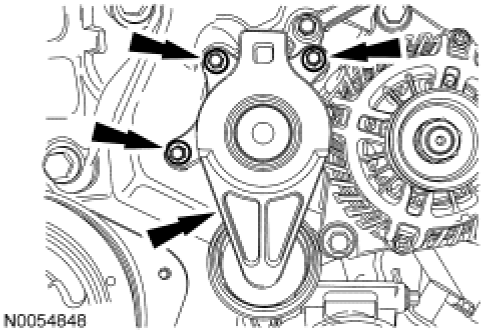


Fig. 605: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

92. Install the power steering pump and the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).

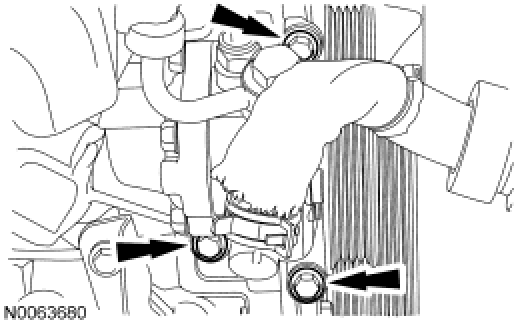


Fig. 606: Locating Power Steering Pump Bolts
Courtesy of FORD MOTOR CO.

93. Install the power steering pressure (PSP) tube bracket and bolt to the RH cylinder head.
    - Tighten to 10 Nm (89 lb-in).

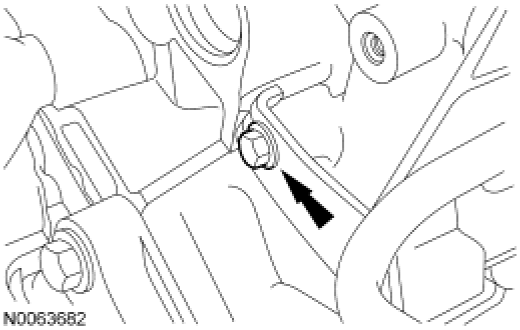


Fig. 607: Identifying Power Steering Pressure (PSP) Tube & Bracket Assembly
Courtesy of FORD MOTOR CO.

94. Install the PSP hose bracket nut.
    - Tighten to 9 Nm (80 lb-in).

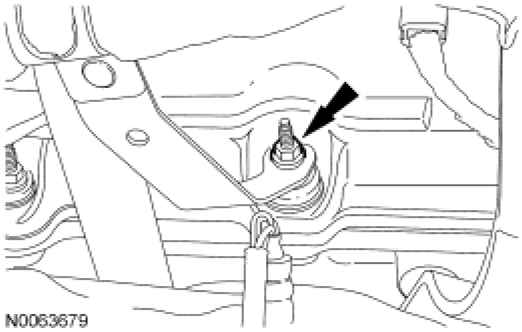


Fig. 608: Identifying PSP Hose Bracket Nut
Courtesy of FORD MOTOR CO.

95. Attach the PSP hose retainer to the engine lifting eye.

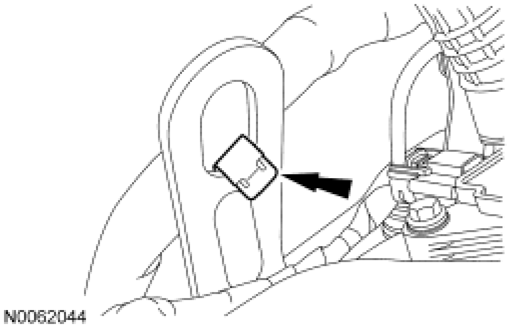


Fig. 609: Locating PSP Hose Retainer From Engine Lifting Eye
Courtesy of FORD MOTOR CO.

96. Install the generator, the nut and the bolt.
    - Tighten to 48 Nm (35 lb-ft).

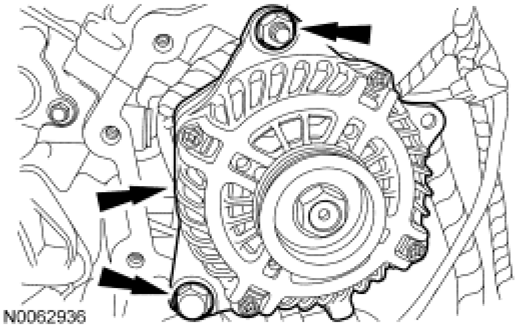


Fig. 610: Locating Generator, Bolts & Nuts
Courtesy of FORD MOTOR CO.

97. Using new O-ring seals, install the A/C manifold and the bolt.
    - Tighten to 25 Nm (18 lb-ft).

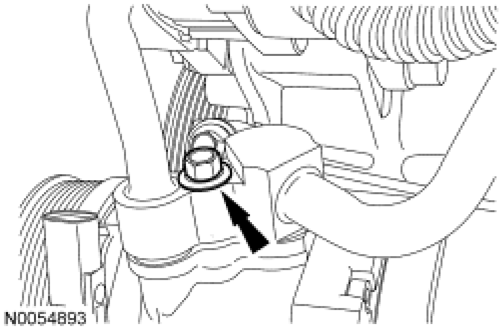


Fig. 611: Locating A/C Manifold Bolt
Courtesy of FORD MOTOR CO.

98. Position the wiring harness onto the engine.
99. Connect the EOP switch electrical connector and the wiring harness pin-type retainer.

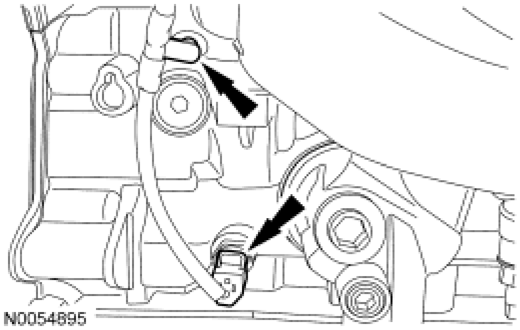


Fig. 612: Locating Engine Oil Pressure (EOP) Switch Electrical Connector & Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

100. Attach the wiring harness retainer to the generator.

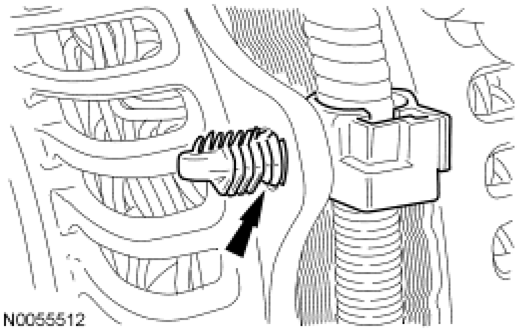


Fig. 613: Identifying Wiring Harness Retainer From Generator
Courtesy of FORD MOTOR CO.

101. Connect the generator electrical connector.

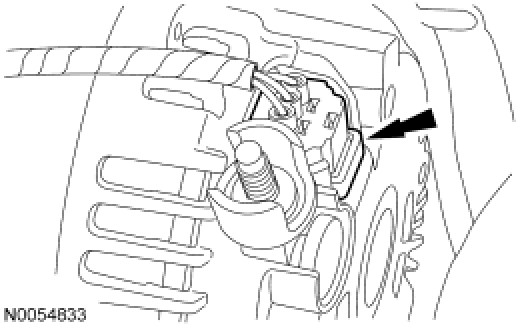


Fig. 614: Identifying Generator Electrical Connector
Courtesy of FORD MOTOR CO.

102. Connect the generator B+ cable and install the nut.
    - Tighten to 6 Nm (53 lb-in).

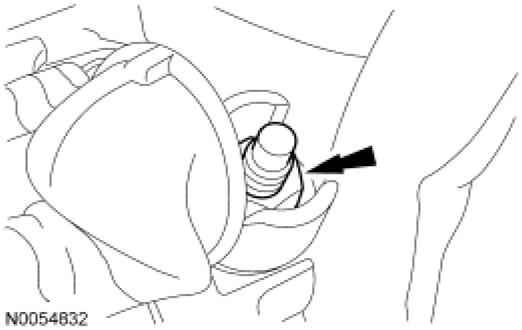


Fig. 615: Identifying Generator B+ Cable & Nut
Courtesy of FORD MOTOR CO.

103. Connect the A/C compressor electrical connector.

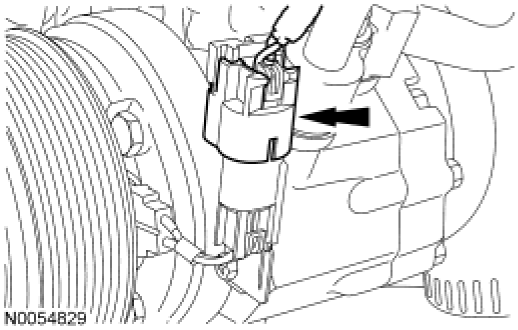


Fig. 616: Identifying A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

104. Connect the CKP sensor electrical connector.

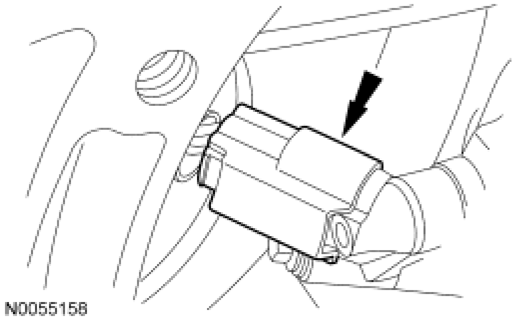


Fig. 617: Identifying Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

105. Install the wiring harness grommet.

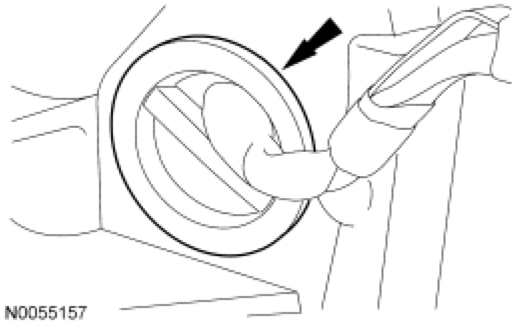


Fig. 618: Identifying Wiring Harness Grommet
Courtesy of FORD MOTOR CO.

106. Install the wiring harness retainer stud bolt.
    - Tighten to 10 Nm (89 lb-in).

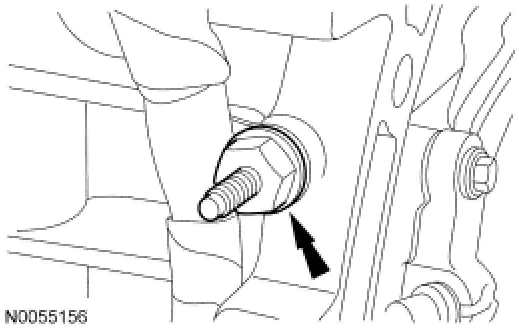


Fig. 619: Identifying Wiring Harness Retainer Stud Bolt
Courtesy of FORD MOTOR CO.

107. Install the heat shield, the nut and the bolt.
    - Tighten to 10 Nm (89 lb-in).

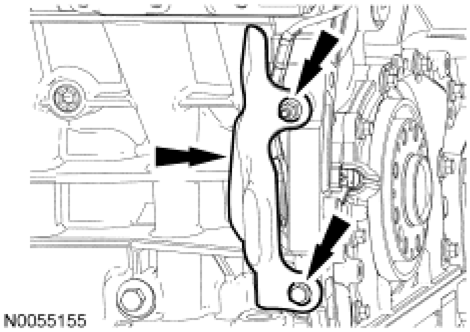


Fig. 620: Identifying Heat Shield, Nut & Bolt
Courtesy of FORD MOTOR CO.

108. Install the wiring harness retainer bolt on the rear of the LH cylinder head.
    - Tighten to 10 Nm (89 lb-in).

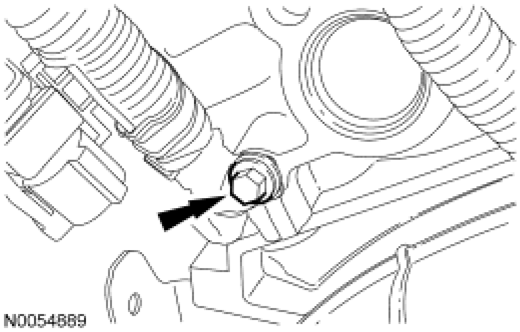


Fig. 621: Identifying Wiring Harness Retainer Bolt From Rear Of LH Cylinder Head
Courtesy of FORD MOTOR CO.

109. Attach all of the wiring harness retainers to the LH valve cover and stud bolts.
110. Connect the LH camshaft VCT solenoid electrical connector.

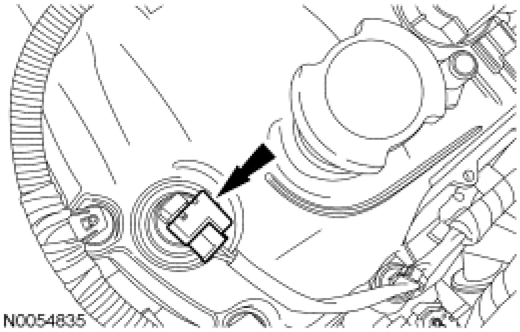


Fig. 622: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

111. Connect the 3 LH coil-on-plug electrical connectors.

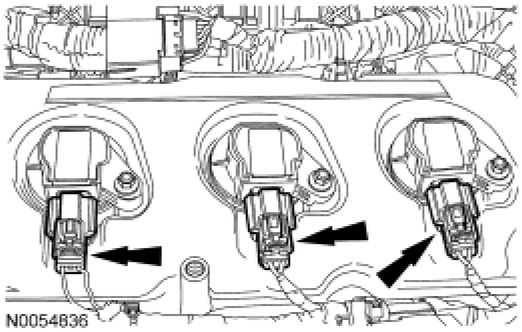


Fig. 623: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

112. Connect the LH HO2S electrical connector.

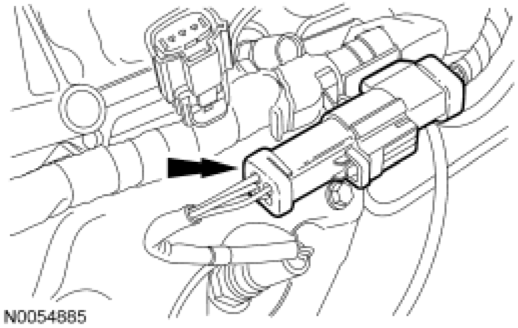


Fig. 624: Locating LH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

113. Connect the LH catalyst monitor sensor electrical connector.

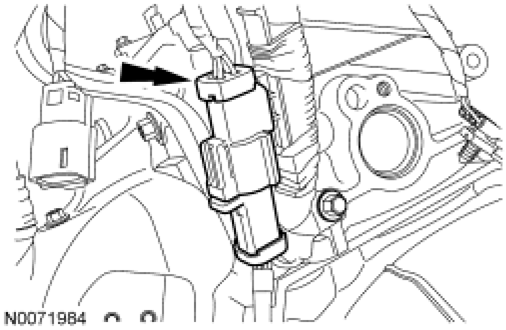


Fig. 625: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

114. Connect the LH CMP sensor electrical connector.

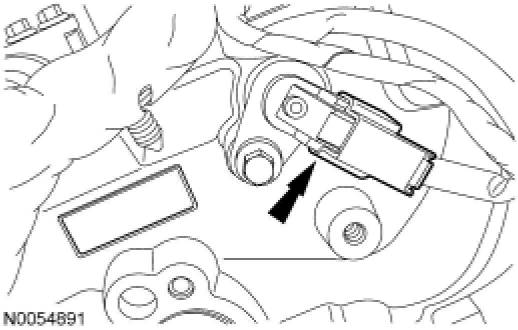


Fig. 626: Locating LH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

115. Connect the CHT sensor electrical connector.

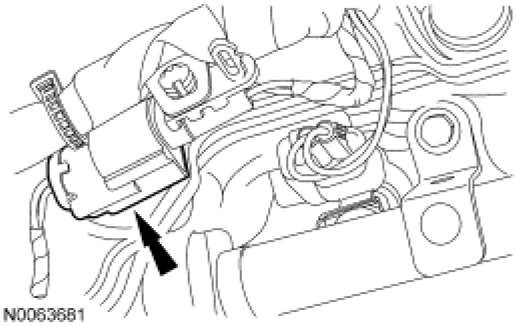


Fig. 627: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

116. Connect the 6 fuel injector electrical connectors (3 shown).

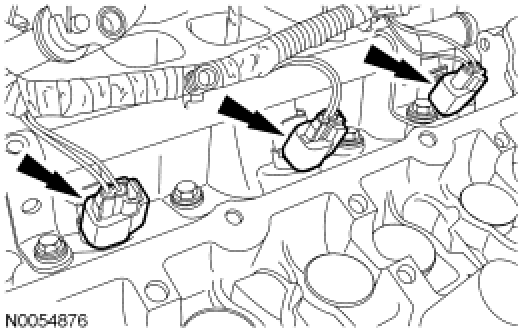


Fig. 628: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

117. Connect the KS electrical connector.

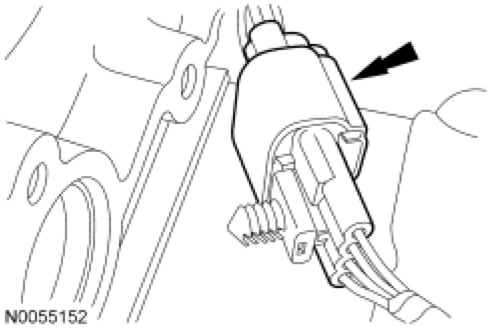


Fig. 629: Locating Knock Sensor (KS) Electrical Connector
Courtesy of FORD MOTOR CO.

118. Connect the RH CMP sensor electrical connector.

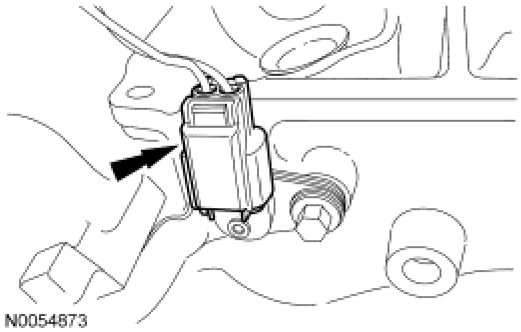


Fig. 630: Locating RH Camshaft Position (CMP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

119. Connect the coolant bypass hose to the thermostat housing.

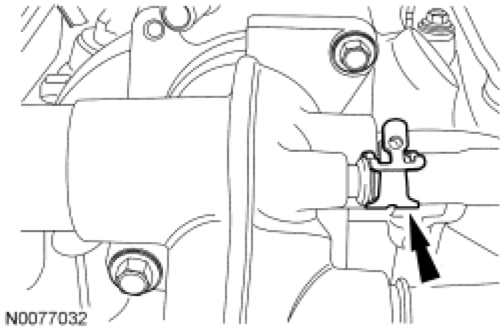


Fig. 631: Identifying Coolant Bypass Hose From Thermostat Housing
Courtesy of FORD MOTOR CO.

120. Attach all of the wiring harness retainers to the RH valve cover and stud bolts.
121. If equipped, connect the heated PCV valve electrical connector.

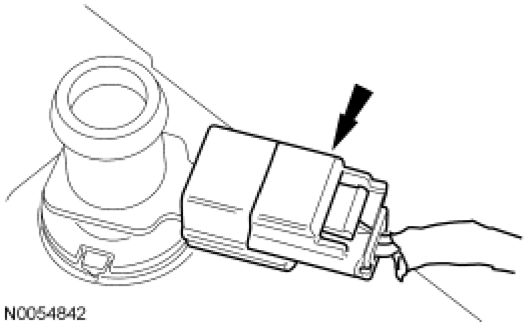


Fig. 632: Locating Heated PCV Valve Electrical Connector
Courtesy of FORD MOTOR CO.

122. Connect the 3 RH coil-on-plug electrical connectors.

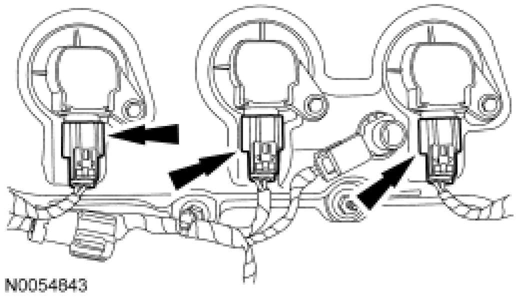


Fig. 633: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

123. Connect the RH VCT solenoid electrical connector.

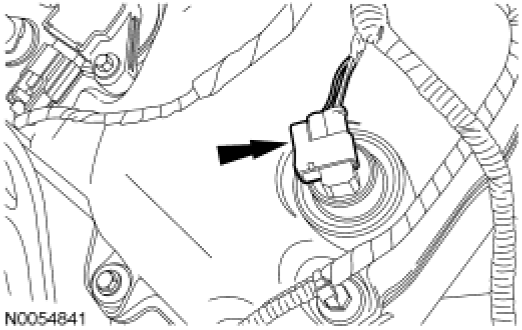


Fig. 634: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

FWD vehicles

124. Connect the RH catalyst monitor sensor electrical connector.

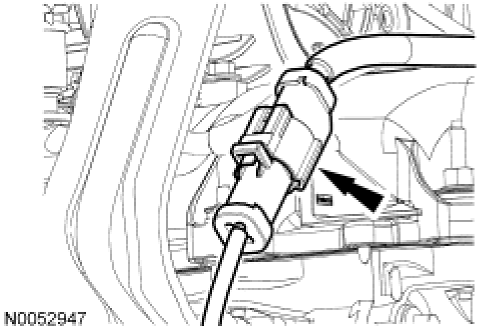


Fig. 635: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

125. Connect the PSP switch electrical connector.

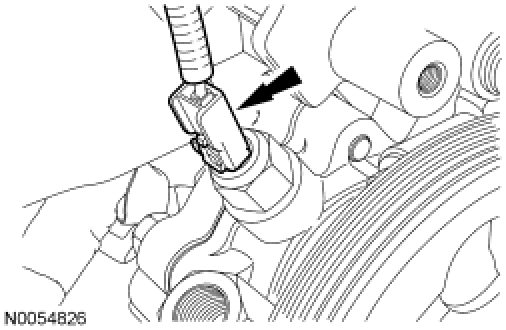


Fig. 636: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

126. Using new gaskets, install the upper intake manifold and the 6 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

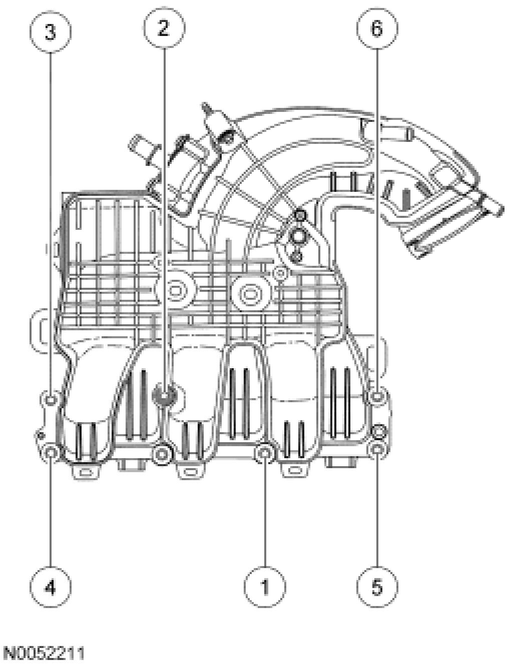


Fig. 637: Installing Upper Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

127. Install the upper intake manifold short support bracket and the 2 bolts (one shown).
    - Tighten to 10 Nm (89 lb-in).

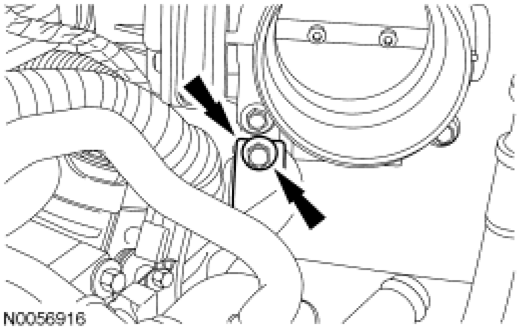


Fig. 638: Identifying Upper Intake Manifold Support Bracket & Bolt
Courtesy of FORD MOTOR CO.

128. If equipped, install the upper intake manifold long support bracket and the 2 bolts (one shown).
    - Tighten the upper bolt 10 Nm (89 lb-in).
    - Tighten the lower bolt 24 Nm (18 lb-ft).

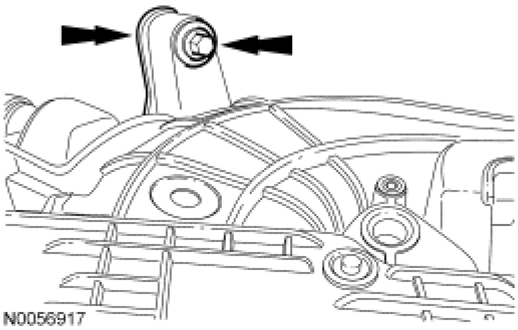


Fig. 639: Identifying Upper Intake Manifold Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

129. Install the RH exhaust manifold heat shield and the 3 bolts.
    - Tighten to 14 Nm (10 lb-ft).

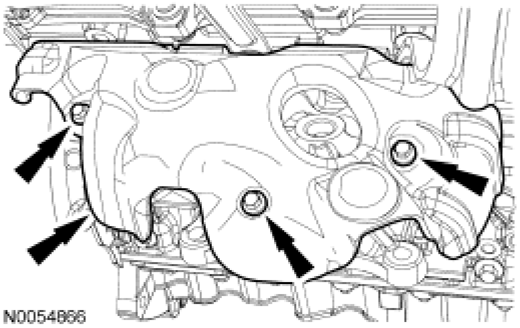


Fig. 640: Locating RH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

130. Connect the RH HO2S electrical connector.

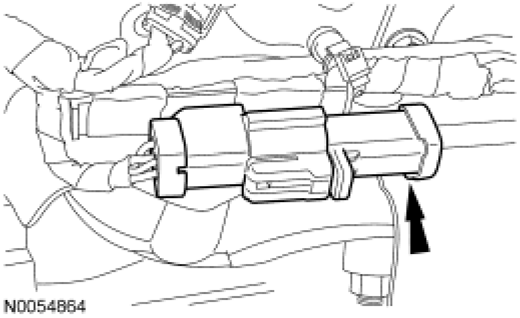


Fig. 641: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

131. Attach the wiring harness retainers to the upper intake manifold.

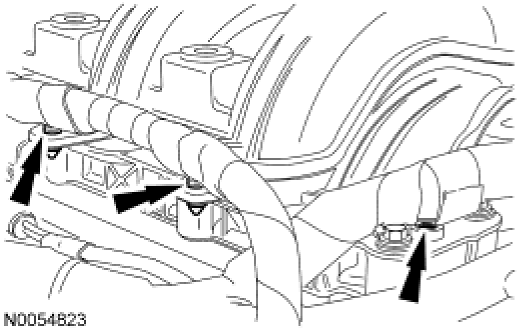


Fig. 642: Locating Wiring Harness Retainers From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

132. Connect the throttle body (TB) electrical connector.

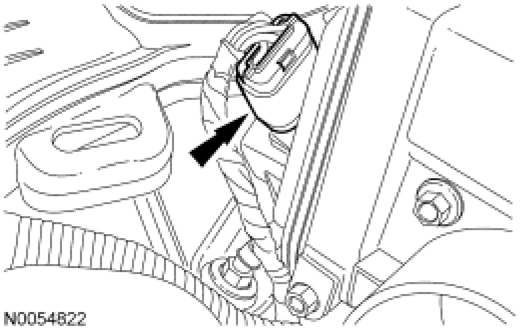


Fig. 643: Locating Throttle Body Electrical Connector
Courtesy of FORD MOTOR CO.

133. Connect the PCV hose to the PCV valve.

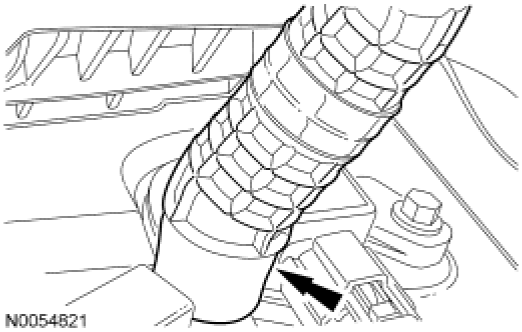


Fig. 644: Identifying PCV Hose From PCV Valve
Courtesy of FORD MOTOR CO.

134. If equipped, connect the heated PCV electrical connector.

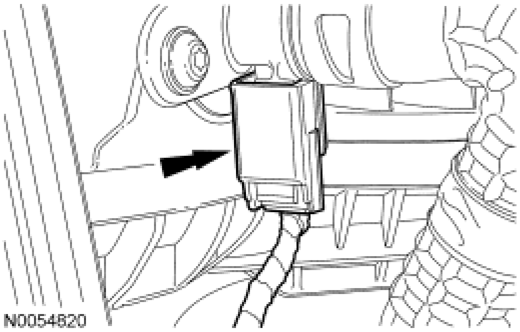


Fig. 645: Identifying Positive Crankcase Ventilation (PCV) Fitting Electrical Connector
Courtesy of FORD MOTOR CO.

135. If equipped, position the block heater wiring harness onto the engine.
    - Attach the block heater wiring harness retainer to the power steering reservoir hose and the PSP hose.

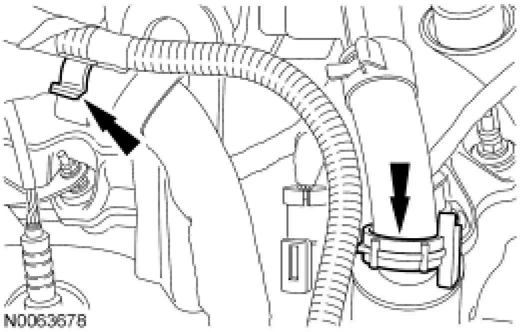


Fig. 646: Identifying Block Heater Wiring Harness From Engine
Courtesy of FORD MOTOR CO.

136. If equipped, connect the block heater electrical connector and install the heat shield.

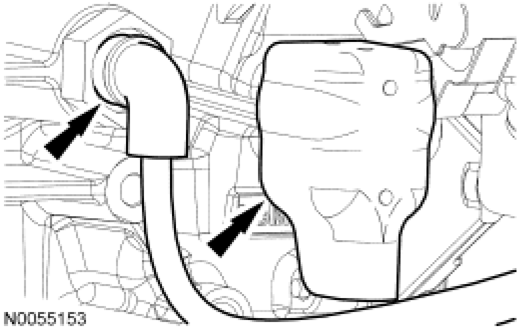


Fig. 647: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

137. If equipped, attach the block heater wiring harness retainer to the upper intake manifold.

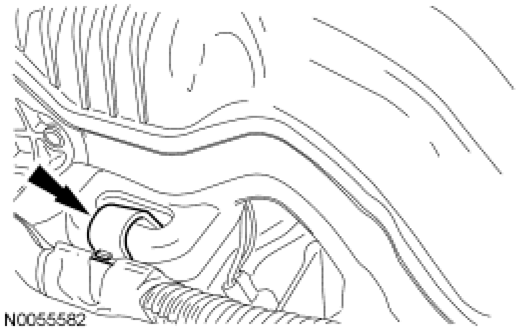


Fig. 648: Identifying Block Heater Wiring Harness Retainer From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

138. Install the special tool on the LH cylinder head.

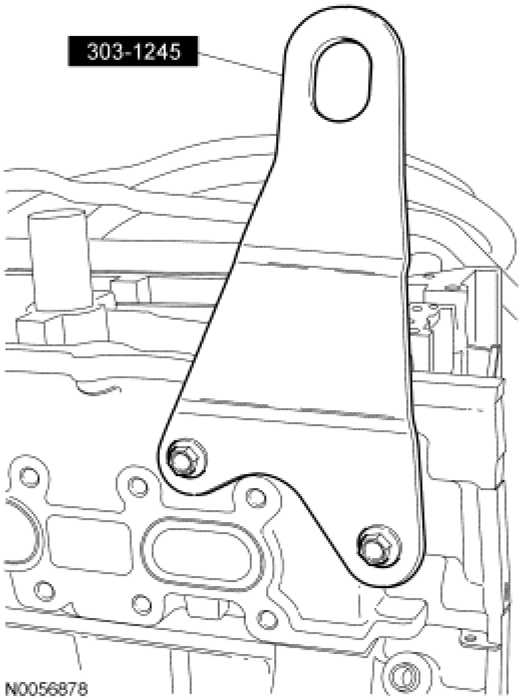


Fig. 649: Installing Special Tool (303-1245) On LH Cylinder Head
Courtesy of FORD MOTOR CO.

139. Using the special tools, remove the engine from the stand.

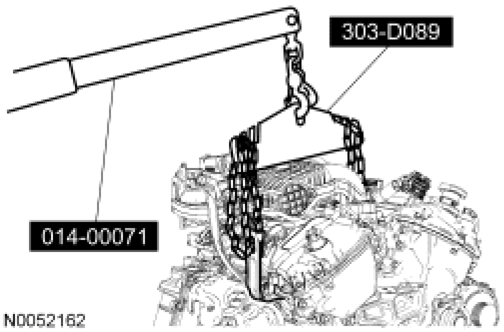


Fig. 650: Removing Engine & Transaxle From Lift Table Using Special Tools (303-D089, 014-00071) & Suitable Engine Crane
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the seal lips and bore with clean engine oil prior to installation.

140. Position the special tool onto the end of the crankshaft and slide a new crankshaft rear seal onto the tool.

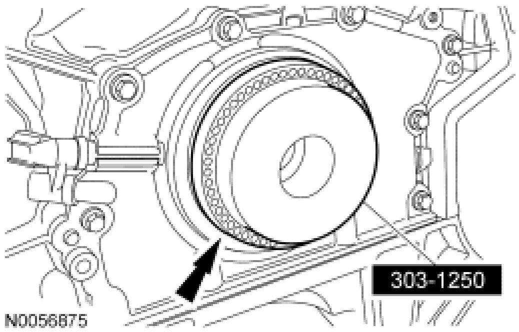


Fig. 651: Positioning Special Tool (303-1250) Onto End Of Crankshaft
Courtesy of FORD MOTOR CO.

141. Using the special tools, install the new crankshaft rear seal.

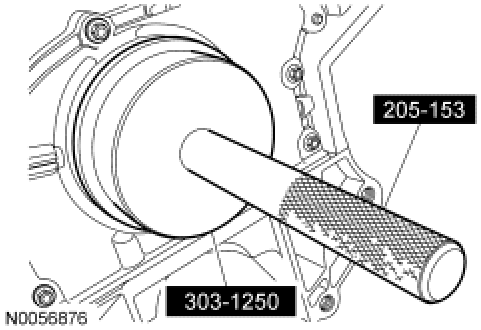


Fig. 652: Installing New Crankshaft Rear Seal Using Special Tools (303-1250) & (205-153)
Courtesy of FORD MOTOR CO.

142. Install the crankshaft sensor ring.

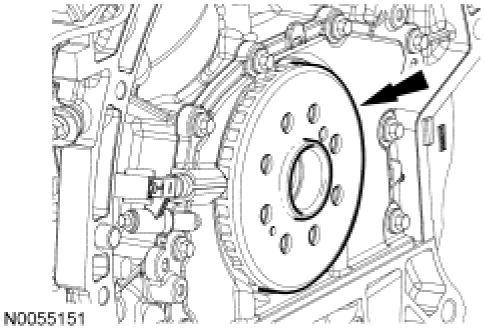


Fig. 653: Identifying Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

143. Install the flexplate and the 8 bolts.
    - Tighten to 80 Nm (59 lb-ft).

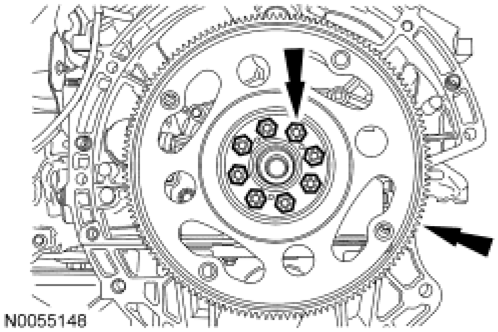


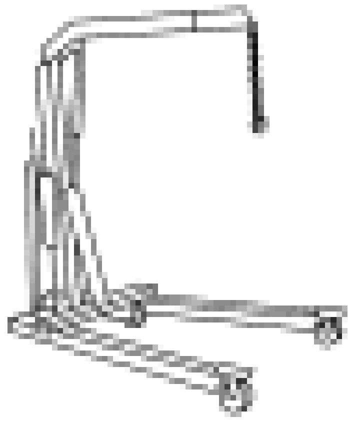
Fig. 654: Identifying Flexplate & Bolts
Courtesy of FORD MOTOR CO.

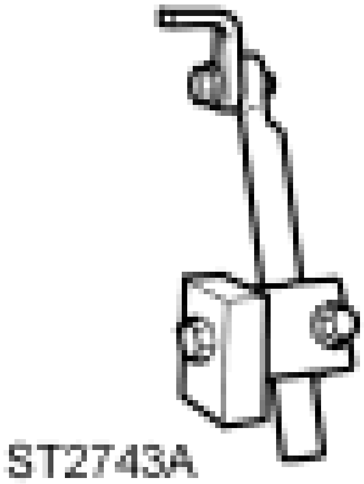
INSTALLATION

ENGINE

Special Tools

Illustration	Tool Name	Tool Number
	Heavy Duty Floor Crane	014-00071 or equivalent

 ST1341-A		
 ST1293-A	Powertrain Lift	014-00765
 ST1602-A	Spreader Bar	303-D089 (D93P-6001-A3) or equivalent
	Universal Adapter Brackets	014-0001

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

All vehicles

1. Align the transaxle to the engine.
2. Install the 4 transaxle-to-engine bolts and the transaxle-to-engine stud bolt.
   - Tighten to 48 Nm (35 lb-ft).

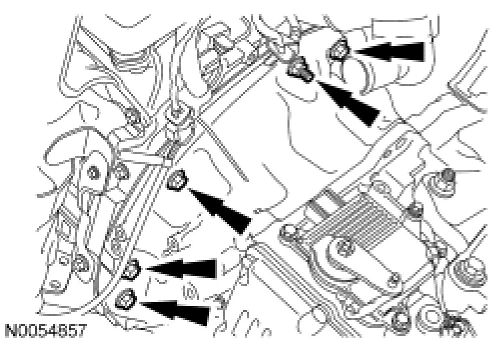


Fig. 655: Locating Transaxle-To-Engine Stud Bolt & Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

3. Install the 2 engine-to-transaxle bolts.
   - Tighten to 48 Nm (35 lb-ft).

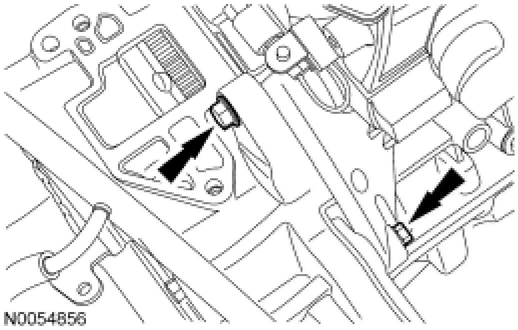


Fig. 656: Locating Engine-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

4. Using the special tools, position the engine and transaxle onto the lift table.

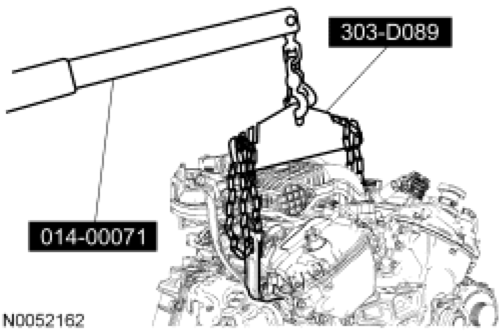


Fig. 657: Removing Engine & Transaxle From Lift Table Using Special Tools (303-D089, 014-00071) & Suitable Engine Crane
Courtesy of FORD MOTOR CO.

NOTE: Position a block of wood under the transaxle.

5. Install the special tools.

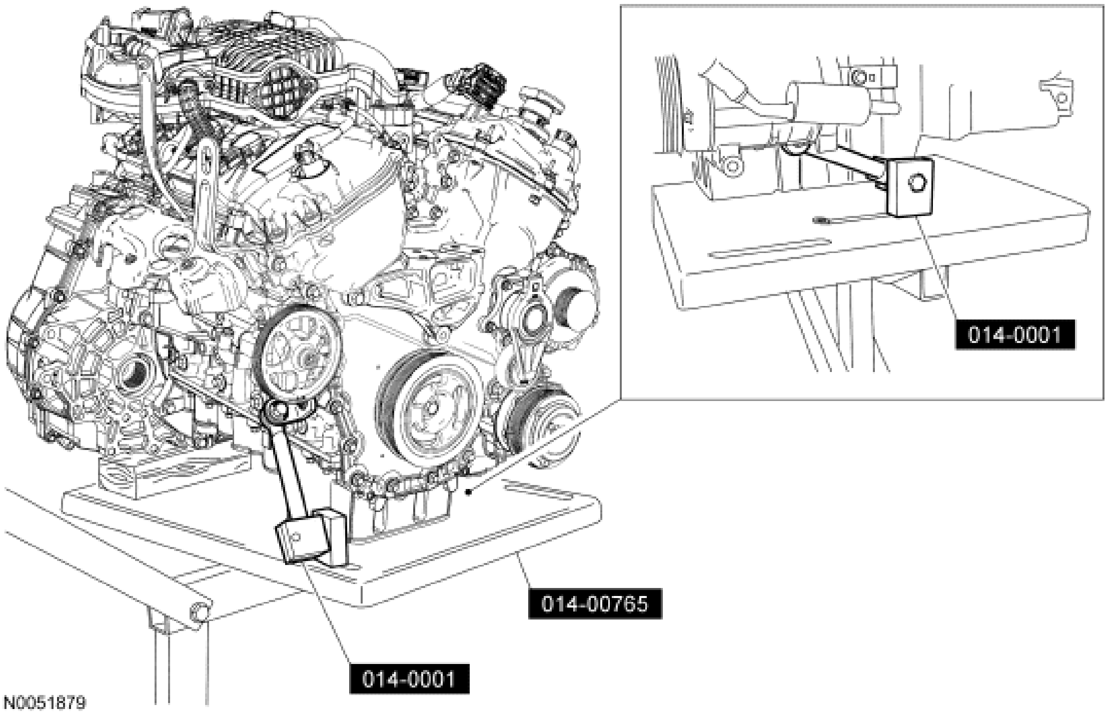


Fig. 658: Positioning Block Of Wood Under Transaxle Using Special Tools (014-0001) & (014-00765)
Courtesy of FORD MOTOR CO.

6. Install the starter and the 2 bolts.
   - Tighten to 26 Nm (19 lb-ft).

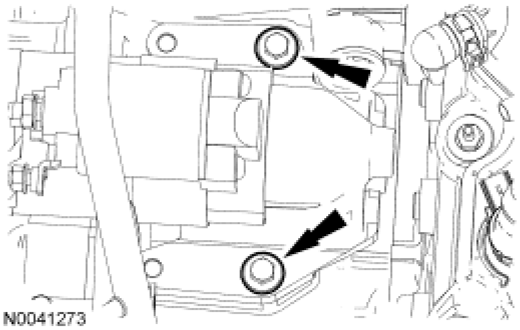


Fig. 659: Locating Starter Motor Bolts
Courtesy of FORD MOTOR CO.

7. Attach the starter wire terminals and install the 2 nuts.
   1. Tighten to 12 Nm (9 lb-ft).
   2. Tighten to 5 Nm (44 lb-in).
      - Position the starter terminal boot over the starter terminal.

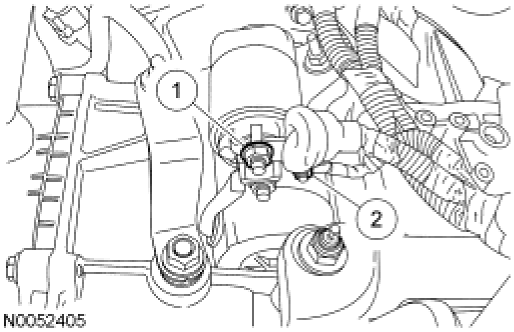


Fig. 660: Identifying Starter Motor Wire Terminals & Nuts
Courtesy of FORD MOTOR CO.

8. Connect the transmission control module (TCM) electrical connector.

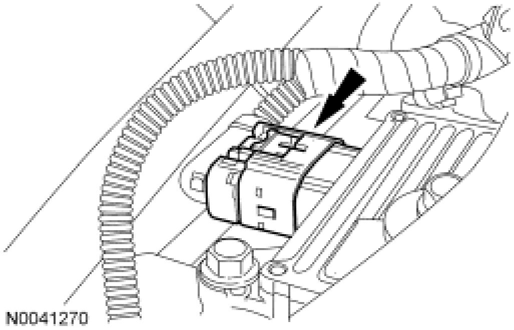


Fig. 661: Locating Transmission Control Module (TCM) Electrical Connector
Courtesy of FORD MOTOR CO.

9. Install the ground wire and bolt.
   - Tighten to 12 Nm (9 lb-ft).

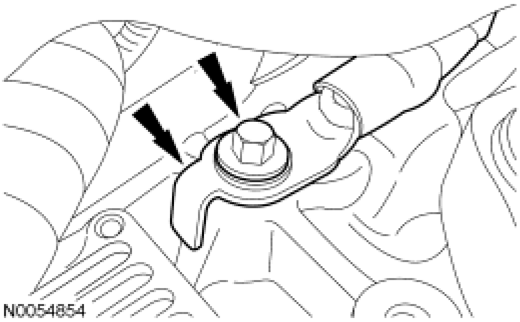


Fig. 662: Identifying Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

10. Connect the wiring harness fasteners to the transaxle-to-engine stud bolt and the starter.

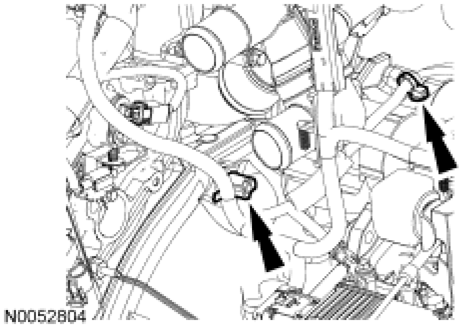


Fig. 663: Identifying Wiring Harness Fasteners & Torque Converter Housing Stud Bolt
Courtesy of FORD MOTOR CO.

11. Raise the engine and transaxle assembly into the vehicle.
12. Install the engine mount, the nut and the 2 bolts.
    - Tighten the bolts to 55 Nm (41 lb-ft).
    - Tighten the nut to 63 Nm (46 lb-ft).

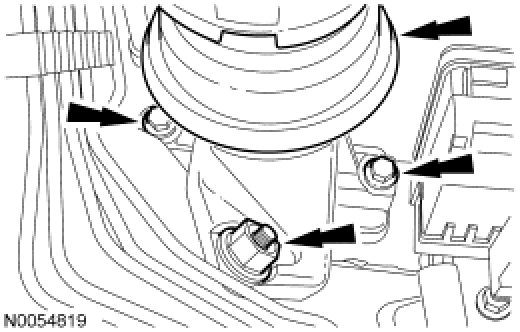


Fig. 664: Identifying Nut, Bolts & Engine Mount
Courtesy of FORD MOTOR CO.

13. Install the 4 engine mount nuts.
    - Tighten to 63 Nm (46 lb-ft).

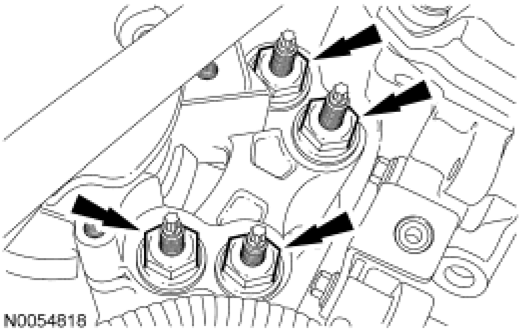


Fig. 665: Identifying Engine Mount Nuts
Courtesy of FORD MOTOR CO.

14. Install the 2 transaxle mount bracket nuts and the bolt.
    - Tighten to 80 Nm (59 lb-ft).

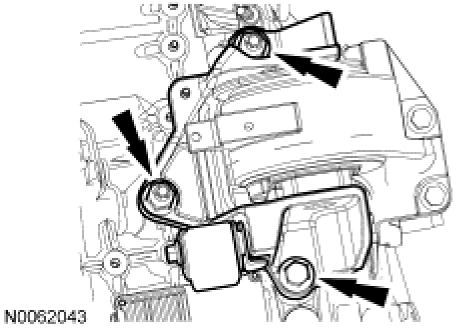


Fig. 666: Identifying Transaxle Mount Bracket Bolt
Courtesy of FORD MOTOR CO.

15. Install the transaxle mount through bolt and nut.
    - Tighten to 90 Nm (66 lb-ft).

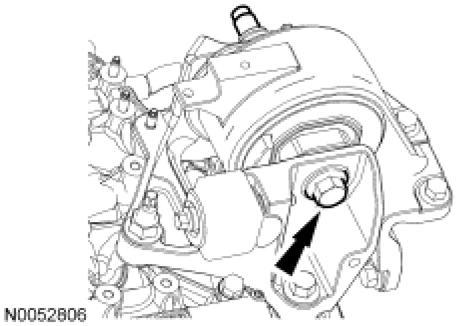


Fig. 667: Identifying Transaxle Support Insulator Through Bolt
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

16. Position the power transfer unit (PTU) in place and install the 5 bolts.
    - Tighten to 90 Nm (66 lb-ft).

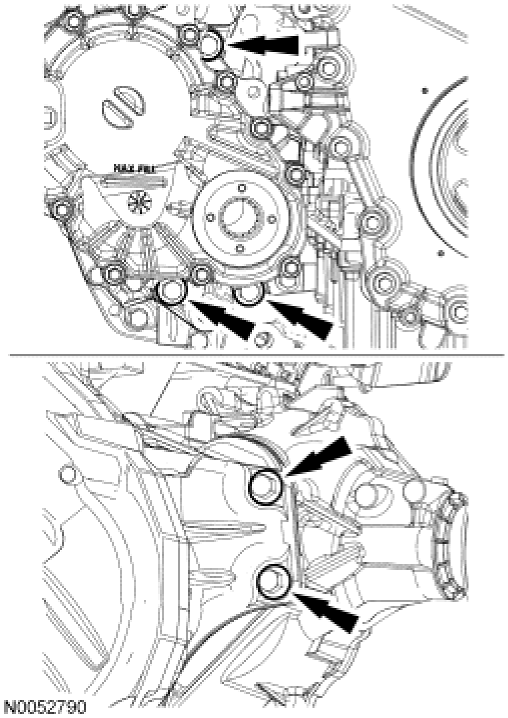


Fig. 668: Locating PTU Bolts
Courtesy of FORD MOTOR CO.

17. Position the PTU support bracket in place and install the 5 bolts.
    - Tighten to 70 Nm (52 lb-ft).

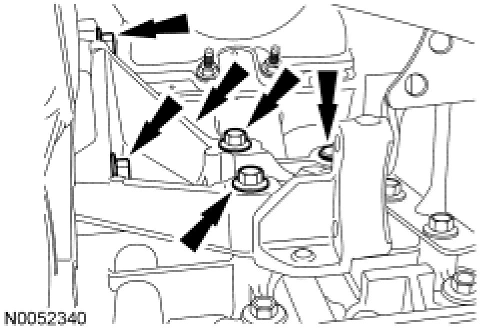


Fig. 669: Locating Power Transfer Unit (PTU) Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

NOTE: Do not tighten the 4 catalytic converter nuts at this time.

18. Using a new gasket, install the RH catalytic converter and 4 new nuts.

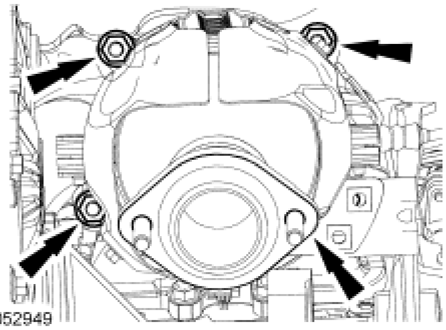

N0052949

Fig. 670: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

19. Install the 2 catalytic converter-to-bracket bolts.
    - Tighten the 4 catalytic converter nuts to 40 Nm (30 lb-ft).
    - Tighten the 2 catalytic converter-to-bracket bolts to 20 Nm (15 lb-ft).

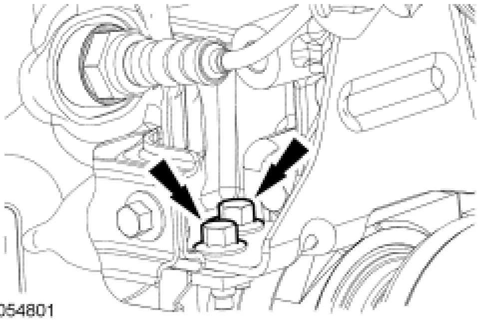

N0054801

Fig. 671: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

20. Connect the RH catalyst monitor electrical connector.

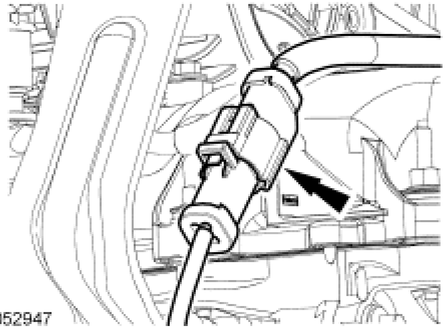

N0052947

Fig. 672: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: **A new PTU seal must be installed whenever the intermediate shaft is removed.**

21. Install a new PTU seal. For additional information, refer to **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.

NOTE:	Prior to installation of the halfshaft, inspect the halfshaft sealing surface for wear or damage and install new, if necessary.

22. Position the RH halfshaft in the transaxle and install the 2 bolts.
    - Tighten to 23 Nm (17 lb-ft).

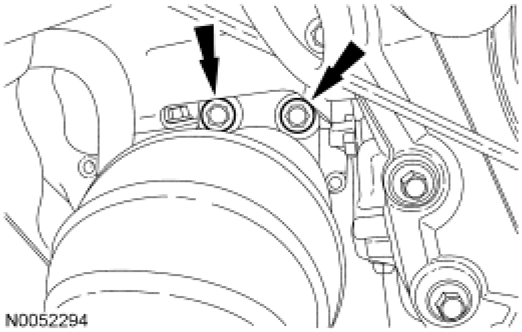


Fig. 673: Locating RH Halfshaft Bearing Support Bracket Bolts
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

NOTE:	Prior to installation of the halfshaft, inspect the halfshaft sealing surface for wear or damage and install new if necessary.

23. Position the RH halfshaft in the transaxle and install the bolt and the 2 stud bolts.
    - Tighten to 55 Nm (41 lb-ft).

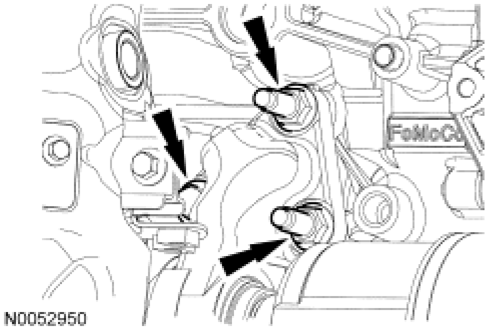


Fig. 674: Identifying Intermediate Shaft Bearing Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

NOTE:	Do not tighten the 2 catalytic converter support bracket bolts at this time.

24. Install the RH catalytic converter support bracket and the 2 bolts.

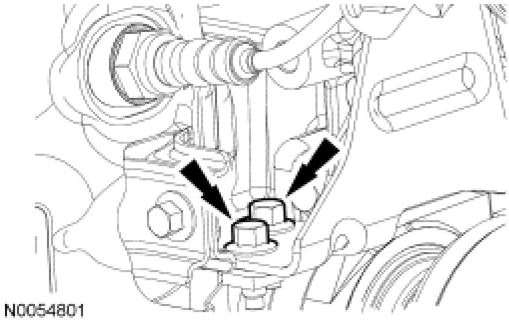


Fig. 675: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

25. Install the 2 catalytic converter support bracket nuts.
    - Tighten to 40 Nm (30 lb-ft).
    - Tighten the 2 catalytic converter support bracket bolts to 20 Nm (15 lb-ft).

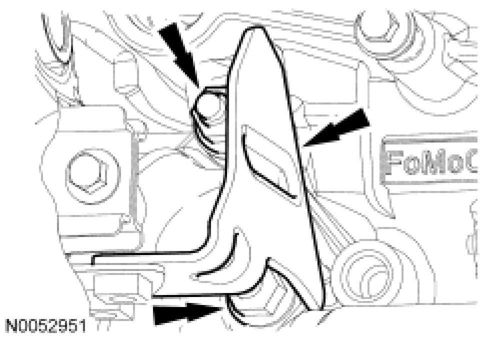


Fig. 676: Identifying Catalytic Converter Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: **Prior to installation of the halfshaft, inspect the halfshaft sealing surface for wear or damage and install new, if necessary.**

26. Install the LH halfshaft into the transaxle.

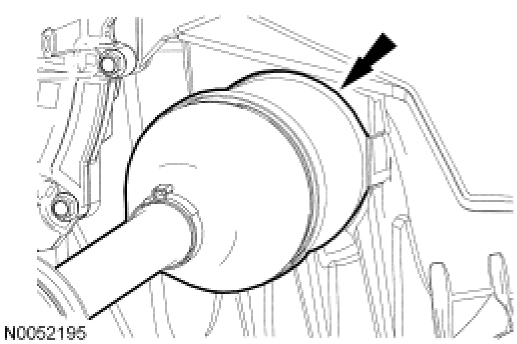


Fig. 677: Identifying LH Halfshaft
Courtesy of FORD MOTOR CO.

27. Using the special tool, raise the subframe into the installed position.

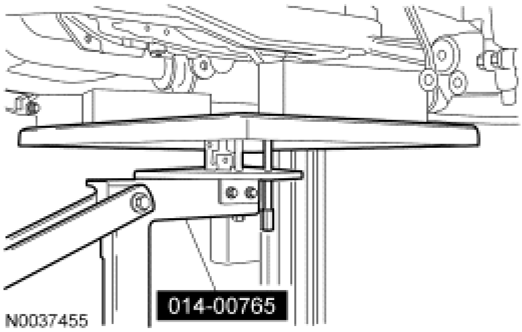


Fig. 678: Positioning Special Tool (014-00765) Under Subframe Assembly
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

28. Install the 2 front subframe nuts.
    - Tighten to 150 Nm (111 lb-ft).

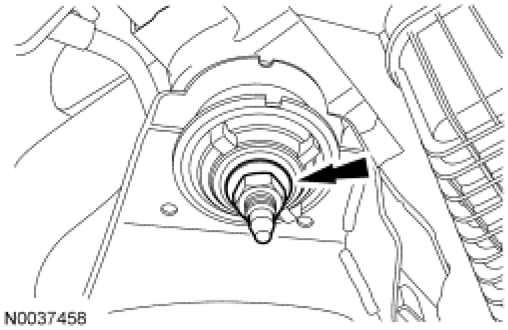


Fig. 679: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

29. Position the subframe brackets and install the 4 bolts finger-tight.

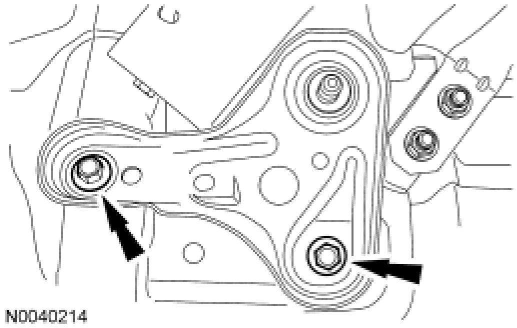


Fig. 680: Locating Subframe Brackets And Bolts Finger-Tight
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

30. Install the 2 rear subframe nuts.
    - Tighten to 150 Nm (111 lb-ft).

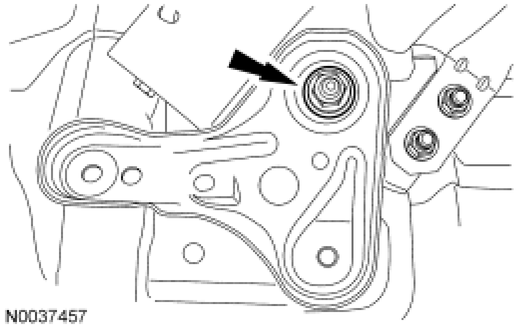


Fig. 681: Locating Subframe Nuts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

31. Tighten the 4 subframe bracket-to-body bolts to 103 Nm (76 lb-ft).

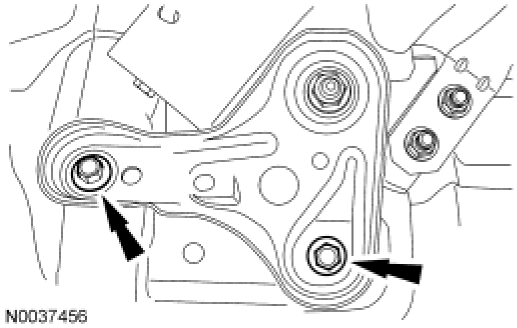


Fig. 682: Locating Subframe Bracket-To-Body Bolts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

32. Install the through bolts into the lower control arms.
    - Tighten to 103 Nm (76 lb-ft).

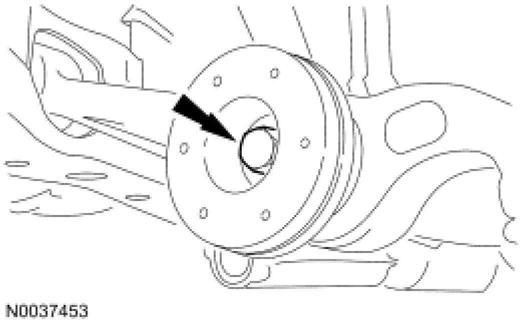


Fig. 683: Locating Lower Control Arms Through Bolt
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

33. Install the 4 lower ball joint nuts.
    - Tighten to 200 Nm (148 lb-ft).

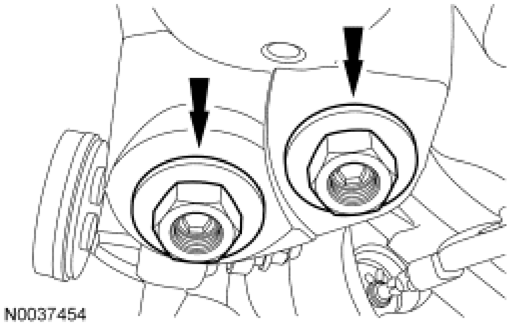


Fig. 684: Locating Lower Ball Joint Nuts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

34. Install the stabilizer bar links and nuts to the struts.
    - Tighten to 40 Nm (30 lb-ft).

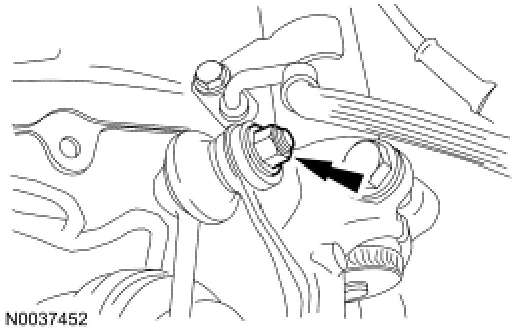


Fig. 685: Locating Stabilizer Bar Links Nut
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

35. Install the tie-rod ends and nuts.
    - Tighten to 48 Nm (35 lb-ft).
    - Install new cotter pins.

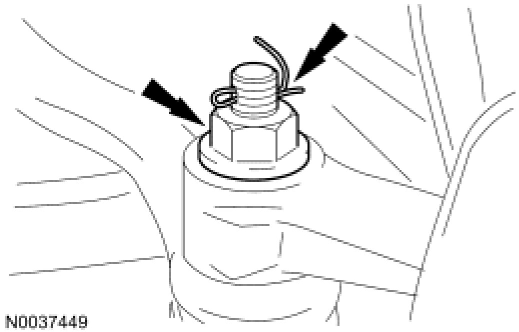


Fig. 686: Locating Tie-Rod Ends Nuts And Cotter Pin
Courtesy of FORD MOTOR CO.

36. Install the engine roll restrictor-to-subframe through bolt.
    - Tighten to 90 Nm (66 lb-ft).

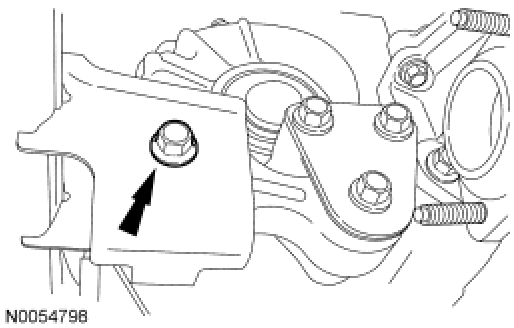


Fig. 687: Locating Roll Restrictor Bolt
Courtesy of FORD MOTOR CO.

AWD vehicles

37. Line up the index marks on the rear driveshaft to the index marks on the PTU flange made during removal and install the 4 bolts.
    - Tighten to 70 Nm (52 lb-ft).

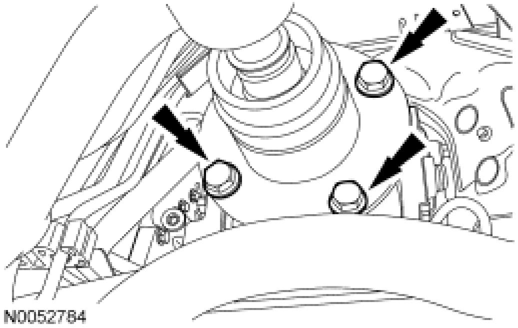


Fig. 688: Identifying Drive Shaft Bolts
Courtesy of FORD MOTOR CO.

All vehicles

38. Install 4 new torque converter nuts.
    - Tighten to 36 Nm (27 lb-ft).

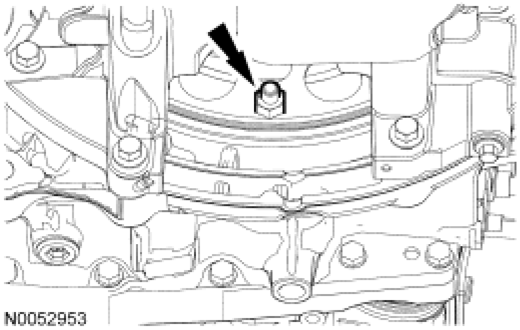


Fig. 689: Identifying Torque Converter Nuts
Courtesy of FORD MOTOR CO.

39. Install the inspection cover and the 2 fasteners.

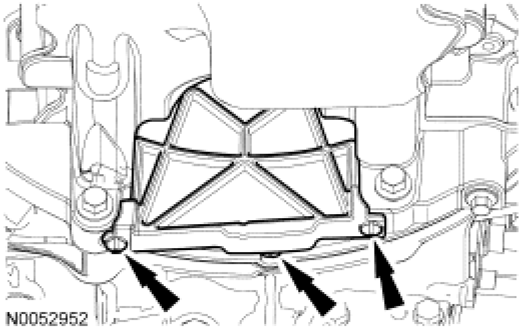


Fig. 690: Identifying Inspection Cover & Fasteners
Courtesy of FORD MOTOR CO.

40. Install the 4 oil pan-to-transaxle bolts.
    - Tighten to 48 Nm (35 lb-ft).

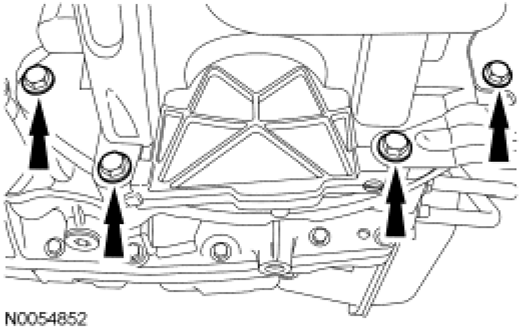


Fig. 691: Locating Oil Pan-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

41. Using new gaskets, install the Y-pipe assembly and 6 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

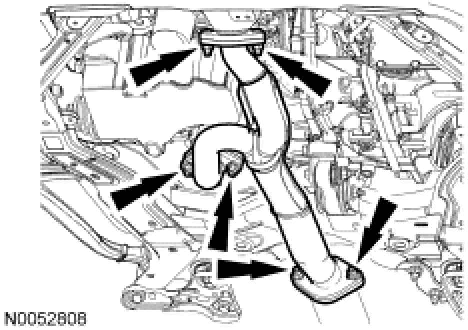


Fig. 692: Locating Y-Pipe Nuts & Y-Pipe Assembly
Courtesy of FORD MOTOR CO.

NOTE: **Lubricate the engine oil filter gasket with clean engine oil prior to installing the oil filter.**

42. Install a new engine oil filter.
    - Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.

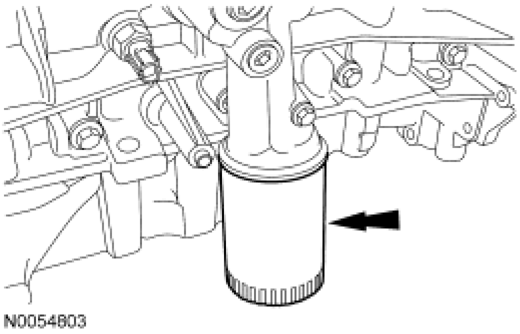


Fig. 693: Identifying Engine Oil Filter
Courtesy of FORD MOTOR CO.

43. Connect the 2 transmission fluid cooler hoses.

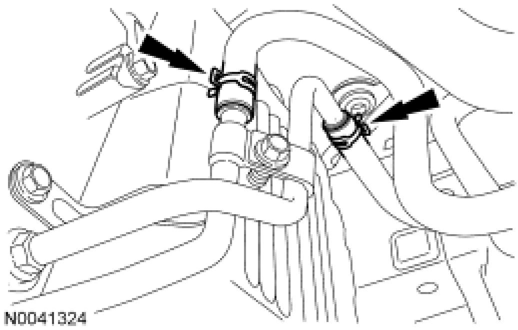


Fig. 694: Locating Transmission Fluid Cooler Hoses
Courtesy of FORD MOTOR CO.

44. Connect the power steering cooler tube.

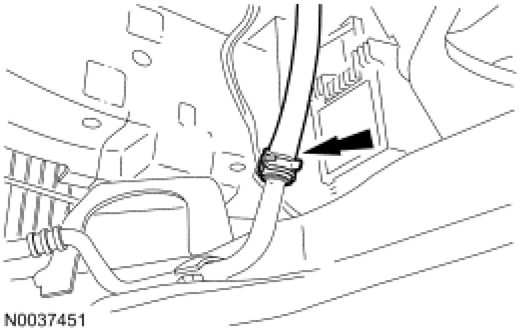


Fig. 695: Locating Power Steering Cooler Tube
Courtesy of FORD MOTOR CO.

45. Slide the steering gear-to-dash seal onto the steering gear and engage the 4 retaining clips into the body.

- From under the vehicle, verify that the seal is properly installed on the steering gear and the retaining clips are fully engaged into the body.

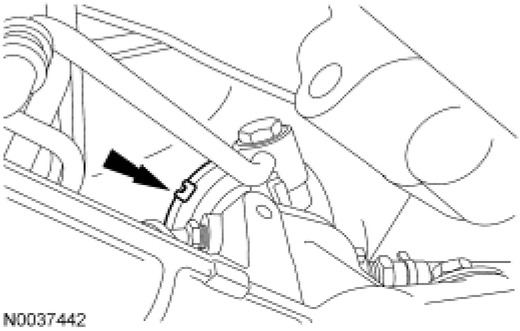


Fig. 696: Locating Steering Gear-To-Dash Seal Clips
Courtesy of FORD MOTOR CO.

46. If equipped, install the underbody shield and the 6 screws.

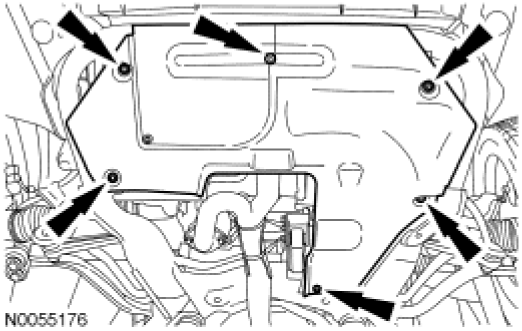


Fig. 697: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

47. Install the LH splash shield and the 6 pin-type retainers (4 shown).

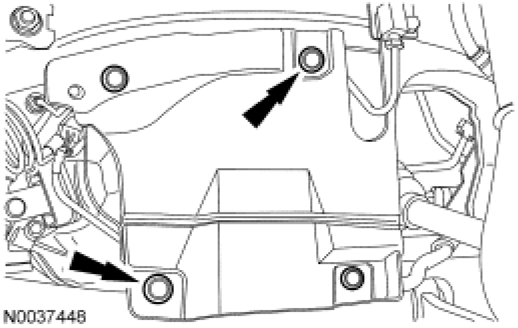


Fig. 698: Locating LH Splash Shield And Pin-Type Retainers
Courtesy of FORD MOTOR CO.

48. Position the LH fender splash shield and install the 4 screws.

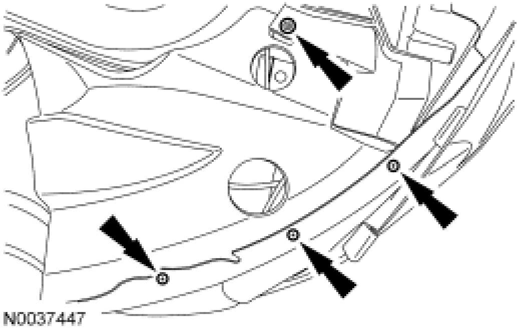


Fig. 699: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

NOTE: Align the index marks made during removal.

49. Install the steering intermediate shaft onto the steering gear and install a new bolt.
    - Tighten to 23 Nm (17 lb-ft).

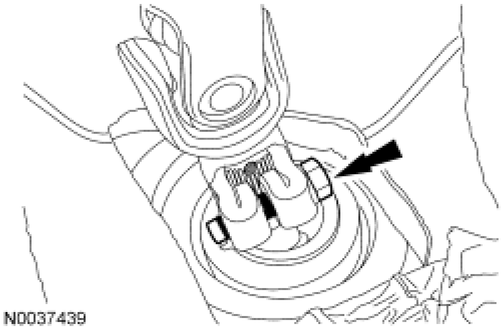


Fig. 700: Locating Steering Intermediate Shaft Bolt
Courtesy of FORD MOTOR CO.

50. Install the steering joint cover and the 2 nuts.

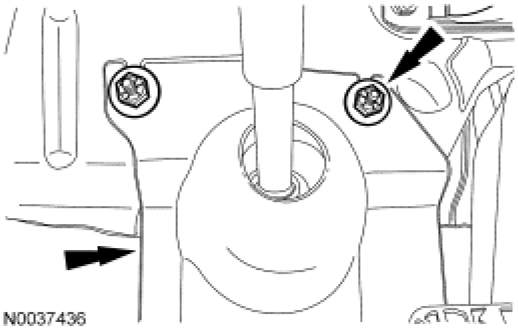


Fig. 701: Locating Steering Joint Cover And Nuts
Courtesy of FORD MOTOR CO.

51. Using a new banjo bolt and 2 new seals, install the power steering pressure (PSP) tube onto the steering

gear.

- Tighten to 37 Nm (27 lb-ft).

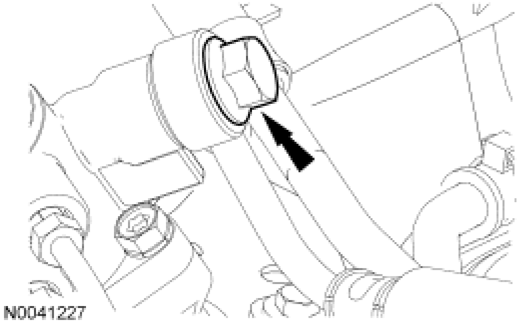


Fig. 702: Locating PSP Hose Banjo Bolt
Courtesy of FORD MOTOR CO.

52. Install the PSP tube bracket and bolt.
    - Tighten to 10 Nm (89 lb-in).

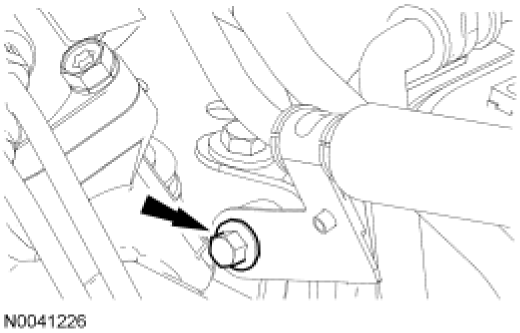


Fig. 703: Locating Power Steering Pressure (PSP) Hose Bracket Bolt
Courtesy of FORD MOTOR CO.

53. Connect the PCM electrical connectors and pin-type retainers.

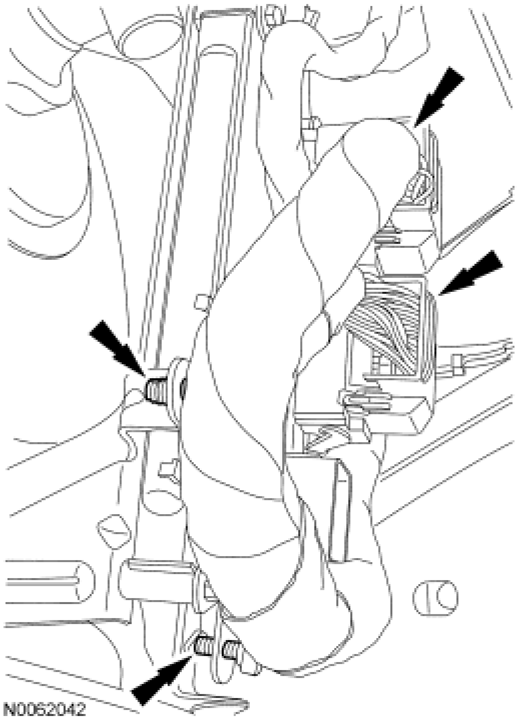


Fig. 704: Locating PCM Electrical Connectors & Pin-Type Retainers
Courtesy of FORD MOTOR CO.

54. Install the engine mount brace and the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).

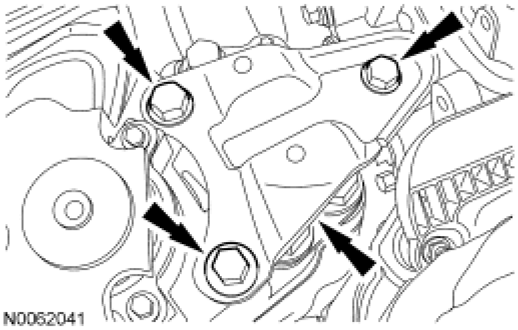


Fig. 705: Locating Engine Mount Brace Bolts
Courtesy of FORD MOTOR CO.

55. Install the ground wire and the bolt.
    - Tighten to 10 Nm (89 lb-in).

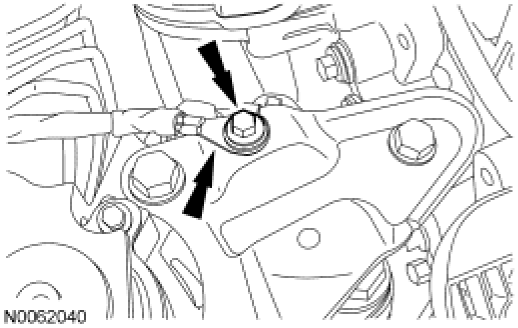


Fig. 706: Identifying Ground Wire Bolt From Engine Mount Brace
Courtesy of FORD MOTOR CO.

56. Connect the fuel supply tube from the fuel rail. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

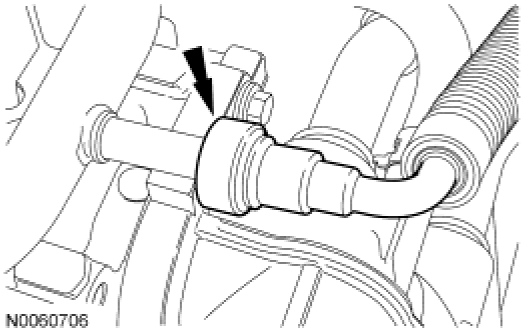


Fig. 707: Identifying Fuel Supply Tube From Fuel Rail
Courtesy of FORD MOTOR CO.

57. Attach the power steering reservoir onto the cowl.

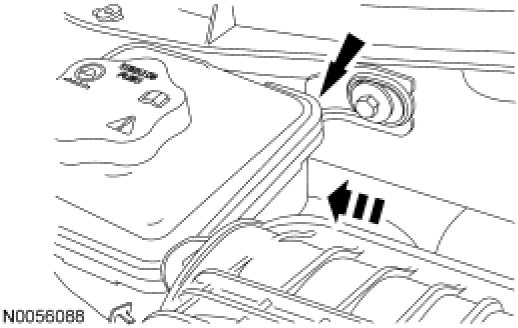


Fig. 708: Attaching Power Steering Reservoir Onto Cowl
Courtesy of FORD MOTOR CO.

58. Connect the hose to the power steering reservoir.
    - Attach the pin-type retainer to the engine mount brace.

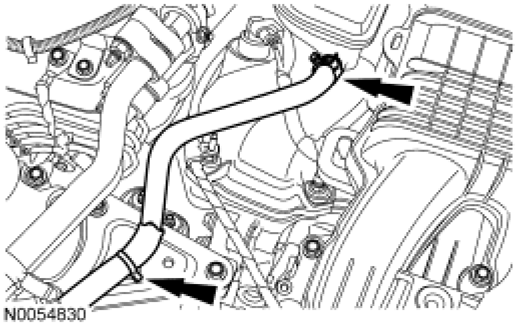


Fig. 709: Identifying Pin-Type Retainer From Engine Mount Brace
Courtesy of FORD MOTOR CO.

59. Install the oil level indicator.

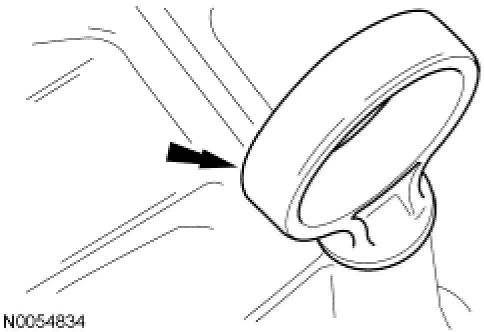


Fig. 710: Identifying Oil Level Indicator
Courtesy of FORD MOTOR CO.

60. Attach the 2 wiring harness retainers to the LH valve cover stud bolts.

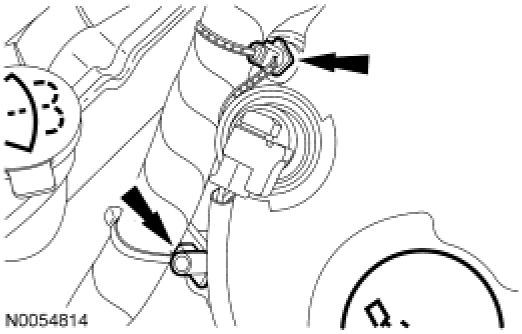


Fig. 711: Identifying Wiring Harness Retainers From LH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

61. Connect the 2 engine wiring harness electrical connectors.

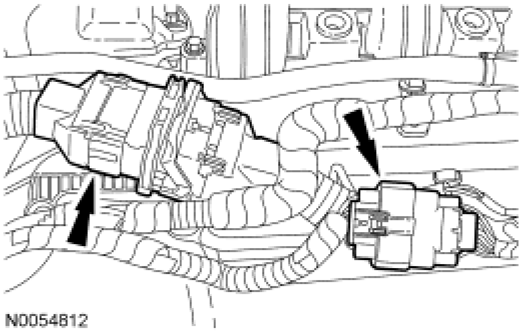


Fig. 712: Identifying Engine Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

62. Attach the 2 wiring harness retainers.

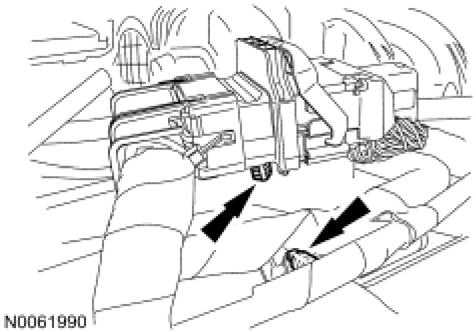


Fig. 713: Identifying Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

63. Using new O-ring seals, connect the A/C tubes and install the 2 nuts.
    - Tighten to 8 Nm (71 lb-in).

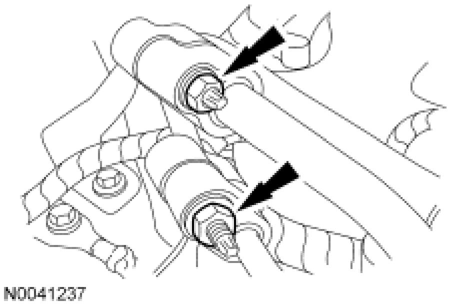


Fig. 714: Locating A/C Tubes And Nuts
Courtesy of FORD MOTOR CO.

64. Install the A/C tube bracket bolt.
    - Tighten to 8 Nm (71 lb-in).

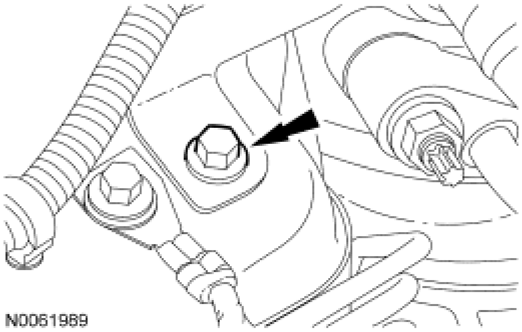


Fig. 715: Locating A/C Tube Bracket Bolt
Courtesy of FORD MOTOR CO.

65. Install the 2 A/C tube bracket bolts.
    - Tighten to 10 Nm (89 lb-in).

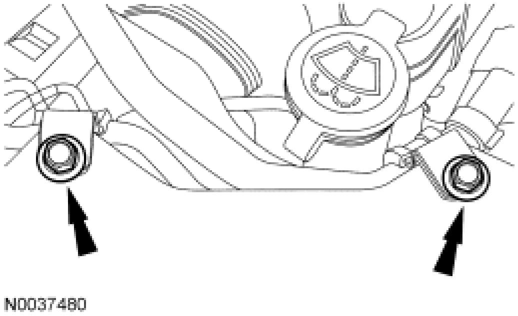


Fig. 716: Locating A/C Tube Bracket Bolts
Courtesy of FORD MOTOR CO.

66. Using a new O-ring seal, connect the A/C tube to the condenser and install the nut.
    - Tighten to 8 Nm (71 lb-in).

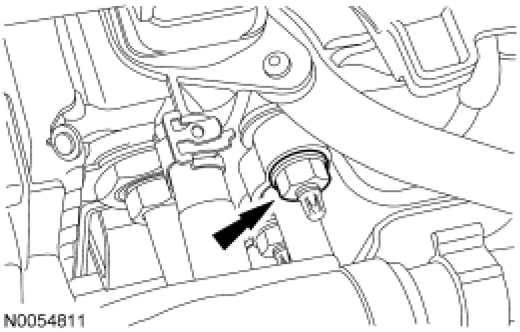


Fig. 717: Locating A/C Tube From Condenser
Courtesy of FORD MOTOR CO.

67. Attach the coolant tube retainer clips to the A/C tube.

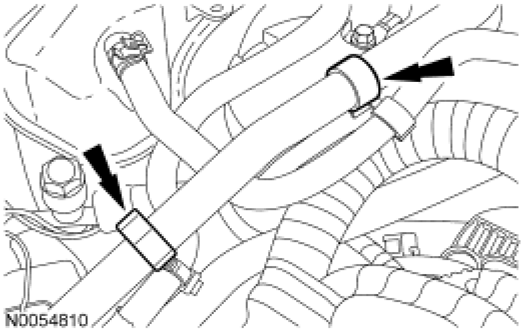


Fig. 718: Identifying Coolant Tube Retainer Clips
Courtesy of FORD MOTOR CO.

68. If equipped, attach the engine block heater harness to the radiator support, power steering hose, A/C tube and the engine wiring harness.
69. Install the ground wire and bolt.
    - Tighten to 12 Nm (9 lb-ft).

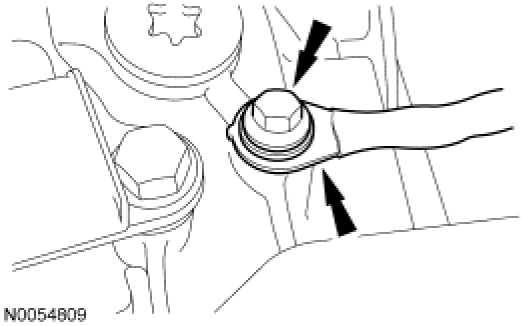


Fig. 719: Locating Ground Wire And Bolt
Courtesy of FORD MOTOR CO.

70. Position the transaxle control cable bracket in place and install the 3 nuts.
    - Tighten to 12 Nm (9 lb-ft).

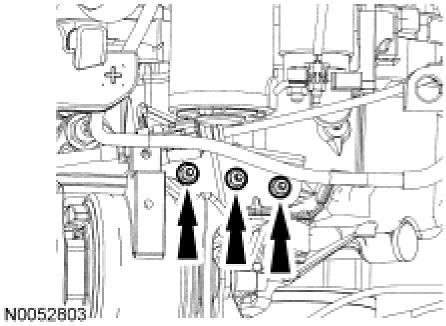


Fig. 720: Identifying Selector Lever Cable Bracket Bolts & Nuts
Courtesy of FORD MOTOR CO.

71. Connect the transaxle control cable to the control lever.

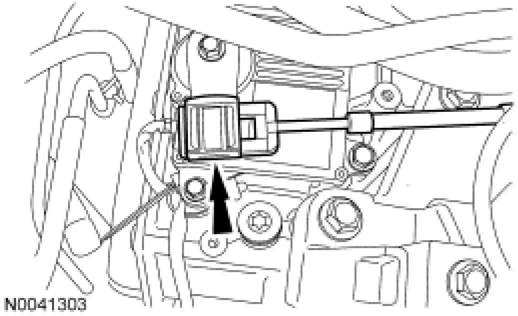


Fig. 721: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

72. Connect the upper radiator hose, lower radiator hose and 2 heater hoses to the thermostat housing.

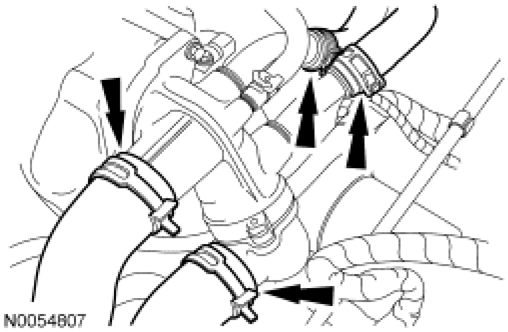


Fig. 722: Locating Upper Radiator Hose, Lower Radiator Hose & Heater Hoses From Thermostat Housing
Courtesy of FORD MOTOR CO.

73. Connect the vacuum hose and the evaporative emissions (EVAP) tube to the upper intake manifold.

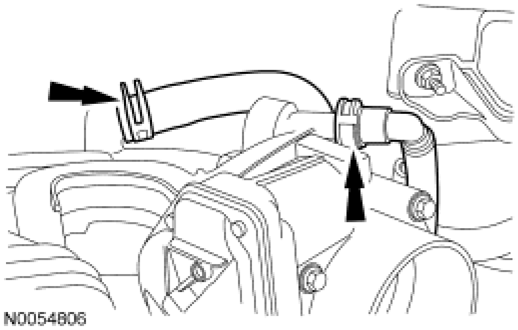


Fig. 723: Locating Vacuum Hose & Evaporative Emissions (EVAP) Tube From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

74. Install the ground wire and the bolt.

- Tighten to 10 Nm (89 lb-in).

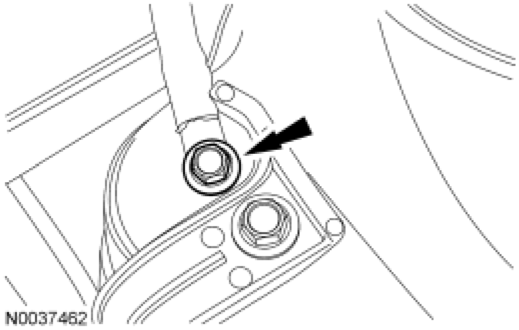


Fig. 724: Locating Ground Wire And Bolt
Courtesy of FORD MOTOR CO.

75. Connect the power feed to the battery terminal and install the nut.
    - Tighten to 6 Nm (53 lb-in).

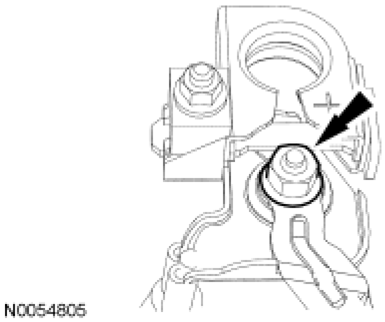


Fig. 725: Locating Power Feed To Battery Terminal And Nut
Courtesy of FORD MOTOR CO.

76. Attach the 2 wiring harness retainers to the transmission mount and the battery tray bracket.

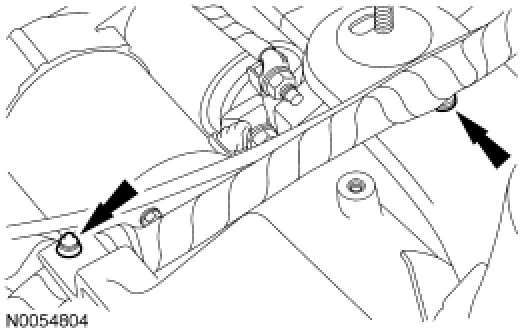


Fig. 726: Locating Wiring Harness Retainers From Transmission Mount & Battery Tray Bracket
Courtesy of FORD MOTOR CO.

77. Connect the 2 engine wiring harness electrical connectors.

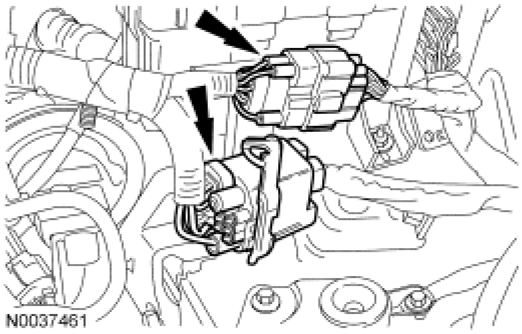


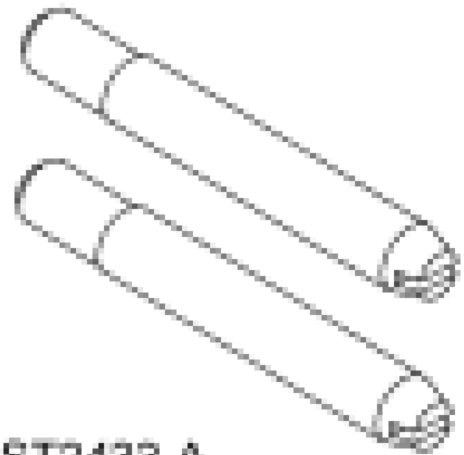
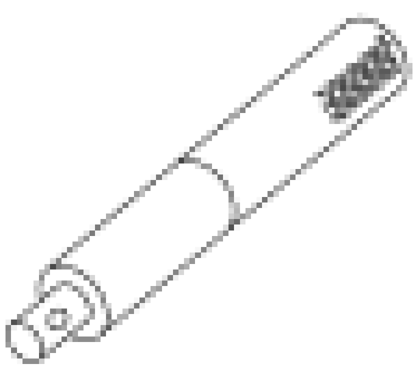
Fig. 727: Locating Engine Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

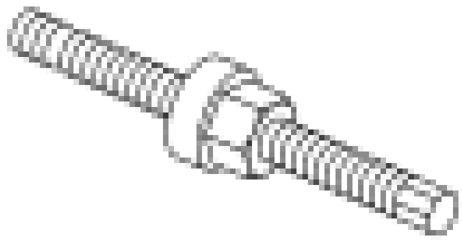
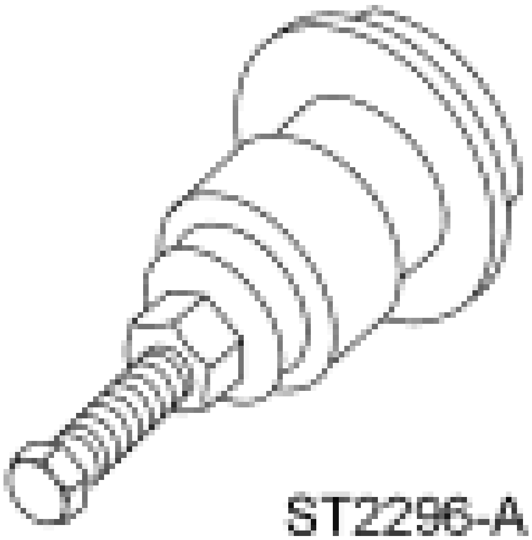
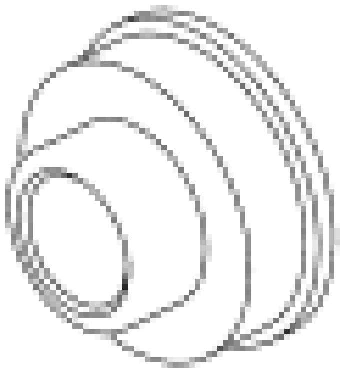
78. Install the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
79. Install the engine air cleaner and the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.
80. Install the degas bottle. For additional information, refer to **ENGINE COOLING** article.
81. Install the accessory drive belt and the power steering belt. For additional information, refer to **ACCESSORY DRIVE - 3.5L** article.
82. Fill the engine with clean engine oil.
83. Fill and bleed the cooling system. For additional information, refer to **ENGINE COOLING** article.
84. Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.
85. Check the transaxle fluid and add fluid if necessary. For additional information, refer to the Transmission Fluid Drain and Refill procedure in **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
86. Recharge the air conditioning system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

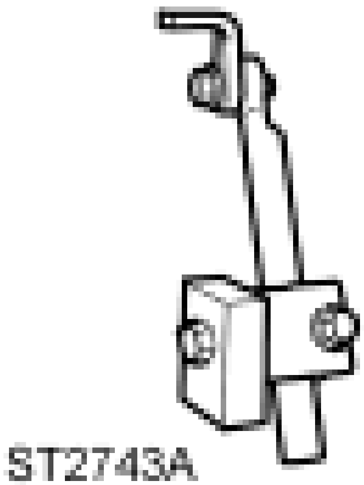
ENGINE FRONT COVER

Special Tools

Illustration	Tool Name	Tool Number
	Alignment Pins	307-399

 ST2433-A		
 ST1326-A	Handle	205-153 (T80T-4000-W)
 ST2981-A	Installer, Crankshaft Front Seal	303-1251
	Installer, Crankshaft Vibration	303-102 (T74P-6316-B)

 ST1287-A	Damper	
 ST2296-A	Installer, Front Cover Oil Seal	303-335
 ST2983-A	Installer, Seal	303-1247/2
	Powertrain Lift	014-00765

		
	303-D055 (D85L-6000-A)	Strap Wrench
	Universal Adapter Brackets	014-0001

Material

Item	Specification
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft Metal Surface Prep ZC-31-A	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket Remover ZC-30	-

All vehicles

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

1. Install the special tools.

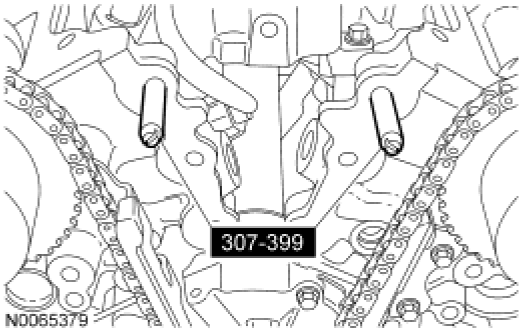


Fig. 728: Identifying Special Tool (307-399)
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The engine front cover and bolts 17, 18, 19 and 20 must be installed within 4 minutes of the initial sealant application. The remainder of the engine front cover bolts and the engine mount bracket bolts must be installed and tightened within 35 minutes of the initial sealant application. If the time limits are exceeded, the sealant must be removed, the sealing area cleaned and sealant reapplied. To clean the sealing area, use silicone

gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

2. Apply a 3.0 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover sealing surfaces including the 3 engine mount bracket bosses.
   - Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the oil pan-to-cylinder block joint and the cylinder head-to-cylinder block joint areas of the engine front cover in 5 places as indicated.

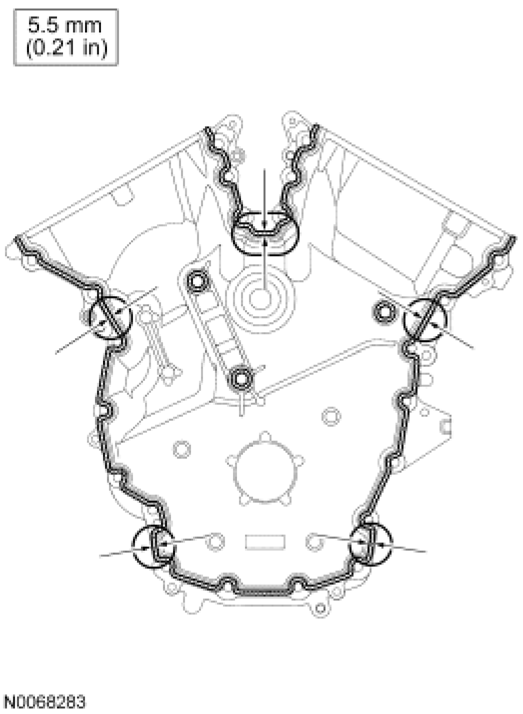


Fig. 729: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover Sealing Surfaces
Courtesy of FORD MOTOR CO.

NOTE: **Make sure the 2 locating dowel pins are seated correctly in the cylinder block.**

3. Install the engine front cover and bolts 17, 18, 19 and 20.
   - Tighten in sequence to 3 Nm (27 lb-in).

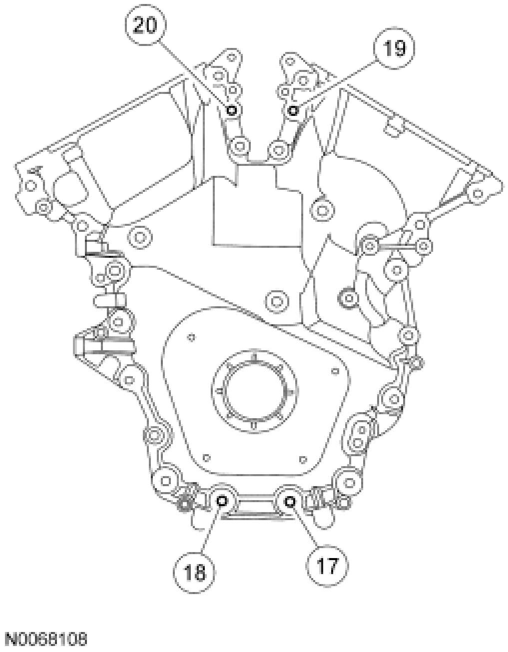


Fig. 730: Installing Engine Front Cover & Bolts In Sequence
Courtesy of FORD MOTOR CO.

4. Remove the special tools (alignment pins).

NOTE: Do not tighten the bolts at this time.

5. Install the engine mount bracket and the 3 bolts.

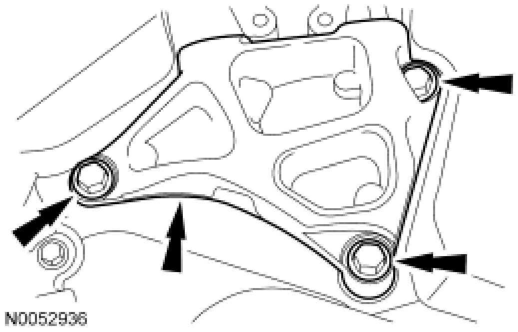


Fig. 731: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Do not expose the Motorcraft High Performance Engine RTV Silicone to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

6. Install the remaining engine front cover bolts. Tighten all of the engine front cover bolts and engine mount bracket bolts in the sequence shown in 2 stages:
    - Stage 1: Tighten bolts 1 thru 22 to 10 Nm (89 lb-in) and bolts 23, 24 and 25 to 15 Nm (11 lb-ft).
    - Stage 2: Tighten bolts 1 thru 22 to 24 Nm (18 lb-ft) and bolts 23, 24 and 25 to 75 Nm (55 lb-ft).

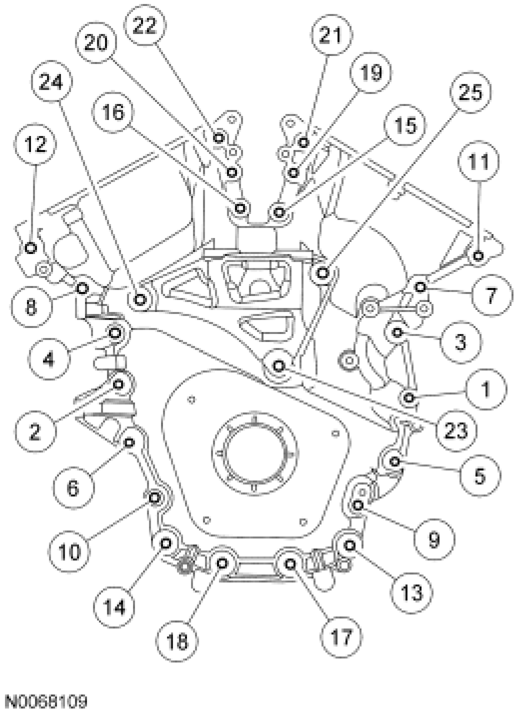


Fig. 732: Identifying Tightening Of Engine Front Cover Bolts & Engine Mount Bracket Bolts In Sequence
Courtesy of FORD MOTOR CO.

7. Install the 2 engine mount studs.
    - Tighten to 18 Nm (13 lb-ft).

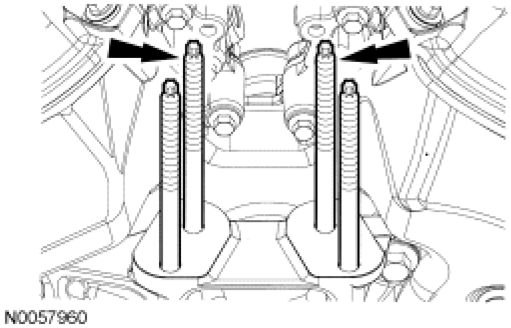


Fig. 733: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

8. Install the engine mount bracket and the 2 bolts.

- Tighten to 24 Nm (18 lb-ft).

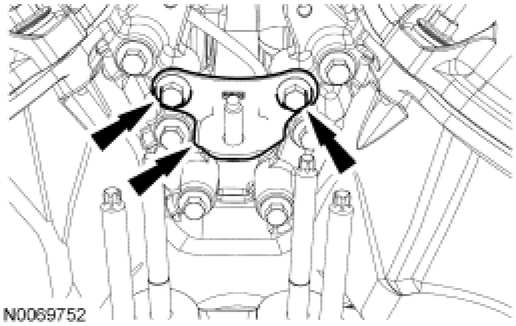


Fig. 734: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

NOTE: Apply clean engine oil to the crankshaft front seal bore in the engine front cover.

9. Using the special tools, install a new crankshaft front seal.

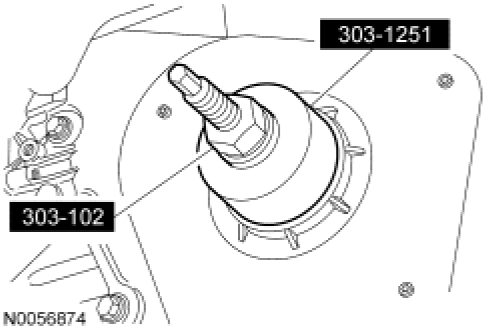


Fig. 735: Installing Crankshaft Front Seal Using Special Tools (303-102) & (303-1251)
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the outside diameter sealing surfaces with clean engine oil.

10. Using the special tools, install the crankshaft pulley.

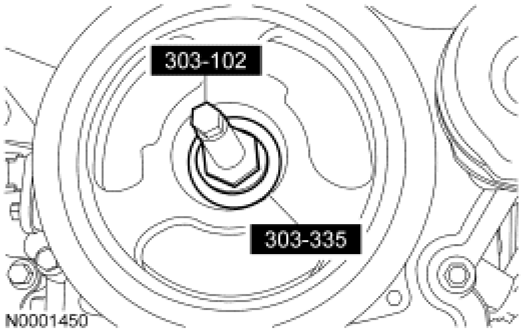


Fig. 736: Installing Crankshaft Pulley
Courtesy of FORD MOTOR CO.

11. Using the special tool, install the crankshaft pulley washer and new bolt and tighten in 4 stages.
    - Stage 1: Tighten to 120 Nm (89 lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.

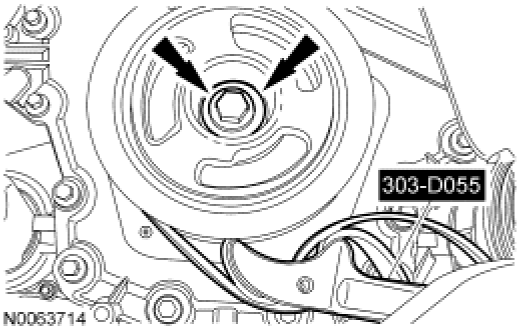


Fig. 737: Installing Crankshaft Pulley Washer & Bolt Using Special Tools (303-D055)
Courtesy of FORD MOTOR CO.

12. Install the accessory drive belt tensioner and the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).

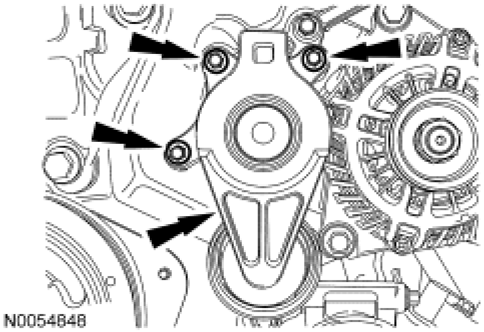


Fig. 738: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

13. Install the power steering pump and the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).

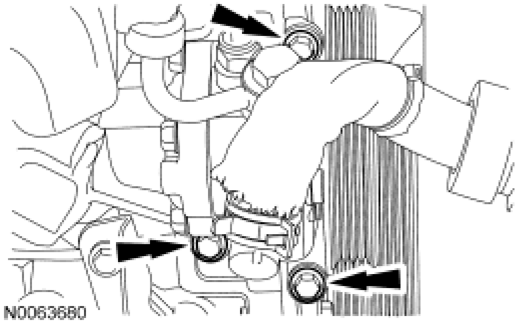


Fig. 739: Locating Power Steering Pump Bolts
Courtesy of FORD MOTOR CO.

NOTE: Installation of new seals is only required if damaged seals were removed during disassembly of the engine.

NOTE: Spark plug tube seal installation shown, variable camshaft timing (VCT) seal installation similar.

14. Using the special tools, install new VCT solenoid and/or spark plug tube seals.

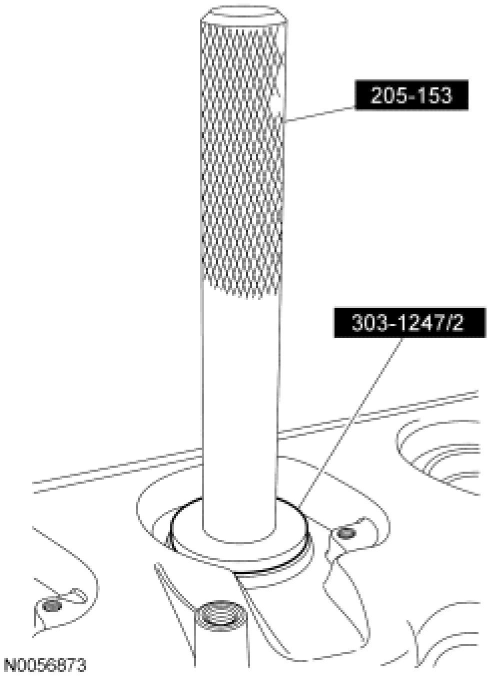


Fig. 740: Installing VCT Solenoid And/Or Spark Plug Tube Seals Using Special Tools (205-153) & (303-1247/2)
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may

cause the engine oil to foam excessively and result in serious engine damage.

NOTE: **If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.**

15. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-RH cylinder head joints.

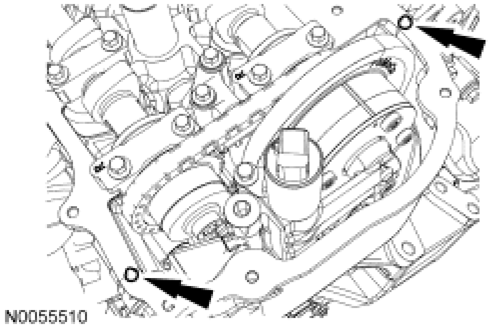


Fig. 741: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-RH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

16. Using a new gasket, install the RH valve cover, bolt and the 10 stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

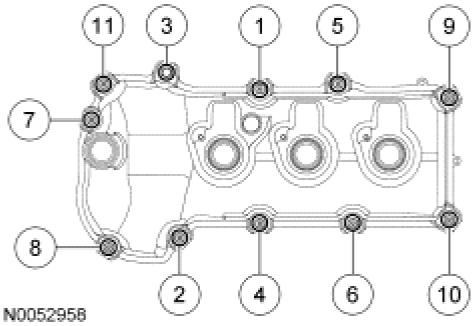


Fig. 742: Installing RH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

CAUTION: **Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.**

NOTE: **If the valve cover is not installed and the fasteners tightened within 4**

minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

17. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-LH cylinder head joints.

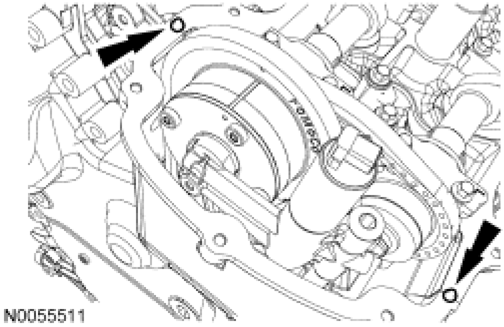


Fig. 743: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-LH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

18. Using a new gasket, install the LH valve cover and 11 stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

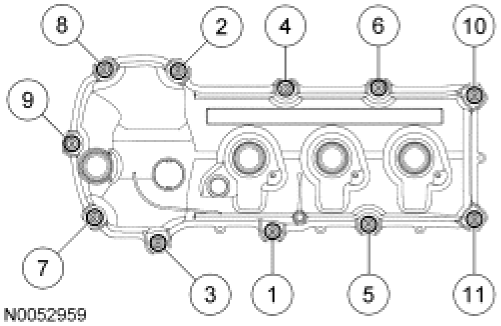


Fig. 744: Installing LH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

19. Install the wiring harness retaining bracket and the 2 nuts.
    - Tighten to 9 Nm (80 lb-in).

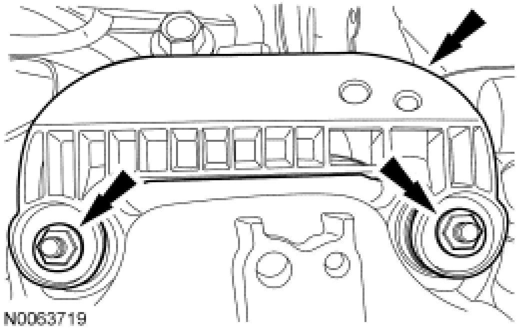


Fig. 745: Identifying Wiring Harness Retaining Bracket & Nuts
Courtesy of FORD MOTOR CO.

20. Install the power steering pressure (PSP) hose bracket and nut.
    - Tighten to 9 Nm (80 lb-in).

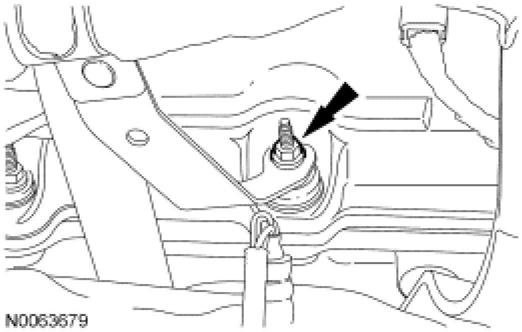


Fig. 746: Identifying PSP Hose Bracket Nut
Courtesy of FORD MOTOR CO.

21. Attach the PSP hose retainer to the engine lifting eye.

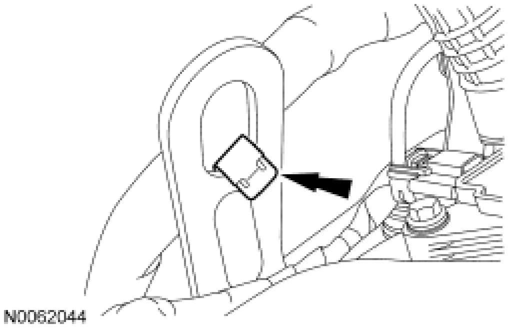


Fig. 747: Locating PSP Hose Retainer From Engine Lifting Eye
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

22. Install the 6 coil-on-plug assemblies and the 6 bolts.

- Tighten to 7 Nm (62 lb-in).

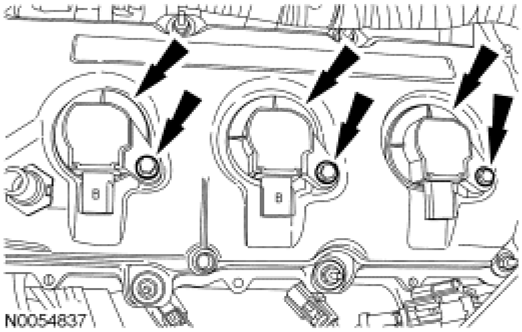


Fig. 748: Locating Coil-On-Plugs & Bolts
Courtesy of FORD MOTOR CO.

23. Attach all of the wiring harness retainers to the LH valve cover and stud bolts.
24. Connect the 3 LH coil-on-plug electrical connectors.

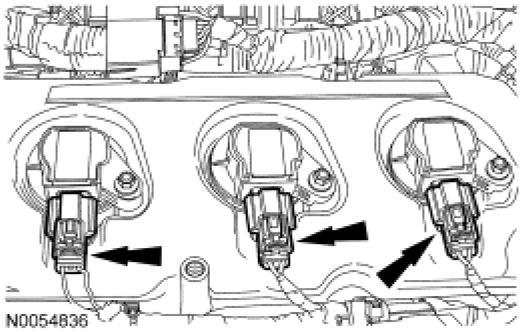


Fig. 749: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

25. Connect the LH camshaft VCT solenoid electrical connector.

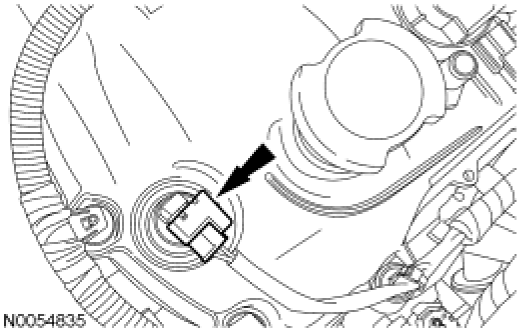


Fig. 750: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

26. Attach all of the wiring harness retainers to the RH valve cover and stud bolts.

27. If equipped, connect the heated PCV valve electrical connector.

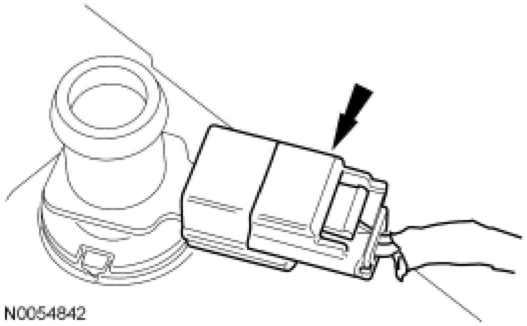


Fig. 751: Locating Heated PCV Valve Electrical Connector
Courtesy of FORD MOTOR CO.

28. Connect the 3 RH coil-on-plug electrical connectors.

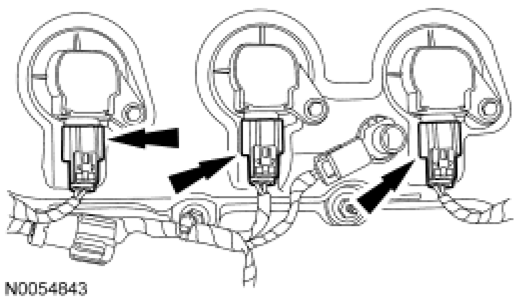


Fig. 752: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

29. Connect the RH VCT solenoid electrical connector.

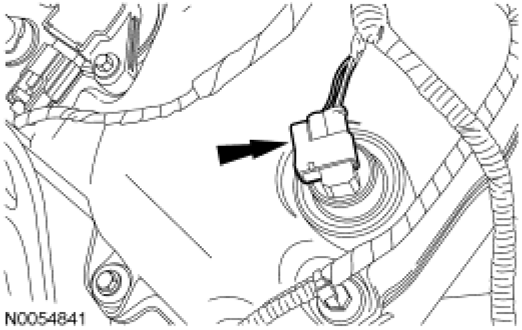


Fig. 753: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

30. Connect the PSP switch electrical connector.

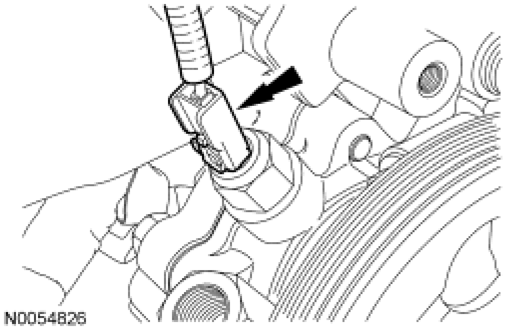


Fig. 754: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

31. Connect the RH catalyst monitor sensor electrical connector.

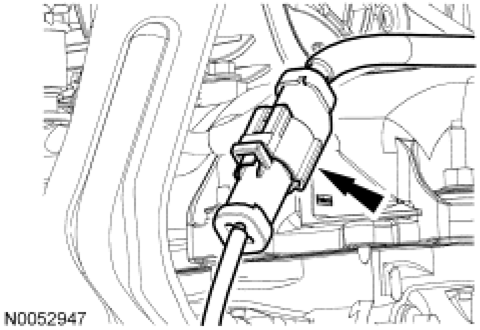


Fig. 755: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

32. Using new gaskets, install the upper intake manifold and the 6 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

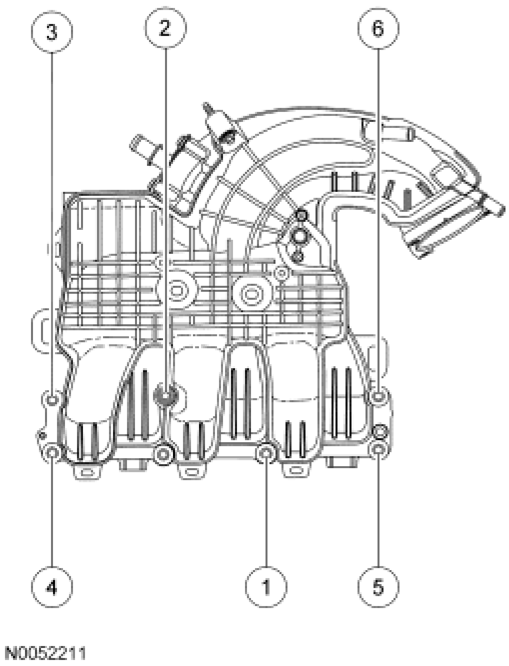


Fig. 756: Installing Upper Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

33. Install the upper intake manifold short support bracket bolt.
    - Tighten to 10 Nm (89 lb-in).

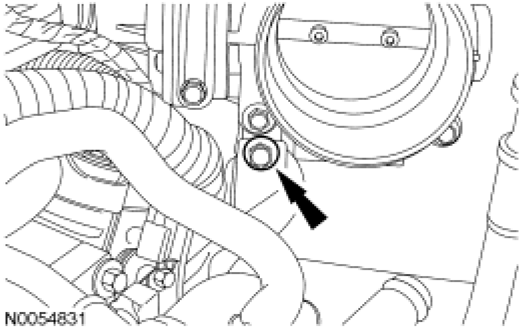


Fig. 757: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

34. If equipped, install the upper intake manifold long support bracket bolt.
    - Tighten to 10 Nm (89 lb-in).

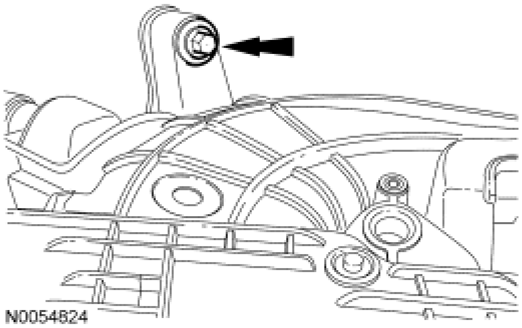


Fig. 758: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

35. Attach the wiring harness retainers to the upper intake manifold.

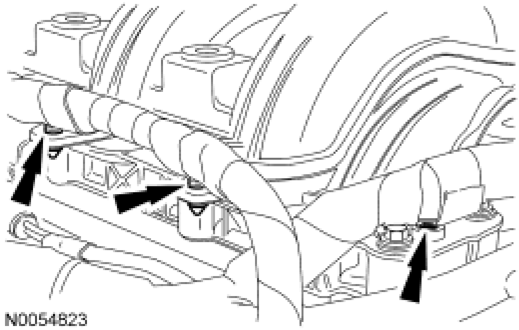


Fig. 759: Locating Wiring Harness Retainers From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

36. Connect the throttle body (TB) electrical connector.

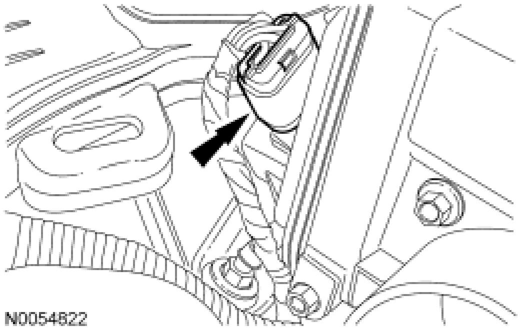


Fig. 760: Locating Throttle Body Electrical Connector
Courtesy of FORD MOTOR CO.

37. Connect the PCV hose to the PCV valve.

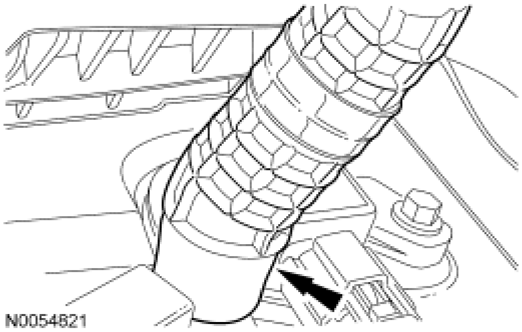


Fig. 761: Identifying PCV Hose From PCV Valve
Courtesy of FORD MOTOR CO.

38. If equipped, connect the PCV electrical connector.

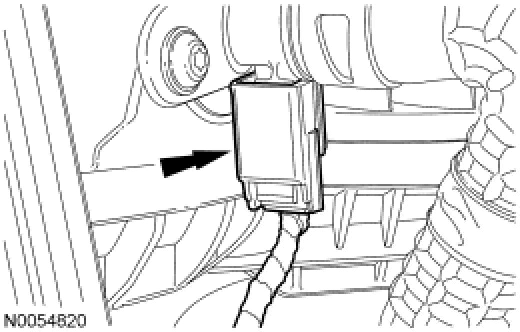


Fig. 762: Identifying Positive Crankcase Ventilation (PCV) Fitting Electrical Connector
Courtesy of FORD MOTOR CO.

39. If equipped, attach the block heater wiring harness retainer to the PSP tube and the power steering reservoir hose.

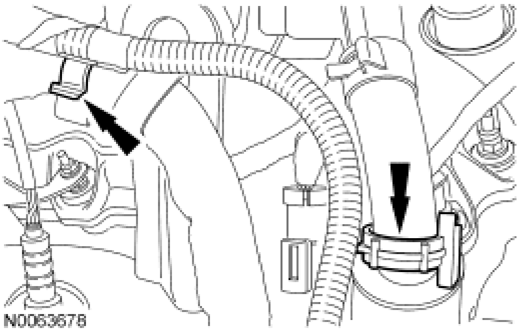


Fig. 763: Identifying Block Heater Wiring Harness From Engine
Courtesy of FORD MOTOR CO.

40. If equipped, attach the block heater wiring harness retainer to the upper intake manifold.

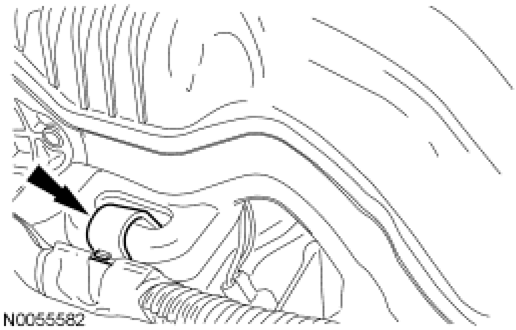


Fig. 764: Identifying Block Heater Wiring Harness Retainer From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

41. Raise the engine and transaxle assembly into the vehicle.
42. Install the engine mount, the nut and the 2 bolts.
    - Tighten the bolts to 55 Nm (41 lb-ft).
    - Tighten the nut to 63 Nm (46 lb-ft).

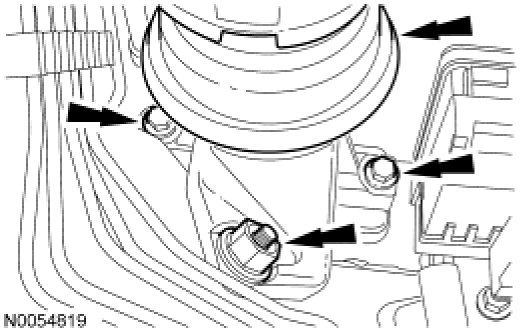


Fig. 765: Identifying Nut, Bolts & Engine Mount
Courtesy of FORD MOTOR CO.

43. Install the 4 engine mount nuts.
    - Tighten to 63 Nm (46 lb-ft).

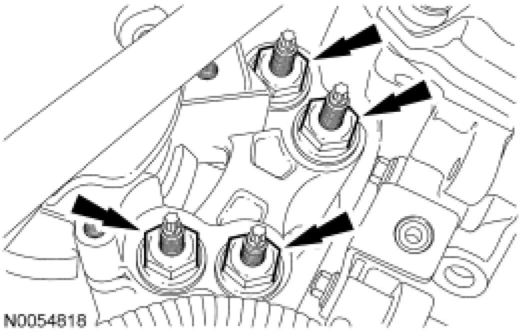


Fig. 766: Identifying Engine Mount Nuts
Courtesy of FORD MOTOR CO.

44. Install the transaxle mount bracket, bolt and the 2 nuts.
    - Tighten to 80 Nm (59 lb-ft).

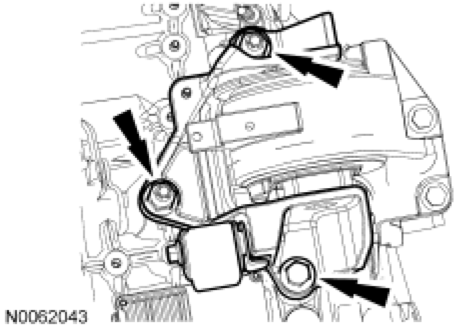


Fig. 767: Identifying Transaxle Mount Bracket Bolt
Courtesy of FORD MOTOR CO.

45. Install the transaxle mount through bolt and nut.
    - Tighten to 90 Nm (66 lb-ft).

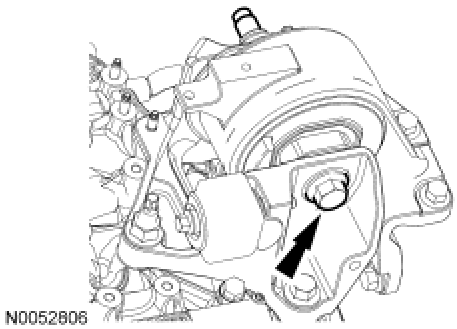


Fig. 768: Identifying Transaxle Support Insulator Through Bolt
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

NOTE: Prior to installation of the halfshaft, inspect the halfshaft sealing surface for wear or damage and install new if necessary.

46. Position the RH halfshaft in the transaxle and install the bolt and the 2 stud bolts.
    - Tighten to 55 Nm (41 lb-ft).

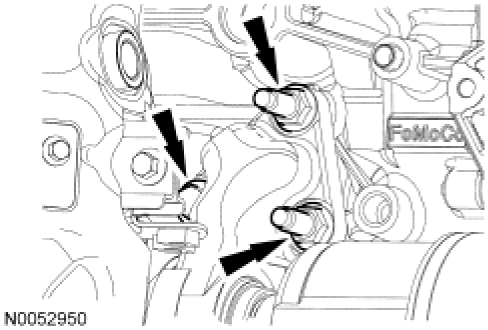


Fig. 769: Identifying Intermediate Shaft Bearing Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

NOTE: **Do not tighten the 2 catalytic converter support bracket bolts at this time.**

47. Install the RH catalytic converter support bracket and the 2 bolts.

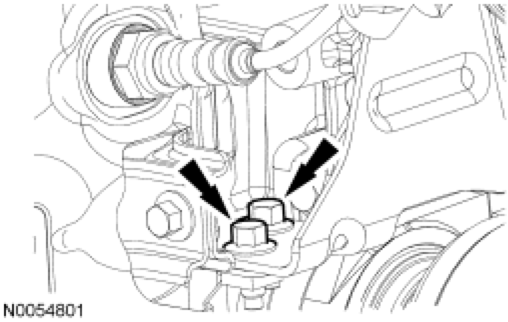


Fig. 770: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

48. Install the 2 catalytic converter support bracket nuts.
    - Tighten to 40 Nm (30 lb-ft).
    - Tighten the 2 catalytic converter support bracket bolts to 20 Nm (15 lb-ft).

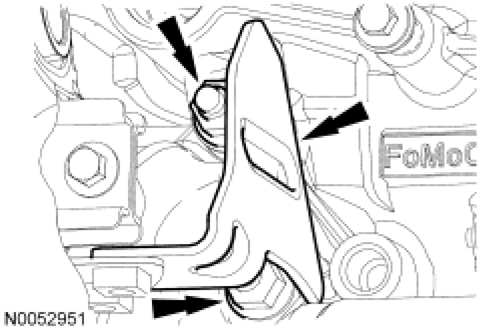


Fig. 771: Identifying Catalytic Converter Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

NOTE:	**A new powertrain transfer unit (PTU) seal must be installed whenever the intermediate shaft is removed.**

49. Install a new PTU seal. For additional information, refer to **ENGINE IGNITION - 3.0L (4V)** article.

NOTE:	**Prior to installation of the halfshaft, inspect the halfshaft sealing surface for wear or damage and install new, if necessary.**

50. Position the RH halfshaft in the transaxle and install the 2 bolts.
    - Tighten to 23 Nm (17 lb-ft).

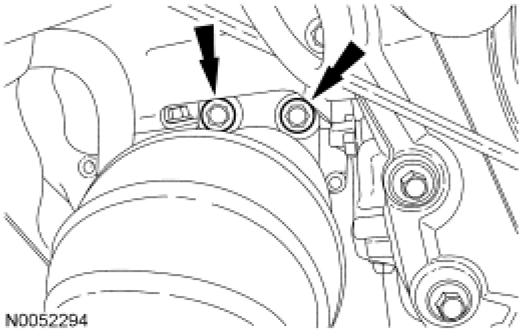


Fig. 772: Locating RH Halfshaft Bearing Support Bracket Bolts
Courtesy of FORD MOTOR CO.

All vehicles

NOTE:	**Prior to installation of the halfshaft, inspect the halfshaft sealing surface for wear or damage and install new, if necessary.**

51. Install the LH halfshaft into the transaxle.

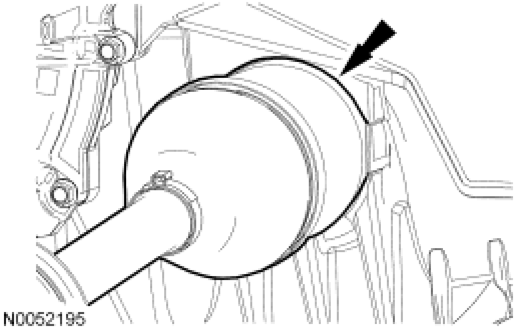


Fig. 773: Identifying LH Halfshaft
Courtesy of FORD MOTOR CO.

52. Using the special tool, raise the subframe into the installed position.

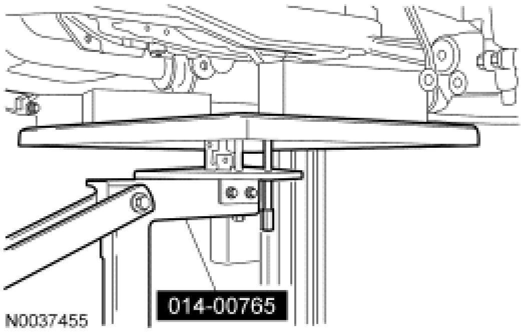


Fig. 774: Positioning Special Tool (014-00765) Under Subframe Assembly
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

53. Install the 2 front subframe nuts.
    - Tighten to 150 Nm (111 lb-ft).

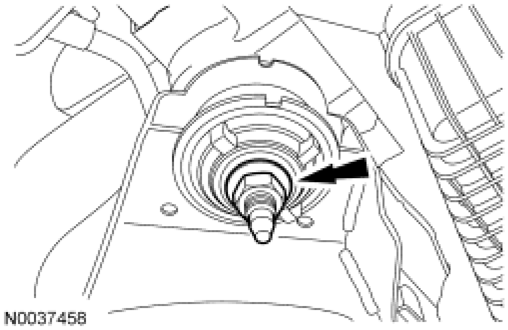


Fig. 775: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

54. Position the subframe brackets and install the 4 bolts finger-tight.

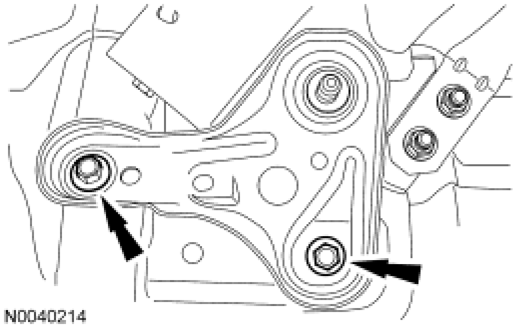


Fig. 776: Locating Subframe Brackets And Bolts Finger-Tight
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

55. Install the 2 rear subframe nuts.
    - Tighten to 150 Nm (111 lb-ft).

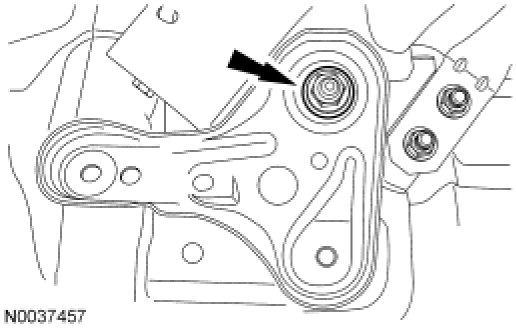


Fig. 777: Locating Subframe Nuts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

56. Tighten the 2 subframe bracket-to-body bolts to 103 Nm (76 lb-ft).

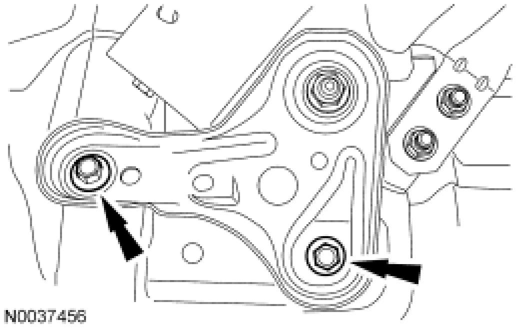


Fig. 778: Locating Subframe Bracket-To-Body Bolts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

57. Install the through bolts into the lower control arms.
    - Tighten to 103 Nm (76 lb-ft).

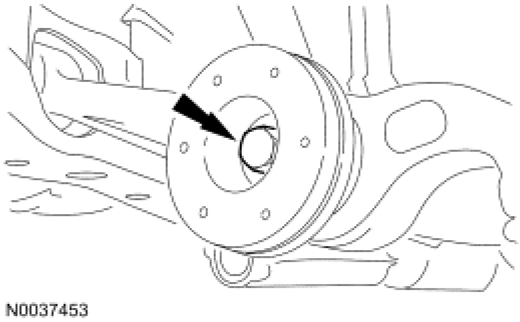


Fig. 779: Locating Lower Control Arms Through Bolt
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

58. Install the 4 lower ball joint nuts.
    - Tighten to 200 Nm (148 lb-ft).

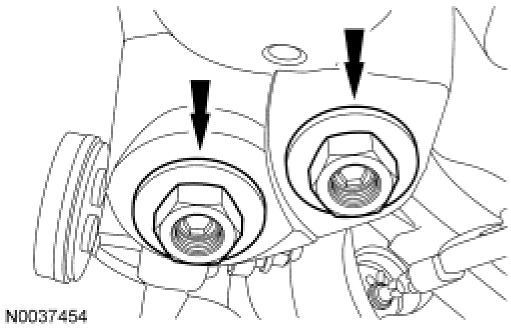


Fig. 780: Locating Lower Ball Joint Nuts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

59. Install the stabilizer bar links and nuts to the struts.

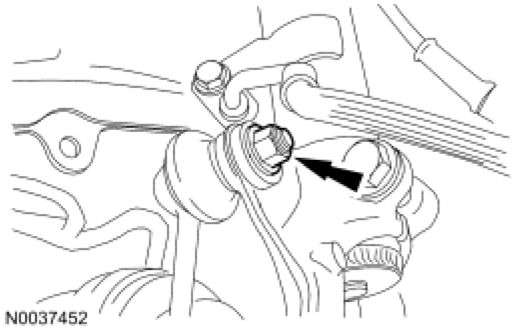


Fig. 781: Locating Stabilizer Bar Links Nut
Courtesy of FORD MOTOR CO.

NOTE: **LH shown, RH similar.**

60. Install the tie-rod ends and nuts.
    - Tighten to 48 Nm (35 lb-ft).
    - Install new cotter pins.

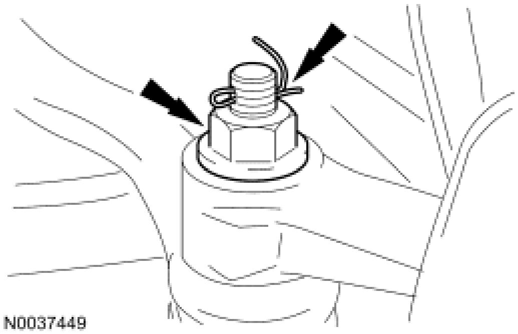


Fig. 782: Locating Tie-Rod Ends Nuts And Cotter Pin
Courtesy of FORD MOTOR CO.

61. Install the engine roll restrictor-to-subframe through bolt.
    - Tighten to 90 Nm (66 lb-ft).

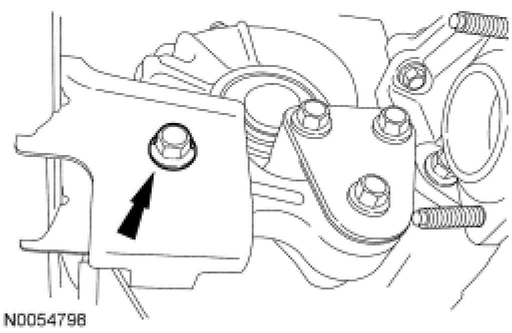


Fig. 783: Locating Roll Restrictor Bolt
Courtesy of FORD MOTOR CO.

AWD vehicles

62. Line up the index marks on the rear driveshaft to the index marks on the PTU flange made during removal and install the 4 bolts (3 shown).
    - Tighten to 70 Nm (52 lb-ft).

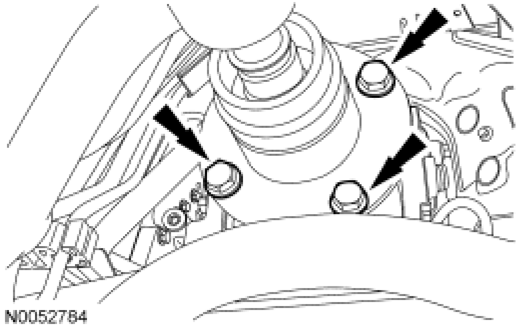


Fig. 784: Identifying Drive Shaft Bolts
Courtesy of FORD MOTOR CO.

All vehicles

63. Using new gaskets, install the Y-pipe assembly and the 6 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

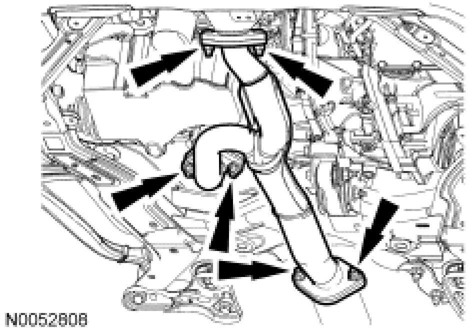


Fig. 785: Locating Y-Pipe Nuts & Y-Pipe Assembly
Courtesy of FORD MOTOR CO.

NOTE:	**Lubricate the engine oil filter gasket with clean engine oil prior to installing the oil filter.**

64. Install a new engine oil filter.
    - Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.

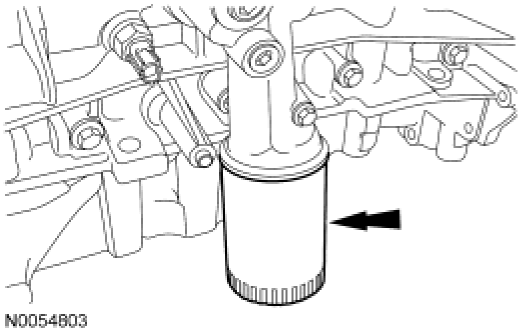


Fig. 786: Identifying Engine Oil Filter
Courtesy of FORD MOTOR CO.

65. Connect the 2 transmission fluid cooler hoses.

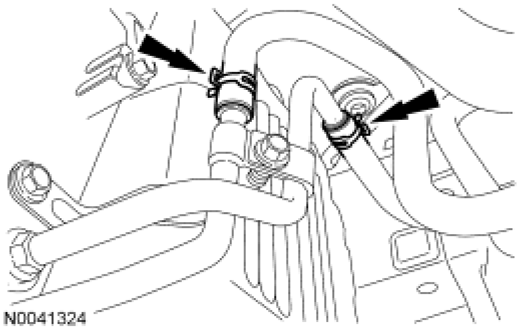


Fig. 787: Locating Transmission Fluid Cooler Hoses
Courtesy of FORD MOTOR CO.

66. Connect the power steering cooler tube.

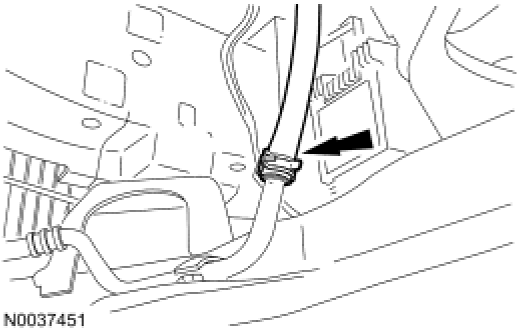


Fig. 788: Locating Power Steering Cooler Tube
Courtesy of FORD MOTOR CO.

67. Slide the steering gear-to-dash seal onto the steering gear and engage the 4 retaining clips into the body.
    - From under the vehicle, verify that the seal is correctly installed on the steering gear and the retaining clips are fully engaged into the body.

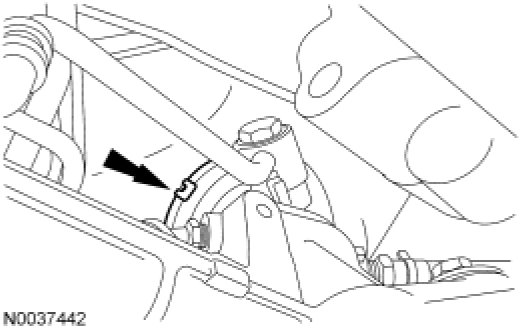


Fig. 789: Locating Steering Gear-To-Dash Seal Clips

Courtesy of FORD MOTOR CO.

68. If equipped, install the underbody shield and the 6 screws.

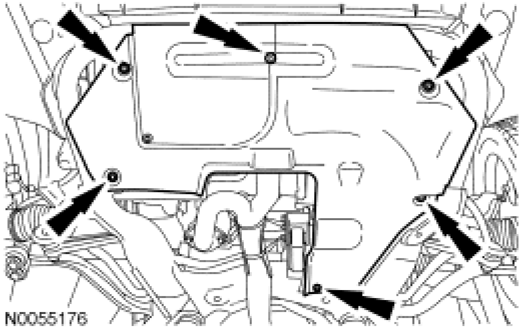


Fig. 790: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

69. Install the LH splash shield and the 6 pin-type retainers (4 shown).

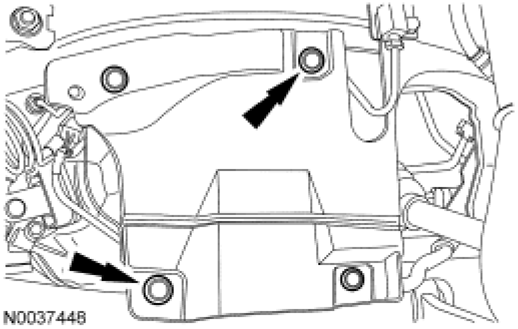


Fig. 791: Locating LH Splash Shield And Pin-Type Retainers
Courtesy of FORD MOTOR CO.

70. Position the LH fender splash shield and install the 4 screws.

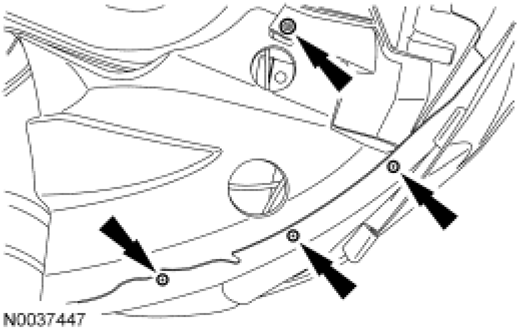


Fig. 792: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

NOTE: Align the index marks made during removal.

71. Install the steering intermediate shaft onto the steering gear and install a new bolt.
    - Tighten to 23 Nm (17 lb-ft).

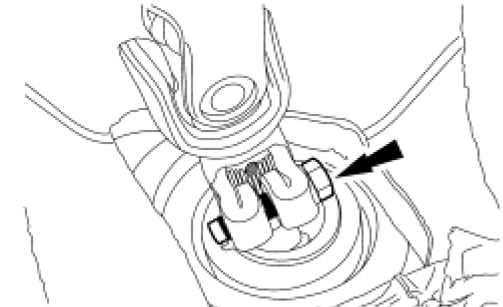


Fig. 793: Locating Steering Intermediate Shaft Bolt
Courtesy of FORD MOTOR CO.

72. Install the steering joint cover and the 2 nuts.

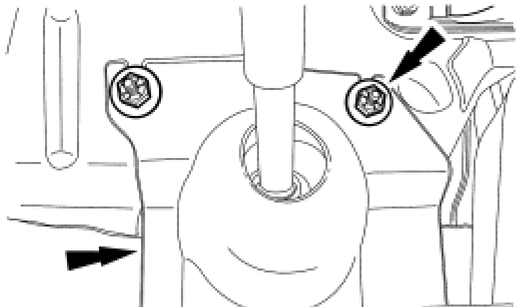


Fig. 794: Locating Steering Joint Cover And Nuts
Courtesy of FORD MOTOR CO.

73. Using a new banjo bolt and 2 new seals, install the PSP tube onto the steering gear.
    - Tighten to 37 Nm (27 lb-ft).

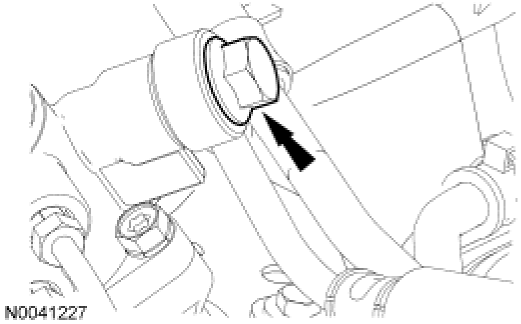


Fig. 795: Locating PSP Hose Banjo Bolt

Courtesy of FORD MOTOR CO.

74. Install the PSP tube bracket and nut.
    - Tighten to 10 Nm (89 lb-in).

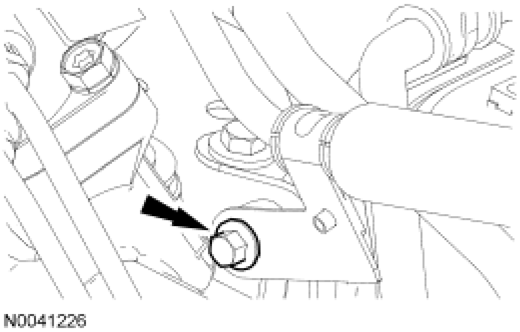


Fig. 796: Locating Power Steering Pressure (PSP) Hose Bracket Bolt
Courtesy of FORD MOTOR CO.

75. Connect the PCM connectors and pin-type retainers.

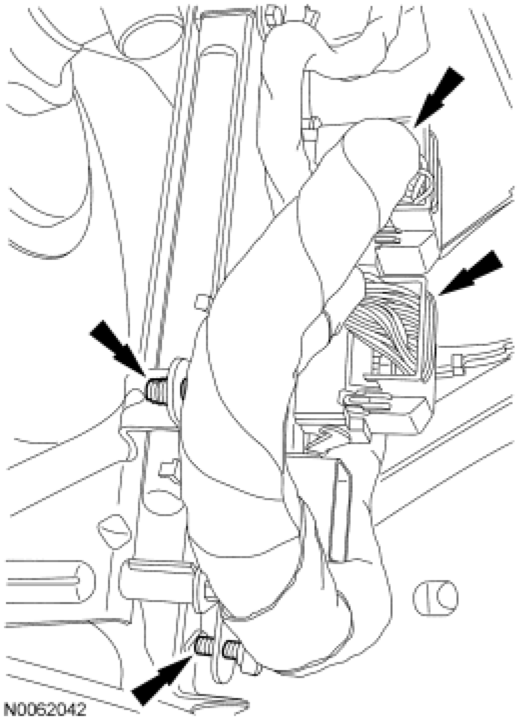


Fig. 797: Locating PCM Electrical Connectors & Pin-Type Retainers
Courtesy of FORD MOTOR CO.

76. Install the engine mount brace and the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).

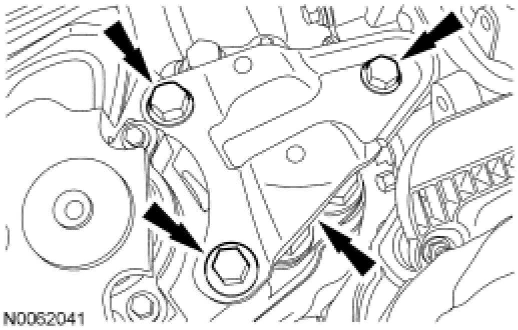


Fig. 798: Locating Engine Mount Brace Bolts
Courtesy of FORD MOTOR CO.

77. Install the ground wire and the bolt.
    - Tighten to 10 Nm (89 lb-in).

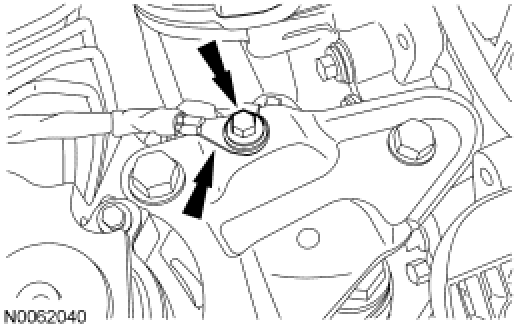


Fig. 799: Identifying Ground Wire Bolt From Engine Mount Brace
Courtesy of FORD MOTOR CO.

78. Connect the fuel supply tube to the fuel rail. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

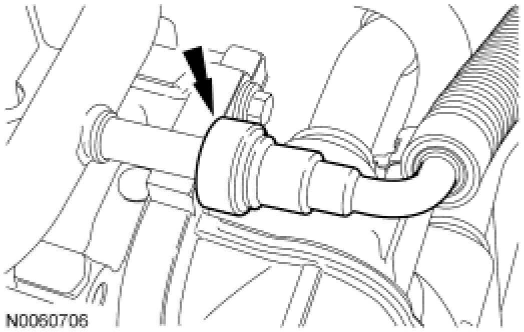


Fig. 800: Identifying Fuel Supply Tube From Fuel Rail
Courtesy of FORD MOTOR CO.

79. Attach the power steering reservoir onto the cowl.

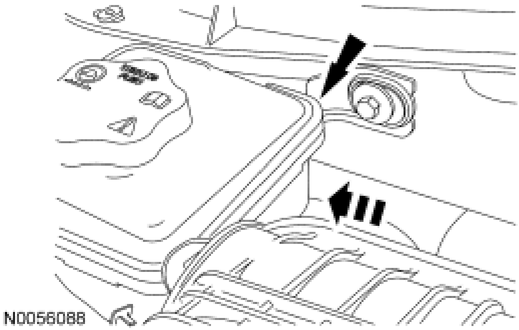


Fig. 801: Attaching Power Steering Reservoir Onto Cowl
Courtesy of FORD MOTOR CO.

80. Connect the hose to the power steering reservoir.
    - Attach the pin-type retainer to the engine mount brace.

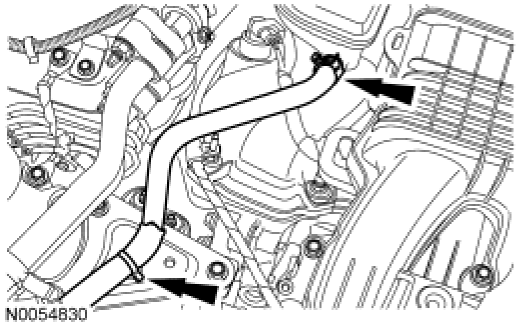


Fig. 802: Identifying Pin-Type Retainer From Engine Mount Brace
Courtesy of FORD MOTOR CO.

81. Install the oil level indicator.

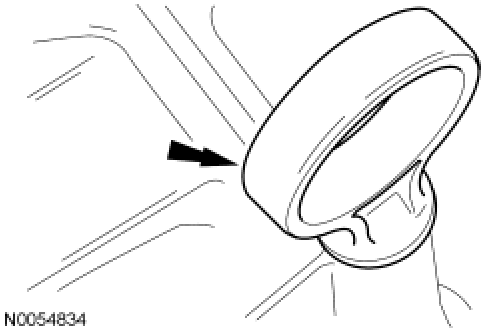


Fig. 803: Identifying Oil Level Indicator
Courtesy of FORD MOTOR CO.

82. Attach the 2 wiring harness retainers to the LH valve cover stud bolts.

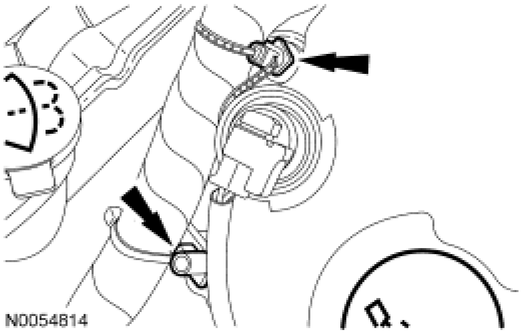


Fig. 804: Identifying Wiring Harness Retainers From LH Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

83. Connect the 2 engine wiring harness electrical connectors.

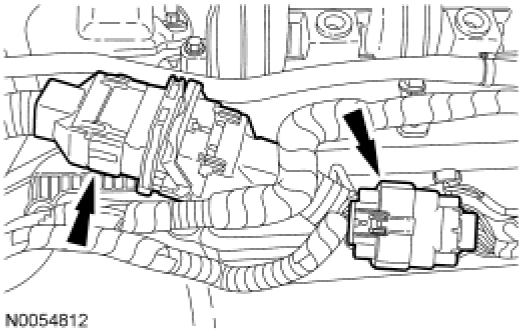


Fig. 805: Identifying Engine Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

84. Attach the 2 wiring harness retainers.

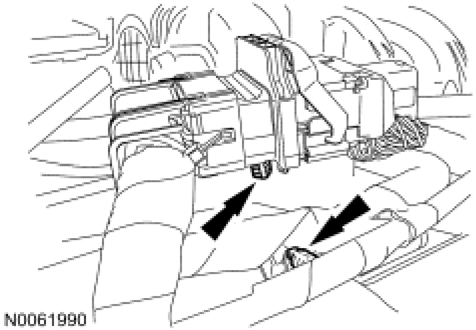


Fig. 806: Identifying Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

85. Using new O-ring seals, connect the A/C tubes and install the 2 nuts.
    - Tighten to 8 Nm (71 lb-in).

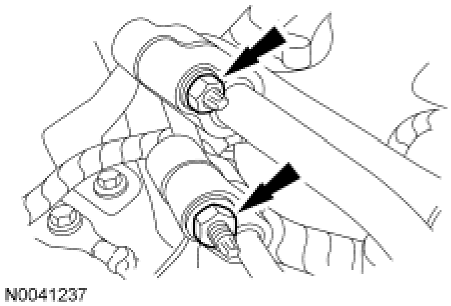


Fig. 807: Locating A/C Tubes And Nuts
Courtesy of FORD MOTOR CO.

86. Install the A/C tube bracket bolt.
    - Tighten to 8 Nm (71 lb-in).

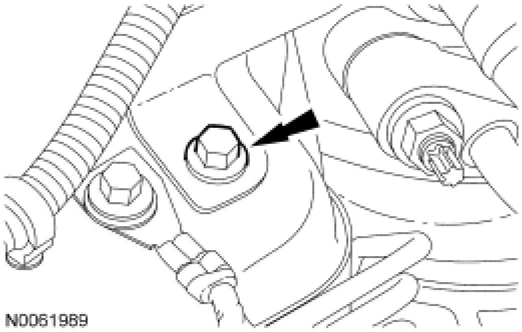


Fig. 808: Locating A/C Tube Bracket Bolt
Courtesy of FORD MOTOR CO.

87. Install the 2 A/C tube bracket bolts.
    - Tighten to 10 Nm (89 lb-in).

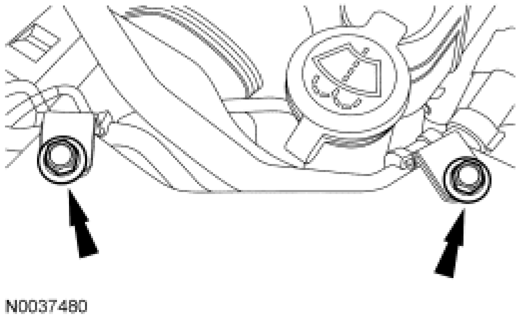


Fig. 809: Locating A/C Tube Bracket Bolts
Courtesy of FORD MOTOR CO.

88. Using a new O-ring seal, connect the A/C tube to the condenser and install the nut.
    - Tighten to 8 Nm (71 lb-in).

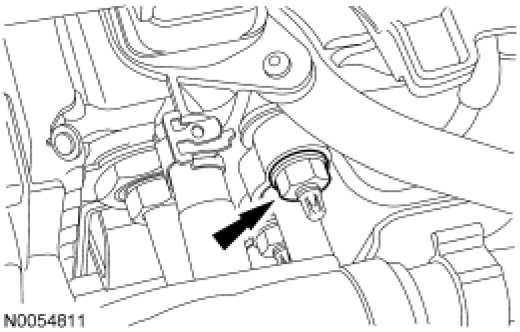


Fig. 810: Locating A/C Tube From Condenser
Courtesy of FORD MOTOR CO.

89. Attach the coolant tube retainer clips to the A/C tube.

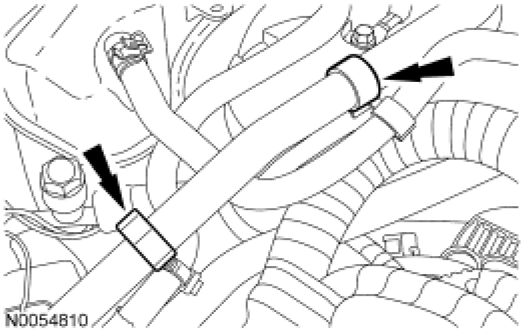


Fig. 811: Identifying Coolant Tube Retainer Clips
Courtesy of FORD MOTOR CO.

90. If equipped, attach the engine block heater harness to the radiator support, power steering hose, A/C tube and the engine wiring harness.
91. Install the ground wire and bolt.
    - Tighten to 12 Nm (9 lb-ft).

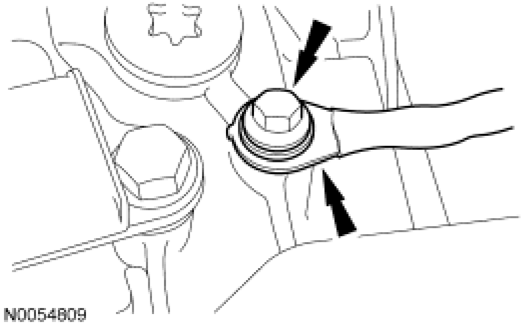


Fig. 812: Locating Ground Wire And Bolt
Courtesy of FORD MOTOR CO.

92. Position the transaxle control cable bracket in place and install the 3 nuts.

- Tighten to 12 Nm (9 lb-ft).

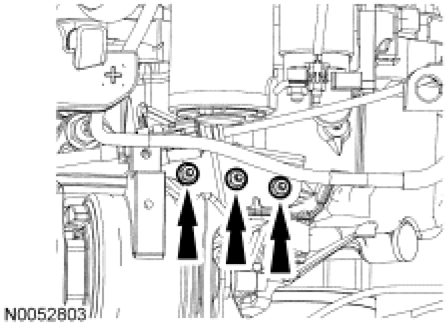


Fig. 813: Identifying Selector Lever Cable Bracket Bolts & Nuts
Courtesy of FORD MOTOR CO.

93. Connect the transaxle control cable to the control lever.

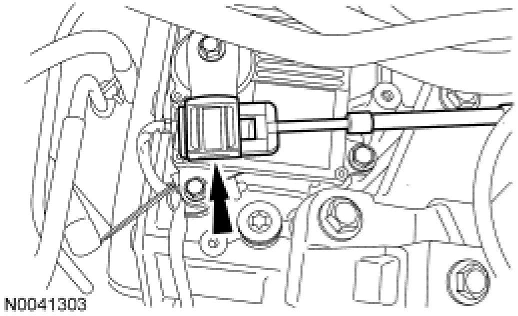


Fig. 814: Locating Selector Lever Cable End
Courtesy of FORD MOTOR CO.

94. Connect the upper radiator hose, lower radiator hose and 2 heater hoses to the thermostat housing.

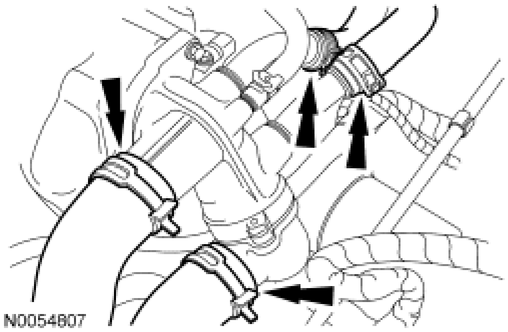


Fig. 815: Locating Upper Radiator Hose, Lower Radiator Hose & Heater Hoses From Thermostat Housing
Courtesy of FORD MOTOR CO.

95. Connect the vacuum hose and the evaporative emissions (EVAP) tube to the upper intake manifold.

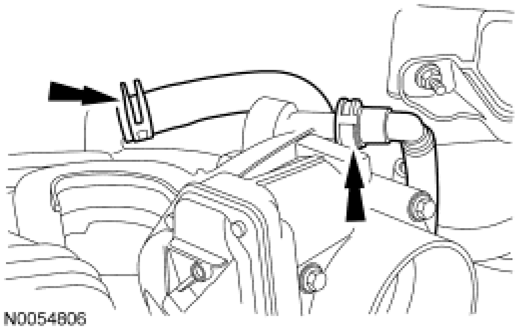


Fig. 816: Locating Vacuum Hose & Evaporative Emissions (EVAP) Tube From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

96. Install the ground wire and the bolt.
    - Tighten to 10 Nm (89 lb-in).

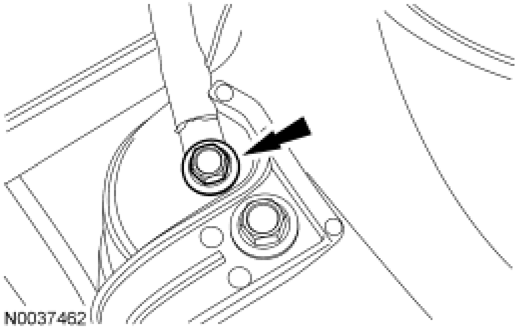


Fig. 817: Locating Ground Wire And Bolt
Courtesy of FORD MOTOR CO.

97. Connect the power feed to the battery terminal and install the nut.
    - Tighten to 6 Nm (53 lb-in).

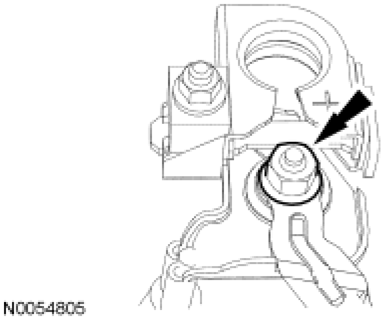


Fig. 818: Locating Power Feed To Battery Terminal And Nut
Courtesy of FORD MOTOR CO.

98. Attach the 2 wiring harness retainers to the transmission mount and the battery tray bracket.

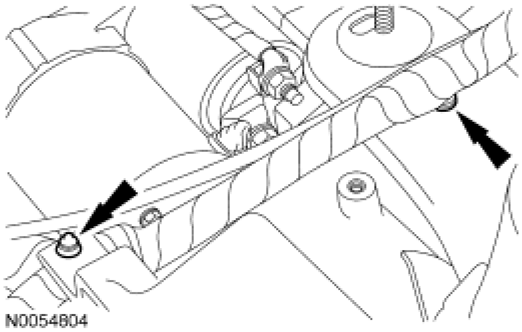


Fig. 819: Locating Wiring Harness Retainers From Transmission Mount & Battery Tray Bracket
Courtesy of FORD MOTOR CO.

99. Connect the 2 engine wiring harness electrical connectors.

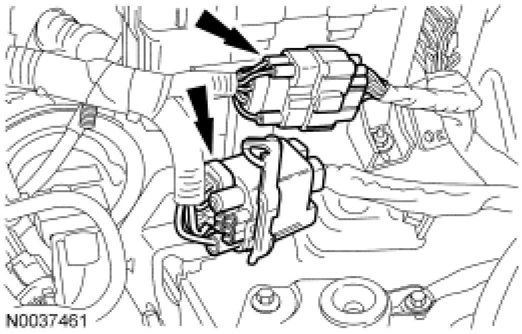


Fig. 820: Locating Engine Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

100. Install the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
101. Install the engine air cleaner and the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.
102. Install the degas bottle. For additional information, refer to **ENGINE COOLING** article.
103. Install the accessory drive belt and the power steering belt. For additional information, refer to **ACCESSORY DRIVE - 3.5L** article.

CAUTION: Do not expose the Motorcraft High Performance Engine RTV Silicone to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

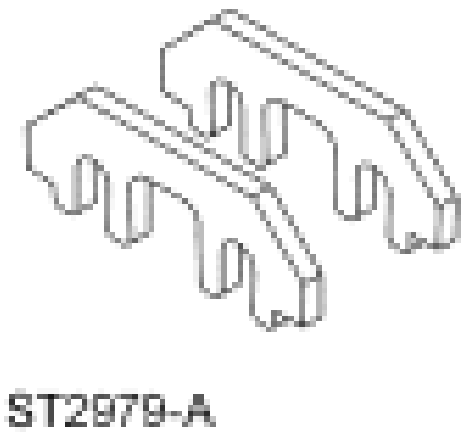
104. Fill the engine with clean engine oil.
105. Fill and bleed the cooling system. For additional information, refer to **ENGINE COOLING** article.
106. Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.
107. Check the transaxle fluid and add fluid if necessary. For additional information, refer to the Transmission Fluid Drain and Refill procedure in **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21**

article.

108. Recharge the air conditioning system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

TIMING DRIVE COMPONENTS

Special Tools

Illustration	Tool Name	Tool Number
	Tool, Camshaft Holding	303-1248

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan can cause engine failure.

1. Install the RH primary timing chain guide and the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

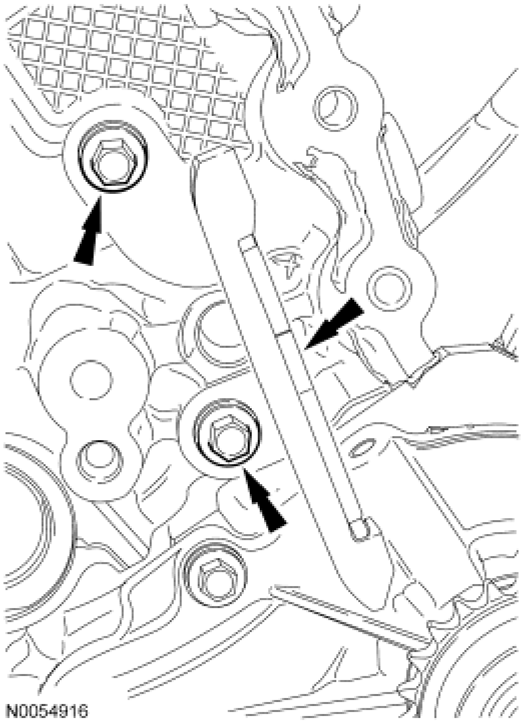


Fig. 821: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

NOTE: **It is necessary to tilt the Camshaft Holding Tool toward the rear of the engine to access the rearmost secondary timing chain tensioner bolt.**

2. Install the RH secondary timing chain tensioner and the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

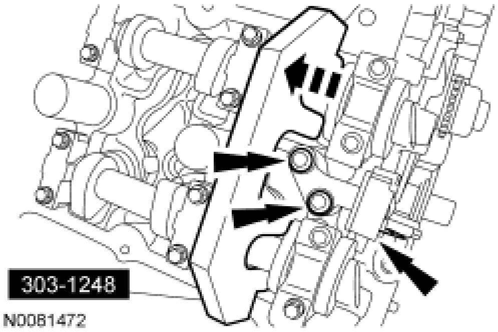


Fig. 822: Locating RH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

3. Assemble the RH Variable Camshaft Timing (VCT) assembly, the RH exhaust camshaft sprocket and the RH secondary timing chain.
   - Align the colored links with the timing marks.

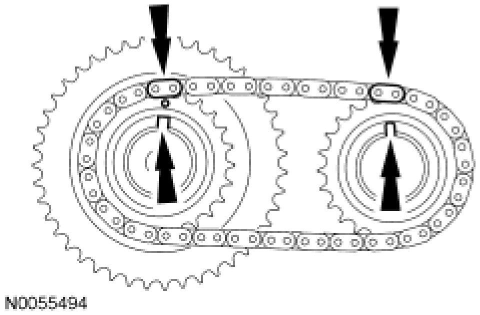


Fig. 823: Aligning RH Exhaust Camshaft Sprocket & RH Secondary Timing Chain Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

4. Position the RH secondary timing assembly onto the camshafts.

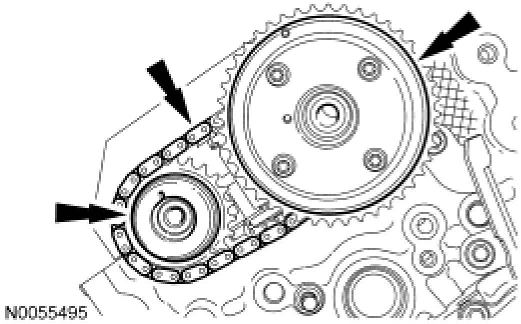


Fig. 824: Positioning RH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

5. Install 2 new bolts and the original washer. Tighten in 4 stages.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 10 Nm (89 lb-in).
    - Stage 4: Tighten 90 degrees.

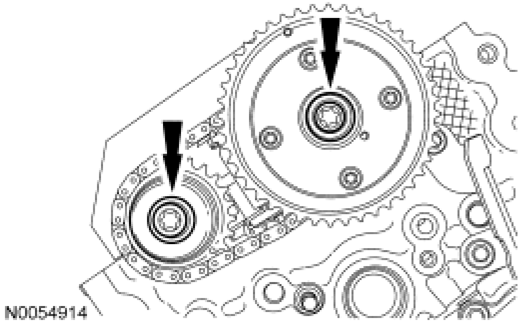


Fig. 825: Locating RH VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

6. Remove the lock pin from the RH secondary timing chain tensioner.

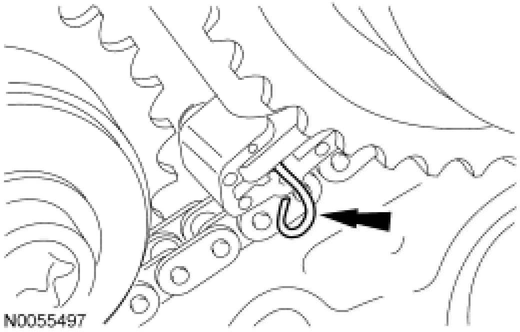


Fig. 826: Identifying Lock Pin On RH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

NOTE:	**It is necessary to tilt the Camshaft Holding Tool toward the rear of the engine to access the rearmost secondary timing chain tensioner bolt.**

7. Install the LH secondary timing chain tensioner and the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

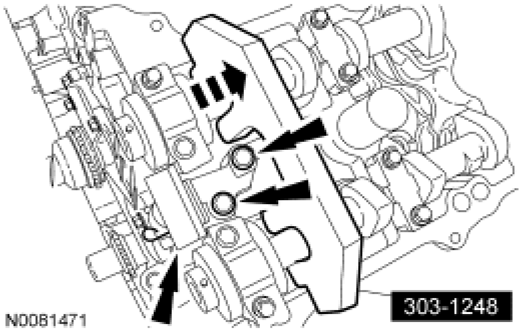


Fig. 827: Locating LH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

8. Assemble the LH VCT assembly, the LH exhaust camshaft sprocket and the LH secondary timing chain.
   - Align the colored links with the timing marks.

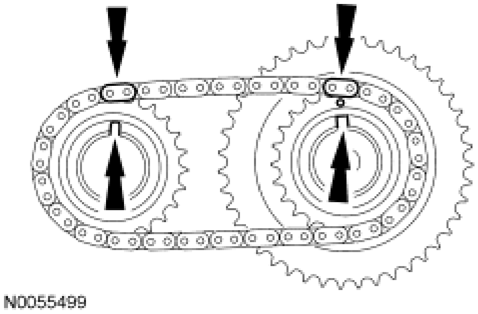


Fig. 828: Aligning LH Exhaust Camshaft Sprocket & LH Secondary Timing Chain Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

9. Position the LH secondary timing assembly onto the camshafts.

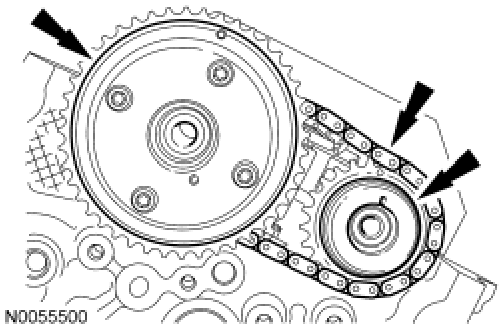


Fig. 829: Positioning LH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

10. Install 2 new bolts and the original washer. Tighten in 4 stages.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 10 Nm (89 lb-in).
    - Stage 4: Tighten 90 degrees.

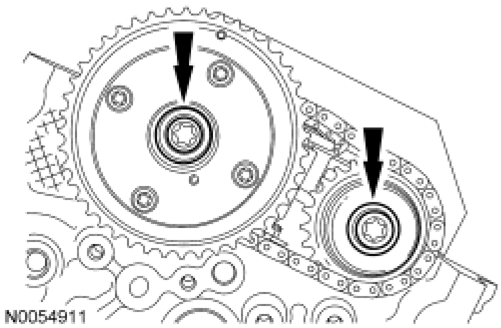


Fig. 830: Locating LH VCT Assembly Bolt & LH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

11. Remove the lock pin from the LH secondary timing chain tensioner.

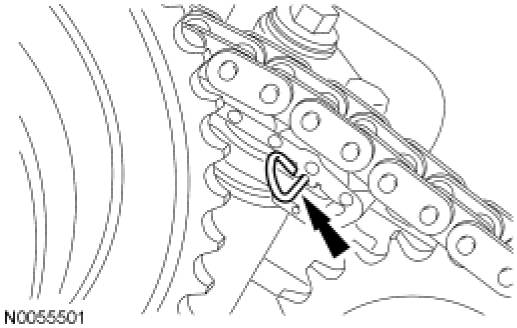


Fig. 831: Locating Lock Pin On LH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

12. Install the crankshaft timing chain sprocket.

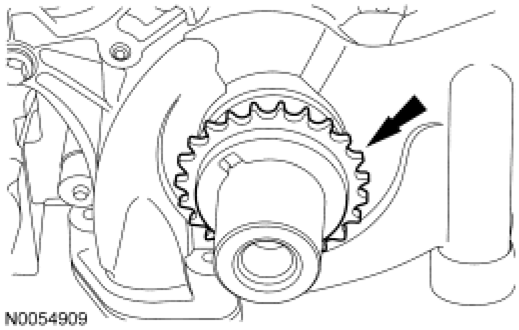


Fig. 832: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

13. Install the primary timing chain with the colored links aligned with the timing marks on the VCT assemblies and the crankshaft sprocket.

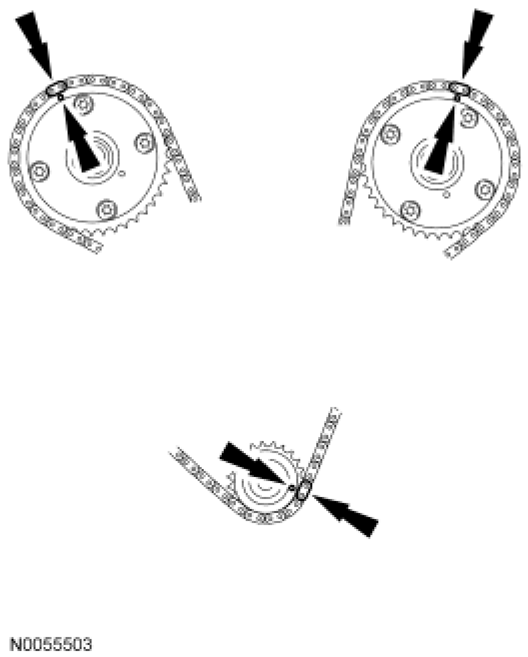


Fig. 833: Aligning Timing Marks On VCT Assemblies & Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

14. Install the upper LH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

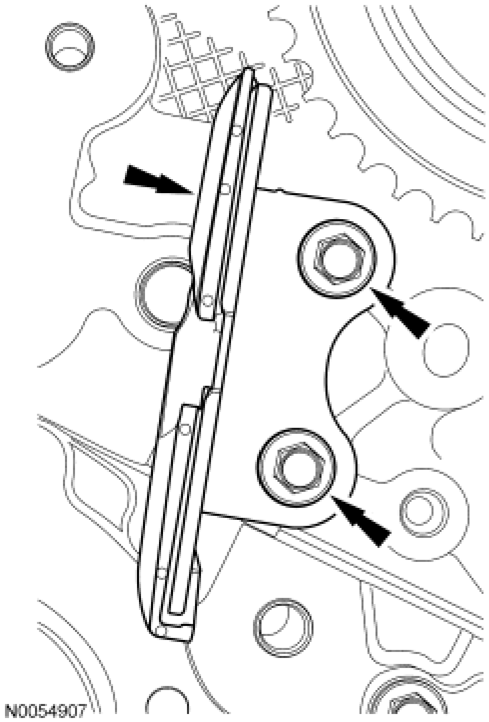


Fig. 834: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

15. Install the lower LH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

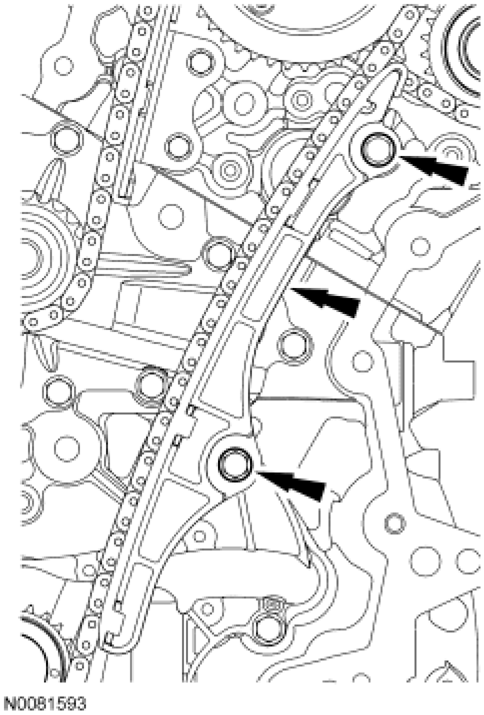


Fig. 835: Locating Lower LH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

16. Install the primary timing chain tensioner arm.

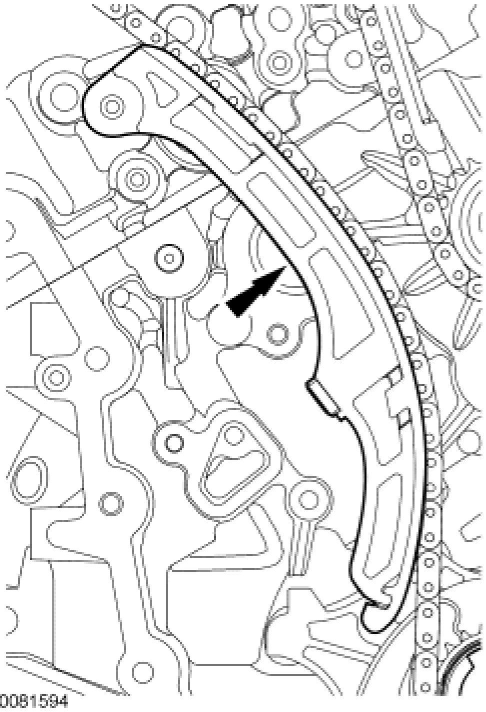


Fig. 836: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

17. Reset the primary timing chain tensioner.
    - Rotate the lever counterclockwise.
    - Using a soft-jawed vise, compress the plunger.
    - Align the hole in the lever with the hole in the tensioner housing.
    - Install a suitable lock pin.

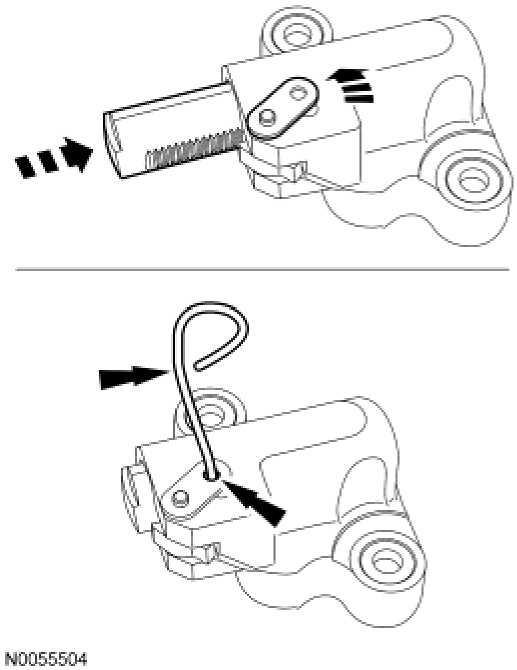


Fig. 837: Compressing Plunger Using A Soft-Jawed Vise
Courtesy of FORD MOTOR CO.

NOTE: It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.

18. Install the primary tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).
    - Remove the lock pin.

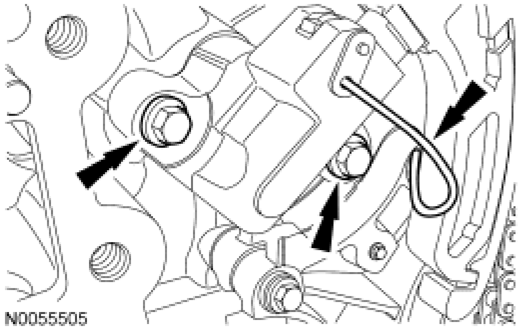


Fig. 838: Locating Primary Tensioner Bolts
Courtesy of FORD MOTOR CO.

19. As a post-check, verify correct alignment of all timing marks.

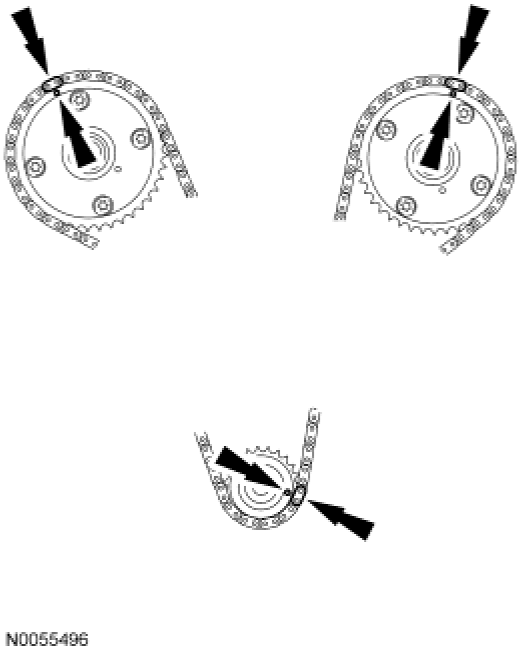


Fig. 839: Verifying Correct Alignment Of All Timing Marks
Courtesy of FORD MOTOR CO.

20. Install new VCT housing seals.

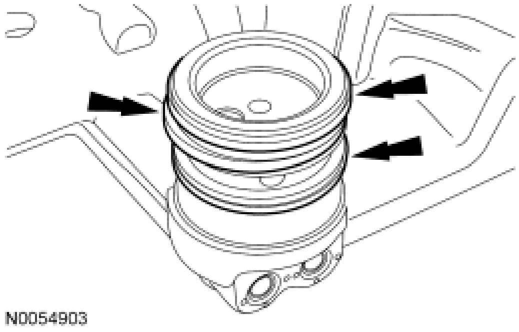


Fig. 840: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

NOTE:	**Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.**

21. Install the LH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

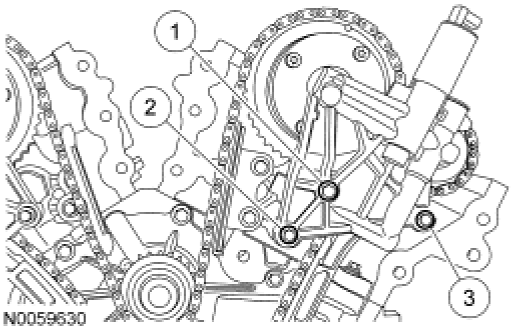


Fig. 841: Identifying LH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE: Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

22. Install the RH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

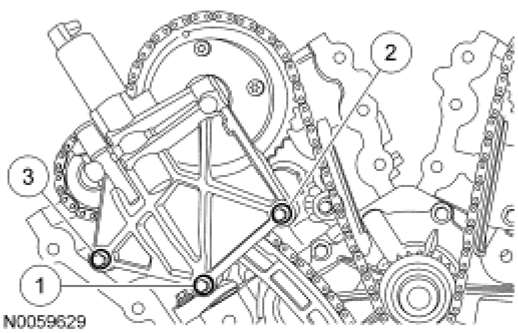


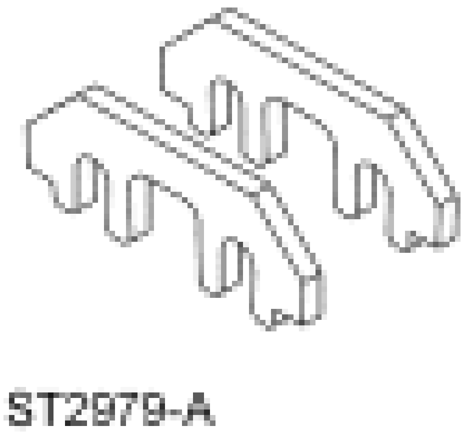
Fig. 842: Identifying RH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

23. Install the engine front cover. For additional information, refer to **Engine Front Cover**.

CAMSHAFT

Special Tools

Illustration	Tool Name	Tool Number
	Tool, Camshaft Holding	303-1248

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

All camshafts

NOTE: **The crankshaft must remain in the freewheeling position (crankshaft dowel pin at 9 o'clock) until after the camshafts are installed and the valve clearance is checked/adjusted. Do not turn the crankshaft until instructed to do so. Failure to follow this process will result in severe engine damage.**

1. Rotate the crankshaft counterclockwise until the crankshaft dowel pin is in the 9 o'clock position.

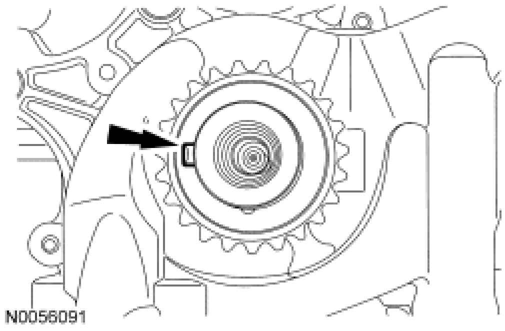


Fig. 843: Rotating Crankshaft Counterclockwise Until Crankshaft Dowel Pin Is In 9 O'clock Position
Courtesy of FORD MOTOR CO.

LH camshafts

NOTE: The camshafts must remain in the neutral position during installation or engine damage may occur.

NOTE: Coat the camshafts with clean engine oil prior to installation.

2. Position the camshafts onto the LH cylinder head in the neutral position as shown.

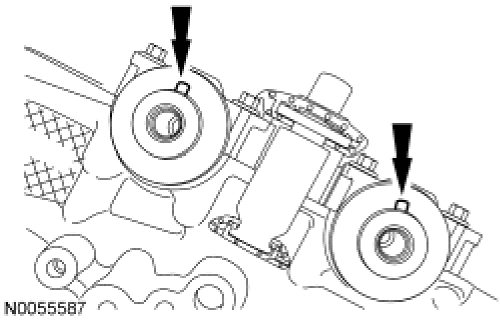


Fig. 844: Verifying LH Camshafts Are In Neutral Position
Courtesy of FORD MOTOR CO.

NOTE: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.

3. Install the 8 camshaft caps and the 16 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

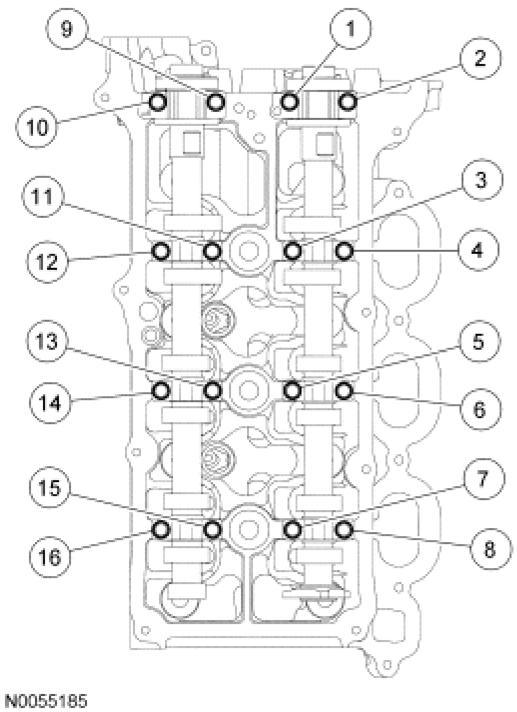


Fig. 845: Installing Camshaft Caps & Bolts In Sequence
Courtesy of FORD MOTOR CO.

RH camshafts

NOTE:	**The camshafts must remain in the neutral position during installation or engine damage may occur.**

NOTE:	**Coat the camshafts with clean engine oil prior to installation.**

4. Position the camshafts onto the RH cylinder head in the neutral position as shown.

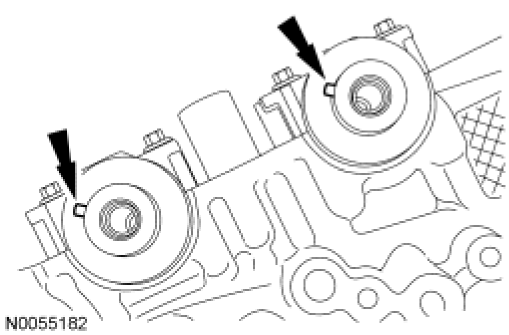


Fig. 846: Positioning Camshafts Onto RH Cylinder Head In Neutral Position
Courtesy of FORD MOTOR CO.

NOTE:	**Cylinder head camshaft bearing caps are numbered to verify that they are**

assembled in their original positions.

5. Install the 8 camshaft caps and the 16 bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

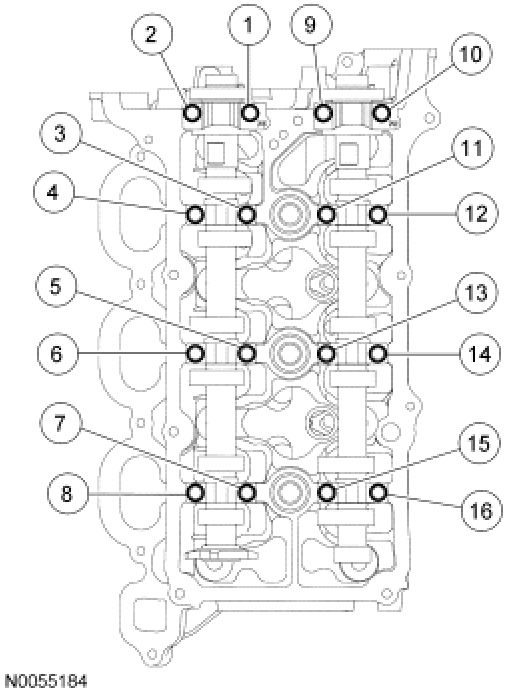


Fig. 847: Installing Camshaft Caps & Bolts In Sequence
Courtesy of FORD MOTOR CO.

All camshafts

NOTE:	**If any components are installed new, the engine valve clearance must be checked/adjusted or engine damage can occur.**

NOTE:	**Use a camshaft sprocket bolt to turn the camshafts.**

6. Using a feeler gauge, confirm that the valve tappet clearances are within specification. If valve tappet clearances are not within specification, the clearance must be adjusted by installing new valve tappet(s) of the correct size. For additional information, refer to **Valve Clearance Check**.

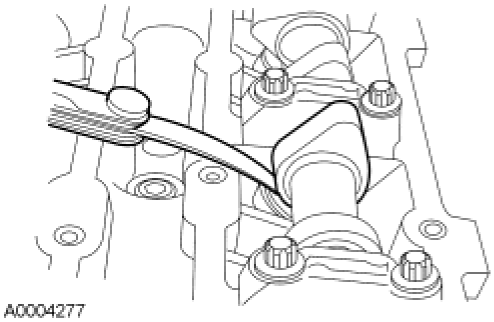


Fig. 848: Measuring Valve Clearance
Courtesy of FORD MOTOR CO.

LH camshafts

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

7. Rotate the LH camshafts to the Top Dead Center (TDC) position and install the Camshaft Holding Tool on the flats of the camshafts.

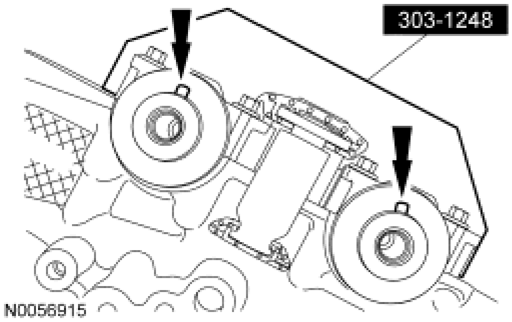


Fig. 849: Installing Special Tool (303-1248) On Flats Of Camshafts
Courtesy of FORD MOTOR CO.

8. Assemble the LH Variable Camshaft Timing (VCT) assembly, the LH exhaust camshaft sprocket and the LH secondary timing chain.
   - Align the colored links with the timing marks.

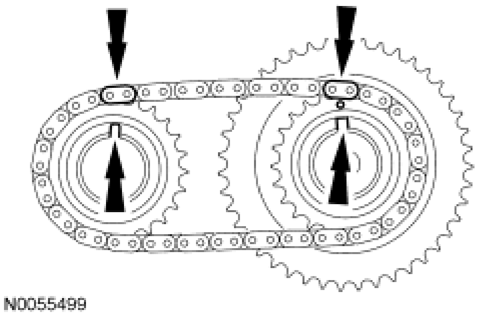


Fig. 850: Aligning LH Exhaust Camshaft Sprocket & LH Secondary Timing Chain Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

9. Position the LH secondary timing assembly onto the camshafts.

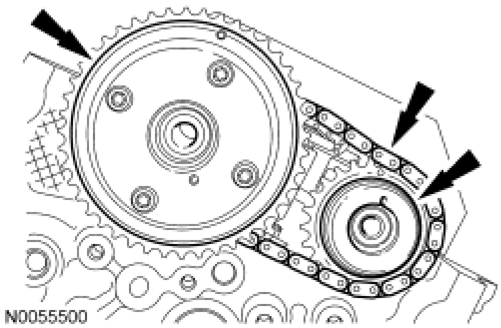


Fig. 851: Positioning LH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

10. Install 2 new bolts and the original washer. Tighten in 4 stages.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 10 Nm (89 lb-in).
    - Stage 4: Tighten 90 degrees.

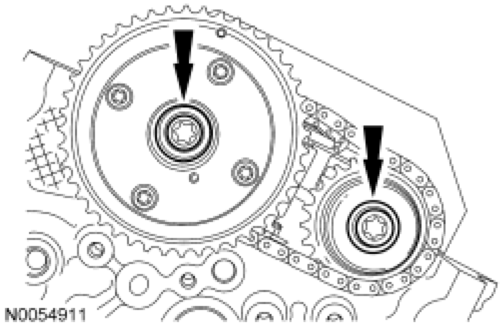


Fig. 852: Locating LH VCT Assembly Bolt & LH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

11. Remove the lock pin from the LH secondary timing chain tensioner.

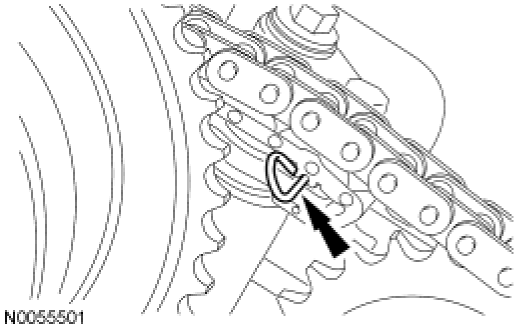


Fig. 853: Locating Lock Pin On LH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

RH camshafts

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

12. Rotate the RH camshafts to the TDC position and install the Camshaft Holding Tool on the flats of the camshafts.

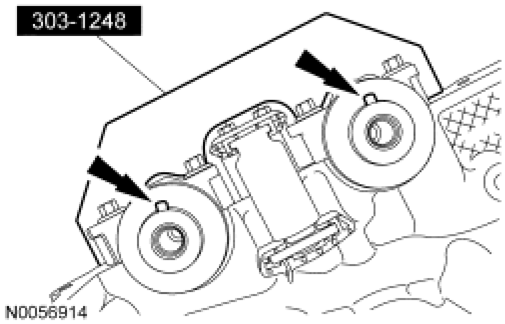


Fig. 854: Installing Special Tool (303-1248) On Flats Of Camshafts
Courtesy of FORD MOTOR CO.

13. Assemble the RH VCT assembly, the RH exhaust camshaft sprocket and the RH secondary timing chain.
    - Align the colored links with the timing marks.

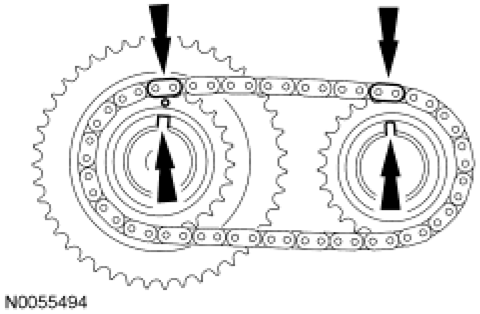


Fig. 855: Aligning RH Exhaust Camshaft Sprocket & RH Secondary Timing Chain Colored Links

With Timing Marks
Courtesy of FORD MOTOR CO.

14. Position the RH secondary timing assembly onto the camshafts.

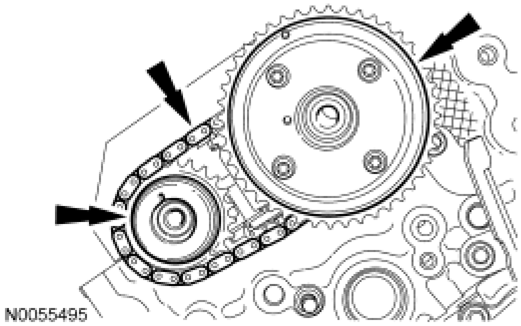


Fig. 856: Positioning RH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

15. Install 2 new bolts and the original washer. Tighten in 4 stages.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 10 Nm (89 lb-in).
    - Stage 4: Tighten 90 degrees.

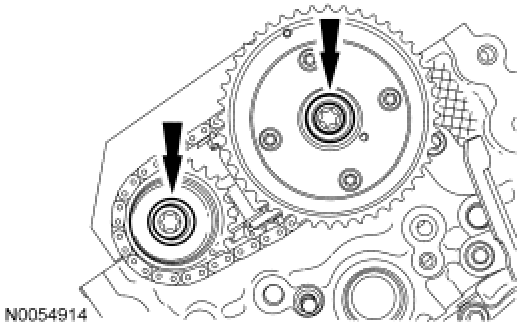


Fig. 857: Locating RH VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

16. Remove the lock pin from the RH secondary timing chain tensioner.

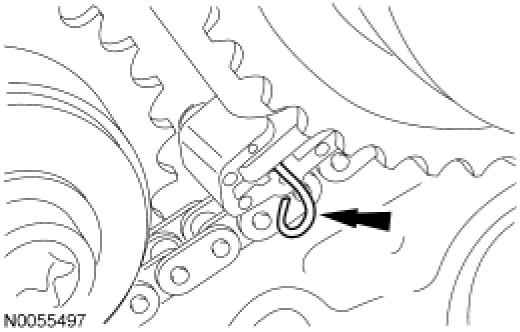


Fig. 858: Identifying Lock Pin On RH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

All camshafts

17. Rotate the crankshaft clockwise 60 degrees to the TDC position (crankshaft dowel pin at 11 o'clock).

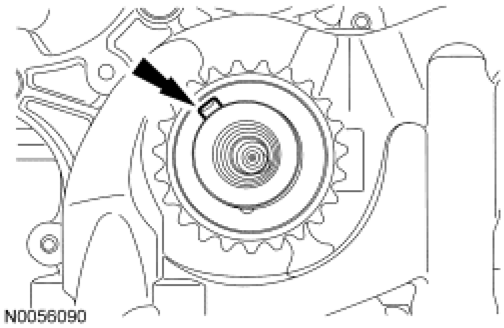


Fig. 859: Identifying Crankshaft Dowel Pin At 11 O'clock
Courtesy of FORD MOTOR CO.

18. Install the primary timing chain with the colored links aligned with the timing marks on the VCT assemblies and the crankshaft sprocket.

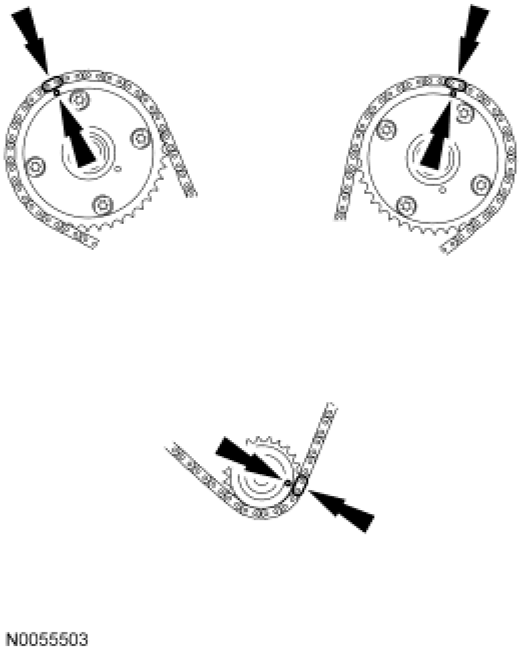
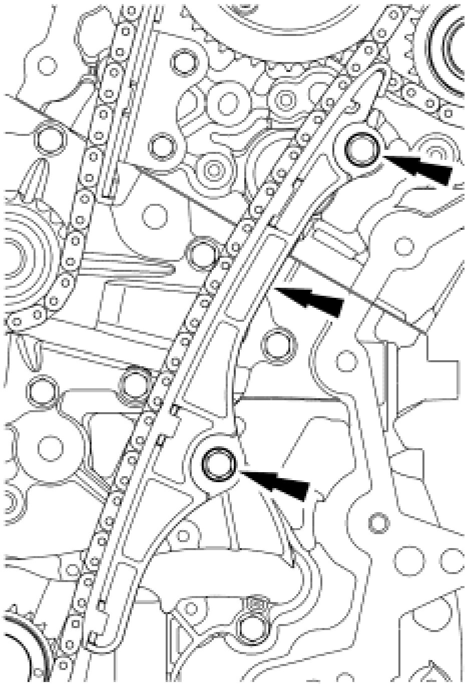


Fig. 860: Aligning Timing Marks On VCT Assemblies & Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

19. Install the lower LH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).



N0081593

Fig. 861: Locating Lower LH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

20. Install the primary timing chain tensioner arm.

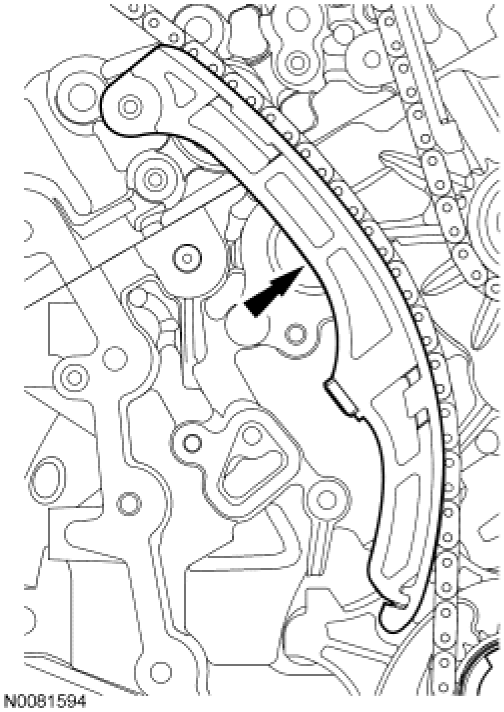


Fig. 862: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

21. Reset the primary timing chain tensioner.
    - Rotate the lever counterclockwise.
    - Using a soft-jawed vise, compress the plunger.
    - Align the hole in the lever with the hole in the tensioner housing.
    - Install a suitable lock pin.

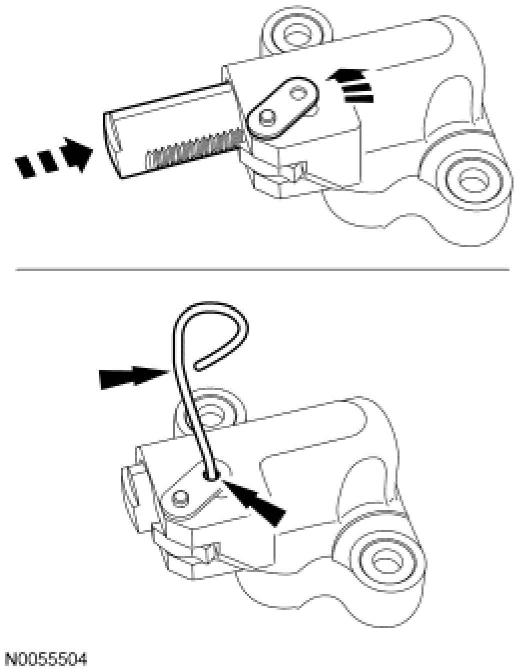


Fig. 863: Compressing Plunger Using A Soft-Jawed Vise
Courtesy of FORD MOTOR CO.

NOTE: It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.

22. Install the primary tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).
    - Remove the lock pin.

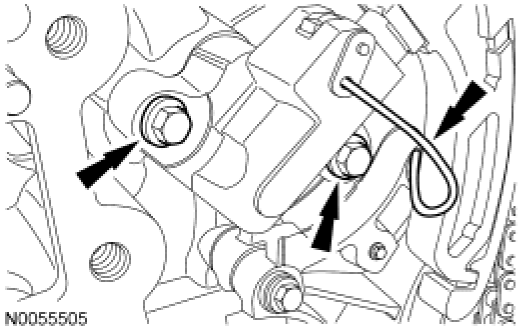


Fig. 864: Locating Primary Tensioner Bolts
Courtesy of FORD MOTOR CO.

23. As a post-check, verify correct alignment of all timing marks.

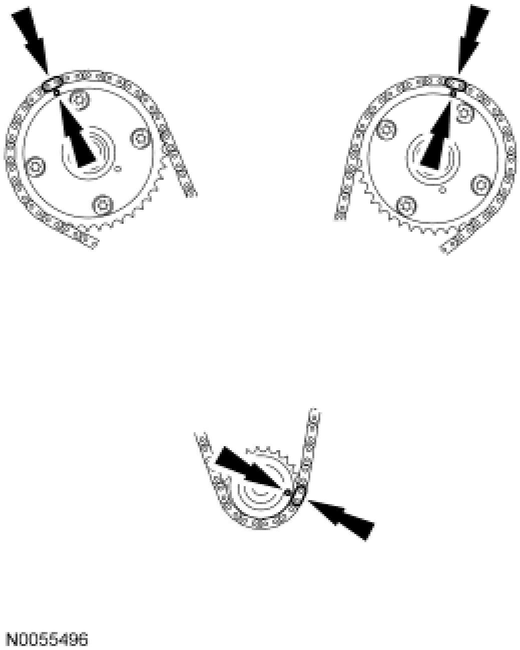


Fig. 865: Verifying Correct Alignment Of All Timing Marks
Courtesy of FORD MOTOR CO.

24. Install new VCT housing seals.

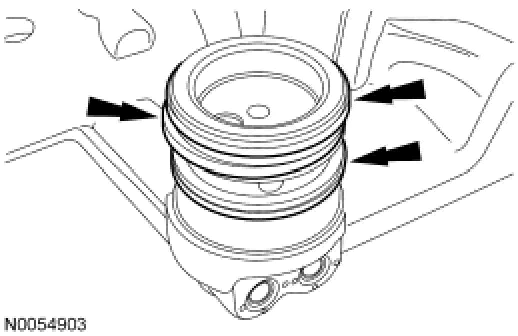


Fig. 866: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

NOTE:	**Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.**

25. Install the LH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

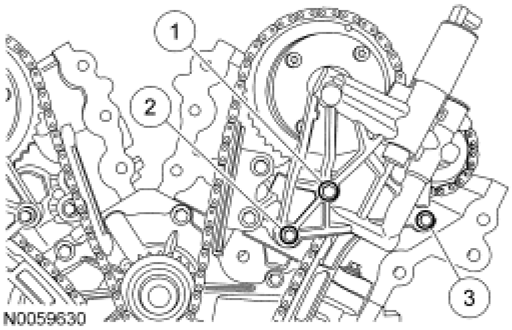


Fig. 867: Identifying LH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE: Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

26. Install the RH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

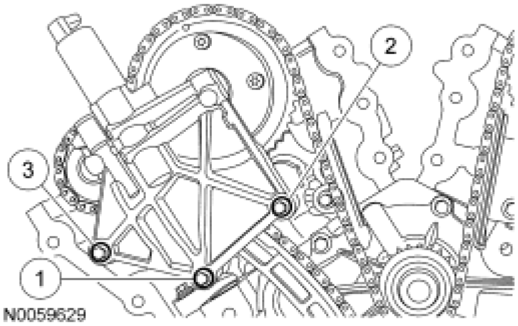


Fig. 868: Identifying RH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

27. Install the engine front cover. For additional information, refer to **Engine Front Cover**.

VALVE TAPPETS

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

NOTE: During engine repair procedures, cleanliness is extremely important. Any

foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

NOTE: The valve tappets must be installed in their original positions.

NOTE: Coat the valve tappets with clean engine oil prior to installation.

1. Install the valve tappets.

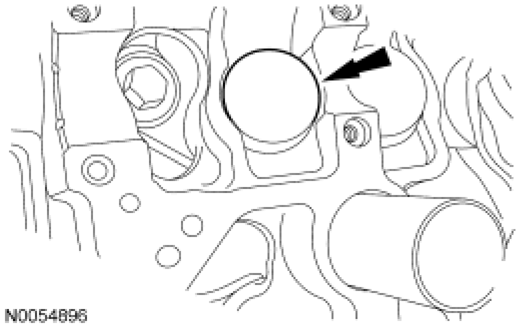
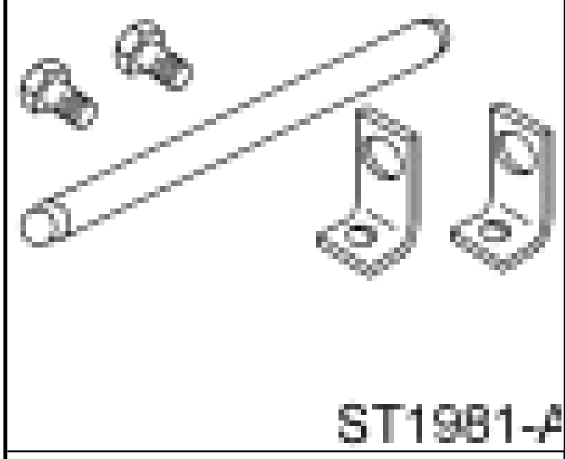


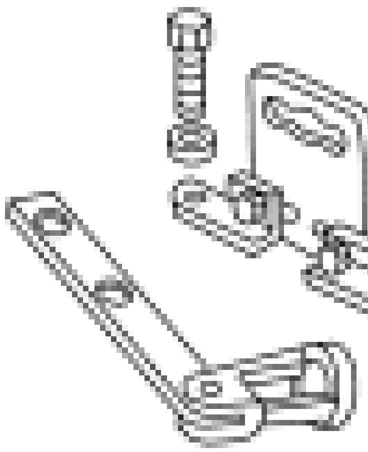
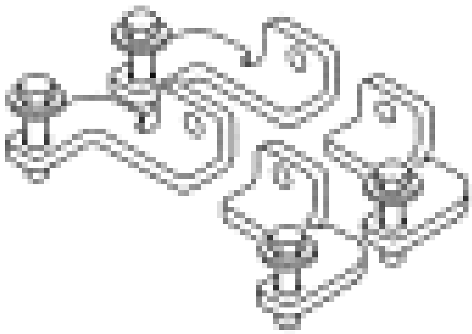
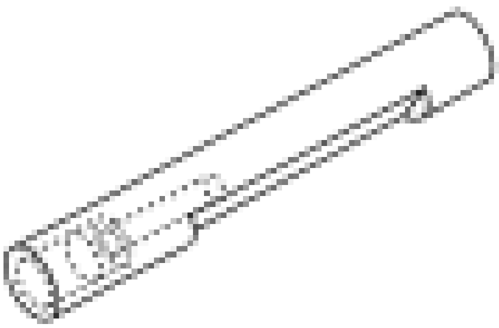
Fig. 869: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

2. Depending on the valve tappets being serviced, install the LH and/or the RH camshafts. For additional information, refer to **Camshaft**.

VALVE SPRING, RETAINER AND SEAL

Special Tools

Illustration	Tool Name	Tool Number
	Compressor, Valve Spring	303-300 (T87C-6565-A)
	Compressor, Valve Spring	303-350 (T89P-6565-A)

 ST1907-A		
 ST3028-A	Compressor, Valve Spring	303-1249
 ST1906-A	Installer, Valve Stem Oil Seal	303-470 (T94P-6510-CH)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

NOTE: Lubricate the valve stem seal with clean engine oil prior to installation.

1. Using the Valve Stem Oil Seal Installer, install a new valve stem seal.

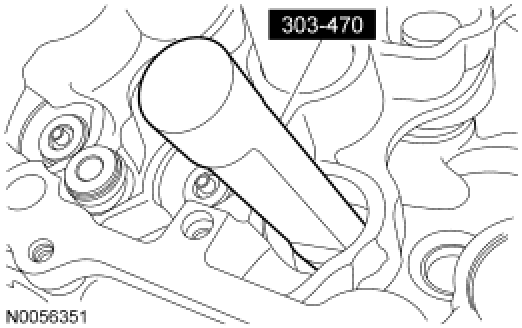


Fig. 870: Installing New Valve Stem Seal Using Special Tool (303-470)
Courtesy of FORD MOTOR CO.

2. Using the Valve Spring Compressors, install the valve spring, retainer and key.

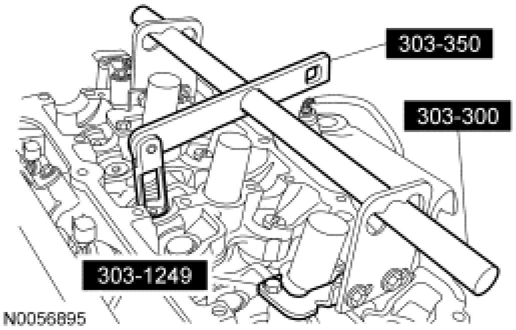


Fig. 871: Removing Keys, Retainer & Spring Using Special Tools (303-1249, 303-350, 303-300)
Courtesy of FORD MOTOR CO.

3. Install the valve tappets. For additional information, refer to **Valve Tappets**.

CYLINDER HEAD - RH

Material

Item	Specification

Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

All vehicles

1. Install a new gasket, the RH cylinder head and 8 new bolts. Tighten in the sequence shown in 5 stages:
   - Stage 1: Tighten to 20 Nm (15 lb-ft).
   - Stage 2: Tighten to 35 Nm (26 lb-ft).
   - Stage 3: Tighten 90 degrees.
   - Stage 4: Tighten 90 degrees.
   - Stage 5: Tighten 90 degrees.

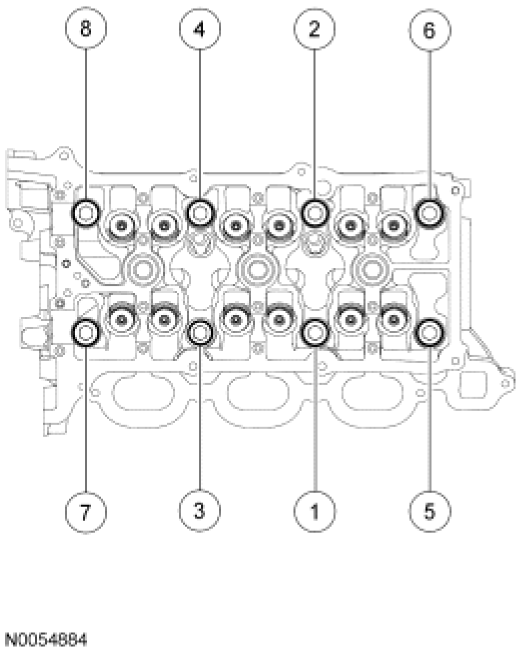


Fig. 872: Installing RH Cylinder Head Bolts In Sequence
Courtesy of FORD MOTOR CO.

2. Install the bolt.
   - Tighten to 10 Nm (89 lb-in).

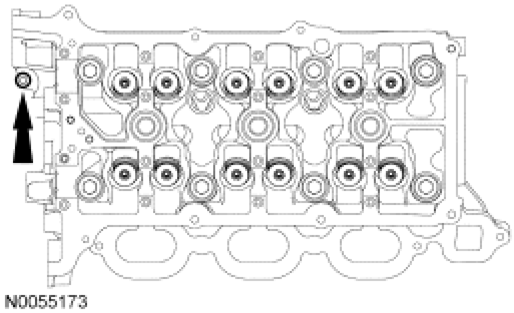


Fig. 873: Identifying M6 Bolt
Courtesy of FORD MOTOR CO.

NOTE:	**The valve tappets must be installed in their original positions.**

NOTE:	**Coat the valve tappets with clean engine oil prior to installation.**

3. Install the valve tappets.

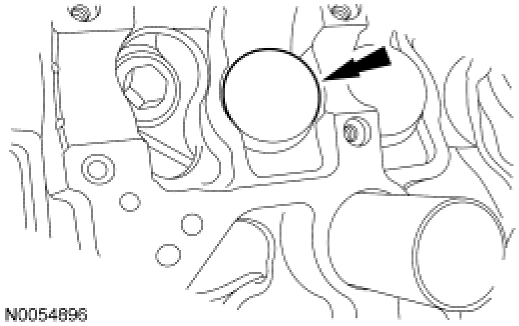


Fig. 874: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

4. Install and connect the cylinder head temperature (CHT) sensor jumper harness.

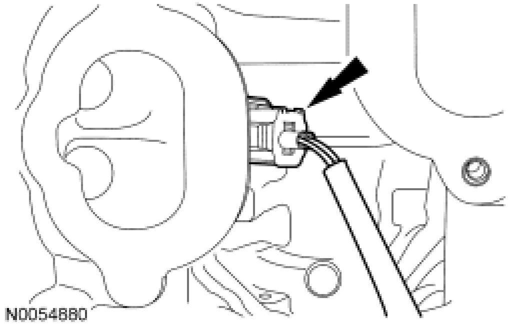


Fig. 875: Identifying CHT Sensor Jumper Harness
Courtesy of FORD MOTOR CO.

5. Using new gaskets, install the lower intake manifold and the 10 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

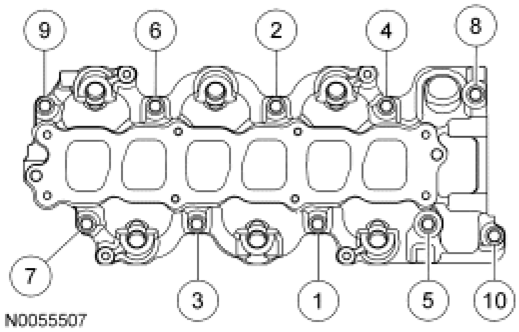


Fig. 876: Installing Lower Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

6. Using a new gasket and O-ring seal, install the thermostat housing and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

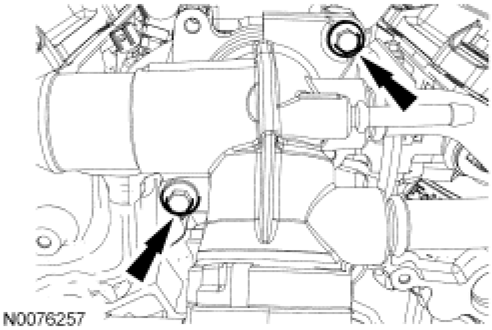


Fig. 877: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

7. Connect the coolant bypass hose to the thermostat housing.

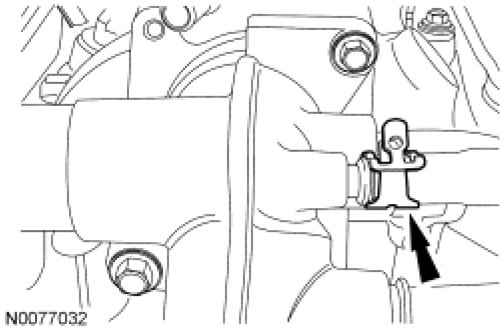


Fig. 878: Identifying Coolant Bypass Hose From Thermostat Housing
Courtesy of FORD MOTOR CO.

CAUTION: Use O-ring seals that are made of special fuel-resistant material. The use of ordinary O-rings can cause the fuel system to leak. Do not reuse the O-ring seals.

NOTE: The upper and lower O-ring seals are not interchangeable.

8. Install new fuel injector O-ring seals.
    - Remove the retaining clips and separate the fuel injectors from the fuel rail.
    - Remove and discard the O-ring seals.
    - Install new O-ring seals and lubricate with clean engine oil.
    - Install the fuel injectors and the retaining clips onto the fuel rail.

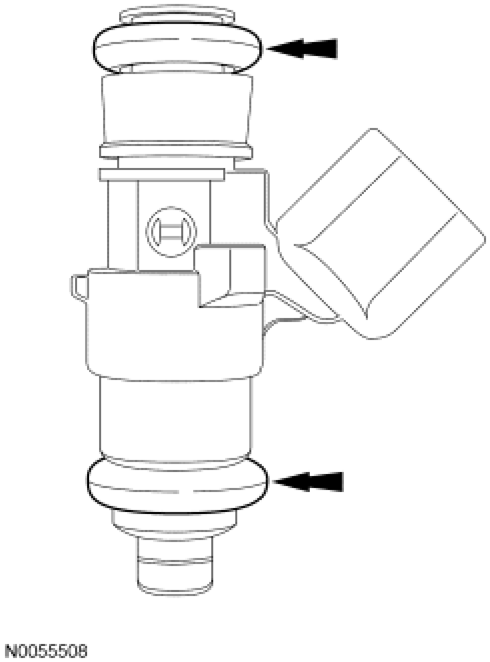


Fig. 879: Identifying Fuel Injector O-Ring Seals
Courtesy of FORD MOTOR CO.

9. Install the fuel rail and injectors as an assembly and install the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).

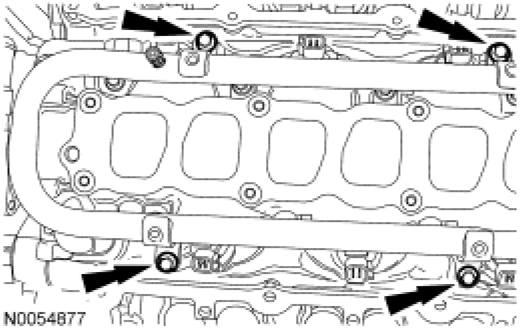


Fig. 880: Locating Fuel Rail And Injectors & Bolts
Courtesy of FORD MOTOR CO.

10. Install the RH camshaft position (CMP) sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).

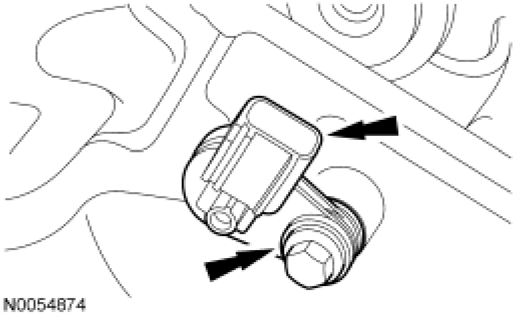


Fig. 881: Locating RH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

NOTE: Align the bracket with the index mark made during removal.

11. Install the upper intake manifold short support bracket and the bolt.
    - Tighten to 10 Nm (89 lb-in).

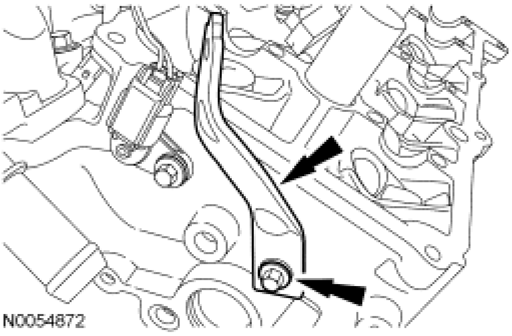


Fig. 882: Locating Upper Intake Manifold Bracket & Bolt
Courtesy of FORD MOTOR CO.

NOTE: Align the bracket with the index mark made during removal.

12. If equipped, install the upper intake manifold long support bracket and the bolt.
    - Tighten to 10 Nm (89 lb-in).

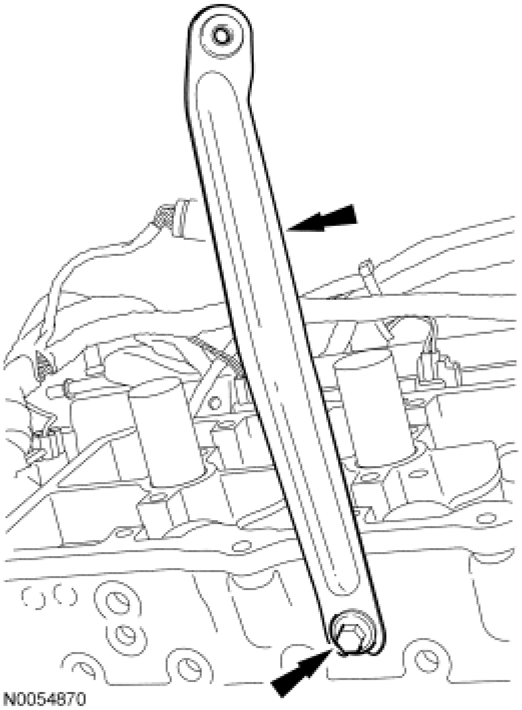


Fig. 883: Locating Upper Intake Manifold Bracket & Bolt
Courtesy of FORD MOTOR CO.

13. Install the engine lifting eye and the 2 bolts.
    - Tighten to 24 Nm (18 lb-ft).

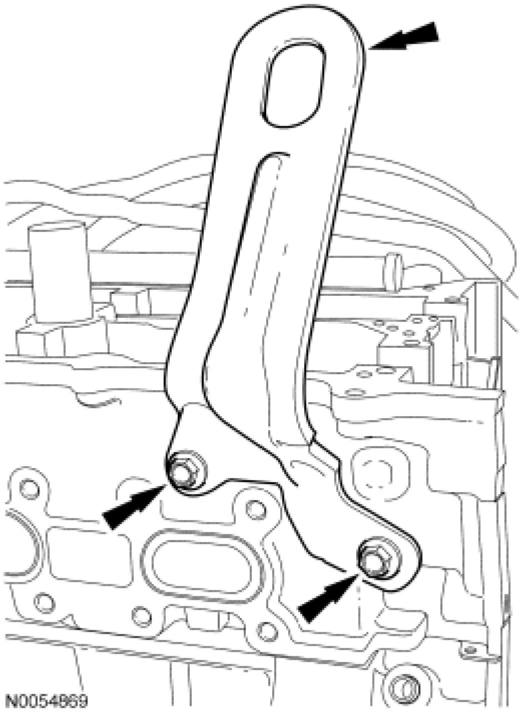


Fig. 884: Locating Engine Lifting Eye & Bolts
Courtesy of FORD MOTOR CO.

14. Install the RH secondary timing chain tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

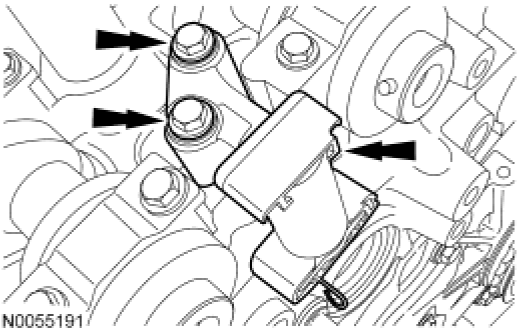


Fig. 885: Locating RH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

15. Install the RH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

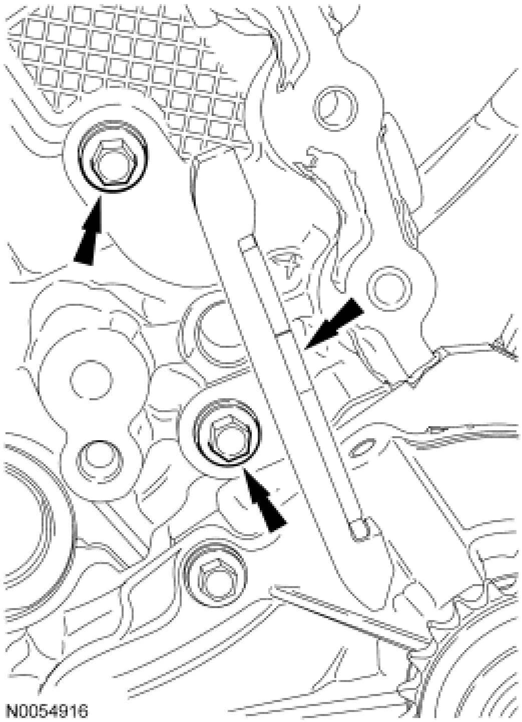


Fig. 886: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

16. Install 6 new RH exhaust manifold studs.
    - Tighten to 12 Nm (9 lb-ft).

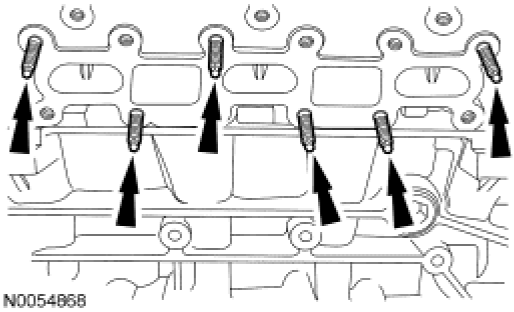


Fig. 887: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

CAUTION: Failure to tighten the exhaust manifold nuts to specification a second time will cause the exhaust manifold to develop an exhaust leak.

17. Using a new gasket, install the RH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown:
    - Stage 1: Tighten to 20 Nm (15 lb-ft).

- Stage 2: Tighten to 20 Nm (15 lb-ft).

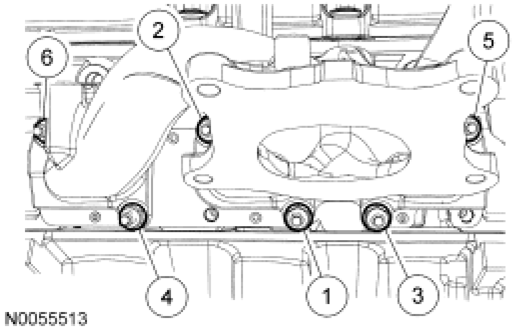


Fig. 888: Installing RH Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

18. Install the RH exhaust manifold heat shield and the 3 bolts.
    - Tighten to 14 Nm (10 lb-ft).

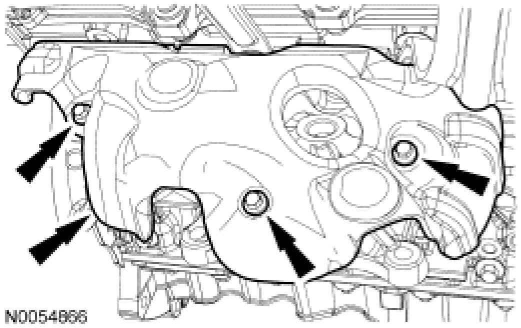


Fig. 889: Locating RH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

19. Install the RH cylinder block drain plug or, if equipped, the block heater.
    - Tighten to 40 Nm (30 lb-ft).

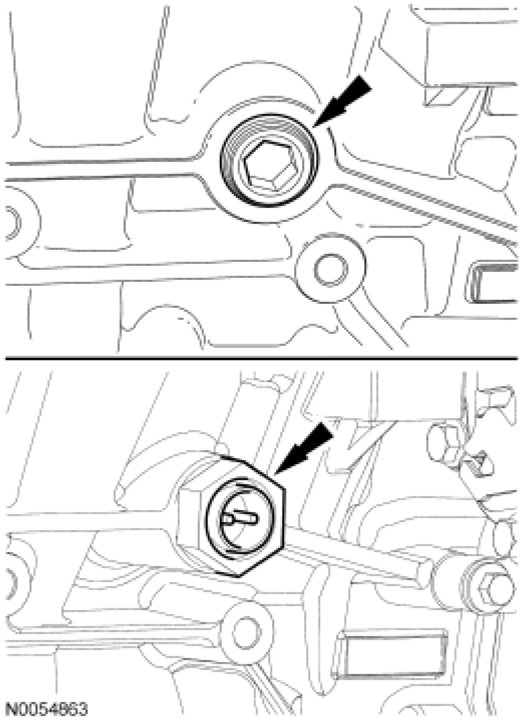


Fig. 890: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

NOTE: Do not tighten the 4 catalytic converter nuts at this time.

20. Using a new gasket, install the RH catalytic converter and 4 new nuts.

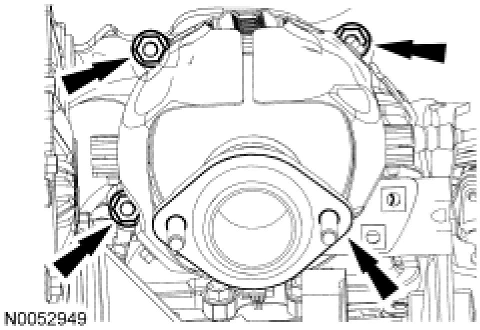


Fig. 891: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

21. Install the 2 RH catalytic converter bracket bolts.
    - Tighten the 4 catalytic converter nuts to 40 Nm (30 lb-ft).
    - Tighten the 2 catalytic converter brackets to 20 Nm (15 lb-ft).

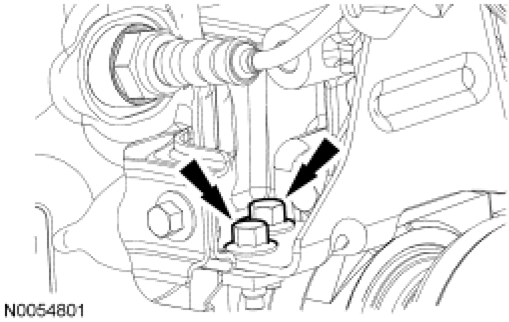


Fig. 892: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

22. Using a new gasket, install the RH catalytic converter and 4 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

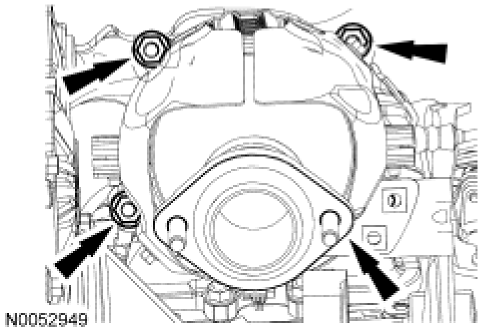


Fig. 893: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

All vehicles

23. Install the LH cylinder block drain plug.
    - Tighten to 20 Nm (15 lb-ft) plus an additional 180 degrees.

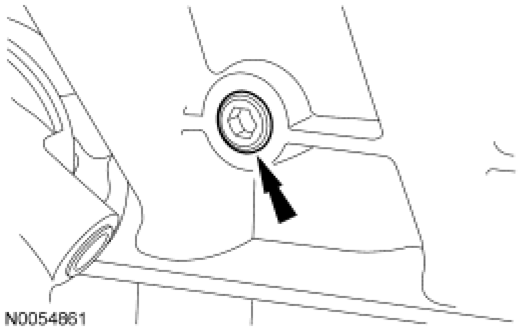


Fig. 894: Locating LH Cylinder Block Drain Plug

Courtesy of FORD MOTOR CO.

24. Using a new gasket, install the LH catalytic converter and 4 new nuts (3 shown).
    - Tighten to 40 Nm (30 lb-ft).

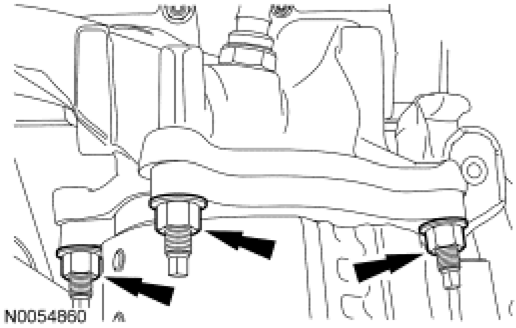


Fig. 895: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

25. Install the 2 LH catalytic converter bracket bolts.
    - Tighten to 20 Nm (15 lb-ft).

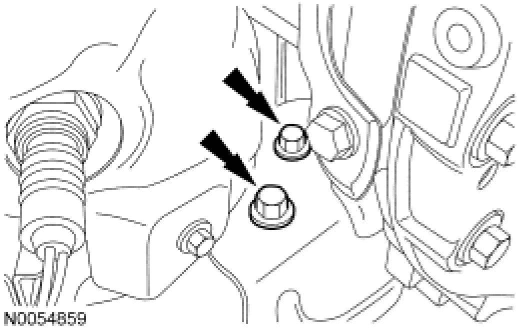


Fig. 896: Locating LH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

26. Connect the LH catalyst monitor sensor electrical connector.

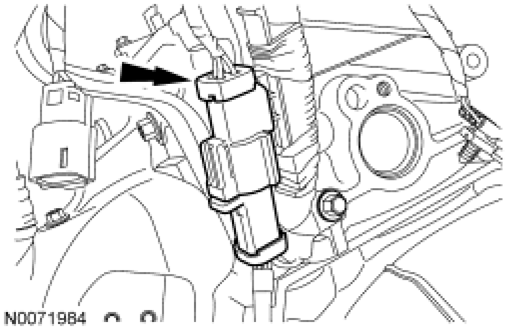


Fig. 897: Identifying LH Catalyst Monitor Sensor Electrical Connector

Courtesy of FORD MOTOR CO.

27. Connect the CHT sensor electrical connector.

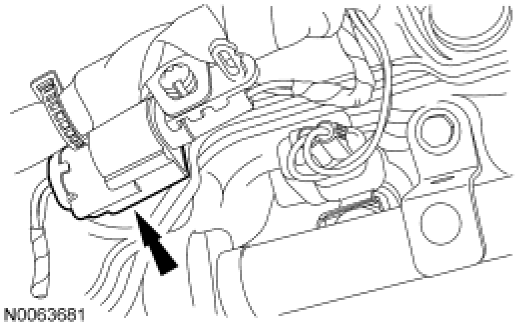


Fig. 898: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

28. Connect the 6 fuel injector electrical connectors (3 shown).

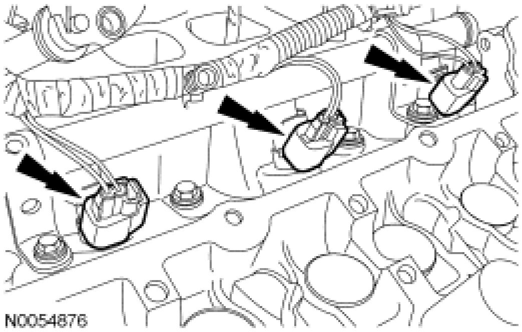


Fig. 899: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

29. Install the power steering pressure (PSP) tube bracket and bolt.
    - Tighten to 10 Nm (89 lb-in).

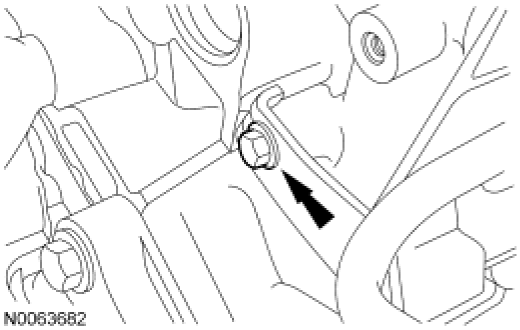


Fig. 900: Identifying Power Steering Pressure (PSP) Tube & Bracket Assembly
Courtesy of FORD MOTOR CO.

30. Connect the RH CMP sensor electrical connector.

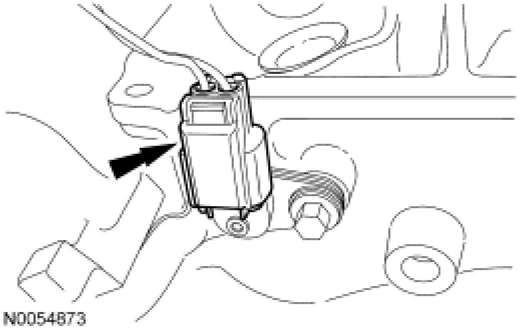


Fig. 901: Locating RH Camshaft Position (CMP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

31. Connect the RH HO2S electrical connector.

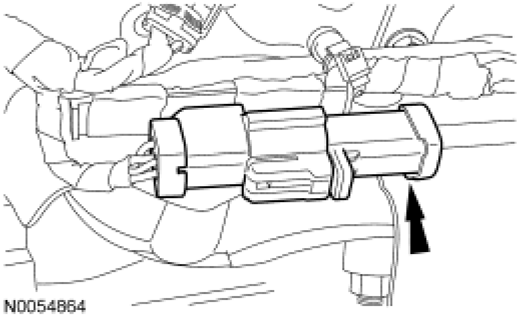


Fig. 902: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

32. If equipped, install the block heater wiring harness onto the engine.
    - Connect the block heater electrical connector and install the heat shield.

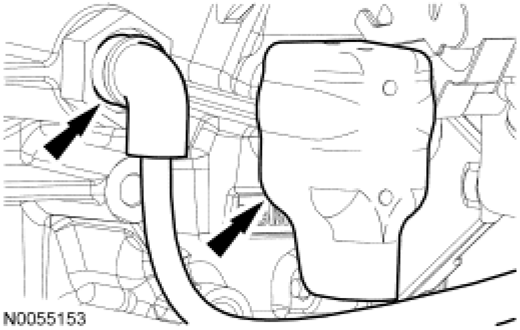


Fig. 903: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

33. Install the RH camshafts. For additional information, refer to **Camshaft**.

CYLINDER HEAD - LH

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

All vehicles

1. Install a new gasket, the LH cylinder head and 8 new bolts. Tighten in the sequence shown in 5 stages:
    - Stage 1: Tighten to 20 Nm (177 lb-in).
    - Stage 2: Tighten to 35 Nm (26 lb-ft).
    - Stage 3: Tighten 90 degrees.
    - Stage 4: Tighten 90 degrees.
    - Stage 5: Tighten 90 degrees.

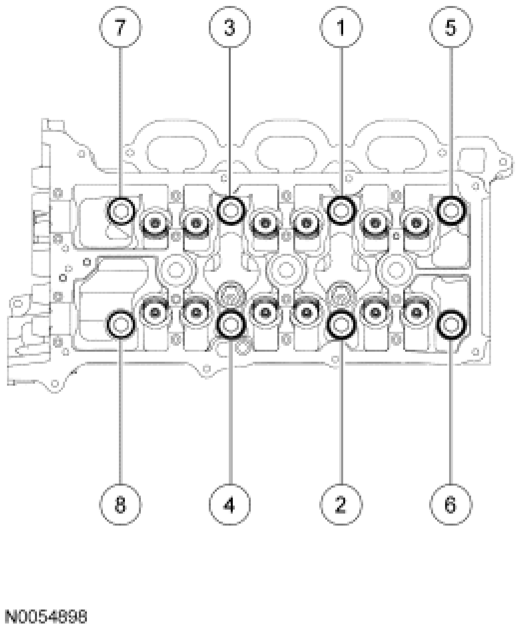


Fig. 904: Installing LH Cylinder Head Bolts In Sequence

Courtesy of FORD MOTOR CO.

2. Install the bolt.
   - Tighten to 10 Nm (89 lb-in).

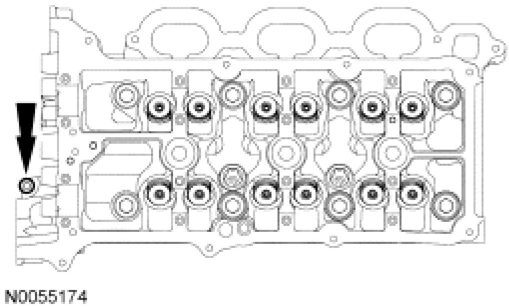


Fig. 905: Identifying M6 Bolt
Courtesy of FORD MOTOR CO.

NOTE: The valve tappets must be installed in their original positions.

NOTE: Coat the valve tappets with clean engine oil prior to installation.

3. Install the valve tappets.

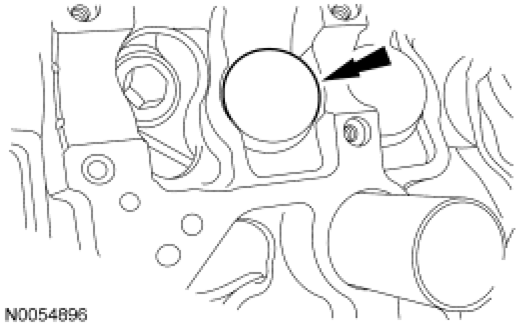


Fig. 906: Identifying Valve Tappets From Cylinder Head
Courtesy of FORD MOTOR CO.

4. Install the LH secondary timing chain tensioner and the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

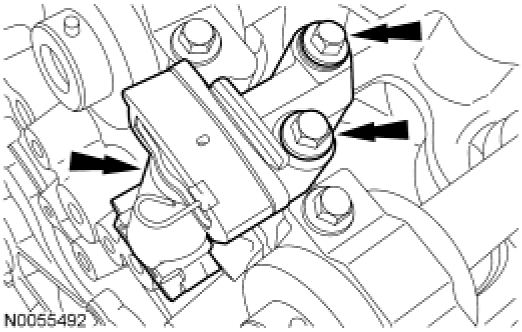


Fig. 907: Locating LH Secondary Timing Chain Tensioner & Bolt
Courtesy of FORD MOTOR CO.

5. Install the upper LH primary timing chain guide and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

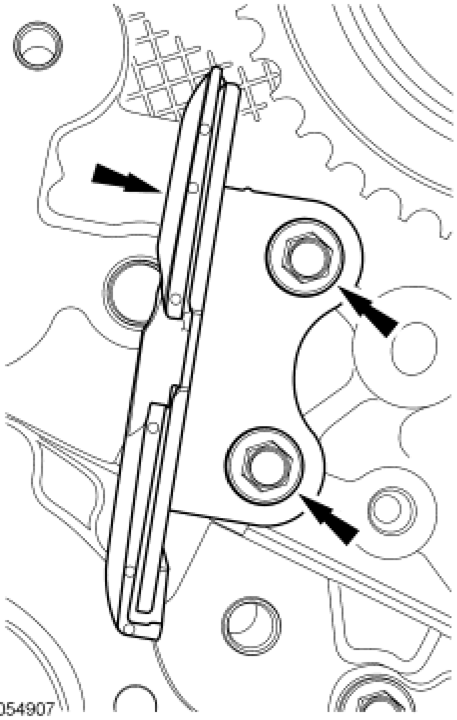


Fig. 908: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

6. Install LH Camshaft Position (CMP) sensor and the bolt.
    - Tighten to 10 Nm (89 lb-in).

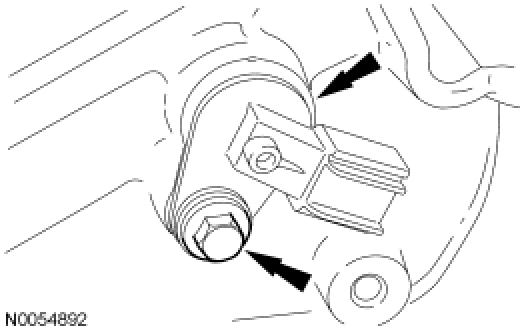


Fig. 909: Locating LH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

7. Using new gaskets, install the lower intake manifold and the 10 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

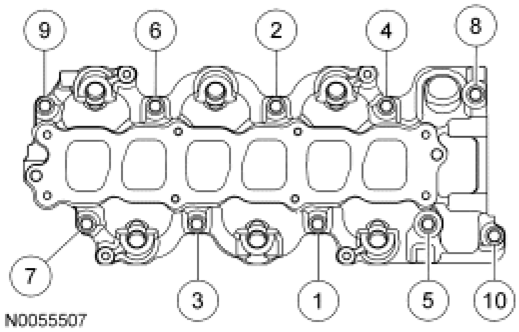


Fig. 910: Installing Lower Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

8. Using a new gasket and O-ring seal, install the thermostat housing and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

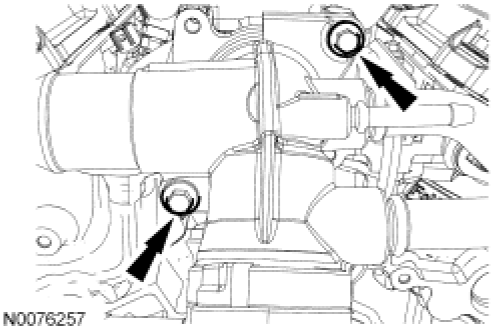


Fig. 911: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

9. Connect the coolant bypass hose to the thermostat housing.

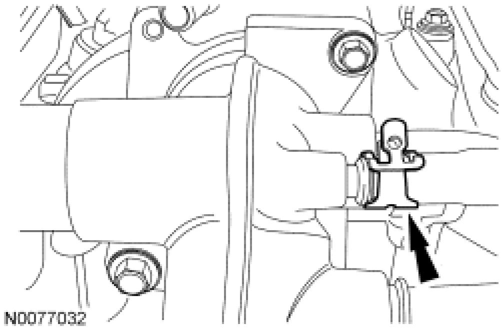


Fig. 912: Identifying Coolant Bypass Hose From Thermostat Housing
Courtesy of FORD MOTOR CO.

NOTE: **Use O-ring seals that are made of special fuel-resistant material. The use of ordinary O-rings can cause the fuel system to leak. Do not reuse the O-ring seals.**

NOTE: **The upper and lower O-ring seals are not interchangeable.**

10. Install new fuel injector O-ring seals.
    - Remove the retaining clips and separate the fuel injectors from the fuel rail.
    - Remove and discard the O-ring seals.
    - Install new O-ring seals and lubricate with clean engine oil.
    - Install the fuel injectors and the retaining clips onto the fuel rail.

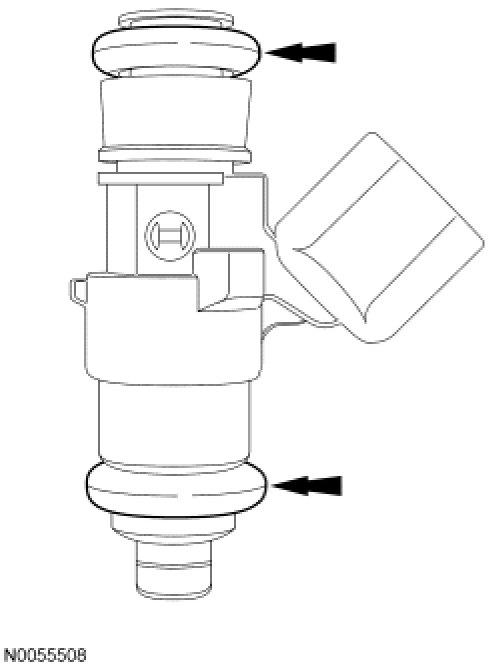


Fig. 913: Identifying Fuel Injector O-Ring Seals
Courtesy of FORD MOTOR CO.

11. Install the fuel rail and injectors as an assembly and install the 4 bolts.
    - Tighten to 10 Nm (89 lb-in).

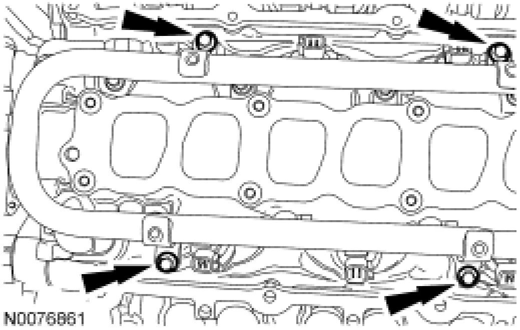


Fig. 914: Identifying Bolts & Fuel Rail
Courtesy of FORD MOTOR CO.

12. Install the RH cylinder block drain plug or, if equipped, the block heater.
    - Tighten to 40 Nm (30 lb-ft).

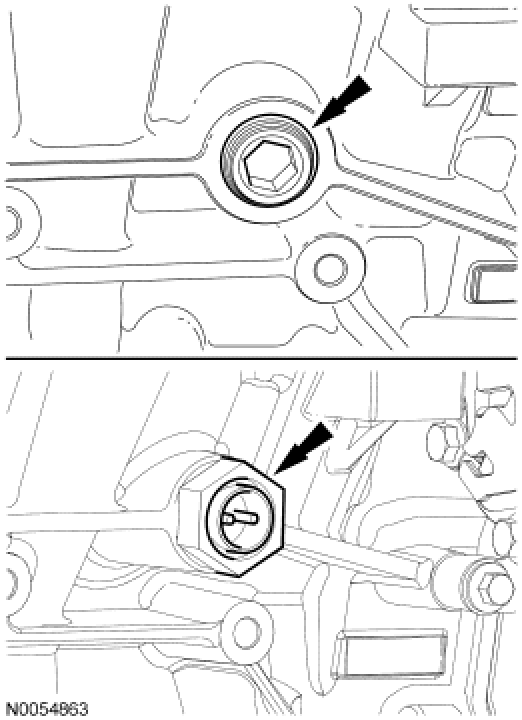


Fig. 915: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

NOTE: Do not tighten the 4 catalytic converter nuts at this time.

13. Using a new gasket, install the RH catalytic converter and 4 new nuts.

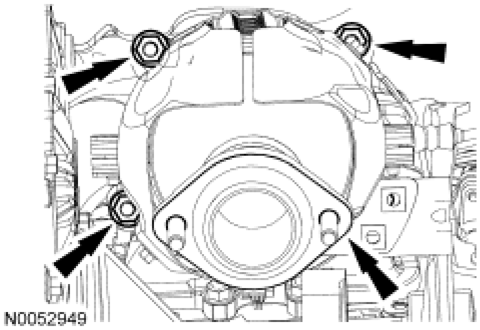


Fig. 916: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

14. Install the 2 RH catalytic converter bracket bolts.
    - Tighten the 4 catalytic converter nuts to 40 Nm (30 lb-ft).
    - Tighten the 2 catalytic converter brackets to 20 Nm (177 lb-in).

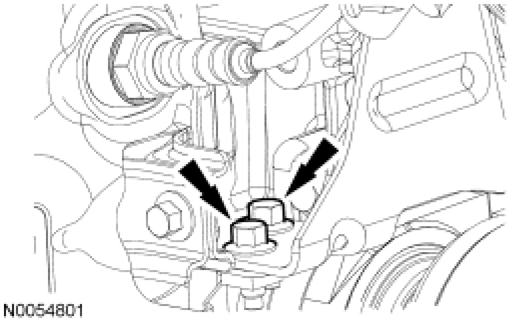


Fig. 917: Identifying RH Catalytic Converter Support Bracket Bolts
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

15. Using a new gasket, install the RH catalytic converter and 4 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

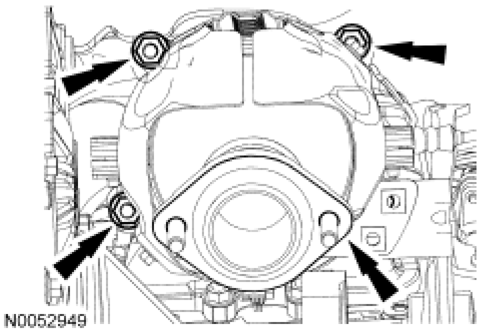


Fig. 918: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

All vehicles

16. Install the LH cylinder block drain plug.
    - Tighten to 20 Nm (177 lb-in) plus an additional 180 degrees.

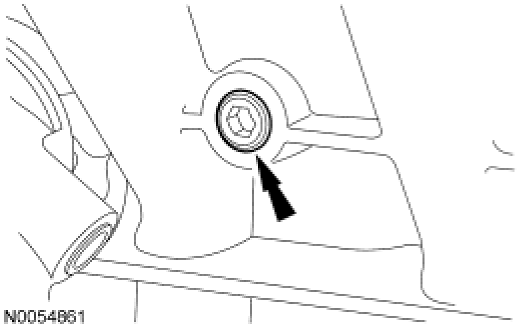


Fig. 919: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

17. Install 6 new LH exhaust manifold studs.
    - Tighten to 12 Nm (106 lb-in).

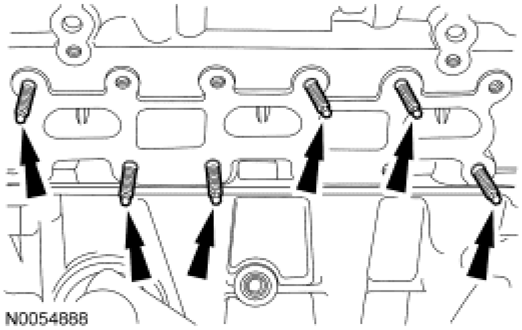


Fig. 920: Locating LH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

NOTE: Failure to tighten the exhaust manifold nuts to specification a second time will cause the exhaust manifold to develop an exhaust leak.

18. Using a new gasket, install the LH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown:
    - Stage 1: Tighten to 20 Nm (177 lb-in).
    - Stage 2: Tighten to 25 Nm (18 lb-ft).

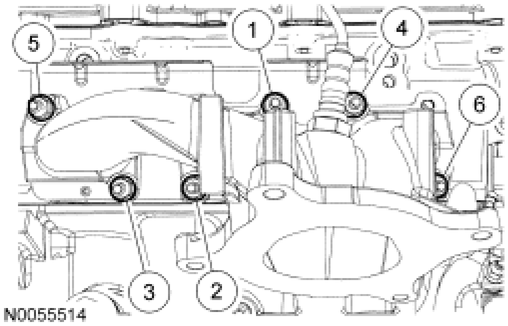


Fig. 921: Installing LH Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

19. Install the LH exhaust manifold heat shield and the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).

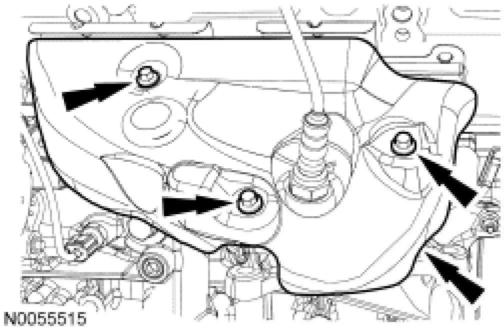


Fig. 922: Locating LH Exhaust Manifold Heat Shield & Nuts
Courtesy of FORD MOTOR CO.

20. Using a new gasket, install the LH catalytic converter and 4 new nuts (3 shown).
    - Tighten to 40 Nm (30 lb-ft).

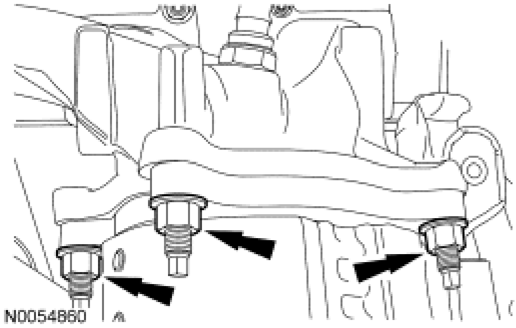


Fig. 923: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

21. Install the 2 LH catalytic converter bracket bolts.
    - Tighten to 20 Nm (177 lb-in).

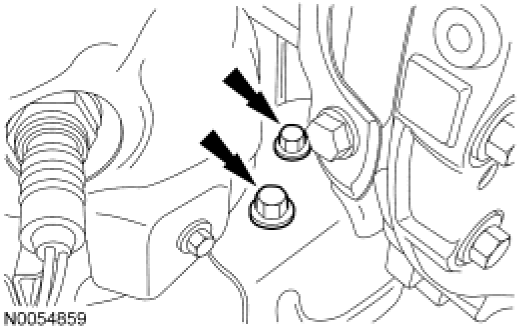


Fig. 924: Locating LH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

22. Install the wiring harness retainer bolt on the rear of the LH cylinder head.
    - Tighten to 10 Nm (89 lb-in).

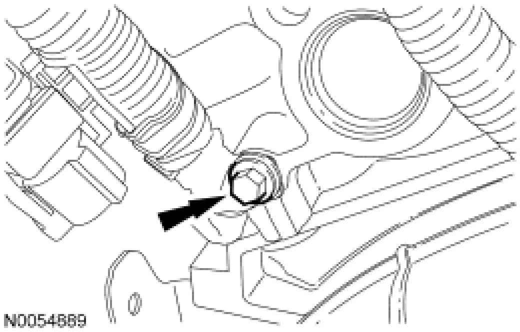


Fig. 925: Identifying Wiring Harness Retainer Bolt From Rear Of LH Cylinder Head
Courtesy of FORD MOTOR CO.

23. Connect the LH catalyst monitor sensor electrical connector.

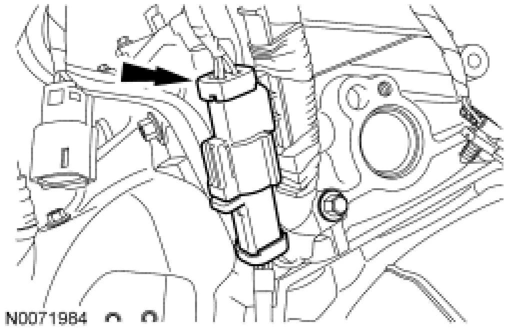


Fig. 926: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

24. Connect the LH Heated Oxygen Sensor (HO2S) electrical connector.

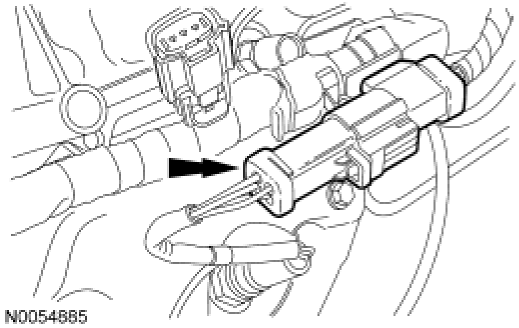


Fig. 927: Locating LH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

25. Connect the LH CMP sensor electrical connector.

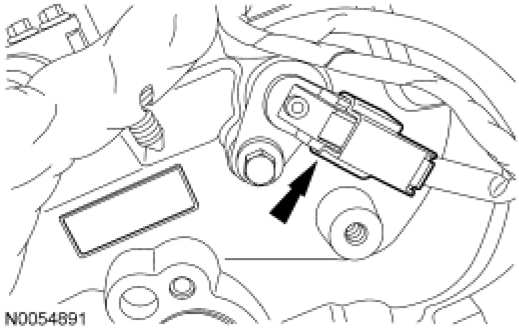


Fig. 928: Locating LH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

26. Connect the Cylinder Head Temperature (CHT) sensor electrical connector.

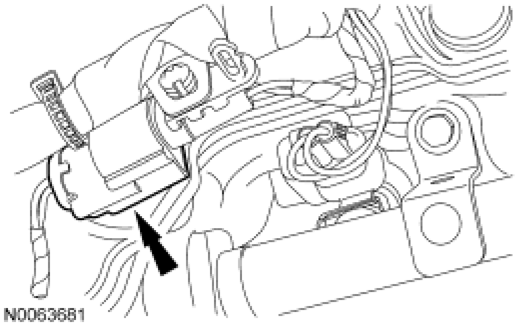


Fig. 929: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

27. Connect the 6 fuel injector electrical connectors (3 shown).

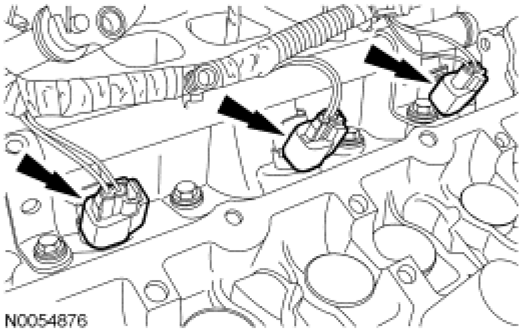


Fig. 930: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

28. Attach the wiring harness pin-type retainer.

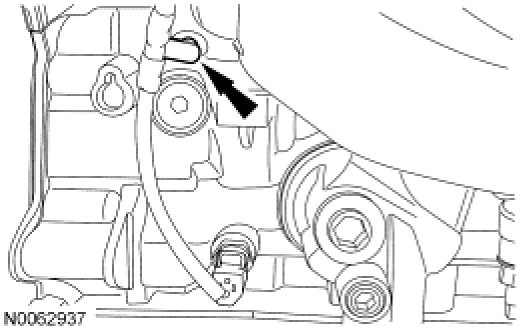


Fig. 931: Identifying Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

29. Install the generator, the bolt and the nut.
    - Tighten to 48 Nm (35 lb-ft).

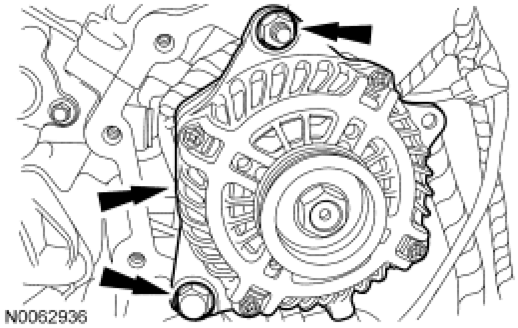


Fig. 932: Locating Generator, Bolts & Nuts
Courtesy of FORD MOTOR CO.

30. Attach the wiring harness retainer to the generator.

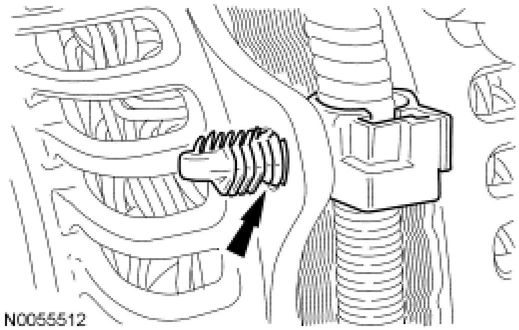


Fig. 933: Identifying Wiring Harness Retainer From Generator
Courtesy of FORD MOTOR CO.

31. Connect the generator electrical connector.

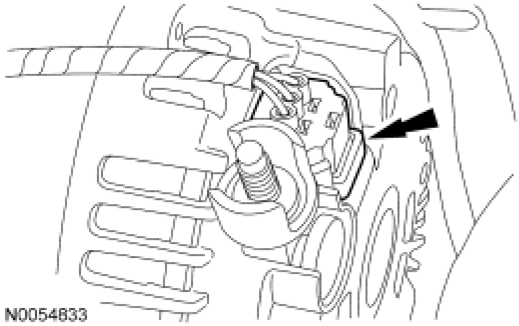


Fig. 934: Identifying Generator Electrical Connector
Courtesy of FORD MOTOR CO.

32. Connect the generator B+ cable and install the nut.
    - Tighten to 6 Nm (53 lb-in).

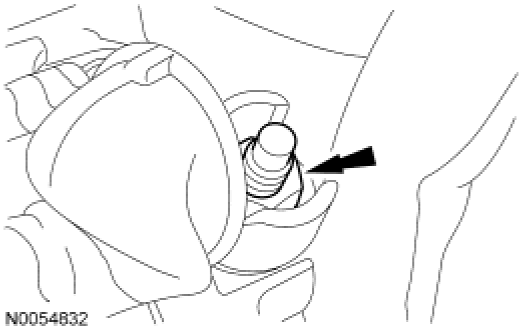


Fig. 935: Identifying Generator B+ Cable & Nut
Courtesy of FORD MOTOR CO.

33. Connect the A/C compressor electrical connector.

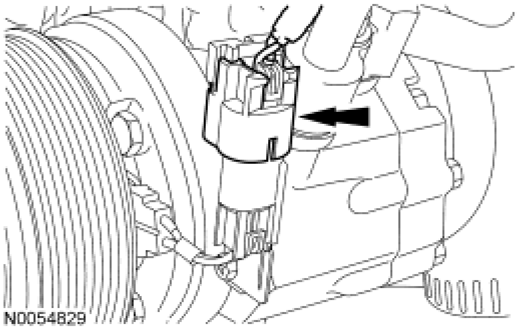


Fig. 936: Identifying A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

34. If equipped, install the block heater wiring harness onto the engine.
    - Connect the block heater electrical connector and install the heat shield.

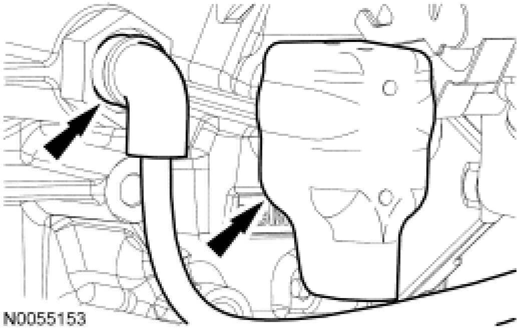
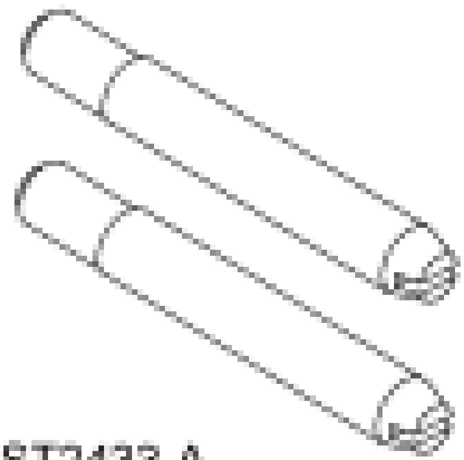
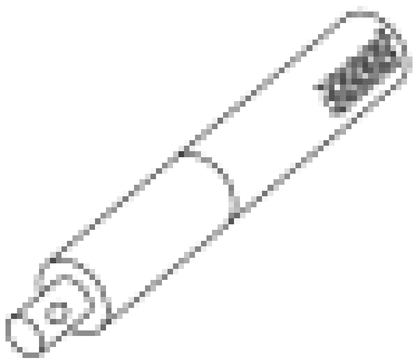


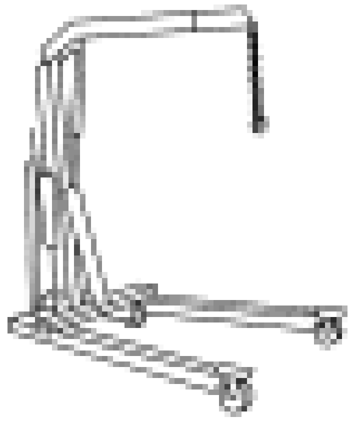
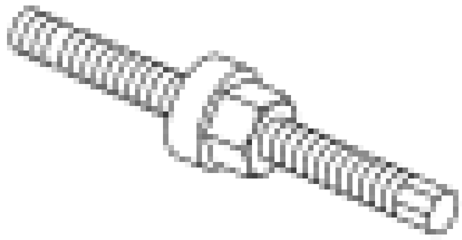
Fig. 937: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

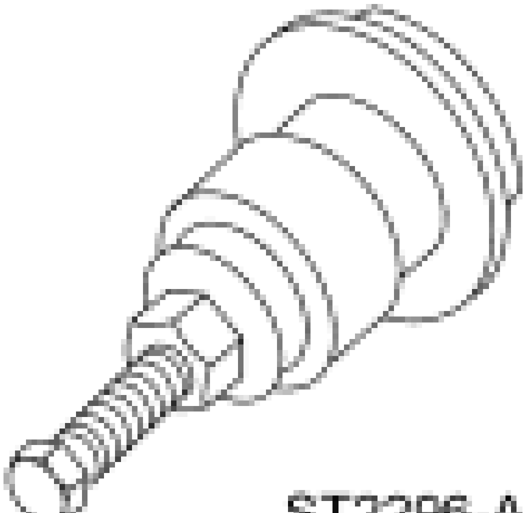
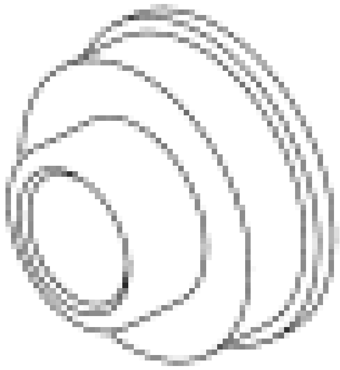
35. Install the LH camshafts. For additional information, refer to **Camshaft**.

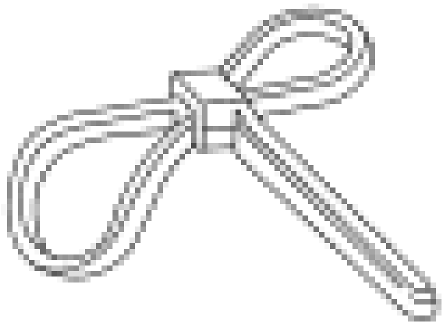
OIL PAN

Special Tools

Illustration	**Tool Name**	**Tool Number**
 ST2433-A	Alignment Pins	307-399
 ST1326-A	Handle	205-153 (T80T-4000-W)
	Heavy Duty Floor Crane	014-00071 or equivalent

 ST1341-A		
 ST2981-A	Installer, Crankshaft Front Seal	303-1251
 ST1287-A	Installer, Crankshaft Vibration Damper	303-102 (T74P-6316-B)
	Installer, Front Cover Oil Seal	303-335

 ST2296-A		
 ST2983-A	Installer, Seal	303-1247/2
 ST1602-A	Spreader Bar	303-D089 (D93P-6001-A3) or equivalent
	Strap Wrench	303-D055 (D85L-6000-A)

 ST1436-A		

Material

Item	Specification
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft Metal Surface Prep ZC-31-A	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket Remover ZC-30	-

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

All vehicles

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The oil pan and the 4 specified bolts must be installed and the oil pan aligned to the cylinder block and A/C compressor within 4 minutes of sealant application. Final tightening of the oil pan bolts must be carried out within 60 minutes of sealant application.

1. Apply a 3 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the sealing surface of the oil pan.
   - Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the 2 crankshaft seal retainer plate-to-cylinder block joint areas on the sealing surface of the oil pan.

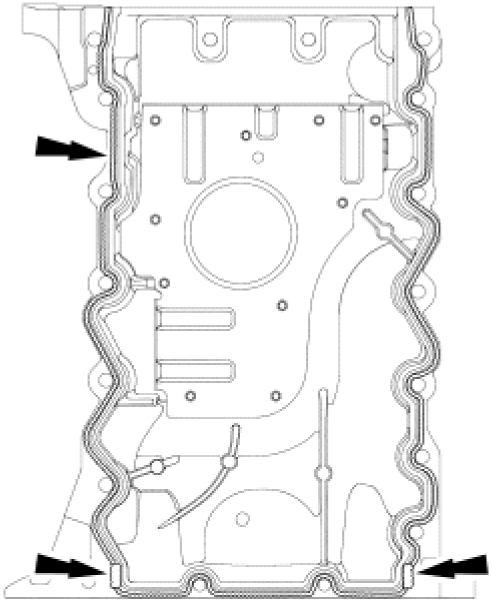


Fig. 938: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Crankshaft Seal Retainer Plate-To-Cylinder Block
Courtesy of FORD MOTOR CO.

NOTE: **The oil pan and the 4 specified bolts must be installed within 4 minutes of the start of sealant application.**

2. Install the oil pan and bolts 10, 11, 13 and 14.
   - Tighten the bolts in the sequence shown to 3 Nm (27 lb-in).
   - Loosen the bolts 180 degrees.

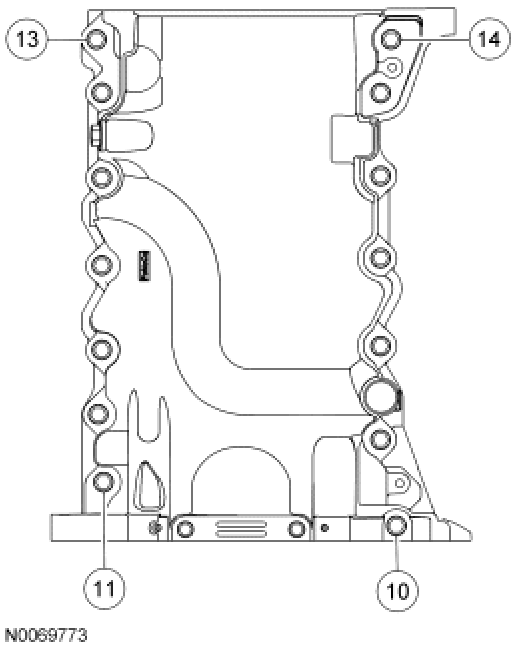


Fig. 939: Installing Oil Pan Bolts 10, 11, 13 & 14 In Sequence
Courtesy of FORD MOTOR CO.

3. Align the oil pan to the cylinder block and A/C compressor.
    - Position the oil pan so the mounting boss is against the A/C compressor and using a straightedge, align the oil pan flush with the rear of the cylinder block at the 2 areas shown.

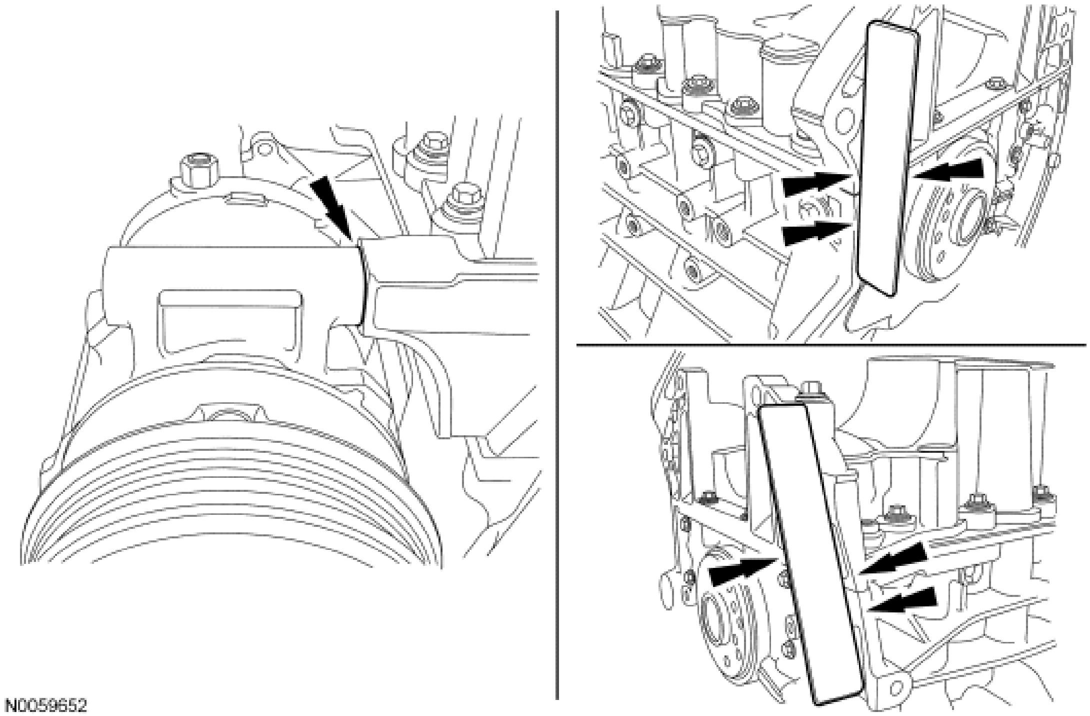


Fig. 940: Aligning Oil Pan Flush With Rear Of Cylinder Block
Courtesy of FORD MOTOR CO.

4. Tighten bolts 10, 11, 13 and 14 in the sequence shown, to 3 Nm (27 lb-in).

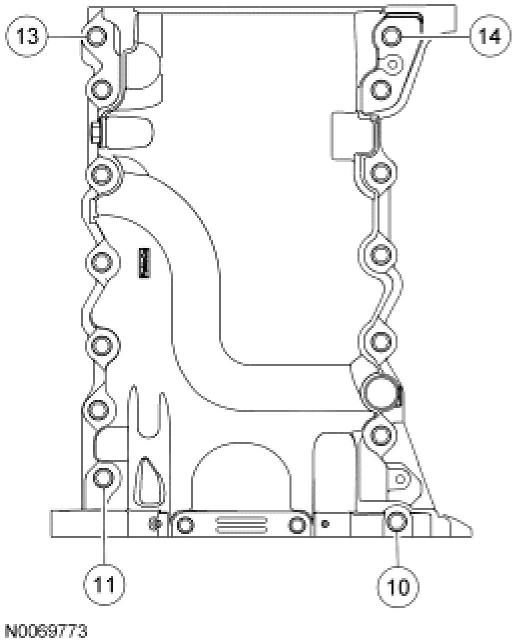


Fig. 941: Installing Oil Pan Bolts 10, 11, 13 & 14 In Sequence

Courtesy of FORD MOTOR CO.

5. Install the remaining oil pan bolts. Tighten all the oil pan bolts in the sequence shown.
   - Tighten the large bolts (1-14) to 24 Nm (18 lb-ft).
   - Tighten the small bolts (15 and 16) to 10 Nm (89 lb-in).

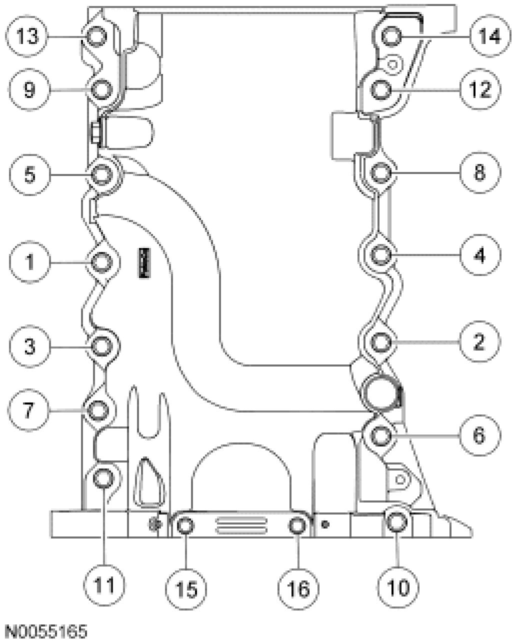


Fig. 942: Installing Remaining Oil Pan Bolts In Sequence
Courtesy of FORD MOTOR CO.

6. Install the A/C compressor mounting stud and nut.
   - Tighten the stud to 9 Nm (80 lb-in) and the nut to 25 Nm (18 lb-ft).

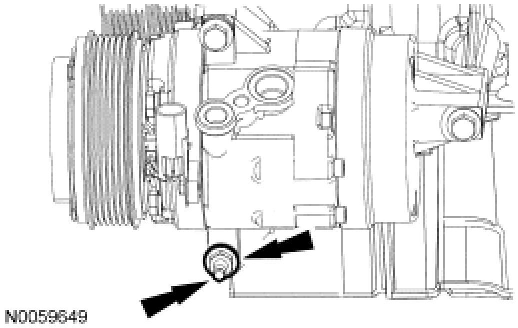


Fig. 943: Identifying A/C Compressor Nut & Stud
Courtesy of FORD MOTOR CO.

7. Install the special tools.

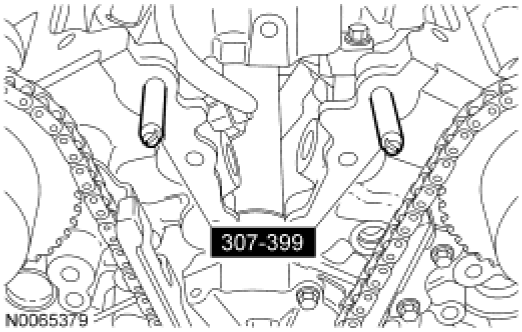


Fig. 944: Identifying Special Tool (307-399)
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The engine front cover and bolts 17, 18, 19 and 20 must be installed within 4 minutes of the initial sealant application. The remainder of the engine front cover bolts and the engine mount bracket bolts must be installed and tightened within 35 minutes of the initial sealant application. If the time limits are exceeded, the sealant must be removed, the sealing area cleaned and sealant reapplied. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

8. Apply a 3.0 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover sealing surfaces including the 3 engine mount bracket bosses.
   - Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the oil pan-to-cylinder block joint and the cylinder head-to-cylinder block joint areas of the engine front cover in 5 places as indicated.

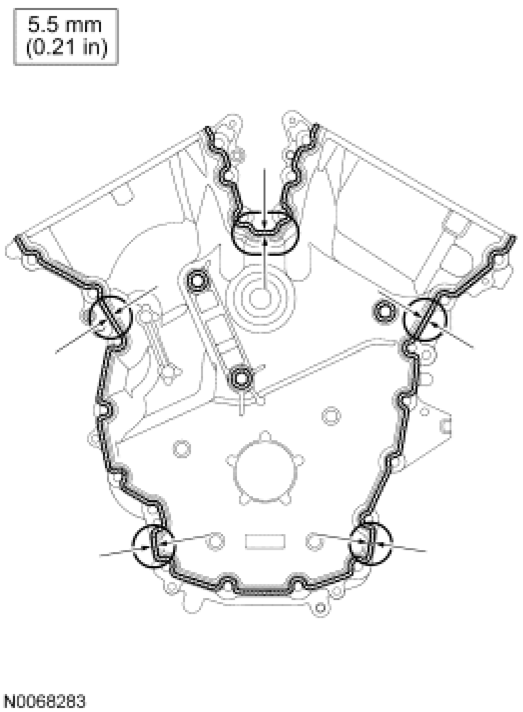


Fig. 945: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover Sealing Surfaces
Courtesy of FORD MOTOR CO.

NOTE:	**Make sure the 2 locating dowel pins are seated correctly in the cylinder block.**

9. Install the engine front cover and bolts 17, 18, 19 and 20.
   - Tighten in sequence to 3 Nm (27 lb-in).

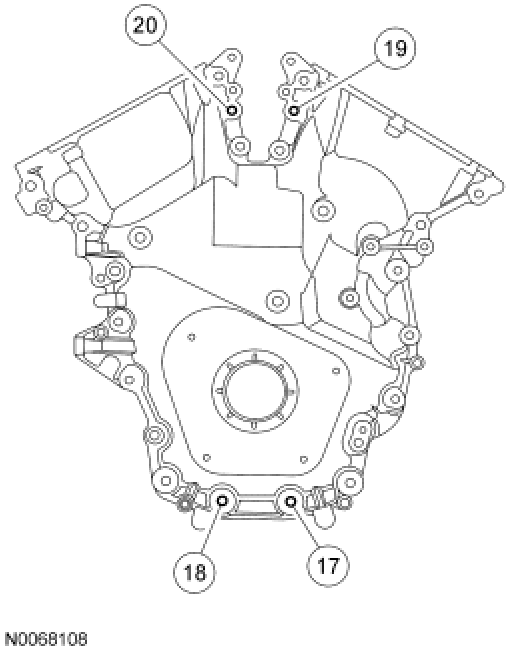


Fig. 946: Installing Engine Front Cover & Bolts In Sequence
Courtesy of FORD MOTOR CO.

10. Remove the special tools (alignment pins).

NOTE: Do not tighten the bolt at this time.

11. Install the engine mount bracket and the 3 bolts.

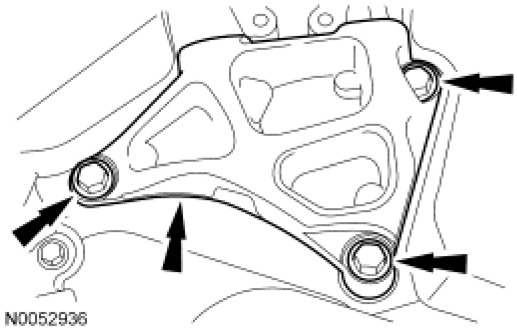


Fig. 947: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Do not expose the Motorcraft High Performance Engine RTV Silicone to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

12. Install the remaining engine front cover bolts. Tighten all the engine front cover bolts and engine mount bracket bolts in the sequence shown in 2 stages:
    - Stage 1: Tighten bolts 1 thru 22 to 10 Nm (89 lb-in) and bolts 23, 24 and 25 to 15 Nm (11 lb-ft).
    - Stage 2: Tighten bolts 1 thru 22 to 24 Nm (18 lb-ft) and bolts 23, 24 and 25 to 75 Nm (55 lb-ft).

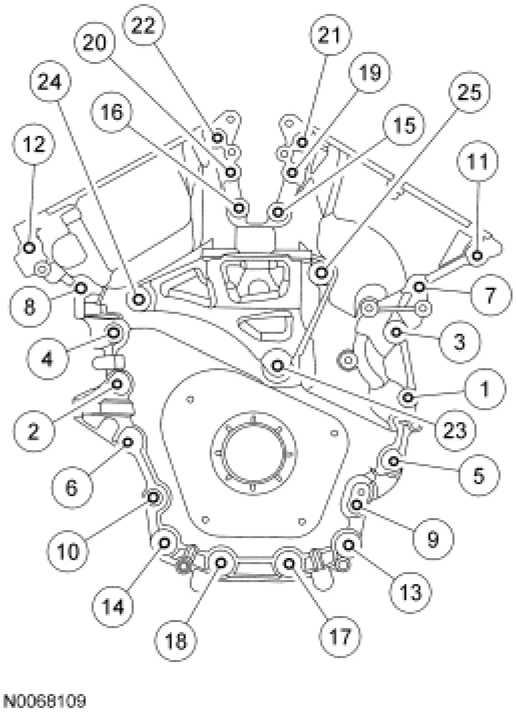


Fig. 948: Identifying Tightening Of Engine Front Cover Bolts & Engine Mount Bracket Bolts In Sequence
Courtesy of FORD MOTOR CO.

13. Install the 2 engine mount studs.
    - Tighten to 18 Nm (13 lb-ft).

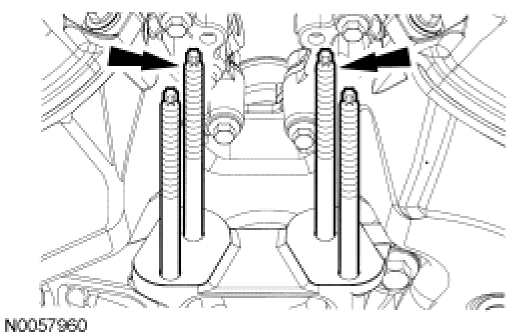


Fig. 949: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

14. Install the engine mount bracket and the 2 bolts.

- Tighten to 24 Nm (18 lb-ft).

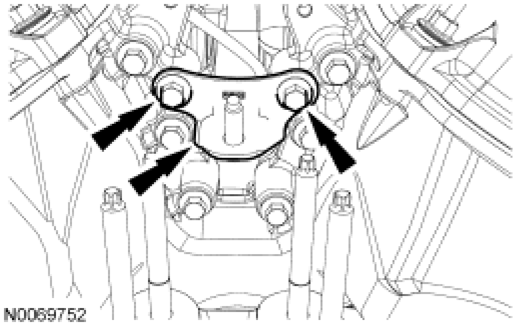


Fig. 950: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

NOTE:	**Apply clean engine oil to the crankshaft front seal bore in the engine front cover.**

15. Using the special tools, install a new crankshaft front seal.

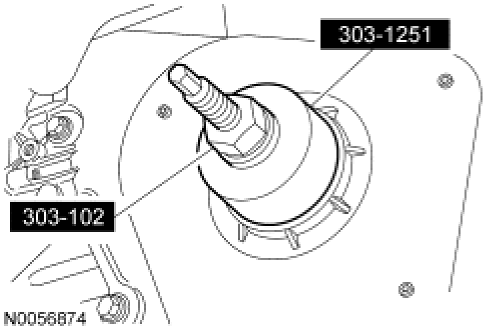


Fig. 951: Installing Crankshaft Front Seal Using Special Tools (303-102) & (303-1251)
Courtesy of FORD MOTOR CO.

NOTE:	**Lubricate the outside diameter sealing surfaces with clean engine oil.**

16. Using the special tools, install the crankshaft pulley.

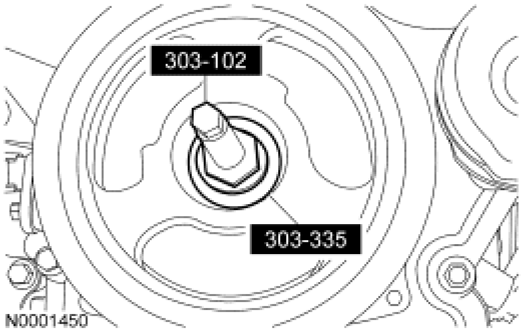


Fig. 952: Installing Crankshaft Pulley
Courtesy of FORD MOTOR CO.

17. Using the special tool, install the crankshaft pulley washer and new bolt and tighten in 4 stages.
    - Stage 1: Tighten to 120 Nm (89 (lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.

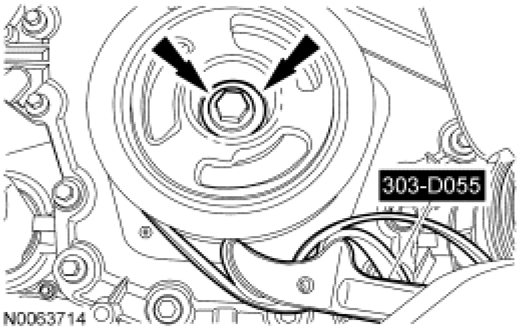


Fig. 953: Installing Crankshaft Pulley Washer & Bolt Using Special Tools (303-D055)
Courtesy of FORD MOTOR CO.

NOTE: Installation of new seals is only required if damaged seals were removed during disassembly of the engine.

NOTE: Spark plug tube seal installation shown, variable camshaft timing (VCT) seal installation similar.

18. Using the special tools, install new VCT solenoid and/or spark plug tube seals.

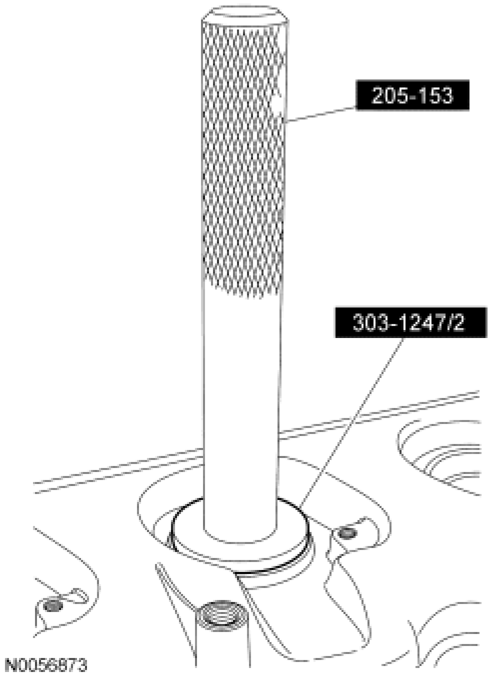


Fig. 954: Installing VCT Solenoid And/Or Spark Plug Tube Seals Using Special Tools (205-153) & (303-1247/2)
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

19. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-RH cylinder head joints.

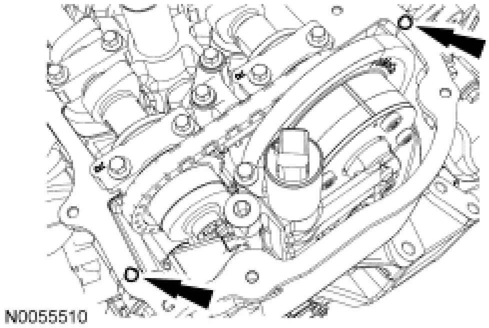


Fig. 955: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-RH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

20. Using a new gasket, install the RH valve cover, bolt and the 10 stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

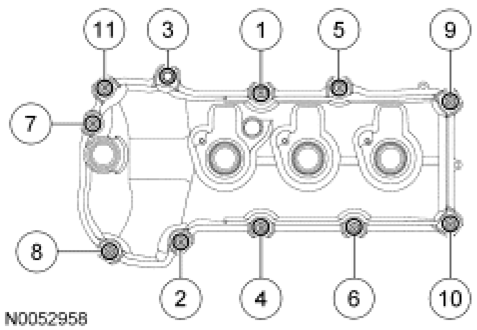


Fig. 956: Installing RH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

CAUTION: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

21. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-LH cylinder head joints.

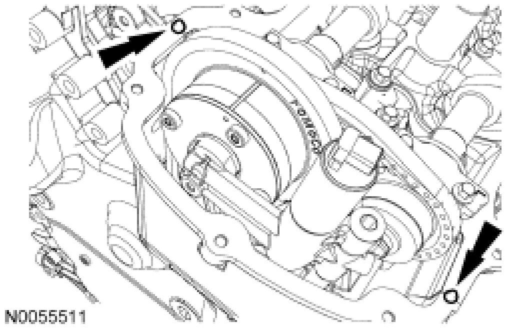


Fig. 957: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Engine Front Cover-To-LH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

22. Using a new gasket, install the LH valve cover and 11 stud bolts.

- Tighten in the sequence shown to 10 Nm (89 lb-in).

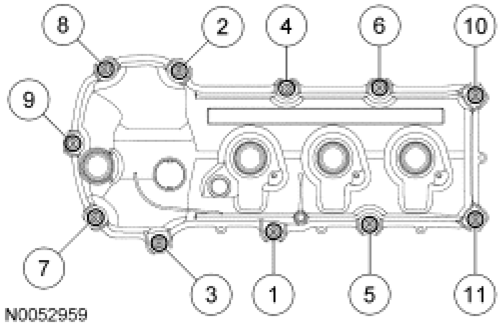


Fig. 958: Installing LH Valve Cover Stud Bolts In Sequence
Courtesy of FORD MOTOR CO.

23. Install the wiring harness retaining bracket and the 2 nuts.
    - Tighten to 9 Nm (80 lb-in).

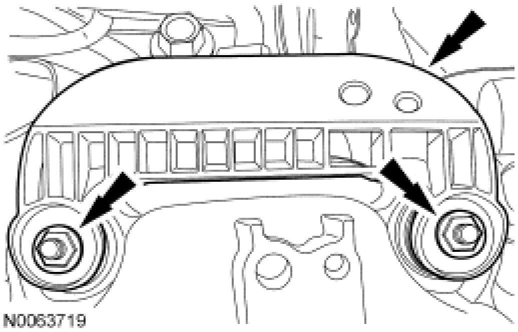


Fig. 959: Identifying Wiring Harness Retaining Bracket & Nuts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

24. Install the 6 coil-on-plug assemblies and the 6 bolts.
    - Tighten to 7 Nm (62 lb-in).

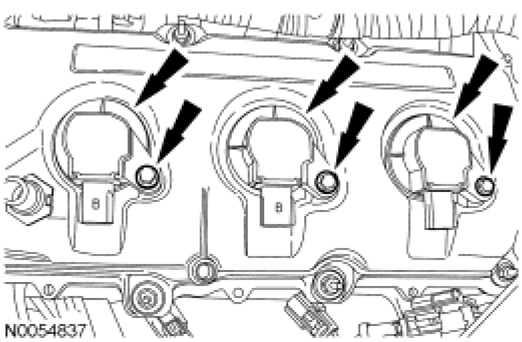


Fig. 960: Locating Coil-On-Plugs & Bolts

Courtesy of FORD MOTOR CO.

25. Install the LH cylinder block drain plug.
    - Tighten to 20 Nm (15 lb-ft) plus an additional 180 degrees.

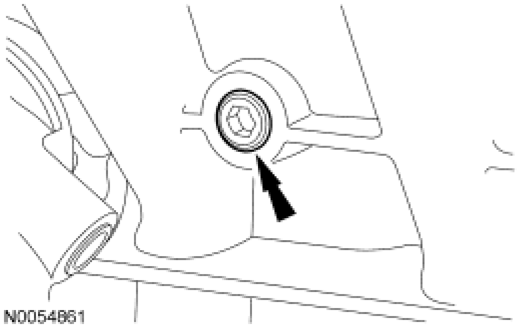


Fig. 961: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

26. Install the RH cylinder block drain plug or, if equipped, the block heater.
    - Tighten to 40 Nm (30 lb-ft).

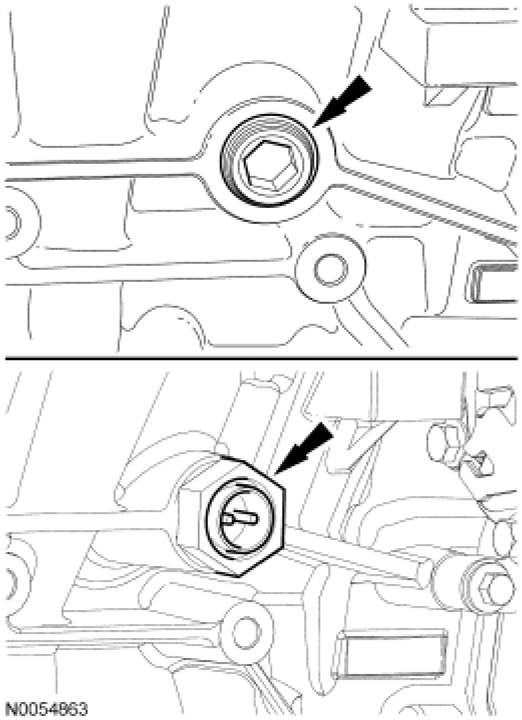


Fig. 962: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

27. Using a new gasket, install the RH catalytic converter and 4 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

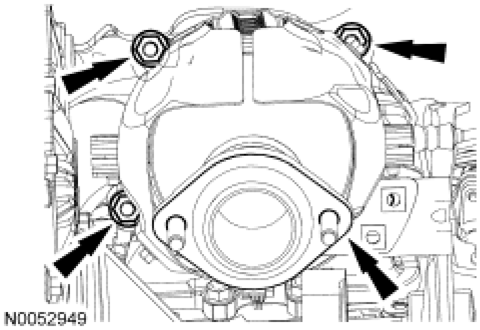


Fig. 963: Locating RH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

All vehicles

28. Using a new gasket, install the LH catalytic converter and 4 new nuts (3 shown).
    - Tighten to 40 Nm (30 lb-ft).

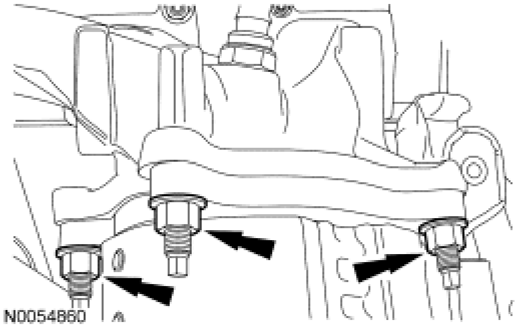


Fig. 964: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

29. Install the accessory drive belt tensioner and the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).

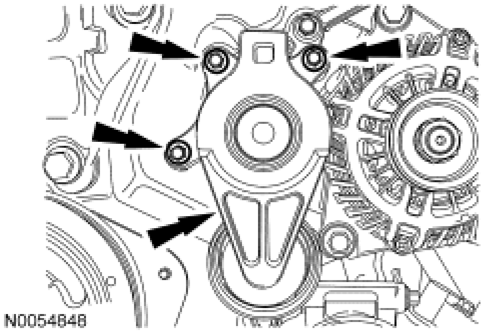


Fig. 965: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

30. Install the power steering pump and the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).

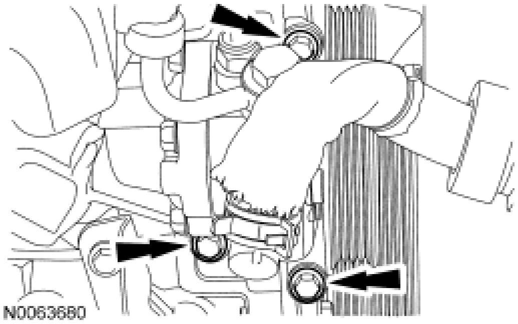


Fig. 966: Locating Power Steering Pump Bolts
Courtesy of FORD MOTOR CO.

31. Install the power steering pressure (PSP) hose bracket and nut.
    - Tighten to 9 Nm (80 lb-in).

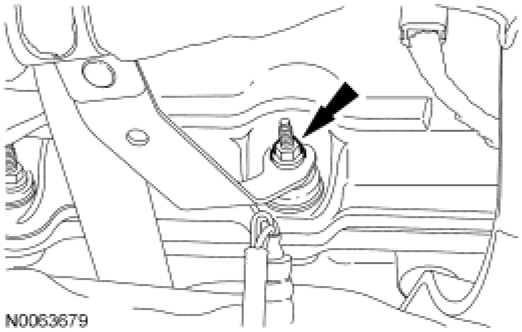


Fig. 967: Identifying PSP Hose Bracket Nut
Courtesy of FORD MOTOR CO.

32. Attach the PSP hose retainer to the engine lifting eye.

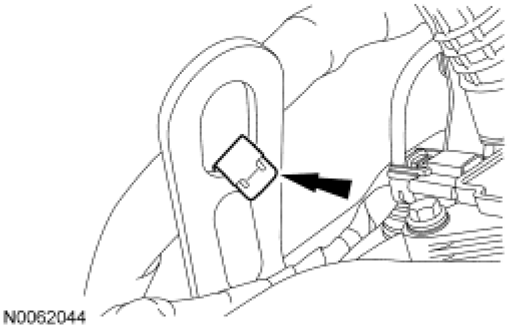


Fig. 968: Locating PSP Hose Retainer From Engine Lifting Eye
Courtesy of FORD MOTOR CO.

33. Attach all of the wiring harness retainers to the LH valve cover and stud bolts.
34. Connect the LH camshaft VCT solenoid electrical connector.

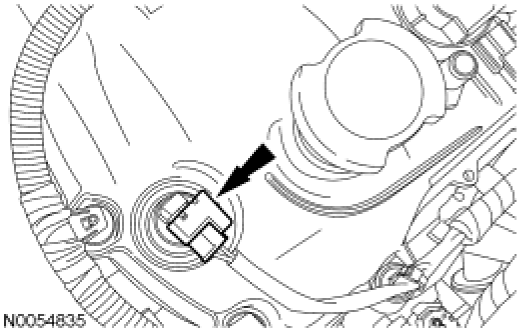


Fig. 969: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

35. Connect the 3 LH coil-on-plug electrical connectors.

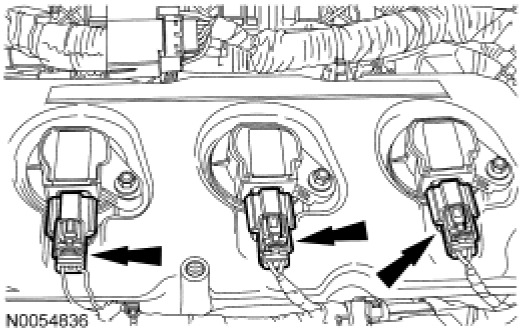


Fig. 970: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

36. Connect the LH catalyst monitor sensor electrical connector.

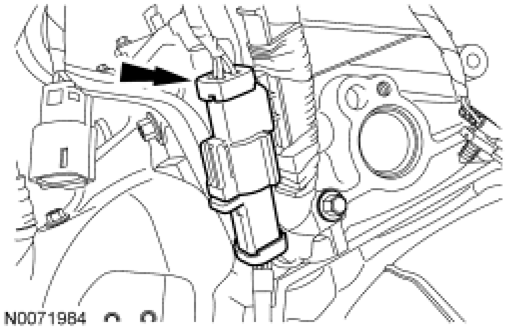


Fig. 971: Identifying LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

37. Attach all of the wiring harness retainers to the RH valve cover and stud bolts.
38. If equipped, connect the heated PCV valve electrical connector.

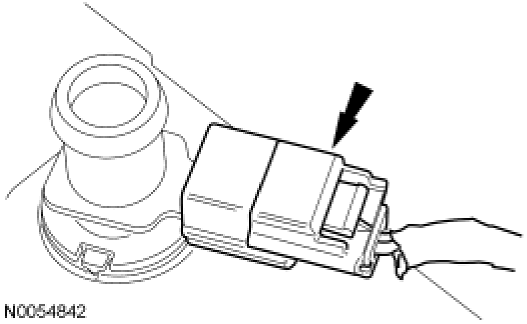


Fig. 972: Locating Heated PCV Valve Electrical Connector
Courtesy of FORD MOTOR CO.

39. Connect the 3 RH coil-on-plug electrical connectors.

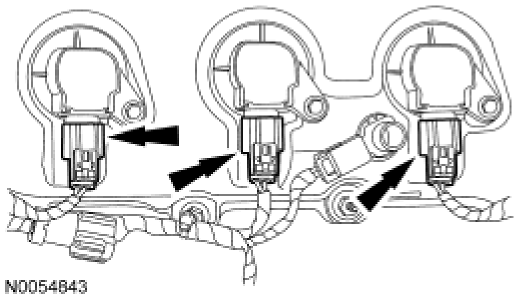


Fig. 973: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

40. Connect the RH VCT solenoid electrical connector.

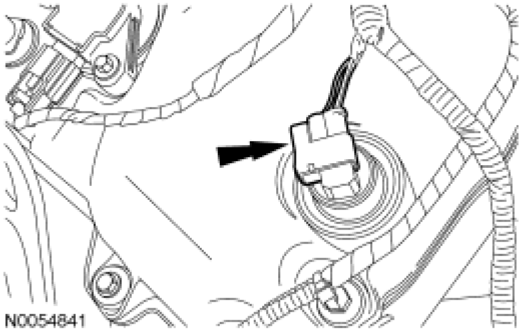


Fig. 974: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

FWD vehicles

41. Connect the RH catalyst monitor sensor electrical connector.

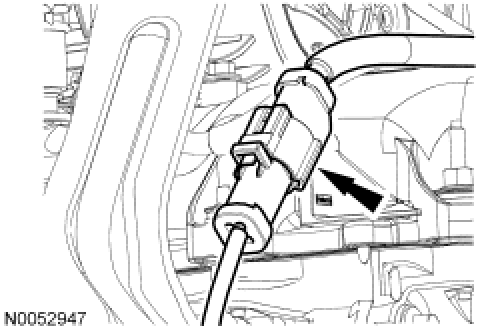


Fig. 975: Locating RH Catalyst Monitor Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

42. Connect the PSP switch electrical connector.

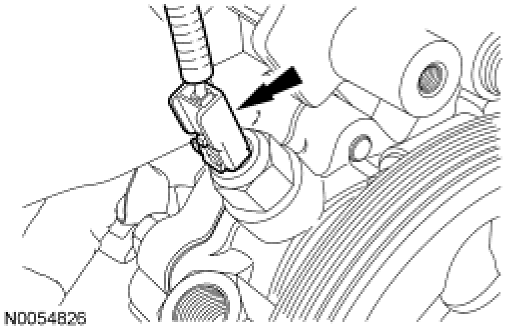


Fig. 976: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

43. Using new gaskets, install the upper intake manifold and the 6 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

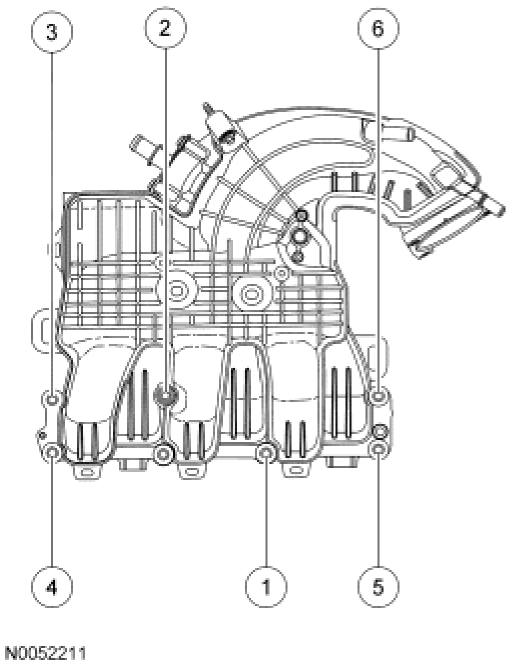


Fig. 977: Installing Upper Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

44. Install the upper intake manifold short support bracket bolt.
    - Tighten to 10 Nm (89 lb-in).

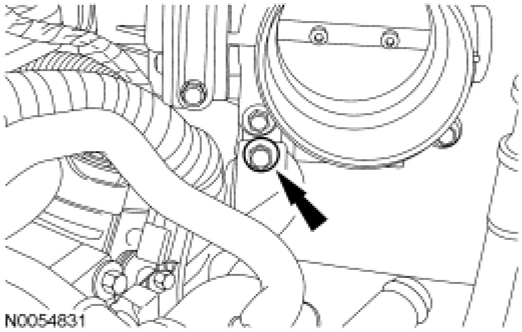


Fig. 978: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

45. If equipped, install the upper intake manifold long support bracket bolt.
    - Tighten to 10 Nm (89 lb-in).

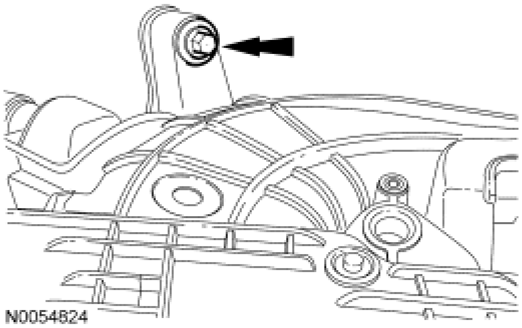


Fig. 979: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

46. Attach the wiring harness retainers to the upper intake manifold.

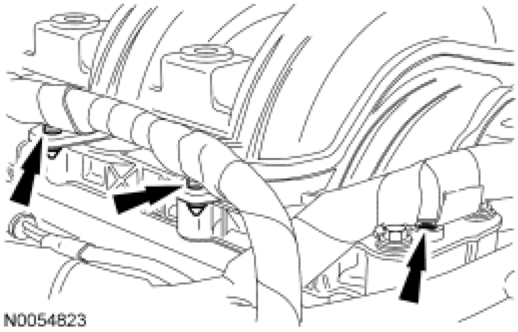


Fig. 980: Locating Wiring Harness Retainers From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

47. Connect the throttle body (TB) electrical connector.

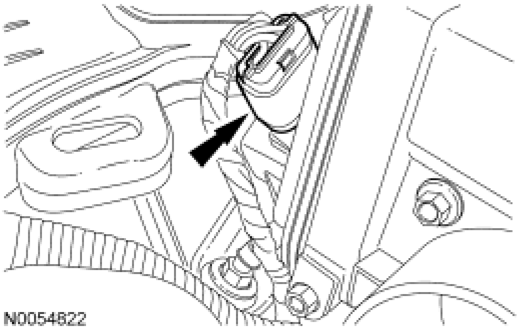


Fig. 981: Locating Throttle Body Electrical Connector
Courtesy of FORD MOTOR CO.

48. Connect the PCV hose to the PCV valve.

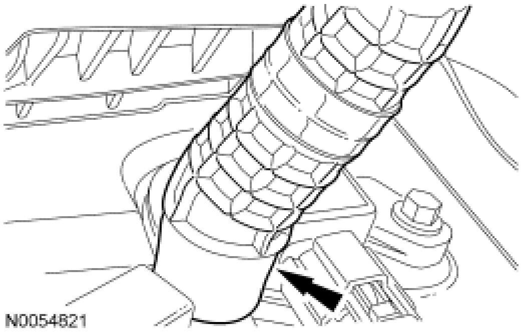


Fig. 982: Identifying PCV Hose From PCV Valve
Courtesy of FORD MOTOR CO.

49. If equipped, connect the heated PCV electrical connector.

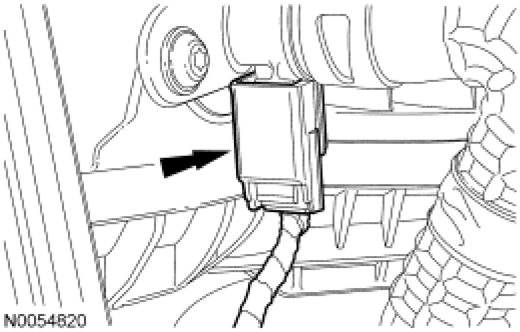


Fig. 983: Identifying Positive Crankcase Ventilation (PCV) Fitting Electrical Connector
Courtesy of FORD MOTOR CO.

50. If equipped, position the block heater wiring harness onto the engine.
    - Attach the block heater wiring harness retainer to the power steering reservoir hose and the PSP hose.

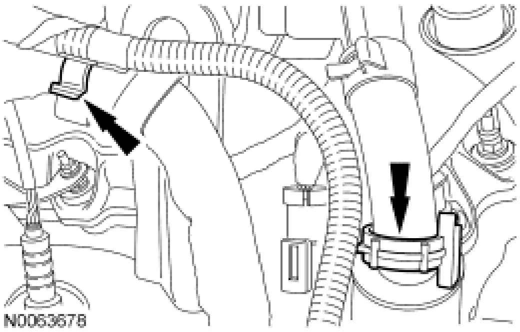


Fig. 984: Identifying Block Heater Wiring Harness From Engine
Courtesy of FORD MOTOR CO.

51. If equipped, connect the block heater electrical connector and install the heat shield.

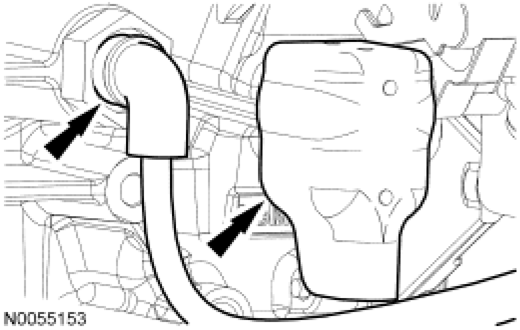


Fig. 985: Identifying Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

52. If equipped, attach the block heater wiring harness retainer to the upper intake manifold.

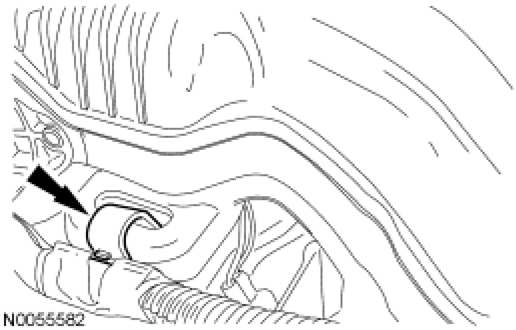


Fig. 986: Identifying Block Heater Wiring Harness Retainer From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

53. Using the special tools, remove the engine from the stand.

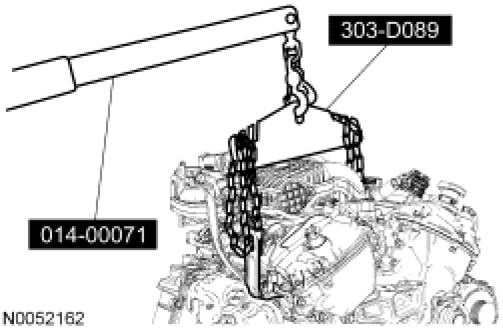


Fig. 987: Removing Engine & Transaxle From Lift Table Using Special Tools (303-D089, 014-00071) & Suitable Engine Crane
Courtesy of FORD MOTOR CO.

54. Install the crankshaft sensor ring.

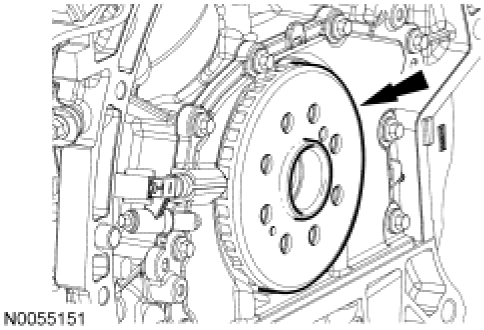


Fig. 988: Identifying Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

55. Install the flexplate and the 8 bolts.
    - Tighten to 80 Nm (59 lb-ft).

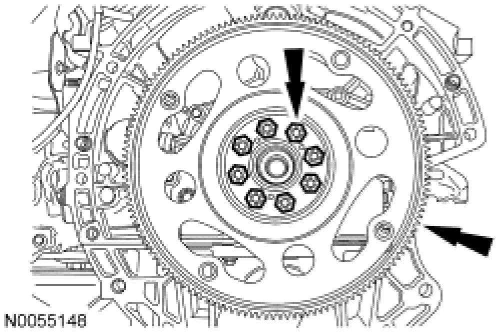


Fig. 989: Identifying Flexplate & Bolts
Courtesy of FORD MOTOR CO.

56. Install the engine in the vehicle. For additional information, refer to **Engine**.

OIL PUMP SCREEN AND PICKUP TUBE

NOTE: **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.**

1. Using a new O-ring seal, install the oil pump screen and pickup tube and the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).

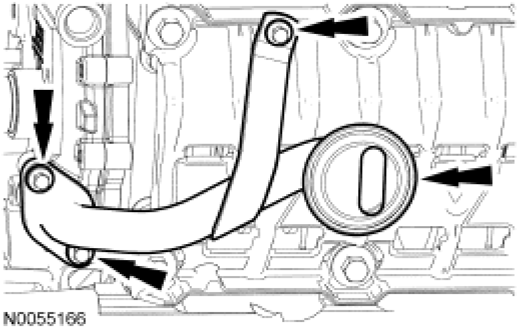


Fig. 990: Identifying Oil Pump Screen, Pickup Tube & Bolts
Courtesy of FORD MOTOR CO.

2. Install the oil pan. For additional information, refer to **Oil Pan**.

OIL PUMP

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

NOTE: Install a new oil pump screen and pickup tube O-ring seal prior to installing the oil pump.

1. Position the oil pump onto the crankshaft and rotate counterclockwise to position the pump onto the oil pump screen and pickup tube.
   - Install the 3 bolts and tighten to 10 Nm (89 lb-in).

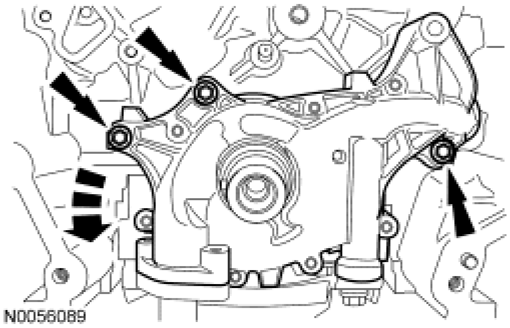


Fig. 991: Locating Oil Pump Screen & Pickup Tube Bolts & Rotating Oil Pump Counterclockwise
Courtesy of FORD MOTOR CO.

2. Install the 2 oil pump screen and pickup tube bolts.
   - Tighten to 10 Nm (89 lb-in).

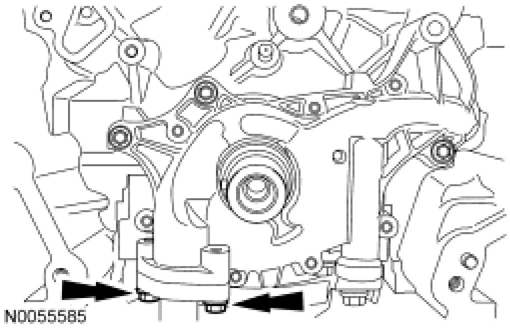


Fig. 992: Locating Oil Pump Bolts
Courtesy of FORD MOTOR CO.

3. Install the crankshaft timing chain sprocket.

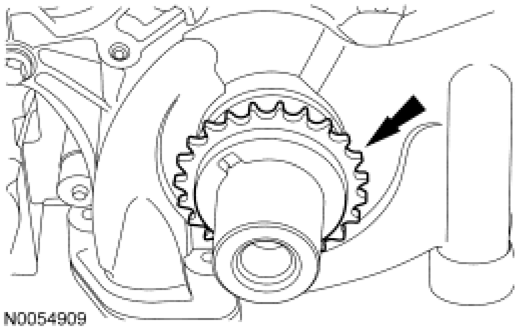


Fig. 993: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

4. Install the primary timing chain with the colored links aligned with the timing marks on the VCT assemblies and the crankshaft sprocket.

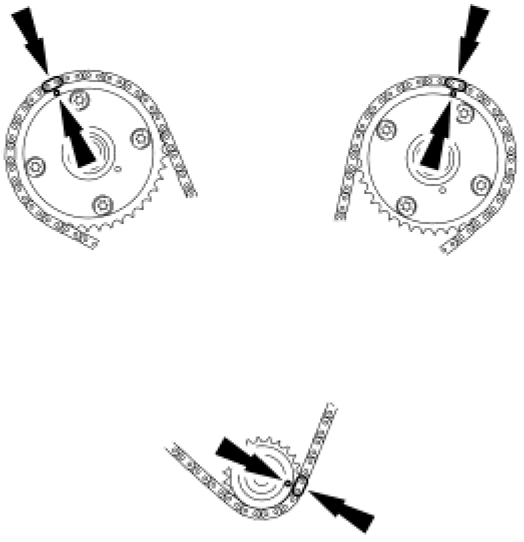


Fig. 994: Aligning Timing Marks On VCT Assemblies & Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

5. Install the LH primary timing chain guide and the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

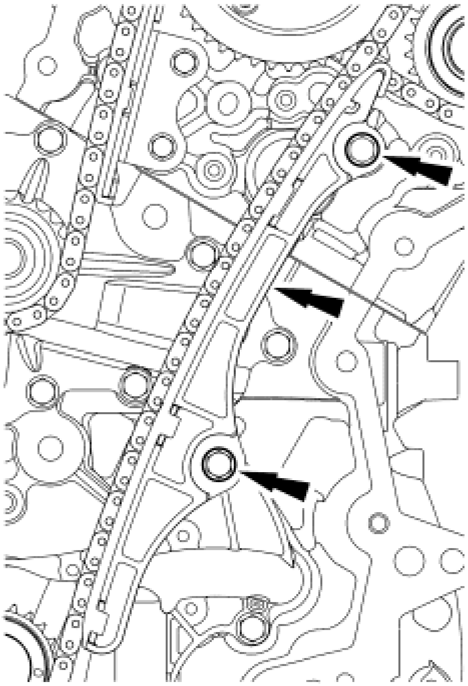


Fig. 995: Locating Lower LH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

6. Install the primary timing chain tensioner arm.

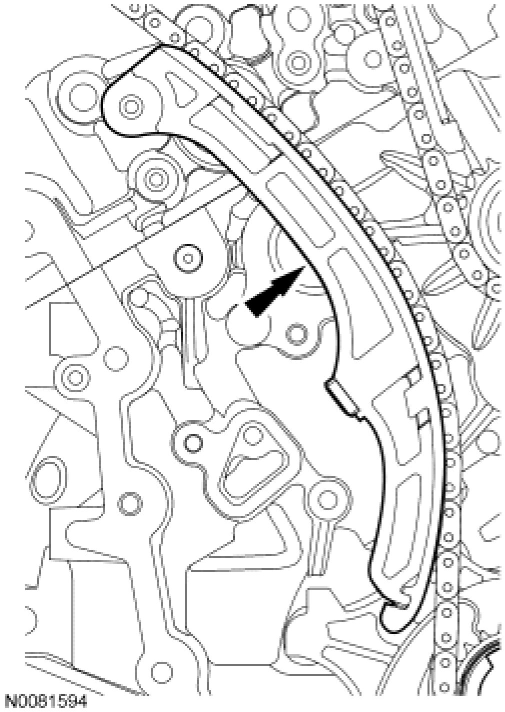


Fig. 996: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

7. Reset the primary timing chain tensioner.
   - Rotate the lever counterclockwise.
   - Using a soft-jawed vise, compress the plunger.
   - Align the hole in the lever with the hole in the tensioner housing.
   - Install a suitable lock pin.

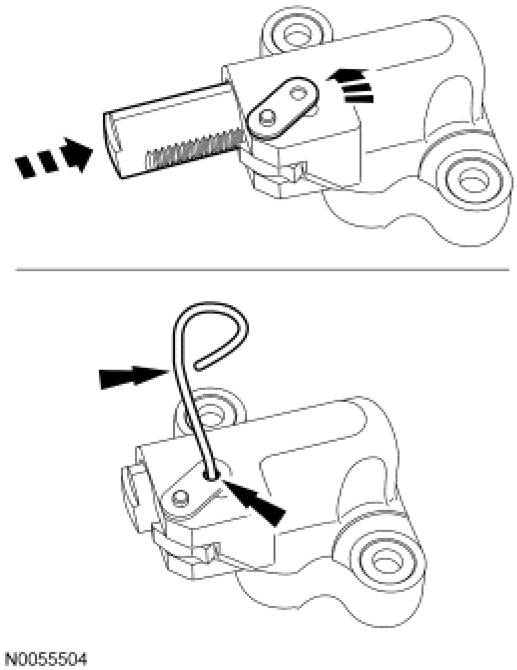


Fig. 997: Compressing Plunger Using A Soft-Jawed Vise
Courtesy of FORD MOTOR CO.

NOTE:	**It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.**

8. Install the primary tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).
    - Remove the lock pin.

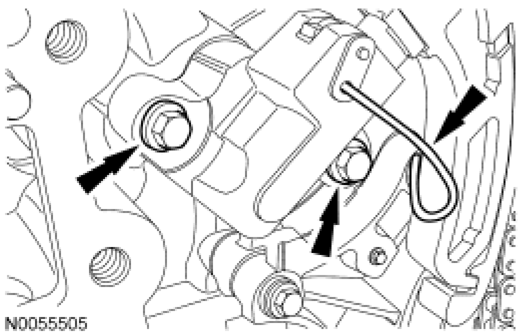


Fig. 998: Locating Primary Tensioner Bolts
Courtesy of FORD MOTOR CO.

9. As a post-check, verify correct alignment of all timing marks.

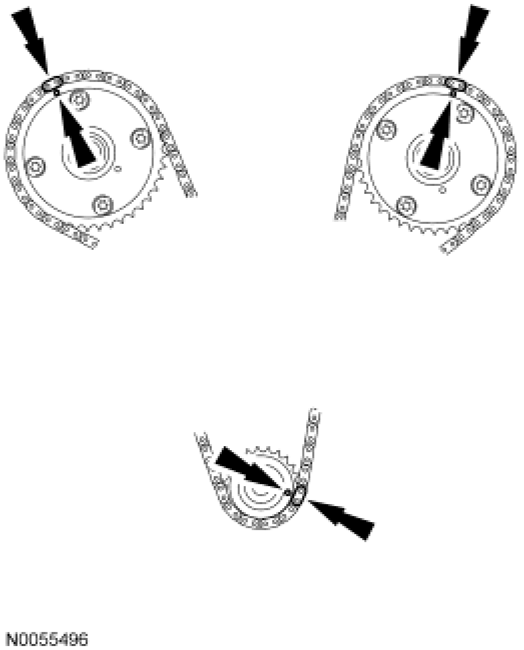


Fig. 999: Verifying Correct Alignment Of All Timing Marks
Courtesy of FORD MOTOR CO.

10. Install new VCT housing seals.

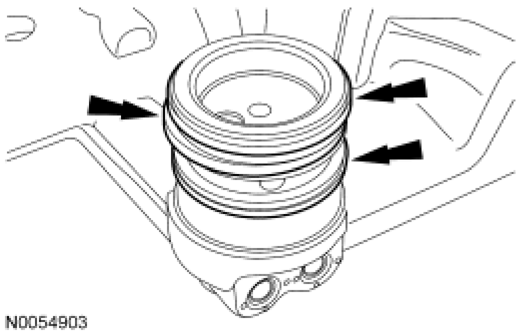


Fig. 1000: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

NOTE: Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

11. Install the LH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

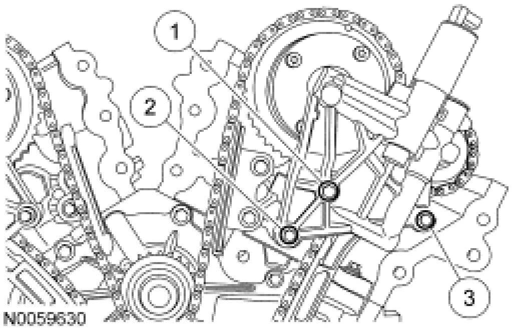


Fig. 1001: Identifying LH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE: **Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.**

12. Install the RH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

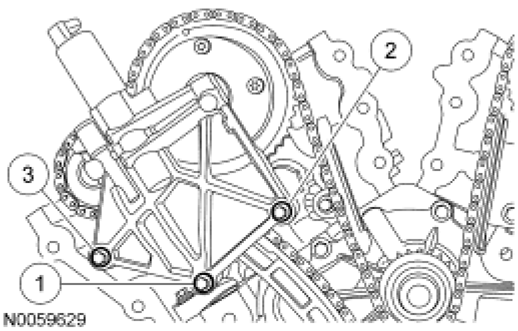


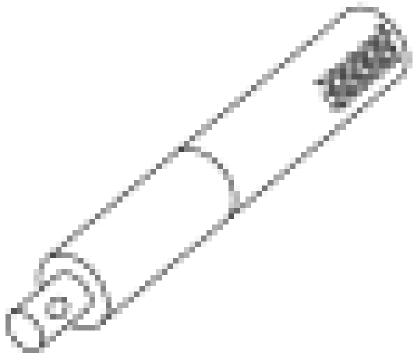
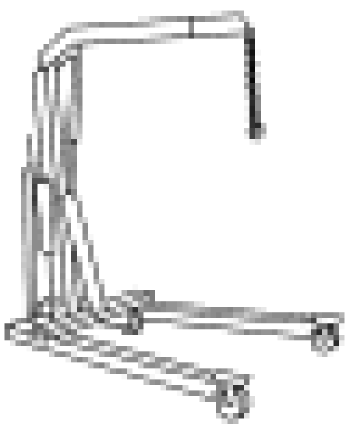
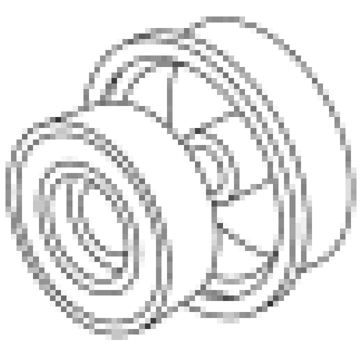
Fig. 1002: Identifying RH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

13. Install the engine front cover. For additional information, refer to **Engine Front Cover**.

CRANKSHAFT REAR SEAL WITH RETAINER PLATE

Special Tools

Illustration	Tool Name	Tool Number
	Handle	205-153 (T80T-4000-W)

 ST1326-A		
 ST1341-A	Heavy Duty Floor Crane	014-00071 or equivalent
 ST2980-A	Installer, Rear Main Seal	303-1250
	Spreader Bar	303-D089 (D93P-6001-A3) or

 ST1602-A		equivalent

Material

Item	Specification
Motorcraft High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The crankshaft rear seal retainer must be installed and the bolts tightened within 4 minutes of sealant application.

1. Apply a 3 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the sealing surface of the crankshaft rear seal retainer.

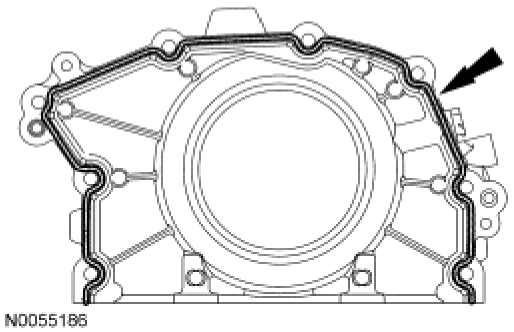


Fig. 1003: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Sealing Surface Of Crankshaft Rear Seal Retainer
Courtesy of FORD MOTOR CO.

2. Install the rear seal retainer and the 8 bolts in the sequence shown.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

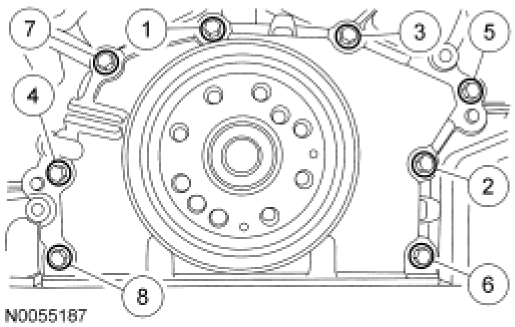


Fig. 1004: Installing Crankshaft Rear Seal Retainer Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the seal lips and bore with clean engine oil prior to installation.

3. Position the Rear Main Seal Installer onto the end of the crankshaft and slide a new crankshaft rear seal onto the tool.

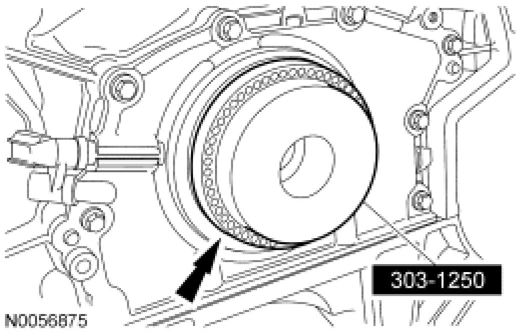


Fig. 1005: Positioning Special Tool (303-1250) Onto End Of Crankshaft
Courtesy of FORD MOTOR CO.

4. Using the Rear Main Seal Installer and Handle, install the new crankshaft rear seal.

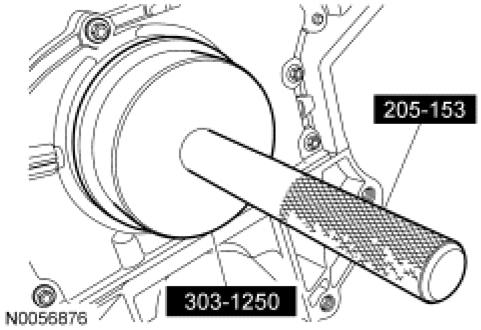


Fig. 1006: Installing New Crankshaft Rear Seal Using Special Tools (303-1250) & (205-153)
Courtesy of FORD MOTOR CO.

5. Install the Crankshaft Position (CKP) sensor and install the bolt.
   - Tighten to 10 Nm (89 lb-in).

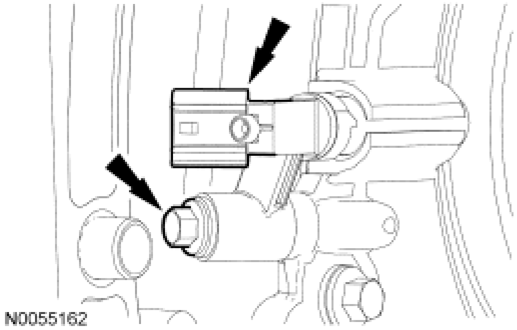


Fig. 1007: Identifying CKP Sensor & Bolt
Courtesy of FORD MOTOR CO.

6. Connect the CKP sensor electrical connector.

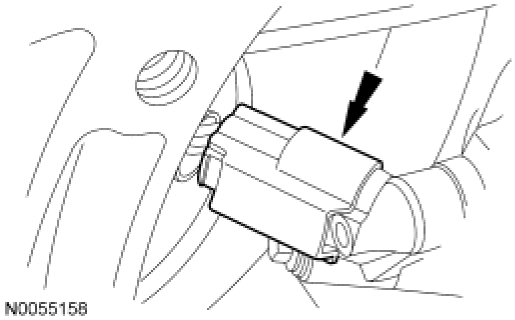


Fig. 1008: Identifying Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

7. Using the Heavy Duty Floor Crane and Spreader Bar, install the engine onto the stand.

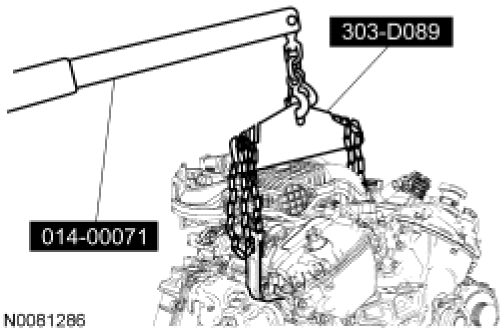


Fig. 1009: Identifying Heavy Duty Floor Crane and Spreader Bar
Courtesy of FORD MOTOR CO.

8. Install the oil pan. For additional information, refer to **Oil Pan**.

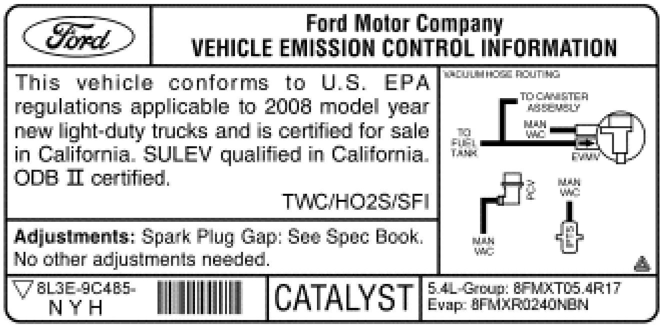
2008 ENGINE PERFORMANCE

Description & Operation - Gasoline Engines

VEHICLE EMISSION CONTROL INFORMATION (VECI)

VECI DECAL

Each vehicle has a VECI decal containing emission control information that applies specifically to the vehicle and engine. The specifications on the decal are critical to repairing the emissions systems.



N0048505

Fig. 1: Typical VECI Decal
Courtesy of FORD MOTOR CO.

VECI DECAL LOCATION

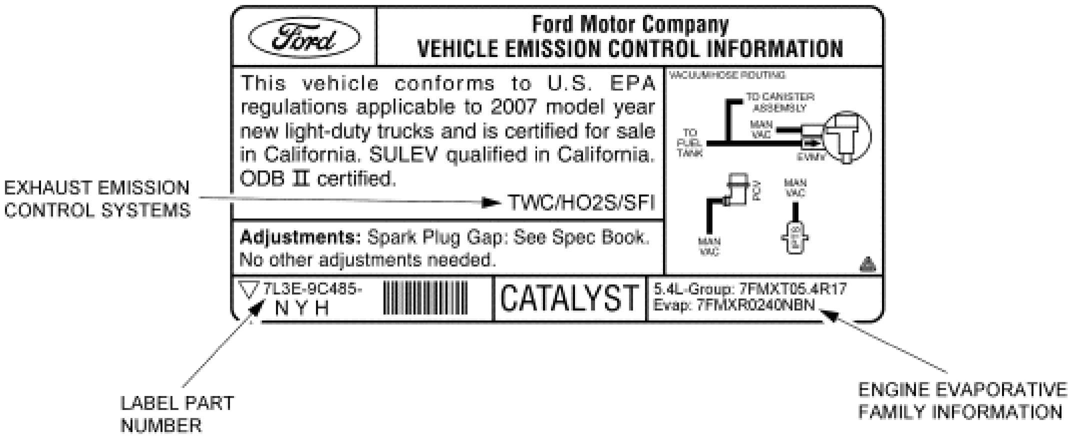
Typical location of the decal is on the underside of the hood or on the radiator support sight shield.

ENGINE/EVAPORATIVE EMISSION (EVAP) SYSTEM INFORMATION

Manufacturers must use a standardized system for identifying their individual engine families. The system described below was developed by the Environmental Protection Agency (EPA) in 1991 to meet new regulatory requirements for 1994 and later model years.

The engine family group and evaporative family name consists of 12 characters each.

Both the engine family group and the evaporative family name are listed in the box on the emission decal as indicated in the area marked as engine evaporative family information. The first line contains engine size and the 12-character engine family group. The second line contains the 12-character evaporative family name information. Both the engine family group and the evaporative family name are specific to the vehicle. Please refer to the Engine Family Group and the Evaporative Family Name worksheet for decoding information.



N0048171

Fig. 2: Typical VECI Decal Used As An Example
Courtesy of FORD MOTOR CO.

ENGINE FAMILY GROUP WORK SHEET

	Year		Manufacturer			Type		Displacement				Wild Card		
	1					5								
Char	Code	Year	2	3	4	Code	Description	6	7	8	9	10	11	12
	1	2001	F	M	X	N	Nonstandard Family	0	1 to 9	•	0 to 9	Alpha/Numeric		
	2	2002				V	Light Duty Vehicle							
	3	2003				T	Light Duty Truck							
	4	2004				C	Motorcycle							
	5	2005				A	Calif Medium Duty Truck							
	6	2006				H	Heavy Duty Engine							
	7	2007				S	Small Nonroad							
	8	2008				L	Large Nonroad							
	9	2009				M	Marine							
Family Name			F	M	X			0	1 to 9	•	0 to 9			

N0009582

Fig. 3: Engine Family Group Work Sheet Chart
Courtesy of FORD MOTOR CO.

Evaporative Family Name Work Sheet

	Year		Manufacturer			Type		Canister Working Capacity				Wild Card		
	1					5								
Char	Code	Year	2	3	4	Code	Description	6	7	8	9	10	11	12
	1	2001	F	M	X	E	Evaporative (Use for Existing/ Enhanced)	a	a	a	a	alpha/numeric		
	2	2002												
	3	2003				R	Evaporative/ Refueling (Use for ORVR)							
	4	2004												
	5	2005												
	6	2006												
	7	2007												
	8	2008												
	9	2009												
Family Name			F	M	X									

a Total Grams in all canisters (Use 0 for each character not used for capacity starting with character 6)

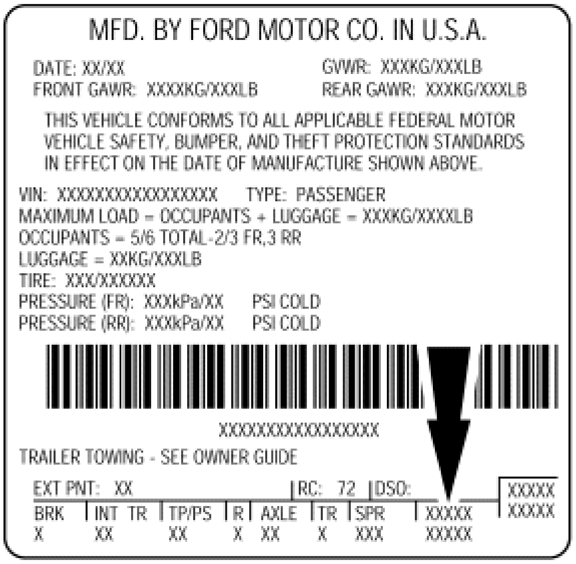
A0029217

Fig. 4: Evaporative Family Name Work Sheet Chart
Courtesy of FORD MOTOR CO.

VEHICLE CERTIFICATION LABEL

BASE ENGINE CALIBRATION INFORMATION

Base engine calibration information, also sometimes referred to as the powertrain calibration, is located in the lower right corner of the vehicle certification label. Engine calibration information is limited to a maximum of 5 characters per line (2 lines maximum). Calibration information more than 5 characters long wrap to the second line of this field. Only the base calibration appears on this label. The revision level is no longer printed on the label, however, it can be found in the On-Line Automotive Service Information System (OASIS). For additional information on the vehicle certification label or engine calibration, refer to the **IDENTIFICATION CODES -- E-SERIES** .



N0009583

Fig. 5: Typical Car Vehicle Certification Label
Courtesy of FORD MOTOR CO.

N0012324

Fig. 6: Identifying Calibration Location On VC Label
Courtesy of FORD MOTOR CO.

VEHICLE CERTIFICATION LABEL LOCATION

Typical location of the vehicle certification label is on the LH door or door post pillar.

ENGINE CALIBRATION CODE

2008 MODEL YEAR EXAMPLE

Engine Calibration Code: 8B7 1 4D 0 A 00	
8	MODEL YEAR - Model year in which the calibration was first introduced. 8 equals 2008
B7	VEHICLE CODE - Vehicle line description. B7 equals Expedition
1	TRANSMISSION CODE - Transmission description. 1 equals automatic, 2 equals manual
4D	UNIQUE CALIBRATION - Identifications are assigned to cover similar vehicles to differentiate between tires, drive configurations, final drive ratios and other calibration-significant factors.
0	FLEET CODE - Describes which fleet the vehicle belongs to. 0 equals Certification (U.S. 4K)
A	CERTIFICATION REGION - Lead region code where multiple regions are included in one calibration. A equals U.S. Federal
00	REVISION LEVEL - Revision level of the calibration. 00 equals Job 1 production or initial calibration. (Not printed on vehicle certification label)

VEHICLE EMISSION CONTROL INFORMATION (VECI) ACRONYM DEFINITIONS

CARB: California Air Resource Board

CARB LEV: Low Emission Vehicle

CARB SULEV: Super Ultra Low Emission Vehicle

CARB TLEV: Transitional Low Emission Vehicle

CARB ULEV: Ultra Low Emission Vehicle

CARB ZEV: Zero Emission Vehicle

CI: Cylinder Injection

EPA: Environmental Protection Agency

EVAP: Evaporative Emissions

GVW: Gross Vehicle Weight

GVWR: Gross Vehicle Weight Rating, curb weight plus payload.

HHDDE: Heavy Heavy Duty Diesel Engine

HHDE: Heavy Heavy Duty Engine

ILEV: Inherently Low Emission Vehicle

LDDT: Light Duty Diesel Truck categories

LDT: Light Duty Truck (gasoline) categories based on weight as defined in the table.

LDV: Light Duty Vehicle, generally passenger cars and light trucks under 2,721.55 Kg (6,000 lb) GVWR.

LEV: Low Emission Vehicle

LEV-II: California regulations beginning in the 2004 model year.

LHDE: Light Heavy Duty Engine (several weight categories).

LVW: Loaded Vehicle Weight, curb weight plus 136.08 Kg (300 lb).

MDPV: Medium Duty Passenger Vehicle

MDT: Medium Duty Truck categories based on weight as defined in the table.

MDV: Medium Duty Vehicle

MHDDE: Medium Heavy Duty Diesel Engine

MHDE: Medium Heavy Duty Engine

MPI: Multi-Port Injection

MY: Model Year

NCP: Non-Compliance Penalty

OBD: On Board Diagnostic

ORVR: On-Board Refueling Vapor Recovery

PC: Passenger Car

PZEV: Partially Zero Emission Vehicle

SI: Sequential Injection

SULEV: Super Ultra Low Emission Vehicle

Tier 0: California and Federal regulations effective prior to Tier 1 phase in dates.

Tier 1: California regulations beginning in 1993 model year and Federal regulations beginning in 1994 model year.

Tier 2: Federal regulations beginning in the 2004 model year.

ULEV: Ultra Low Emission Vehicle

ZEV: Zero Emission Vehicle

ENGINE CONTROL COMPONENTS

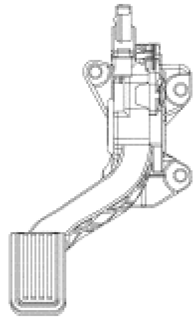
NOTE:	**Transmission inputs, which are not described are discussed in the applicable Workshop article transmission part.**

ACCELERATOR PEDAL POSITION (APP) SENSOR

The APP sensor is an input to the powertrain control module (PCM) and is used to determine the amount of torque requested by the operator. Depending on the application either a 2-track or 3-track APP sensor is used.

2-Track APP Sensor - There are 2 pedal position signals in the sensor. Both signals, APP1 and APP2, have a positive slope (increasing angle, increasing voltage), but are offset and increase at different rates. The 2 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other input is used. There are 2 reference voltage circuits, 2 signal return circuits, and 2 signal circuits (a total of 6 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor. The pedal position signal is

converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy. For additional information, refer to **TORQUE BASED ELECTRONIC THROTTLE CONTROL (ETC)**.



N0072972

Fig. 7: Identifying Accelerator Pedal Position (APP) 2-Track APP Sensor
Courtesy of FORD MOTOR CO.

3-Track APP Sensor - There are 3 pedal position signals in the sensor. Signal 1, APP1, has a negative slope (increasing angle, decreasing voltage) and signals 2 and 3, APP2 and APP3, both have a positive slope (increasing angle, increasing voltage). During normal operation APP1 is used as the indication of pedal position by the strategy. The 3 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other inputs are used. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy. There are 2 reference voltage circuits, 2 signal return circuits, and 3 signal circuits (a total of 7 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor. For additional information, refer to **TORQUE BASED ELECTRONIC THROTTLE CONTROL (ETC)**.

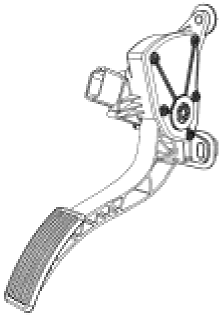


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Fig. 8: Identifying Accelerator Pedal Position (APP) Typical 3-Track APP Sensor
Courtesy of FORD MOTOR CO.

AIR CONDITIONING (A/C) CLUTCH RELAY (A/CCR)

NOTE:	**The PCM PIDs WAC and wide open throttle air conditioning cutoff fault (WACF) are used to monitor the A/CCR output.**

The A/CCR is wired normally open. There is no direct electrical connection between the A/C switch or

electronic automatic temperature control (EATC) module and the A/C clutch. The PCM receives a signal indicating that A/C is requested. For some applications, this message is sent through the communications network. When A/C is requested, the PCM checks other A/C related inputs that are available, such as A/C pressure switch and A/C cycling switch. If these inputs indicate A/C operation is OK, and the engine conditions are OK (coolant temperature, engine RPM, throttle position), the PCM grounds the A/CCR output, closing the relay contacts and sending voltage to the A/CCR.

AIR CONDITIONING (A/C) CYCLING SWITCH

The A/C cycling switch may be wired to either the ACCS or ACPSW PCM input. When the A/C cycling switch opens, the PCM turns off the A/C clutch. For information on the specific function of the A/C cycling switch, refer to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** . Also, refer to the applicable Wiring Diagrams article for vehicle specific wiring.

If the ACCS signal is not received by the PCM, the PCM circuit will not allow the A/C to operate. For additional information, refer to wide open throttle air conditioning cutoff (WAC).

Some applications do not have a dedicated (separate) input to the PCM indicating that A/C is requested. This information is received by the PCM through the communication link.

AIR CONDITIONING EVAPORATOR TEMPERATURE (ACET) SENSOR

The ACET sensor measures the evaporator air discharge temperature. The ACET sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The PCM sources a low current 5 volts on the ACET circuit. With SIG RTN also connected to the ACET sensor, the varying resistance changes the voltage drop across the sensor terminals. As A/C evaporator air temperature changes, the varying resistance of the ACET sensor changes the voltage the PCM detects.

The ACET sensor is used to more accurately control A/C clutch cycling, improve defrost/demist performance, and reduce A/C clutch cycling.

NOTE: **These values can vary 15% due to sensor and VREF variations. Voltage values were calculated for VREF equals 5.0 volts.**

A/C EVAPORATOR TEMPERATURE (ACET) SENSOR VOLTAGE AND RESISTANCE

°C	°F	Volts	Resistance (K ohms)
100	212	0.47	2.08
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.34
60	140	1.37	7.55
50	122	1.77	10.93
40	104	2.23	16.11
30	86	2.74	24.25
20	68	3.26	37.34

10	50	3.73	58.99
0	32	4.14	95.85
-10	14	4.45	160.31
-20	-4	4.66	276.96

AIR CONDITIONING (A/C) HIGH PRESSURE SWITCH

The A/C high pressure switch is used for additional A/C system pressure control. The A/C high pressure switch is either dual function for multiple speed, relay controlled electric fan applications, or single function for all others.

For refrigerant containment control, the normally closed high pressure contacts open at a predetermined A/C pressure. This results in the A/C turning off, preventing the A/C pressure from rising to a level that would open the A/C high pressure relief valve.

For fan control, the normally open medium pressure contacts close at a predetermined A/C pressure. This grounds the ACPSW circuit input to the PCM. The PCM then turns on the high speed fan to help reduce the pressure.

For additional information, refer to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** or the Wiring Diagrams article.

AIR CONDITIONING PRESSURE (ACP) TRANSDUCER SENSOR

The ACP transducer sensor is located in the high pressure (discharge) side of the A/C system. The ACP transducer sensor provides a voltage signal to the PCM that is proportional to the A/C pressure. The PCM uses this information for A/C clutch control, fan control and idle speed control.

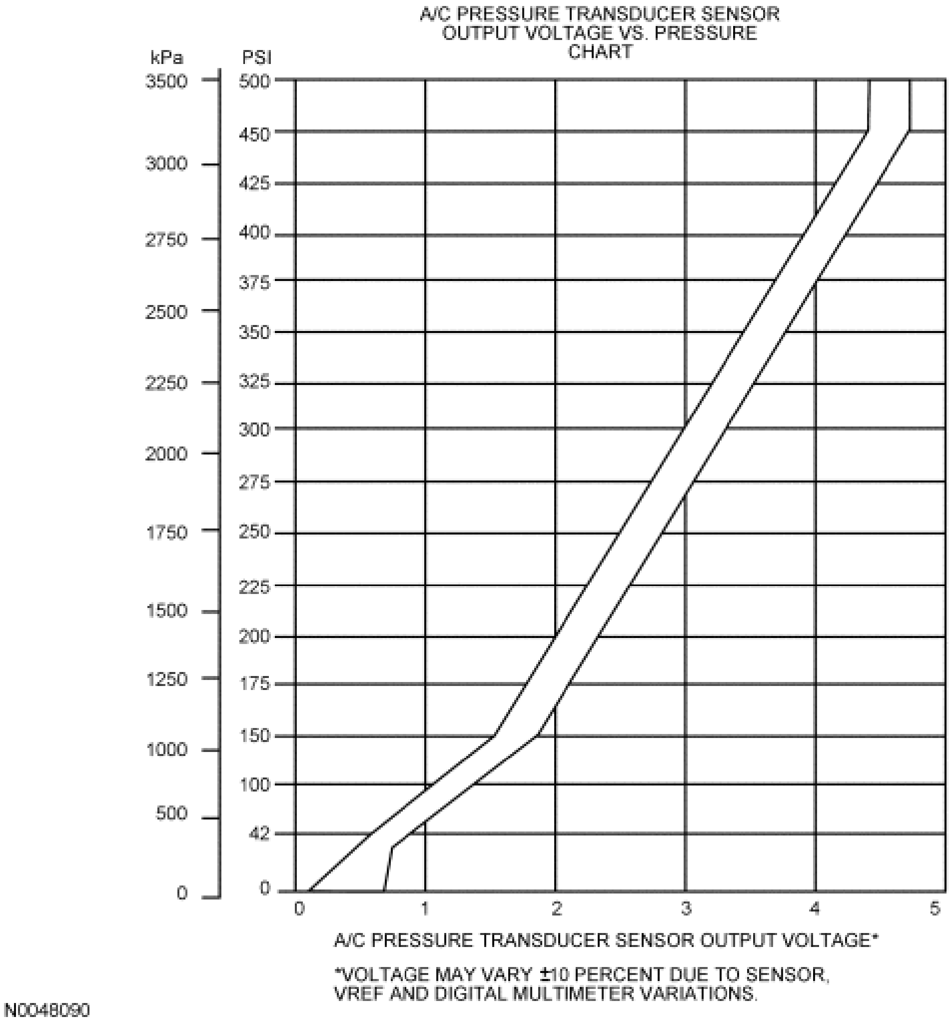


Fig. 9: A/C Pressure Transducer Sensor Output Voltage Vs. Pressure Chart
Courtesy of FORD MOTOR CO.

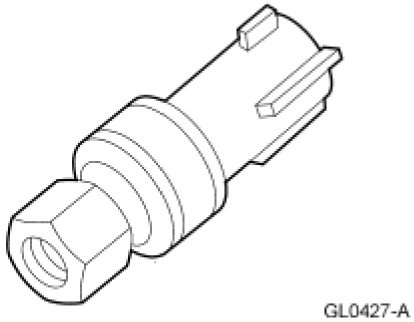


Fig. 10: Typical ACP Transducer Sensor
Courtesy of FORD MOTOR CO.

BRAKE PEDAL POSITION (BPP) SWITCH

The BPP switch is sometimes referred to as the stoplamp switch. The BPP switch provides a signal to the PCM

indicating that the brakes are applied. The BPP switch is normally open and is mounted on the brake pedal support. Depending on the vehicle application the BPP switch can be hardwired as follows:

- to the PCM supplying battery positive voltage (B+) when the vehicle brake pedal is applied.
- to the antilock brake system (ABS) module, or lighting control module (LCM), the BPP signal is then broadcast over the network to be received by the PCM.
- to the ABS traction control/stability assist module. The ABS module interprets the BPP switch input along with other ABS inputs and generates an output called the driver brake application (DBA) signal. The DBA signal is then sent to the PCM and to other BPP signal users.

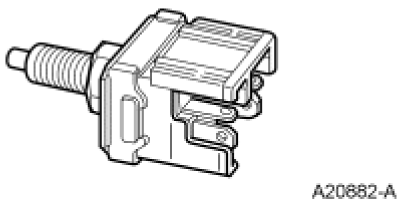


Fig. 11: Typical Brake Pedal Position Switch
Courtesy of FORD MOTOR CO.

BRAKE PEDAL SWITCH (BPS)/BRAKE DEACTIVATOR SWITCH

The BPS, also called the brake deactivator switch, is for vehicle speed control deactivation. A normally closed switch supplies battery positive voltage (B+) to the PCM when the brake pedal is not applied. When the brake pedal is applied, the normally closed switch opens and power is removed from the PCM.

On some applications the normally closed BPS, along with the normally open BPP switch, are used for a brake rationality test within the PCM. The PCM misfire monitor profile learn function may be disabled if a brake switch concern occurs. If one or both brake pedal inputs to the PCM is not changing states when they were expected to, a diagnostic trouble code (DTC) is set by the PCM strategy.

CAMSHAFT POSITION (CMP) SENSOR

The CMP sensor detects the position of the camshaft. The CMP sensor identifies when piston number 1 is on its compression stroke. A signal is then sent to the PCM and used for synchronizing the sequential firing of the fuel injectors. Coil on plug (COP) ignition applications use the CMP signal to select the correct ignition coil to fire.

Vehicles with 2 CMP sensors are equipped with variable camshaft timing (VCT). They use the second sensor to identify the position of the camshaft on bank 2 as an input to the PCM.

There are 2 types of CMP sensors: the 3-pin connector Hall-effect type sensor and the 2-pin connector variable reluctance type sensor.

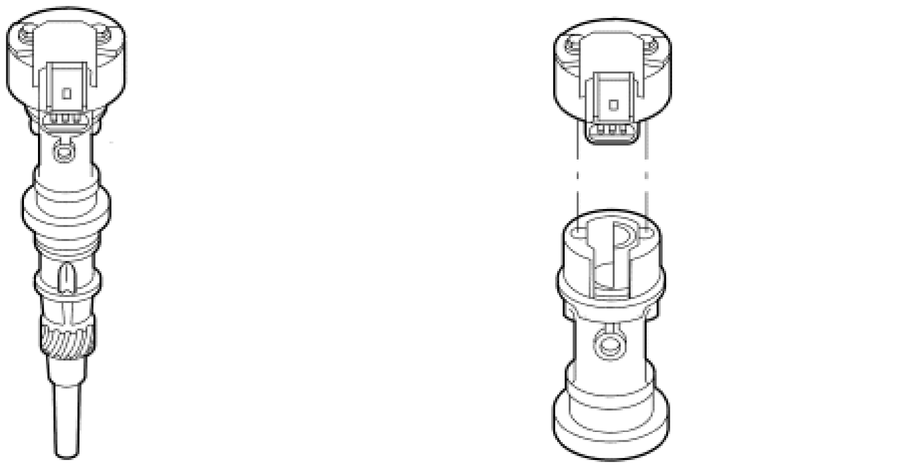


Fig. 12: Typical Synchronizer Hall-Effect CMP Sensor
Courtesy of FORD MOTOR CO.

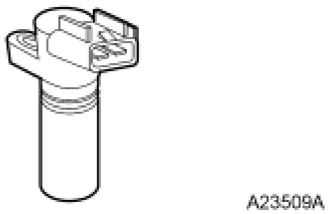


Fig. 13: Identifying Camshaft Position (CMP) Sensor
Courtesy of FORD MOTOR CO.

CANISTER VENT (CV) SOLENOID

During the evaporative emissions (EVAP) leak check monitor, the CV solenoid seals the EVAP canister from the atmospheric pressure. This allows the EVAP canister purge valve to obtain the target vacuum in the fuel tank during the EVAP leak check monitor.

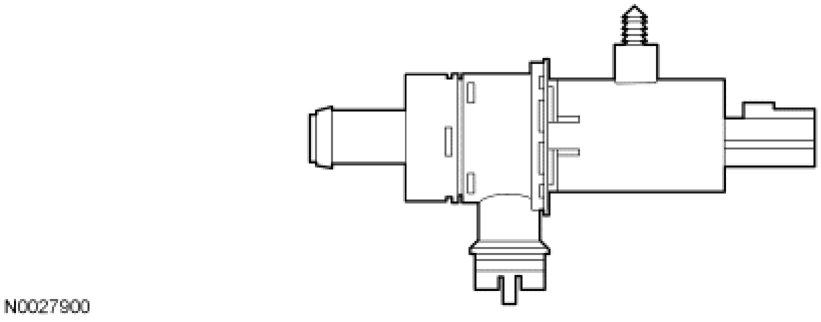


Fig. 14: Typical Canister Vent (CV) Solenoid
Courtesy of FORD MOTOR CO.

CHECK FUEL CAP INDICATOR

The check fuel cap indicator is a communications network message sent by the PCM. The PCM sends the

message to illuminate the lamp when the strategy determines there is a concern in the EVAP system due to the fuel filler cap or capless fuel tank filler pipe not being sealed correctly. This would be detected by the inability to pull vacuum in the fuel tank, after a fueling event.

CLUTCH PEDAL POSITION (CPP) SWITCH

The CPP switch is an input to the PCM indicating the clutch pedal position. The PCM provides a low current voltage on the CPP circuit. When the CPP switch is closed, this voltage is pulled low through the SIG RTN circuit. The CPP input to the PCM is used to detect a reduction in engine load. The PCM uses the load information for mass air flow and fuel calculations.

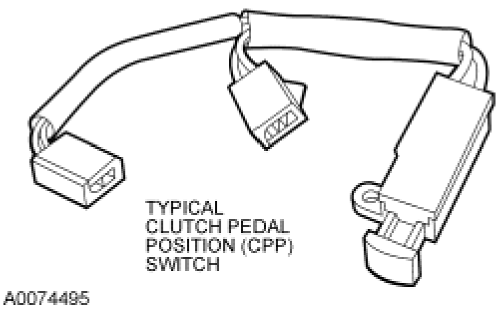


Fig. 15: Typical Clutch Pedal Position (CPP) Switch
Courtesy of FORD MOTOR CO.

COIL ON PLUG (COP)

The COP ignition operates similar to a standard coil pack ignition except each plug has one coil per plug. The COP has 3 different modes of operation: engine crank, engine running, and CMP failure mode effects management (FMEM). For additional information, refer to **IGNITION SYSTEMS**.

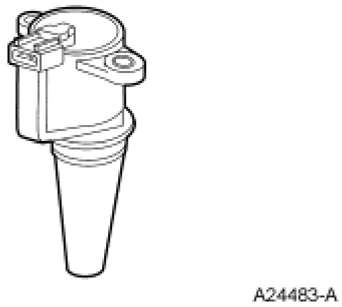


Fig. 16: Typical Coil On Plug (COP)
Courtesy of FORD MOTOR CO.

COIL PACK

The PCM provides a grounding switch for the coil primary circuit. When the switch is closed, voltage is applied to the coil primary circuit. This creates a magnetic field around the primary coil. The PCM opens the switch, causing the magnetic field to collapse, inducing the high voltage in the secondary coil windings and firing the spark plug. The spark plugs are paired so that as one spark plug fires on the compression stroke, the other spark

plug fires on the exhaust stroke. The next time the coil is fired the order is reversed. The next pair of spark plugs fire according to the engine firing order.

Coil packs come in 4-tower, 6-tower horizontal and series 5 6-tower models. Two adjacent coil towers share a common coil and are called a matched pair. For 6-tower coil pack (6 cylinder) applications, the matched pairs are 1 and 5, 2 and 6, and 3 and 4. For 4-tower coil pack (4 cylinder) applications, the matched pairs are 1 and 4, and 2 and 3.

When the coil is fired by the PCM, spark is delivered through the matched pair towers to their respective spark plugs. The spark plugs are fired simultaneously and are paired so that as one fires on the compression stroke, the other spark plug fires on the exhaust stroke. The next time the coil is fired, the situation is reversed. The next pair of spark plugs fire according to the engine firing order.

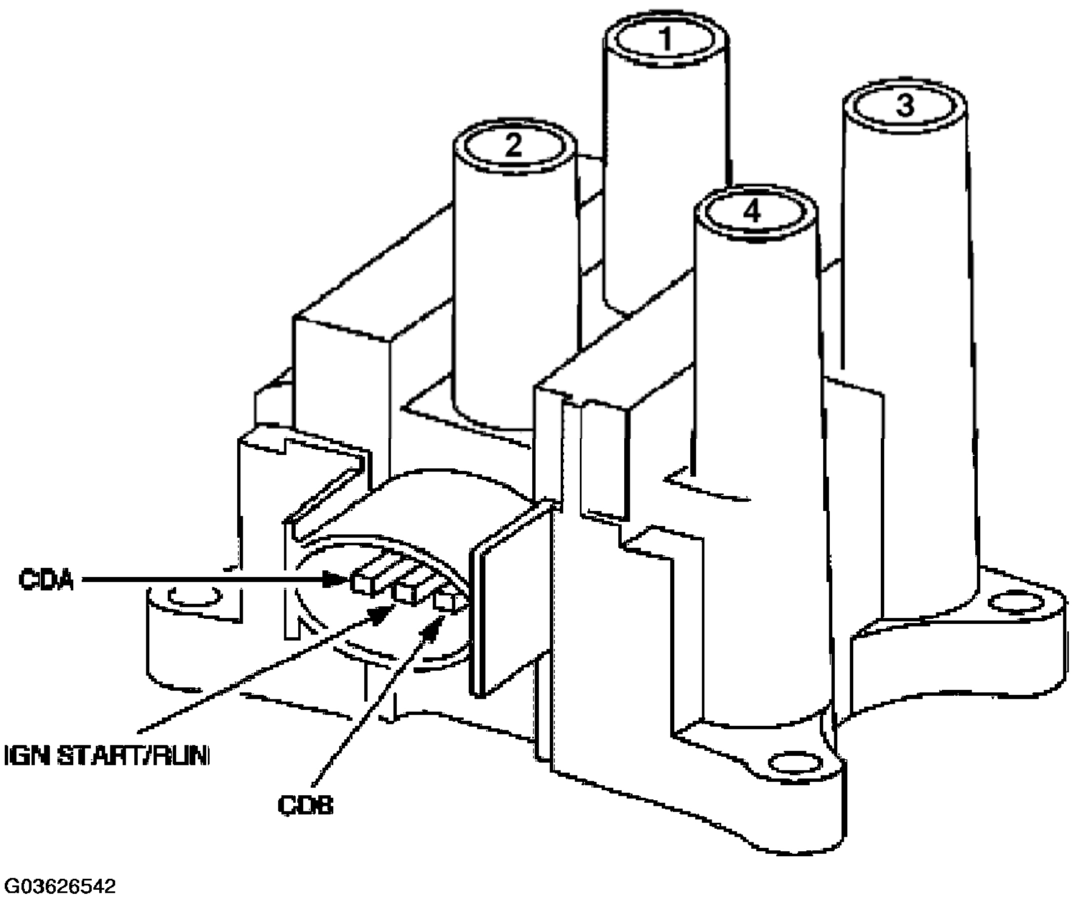


Fig. 17: Typical Four-Tower Coil Pack
Courtesy of FORD MOTOR CO.

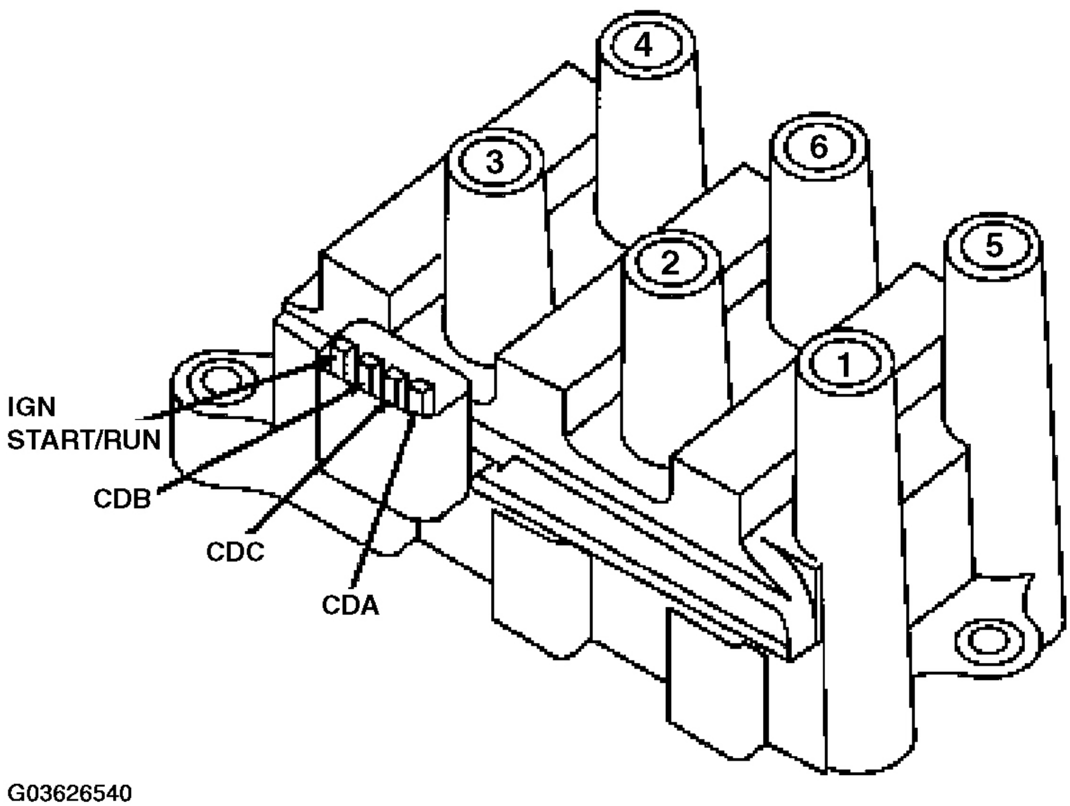


Fig. 18: Typical Six-Tower Coil Pack
Courtesy of FORD MOTOR CO.

COOLING FAN CLUTCH

The cooling fan clutch is an electrically actuated viscous clutch that consists of 3 main elements:

- a working chamber
- a reservoir chamber
- a cooling fan clutch actuator valve and a fan speed sensor (FSS)

The cooling fan clutch actuator valve controls the fluid flow from the reservoir into the working chamber. Once viscous fluid is in the working chamber, shearing of the fluid results in fan rotation. The cooling fan clutch actuator valve is activated with a pulse width modulated (PWM) output signal from the PCM. By opening and closing the fluid port valve, the PCM can control the cooling fan clutch speed. The cooling fan clutch speed is measured by a Hall-effect sensor and is monitored by the PCM during closed loop operation.

The PCM optimizes fan speed based on engine coolant temperature (ECT), engine oil temperature (EOT), transmission fluid temperature (TFT), intake air temperature (IAT), or air conditioning requirements. When an increased demand for fan speed is requested for vehicle cooling, the PCM monitors the fan speed through the Hall-effect sensor. If a fan speed increase is required, the PCM outputs the PWM signal to the fluid port,

providing the required fan speed increase.

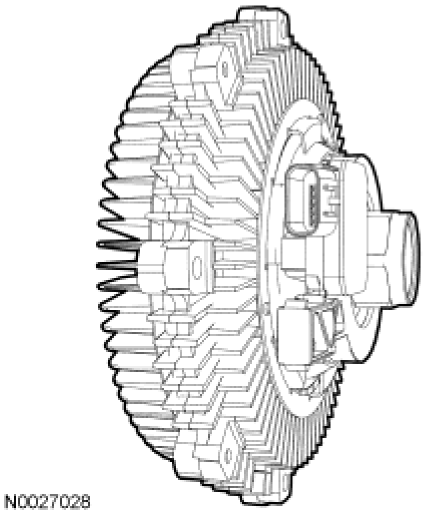


Fig. 19: Identifying Cooling Fan Clutch With Fan Speed Sensor (FSS)
Courtesy of FORD MOTOR CO.

CRANKSHAFT POSITION (CKP) SENSOR

The CKP sensor is a magnetic transducer mounted on the engine block adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel, the CKP is the primary sensor for ignition information to the PCM. The pulse wheel has a total of 35 teeth spaced 10 degrees apart with one empty space for a missing tooth. The 6.8L 10-cylinder pulse wheel has 39 teeth spaced 9 degrees apart and one 9 degree empty space for a missing tooth. By monitoring the pulse wheel, the CKP sensor signal indicates crankshaft position and speed information to the PCM. By monitoring the missing tooth, the CKP sensor is also able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to a fixed reference for the CKP sensor configuration. The PCM also uses the CKP signal to determine if a misfire has occurred by measuring rapid decelerations between teeth.

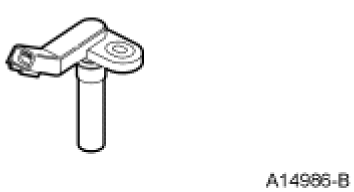


Fig. 20: Typical Crankshaft Position (CKP) Sensor
Courtesy of FORD MOTOR CO.

CYLINDER HEAD TEMPERATURE (CHT) SENSOR

The CHT sensor is a thermistor device in which resistance changes with the temperature. The electrical resistance of a thermistor decreases as temperature increases, and the resistance increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

The CHT sensor is installed in the cylinder head and measures the metal temperature. The CHT sensor can provide complete engine temperature information and can be used to infer coolant temperature. If the CHT sensor conveys an overheating condition to the PCM, the PCM initiates a fail-safe cooling strategy based on information from the CHT sensor. A cooling system concern such as low coolant or coolant loss could cause an overheating condition. As a result, damage to major engine components could occur. Using both the CHT sensor and fail-safe cooling strategy, the PCM prevents damage by allowing air cooling of the engine and limp home capability. For additional information, refer to **POWERTRAIN CONTROL SOFTWARE** for Fail-Safe Cooling Strategy.

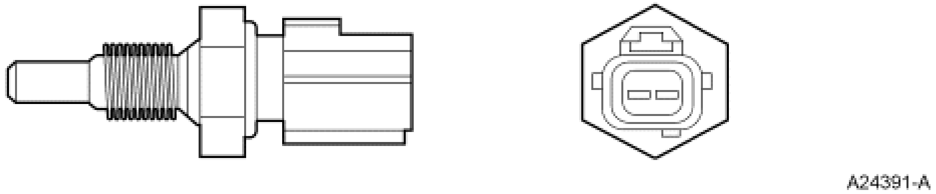
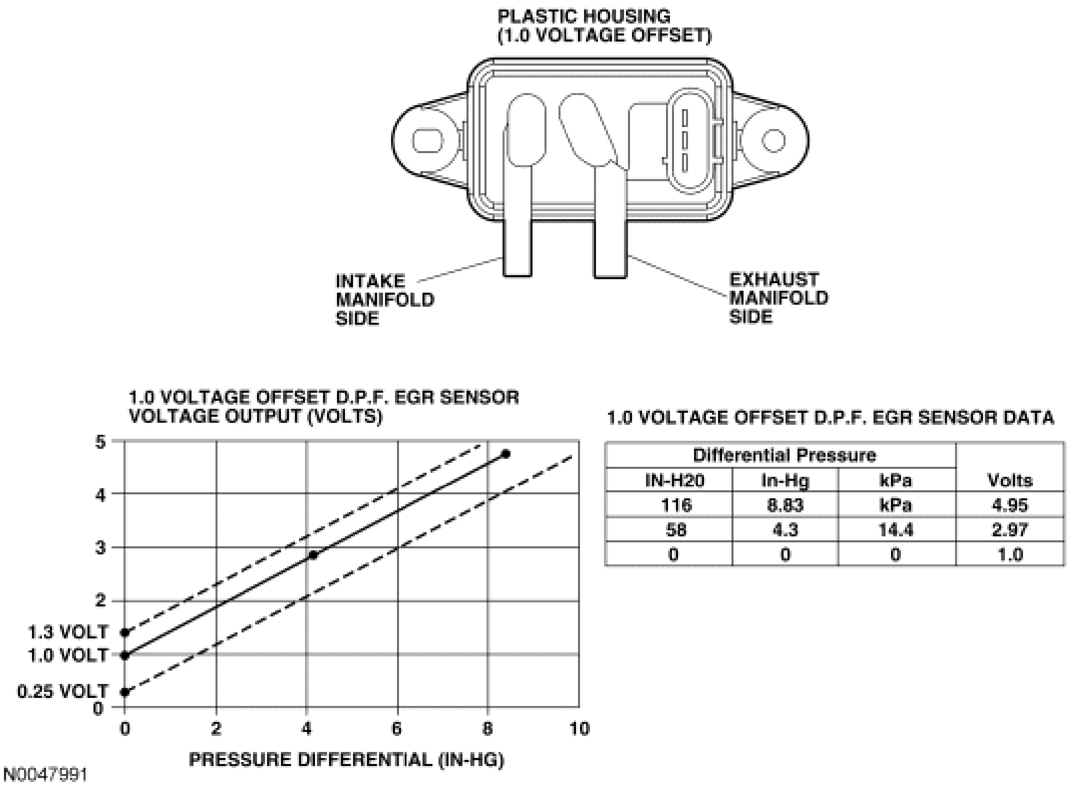


Fig. 21: Typical Cylinder Head Temperature Sensor
Courtesy of FORD MOTOR CO.

DIFFERENTIAL PRESSURE FEEDBACK EXHAUST GAS RECIRCULATION (EGR) SENSOR

The differential pressure feedback EGR sensor is a ceramic, capacitive-type pressure transducer that monitors the differential pressure across a metering orifice located in the orifice tube assembly. The differential pressure feedback EGR sensor receives this signal through 2 hoses referred to as the downstream pressure hose (REF SIGNAL) and upstream pressure hose (HI SIGNAL). The HI and REF hose connections are marked on the differential pressure feedback EGR sensor housing for identification (note that the HI signal uses a larger diameter hose). The differential pressure feedback EGR sensor outputs a voltage proportional to the pressure drop across the metering orifice and supplies it to the PCM as EGR flow rate feedback.



Differential Pressure			Volts
IN-H20	In-Hg	kPa	
116	8.83	kPa	4.95
58	4.3	14.4	2.97
0	0	0	1.0

Fig. 22: Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor
Courtesy of FORD MOTOR CO.

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

The tube mounted differential pressure feedback EGR sensor is identical in operation as the larger plastic differential pressure feedback EGR sensors and uses a 1.0 volt offset. The HI and REF hose connections are marked on the side of the sensor.

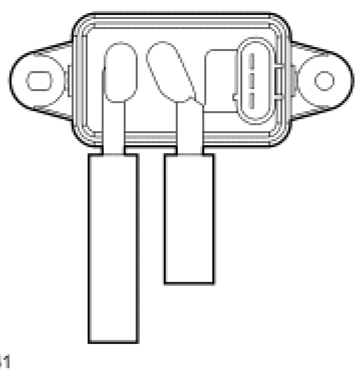


Fig. 23: Identifying DPFE Sensor - Tube Mounted
Courtesy of FORD MOTOR CO.

ELECTRIC EXHAUST GAS RECIRCULATION (EEGR) VALVE

Depending on the application, the EEGR valve is a water cooled or an air cooled motor/valve assembly. The motor is commanded to move in 52 discrete steps as it acts directly on the EEGR valve. The position of the valve determines the rate of EGR. The built-in spring works to close the valve (against the motor opening force).

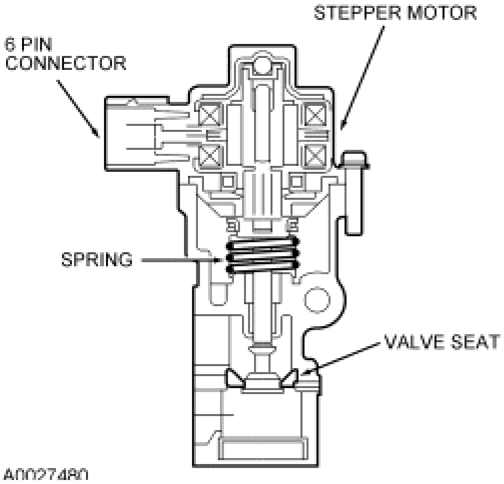


Fig. 24: Identifying EEGR Motor/Valve Assembly
Courtesy of FORD MOTOR CO.

ELECTRONIC THROTTLE ACTUATOR CONTROL (TAC)

The electronic TAC is a DC motor controlled by the PCM (requires 2 wires). There are 2 designs for the TAC, parallel and inline. The parallel design has the motor under the bore parallel to the plate shaft. The motor housing is integrated into the main housing. The inline design has a separate motor housing. An internal spring is used in both designs to return the throttle plate to a default position. The default position is typically a throttle angle of 7 to 8 degrees from the hard stop angle. The closed throttle plate hard stop is used to prevent the throttle from binding in the bore (approximately 0.75 degree). This hard stop setting is not adjustable and is set to result in less airflow than the minimum engine airflow required at idle. For additional information, refer to **TORQUE BASED ELECTRONIC THROTTLE CONTROL (ETC)**.

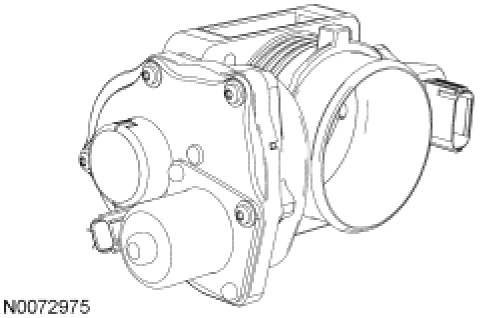


Fig. 25: Typical Inline TAC Design
Courtesy of FORD MOTOR CO.

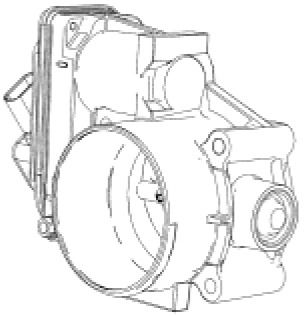


Fig. 26: Typical Parallel TAC Design
Courtesy of FORD MOTOR CO.

ELECTRONIC THROTTLE BODY (ETB) THROTTLE POSITION SENSOR

The ETB throttle position sensor has 2 signal circuits in the sensor for redundancy. The redundant ETB throttle position signals are required for increased monitoring. The first ETB throttle position sensor signal (TP1) has a negative slope (increasing angle, decreasing voltage) and the second signal (TP2) has a positive slope (increasing angle, increasing voltage). The 2 ETB throttle position sensor signals make sure the PCM receives a correct input even if 1 signal has a concern. There is 1 reference voltage circuit and 1 signal return circuit for the sensor. The reference voltage circuit and the signal return circuit is shared with the reference voltage circuits and signal return circuits used by the APP sensor. For additional information, refer to **TORQUE BASED ELECTRONIC THROTTLE CONTROL (ETC)**.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

The ECT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The ECT measures the temperature of the engine coolant. The PCM uses the ECT input for fuel control and for cooling fan control. There are 3 types of ECT sensors, threaded, push-in, and twist-lock. The ECT sensor is located in an engine coolant passage.

Fig. 27: Typical Thread Type ECT Sensor
Courtesy of FORD MOTOR CO.

ENGINE OIL TEMPERATURE (EOT) SENSOR

The EOT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The EOT sensor measures the temperature of the engine oil. The sensor is typically threaded into the engine oil lubrication system. The PCM can use the EOT sensor input to determine the following:

- On variable camshaft timing (VCT) applications the EOT input is used to adjust the VCT control gains and logic for camshaft timing.
- The PCM can use EOT sensor input in conjunction with other PCM inputs to determine oil degradation.
- The PCM can use EOT sensor input to initiate a soft engine shutdown. To prevent engine damage from occurring as a result of high oil temperatures, the PCM has the ability to initiate a soft engine shutdown. Whenever engine RPM exceeds a calibrated level for a certain period of time, the PCM begins reducing power by disabling engine cylinders.

Fig. 28: Typical EOT Sensor
Courtesy of FORD MOTOR CO.

EVAPORATIVE EMISSION (EVAP) CANISTER PURGE VALVE

NOTE:	**The EVAP canister purge valve may also be referred to as a vapor management valve (VMV).**

The EVAP canister purge valve is part of the enhanced EVAP system that is controlled by the PCM. This valve controls the flow of vapors (purging) from the EVAP canister to the intake manifold during various engine operating modes. The EVAP canister purge valve is a normally closed valve. The EVAP canister purge valve controls the flow of vapors by way of a solenoid, eliminating the need for an electronic vacuum regulator and vacuum diaphragm. The PCM outputs a signal between 0 mA and 1,000 mA to control the EVAP canister purge valve.

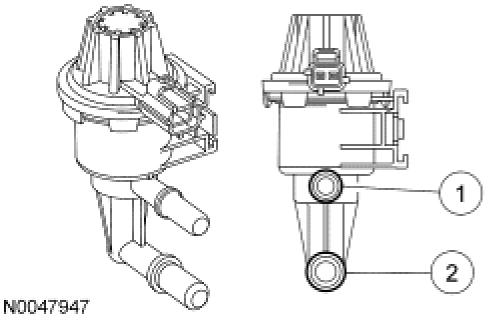


Fig. 29: Typical EVAP Canister Purge Valve
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Fuel Vapor to Intake Manifold
2	-	Fuel Vapor to EVAP Canister

EXHAUST GAS RECIRCULATION (EGR) ORIFICE TUBE ASSEMBLY

The orifice tube assembly is a section of tubing connecting the exhaust system to the intake manifold. The assembly provides the flow path for the EGR to the intake manifold and also contains the metering orifice and 2 pressure pick-up tubes. The internal metering orifice creates a measurable pressure drop across it as the EGR valve opens and closes. This pressure differential across the orifice is picked up by the differential pressure feedback EGR sensor which provides feedback to the PCM.

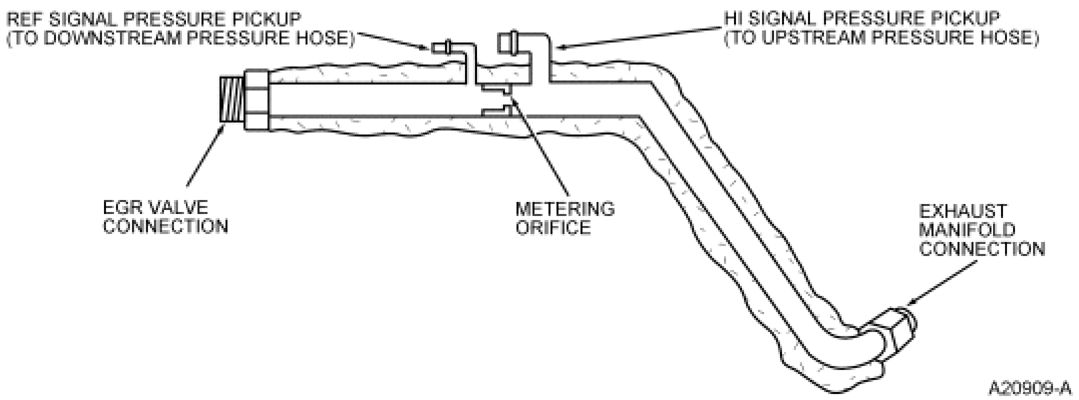


Fig. 30: EGR Orifice Tube Assembly
Courtesy of FORD MOTOR CO.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM MODULE (ESM)

The ESM is an integrated differential pressure feedback EGR system that functions in the same manner as a conventional differential pressure feedback EGR system. The various system components have been integrated into a single component called the ESM. The flange of the valve portion of the ESM bolts directly to the intake manifold with a metal gasket that forms the metering orifice. This arrangement increases system reliability, response time, and system precision. By relocating the EGR orifice from the exhaust to the intake side of the EGR valve, the downstream pressure signal measures manifold absolute pressure (MAP). This MAP signal is used for EGR correction and inferred barometric pressure (BARO) at key on. The system provides the

powertrain control module (PCM) with a differential pressure feedback EGR signal, identical to a traditional differential pressure feedback EGR system.

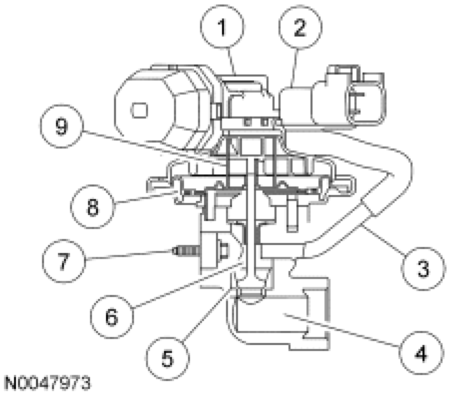


Fig. 31: Exhaust Gas Recirculation System Module
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	EGR Vacuum Regulator Integrated into Upper Body
2	-	Differential Pressure Feedback EGR and MAP Sensor
3	-	Upstream Differential Pressure Feedback EGR Port
4	-	Exhaust Flow
5	-	Valve Seat
6	-	Pin/Pintle
7	-	To Intake Manifold Plenum
8	-	Diaphragm
9	-	EGR Spring

EXHAUST GAS RECIRCULATION (EGR) VACUUM REGULATOR SOLENOID

The EGR vacuum regulator solenoid is an electromagnetic device used to regulate the vacuum supply to the EGR valve. The solenoid contains a coil which magnetically controls the position of a disc to regulate the vacuum. As the duty cycle to the coil increases, the vacuum signal passed through the solenoid to the EGR valve also increases. Vacuum not directed to the EGR valve is vented through the solenoid vent to atmosphere. Note that at 0% duty cycle (no electrical signal applied), the EGR vacuum regulator solenoid allows some vacuum to pass, but not enough to open the EGR valve.

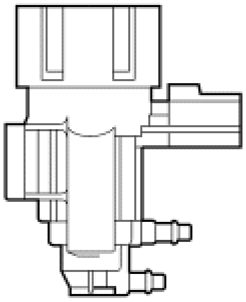


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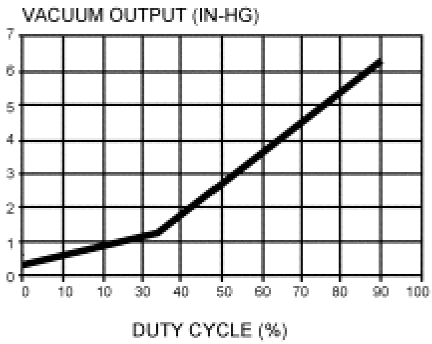
Fig. 32: Identifying EVR Solenoid
Courtesy of FORD MOTOR CO.



A20906-A

Fig. 33: Vacuum Output And Duty Cycle Graph
Courtesy of FORD MOTOR CO.

EGR VACUUM REGULATOR SOLENOID DATA

	Vacuum Output					
	Minimum		Nominal		Maximum	
Duty Cycle (%)	**In-Hg**	**kPa**	**In-Hg**	**kPa**	**In-Hg**	**kPa**
0	0	0	0.38	1.28	0.75	2.53
33	0.55	1.86	1.3	4.39	2.05	6.9
90	5.69	19.2	6.32	21.3	6.95	23.47
EGR vacuum regulator resistance: 26-40 Ohms						

EXHAUST GAS RECIRCULATION (EGR) VALVE

The EGR valve in the differential pressure feedback EGR system is a conventional, vacuum-actuated. The valve increases or decreases the flow of EGR. As vacuum applied to the EGR valve diaphragm overcomes the spring force, the valve begins to open. As the vacuum signal weakens, at 5.4 kPa (1.6 in-Hg) or less, the spring force closes the valve. The EGR valve is fully open at about 15 kPa (4.5 in-Hg).

Since EGR flow requirement varies greatly, providing repair specifications on flow rate is impractical. The on board diagnostic (OBD) system monitors the EGR valve function and triggers a diagnostic trouble code (DTC) if the test criteria is not met. The EGR valve flow rate is not measured directly as part of the diagnostic procedures.

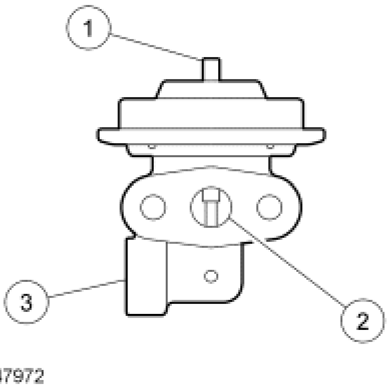


Fig. 34: Typical EGR Valve
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Vacuum Connection from EGR Vacuum Regulator Solenoid
2	-	Intake Manifold Connector
3	-	Orifice Tube Connection

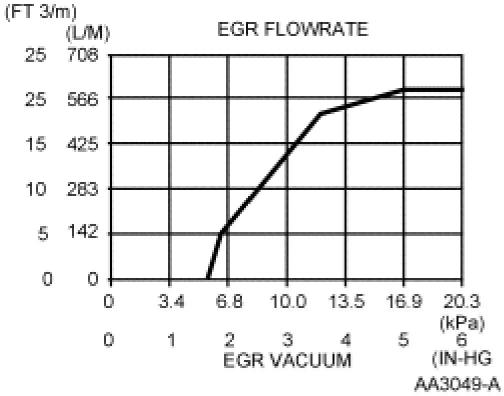


Fig. 35: EGR Flow Rate Graph
Courtesy of FORD MOTOR CO.

FAN CONTROL

The PCM monitors certain parameters (such as engine coolant temperature, vehicle speed, A/C on/off status, A/C pressure) to determine engine cooling fan needs.

For variable speed electric fan(s):

The PCM controls the fan speed and operation using a duty cycle output on the fan control variable (FCV) circuit. The fan controller (located at or integral to the engine cooling fan assembly) receives the FCV command and operates the cooling fan at the speed requested (by varying the power applied to the fan motor).

EDGE/MKX, TAURUS/TAURUS X/SABLE, FUSION/MILAN/MKZ, CROWN VICTORIA/GRAND

MARQUIS, TOWN CAR: FCV DUTY CYCLE OUTPUT FROM PCM (NEGATIVE DUTY CYCLE)

FCV Duty Cycle Command (NEGATIVE (-) duty cycle)	Cooling Fan Response/Speed
Greater than 0 but less than 5%	Fan off, controller inactive
Greater than 5% but less than 10%	Fan off, controller is in active/ready state
Edge/MKX, Crown Victoria/Grand Marquis, Town Car: 10% - 90%	Edge/MKX, Crown Victoria/Grand Marquis, Town Car: Linear speed increase from 30% to 100%
Taurus/Taurus X/Sable, Fusion/Milan/MKZ: 30% - 90%	Taurus/Taurus X/Sable, Fusion/Milan/MKZ: Linear speed increase from 50% to 100%
Greater than 90% but less than 95%	100%
Greater than 95% but less than 100%	Fan off

For relay controlled fans:

The PCM controls the fan operation through the fan control (FC) (single speed fan applications), low fan control (LFC), medium fan control (MFC), and high fan control (HFC) outputs. Some applications will have the xFC circuit wired to 2 separate relays.

For 3-speed fans, although the PCM output circuits are called low, medium, and high fan control (FC), cooling fan speed is controlled by a combination of these outputs. Refer to the following table.

2.0L FOCUS (WITH A/C): PCM FC OUTPUT STATE FOR COOLING FAN SPEEDS

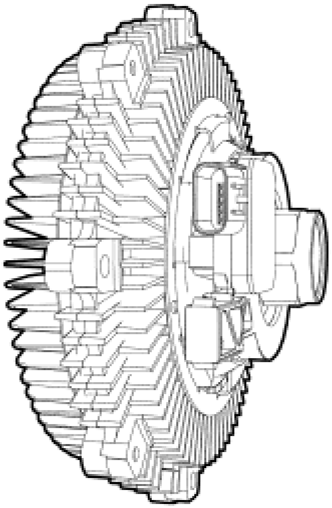
PCM OUTPUT	LOW SPEED	MEDIUM SPEED	HIGH SPEED	FAN OFF
LFC (FC1)	ON	ON	ON	OFF
MFC (FC2)	ON	OFF	ON	OFF
HFC (FC3)	ON	OFF	OFF	OFF

2.3L ESCAPE: PCM FC OUTPUT STATE FOR COOLING FAN SPEEDS

PCM OUTPUT	LOW SPEED	MEDIUM SPEED	HIGH SPEED	FAN OFF
LFC (FC1)	ON	ON	ON	OFF
MFC (FC2)	OFF	ON	OFF (or ON)	OFF
HFC (FC3)	OFF	OFF	ON	OFF

FAN SPEED SENSOR (FSS)

The FSS is a Hall-effect sensor that measures the cooling fan clutch speed by generating a waveform with a frequency proportional to the fan speed. If the cooling fan clutch is moving at a relatively low speed, the sensor produces a signal with a low frequency. As the cooling fan clutch speed increases, the sensor generates a signal with a higher frequency. The PCM uses the frequency signal generated by the FSS as a feedback for closed loop control of the cooling fan clutch. For additional information on the cooling fan clutch, refer to the Cooling Fan Clutch.



N0027028

Fig. 36: Identifying Cooling Fan Clutch With Fan Speed Sensor (FSS)
Courtesy of FORD MOTOR CO.

FUEL INJECTORS

NOTE:	**Do not apply battery positive voltage (B+) directly to the fuel injector electrical connector terminals. The solenoids may be damaged internally in a matter of seconds.**

The fuel injector is a solenoid-operated valve that meters fuel flow to the engine. The fuel injector is opened and closed a constant number of times per crankshaft revolution. The amount of fuel is controlled by the length of time the fuel injector is held open.

The fuel injector is normally closed, and is operated by a 12-volt source from either the electronic engine control (EEC) power relay or fuel pump relay. The ground signal is controlled by the PCM.

The injector is the deposit resistant injector (DRI) type and does not have to be cleaned. However, it can be flow checked and, if found outside of specification, a new fuel injector should be installed.

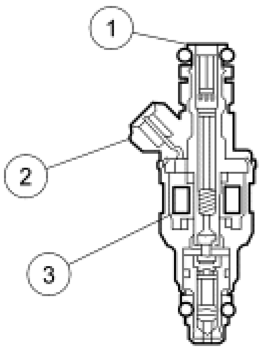


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Fig. 37: Typical Fuel Injector
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Fuel Filter Screen
2	-	Connector
3	-	Solenoid Coil

FUEL LEVEL INPUT (FLI)

The FLI is a communications network message. Most vehicle applications use a potentiometer type FLI sensor connected to a float in the FP module to determine fuel level.

FUEL PUMP (FP) MODULE

The FP module is a device that contains the fuel pump and sender assembly. The fuel pump is located inside the FP module reservoir and supplies fuel through the FP module manifold to the engine and FP module jet pump. The jet pump continuously refills the reservoir with fuel, and a check valve located in the manifold outlet maintains system pressure when the fuel pump is not energized. A flapper valve located in the bottom of the reservoir allows fuel to enter the reservoir and prime the fuel pump during the initial fill.

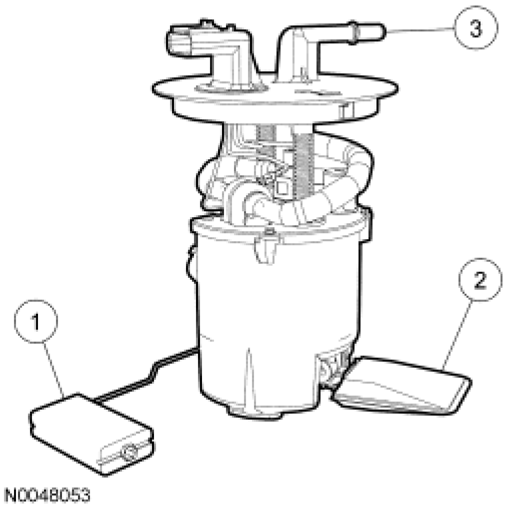

Fig. 38: Typical Electronic Returnless Fuel Pump (FP) Module
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Fuel Level Float
2	-	Fuel Intake Filter
3	-	Fuel Supply

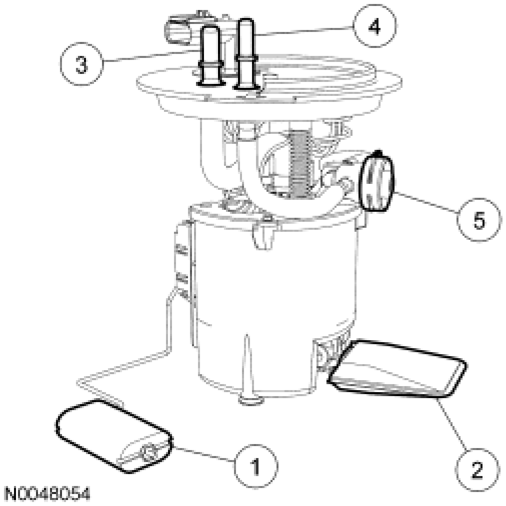

Fig. 39: Typical Mechanical Returnless Fuel Pump (FP) Module
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Fuel Level Float
2	-	Fuel Intake Filter
3	-	Fuel Supply
4	-	Fuel Return from Fuel Filter
5	-	Fuel Pressure Regulator

FUEL PUMP (FP) MODULE AND RESERVOIR

The FP module is mounted inside the fuel tank in a reservoir. The pump has a discharge check valve that maintains the system pressure after the key has been turned off to minimize starting concerns. The reservoir prevents fuel flow interruptions during extreme vehicle maneuvers with low tank fill levels.

FUEL RAIL PRESSURE TEMPERATURE (FRPT) SENSOR

The FRPT sensor measures the pressure and temperature of the fuel in the fuel rail and sends these signals to the PCM. The sensor uses the intake manifold vacuum as a reference to determine the pressure difference between the fuel rail and the intake manifold. The relationship between fuel pressure and fuel temperature is used to determine the possible presence of fuel vapor in the fuel rail.

The temperature sensing portion of the FRPT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of the thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Both the pressure and temperature signals are used to control the speed of the fuel pump. The speed of the fuel pump sustains fuel rail pressure which preserves fuel in its liquid state. The dynamic range of the fuel injectors increase because of the higher rail pressure, which allows the injector pulse width to decrease.

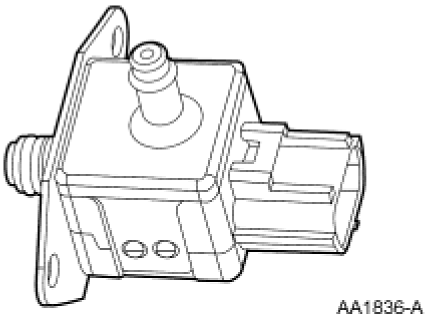

Fig. 40: Typical Fuel Rail Pressure Temperature (FRPT) Sensor
Courtesy of FORD MOTOR CO.

FUEL RAIL PULSE DAMPER

The fuel rail pulse damper is located on the fuel rail and reduces the fuel system noise caused by the pulsing of the fuel injectors. The vacuum port located on the damper is connected to manifold vacuum to avoid fuel spillage if the pulse damper diaphragm ruptures. The fuel rail pulse damper should not be confused with a fuel pressure regulator; it does not regulate the fuel rail pressure.

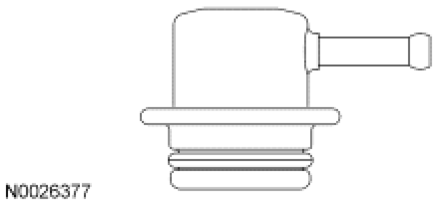

Fig. 41: Typical Fuel Rail Pulse Damper
Courtesy of FORD MOTOR CO.

FUEL TANK PRESSURE (FTP) SENSOR

The FTP sensor or inline FTP sensor is used to measure the fuel tank pressure.

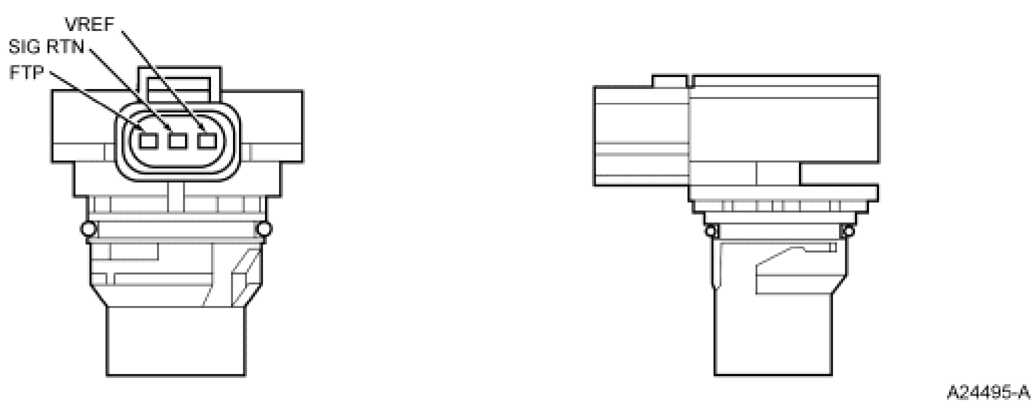

Fig. 42: Fuel Tank Pressure (FTP) Sensor
Courtesy of FORD MOTOR CO.

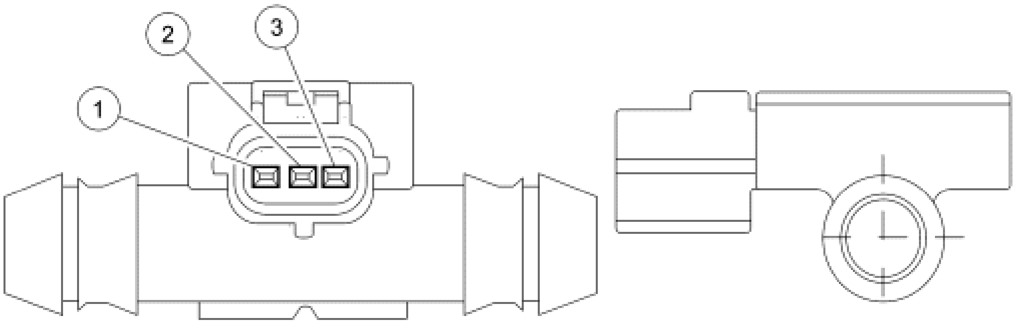

Fig. 43: In-Line Fuel Tank Pressure (FTP) Sensor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	VREF
2	-	SIG RTN
3	-	FTP

HEATED OXYGEN SENSOR (HO2S)

The HO2S detects the presence of oxygen in the exhaust and produces a variable voltage according to the amount of oxygen detected. A high concentration of oxygen (lean air/fuel ratio) in the exhaust produces a voltage signal less than 0.4 volt. A low concentration of oxygen (rich air/fuel ratio) produces a voltage signal greater than 0.6 volt. The HO2S provides feedback to the PCM indicating air/fuel ratio in order to achieve a near stoichiometric air/fuel ratio of 14.7:1 during closed loop engine operation. The HO2S generates a voltage between 0.0 and 1.1 volts.

Embedded with the sensing element is the HO2S heater. The heating element heats the sensor to a temperature of 800°C (1,472°F). At approximately 300°C (572°F) the engine can enter closed loop operation. The VPWR circuit supplies voltage to the heater. The PCM turns the heater on by providing the ground when the correct conditions occur. The heater allows the engine to enter closed loop operation sooner. The use of this heater requires the HO2S heater control to be duty cycled, to prevent damage to the heater.

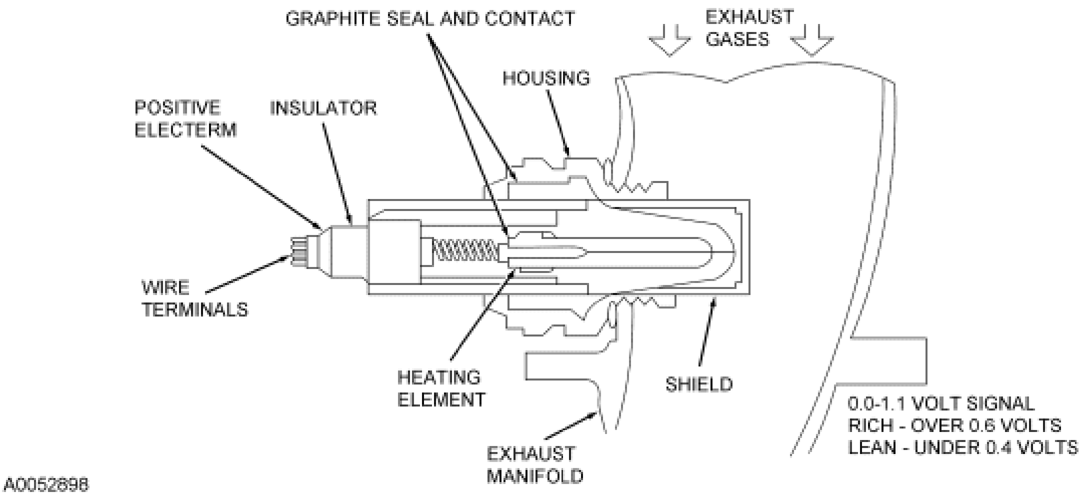

Fig. 44: Identifying Typical Heated Oxygen Sensor (HO2S)
Courtesy of FORD MOTOR CO.

IDLE AIR CONTROL (IAC) VALVE

NOTE: **The IAC valve assembly is not adjustable and cannot be cleaned, also some IAC valves are normally open and others are normally closed. Some IAC valves require engine vacuum to operate.**

The IAC valve assembly controls the engine idle speed and provides a dashpot function. The IAC valve assembly meters intake air around the throttle plate through a bypass within the IAC valve assembly and throttle body. The PCM determines the desired idle speed or bypass air and signals the IAC valve assembly through a specified duty cycle. The IAC valve responds by positioning the IAC valve to control the amount of bypassed air. The PCM monitors engine RPM and increases or decreases the IAC duty cycle in order to achieve the desired RPM.

The PCM uses the IAC valve assembly to control:

- no touch start
- cold engine fast idle for rapid warm-up
- idle (corrects for engine load)
- stumble or stalling on deceleration (provides a dashpot function)
- over-temperature idle boost

INERTIA FUEL SHUTOFF (IFS) SWITCH

The IFS switch is used in conjunction with the electric fuel pump. The purpose of the IFS switch is to shutoff the fuel pump if a collision occurs. It consists of a steel ball held in place by a magnet. When a sharp impact occurs, the ball breaks loose from the magnet, rolls up a conical ramp and strikes a target plate which opens the electrical contacts of the switch and shuts off the electric fuel pump. Once the switch is open, it must be manually reset before restarting the vehicle. Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.

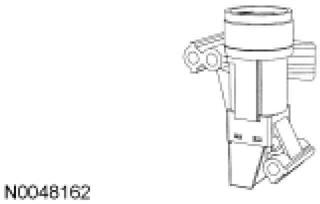

Fig. 45: Typical Inertia Fuel Shutoff (IFS) Switch
Courtesy of FORD MOTOR CO.

INTAKE AIR TEMPERATURE (IAT) SENSOR

The IAT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The IAT provides air temperature information to the PCM. The PCM uses the air temperature information as a correction factor in the calculation of fuel, spark, and air flow.

The IAT sensor provides a quicker temperature change response time than the ECT or CHT sensor.

Currently there are 2 design types of IAT sensors used, a stand-alone/non-integrated type and a integrated type. Both types function the same, however the integrated type is incorporated into the mass air flow (MAF) sensor instead of being a stand alone sensor.

Supercharged vehicles use 2 IAT sensors. Both sensors are thermistor type devices and operate as described above. One is located before the supercharger at the air cleaner for standard OBD/cold weather input, while a second sensor (IAT2) is located after the supercharger in the intake manifold. The IAT2 sensor located after the supercharger provides air temperature information to the PCM to control spark and to help determine charge air cooler (CAC) efficiency.

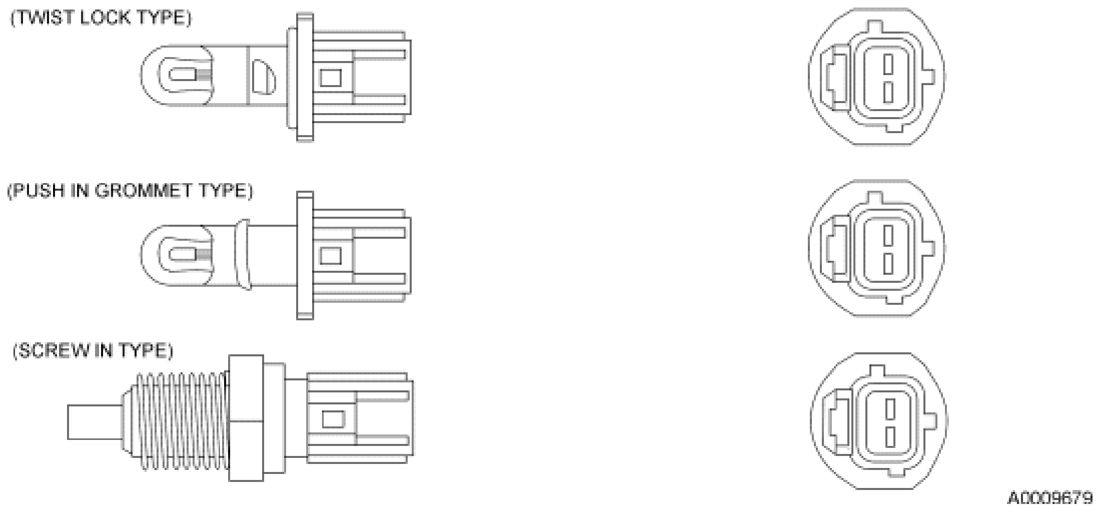

Fig. 46: Typical Stand-Alone/Non-Integrated Intake Air Temperature (IAT) Sensors
Courtesy of FORD MOTOR CO.

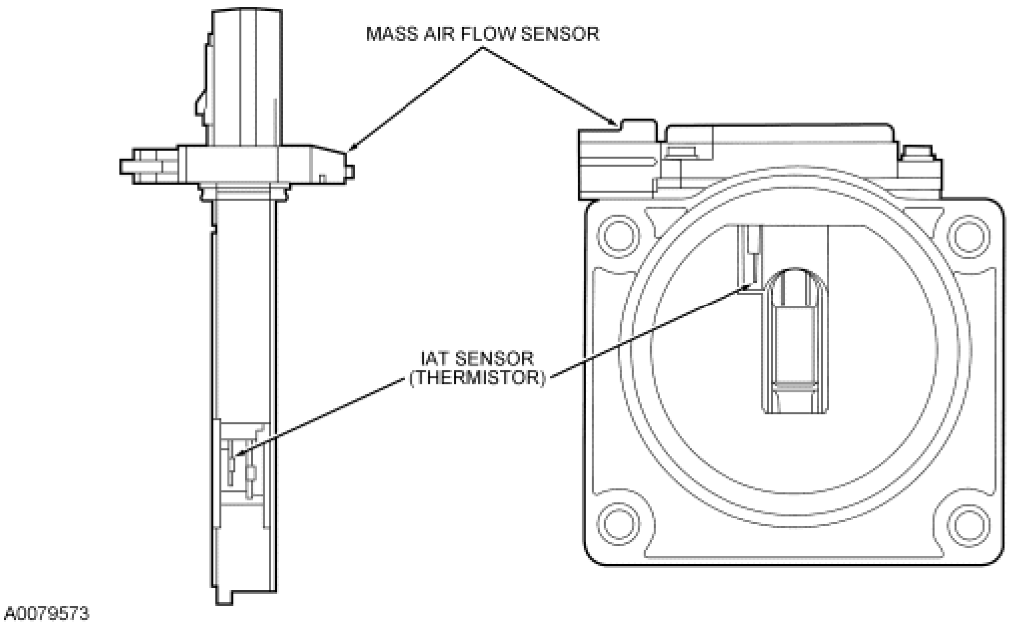

Fig. 47: Identifying Integrated Intake Air Temperature (IAT) Sensor Incorporated Into MAF Sensor
Courtesy of FORD MOTOR CO.

INTAKE MANIFOLD TUNING VALVE (IMTV)

WARNING: **Substantial opening and closing torque is applied by this system. To prevent injury, be careful to keep fingers away from lever mechanisms when actuated.**

The IMTV is a motorized actuated unit mounted directly to the intake manifold. The IMTV actuator controls a shutter device attached to the actuator shaft. There is no monitor input to the PCM with this system to indicate shutter position.

The motorized IMTV unit is not energized below approximately 2,600 RPM. The shutter is in the closed position not allowing airflow blend to occur in the intake manifold. The motorized unit is energized above approximately 2,600 RPM. The motorized unit is commanded on by the PCM initially at a 100 percent duty cycle to move the shutter to the open position, and then falling to approximately 50 percent to continue to hold the shutter open.

KNOCK SENSOR (KS)

The KS is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The PCM uses this signal to determine the presence of engine knock and to retard spark timing.

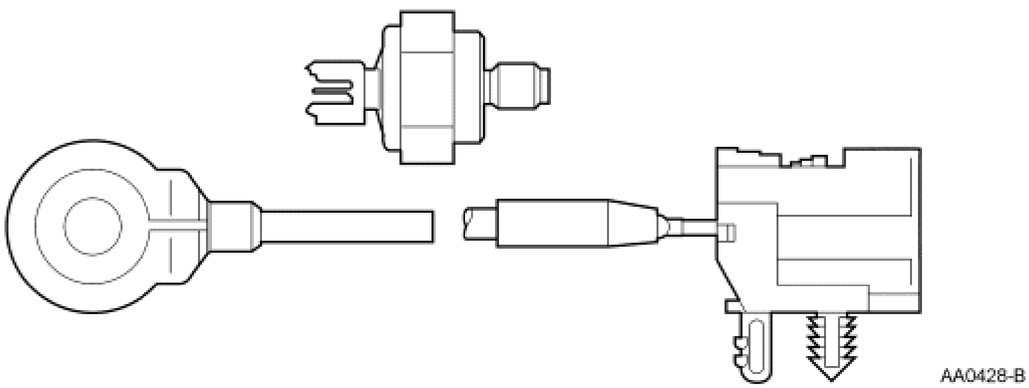

Fig. 48: Two Types of Knock Sensor (KS)
Courtesy of FORD MOTOR CO.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

The MAP sensor measures intake manifold absolute pressure. The PCM uses information from the MAP sensor to measure how much exhaust gas is introduced into the intake manifold.

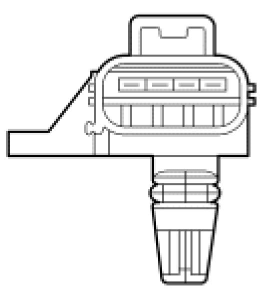

Fig. 49: Typical Manifold Absolute Pressure (MAP) Sensor
Courtesy of FORD MOTOR CO.

MASS AIR FLOW (MAF) SENSOR

The MAF sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above the ambient temperature as measured by a constant cold wire. The current required to maintain the temperature of the hot wire is

proportional to the mass air flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio. This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly. Most MAF sensors have integrated bypass technology with an integrated intake air temperature (IAT) sensor. The hot wire electronic sensing element must be replaced as an assembly. Replacing only the element may change the air flow calibration.

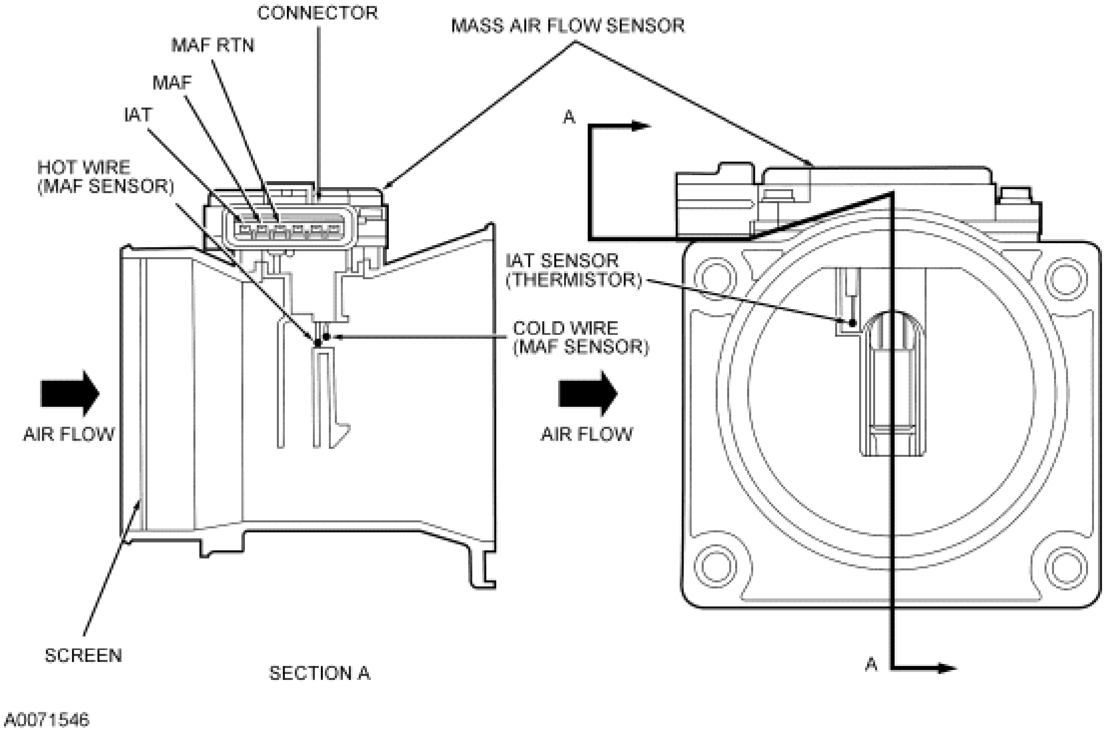

Fig. 50: Cutaway View Of MAF Sensor
Courtesy of FORD MOTOR CO.

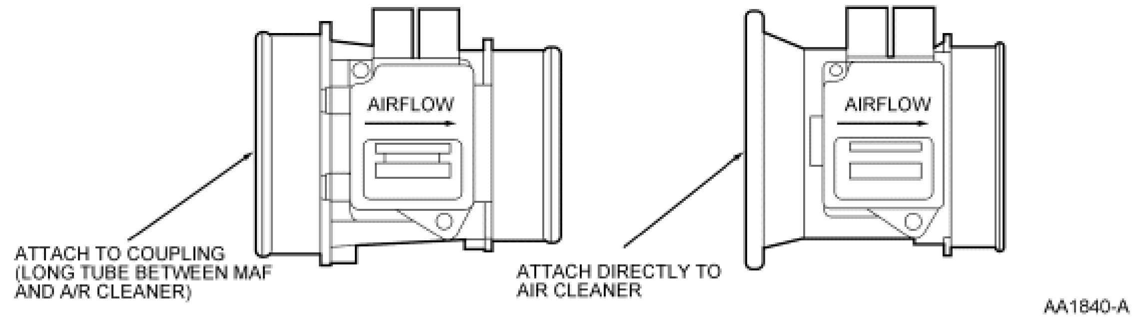

Fig. 51: Typical Mass Air Flow (MAF) Sensor
Courtesy of FORD MOTOR CO.

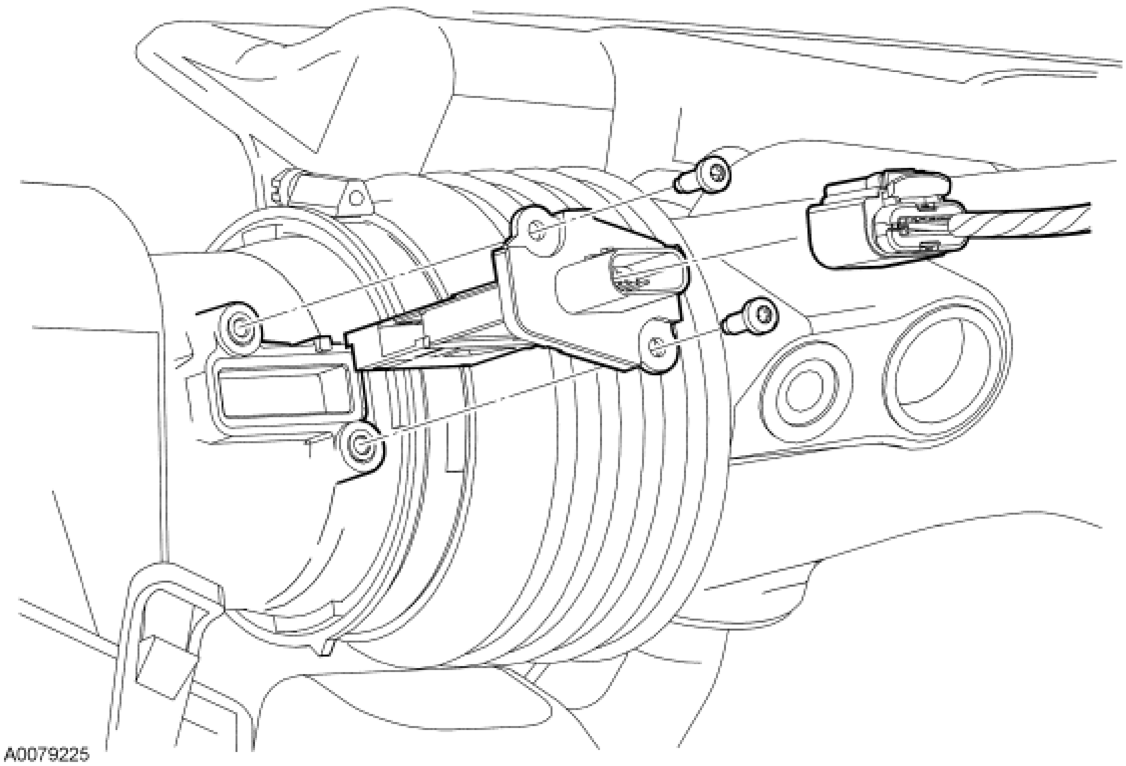

Fig. 52: Identifying Typical Drop-in Mass Air Flow (MAF) Sensor
Courtesy of FORD MOTOR CO.

OUTPUT SHAFT SPEED (OSS) SENSOR

The OSS sensor provides the PCM with information about the rotational speed of an output shaft. The PCM uses the information to control and diagnose powertrain behavior. In some applications, the sensor is also used as the source of vehicle speed. The sensor may be physically located in different places on the vehicle, depending upon the specific application. The design of each speed sensor is unique and depends on which powertrain control feature uses the information that is generated.

POWER STEERING PRESSURE (PSP) SENSOR

The PSP sensor monitors the hydraulic pressure within the power steering system. The PSP sensor voltage input to the PCM changes as the hydraulic pressure changes. The PCM uses the input signal from the PSP sensor to compensate for additional loads on the engine by adjusting the idle RPM and preventing engine stall during parking maneuvers. Also, the PSP sensor signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example, during parking maneuvers.

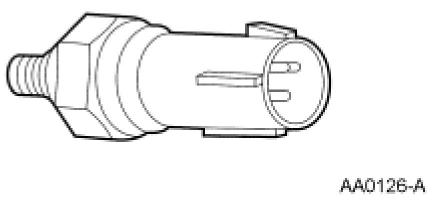

Fig. 53: Typical Power Steering Pressure (PSP) Sensor
Courtesy of FORD MOTOR CO.

POWER STEERING PRESSURE (PSP) SWITCH

The PSP switch monitors the hydraulic pressure within the power steering system. The PSP switch is a normally closed switch that opens as the hydraulic pressure increases. The PCM provides a low current voltage on the PSP circuit. When the PSP switch is closed, this voltage is pulled low through the SIG RTN circuit. The PCM uses the input signal from the PSP switch to compensate for additional loads on the engine by adjusting the idle RPM and preventing engine stall during parking maneuvers. Also, the PSP switch signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example during parking maneuvers.

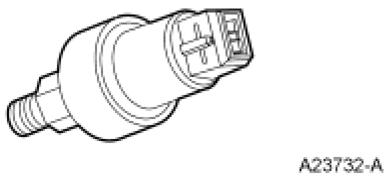

Fig. 54: Typical Power Steering Pressure (PSP) Switch
Courtesy of FORD MOTOR CO.

POWER TAKE-OFF (PTO) SWITCH AND CIRCUITS

The PTO circuit is used by the PCM to disable some of the on board diagnostics (OBD) monitors during PTO operation. The PTO switch is normally open. When the PTO unit is activated, the PTO switch is closed and battery voltage is supplied to the PTO input circuit. This indicates to the PCM that an additional load is being applied to the engine. The PTO indicator lamp illuminates when the PTO system is functioning correctly and flashes when the PTO system is damaged.

When the PTO unit is activated, the PCM disables some OBD monitors, which may not function reliably during PTO operation. Without the PTO circuit information to the PCM, false DTCs may be set during PTO operation. Prior to an Inspection/Maintenance test, operate the vehicle with the PTO disengaged long enough to successfully complete the OBD Monitors.

PTO Circuits Description - The 3 PTO input circuits are PTO mode, PTO engage, and PTO RPM.

The PTO engage circuit is used when the operator is requesting the PCM to check the needed inputs required to initiate the PTO engagement.

The PTO RPM circuit is used for the operator to request additional engine RPM for PTO operation.

POWERTRAIN CONTROL MODULE - VEHICLE SPEED OUTPUT (PCM-VSO)

The PCM-VSO speed signal subsystem generates vehicle speed information for distribution to the vehicle's electrical/electronic modules and subsystems that require vehicle speed data. This subsystem senses the transmission output shaft speed with a sensor. The data is processed by the PCM and distributed as a hardwired signal or as a message on the vehicle communication network.

The key features of the PCM-VSO system are to:

- infer vehicle movement from the output shaft speed (OSS) sensor signal.
- convert transmission output shaft rotational information to vehicle speed information.
- compensate for tire size and axle ratio with a programmed calibration variable.
- use a transfer case speed sensor (TCSS) for four wheel drive (4WD) applications.
- distribute vehicle speed information as a multiplexed message and/or an analog signal.

The signal from a non-contact shaft sensor OSS or TCSS mounted on the transmission (automatic, manual, or 4WD transfer case) is sensed directly by the PCM. The PCM converts the OSS or TCSS information to 8,000 pulses per mile, based on a tire and axle ratio conversion factor. This conversion factor is programmed into the PCM at the time the vehicle is assembled and can be reprogrammed in the field for servicing changes in the tire size and axle ratio. The PCM transmits the computed vehicle speed and distance traveled information to all the vehicle speed signal users on the vehicle. VSO information can be transmitted by a hardwired interface between the vehicle speed signal user and the PCM, or by a speed and odometer data message through the vehicle communication network data link.

The PCM-VSO hardwired signal wave form is a DC square wave with a voltage level of 0 to VBAT. Typical output operating range is 1.3808 Hz per 1 km/h (2.22 Hz per mph).

SECONDARY AIR INJECTION (AIR) BYPASS SOLENOID

The secondary AIR bypass solenoid is used by the PCM to control vacuum to the secondary air injection diverter (AIR diverter) valve. The secondary AIR bypass solenoid is a normally closed solenoid. The secondary AIR bypass solenoid also has a filtered vent feature to permit vacuum release.

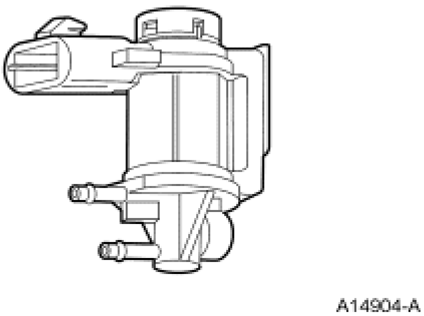

Fig. 55: Secondary AIR Bypass Solenoid
Courtesy of FORD MOTOR CO.

SECONDARY AIR DIVERTER VALVE

The secondary AIR diverter valve is used with the secondary AIR pump to provide on/off control of air to the exhaust manifold and catalytic converter. When the secondary AIR pump is on and vacuum is supplied to the AIR diverter valve, air passes the integral check valve disk. When the secondary AIR pump is off, and vacuum is removed from the AIR diverter valve, the integral check valve disk is held on the seat and stops air from being drawn into the exhaust system and prevents the back flow of the exhaust into the secondary AIR system.

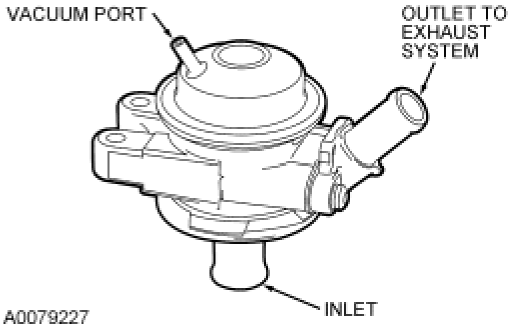

Fig. 56: Air Injection Diverter (AIR Diverter) Valve
Courtesy of FORD MOTOR CO.

SECONDARY AIR PUMP

The secondary AIR pump provides pressurized air to the secondary AIR system. The secondary AIR pump functions independently of RPM and is controlled by the PCM. The secondary AIR pump is only used for short periods of time. Delivery of air is dependent on the amount of system backpressure and system voltage. The secondary AIR pump draws dry filtered air from the intake air system downstream of the MAF/IAT sensor. For additional information on the secondary AIR injection system, refer to **SECONDARY AIR INJECTION (AIR) SYSTEM**.

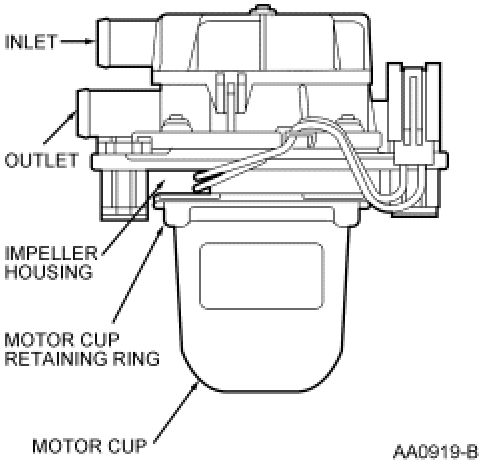

Fig. 57: Secondary Air Pump
Courtesy of FORD MOTOR CO.

STARTER MOTOR REQUEST (SMR) CIRCUIT

The SMR circuit provides the PCM with a signal from the ignition switch to the PCM. The input is pulled high when the key is in the START position and the transmission range sensor ignition lockout circuit allows the starter to engage.

THROTTLE POSITION (TP) SENSOR

The TP sensor is a rotary potentiometer sensor that provides a signal to the PCM that is linearly proportional to

the throttle plate/shaft position. The sensor housing has a 3-blade electrical connector that may be gold plated. The gold plating increases the corrosion resistance on the terminals and increases the connector durability. The TP sensor is mounted on the throttle body. As the TP sensor is rotated by the throttle shaft, 4 operating conditions are determined by the PCM from the TP. The operating conditions are:

- closed throttle (includes idle or deceleration)
- part throttle (includes cruise or moderate acceleration)
- wide open throttle (includes maximum acceleration or de-choke on crank)
- throttle angle rate

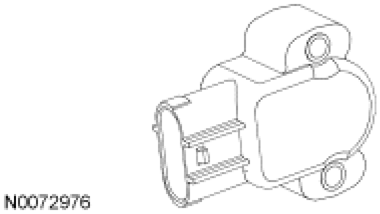

Fig. 58: Typical TP Sensor
Courtesy of FORD MOTOR CO.

TRANSMISSION CONTROL INDICATOR LAMP (TCIL)

The TCIL is an output signal from the PCM that controls the lamp on/off function depending on the engagement or disengagement of overdrive.

TRANSMISSION CONTROL SWITCH (TCS)

The TCS signals the PCM with VPWR whenever the TCS is pressed. On vehicles with this feature, the transmission control indicator lamp (TCIL) illuminates when the TCS is cycled to disengage overdrive.

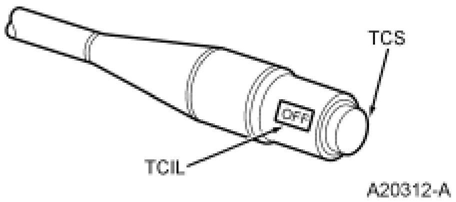

Fig. 59: Typical Transmission Control Switch (TCS)
Courtesy of FORD MOTOR CO.

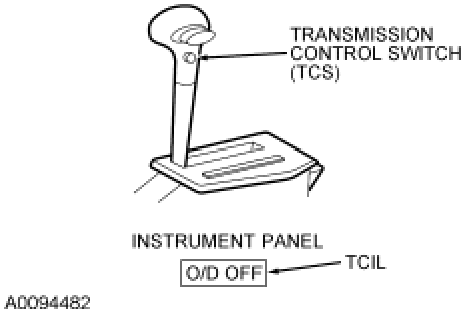

Fig. 60: Typical Transmission Control Switch (TCS)
Courtesy of FORD MOTOR CO.

UNIVERSAL HO2S

The universal HO2S, sometimes referred to as a wide band oxygen sensor, uses the typical HO2S combined with a current controller in the PCM to infer an air/fuel ratio relative to the stoichiometric air/fuel ratio. This is accomplished by balancing the amount of oxygen ions pumped in or out of a measurement chamber within the sensor. The typical HO2S within the universal HO2S is used to detect the oxygen content of the exhaust gas in the measurement chamber. The oxygen content inside the measurement chamber is maintained at the stoichiometric air/fuel ratio by pumping oxygen ions in and out of the measurement chamber. As the exhaust gasses get richer or leaner, the amount of oxygen that must be pumped in or out to maintain a stoichiometric air/fuel ratio in the measurement chamber varies in proportion to the air/fuel ratio. The amount of current required to pump the oxygen ions in or out of the measurement chamber is used to measure the air/fuel ratio. The measured air/fuel ratio is actually the output from the current controller in the PCM and not a signal that comes directly from the sensor.

The universal HO2S also uses a self-contained reference chamber to make sure an oxygen differential is always present. The oxygen for the reference chamber is supplied by pumping small amounts of oxygen ions from the measurement chamber into the reference chamber. The universal HO2S does not need access to outside air.

Part to part variance is compensated for by placing a resistor in the connector. This resistor is used to trim the current measured by the current controller in the PCM.

Embedded with the sensing element is the universal HO2S heater. The heater allows the engine to enter closed loop operation sooner. The heating element heats the sensor to a temperature of 780°C (1,436°F). The VPWR circuit supplies voltage to the heater. The PCM controls the heater on and off by providing the ground to maintain the sensor at the correct temperature for maximum accuracy.

VEHICLE SPEED SENSOR (VSS)

The VSS is a variable reluctance or Hall-effect sensor that generates a waveform with a frequency that is proportional to the speed of the vehicle. If the vehicle is moving at a relatively low velocity, the sensor produces a signal with a low frequency. As the vehicle velocity increases, the sensor generates a signal with a higher frequency. The PCM uses the frequency signal generated by the VSS (and other inputs) to control such parameters as fuel injection, ignition control, transmission/transaxle shift scheduling, and torque converter clutch scheduling.

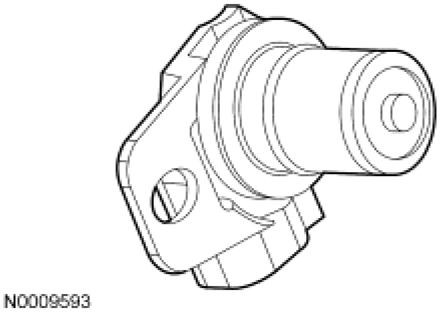

Fig. 61: Typical Vehicle Speed Sensor (VSS)

ELECTRONIC ENGINE CONTROL (EEC) SYSTEM

OVERVIEW

The EEC system provides optimum control of the engine and transmission through the enhanced capability of the powertrain control module (PCM). The EEC system also has an on board diagnostics (OBD) monitoring system with features and functions to meet federal regulations on exhaust emissions.

Some vehicle applications use a stand-alone transmission control module (TCM). Even though it is still part of the EEC system, the TCM communicates with the PCM, the antilock brake system (ABS) module, the instrument cluster, and the four-wheel drive (4WD) control modules using the high speed controller area network (CAN) communications network. The TCM incorporates a stand alone OBD-II system. The TCM independently processes and stores diagnostic trouble codes (DTCs), freeze frame, support PIDs as well as J1979 Mode 09 CALID and calibration verification number. The TCM does not directly illuminate the malfunction indicator lamp (MIL), but requests the PCM to do so. The TCM is located inside the transmission assembly. It is not repairable, with the exception of reprogramming.

Below is a list of transmissions that use a TCM:

- AWF21 (FWD) 6-speed automatic transmission
- FNR5 (FWD) transmission
- F21 (FWD) transmission
- ZF CFT30 (FWD) continuously variable transmission (CVT)
- ZF 6HP26 (RWD) transmission
- ZF 6R (RWD)
- 6R60 (RWD)

For additional information on these transmissions and TCM diagnostics, refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .

The EEC system has 2 major divisions: hardware and software. The hardware includes the PCM, sensors, switches, actuators, solenoids, and interconnecting terminals. The software in the PCM provides the strategy control for outputs (engine hardware) based on the values of the inputs to the PCM. The EEC hardware and software are discussed.

This part contains detailed descriptions of the operation of the EEC system input sensors and switches, output actuators, solenoids, relays and connector pins (including other power-ground signals). For additional information on the input sensors and output actuators, refer to **ENGINE CONTROL COMPONENTS**.

The PCM receives information from a variety of sensor and switch inputs. Based on the strategy and calibration stored within the memory chip, the PCM generates the appropriate output. The system is designed to minimize emissions and optimize fuel economy and driveability. The software strategy controls the basic operation of the engine and transmission, provides the OBD strategy, controls the MIL, communicates to the scan tool via the data link connector (DLC), allows for flash electrically erasable programmable read only memory (EEPROM),

provides idle air and fuel trim, and controls failure mode effects management (FMEM).

MODIFICATIONS TO OBD VEHICLES

Modifications or additions to the vehicle may cause incorrect operation of the OBD system. Install anti-theft systems, remote starters, cellular telephones and aftermarket radios carefully. **Do not install these devices by tapping into or running wires close to the powertrain control system wires or components.**

POWERTRAIN CONTROL HARDWARE

POWERTRAIN CONTROL MODULE (PCM)

The center of the electronic engine control (EEC) system is a microprocessor called the PCM. The PCM receives input from sensors and other electronic components (switches, relays). Based on the information received and programmed into its memory, the PCM generates output signals to control various relays, solenoids and actuators. There are several different types of PCMs in use for this model year. Refer to the Vehicle PCM Application Table below for PCM types and their applications.

VEHICLE PCM APPLICATION TABLE

PCM Type	Applications
140-Pin	Expedition, Fusion, Milan, MKZ, Navigator
150-Pin	Escape, Mariner
170-Pin	Crown Victoria, E-Series, Explorer, Explorer Sport Trac, F-Super Duty, Grand Marquis, Mountaineer, Mustang, Ranger, Town Car
190-Pin	Edge, F-Series, Focus, Mark LT, MKX, Sable, Taurus, Taurus X

PCM LOCATIONS

For PCM removal and installation procedures, refer to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** .

- Focus - engine compartment, driver side, front of battery.
- Taurus, Taurus X, Sable - engine compartment, passenger side, mounted to the cowl.
- Fusion, Milan, MKZ - engine compartment, driver side, under battery, mounted to the cowl.
- Mustang - front of engine compartment, passenger side, near fender, under the battery junction box (BJB).
- Crown Victoria, Grand Marquis, Town Car - engine compartment, driver side, fender mounted.
- Explorer, Explorer Sport Trac, Mountaineer - passenger side, near side cowl, behind the glove compartment.
- Escape, Mariner, Ranger - behind the instrument panel (cowl), center to both driver and passenger sides (access from the engine compartment).
- Edge, Expedition, Mark LT, MKX, Navigator, F-Series, F-Super Duty - passenger side of the engine compartment, mounted to the cowl.
- E-Series - engine compartment, driver side, near the cowl (access from the engine compartment).

140-PIN PCM - EXPEDITION/NAVIGATOR

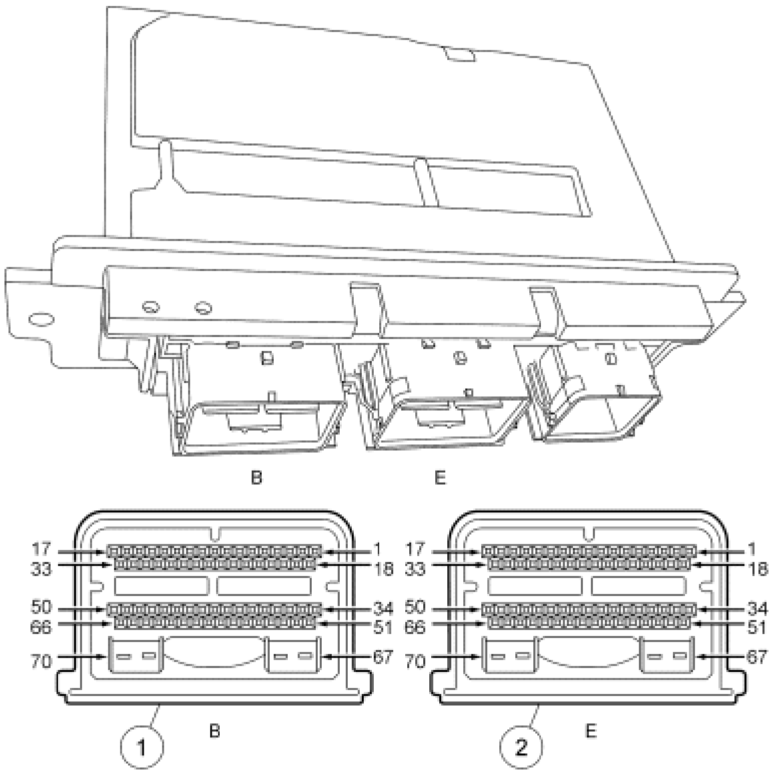

Fig. 62: Identifying 140-Pin PCM - Expedition/Navigator Connectors/Terminals
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Body
2	-	Engine

TABLE 1 - 140-PIN PCM POWER AND GROUNDS

Function	Description	Connector/Pin
VPWR	Voltage input to module	B51, B52, B53
PWRGND	Power ground	B67, B68, B69, B70
CSEGND	Case ground	B66
SIGRTN	Signal return	B58, E58
VREF	5.0-volt reference	E57
KAPWR	Keep alive power	B54

140-PIN PCM - ALL OTHERS

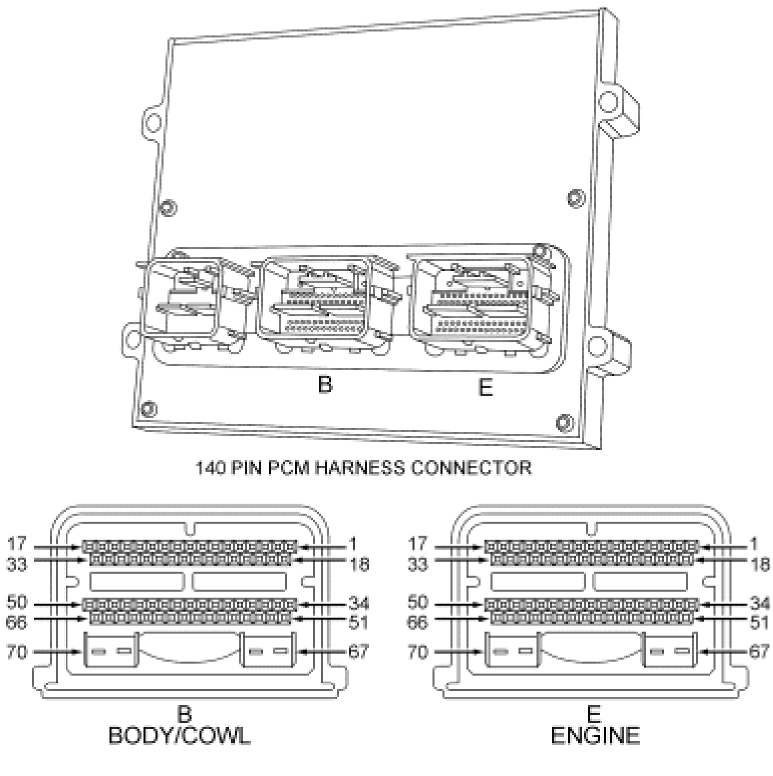

Fig. 63: Identifying 140-Pin PCM Connectors/Terminals
Courtesy of FORD MOTOR CO.

TABLE 1 - 140-PIN PCM POWER AND GROUNDS

Function	Description	Connector/Pin
VPWR	Voltage input to module	B51, B52
PWRGND	Power ground	B67, B68, B69
CSEGND	Case ground	B66
SIGRTN	Signal return	B58, E58
VREF	5.0-volt reference	B33, E57
KAPWR	Keep alive power	B54

150-PIN PCM

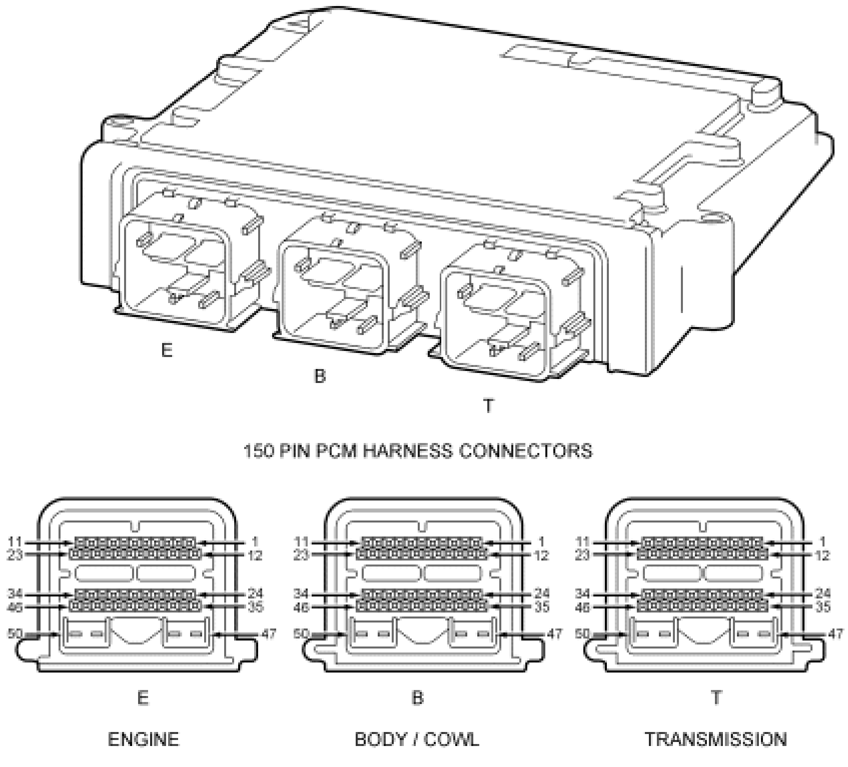

Fig. 64: Identifying 150-Pin PCM Connectors/Terminals
Courtesy of FORD MOTOR CO.

TABLE 1 - 150-PIN PCM POWER AND GROUNDS

Function	Description	Connector/Pin
VPWR	Voltage input to module	B35, B36
PWRGND	Power ground	B47, B48, B49, B50
CSEGND	Case ground	B10
SIGRTN	Signal return	B41, E41, T41
VREF	5.0-volt reference	B40, E40
KAPWR	Keep alive power	B45

170-PIN PCM

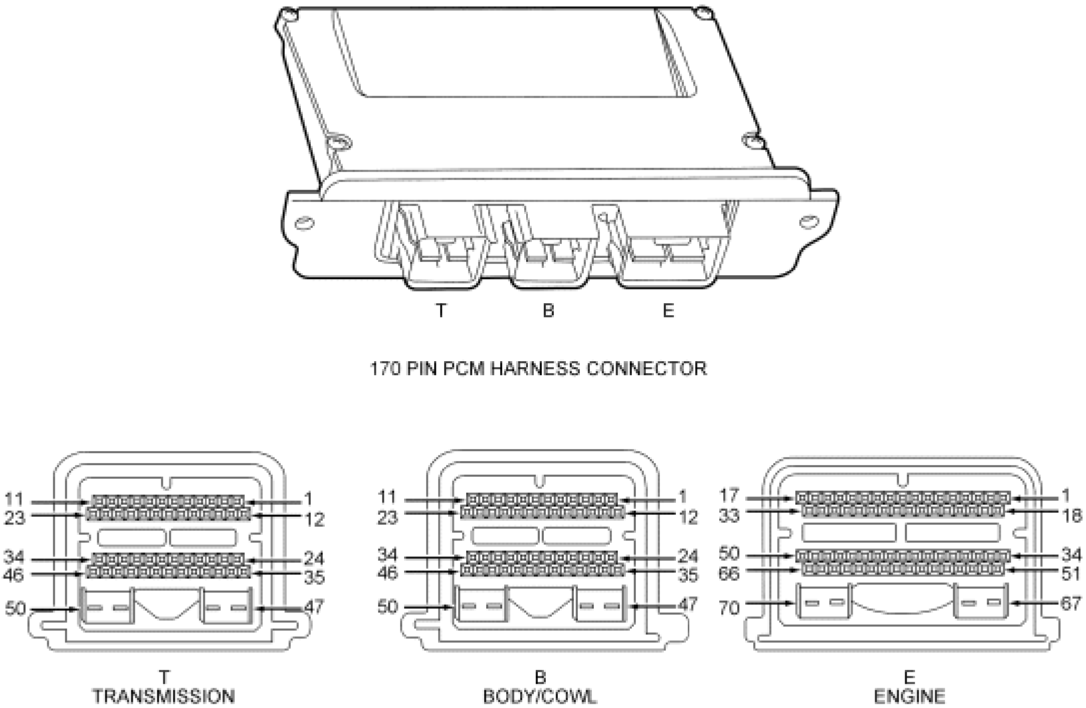

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Fig. 65: Identifying 170-Pin PCM Connectors/Terminals
Courtesy of FORD MOTOR CO.

TABLE 1 - 170-PIN PCM POWER AND GROUNDS

Function	Description	Connector/Pin
VPWR	Voltage input to module	B35, B36
PWRGND	Power ground	B47, B48, B49, B50
CSEGND	Case ground	B10
SIGRTN	Signal return	B41, E58, T41
VREF	5.0-volt reference	B40, E57
KAPWR	Keep alive power	B45

190-PIN PCM

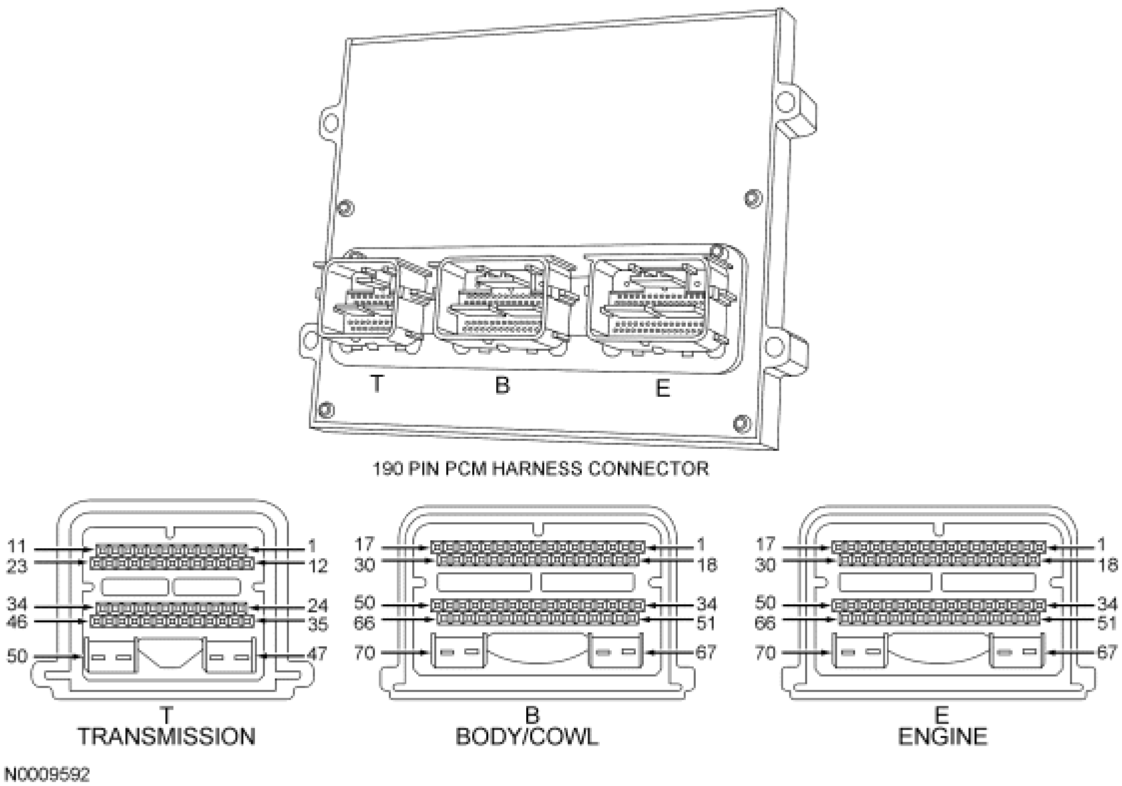

Fig. 66: Identifying 190-Pin PCM Connectors/Terminals
Courtesy of FORD MOTOR CO.

TABLE 1 - 190-PIN PCM POWER AND GROUNDS

Function	Description	Connector/Pin (Focus)	Connector/Pin (F-Series and Mark LT)	Connector/Pin (All Others)
VPWR	Voltage input to module	B67, B68	B51, B52, B53	B51, B52, B53
PWRGND	Power ground	B69, B70	B67, B68, B69, B70	B67, B68, B69, B70
CSEGND	Case ground	B50	B66	B66
SIGRTN	Signal return	B58, E64, T40	B58, E58, T43	B58, E58
VREF	5.0-volt reference	B52, B66, E63	B29, E57	B29, B64
KAPWR	Keep alive power	B62	B54	B54

FUEL PUMP DRIVER MODULE (FPDM)

NOTE: **The Mustang 5.4L uses 2 FPDMs to control fuel for the fuel delivery system. The PCM outputs only one fuel pump duty cycle on the fuel pump control (FPC) circuit. This circuit is used by both FPDMs. The PCM individually monitors the FPDMs through the fuel pump monitor (FPM) and FPM2 circuits. The FPDM located on the driver side of the luggage compartment is referred to as FPDM and the FPDM located on the passenger side of the luggage compartment, is referred to as FPDM2.**

The FPDM receives a duty cycle signal from the PCM and controls the fuel pump operation in relation to this duty cycle. This results in variable speed fuel pump operation. The FPDM sends diagnostic information to the PCM on the fuel pump monitor circuit. For additional information on the fuel pump control and the fuel pump monitor, refer to **FUEL SYSTEMS**.

KEEP ALIVE MEMORY (KAM)

The PCM stores information in KAM (a memory integrated circuit chip) about vehicle operating conditions and then uses this information to compensate for component variability. The KAM remains powered when the key is in the OFF position so that this information is not lost.

INTEGRATED ELECTRONIC IGNITION SYSTEM

The integrated electronic ignition system consists of a CKP sensor, coil pack(s), connecting wiring, and PCM. The coil on plug (COP) integrated electronic ignition system uses a separate coil for each spark plug and each coil is mounted directly onto the plug. The COP integrated electronic ignition system eliminates the need for spark plug wires but does require input from the camshaft position (CMP) sensor.

POWER AND GROUND SIGNALS

Electronic Throttle Control Reference Voltage (ETCREF)

ETCREF is a consistent positive voltage (5.0 volts ± 0.5) supplied by the PCM. ETCREF is internally bussed within the PCM and is specifically dedicated to the accelerator pedal position (APP) sensor and the electronic throttle body (ETB) throttle position (TP) sensor.

Electronic Throttle Control Return (ETCRTN)

ETCRTN is a return path for ETCREF and is internally bussed within the PCM. ETCRTN is specifically dedicated to the APP sensor and the ETB TP sensor.

Gold Plated Pins

NOTE: Gold plated terminals should only be replaced with new gold plated terminals.

Some engine control hardware has gold plated pins within the connectors and mating harness connectors to improve electrical stability for low current draw circuits and to enhance corrosion resistance. The electronic engine control (EEC) components equipped with gold terminals vary by vehicle application.

Keep Alive Power (KAPWR)

KAPWR provides a constant voltage input independent of ignition switch state to the PCM. This voltage is used by the PCM to maintain the keep alive memory (KAM).

Mass Air Flow (MAF) Return

The mass air flow return (MAF RTN) is a dedicated analog signal return from the MAF sensor. It serves as a ground offset for the analog voltage differential input by the MAF sensor to the PCM.

Power Ground (PWR GND)

The PWR GND circuit(s) is directly connected to the battery negative terminal. PWR GND provides a return path for the PCM vehicle power (VPWR) circuits.

Signal Return (SIG RTN)

SIG RTN is a dedicated return path for VREF applied components.

Variable Reluctance Sensor Return (VRSRTN)

The VRSRTN circuit is a dedicated return path for variable reluctance (VR) type sensors.

Vehicle Buffered Power (VBPWR)

VBPWR is a regulated voltage supplied by the PCM to vehicle sensors. These sensors require a constant 12 volts for operation and cannot withstand VPWR voltage variations. VBPWR is regulated to VPWR minus 1.5 volts and is also current limited to protect the sensors.

Vehicle Power (VPWR)

VPWR is the primary source of PCM power. VPWR is switched through the EEC power relay and is controlled by the ignition switch.

Vehicle Reference Voltage (VREF)

VREF is a consistent positive voltage (5.0 volts ± 0.5) provided by the PCM. VREF is typically used by 3-wire sensors and some digital input signals.

POWERTRAIN CONTROL SOFTWARE

ADAPTIVE AIRFLOW

Some vehicles equipped with electronic throttle control (ETC) have an adaptive airflow strategy that allows the powertrain control module (PCM) to correct for changes in the airflow. During idle, the PCM monitors the throttle angle and air flow. If the air flow is determined to be less than expected, the PCM adjusts the throttle angle to compensate.

The PCM only learns the adaptive airflow when the vehicle is at idle and normal operating temperature and the airflow is less than a calibrated limit. Whenever the battery is disconnected or the keep alive memory (KAM) is reset, it is necessary for the PCM to learn the new value and not use the default value. For additional information on a KAM reset, refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .

COMPUTER CONTROLLED SHUTDOWN

The PCM controls the PCM power relay when the key is turned to the ON or START position, by grounding the PCM relay control (PCMRC) circuit. After the key is turned to the OFF, ACC or LOCK position, the PCM stays powered up until the correct engine shutdown occurs.

The ignition switch position run (ISP-R) and the injector power monitor (INJPWRM) circuits provide the key state input to the PCM. Based on the ISP-R and INJPWRM signals the PCM determines when to power down the PCM power relay.

ENGINE RPM/VEHICLE SPEED LIMITER

The PCM disables some or all of the fuel injectors whenever an engine RPM or vehicle over speed condition is detected. The purpose of the engine RPM or vehicle speed limiter is to prevent damage to the powertrain. The vehicle exhibits a rough running engine condition, and the PCM stores one of the following continuous memory diagnostic trouble codes (DTCs): P0219, P0297, or P1270. Once the driver reduces the excessive speed, the engine returns to the normal operating mode. No repair is required. However, the technician should clear the DTCs and inform the customer of the reason for the DTC.

Excessive wheel slippage may be caused by sand, gravel, rain, mud, snow, ice, or excessive and sudden increase in RPM while in NEUTRAL or while driving.

FAIL-SAFE COOLING STRATEGY

NOTE: Not all vehicles with a cylinder head temperature (CHT) sensor have the fail-safe cooling strategy.

The fail-safe cooling strategy is activated by the PCM only in the event that an overheating condition has been identified. This strategy provides engine temperature control when the cylinder head temperature exceeds certain limits. The cylinder head temperature is measured by the CHT sensor. For additional information about the CHT sensor, refer to **ENGINE CONTROL COMPONENTS**.

A cooling system failure such as low coolant or coolant loss could cause an overheating condition. As a result, damage to major engine components could occur. Along with a CHT sensor, the fail-safe cooling strategy is used to prevent damage by allowing air cooling of the engine. This strategy allows the vehicle to be driven safely for a short time with some loss of performance when a overheat condition exist.

Engine temperature is controlled by varying and alternating the number of disabled fuel injectors. This allows all cylinders to cool. When the fuel injectors are disabled, the respective cylinders work as air pumps, and this air is used to cool the cylinders. The more fuel injectors that are disabled, the cooler the engine runs, but the engine has less power.

A wide open throttle (WOT) delay is incorporated if the CHT temperature is exceeded during WOT operation. At WOT, the injectors function for a limited amount of time allowing the customer to complete a passing maneuver.

Before injectors are disabled, the fail-safe cooling strategy alerts the customer to a cooling system problem by moving the instrument cluster temperature gauge to the hot zone and DTC P1285 is set. Depending on the vehicle, other indicators, such as an audible chime or warning lamp, can be used to alert the customer of fail-safe cooling. If overheating continues, the strategy begins to disable the fuel injectors, DTC P1299 is stored in the PCM memory, and a malfunction indicator lamp (MIL) illuminates. If the overheating condition continues and a critical temperature is reached, all fuel injectors are turned off and the engine is disabled.

FAILURE MODE EFFECTS MANAGEMENT (FMEM)

The FMEM is an alternate system strategy in the PCM designed to maintain engine operation if one or more sensor inputs fail.

When a sensor input is determined to be out-of-limits by the PCM, an alternative strategy is initiated. The PCM substitutes a fixed value for the incorrect input and continues to monitor the suspect sensor input. If the suspect sensor begins to operate within limits, the PCM returns to the normal engine operational strategy.

All FMEM sensors display a sequence error message on the scan tool. The message may or may not be followed by key on engine off (KOEO) or continuous memory DTCs when attempting key on engine running (KOER) self-test mode.

FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)

The flash EEPROM is an integrated circuit within the PCM. This integrated circuit contains the software code required by the PCM to control the powertrain. One feature of the EEPROM is that it can be electrically erased and then reprogrammed through the data link connector (DLC) without removing the PCM from the vehicle.

FUEL TRIM

Short Term Fuel Trim

If the oxygen sensors are warmed up and the PCM determines that the engine can operate near stoichiometric air/fuel ratio (14.7:1 for gasoline), the PCM enters closed loop fuel control mode. Since an oxygen sensor can only indicate rich or lean, the fuel control strategy continuously adjusts the desired air/fuel ratio between rich and lean causing the oxygen sensor to switch around the stoichiometric point. If the time between rich and lean switches are the same, then the system is actually operating at stoichiometric. The desired air/fuel control parameter is called short term fuel trim (SHRTFT1 and 2) where stoichiometric is represented by 0%. Richer (more fuel) is represented by a positive number and leaner (less fuel) is represented by a negative number. Normal operating range for short term fuel trim is +/- 25%. Some calibrations have time between switches and short term fuel trim excursions that are not equal. These unequal excursions are used to run the system slightly lean or rich of stoichiometric. This practice is referred to as using bias. For example, the fuel system can be biased slightly rich during closed loop fuel to help reduce oxides of nitrogen (NO_x).

Values for SHRTFT1 and 2 may change significantly on a scan tool as the engine is operated at different RPM and load points. This is because SHRTFT1 and 2 react to fuel delivery variability that changes as a function of engine RPM and load. Short term fuel trim values are not retained after the engine is turned off.

Long Term Fuel Trim

While the engine is operating in closed loop fuel control, the short term fuel trim corrections are learned by the PCM as long term fuel trim (LONGFT1 and 2) corrections. These corrections are stored in the keep alive memory (KAM) fuel trim tables. Fuel trim tables are based on engine speed and load and by bank for engines with 2 heated oxygen sensor (HO2S) forward of the catalyst. Learning the corrections in KAM improves both open loop and closed loop air/fuel ratio control. Advantages include:

- Short term fuel trim does not have to generate new corrections each time the engine goes into closed loop.
- Long term fuel trim corrections can be used both while in open loop and closed loop modes.

Long term fuel trim is represented as a percentage, similar to the short term fuel trim, however it is not a single parameter. A separate long term fuel trim value is used for each RPM/load point of engine operation. Long term fuel trim corrections may change depending on the operating conditions of the engine (RPM and load), ambient air temperature, and fuel quality (% alcohol, oxygenates). When viewing the LONGFT1/2 PID(s), the values may change a great deal as the engine is operated at different RPM and load points. The LONGFT1/2 PID(s) display the long term fuel trim correction that is currently being used at that RPM/load point.

HIGH SPEED CONTROLLER AREA NETWORK (CAN)

High speed CAN is a serial communication language protocol used to transfer messages (signals) between electronic modules or nodes. Two or more signals can be sent over one CAN communications network circuit allowing 2 or more electronic modules or nodes to communicate with each other. This communication or multiplexing network operates at 500kB/sec (kilobytes per second) and allows the electronic modules to share their information messages.

Included in these messages is diagnostic data that is outputted over the CAN + and CAN - lines to the DLC. PCM connection to the DLC is typically done with a 2-wire, twisted pair cable used for the network interconnection. The diagnostic data such as self-test or PIDs can be accessed with a scan tool. For additional information on scan tool equipment, refer to**DIAGNOSTIC METHODS** .

IDLE AIR TRIM

Idle air trim is designed to adjust the idle air control (IAC) calibration to correct for wear and aging of components. When the engine conditions meet the learning requirement, the strategy monitors the engine and determines the values required for ideal idle calibration. The idle air trim values are stored in a table for reference. This table is used by the PCM as a correction factor when controlling the idle speed. The table is stored in the KAM and retains the learned values even after the engine is shut off. A DTC is set if the idle air trim has reached its learning limits.

Whenever an IAC component is replaced, or a repair affecting idle is carried out, it is recommended that the KAM be reset. This is necessary so the idle strategy does not use the previously learned idle air trim values.

To reset the KAM, refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . It is important to note that erasing DTCs with a scan tool does not reset the idle air trim table.

Once the KAM has been reset, the engine must idle for 15 minutes (actual time varies between strategies) to learn new idle air trim values. Idle quality improves as the strategy adapts. Adaptation occurs in 4 separate modes as shown in the following table.

IDLE AIR TRIM LEARNING MODES

Transmission Range	Air Conditioning Mode
NEUTRAL	A/C ON
NEUTRAL	A/C OFF

DRIVE	A/C ON
DRIVE	A/C OFF

IDLE SPEED CONTROL CLOSED THROTTLE DETERMINATION - APPLICATIONS WITHOUT ELECTRONIC THROTTLE CONTROL (ETC)

One of the fundamental criteria for entering RPM control is an indication of closed throttle. Throttle mode is always calculated to the lowest learned throttle position (TP) voltage seen since engine start. This lowest learned value is called ratch, since the software acts like a one-way ratch. The ratch value (voltage) is displayed as the TPREL PID. The ratch value is relearned after every engine start. Ratch learns the lowest, steady TP voltage seen after the engine starts. In some cases, ratch can learn higher values of TP. The time to learn the higher values is significantly longer than the time to learn the lower values. The brakes must also be applied to learn the higher values.

All PCM functions are done using this ratch voltage, including idle speed control. The PCM goes into closed throttle mode when the TP voltage is at the ratch (TPREL PID) value. An increase in TP voltage, normally less than 0.05 volts, puts the PCM in part throttle mode. Throttle mode can be viewed by looking at the TP MODE PID. With the throttle closed, the PID must read C/T (closed throttle). Slightly corrupt values of ratch can prevent the PCM from entering closed throttle mode. An incorrect part throttle indication at idle prevents entry into closed throttle RPM control, and could result in a high idle. Ratch can be corrupted by a throttle position sensor or a circuit that drops out or is noisy, or by loose/worn throttle plates that close tight during a deceleration and spring back at a normal engine vacuum.

INTERNATIONAL STANDARDS ORGANIZATION (ISO) 14229 DIAGNOSTIC TROUBLE CODE (DTC) DESCRIPTIONS

The ISO 14229 is a global, diagnostic communication standard. The ISO 14229 is a set of standard diagnostic messages that can be used to diagnose any vehicle module in service, and at the assembly plant. The ISO 14229 is similar to the society of automotive engineers (SAE) J2190 diagnostic communication standard that was used by all original equipment manufacturers (OEMs) for previous communication protocols, like J1850 standard corporate protocol (SCP).

For the 2008 model year, the new ISO 14229 standard is standard on the Focus powertrain control module (PCM). The ISO 14229 changes the way PIDs, DTCs, and output state control is processed internally in the PCM and in the scan tool software. Most of the changes are to make data transfer between electronic modules more efficient, and the amount and type of information that is available for each DTC. This information may be helpful in diagnosing driveability concerns.

DTC Structure - Like all digital signals, DTCs are sent to the scan tool as a series of 1s and 0s. Each DTC is made up of 2 data bytes which each consist of 8 bits that can be set to 1 or 0. The data is decoded by the scan tool to display each set of 4 bits as a hexadecimal number (0 to F) in order to display the DTCs in the conventional format. For example, P0420 - Catalyst System Efficiency Below Threshold (Bank 1).

DTC Byte 1		DTC Byte 2	
0000	0100	0010	0000
P0	4	2	0

The table below shows how to decode the bits into hex digits.

Binary Bit Pattern	Hex Digit	Binary Bit Pattern	Hex Digit
0000	0	1000	8
0001	1	1001	9
0010	2	1010	A
0011	3	1011	B
0100	4	1100	C
0101	5	1101	D
0110	6	1110	E
0111	7	1111	F

The first 4 bits of a DTC do not convert directly into hex digits. The conversion into different types of DTCs (P, B, C and U) is defined by SAE J2012. This standard contains DTC definitions and formats.

Binary Bit Pattern	SAE DTC Type	Binary Bit Pattern	SAE DTC Type
0000	P0	1000	B0
0001	P1	1001	B1
0010	P2	1010	B2
0011	P3	1011	B3
0100	C0	1100	U0
0101	C1	1101	U1
0110	C2	1110	U2
0111	C3	1111	U3

ISO 14229 sends 2 additional bytes of information with each DTC, a failure type byte and a status byte.

DTC Byte 1		DTC Byte 2		Failure Type Byte		Status Byte	
0000	0100	0010	0000	0000	0000	1111	0101
P0	4	2	0	0	0	F	9

All ISO 14229 DTCs are 4 bytes long instead of 3 bytes or 2 bytes long. Additionally, the status byte for ISO 14229 DTCs is defined differently than the status byte for previous applications with 3 byte DTCs.

Failure Type Byte - The failure type byte is designed to describe the specific failure associated with the basic DTC. For example, an failure type byte of 1C means circuit voltage out of range, 73 means actuator stuck closed. When combined with a basic component DTC, it allows one basic DTC to describe many types of failures.

DTC Byte 1		DTC Byte 2		Failure Type Byte		Status Byte	
0000	0001	0001	0000	0001	1100	1010	1111
P0	1	1	0	1	C	A	F

For example, P0110:1C-AF means intake air temperature sensor circuit voltage out of range. The base DTC, P0110, means intake air temperature sensor circuit, while the failure type byte 1C means circuit voltage out of range. This DTC structure was designed to allow manufacturers to more precisely identify different kinds of faults without always having to define new DTC numbers.

The PCM does not use failure type bytes and always sends a failure type byte of 00 (no sub type information). This is because OBD-II regulations require manufacturers to use 2 byte DTCs for generic scan tool communications. Additionally, the OBD-II regulations require the 2 byte DTCs to be very specific, so there is no additional information that the failure type byte could provide.

A list of failure type bytes is defined by SAE J2012 but is not described here because the PCM does not use the failure type byte.

Status Byte - The status byte is designed to provide additional information about the DTC, such as when the DTC failed, when the DTC was last evaluated, and if any warning indication has been requested. Each of the 8 bits in the status byte has a precise meaning that is defined in ISO 14229.

The protocol is that bit 7 is the most significant bit and is the left-most bit while bit 0 is the least significant bit and is the right-most bit.

Most Significant Bits				**Least Significant Bit**			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

DTC Status Bit Definitions - Refer to the following status bit descriptions:

Bit 7

- 0 - The ECU is not requesting warning indicator to be active
- 1 - The ECU is requesting warning indicator to be active

Bit 6

- 0 - The DTC test completed this monitoring cycle
- 1 - The DTC test has not completed this monitoring cycle

Bit 5

- 0 - The DTC test never failed since last code clear
- 1 - The DTC test failed at least once since last code clear

Bit 4

- 0 - The DTC test completed since the last code clear
- 1 - The DTC test not completed since the last code clear

Bit 3

- 0 - The DTC is not confirmed at the time of the request
- 1 - The DTC is confirmed at the time of the request

Bit 2

- 0 - The DTC was not failed on the current or previous monitoring cycle
- 1 - The DTC failed on the current or previous monitoring cycle

Bit 1

- 0 - The DTC never failed on the current monitoring cycle
- 1 - The DTC failed on the current monitoring cycle

Bit 0

- 0 - The DTC is not failed at the time of request
- 1 - The DTC is failed at the time of request

For DTCs that illuminate the MIL, a confirmed DTC means the PCM has stored a DTC and has illuminated the MIL. If the fault has corrected itself, the MIL may no longer be illuminated but the DTC still shows a confirmed status for 40 warm up cycles at which time the DTC is erased. Bit 7 can be used to determine if the MIL is illuminated for the DTC.

For DTCs that do not illuminate the MIL, a confirmed DTC means the PCM has stored a DTC. If the fault has corrected itself, the DTC still shows a confirmed status for 40 warm up cycles at which time the DTC is erased.

To determine if a test has completed and passed, for example, after a repair, information can be combined from 2 bits as follows:

If bit 6 is 0 (the DTC test completed this monitoring cycle), and bit 1 is 0 (the DTC never failed on the current monitoring cycle), then the DTC has been evaluated at least once this drive cycle and was a pass.

If bit 6 is 0 (the DTC test completed this monitoring cycle) and bit 0 is 0 (the DTC is not failed at the time of request), then the most recent test result for that DTC was a pass.

The status byte bits can be decoded as a 2 digit hexadecimal number, and can be displayed as the last 2 digits of the DTC, for example for DTC P0110:1C-AF, AF represents the status byte info.

Status Byte							
A equals 1010				F equals 1111			
Bit 7 equals 1	Bit 6 equals 0	Bit 5 equals 1	Bit 4 equals 0	Bit 3 equals 1	Bit 2 equals 1	Bit 1 equals 1	Bit 0 equals 1

MULTIPLEXING

The increased number of modules on the vehicle necessitates a more efficient method of communication. Multiplexing is a method of sending 2 or more signals simultaneously over a single circuit. In an automotive application, multiplexing is used to allow 2 or more electronic modules to communicate simultaneously over a single media. Typically this media is a twisted pair of wires. The information or messages that can be communicated on these wires consists of commands, status or data. The advantage of using multiplexing is to reduce the weight of the vehicle by reducing the number of redundant components and electrical wiring.

MULTIPLEXING IMPLEMENTATION

Currently Ford Motor Company uses CAN communication language protocol to communicate with the PCM.

For additional information about the module communications network, refer to the **MODULE COMMUNICATIONS NETWORK -- E-SERIES** .

MALFUNCTION INDICATOR LAMP (MIL)

The MIL notifies the driver that the powertrain control module (PCM) has detected an on board diagnostic (OBD) emission-related component or system concern. When this occurs, an OBD diagnostic trouble code (DTC) sets.

- The MIL is located in the instrument cluster and is labeled CHECK ENGINE, SERVICE ENGINE SOON or the international standards organization (ISO) standard engine symbol.
- The MIL is illuminated during the instrument cluster prove out for approximately 4 seconds.
- The MIL remains illuminated after instrument cluster prove out if:
  - an emission-related concern and DTC exists.
  - the PCM does not send a control message to the instrument cluster (applications with the MIL controlled through the communication link).
  - the PCM is operating in the hardware limited operation strategy (HLOS).
- The MIL remains off during the instrument cluster prove out if an indicator or instrument cluster concern is present.
- To turn off the MIL after a repair, a reset command from the scan tool must be sent, or 3 consecutive drive cycles must be completed without a concern.
- For all MIL concerns, go to the **SYMPTOM CHARTS** article, Symptom Charts.
- If the MIL flashes at a steady rate, a severe misfire condition may exist.
- If the MIL flashes erratically, the PCM can reset while cranking if the battery voltage is low.
- The MIL flashes after a period of time with the key in the RUN position (engine not running) if DTC P1000 is set.

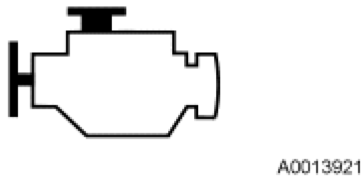

Fig. 67: Check Engine, Service Engine Soon, Or ISO Standard Engine Symbol

Courtesy of FORD MOTOR CO.

CATALYST AND EXHAUST SYSTEMS

OVERVIEW

The catalytic converter and exhaust systems work together to control the release of harmful engine exhaust emissions into the atmosphere. The engine exhaust gas consists mainly of nitrogen (N), carbon dioxide (CO_2) and water vapor (H_2O). However, it also contains carbon monoxide (CO), oxides of nitrogen (NO_x), hydrogen (H), and various unburned hydrocarbons (HCs). The major air pollutants of CO, NO_x, and HCs, and their emission into the atmosphere must be controlled.

The exhaust system generally consists of an exhaust manifold, front exhaust pipe, front heated oxygen sensor (HO2S), rear exhaust pipe, catalyst HO2S, a muffler, and an exhaust tailpipe. The catalytic converter is typically installed between the front and rear exhaust pipes. On some vehicle applications, more than one catalyst is used between the front and rear exhaust pipes. Catalytic converter efficiency is monitored by the on board diagnostic (OBD) system strategy in the powertrain control module (PCM). For information on the OBD catalyst monitor, refer to the description for the **CATALYST EFFICIENCY MONITOR**.

For most vehicles, only 2 HO2Ss are used in an exhaust stream. The front sensors (HO2S11/HO2S21) before the catalyst are used for primary fuel control while the ones after the catalyst (HO2S12/HO2S22) are used to monitor catalyst efficiency. However, some partial zero emission vehicles (PZEV) use 3 HO2Ss for each engine bank. The stream 1 sensors (HO2S11/HO2S21) located before the catalyst are used for primary fuel control, the stream 2 sensors (HO2S12/HO2S22) are used to monitor the light-off catalyst, and the stream 3 sensors (HO2S13/HO2S23) located after the catalyst are used for long term fuel trim control to optimize catalyst efficiency (fore aft oxygen sensor control).

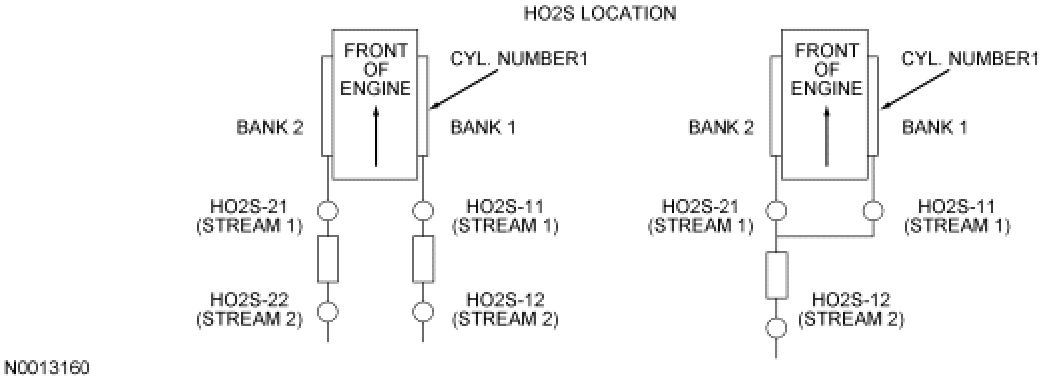

Fig. 68: Identifying V- Engines HO2S Location
Courtesy of FORD MOTOR CO.

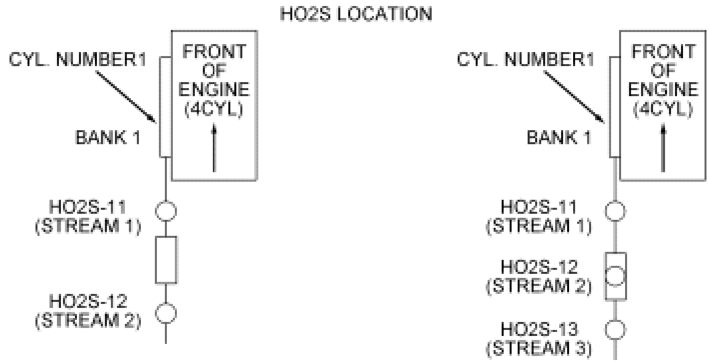

Fig. 69: Identifying In-Line Engines HO2S Location
Courtesy of FORD MOTOR CO.

Catalytic Converter

A catalyst is a material that remains unchanged when it initiates and increases the speed of a chemical reaction. A catalyst also enables a chemical reaction to occur at a lower temperature. The concentration of exhaust gas products released to the atmosphere must be controlled. The catalytic converter assists in this task. It contains a catalyst in the form of a specially treated ceramic honeycomb structure saturated with catalytically active precious metals. As the exhaust gases come in contact with the catalyst, they are changed into mostly harmless products. The catalyst initiates and speeds up heat producing chemical reactions of the exhaust gas components so they are used up as much as possible.

Light Off Catalyst

As the catalyst heats up, converter efficiency rises rapidly. The point at which conversion efficiency exceeds 50% is called catalyst light off. For most catalysts this point occurs at 246°C to 302°C (475°F to 575°F). A fast light catalyst is a 3-way catalyst (TWC) that is located as close to the exhaust manifold as possible. Because the light off catalyst is located close to the exhaust manifold it lights off faster and reduces emissions more quickly than the catalyst located under the body. Once the catalyst lights off, the catalyst quickly reaches the maximum conversion efficiency for that catalyst.

Three-Way Catalyst (TWC) Conversion Efficiency

A TWC requires a stoichiometric fuel ratio, 14.7 pounds of air to 1 pound of fuel (14.7:1), for high conversion efficiency. In order to achieve these high efficiencies, the air/fuel ratio must be tightly controlled with a narrow window of stoichiometric. Deviations outside of this window greatly decrease the conversion efficiency. For example a rich mixture decreases the HC and CO conversion efficiency while a lean mixture decreases the NO_x conversion efficiency.

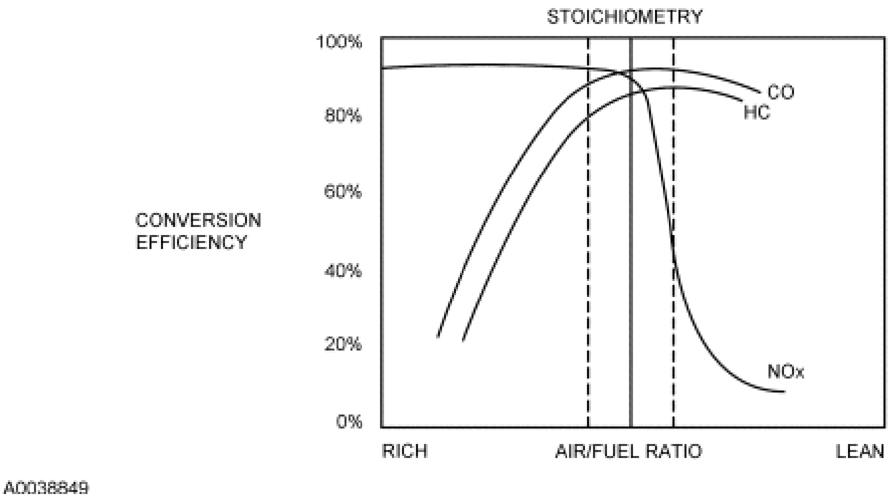

Fig. 70: TWC Conversion Efficiency Chart
Courtesy of FORD MOTOR CO.

Exhaust System

The purpose of the exhaust system is to convey engine emissions from the exhaust manifold to the atmosphere. Engine exhaust emissions are directed from the engine exhaust manifold to the catalytic converter through the front exhaust pipe. A HO2S is mounted on the front exhaust pipe before the catalyst. The catalytic converter reduces the concentration of CO, unburned HCs, and NO_x in the exhaust emissions to an acceptable level. The reduced exhaust emissions are directed from the catalytic converter past another HO2S mounted in the rear exhaust pipe and then on into the muffler. Finally, the exhaust emissions are directed to the atmosphere through an exhaust tailpipe.

On some PZEV, there is a total of 3 HO2S in the exhaust stream. One near the exhaust manifold (stream 1), one in the middle of the light-off catalyst (stream 2), and the third (stream 3) is mounted after the light-off catalyst.

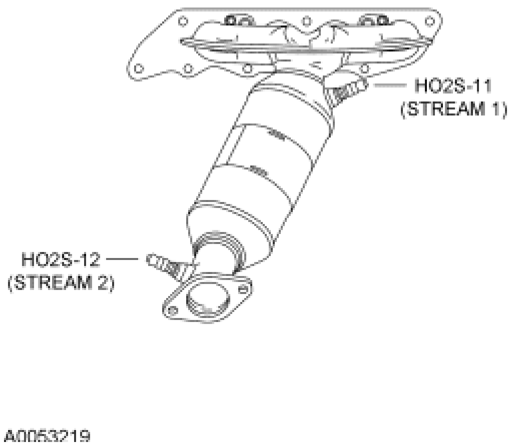

Fig. 71: Identifying Bank 1 Catalyst 2 HO2S Location
Courtesy of FORD MOTOR CO.

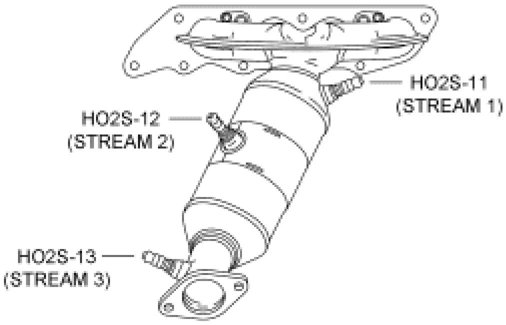

Fig. 72: Bank 1 Catalyst Three HO2S Configuration
Courtesy of FORD MOTOR CO.

UNDERBODY CATALYST

The underbody catalyst is located after the light off catalyst. The underbody catalyst may be in line with the light off catalyst, or the underbody catalyst may be common to 2 light off catalysts, forming a Y pipe configuration. For an exact configuration of the catalyst and exhaust system for a specific vehicle, refer to the **EXHAUST SYSTEM -- E-SERIES** .

Three-Way Catalytic (TWC) Converter

The TWC converter contains either platinum (Pt) and Rhodium (Rh) or palladium (Pd) and Rhodium (Rh). The TWC converter catalyzes the oxidation reactions of unburned HCs and CO and the reduction reaction of NO_x . The 3-way conversion can be best accomplished by always operating the engine air fuel/ratio at or close to stoichiometric.

Exhaust Manifold Runners

The exhaust manifold runners collect exhaust gases from engine cylinders. The number of exhaust manifolds and exhaust manifold runners depends on the engine configuration and number of cylinders.

Exhaust Pipes

Exhaust pipes are usually treated during manufacturing with an anti-corrosive coating agent to increase the life of the product. The pipes serve as guides for the flow of exhaust gases from the engine exhaust manifold through the catalytic converter and the muffler.

Heated Oxygen Sensor (HO2S)

The HO2Ss provide the PCM with information related to the oxygen content of the exhaust gas. For additional information on the HO2S, refer to **ENGINE CONTROL COMPONENTS**.

Muffler

Mufflers are usually treated during manufacturing with an anti-corrosive coating agent to increase the life of the product. The muffler reduces the level of noise produced by the engine, and also reduces the noise produced by exhaust gases as they travel from the catalytic converter to the atmosphere.

EVAPORATIVE EMISSION (EVAP) SYSTEMS

OVERVIEW

The EVAP system prevents fuel vapor build-up in the sealed fuel tank. Fuel vapors trapped in the sealed tank are vented through the vapor valve assembly on top of the tank. The vapors leave the valve assembly through a single vapor line and continue to the EVAP canister for storage until the vapors are purged to the engine for burning.

All applications required to meet on board diagnostics (OBD) regulations use the enhanced EVAP system. Some applications also incorporate an on-board refueling vapor recovery (ORVR) system. Refer to the **EVAPORATIVE EMISSIONS -- E-SERIES** for vehicle specific information on the description and operation of the evaporative emissions system.

Enhanced Evaporative Emission (EVAP) System

The enhanced EVAP system consists of a fuel tank, fuel filler cap or capless fuel tank filler pipe, fuel tank mounted or inline fuel vapor control valve, fuel vapor vent valve, EVAP canister, fuel tank mounted or fuel pump mounted or inline fuel tank pressure (FTP) sensor, EVAP canister purge valve or vapor management valve (VMV), intake manifold hose assembly, EVAP canister vent (CV) solenoid, powertrain control module (PCM) and connecting wires, and fuel vapor hoses. For additional information on the EVAP system components, refer to **ENGINE CONTROL COMPONENTS**.

1. The enhanced EVAP system uses inputs from the engine coolant temperature (ECT) sensor or cylinder head temperature (CHT) sensor, the intake air temperature (IAT) sensor, the mass air flow (MAF) sensor, the vehicle speed and the FTP sensor to provide information about engine operating conditions to the PCM. The fuel level input (FLI) and FTP sensor signals to the PCM are used by the PCM to determine activation of the EVAP leak check monitor based on the presence of vapor generation or fuel sloshing.
2. The PCM determines the desired amount of purge vapor flow to the intake manifold for a given engine condition. The PCM can then output the required signal to the EVAP canister purge valve or VMV. The PCM uses the enhanced EVAP system inputs to evacuate the system using the EVAP canister purge valve or VMV, seals the enhanced EVAP system from the atmosphere using the CV solenoid, and uses the FTP sensor to observe total vacuum lost for a period of time.
3. The CV solenoid seals the enhanced EVAP system to atmosphere during the EVAP leak check monitor.
4. The PCM outputs a variable current (between 0 mA and 1,000 mA) to the solenoid on the EVAP canister purge valve or VMV.
5. The FTP sensor monitors the fuel tank pressure during engine operation and continuously transmits an input signal to the PCM. During the EVAP monitor testing, the FTP sensor monitors the fuel tank pressure or vacuum bleed-up.
6. The fuel tank mounted fuel vapor vent valve assembly and the fuel tank mounted fuel vapor control valve

(or remote fuel vapor control valve) are used in the enhanced EVAP system to control the flow of fuel vapor entering the engine. All of these valves also prevent fuel tank overfilling during refueling operation and prevent liquid fuel from entering the EVAP canister and the EVAP canister purge valve or VMV under any vehicle altitude, handling, or rollover condition.

7. The enhanced EVAP system, including all the fuel vapor hoses, can be checked when a leak is detected by the PCM.

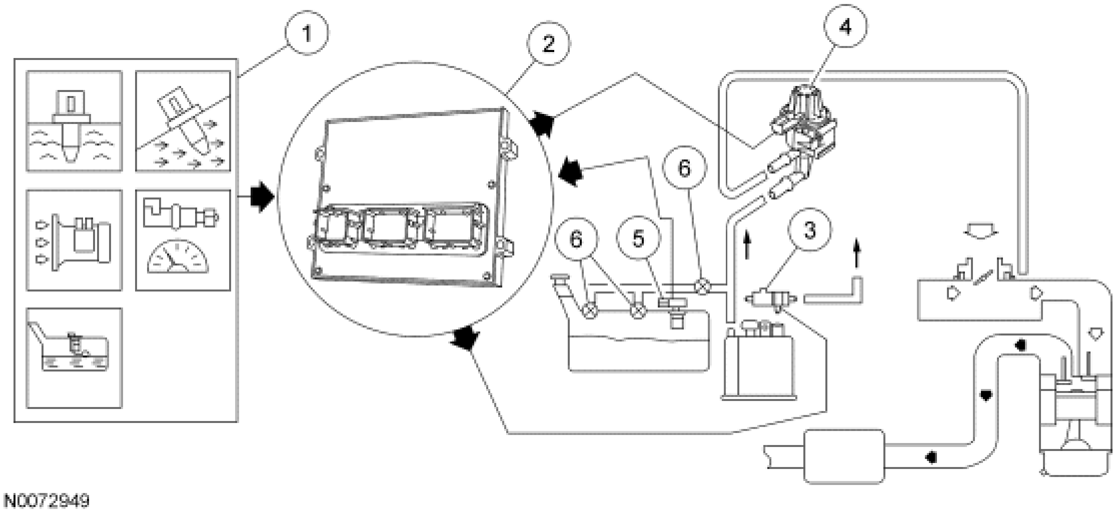

Fig. 73: Enhanced Evaporative Emission System
Courtesy of FORD MOTOR CO.

EXHAUST GAS RECIRCULATION (EGR) SYSTEMS

OVERVIEW

The EGR system controls the oxides of nitrogen (NO_x) emissions. Small amounts of exhaust gases are recirculated back into the combustion chamber to mix with the air/fuel charge. The combustion chamber temperature is reduced, lowering NO_x emissions.

DIFFERENTIAL PRESSURE FEEDBACK EXHAUST GAS RECIRCULATION (EGR) SYSTEM

The differential pressure feedback EGR system consists of a differential pressure feedback EGR sensor, EGR vacuum regulator solenoid, EGR valve, orifice tube assembly, powertrain control module (PCM), and connecting wires and vacuum hoses. For additional information on the differential pressure feedback EGR system, refer to **ENGINE CONTROL COMPONENTS**. Operation of the system is as follows:

1. The differential pressure feedback EGR system receives signals from the engine coolant temperature (ECT) sensor or cylinder head temperature (CHT) sensor, intake air temperature (IAT) sensor, throttle position (TP) sensor, mass air flow (MAF) sensor, and crankshaft position (CKP) sensor to provide information on engine operating conditions to the PCM. The engine must be warm, stable, and running at a moderate load and RPM before the EGR system is activated. The PCM deactivates EGR during idle, extended wide open throttle, or whenever a concern is detected in an EGR component or EGR required input.

2. The PCM calculates the desired amount of EGR flow for a given engine condition. It then determines the desired pressure drop across the metering orifice required to achieve that flow and outputs the corresponding signal to the EGR vacuum regulator solenoid.
3. The EGR vacuum regulator solenoid receives a variable duty cycle signal (0 to 90%). The higher the duty cycle the more vacuum the solenoid diverts to the EGR valve.
4. The increase in vacuum acting on the EGR valve diaphragm overcomes the valve spring and begins to lift the EGR valve pintle off its seat, causing exhaust gas to flow into the intake manifold.
5. Exhaust gas flowing through the EGR valve must first pass through the EGR metering orifice. With one side of the orifice exposed to exhaust backpressure and the other downstream of the metering orifice, a pressure drop is created across the orifice whenever there is EGR flow. When the EGR valve closes, there is no longer flow across the metering orifice and pressure on both sides of the orifice is the same. The PCM constantly targets a desired pressure drop across the metering orifice to achieve the desired EGR flow.
6. The differential pressure feedback EGR sensor measures the actual pressure drop across the metering orifice and relays a proportional voltage signal (0 to 5 volts) to the PCM. The PCM uses this feedback signal to correct for any errors in achieving the desired EGR flow.

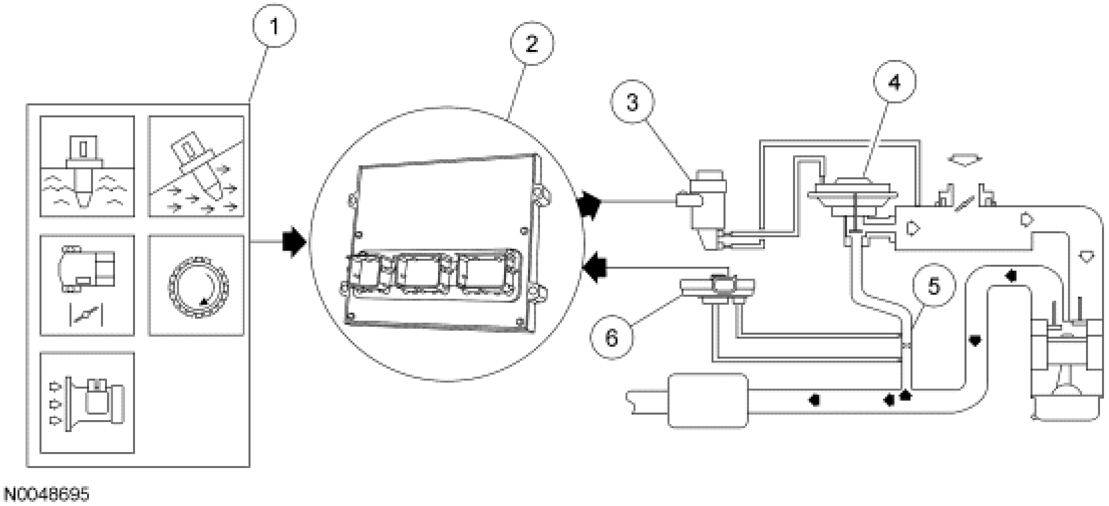

Fig. 74: Differential Pressure Feedback EGR System Operation
Courtesy of FORD MOTOR CO.

ELECTRIC EXHAUST GAS RECIRCULATION (EEGR) SYSTEM

Highlights of the EEGR System

- The EEGR valve is activated by an electric stepper motor and does not use vacuum to control the physical movement of the valve.
- No vacuum diaphragm is used.
- No differential pressure feedback EGR sensor is used.
- No orifice tube/assembly is used.
- No EGR vacuum regulator solenoid is used.
- Engine coolant is routed through the assembly on some vehicle applications. Some vehicle applications

are air cooled.

Overview

The EEGR system uses exhaust gas recirculation to control the oxides of nitrogen (NO_x) emissions just like vacuum operated systems. The only difference is the way in which the exhaust gas is controlled.

The EEGR system consists of an electric motor/EGR valve integrated assembly, a PCM, and connecting wiring. Additionally a manifold absolute pressure (MAP) sensor is also required. For additional information on the EGR system components, refer to **ENGINE CONTROL COMPONENTS**. Operation of the system is as follows:

1. The EEGR system receives signals from the ECT or CHT sensor, TP sensor, MAF sensor, CKP sensor, and the MAP sensor to provide information on engine operating conditions to the PCM. The engine must be warm, stable, and running at a moderate load and RPM before the EEGR system is activated. The PCM deactivates the EEGR during idle, extended wide open throttle (WOT), or whenever a concern is detected in an EEGR component or EGR required input.
2. The PCM calculates the desired amount of EGR for a given set of engine operating conditions.
3. The PCM in turn outputs signals the EEGR motor to move (advance or retract) a calibrated number of discrete steps. The electric stepper motor directly actuates the EEGR valve, independent of engine vacuum. The EEGR valve is commanded from 0 to 52 discrete steps to get the EGR valve from a fully closed to fully open position. The position of the EGR valve determines the EGR flow.
4. A MAP sensor is used to measure variations in manifold pressure as exhaust gas recirculation is introduced into the intake manifold. Variations in EGR being used correlate to the MAP signal (increasing EGR increases manifold pressure values).

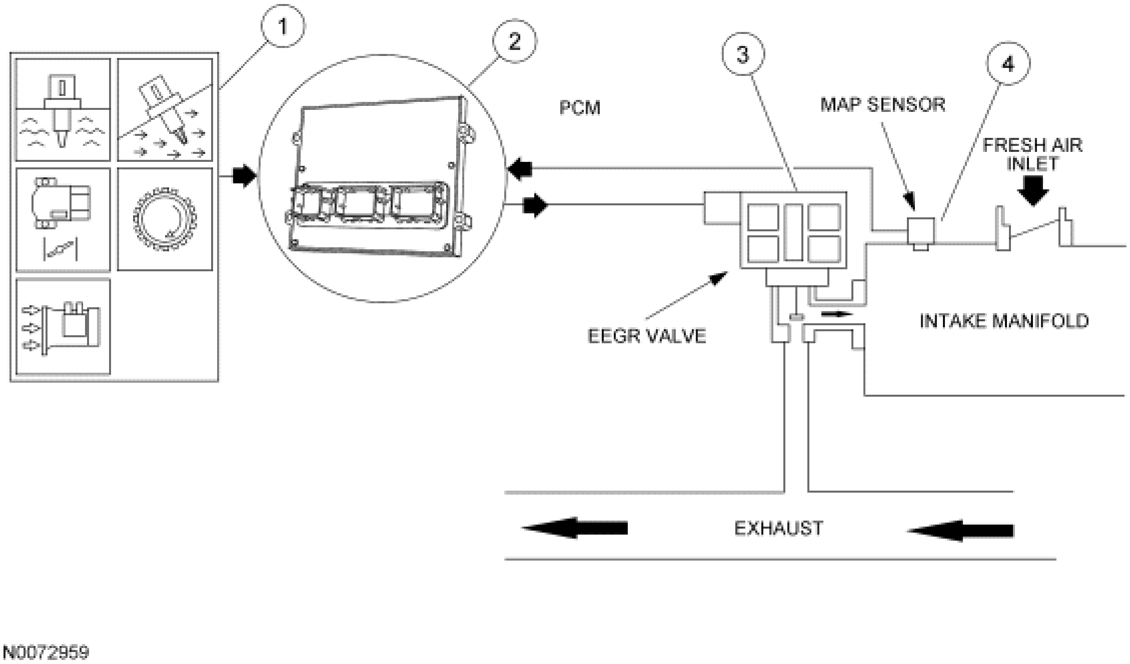

Fig. 75: EEGR System
Courtesy of FORD MOTOR CO.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM MODULE (ESM)

Overview

The ESM is an updated differential pressure feedback EGR system. It functions in the same manner as the conventional differential pressure feedback EGR system, however the various system components have been integrated into a single component called the ESM. For additional information on the ESM system components, refer to **ENGINE CONTROL COMPONENTS**. The flange of the valve portion of the ESM bolts directly to the intake manifold or cold tube with a metal gasket that forms the metering orifice. This arrangement increases system reliability, response time, and system precision. By relocating the EGR orifice from the exhaust to the intake side of the EGR valve, the downstream pressure signal measures MAP. This MAP signal is used for EGR correction and inferred barometric pressure (BARO) at key on. The system provides the PCM with a differential pressure feedback EGR signal, identical to a traditional differential pressure feedback EGR system.

First, the differential pressure feedback EGR sensor input circuit is checked for out of range values (DTCs P0405 or P0406). The EGR vacuum regulator output circuit is checked for opens and shorts (DTC P0403).

The EGR system normally has large amounts of water vapor that are the result of the engine combustion process. During cold ambient temperatures, under some circumstances, water vapor can freeze in the differential pressure feedback EGR sensor, hoses, as well as other components in the EGR system. In order to prevent malfunction indicator lamp (MIL) illumination for temporary freezing, the following logic is used.

If an EGR system concern is detected below 0°C (32°F), only the EGR system is disabled for the current driving cycle. A diagnostic trouble code (DTC) is not stored and the I/M readiness status for the EGR monitor does not change. The EGR monitor, however, continues to operate. If the EGR monitor determines that the concern is no longer present, the EGR system is enabled and normal system operation is restored.

If an EGR system concern is detected above 0°C (32°F), the EGR system and the EGR monitor is disabled for the current driving cycle. A DTC is stored and the MIL is illuminated if the concern has been detected on 2 consecutive driving cycles.

After the vehicle has warmed up and normal EGR rates are being commanded by the PCM, the low flow check is carried out. Since the EGR system is a closed loop system, the EGR system delivers the requested EGR flow as long as it has the capability to do so. If the EGR vacuum regulator duty cycle is at maximum (90% duty cycle), the differential pressure indicated by the differential pressure feedback EGR sensor is evaluated to determine the amount of EGR system restriction. If the differential pressure is below a calibrated threshold, a low flow concern is indicated (DTCs P0401/P0406).

Finally, the differential pressure indicated by the differential pressure feedback EGR sensor is also checked at idle with zero requested EGR flow to carry out the high flow check. If the differential pressure exceeds a calibrated limit, it indicates a stuck open EGR valve or debris temporarily lodged under the EGR valve seat (DTC P0402).

If the inferred ambient temperature is less than 0°C (32°F), or greater than 60°C (140°F), or the altitude is greater than 8,000 feet (BARO less than 22.5 in-Hg), the EGR monitor cannot be run reliably. In these conditions, a timer starts to accumulate the time in these conditions. If the vehicle leaves these extreme conditions, the timer starts to decrement, and, if conditions permit, attempts to complete the EGR flow monitor. If the timer reaches 800 seconds, the EGR monitor is disabled for the remainder of the current driving cycle and the EGR monitor I/M readiness bit is set to a ready condition after one such driving cycle. Vehicles require 2 such driving cycles for the EGR monitor to be set to a ready condition.

FUEL SYSTEMS

OVERVIEW

The fuel system supplies the sequential multiport fuel injection (SFI) fuel injectors with clean fuel at a controlled pressure. The powertrain control module (PCM) controls the fuel pump and monitors the fuel pump circuit. The PCM controls the fuel injector on/off cycle duration and determines the correct timing and amount of fuel delivered. When a new fuel injector is installed it is necessary to reset the learned values contained in the keep alive memory (KAM) in the PCM. Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .

The 2 types of fuel systems used are:

- electronic returnless fuel
- mechanical returnless fuel

ELECTRONIC RETURNLESS FUEL SYSTEM (ERFS)

The ERFS consists of a fuel tank with reservoir, the fuel pump, the fuel rail pressure temperature (FRPT)

sensor, the fuel filter, the fuel supply line, the fuel rail, and the fuel injectors. For additional information on the fuel system components, refer to **ENGINE CONTROL COMPONENTS**. Operation of the system is as follows:

1. The fuel delivery system is enabled during key ON, engine OFF for 1 second and during crank or running mode once the PCM receives a crankshaft position (CKP) sensor signal.
2. The fuel pump logic is defined in the fuel system control strategy and is executed by the PCM.
3. The PCM commands a duty cycle to the fuel pump driver module (FPDM).
4. The FPDM modulates the voltage to the fuel pump (FP) required to achieve the correct fuel pressure. Voltage for the fuel pump is supplied by the power relay or FPDM power supply relay. For additional information refer to Fuel Pump Control and Fuel Pump Monitor.
5. The FRPT sensor measures the pressure and temperature of the fuel in the fuel rail. The PCM uses this information to vary the duty cycle output to the FPDM, which changes the fuel pressure, to compensate for varying loads and to avoid fuel system vaporization.
6. The fuel injector is a solenoid-operated valve that meters the fuel flow to each combustion cylinder. The fuel injector is opened and closed a constant number of times per crankshaft revolution. The amount of fuel is controlled by the length of time the fuel injector is held open. The fuel injector is normally closed, and is operated by a 12-volt source from either the electronic engine control (EEC) power relay or the fuel pump relay. The ground signal is controlled by the PCM.
7. There are 3 filtering or screening devices in the fuel delivery system. The intake filter is a fine, nylon mesh screen mounted on the intake side of the fuel pump. There is a fuel filter screen located at the fuel rail side of the fuel injector. The fuel filter assembly is located between the fuel pump and the fuel rail.
8. The fuel pump (FP) module is a device that contains the fuel pump and the fuel sender assembly. The fuel pump is located inside the reservoir and supplies fuel through the fuel pump module manifold to the engine and the fuel pump module jet pump.
9. The inertia fuel shut-off (IFS) switch is used to de-energize the fuel delivery secondary circuit in the event of a collision. The IFS switch is a safety device that should only be reset after a thorough inspection of the vehicle following a collision.

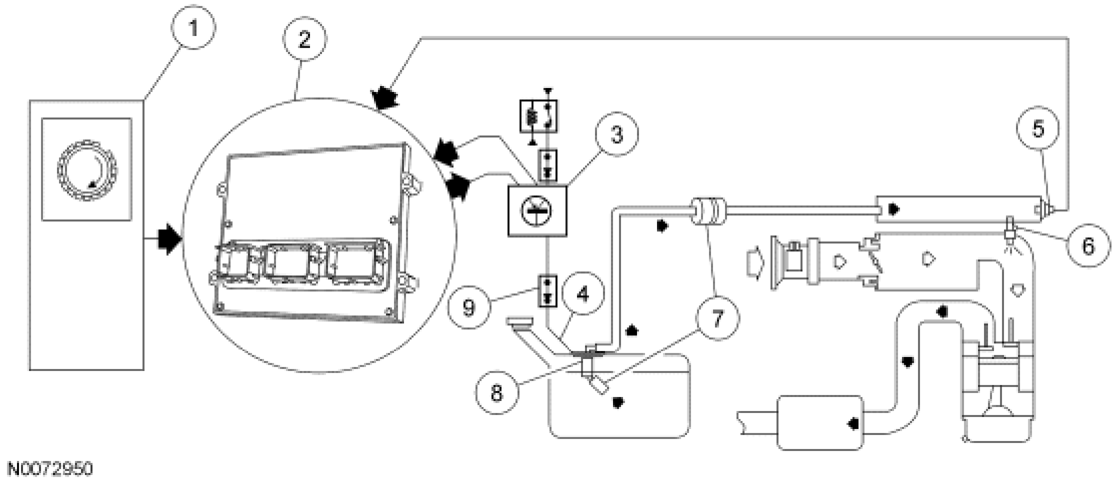

Fig. 76: Electronic Returnless Fuel System
Courtesy of FORD MOTOR CO.

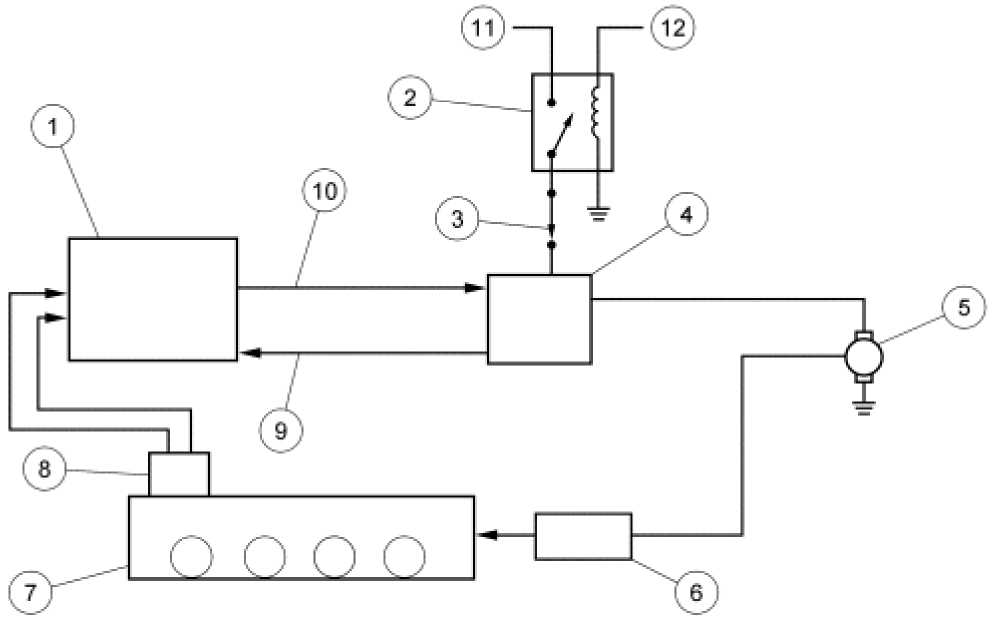

Fig. 77: Typical Electronic Returnless Fuel System Schematic
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	PCM
2	-	FPDM Relay
3	-	IFS Switch
4	-	FPDM
5	-	FP Module
6	-	Fuel Filter
7	-	Fuel Rail and Injectors
8	-	FRPT Sensor
9	-	Diagnostic
10	-	Pulse Width Modulation
11	-	Power Source
12	-	Ignition Switch

FUEL PUMP CONTROL - ERFS

NOTE: **The Mustang 5.4L uses 2 FPDMs to control fuel for the fuel delivery system. The PCM sends one FP duty cycle on the fuel pump control (FPC) circuit. This circuit is used by both FPDMs.**

The FP signal is a duty cycle command sent from the PCM to the FPDM. The FPDM uses the FP command to operate the fuel pump at the speed requested by the PCM or to turn the pump off. When the key is turned on,

the electric fuel pump runs for about 1 second and is requested off by the PCM if engine rotation is not detected

FUEL PUMP DUTY CYCLE OUTPUT FROM PCM

FP Duty Cycle Command	PCM Status	FPDM Actions
0-4%	The PCM does not output this duty cycle.	Invalid FP duty cycle. The FPDM sends 25% duty cycle signal on the fuel pump monitor (FPM) circuit. The fuel pump is off.
4-5%	Dead band range for transitions between FPDM states.	-
5-45%	Normal operation.	The FPDM operates the fuel pump at the speed requested. "FP duty cycle" x 2 equals pump speed % of full on. (for example, FP duty cycle equals 42%. 42x2 equals 84. Pump is run at 84% of full on). The FPDM sends 50% duty cycle signal on FPM circuit.
45-48%	Normal operation. An open circuit cannot be detected in this range.	The FPDM operates the fuel pump at the speed requested. "FP duty cycle" x 2 equals pump speed % of full on. The FPDM sends 50% duty cycle signal on FPM circuit.
48-51%	Normal operation.	The FPDM operates the fuel pump at full on. The FPDM sends 50% duty cycle signal on FPM circuit.
51-52%	Dead band range for transitions between FPDM states.	-
52-68%	The PCM does not output this duty cycle.	Invalid FP duty cycle. The FPDM sends 25% duty cycle signal on the FPM circuit. The fuel pump is off.
68-70%	Dead band range for transitions between FPDM states.	-
70-81%	To request the fuel pump off, the PCM outputs this duty cycle.	Valid fuel pump off command from the PCM. The FPDM does not operate the fuel pump. The FPDM sends a 50% duty cycle signal on the FPM circuit.
81-83%	Dead band range for transitions between FPDM states.	-
83-100%	The PCM does not output this duty cycle.	Invalid FP duty cycle. The FPDM sends 25% duty cycle signal on the FPM circuit. The fuel pump is off.

For additional information, refer to **POWERTRAIN CONTROL HARDWARE**, Fuel Pump Driver Module (FPDM).

FUEL PUMP MONITOR (FPM) - ERFS

NOTE: The Mustang 5.4L uses 2 FPDMs to control fuel for the fuel delivery system. The PCM individually monitors both FPDMs through the FPM and FPM2 circuits.

The FPDM communicates diagnostic information to the PCM through the FPM circuit. This information is sent by the FPDM as a duty cycle signal. The 3 duty cycle signals that may be sent are listed in the following table.

FUEL PUMP DRIVER MODULE DUTY CYCLE SIGNALS

Duty Cycle	Comments	FP_M PID[a]
50%	This duty cycle indicates that the FPDM is functioning normally.	80-125%
25%	This duty cycle indicates that the FPDM either did not receive a fuel pump (FP) duty cycle command from the PCM or did not receive a valid FP duty cycle command from the PCM.	15-60%
75%	This duty cycle indicates that the FPDM detects a concern in the circuits between the fuel pump and FPDM.	250-400%

[a] Some scan tools display the FP_M PID as the duty cycle in column 1. Other scan tools display the FP_M PID as a value shown in the FP_M PID column. This value fluctuates randomly. It is OK for the value to briefly go outside this range, then return.

For additional information, refer to **POWERTRAIN CONTROL HARDWARE**, Fuel Pump Driver Module (FPDM).

MECHANICAL RETURNLESS FUEL SYSTEM (MRFS)

The MRFS consists of a fuel tank with reservoir, the fuel pump, the fuel pressure regulator, the fuel filter, the fuel supply line, the fuel rail, the fuel rail pulse damper (if equipped), fuel injectors, and a Schrader valve/pressure test point. For additional information on the fuel system components, refer to **ENGINE CONTROL COMPONENTS**. Operation of the system is as follows:

1. The fuel delivery system is enabled during key ON, engine OFF for 1 second and during crank or running mode once the PCM receives a CKP sensor signal.
2. The fuel pump logic is defined in the fuel system control strategy and is executed by the PCM.
3. The PCM grounds the fuel pump relay, which provides power to the fuel pump.
4. The IFS switch is used to de-energize the fuel delivery secondary circuit in the event of collision. The IFS switch is a safety device that should only be reset after a thorough inspection of the vehicle following a collision.
5. A pressure test point valve, Schrader valve, is located on the fuel rail and is used to measure the fuel injector supply pressure for diagnostic procedures and repairs. On vehicles not equipped with a Schrader valve, use the Rotunda Fuel Pressure Test Kit 134-R0087 or equivalent.
6. A pulse damper is located on the fuel rail (if equipped). The pulse damper reduces the fuel system noise

caused by the pulsing of the fuel injectors. The vacuum port located on the damper is connected to manifold vacuum to avoid fuel spillage if the pulse damper diaphragm ruptures. The pulse damper should not be confused with a fuel pressure regulator.

7. The fuel injector is a solenoid-operated valve that meters the fuel flow to each combustion cylinder. The fuel injector is opened and closed a constant number of times per crankshaft revolution. The amount of fuel is controlled by the length of time the fuel injector is held open. The fuel injector is normally closed, and is operated by a 12-volt source from either the EEC power relay or the fuel pump relay. The ground signal is controlled by the PCM.
8. There are 3-5 filtering or screening devices in the fuel delivery system. For additional information refer to Fuel Filters.
9. The fuel pump (FP) module contains the fuel pump, the fuel pressure regulator, and the fuel sender assembly. The fuel pressure regulator is attached to the FP module and regulates the pressure of the fuel supplied to the fuel injectors. The fuel pressure regulator controls the pressure of the clean fuel as the fuel returns from the fuel filter. The fuel pressure regulator is a diaphragm-operated relief valve. Fuel pressure is established by a spring preload applied to the diaphragm. The FP module is located in the fuel tank.

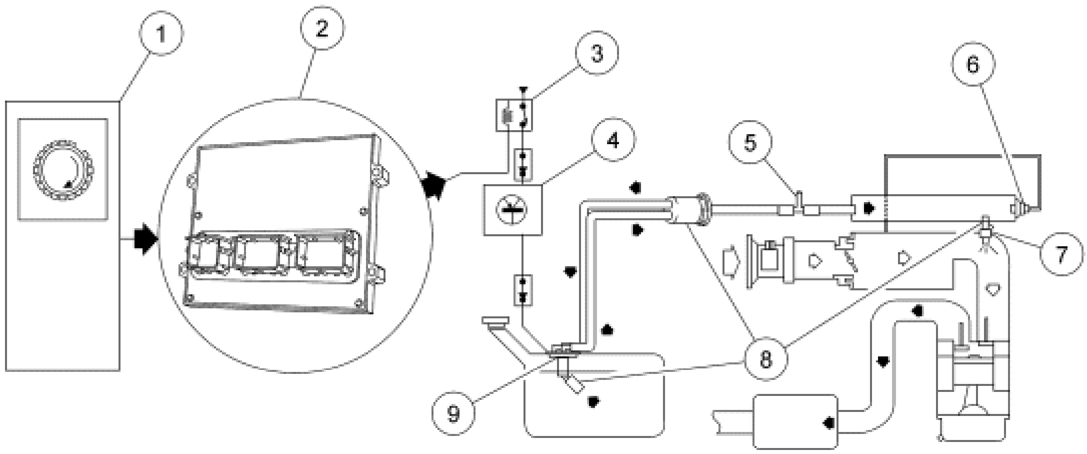

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Fig. 78: Typical Mechanical Returnless Fuel System with External Fuel Filter
Courtesy of FORD MOTOR CO.

FUEL PUMP CONTROL - MRFS

The output signal from the PCM, FP, is used to control the electric fuel pump. With the EEC power relay contacts closed, vehicle power (VPWR) is sent to the coil of the fuel pump relay. For electric fuel pump operation, the PCM grounds the FP circuit, which is connected to the coil of the fuel pump relay. This energizes the coil and closes the contacts of the relay, sending B+ through the FP PWR circuit to the electric fuel pump. When the key is turned on, the electric fuel pump runs for about 1 second and is turned off by the PCM if engine rotation is not detected.

FUEL PUMP MONITOR (FPM) - MRFS

The FPM circuit is spliced into the fuel pump power (FP PWR) circuit and is used by the PCM for diagnostic purposes. The PCM sources a low current voltage down the FPM circuit. With the fuel pump off, this voltage is pulled low by the path to ground through the fuel pump. With the fuel pump off and the FPM circuit low, the

PCM can verify that the FPM circuit and the FP PWR circuit are complete from the FPM splice through the fuel pump to ground. This also confirms that the FP PWR or FPM circuits are not short to power. With the fuel pump on, voltage is now being supplied from the fuel pump relay to the FP PWR and FPM circuits. With the fuel pump on and the FPM circuit high, the PCM can verify that the FP PWR circuit from the fuel pump relay to the FPM splice is complete. It can also verify that the fuel pump relay contacts are closed and there is a B+ supply to the fuel pump relay.

FUEL FILTERS

The system contains 3-5 filtering or screening devices. Refer to **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** for the individual component locations.

1. The fuel intake filter or screen is a fine nylon mesh filter mounted on the intake side of the fuel pump. It is part of the assembly and cannot be repaired separately.
2. The filter/screen at the fuel rail port of the injectors is part of the fuel injector assembly and cannot be repaired separately.
3. The filter/screen at fuel inlet side of the fuel pressure regulator is part of the regulator assembly and cannot be repaired separately.
4. The fuel filter assembly is located between the fuel pump and the pressure test point (Schrader valve) or injectors. This filter may be a lifetime fuel filter located in the fuel pump module or an external 3-port inline filter that allows clean fuel to return to the fuel tank. A new filter may be installed for the external filter.
5. The fuel filter sock is located on the fuel pump module between the reservoir and the fuel tank.

PRESSURE TEST POINT

On some applications there is a pressure test point with a Schrader fitting in the fuel rail that relieves the fuel pressure and measures the fuel injector supply pressure for repair and diagnostic procedures. Before repairing or diagnosing the fuel system, read any WARNING, CAUTION, and HANDLING information. On vehicles not equipped with a Schrader valve, use the Rotunda Fuel Pressure Test Kit 134-R0087 or equivalent.

IGNITION SYSTEMS

OVERVIEW

The ignition system is designed to ignite the compressed air/fuel mixture in an internal combustion engine by a high voltage spark delivered from an ignition coil controlled by the powertrain control module (PCM).

INTEGRATED ELECTRONIC IGNITION SYSTEM

NOTE: **Electronic ignition engine timing is entirely controlled by the PCM. Electronic ignition engine timing is not adjustable. Do not attempt to check base timing. You will receive false readings.**

The integrated electronic ignition system consists of a crankshaft position (CKP) sensor, coil pack(s), connecting wiring, and a PCM. For additional information on the ignition system components, refer to

ENGINE CONTROL COMPONENTS. The coil on plug (COP) integrated electronic ignition system uses a separate coil per spark plug, and each coil is mounted directly onto the plug. The COP integrated electronic ignition system eliminates the need for spark plug wires, but does require input from the camshaft position (CMP) sensor. Operation of the components are as follows:

1. The CKP sensor is used to indicate the crankshaft position and speed by sensing a missing tooth on a pulse wheel mounted to the crankshaft. The CMP sensor is used by the COP integrated electronic ignition system to identify the compression stroke of cylinder 1 and to synchronize the firing of the individual coils.
2. The PCM uses the CKP signal to calculate a spark target and then fires the coil pack(s) to that target shown. The PCM uses the CMP sensor to identify the compression stroke of cylinder 1, and to synchronize the firing of the individual coils.
3. The PCM controls the ignition coils after it calculates the spark target. The COP system fires only one spark plug per coil upon synchronization during the compression stroke. For the coil pack ignition system, each coil within a pack fires 2 spark plugs at the same time. The plugs are paired so that as one fires during the compression stroke the other fires during the exhaust stroke. The next time the coil is fired the situation is reversed.

   The current flow, or dwell, through the primary ignition coil is controlled by the PCM by providing a switched ground path through the ignition coil driver to ground. When the ignition coil driver is switched on, current rapidly builds up to a maximum value, determined by the coil inductance and resistance. When the current is switched off, the magnetic field collapses which induces a secondary high voltage surge and the spark plug is fired. This high voltage surge creates a fly back voltage which the PCM uses as a feedback during the ignition diagnostics. The PCM uses the charge current dwell time characteristics to carry out the ignition diagnostics.

4. The PCM processes the CKP signal and uses it to drive the tachometer as the clean tach out (CTO) signal.

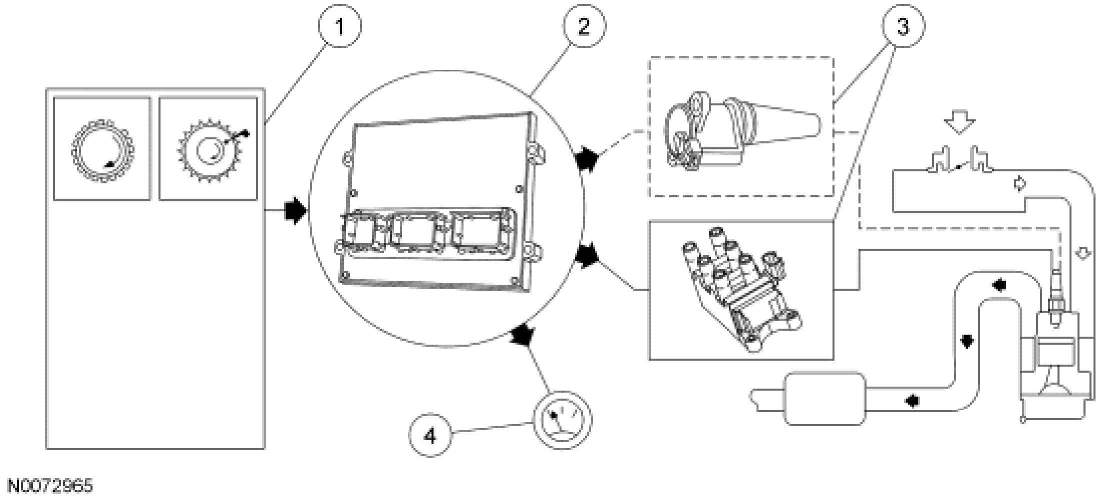

Fig. 79: Integrated Electronic Ignition System
Courtesy of FORD MOTOR CO.

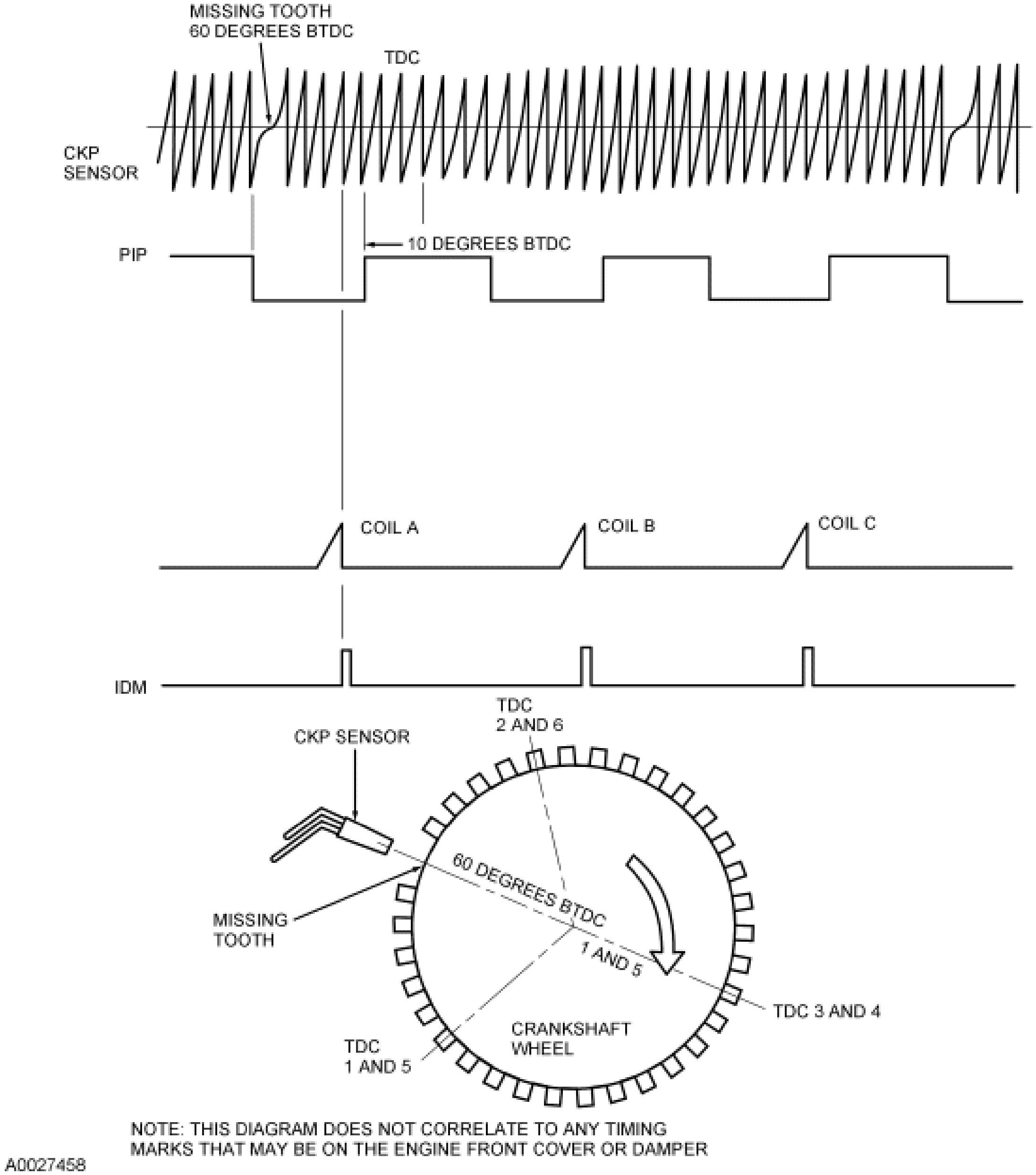

Fig. 80: Six Cylinder Integrated Electronic Ignition Waveforms (4, 8, And 10-Cylinder Are Similar)
Courtesy of FORD MOTOR CO.

ENGINE CRANK/ENGINE RUNNING

During engine crank the PCM fires 2 spark plugs simultaneously. Of the 2 plugs simultaneously fired one will be under compression the other will be on the exhaust stroke. Both plugs fire until camshaft position is identified by a successful CMP sensor signal. Once camshaft position is identified only the cylinder under compression is fired.

CMP FMEM

During CMP FMEM the COP ignition works the same as during engine crank. This allows the engine to operate without the PCM knowing if cylinder one is under compression or exhaust.

INTAKE AIR SYSTEMS

OVERVIEW

The intake air system provides clean air to the engine, optimizes air flow, and reduces unwanted induction noise. The intake air system consists of an air cleaner assembly, resonator assemblies, and hoses. Some vehicles use a hydrocarbon filter trap to help reduce emissions by preventing fuel vapor from escaping into the atmosphere from the intake when the engine is off. It is typically located inside the air intake system. The mass air flow (MAF) sensor is attached to the air cleaner assembly and measures the volume of air delivered to the engine. The hydrocarbon trap is part of the EVAP system. For more information on the EVAP system, refer to **EVAPORATIVE EMISSION (EVAP) SYSTEMS**. The MAF sensor can be replaced as an individual component. The intake air system also contains a sensor that measures the intake air temperature (IAT), which is also integrated with the MAF sensor. For additional information on the intake air system components, refer to **ENGINE CONTROL COMPONENTS**. Intake air components can be separate components or part of the intake air housing. The function of a resonator is to reduce induction noise. The intake air components are connected to each other and to the throttle body assembly with hoses.

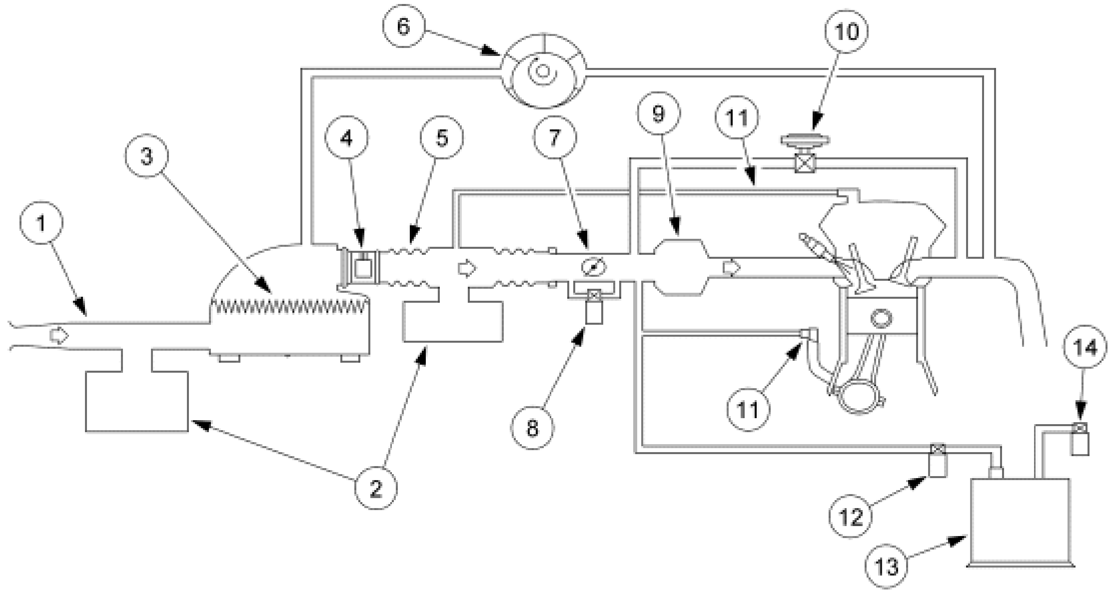

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Fig. 81: Typical Intake Air System
Courtesy of FORD MOTOR CO.

Intake Air System	Component
1	Air Cleaner Intake Pipe
2	Intake Air Resonator
3	Air Cleaner Element
4	Mass Air Flow/Intake Air Temperature
5	Air Cleaner Outlet

6	Secondary AIR Pump (if equipped)
7	Throttle Body
8	Idle Air Control
9	Upper Intake Manifold
10	Exhaust Gas Recirculation (EGR)
11	Positive Crankcase Ventilation (PCV)
12	Evaporative Emission Canister Purge Valve
13	Evaporative Emission Canister
14	Evaporative Emission Canister Vent (CV) Solenoid

THROTTLE BODY SYSTEM OVERVIEW

NOTE: This overview is for applications without electronic throttle control (ETC). For ETC applications, refer to TORQUE BASED ELECTRONIC THROTTLE CONTROL (ETC).

NOTE: The traditional idle air adjust procedure and the throttle return screw are no longer used on OBD applications.

The throttle body system meters air to the engine during idle, part throttle, and wide open throttle (WOT) conditions. The throttle body system consists of an idle air control (IAC) valve assembly, an idle air orifice, single or dual bores with butterfly valve throttle plates, and a throttle position (TP) sensor. One other source of idle air flow is the positive crankcase ventilation (PCV) system. The combined idle air flow (from idle air orifice IAC flow and PCV flow) is measured by the MAF sensor on all applications.

During idle, the throttle body assembly provides a set amount of air flow to the engine through the idle air passage and the PCV valve. The IAC valve assembly provides additional air when commanded by the powertrain control module (PCM) to maintain the correct engine idle speed under varying conditions. The IAC valve assembly mounts directly to the intake manifold assembly in most applications. Idle speed is controlled by the PCM and cannot be adjusted.

Throttle rotation is controlled by a cam/cable linkage to slow the initial opening rate of the throttle plate. The TP sensor monitors the throttle position and provides a signal to the PCM. Some throttle body applications provide an air supply channel upstream of the throttle plate to provide fresh air to the PCV or IAC systems. Other throttle body applications provide individual vacuum taps downstream of the throttle plate for PCV return, exhaust gas recirculation (EGR), evaporative emission (EVAP), and miscellaneous control signals.

Throttle Body System Hardware - The major components of the throttle body assembly include the TP sensor, the IAC valve assembly, and the throttle body housing assembly. For additional information on the intake air system components, refer to **ENGINE CONTROL COMPONENTS**.

Throttle Body Housing - The throttle body housing assembly is a single piece aluminum or plastic casting with an air passage and a butterfly throttle plate with linkage mechanisms. When the throttle plate is in the idle (or closed) position, the throttle lever arm should be in contact with the throttle return stop. The throttle return stop prevents the throttle plate from contacting the bore and sticking closed. The setting also establishes the amount

of air flow between the throttle plate and bore. To minimize the closed plate air flow, a special coating is applied to the throttle plate and bore to help seal this area. This sealant/coating also makes the throttle body resistant to engine intake sludge accumulation.

Features of the Throttle Body Assembly include:

1. IAC valve assembly mounted directly to the throttle body assembly (some vehicles).
2. A pre-set stop to locate the WOT position.
3. An air supply channel upstream of the throttle plate to provide fresh air to the PCV system (some vehicles only).
4. Individual vacuum taps for PCV, EGR, EVAP and miscellaneous control signals (some vehicles only).
5. PCV air return (if applicable).
6. A throttle body-mounted TP sensor.
7. A sealant/coating on the throttle bore and throttle plate makes the throttle body air flow tolerant to engine intake sludge accumulation. These throttle body assemblies must not be cleaned and have a white/black attention decal advising not to clean.
8. A non-adjustable stop screw for close plate idle air flow.

OVERVIEW OF THE INTAKE MANIFOLD RUNNER CONTROL (IMRC) AND INTAKE MANIFOLD TUNING VALVE (IMTV) SYSTEMS

There are 3 basic types of intake air sub-systems:

- IMRC electric actuated system
- IMRC vacuum actuated system
- IMTV

There are several different styles of hardware used to control airflow within the engine air intake system. In general, the devices are defined based on whether they control in-cylinder motion (charge motion) or manifold dynamics (tuning).

The IMRC is a charge motion device that modifies the air charge motion in the manifold. The IMRC control valve is located close to the intake valve/cylinder head. The IMRC actuator can be either electric or vacuum controlled. The IMRC system must have a monitor feedback system in order to meet OBD-II regulations.

The IMTV is a manifold tuning device that effects the air flow volume of the manifold by connecting multiple plenums or inlets within the manifold system. The IMTV control valve is located in the center of the intake manifold away from the intake valve or cylinder head. The IMTV actuator can be either electric or vacuum controlled. The IMTV system does not have to be monitored for OBD-II regulations.

Some vehicles may use both systems.

These subsystems are used to provide increased intake airflow to improve torque, emissions and performance. The overall volume of air metered to the engine is controlled by the throttle body. Vehicles equipped with electronic throttle control (ETC) do not use idle air control (IAC).

INTAKE MANIFOLD RUNNER CONTROL (IMRC) ELECTRIC ACTUATED SYSTEM

WARNING: Substantial opening and closing torque is applied by this system. To prevent injury, be careful to keep fingers away from lever mechanisms when actuated. Failure to follow these instructions may result in personal injury.

The IMRC electric actuated system consists of a remote mounted motorized actuator with an attaching linkage for each housing on each bank. For additional information on IMRC components, refer to **ENGINE CONTROL COMPONENTS**. The linkage attaches to the housing butterfly plate levers. Some variations can have either 2 intake air passages for each cylinder with one passageway that is always open and the other is opened and closed with a butterfly valve plate. The other type has a butterfly valve with a small passageway that opens up into a larger size orifice when the butterfly plates are opened. The butterfly valve plates are opened and closed by an electric motor and the motorized actuator houses an internal switch or switches, depending on the application, to provide feedback to PCM indicating the butterfly valve plate position. If the IMRC system is not working correctly then a DTC is set.

Below approximately 3,000 RPM, the motorized actuator is not energized. This allows the linkage to fully extend and the butterfly valve plates to remain closed. Above approximately 3,000 RPM the motorized actuator is energized. The attaching linkage pulls the butterfly valve plates into the open position. Some vehicles activate the IMRC near 1,500 RPM.

1. The PCM uses the TP sensor and CKP signals to determine activation of the IMRC system. There must be a positive change in voltage from the TP sensor along with the increase in RPM to open the valve plates.
2. The PCM uses the information from the input signals to control the IMRC motorized actuator based upon RPM and changes in the throttle position.
3. The PCM energizes the actuator to open the butterfly plates.
4. The IMRC housing contains butterfly plates to allow increased air flow.

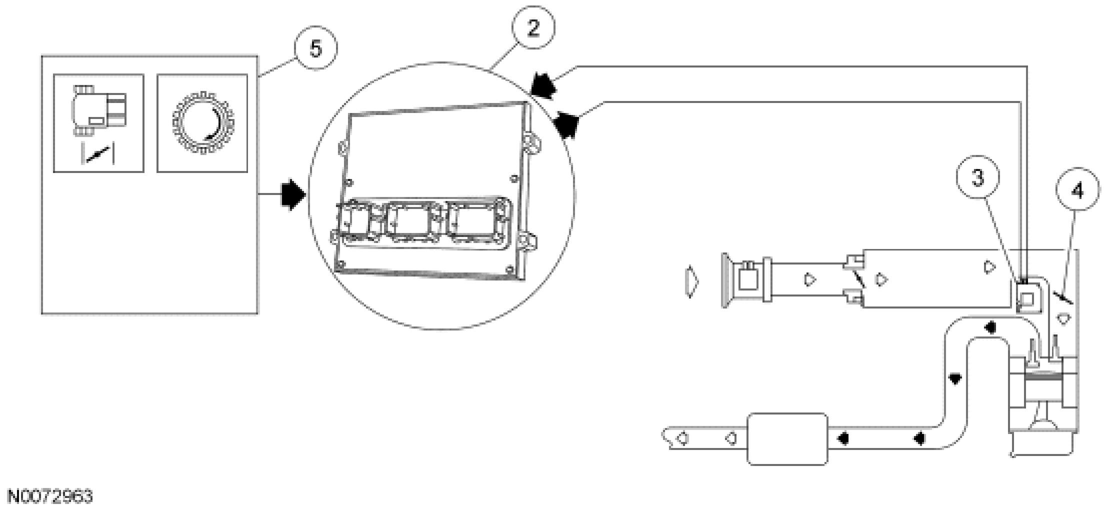

Fig. 82: Intake Manifold Runner Control (IMRC) Electric Actuated System
Courtesy of FORD MOTOR CO.

INTAKE MANIFOLD RUNNER CONTROL (IMRC) VACUUM ACTUATED SYSTEM

WARNING: **Substantial opening and closing torque is applied by this system. To prevent injury, be careful to keep fingers away from lever mechanisms when actuated. Failure to follow these instructions may result in personal injury.**

The IMRC vacuum actuated system consists of a manifold mounted vacuum actuator and a PCM controlled electric solenoid. For additional information on IMRC vacuum actuated components, refer to **ENGINE CONTROL COMPONENTS**. The linkage from the actuator attaches to the manifold butterfly plate lever. The IMRC actuator and manifold are composite/plastic with a single intake air passage for each cylinder. The passage has a butterfly valve plate that blocks a large percentage of the opening when actuated, leaving the top of the passage open to generate turbulence. The housing uses a return spring to hold the butterfly valve plates open. The vacuum actuator houses an internal monitor circuit to provide feedback to the PCM indicating the butterfly valve plate position.

Below approximately 3,000 RPM, the vacuum solenoid is energized. This allows manifold vacuum to be applied and the butterfly valve plates to remain closed. Above approximately 3,000 RPM, the vacuum solenoid is de-energized. This allows vacuum to vent from the actuator and the butterfly valve plates to open.

1. The PCM monitors the TP sensor, CHT, and CKP signals to determine activation of the IMRC system. There must be a positive change in voltage from the TP sensor along with the increase in RPM at the correct engine temperature to open the valve plates.
2. The PCM uses the information from the input signals to control the IMRC electric solenoid based upon changes in the throttle position, the engine temperature, and the RPM.
3. The PCM energizes the solenoid with the key on and the engine running. Vacuum is then applied to the actuator to pull the butterfly plates closed.

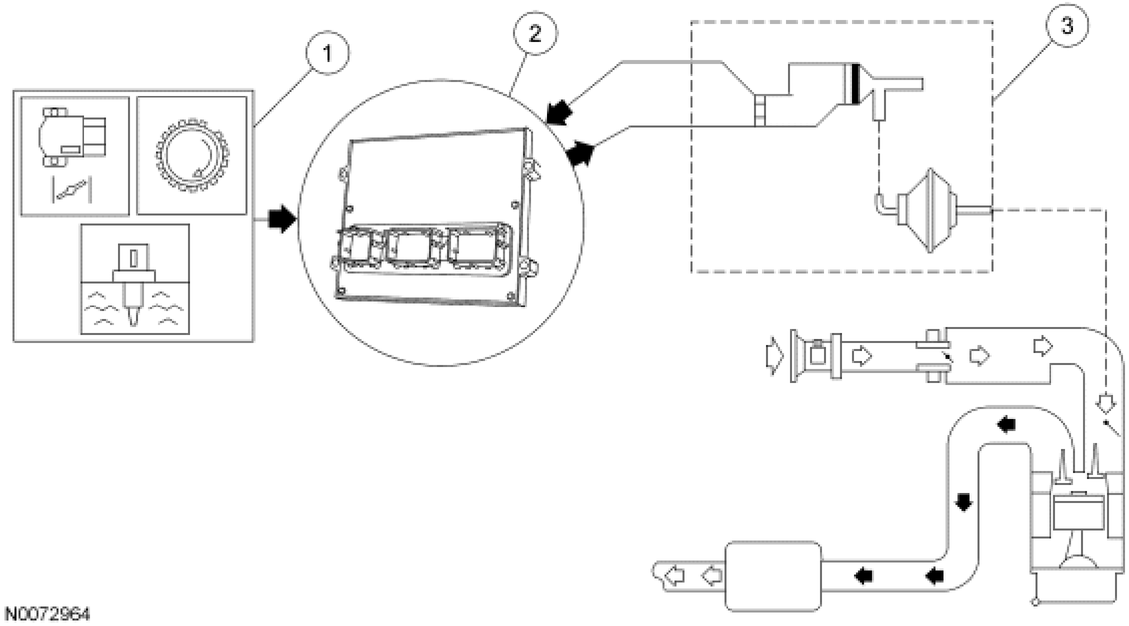

Fig. 83: Intake Manifold Runner Control (IMRC) Vacuum Actuated System

Courtesy of FORD MOTOR CO.

INTAKE MANIFOLD TUNING VALVE (IMTV) SYSTEM

WARNING: **Substantial opening and closing torque is applied by this system. To prevent injury, be careful to keep fingers away from lever mechanisms when actuated. Failure to follow these instructions may result in personal injury.**

The IMTV is a motorized actuated unit mounted directly to the intake manifold. For additional information on IMTV components, refer to **ENGINE CONTROL COMPONENTS**.

The motorized IMTV unit is not energized below approximately 2,600 RPM. The shutter is in the closed position not allowing airflow blend to occur in the intake manifold. Above approximately 2,600 RPM the motorized unit is energized. The motorized unit is commanded on by the PCM initially at a 100 percent duty cycle to move the shutter to the open position, and then falling to approximately 50 percent to continue to hold the shutter open.

1. The PCM uses the TP sensor and CKP signals to determine activation of the IMTV system. There must be a positive change in voltage from the TP sensor along with the increase in RPM to open the shutter.
2. The PCM uses the information from the input signals to control the IMTV.
3. When commanded on by the PCM, the motorized actuator shutter opens up the end of the vertical separating wall at high engine speeds to allow both sides of the manifold to blend together.

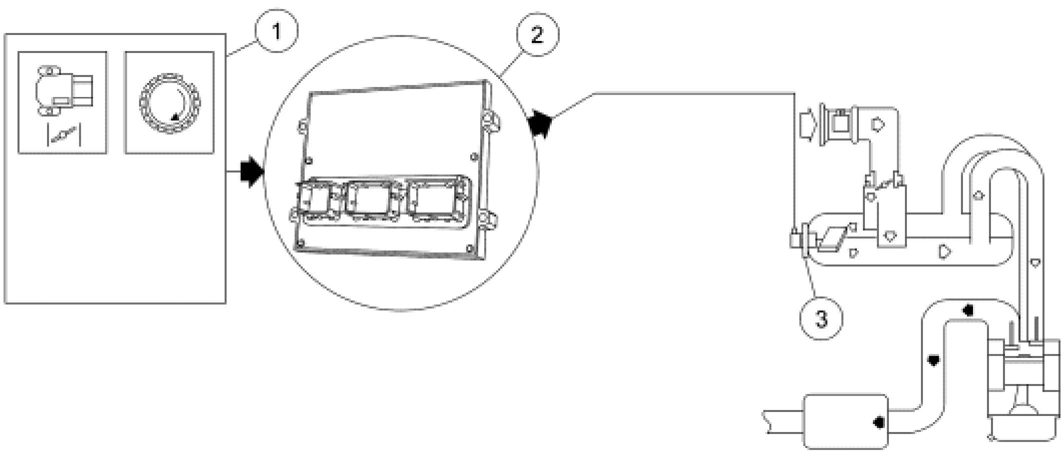

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Fig. 84: Intake Manifold Tuning Valve (IMTV)
Courtesy of FORD MOTOR CO.

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

OVERVIEW

The PCV system cycles crankcase gases back through the intake air system into the engine where they are

burned. The PCV valve regulates the amount of ventilated air and blow-by gases to the intake manifold.

Currently, both heated and non-heated PCV systems are used. The heated systems use either a water heated valve, an electrically heated valve, or an electrically heated tube. Engine coolant flows around the water heated valve to prevent it from freezing. Electrically heated systems use a heating element enclosed in the PCV valve, PCV fitting or the PCV tube to prevent the valve or tube from freezing. The valve or the tube heater can be controlled by either the powertrain control module (PCM) or the thermal harness.

- Thermal harness controlled heater - On vehicle applications that are equipped with a thermal harness to the PCV valve or tube. The thermal harness only provides electrical continuity to the heating element when temperatures are less than 5°C +/- 4°C (40°F +/- 7°F). Typically this harness is located close to the PCV valve or tube.
- PCM controlled heater - On these applications the PCV heater is turned on by the PCM. When the intake air temperature is less than 0°C (32°F) the PCM grounds the positive crankcase ventilation valve heater control (PCVHC) circuit and turns the heater ON. When the intake air temperature exceeds 9°C (48°F) the heater is turned OFF. The PCV heater is also OFF when the engine is not running to prevent unnecessary battery drain. The heater is also OFF if the vehicle charging system is greater than 16 volts. This minimizes heater element overload.

PCV systems that comply with OBD PCV monitoring requirements use a quarter-turn cam-lock thread design at one end to prevent accidental disconnection from the valve cover. For more information about the PCV monitor refer to **POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM MONITOR**.

PCV Types

Heated Tubes

- PCM-controlled (no thermistor in harness)
- non-PCM controlled (thermistor in harness)

PCV Valves

- water heated
- non-heated
- PCM-controlled
- non-PCM controlled electrically heated thermistor in harness

Refer to the following figures for examples of these types of PCV valves.

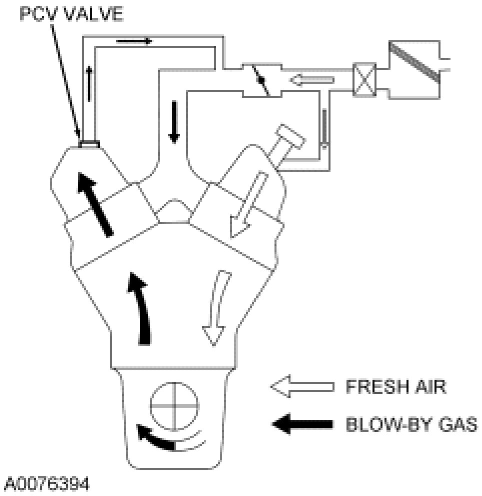

Fig. 85: Identifying Typical PCV System For V-Engine
Courtesy of FORD MOTOR CO.

HARDWARE

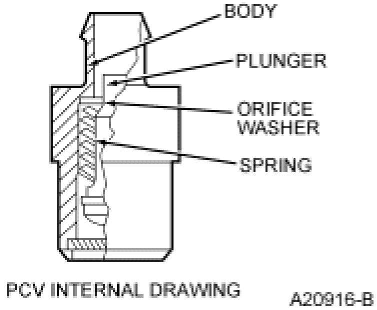

Fig. 86: Typical PCV Internal Drawing
Courtesy of FORD MOTOR CO.

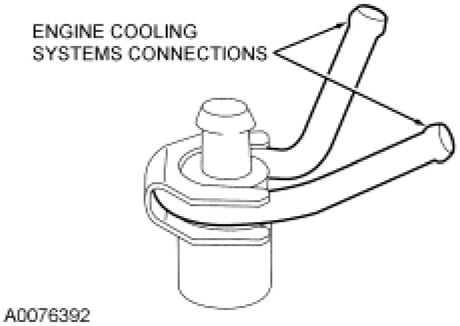

Fig. 87: Identifying Water Heated PCV
Courtesy of FORD MOTOR CO.

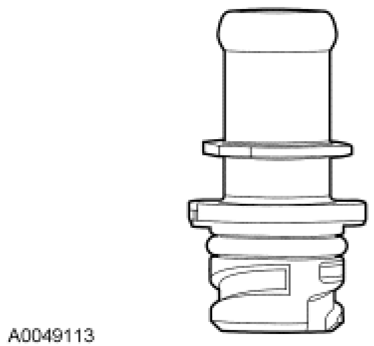

Fig. 88: Quarter-Turn Cam-Lock Design PCV
Courtesy of FORD MOTOR CO.

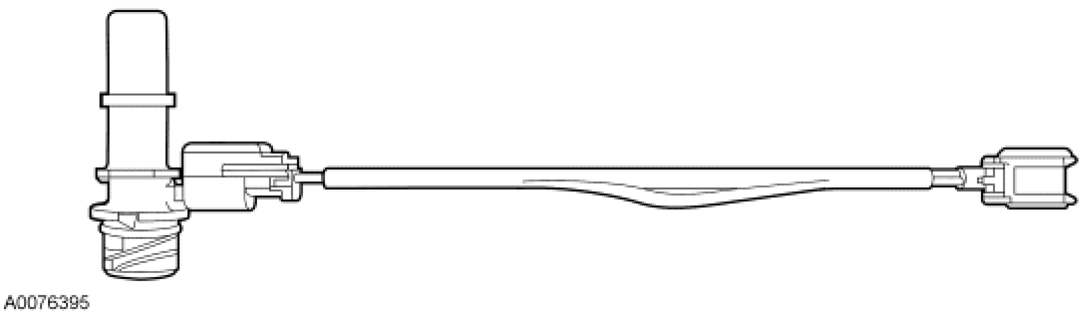

Fig. 89: Electrically Heated PCV (With Thermal Harness)
Courtesy of FORD MOTOR CO.

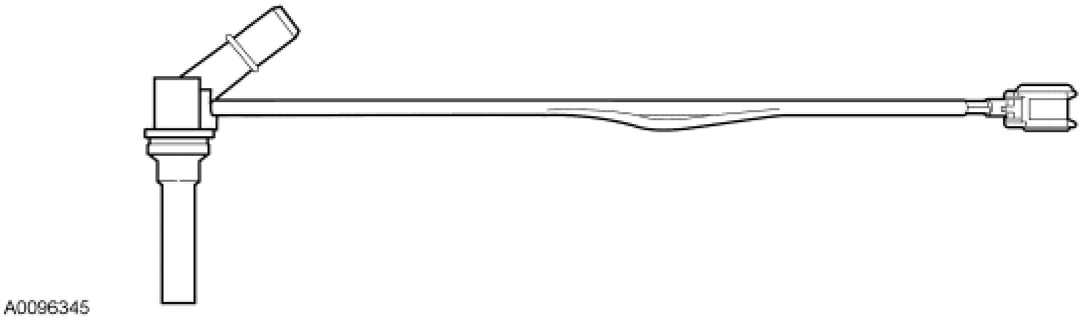

Fig. 90: Electrically Heated PCV Tube (With Thermal Harness)
Courtesy of FORD MOTOR CO.

POWERTRAIN CONTROL MODULE (PCM) CONTROLLED CHARGING SYSTEM

OVERVIEW

NOTE:	**When the battery (or PCM) is disconnected and connected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The charging system set point may also vary. The vehicle may need to be driven to relearn its strategy.**

The PCM-controlled charging system provides many additional benefits over the current integral generator regulator system. The first benefit is improved battery life. In a PCM-controlled charging system, the regulator voltage set point is determined by the PCM and communicated to the regulator through the generator regulator control (GENRC) circuit. The PCM uses an algorithm to estimate battery temperature. Improving battery temperature estimates reduces battery damage caused by over- and undercharging.

The second benefit is improved engine performance. Whenever the PCM senses a wide open throttle (WOT) condition, the PCM momentarily lowers the regulator voltage set point. This reduces the torque load of the generator on the engine and improves acceleration. The PCM has a calibratable time limit on this reduced voltage feature. This is to prevent the generator output from being cut back for an extended WOT period, which could cause battery discharge.

The third benefit is improved idle stability. In response to the PCM GENRC signal, the regulator uses a generator load input (GENLI) signal to provide feedback to the PCM. The GENLI signal provides the PCM with charging system information. Specifically, it lets the PCM know when the charging system receives a transient electrical load which would normally affect idle stability. Because the PCM can anticipate additional loads, actions can be taken to minimize idle sag. The PCM can choose to either reduce the regulator set point or increase engine idle speed, both of which are calibratable features. In order to establish whether the regulator is accurately maintaining the desired voltage set point, the regulator uses a charging system voltage line to sense battery voltage.

The fourth benefit is reduced cranking efforts. The PCM can reduce the mechanical load on the starter by initially commanding a low voltage set point. This may improve start times.

If the PCM detects a charging system error, it broadcasts a low voltage telltale (ON) network communication message which tells the cluster to illuminate the charge indicator. The charge indicator is illuminated if the PCM does not see a signal on the GENLI circuit for a time period greater than 500 milliseconds. This telltale command is also used to indicate over-voltage conditions detected by the PCM-controlled generator.

Each time the ignition switch is cycled to the run position, the instrument cluster initiates a bulb check by illuminating the charge indicator. It is the responsibility of the PCM to issue a low voltage telltale (OFF) command if the charging system is functioning correctly. This message should be sent during the network initialization in the voluntary phase (250 milliseconds to 450 milliseconds after the ignition switch is cycled to the run position). If a low voltage telltale (OFF) communications network message is not received, the instrument cluster continues to illuminate the charge indicator indefinitely.

SECONDARY AIR INJECTION (AIR) SYSTEM

OVERVIEW

The secondary AIR system controls emissions during the first few seconds of engine operation by forcing air downstream into the exhaust manifolds to oxidize the hydrocarbons and carbon monoxide created by running rich at start up.

SECONDARY AIR SYSTEM

The secondary AIR system consists of an secondary AIR pump, check air injection diverter (AIR diverter)

valve, an secondary AIR bypass solenoid, an AIR relay, a powertrain control module (PCM) and connecting wires, and vacuum hoses. For additional information on the secondary AIR system components, refer to **ENGINE CONTROL COMPONENTS**.

1. The PCM requires engine coolant temperature (ECT) or cylinder head temperature (CHT), mass air flow/intake air temperature (MAF/IAT), and crankshaft position (CKP) sensor inputs to initiate the secondary air injection function.
2. When the engine is started, the strategy determines when to enable the secondary AIR pump. The PCM signals the AIR relay and the AIR bypass solenoid, after a 5 to 15 second delay, to begin system operation. Once the catalyst is lit-off, the PCM then signals the AIR relay to stop secondary AIR pump operation and to close the AIR bypass solenoid from supplying vacuum to the AIR diverter valve.
3. The AIR relay provides the start-up signal and switches the high current required to operate the secondary AIR pump.
4. The AIR bypass solenoid applies a vacuum to the AIR diverter valve(s) causing it to open and to allow air to flow into the exhaust manifolds.
5. The secondary AIR pump draws dry filtered air from the intake air system downstream of the MAF/IAT sensor.
6. The secondary AIR pump delivers the required amount of air to control emissions during engine operation. Air is forced into the exhaust manifolds to oxidize the hydrocarbons and carbon monoxide created by running rich at start up.

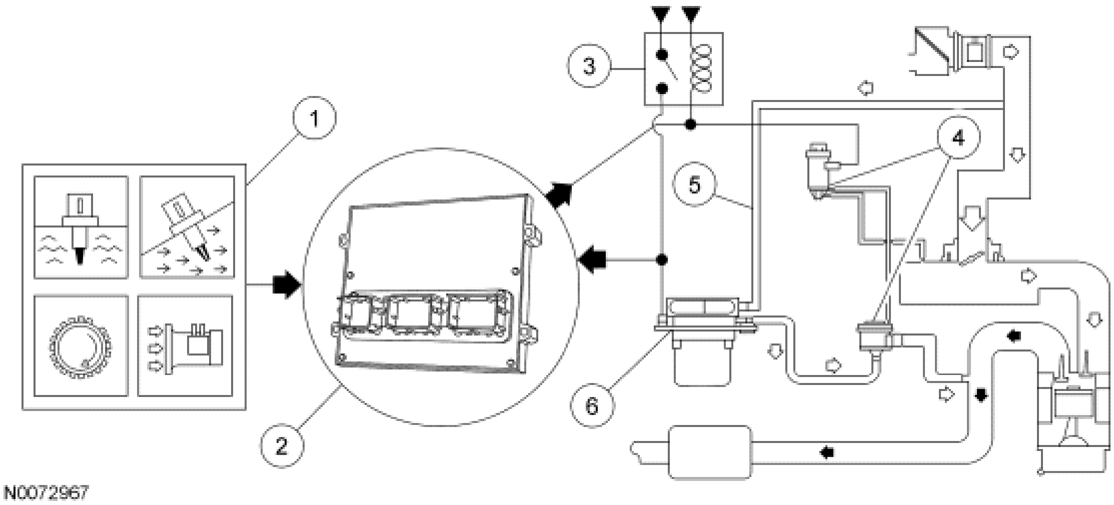

Fig. 91: Secondary Air Injection (AIR) System
Courtesy of FORD MOTOR CO.

SUPERCHARGER AND CHARGE AIR COOLER (CAC) SYSTEMS

SUPERCHARGER ASSEMBLY

The supercharger assembly is a positive displacement pump. The supercharger will supply an excess volume of intake air to the engine by increasing air pressure and density in the intake manifold. The supercharger assembly incorporates the bypass system to reduce air handling losses when boost is not required, resulting in better fuel economy. When integrated on the engine the supercharger increases torque across the entire engine operating

range from 25 to 50 percent without compromising driveability or emissions. The supercharger is matched to the engine by its displacement, and belt ratio and can provide excess airflow at any engine speed. It contains 2 screw-type 3-lobed rotors. The helical shape of the rotors and specialized porting provide a smooth discharge flow and a low level of noise during operation. The rotors are supported by ball bearings in front and needle bearings at the rear.

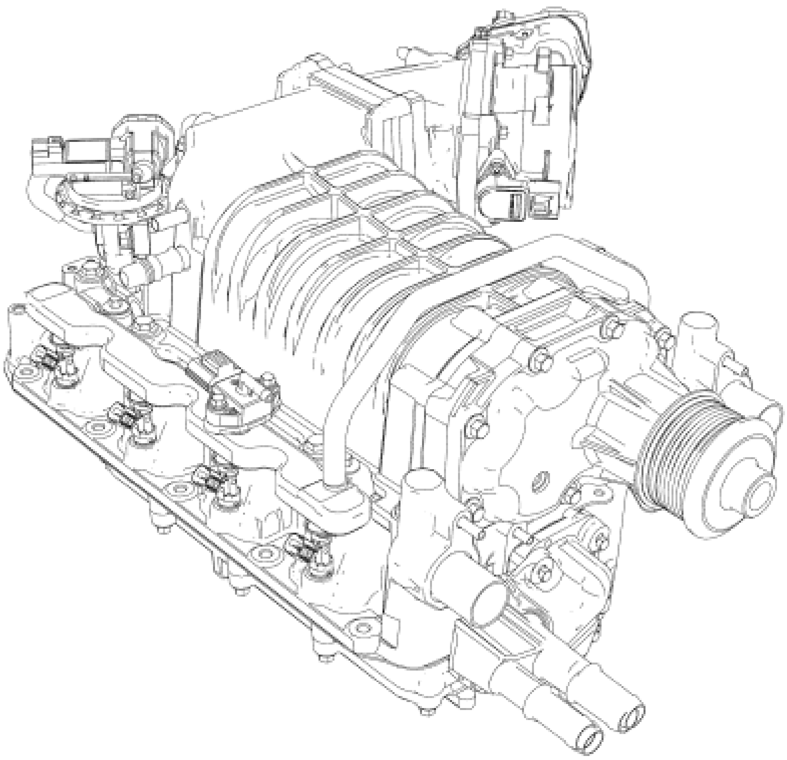

Fig. 92: 5.4L Supercharger Assembly
Courtesy of FORD MOTOR CO.

SUPERCHARGER BYPASS (SCB) SYSTEM

The SCB system allows the high pressure air at the outlet of the supercharger to vent back into the inlet of the supercharger, equalizing the pressure. This eliminates the boost (increased pressure that the supercharger produces) for times when supercharger function is undesirable. The system uses a vacuum bypass actuator, which controls the bypass valve inside the supercharger. The system normally operates with engine vacuum applied to the upper port of the vacuum bypass actuator, while the lower port references the air pressure in the clean air tube to cancel out any pressure difference in the intake air system. The actuator is set to open (bypassing the supercharger) during high vacuum engine conditions. As the throttle is opened and engine vacuum decreases, the actuator closes to allow the supercharger to pressurize the air in the manifold.

CHARGE AIR COOLER (CAC) SYSTEM

The CAC system is designed to cool the intake air which has been heated by the supercharger. The removal of heat from the pressurized air going into the CAC increases the air density which improves combustion efficiency, engine horsepower, and torque. The system consists of an additional CAC radiator in the grille, a reservoir (independent from the engine cooling system), an electric water pump, the CAC located in the lower

intake manifold, and tubing to interconnect these components. The CAC is positioned after the supercharger directly in the flow of the intake air. As the heated air flows through the CAC, heat is transferred to the coolant which is circulated back to the CAC radiator to be cooled by the airflow through the grille. The CAC pump is controlled by the powertrain control module (PCM). The PCM maintains a desirable intake air temperature by monitoring a second intake air temperature (IAT2) sensor in the lower intake manifold.

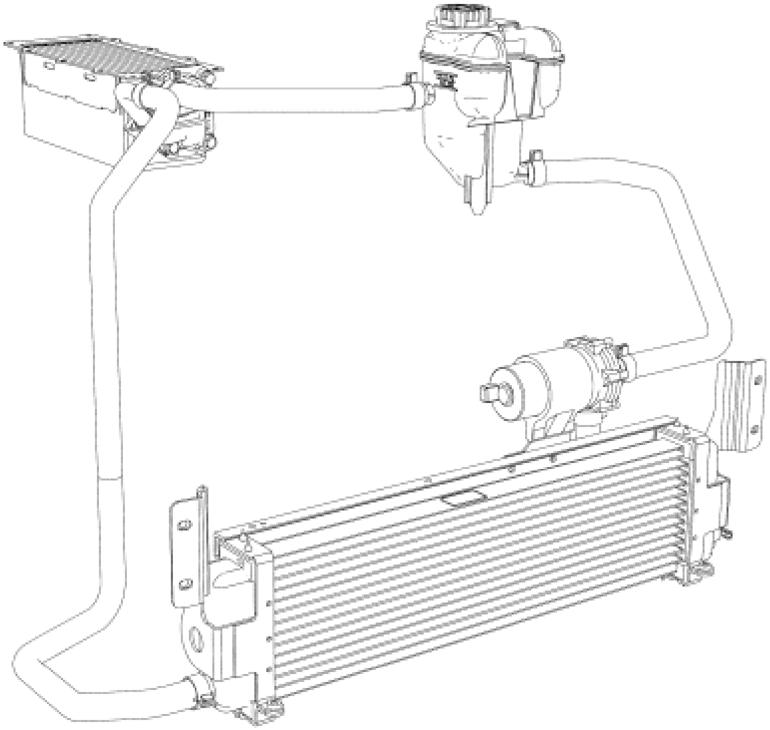

Fig. 93: Charge Air Cooler (CAC) System
Courtesy of FORD MOTOR CO.

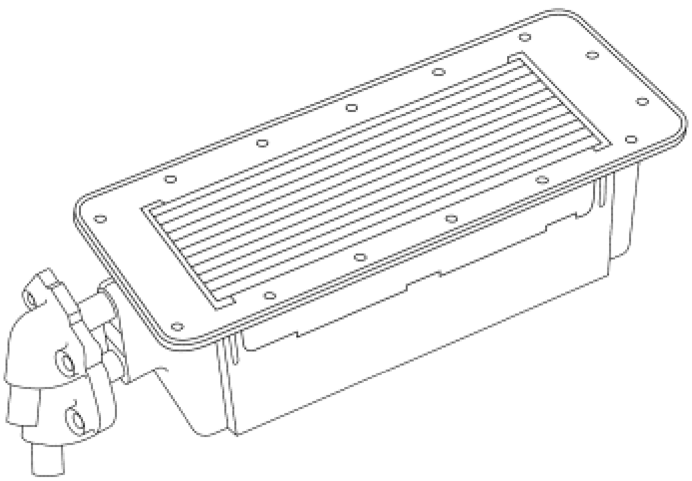

Fig. 94: Charge Air Cooler (CAC)
Courtesy of FORD MOTOR CO.

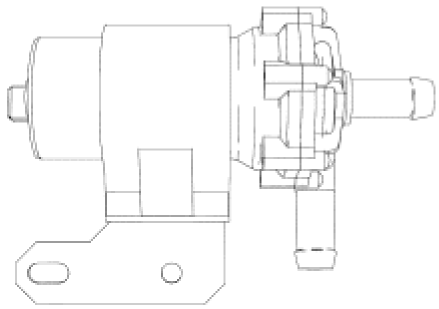

Fig. 95: Charge Air Cooler (CAC) Pump
Courtesy of FORD MOTOR CO.

TORQUE BASED ELECTRONIC THROTTLE CONTROL (ETC)

OVERVIEW

The torque based ETC is a hardware and software strategy that delivers an engine output torque (via throttle angle) based on driver demand (pedal position). It uses an electronic throttle body, the powertrain control module (PCM), and an accelerator pedal assembly to control the throttle opening and engine torque.

Torque based ETC enables aggressive automatic transmission shift schedules (earlier upshifts and later downshifts). This is possible by adjusting the throttle angle to achieve the same wheel torque during shifts, and by calculating this desired torque, the system prevents engine lugging (low RPM and low manifold vacuum) while still delivering the performance and torque requested by the driver. It also enables many fuel economy/emission improvement technologies such as variable camshaft timing (VCT) (deliver same torque during transitions).

Torque based ETC also results in less intrusive vehicle and engine speed limiting, along with smoother traction control.

Other benefits of ETC are:

- eliminate cruise control actuators
- eliminate idle air control (IAC) valve
- better airflow range
- packaging (no cable)
- more responsive powertrain at altitude and improved shift quality

The ETC system illuminates a powertrain malfunction indicator (wrench) on the instrument cluster when a concern is present. Concerns are accompanied by diagnostic trouble codes (DTCs) and may also illuminate the malfunction indicator lamp (MIL).

ELECTRONIC THROTTLE BODY (ETB)

The ETB has the following characteristics:

- The throttle actuator control (TAC) motor is a DC motor controlled by the PCM (requires 2-wires).
- There are 2 designs: parallel and inline. The parallel design has the motor under the bore parallel to the plate shaft. The motor housing is integrated into the main housing. The inline design has a separate motor housing.
- An internal spring is used in both designs to return the throttle plate to a default position. The default position is typically a throttle angle of 7 to 8 degrees from the hard stop angle.
- The closed throttle plate hard stop is used to prevent the throttle from binding in the bore (approximately 0.75 degree). This hard stop setting is not adjustable and is set to result in less airflow than the minimum engine airflow required at idle.
- The required idle airflow is provided by the plate angle in the throttle body assembly. This plate angle controls idle, idle quality, and eliminates the need for an IAC valve.
- There is 1 reference voltage and 1 signal return circuit between the PCM and the ETB. The reference voltage circuit and the signal return circuit is shared with the reference voltage circuits and signal return circuits used by the APP sensor. There are also 2 TP signal circuits for redundancy. The redundant TP signals are required for increased monitoring reasons. The first TP signal (TP1) has a negative slope (increasing angle, decreasing voltage) and the second signal (TP2) has a positive slope (increasing angle, increasing voltage). The TP2 signal reaches a limit of approximately 4.5 volts at approximately 45 degrees of throttle angle.

ACCELERATOR PEDAL POSITION (APP) SENSOR

Depending on the application either a 2-track or 3-track APP sensor is used. For additional information on the APP sensor, refer to **ENGINE CONTROL COMPONENTS**.

ELECTRONIC THROTTLE CONTROL (ETC) SYSTEM STRATEGY

The torque based ETC strategy was developed to improve fuel economy and to accommodate variable camshaft timing (VCT). This is possible by not coupling the throttle angle to the driver pedal position. Uncoupling the throttle angle (produce engine torque) from the pedal position (driver demand) allows the powertrain control strategy to optimize fuel control and transmission shift schedules while delivering the requested wheel torque.

The ETC monitor system is distributed across 2 processors within the PCM: the main powertrain control processor unit (CPU) and a separate monitoring processor. The primary monitoring function is carried out by the independent plausibility check (IPC) software, which resides on the main processor. It is responsible for determining the driver-demanded torque and comparing it to an estimate of the actual torque delivered. If the generated torque exceeds driver demand by a specified amount, appropriate corrective action is taken.

ETC SYSTEM WITH A 3-TRACK APP SENSOR FAILURE MODE AND EFFECTS MANAGEMENT:

Effect	Failure Mode [a]
	A loss of redundancy or loss of a non-critical input could result in a concern that does not affect

No Effect on Driveability	driveability. The powertrain malfunction indicator (wrench) illuminates, but the throttle control and torque control systems function normally. A DTC is set to indicate the component or circuit with the concern.
Disable Speed Control	If certain concerns are detected, speed control is disabled. Throttle control and torque control continue to function normally.
RPM Guard with Pedal Follower	In this mode, torque control is disabled due to the loss of a critical sensor or PCM concern. The throttle is controlled in pedal-follower mode as a function of the pedal position sensor input only. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values.
RPM Guard with Default Throttle	In this mode, the throttle plate control is disabled due to the loss of throttle position, the throttle plate position controller, or other major electronic throttle body concern. Depending on the concern detected, the throttle plate is either commanded to the default (limp home) position or the motor is disabled and the spring returns the throttle plate to the default (limp home) position. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC P2110 is set. EGR, VCT, and IMRC outputs are set to default values.
RPM Guard with High Forced Idle	This mode is caused by the loss of 2 or 3 pedal position sensor inputs due to sensor, wiring, or PCM concerns. The system is unable to determine driver demand, and the throttle is controlled to a fixed high idle airflow. There is no response to the driver input. The maximum allowed RPM is a fixed value (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC P2104 is set. EGR, VCT, and IMRC outputs are set to default values.

Shutdown	If a significant processor concern is detected, the monitor forces vehicle shutdown by disabling all fuel injectors. The powertrain malfunction indicator (wrench) illuminates in this mode and a DTC P2105 is set.

[a] ETC illuminates or displays a message on the message center immediately; MIL illuminates after 2 driving cycles

ETC SYSTEM WITH A 2-TRACK APP SENSOR FAILURE MODE AND EFFECTS MANAGEMENT:

Effect	Failure Mode
No Effect on Driveability	A loss of redundancy or loss of a non-critical input could result in a concern that does not affect driveability. The powertrain malfunction indicator (wrench) and the MIL do not illuminate. However, speed control and power take off (PTO) may be disabled. A DTC is set to indicate the component or circuit with the concern.
Delayed APP Sensor Response with Brake Override	This mode is caused by the loss of 1 APP sensor input due to sensor, wiring, or PCM concerns. The system is unable to verify the APP sensor input and driver demand. The throttle plate response to the APP sensor input is delayed as the accelerator pedal is applied. The engine returns to idle RPM whenever the brake pedal is applied. The powertrain malfunction indicator (wrench) illuminates, but the MIL does not illuminate in this mode. An APP sensor related DTC is set.
Time-Based Driver Demand with Brake Override	This mode is caused by the loss of one brake pedal position (BPP) and one APP sensor input or both APP sensor inputs due to sensor, wiring, or PCM concerns. The system is unable to determine driver demand. There is no response when the accelerator pedal is applied. The engine returns to idle RPM whenever the brake pedal is applied. When the brake pedal is released, the PCM slowly increases the APP signal to a fixed value. The powertrain malfunction indicator (wrench) illuminates, but the MIL does not illuminate in this mode. An APP or BPP sensor related DTC is set.
	In this mode, torque control is disabled due to the loss of a critical sensor or PCM concern. The throttle is controlled in pedal-follower mode as a function of the APP sensor input only. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual

RPM Guard with Pedal Follower	RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values and speed control is disabled.
RPM Guard with Default Throttle	In this mode, the throttle plate control is disabled due to the loss of both TP sensor inputs, loss of throttle plate control, stuck throttle plate, significant processor concerns, or other major electronic throttle body concern. The spring returns the throttle plate to the default (limp home) position. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values and speed control is disabled.

ELECTRONIC THROTTLE MONITOR OPERATION:

DTCs [a]	
P060X, P061X	PCM processor concern (MIL, powertrain malfunction indicator [wrench])
P2104 (ETC system with a 3-track APP sensor)	ETC FMEM - forced idle, 2 or 3 pedal sensor concerns (MIL, powertrain malfunction indicator [wrench])
P2105 (ETC system with a 3-track APP sensor)	ETC FMEM - forced engine shutdown; PCM concern (MIL, powertrain malfunction indicator [wrench])
P2110 (ETC system with a 3-track APP sensor)	ETC FMEM - forced limited RPM; Concern with both TP sensors; throttle plate position control concern (MIL, powertrain malfunction indicator [wrench])
U0300	ETC software version mismatch between processors internal to the PCM (non-MIL, powertrain malfunction indicator [wrench])

[a] Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern.

APP AND TP SENSOR INPUTS

ACCELERATOR PEDAL POSITION (APP) SENSOR CHECK:

DTCs[a]	
P1575 (ETC system with a 2-track APP sensor)	APP sensor out of self-test range

P2122, P2123, P2127, P2128, P2132, P2133	APP sensor circuit continuity test (powertrain malfunction indicator [wrench], non-MIL)
P2121, P2126, P2131 (ETC system with a 3-track APP sensor)	APP range/performance (powertrain malfunction indicator [wrench], non-MIL)
P2138 (ETC system with a 2-track APP sensor)	APP to APP signal correlation (powertrain malfunction indicator [wrench], non-MIL)

[a] Correlation and range/performance - sensor disagreement between processors internal to the PCM. Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern. Refer to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** for additional DTC information.

THROTTLE POSITION (TP) SENSOR CHECK:

DTCs [a]	
P0122, P0123, P0222, P0223	TP circuit continuity test (MIL, powertrain malfunction indicator [wrench])
P0121, P0221 (ETC system with a 3-track APP sensor)	TP range/performance (non-MIL)
P1124 (ETC system with a 2-track APP sensor)	TP sensor out of self-test range
P2135	TP to TP sensor correlation test (powertrain malfunction indicator [wrench], non-MIL)

[a] Correlation and range/performance - sensor disagreement between processors internal to the PCM, TP inconsistent with requested throttle plate position. Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern. Refer to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** for additional DTC information.

ELECTRONIC THROTTLE ACTUATOR CONTROL (TAC) OUTPUT

ELECTRONIC TAC OPERATION CHECK:

DTCs [a]	
P115E	Throttle actuator airflow trim at maximum limit (non-MIL)
P2072 (ETC system with a 3-track APP sensor)	Throttle body ice blockage (non-MIL)
P2100 (ETC system with a 3-track APP sensor)	Throttle actuator circuit open, short to power, short to ground (MIL)
P2101	Throttle actuator range/performance test (MIL)
P2107	Processor and TAC motor circuit test (MIL)
P2111	Throttle actuator system stuck open (MIL)
P2112	Throttle actuator system stuck closed (MIL)

[a] Note: For all DTCs, in addition to the MIL, the powertrain malfunction indicator (wrench) is on for the concern that caused the FMEM action. Monitor execution is continuous. Monitor false detection duration is less

than 5 seconds to register a concern.

VARIABLE CAMSHAFT TIMING (VCT) SYSTEM

OVERVIEW

The VCT enables rotation of the camshaft(s) relative to the crankshaft rotation as a function of engine operating conditions. There are 4 types of VCT systems.

- Exhaust phase shifting (EPS) system - the exhaust cam is the active cam being retarded.
- Intake phase shifting (IPS) system - the intake cam is the active cam being advanced.
- Dual equal phase shifting (DEPS) system - both intake and exhaust cams are phase shifted and equally advanced or retarded.
- Dual independent phase shifting (DIPS) system - where both the intake and exhaust cams are shifted independently.

All systems have 4 operational modes: idle, part throttle, wide open throttle (WOT), and default mode. At idle and low engine speeds with closed throttle, the powertrain control module (PCM) determines the phase angle based on air flow, engine oil temperature and engine coolant temperature. At part and wide open throttle the PCM determines the phase angle based on engine RPM, load, and throttle position. VCT systems provide reduced emissions and enhanced engine power, fuel economy and idle quality. IPS systems also have the added benefit of improved torque. In addition, some VCT system applications can eliminate the need for an external exhaust gas recirculation (EGR) system. The elimination of the EGR system is accomplished by controlling the overlap time between the intake valve opening and exhaust valve closing. Currently, both the IPS and DEPS systems are used.

VARIABLE CAMSHAFT TIMING (VCT) SYSTEM

The VCT system consists of an electric hydraulic positioning control solenoid, a camshaft position (CMP) sensor, and a trigger wheel. The CMP trigger wheel has a number of equally spaced teeth equal to the number (n) of cylinders on a bank plus one extra tooth (n+1). Four cylinder and V8 engines use a CMP 4+1 tooth trigger wheel. V6 engines use a CMP 3+1 tooth trigger wheel. The extra tooth placed between the equally spaced teeth represents the CMP signal for that bank. A crankshaft position (CKP) sensor provides the PCM with crankshaft positioning information in 10 degree increments.

1. The PCM receives input signals from the intake air temperature (IAT) sensor, engine coolant temperature (ECT) sensor, engine oil temperature (EOT) sensor, CMP, throttle position (TP) sensor, mass air flow (MAF) sensor, and CKP to determine the operating conditions of the engine. At idle and low engine speeds with closed throttle, the PCM controls the camshaft position based on ECT, EOT, IAT, and MAF. During part and wide open throttle, the camshaft position is determined by engine RPM, load and throttle position. The VCT system does not operate until the engine is at normal operating temperature.
2. The VCT system is enabled by the PCM when the correct conditions are met.
3. The CKP signal is used as a reference for CMP positioning.
4. The VCT solenoid valve is an integral part of the VCT system. The solenoid valve controls the flow of engine oil in the VCT actuator assembly. As the PCM controls the duty cycle of the solenoid valve, oil pressure/flow advances or retards the cam timing. Duty cycles near 0% or 100% represent rapid

movement of the camshaft. Retaining a fixed camshaft position is accomplished by dithering (oscillating) the solenoid valve duty cycle.

The PCM calculates and determines the desired camshaft position. It continually updates the VCT solenoid duty cycle until the desired position is achieved. A difference between the desired and actual camshaft position represents a position error in the PCM VCT control loop. The PCM disables the VCT and places the camshaft in a default position if a concern is detected. A related DTC is also set when the concern is detected.

5. When the VCT solenoid is energized, engine oil is allowed to flow to the VCT actuator assembly which advances or retards the camshaft timing. One half of the VCT actuator is coupled to the camshaft and the other half is connected to the timing chain. Oil chambers between the 2 halves couple the camshaft to the timing chain. When the flow of oil is shifted from one side of the chamber to the other, the differential change in oil pressure forces the camshaft to rotate in either an advance or retard position depending on the oil flow.

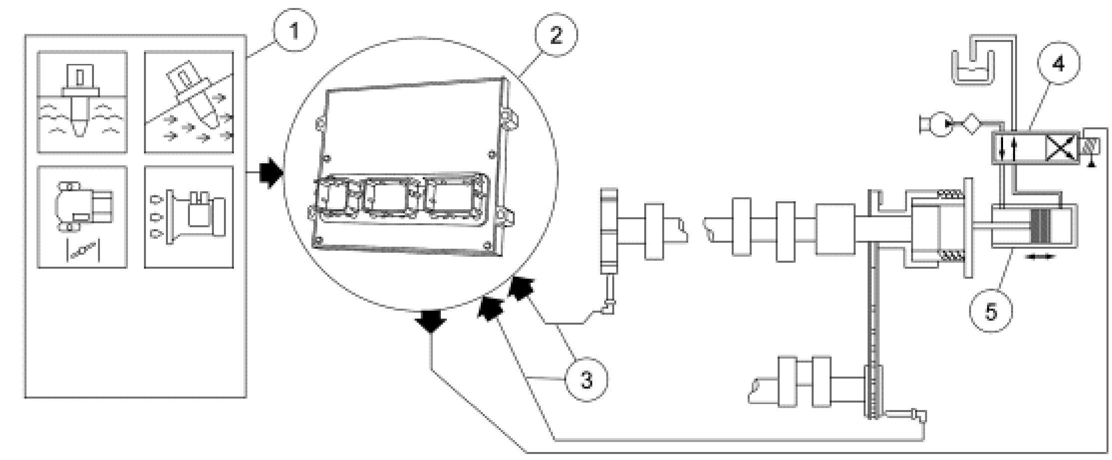

Fig. 96: VCT System
Courtesy of FORD MOTOR CO.

ON BOARD DIAGNOSTICS (OBD) MONITORS

OBD-I, OBD-II AND ENGINE MANUFACTURER DIAGNOSTICS (EMD) OVERVIEW

The California Air Resources Board (CARB) began regulating OBD systems for vehicles sold in California beginning with the 1988 model year. The initial requirements, known as OBD-I, required identifying the likely area of malfunction with regard to the fuel metering system, exhaust gas recirculation (EGR) system, emission-related components and the powertrain control module (PCM). A malfunction indicator lamp (MIL) was required to illuminate and alert the driver of the malfunction and the need to repair the emission control system. A diagnostic trouble code (DTC) was required to assist in identifying the system or component associated with the malfunction.

Starting with the 1994 model year, both CARB and the Environmental Protection Agency (EPA) mandated enhanced OBD systems, commonly known as OBD-II. The objectives of the OBD-II system are to improve air

quality by reducing high in-use emissions caused by emission-related malfunctions, reducing the time between the occurrence of a malfunction and its detection and repair, and assisting in the diagnosis and repair of emission-related problems.

OBD-II Systems - The OBD-II system monitors virtually all emission control systems and components that can affect tailpipe or evaporative emissions. In most cases, malfunctions must be detected before emissions exceed 1.5 times the applicable 120,000 or 150,000 mile emission standards. Partial zero emission vehicles (PZEV) and super ultra low emission vehicles (SULEV-II) can use 2.5 times the standard in place of the 1.5 times the standard. If a system or component exceeds emission thresholds or does not operate within a manufacturer's specifications, a DTC is stored and the MIL is illuminated within 2 drive cycles.

The OBD-II system monitors for malfunctions either continuously, (regardless of driving mode), or non-continuously (once per drive cycle during specific drive modes). A pending DTC is stored in the PCM keep alive memory (KAM) when a malfunction is initially detected. Pending DTCs are displayed as long as the malfunction is present. Note that OBD regulations required a complete malfunction-free monitoring cycle to occur before erasing a pending DTC. This means that a pending DTC is erased on the next power-up after a malfunction-free monitoring cycle. However, if the malfunction is still present after 2 consecutive drive cycles, the MIL is illuminated. Once the MIL is illuminated, 3 consecutive drive cycles without a malfunction detected are required to extinguish the MIL. The DTC is erased after 40 engine warm-up cycles once the MIL is extinguished.

In addition to specifying and standardizing much of the diagnostics and MIL operation, OBD requires the use of a standard data link connector (DLC), standard communication links and messages, standardized DTCs and terminology. Examples of standard diagnostic information are freeze frame data and inspection maintenance (IM) readiness indicators.

Freeze frame data describes data stored in KAM at the point the malfunction is initially detected and the pending DTC is stored. Freeze frame data consists of parameters such as engine RPM, engine load, vehicle speed or throttle position. Freeze frame data is updated when the malfunction is detected again on a subsequent drive cycle and a confirmed DTC is stored; however, a previously stored freeze frame is overwritten if a higher priority fuel or misfire malfunction is detected. This data is accessible with the scan tool to allow duplicating the conditions when the malfunction occurred in order to assist in repairing the vehicle.

OBD I/M readiness indicators show whether all of the OBD monitors have been completed since the last time the KAM or the PCM DTC(s) have been cleared. Ford stores a DTC P1000 and blinks the MIL after 15 seconds of key-on engine-off time to indicate that some monitors have not completed. In some states, it may be necessary to carry out an OBD check in order to renew a vehicle registration. The IM readiness indicators must show that all monitors have been completed prior to the OBD check.

OBD-II was required on all California and California State gasoline engine vehicles up to 14,000 lbs. Gross vehicle weight rating (GVWR) starting in the 1996 MY and all diesel engine vehicles up to 14,000 lbs. GVWR starting in the 1997 MY.

California States are ones that have adopted California emission regulations, starting in the 1998 MY. For example, Massachusetts, New York, Vermont and Maine have adopted California's emission regulations. These States receive California-certified vehicles for passenger cars and light trucks, and medium-duty vehicles, up to 14,000 lbs GVWR.

OBD-II was also required on all Federal gasoline engine vehicles up to 8,500 lbs. GVWR starting in the 1996 MY and all diesel engine vehicles up to 8,500 lbs. GVWR starting in the 1997 MY.

Starting in the 2004 MY, Federal vehicle over 8,500 lbs. were required to phase in OBD-II. By the 2006 MY, all of Ford's Federal vehicles from 8,500 to 14,000 lbs GVWR have been phased into OBD-II and OBD-I systems are no longer utilized in vehicles up to 14,000 lbs GVWR.

EMD Systems - EMD was required on all 2007 MY and beyond California gasoline-fueled and diesel fueled on-road heavy duty engines used in vehicles over 14,000 lbs GVWR. EMD systems are required to functionally monitor the fuel delivery system, exhaust gas recirculation system, particulate matter trap, as well as emission related PCM inputs for circuit continuity and rationality, and emission-related outputs for circuit continuity and functionality. For gasoline engines, which have no PM trap, EMD requirements are very similar to current OBD-I system requirements. As such, OBD-I system philosophy is employed, the only change being the addition of some comprehensive component monitor (CCM) rationality and functionality checks.

EMD vehicles use that same PCM, CAN serial data communication link, J1962 DLC, and PCM software as the corresponding OBD-II vehicle. The only difference is the possible removal of the rear oxygen sensor(s), fuel tank pressure sensor, canister vent solenoid, and a different PCM calibration.

The following list indicates what monitors and functions have been altered from OBD-II for gasoline engine EMD calibrations:

Monitor/Feature	Calibration for Gasoline Engines
Catalyst Monitor	Not required, monitor calibrated out, rear O2 sensors may be deleted.
Misfire Monitor	Calibrated in for repair, all DTC are non-MIL. Catalyst damage misfire criteria calibrated out, emission threshold criteria set to 4%, enabled between 66°C (150°F) and 104°C (220°F), 254 second start-up delay.
Oxygen Sensor Monitor	Rear heated oxygen sensor (HO2S) test calibrated out, rear HO2S may be deleted, front HO2S response test calibrated out.
EGR Monitor	Same as OBD-II calibration except that DTC P0402 test uses a higher threshold.
Fuel System Monitor	Same as OBD-II calibration.
Secondary Air Monitor	Functional (low flow) test calibrated out, circuit codes are same as OBD-II calibration.
Evaporative Emission (EVAP) System Monitor	EVAP system leak check calibrated out, fuel level input circuit checks retained as non-MIL. Fuel tank pressure sensor and canister vent solenoid may be deleted.
PCV Monitor	Same hardware and function as OBD-II
Thermostat Monitor	Thermostat monitor calibrated out.

Comprehensive Component Monitor (CCM)	All circuit checks, rationality and functional tests are the same as OBD-II.
Communication Protocol and DLC	Same as OBD-II, all generic and enhanced scan tool modes work the same as OBD-II, but reflect the EMD calibration that contains fewer supported monitors. OBD supported PID indicates.
MIL Control	Same as OBD-II, it takes 2 drive cycles to illuminate the MIL.

The following monitor descriptions provide a general description of each OBD monitor. In these descriptions, the monitor strategy, hardware, testing requirements, and methods are presented to provide an overall understanding of monitor operation. An illustration of each monitor may also be provided. These illustrations should be used as typical examples and are not intended to represent all possible vehicle configurations.

Each illustration depicts the PCM as the main focus with primary inputs and outputs for each monitor. The icons to the left of the PCM represent the inputs used by each of the monitor strategies to enable or activate the monitor. The components and subsystems to the right of the PCM represent the hardware and signals used while carrying out the tests and the systems being tested. The CCM illustration has numerous components and signals involved which are shown generically. When referring to the illustrations, match the numbers to the corresponding numbers in the monitor descriptions for a better comprehension of the monitor and associated DTCs.

These icons are used in the illustrations of the OBD monitors and throughout this part.

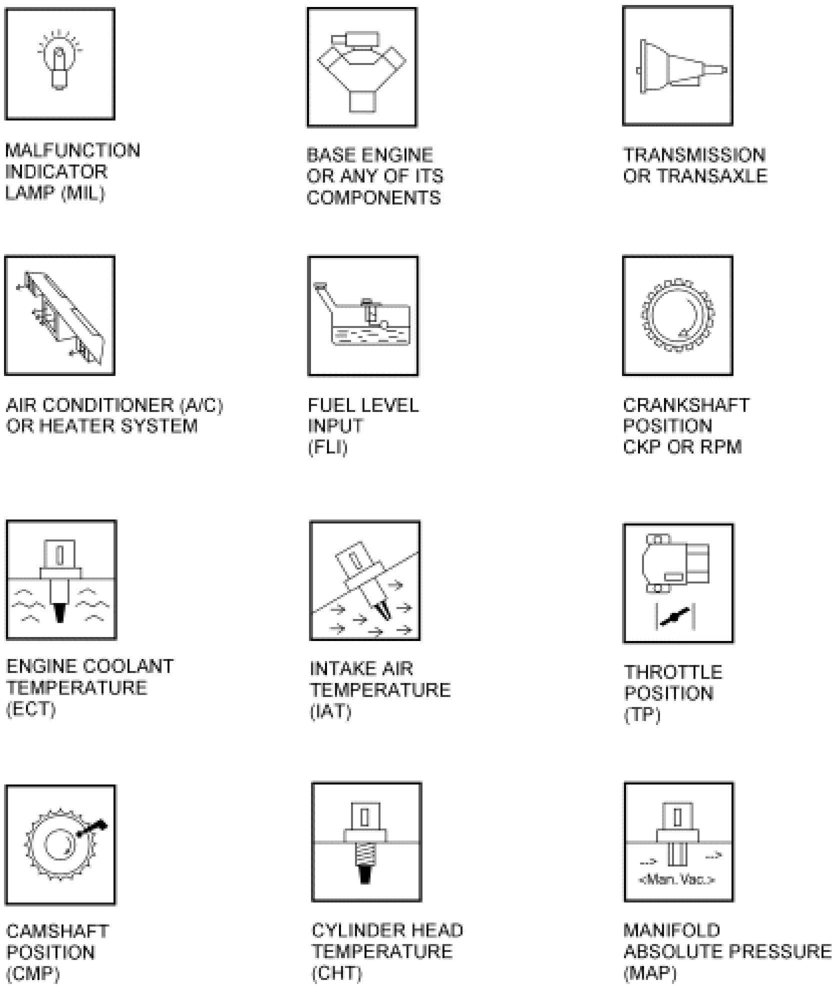

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Fig. 97: Identifying On Board Diagnostic Monitors Icons
Courtesy of FORD MOTOR CO.

CATALYST EFFICIENCY MONITOR

The catalyst efficiency monitor uses an oxygen sensor before and after the catalyst to infer the hydrocarbon (HC) efficiency based on the oxygen storage capacity of the catalyst. During monitor operation the powertrain control module (PCM) calculates the length of the signal while the sensors are switching. Under normal closed-loop fuel conditions, high efficiency catalysts have significant oxygen storage. This makes the switching frequency of the rear heated oxygen sensor (HO2S) very slow and reduces the amplitude, which provides for a shorter signal length. The front HO2S switches more frequently with greater amplitude, which provides for a longer signal length. As the catalyst efficiency deteriorates due to thermal and chemical deterioration, its ability to store oxygen declines. The post-catalyst or downstream HO2S signal begins to switch more rapidly with increasing amplitude and signal length, approaching the switching frequency, amplitude, and signal length of the pre-catalyst or upstream HO2S. The predominant failure mode for high mileage catalysts is chemical deterioration (phosphorus deposits on the front brick of the catalyst), not thermal deterioration.

For the typical HO2S, the catalyst monitor counts the number of front HO2S switches during part-throttle,

closed-loop fuel conditions after the engine is warmed-up and the inferred catalyst temperature is within limits. The number of front switches are accumulated, depending on the calibration, in up to 3 different air mass regions or cells. While catalyst monitoring entry conditions are being met, the front and rear HO2S signal lengths are continually being calculated. When the required number of front switches has accumulated in each cell, the total signal length of the rear HO2S is divided by the total signal length of the front HO2S to compute a catalyst index ratio. An index ratio near 0.0 indicates high oxygen storage capacity, hence high HC efficiency. An index ratio near 1.0 indicates low oxygen storage capacity, hence low HC efficiency. If the actual index ratio exceeds the threshold index ratio, the catalyst is considered failed.

For the universal HO2S, the catalyst monitor calculates the rear HO2S signal lengths for 10-20 seconds during part-throttle, closed-loop fuel conditions after the engine is warmed-up, the inferred catalyst temperature is within limits, and fuel tank vapor purge is disabled. The catalyst monitor is enabled for 10-20 seconds per drive cycle. When the catalyst monitor is active, the PCM commands a fixed fuel control routine. The fixed fuel control routine is the same for every vehicle with universal HO2Ss. During monitor operation the rear HO2S signal lengths are continually calculated. The calculated rear HO2S signal length is then divided by a calibrated signal length, which has compensation for mass air flow. The calibrated signal length is based on the signal length of an HO2S placed after a catalyst without a wash coat. An index ratio near 0.0 indicates high oxygen storage capacity, hence high HC efficiency. An index ratio near 1.0 indicates low oxygen storage capacity, hence low HC efficiency. If the actual index ratio exceeds the threshold index ratio, the catalyst is considered failed.

Inputs from engine coolant temperature (ECT) or cylinder head temperature (CHT), intake air temperature (IAT), mass air flow (MAF), crankshaft position (CKP), throttle position (TP), and vehicle speed sensors are required to enable the Catalyst Efficiency Monitor.

Typical Monitor Entry Conditions:

- Minimum 330 seconds since start-up at 21°C (70°F)
- Engine coolant temperature is between 76.6°C - 110°C (170°F - 230°F)
- Intake air temperature is between -7°C - 82°C (20°F - 180°F)
- Time since entering closed-loop is 30 seconds
- Inferred rear HO2S sensor temperature of 482°C (900°F)
- EGR is between 1% and 12%
- Part throttle, maximum rate of change is 0.2 volts/0.050 sec
- Vehicle speed is between 8 and 112 km/h (5 and 70 mph)
- Fuel level is greater than 15%
- First Air Flow Cell
    - Engine RPM 1,000 to 1,300 RPM
    - Engine load 15 to 35%
    - Inferred catalyst temperature 454°C - 649°C (850°F - 1,200°F)
    - Number of front HO2S switches is 50
- Second Air Flow Cell
    - Engine RPM 1,200 to 1,500 RPM
    - Engine load 20 to 35%

  - Inferred catalyst temperature 482°C - 677°C (900°F - 1,250°F)
  - Number of front HO2S switches: 70
- Third Air Flow Cell
  - Engine RPM 1,300 to 1,600 RPM
  - Engine load 20 to 40%
  - Inferred catalyst temperature 510°C - 704°C (950°F - 1,300°F)
  - Number of front HO2S switches is 30

The DTCs associated with this test are DTC P0420 (Bank 1 or Y-pipe system) and P0430 (Bank 2). Because an exponentially weighted moving average algorithm is used to determine a concern, up to 6 driving cycles may be required to illuminate the MIL during normal customer driving. If the KAM is reset or the battery is disconnected, a concern illuminates the MIL in 2 drive cycles.

GENERAL CATALYST MONITOR OPERATION

Monitor execution is once per drive cycle. The typical monitor duration is 700 seconds or 10-20 seconds for the universal HO2S. In order for the catalyst monitor to run, the HO2S monitor must be complete and the secondary AIR and EVAP system functional with no stored DTCs. If the catalyst monitor does not complete during a particular driving cycle, the already accumulated switch/signal data is retained in the KAM and is used during the next driving cycle to allow the catalyst monitor a better opportunity to complete.

Rear HO2S can be located in various configurations to monitor different kinds of exhaust systems. Inline engines and many V-engines are monitored by their individual bank. A rear HO2S is used along with the front, fuel control HO2S for each bank. Two sensors are used on an inline engine and 4 sensors are used on a V-engine. Some V-engines have exhaust banks that combine into a single underbody catalyst. These systems are referred to as Y-pipe systems. They use only 1 rear HO2S along with the 2 front, fuel-control HO2S. The Y-pipe system uses 3 sensors in all. For Y-piped systems, the 2 front HO2S signals are combined by the PCM software to infer what the HO2S signal would have been in front of the monitored catalyst. The inferred front HO2S signal and the actual single, rear HO2S signal is then used to calculate the index ratio.

Exhaust systems that use an underbody catalyst without a downstream/rear HO2S are not monitored by the catalyst efficiency monitor.

Most vehicles that are part of the low emission vehicle (LEV) catalyst monitor phase-in, monitor less than 100% of the catalyst volume. Often this is the first catalyst brick of the catalyst system. Partial volume monitoring is done on LEV and ultra low emission vehicle (ULEV) vehicles in order to meet the 1.75 emission standard. The rationale for this strategy is that the catalyst nearest the engine deteriorate first, allowing the catalyst monitor to be more sensitive and illuminate the MIL correctly at lower emission standards.

Most applications use partial-volume monitoring, where the rear HO2S is located after the first light-off catalyst can or after the second catalyst can in a 3-can per bank system. (A few applications placed the HO2S in the middle of the catalyst can, between the first and second bricks).

Some partial zero emission vehicles (PZEV) use 3 HO2S per engine bank. The front sensors or stream 1 (HO2S11/HO2S21) are the primary fuel control sensors. The next sensors downstream or stream 2 in the exhaust are used to monitor the light-off catalyst (HO2S12/HO2S22). The last sensors downstream or stream 3

in the exhaust (HO2S13/HO2S23) are used for very long term fuel trim in order to optimize catalyst efficiency (fore aft oxygen sensor control). For additional heated oxygen sensor information, refer to the **HEATED OXYGEN SENSOR (HO2S) MONITOR**.

Index ratios for ethanol (flex fuel) vehicles vary based on the changing concentration of alcohol in the fuel. The threshold to determine a concern typically increases as the percent of alcohol increases. For example, a threshold of 0.5 may be used at E10 (10% ethanol) and 0.9 may be used at E85 (85% ethanol). The thresholds are adjusted based on the percentage of alcohol in the fuel. Standard fuel may contain up to 10% ethanol.

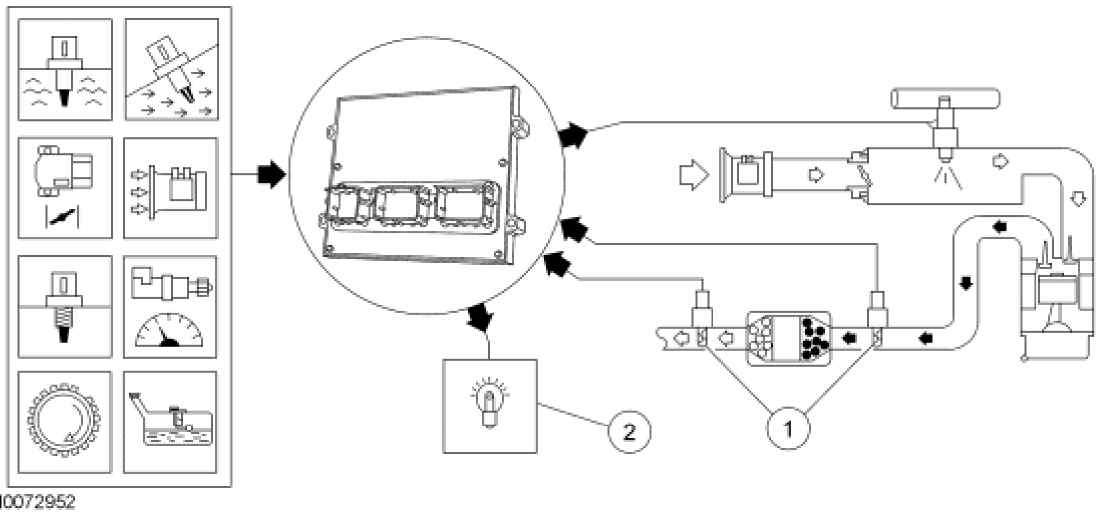


Fig. 98: Catalyst Efficiency Monitor
Courtesy of FORD MOTOR CO.

COLD START EMISSION REDUCTION MONITOR

OVERVIEW

The cold start emission reduction monitor is an on-board strategy designed for vehicles that meet the low emissions vehicle-II (LEV-II) emissions standards. The monitor works by validating the operation of the components of the system required to achieve the cold start emission reduction strategy. There are 2 types of monitors:

- cold start emission reduction component monitor
- cold start emission reduction system monitor

COLD START EMISSION REDUCTION COMPONENT MONITOR

Two different tests are carried out during the cold start emission reduction component monitor. The low idle airflow test which checks the performance of the idle air control strategy and the spark timing monitor test which checks the spark timing strategy.

Low Idle Air Flow Test - When the cold start emission reduction monitor is enabled, the powertrain control module (PCM) commands the idle air control system to increase the RPM, which elevates engine air flow. While this cold start emission reduction elevated air flow is requested, the low idle air flow test compares the

measured idle air flow from the mass air flow (MAF) sensor to the commanded idle air control strategy. For the purpose of detecting low air flow concerns, the low air flow test uses the measured air flow and the commanded air flow to create a low air flow index.

Low idle air flow test operation: -

- DTC: P050A cold start idle air control system performance
- Monitor execution: Once per driving cycle, from start up with the cold start emissions reduction active
- Monitor sequence: none
- Monitoring duration: 7 seconds

Low idle air flow test entry conditions: -

- Engine coolant temperature is between 4.4°C (40°F) and 82.2°C (180°F)
- Barometric pressure is between 76.2 kPa (22.5 in-Hg) and 105 kPa (31 in-Hg)
- Engine off soak time is at least 50 minutes
- Throttle is at closed position

Spark Timing Monitor Test - The PCM is equipped with a spark conduction capture circuit which measures the timing and duration of the spark delivered by processing the fly back voltage signal from the primary side of the ignition coil. When the cold start emission reduction monitor is enabled, the spark control strategy in the PCM commands the spark timing strategy to retard the spark timing. While retarded spark timing is requested, the spark timing monitor compares the measured spark timing from the spark conduction capture circuit to the commanded spark timing from the spark control strategy. For the purpose of detecting spark timing failures, the spark timing monitor increments a fault filter if the measured spark timing is advanced by more than 5 degrees from the commanded spark timing. A failure is indicated if the fault filter exceeds a value of 200, equivalent to a failure duration of approximately 4 seconds.

Spark timing monitor test operation: -

- DTC: P050B cold start ignition timing performance
- Monitor execution: once per driving cycle, from start up with the cold start emission reduction monitor active
- Monitor sequence: none
- Monitoring duration: 7 seconds

Spark timing monitor test entry conditions: -

- Engine speed is between 400 RPM and 2,000 RPM
- Engine position and cylinder identification are synchronized
- There is no concerns with the ignition coils primary circuits

COLD START EMISSION REDUCTION SYSTEM MONITOR

The PCM uses the cold start emission reduction system monitor to calculate the actual catalyst warm up

temperature during a cold start. The actual catalyst warm up temperature calculation uses measured engine speed, measured air mass and commanded spark timing inputs to the PCM. The PCM then compares the actual temperature to the expected catalyst temperature model. The expected catalyst temperature model calculation uses desired engine speed, desired air mass and desired spark timing inputs to the PCM. The difference between the actual and expected temperatures is reflected in a ratio. This ratio is a measure of how much loss of catalyst heating occurred over the period of time and when compared with a calibrated threshold it helps the PCM to determine if the cold start emission reduction system is working properly. This ratio correlates to tailpipe emissions, and a malfunction indicator lamp (MIL) illuminates when the calibrated threshold is exceeded. The monitor is disabled if a concern is present in any of the sensors or systems used for expected catalyst temperature model calculation.

Cold start emission reduction system monitor test operation: -

- DTC: P050E cold start engine exhaust temperature out of range
- Monitor execution: once per driving cycle, from start up with the cold start emission reduction monitor active
- Monitor sequence: the monitor collects data during first 15 seconds of the cold start
- Monitoring duration: the monitor completes 300 seconds after initial engine start

Cold start emission reduction system monitor entry conditions: -

- Engine coolant temperature at the start of the monitor is between 1.67°C (35°F) and 37.78°C (100°F)
- Barometric pressure is above 74.5 kPa (22 in-Hg)
- Catalyst temperature at the start of the monitor is between 1.67°C (35°F) and 51.67°C (125°F)
- Fuel level is above 15%
- Power take-off operation is disabled

COMPREHENSIVE COMPONENT MONITOR (CCM)

The CCM monitors for concerns in any powertrain electronic component or circuit that provides input or output signals to the powertrain control module (PCM) that can affect emissions and is not monitored by another on board diagnostics (OBD) monitor. Inputs and outputs are, at a minimum, monitored for circuit continuity or correct range of values. Where feasible, inputs are also checked for rationality, and outputs are also checked for correct functionality.

The CCM covers many components and circuits and tests them in various ways depending on the hardware, function, and type of signal. For example, analog inputs such as throttle position or engine coolant temperature are typically checked for opens, shorts, and out-of-range values. This type of monitoring is carried out continuously. Some digital inputs like brake switch or crankshaft position rely on rationality checks - checking to see if the input value makes sense at the current engine operating conditions. These types of tests may require monitoring several components and can only be carried out under the appropriate test conditions.

Outputs such as coil drivers are checked for opens and shorts by monitoring a feedback circuit or smart driver associated with the output. Other outputs, such as relays, require additional feedback circuits to monitor the secondary side of the relay. Some outputs are also monitored for correct function by observing the reaction of the control system to a given change in the output command. An idle air control solenoid can be functionally

tested by monitoring the idle RPM relative to the target idle RPM. Some tests can only be carried out under the appropriate test conditions. For example, the transmission shift solenoids can only be tested when the PCM commands a shift.

The following is an example of some of the input and output components monitored by the CCM. The component monitor may belong to the engine, ignition, transmission, air conditioning, or any other PCM supported subsystem.

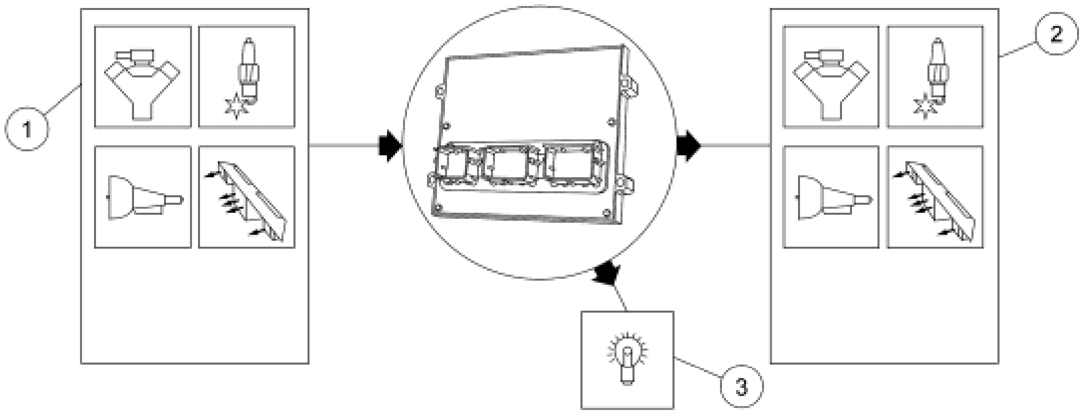
1. Inputs:

   Air conditioning pressure (ACP) transducer sensor, camshaft position (CMP) sensor, crankshaft position (CKP) sensor, engine coolant temperature (ECT) sensor, engine oil temperature (EOT) sensor, fuel rail pressure temperature (FRPT) sensor, fuel tank pressure (FTP) sensor, intake air temperature (IAT) sensor, mass air flow (MAF) sensor, throttle position (TP) sensor.

2. Outputs:

   EVAP canister purge valve, EVAP canister vent (CV) solenoid, fuel injector, fuel pump (FP), idle air control (IAC), intake manifold runner control (IMRC), shift solenoid, torque converter clutch (TCC) solenoid, variable camshaft timing (VCT) actuator, wide open throttle A/C cutout (WAC).

3. The CCM is enabled after the engine starts and is running. A diagnostic trouble code (DTC) is stored in keep alive memory (KAM) and the malfunction indicator lamp (MIL) is illuminated after 2 driving cycles when a concern is detected. Many of the CCM tests are also carried out during an on-demand self-test.



N0072953

Fig. 99: Comprehensive Component Monitor (CCM)
Courtesy of FORD MOTOR CO.

ELECTRIC EXHAUST GAS RECIRCULATION (EEGR) SYSTEM MONITOR

The EEGR system monitor is an on-board strategy designed to test the integrity and flow characteristics of the EGR system. The monitor is activated during EGR system operation and after certain base engine conditions are satisfied. Inputs from the engine coolant temperature (ECT) or cylinder head temperature (CHT), intake air

temperature (IAT), throttle position (TP), crankshaft position (CKP), mass air flow (MAF), and manifold absolute pressure (MAP) sensors are required to activate the EGR system monitor. Once activated, the EGR system monitor carries out each of the tests described below during the engine modes and conditions indicated. Some of the EGR system monitor tests are also carried out during a key on engine off (KOEO) or key on engine running (KOER) self-test.

The EEGR monitor consists of an electrical and functional test that checks the stepper motor and the EEGR system for correct flow. The powertrain control module (PCM) controls the EEGR valve by commanding from 0 to 52 discreet increments or steps to get the valve from fully closed to fully open respectively. The stepper motor electrical test is a continuous check of the 4 electric stepper motor coils and circuits to the PCM. A concern is indicated if an open circuit, short to voltage, or short to ground has occurred in 1 or more of the stepper motor coils or circuits for a calibrated period of time. If a concern has been detected, the EEGR system is disabled, setting diagnostic trouble code (DTC) P0403. Additional monitoring is suspended for the remainder of the drive cycle, or until the next engine startup.

After the vehicle has warmed up and normal EEGR flow rates are being commanded by the PCM, the EEGR flow check is carried out. The flow test is carried out once per drive cycle when a minimum amount of exhaust gas is requested and the remaining entry conditions required to initiate the test are satisfied. If a concern is detected, the EEGR system, as well as the EEGR monitor, is disabled until the next engine startup.

An EGR flow concern is indicated by either a no flow condition or a low flow condition prior to exceeding 1.5 times the applicable emission standard. The criteria used to determine which flow concern threshold applies is based upon whether or not the applicable emission standards are exceeded on the federal test procedure test cycle without EGR delivery.

The EGR flow test is done by observing the behavior of 2 different values of MAP - the analog MAP sensor reading, and inferred MAP, (MAP calculated from the MAF, throttle position, RPM, barometric pressure (BARO) and other sensors). Due to the location of the MAF sensor, the calculation of inferred MAP is not compensated for EGR flow. Therefore, it does not account for the effects of EGR flow whereas measured MAP does respond to the effects of EGR flow. The amount of EGR flow can therefore be calculated by looking at the difference between measured MAP and inferred MAP under the correct engine operating conditions.

Some differences always exist between measured MAP and inferred MAP due to hardware variations. These variations are learned during steady engine operating conditions without EGR flow and the estimated EGR flow is compensated for these differences. The result of this compensation is values of measured MAP and inferred MAP that are equal under conditions where no EGR is flowing. Hence, when EGR is flowing the increased pressure in measured MAP over inferred MAP represents the pressure change due to EGR flow. This pressure change is normalized to a value between 0 and 1 representing the ratio of measured EGR flow to the scheduled EGR flow and is referred as the EGR flow degradation index. A value near 1 indicates the system is functioning correctly whereas a value near 0 reflects EGR severe flow degradation.

The EGR flow degradation index is compared to a calibrated threshold to determine if a low flow concern has occurred. If an EGR flow concern has occurred, the P0400 DTC flow concern is registered.

If the inferred ambient temperature is less than -7°C (20°F), greater than 54°C (130°F), or the altitude is greater than 8,000 feet (BARO less than 22.5 in-Hg), the EEGR flow test cannot be reliably done. In these conditions, the EEGR flow test is suspended and a timer starts to accumulate the time in these conditions. When the vehicle leaves these extreme conditions, the timer starts to decrement, and if conditions permit, attempts to complete the

EGR flow monitor. If the timer reaches 800 seconds, the EEGR flow test is disabled for the remainder of the current driving cycle and the EGR monitor is set to a ready condition.

Note: BARO is inferred at engine startup using the KOEO MAP sensor reading. It is updated during high, part-throttle, engine operation.

A DTC P1408, like the P0400, indicates an EGR flow concern (outside the minimum or maximum limits) but is only set during the KOER self-test. The P0400 and P0403 are MIL codes. P1408 is a non-MIL code.

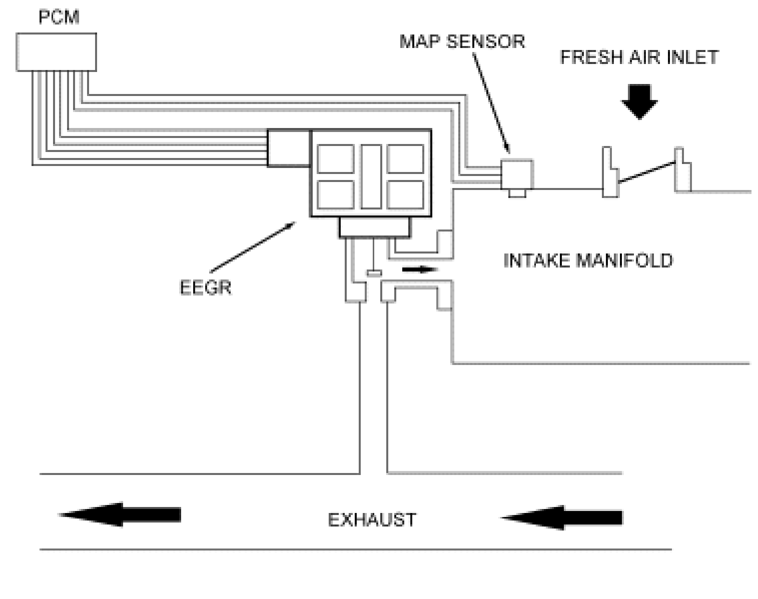


Fig. 100: Identifying Electric EGR System
Courtesy of FORD MOTOR CO.

EVAPORATIVE EMISSION (EVAP) LEAK CHECK MONITOR

The EVAP leak check monitor is an on-board strategy designed to detect a leak from a hole (opening) equal to or greater than 0.508 mm (0.020 inch) in the enhanced EVAP system. The correct function of the individual components of the enhanced EVAP system, as well as its ability to flow fuel vapor to the engine, is also examined. The EVAP leak check monitor relies on the individual components of the enhanced EVAP system to either allow a natural vacuum to occur in the fuel tank or apply engine vacuum to the fuel tank and then seal the entire enhanced EVAP system from the atmosphere. The fuel tank pressure is then monitored to determine the total vacuum lost (bleed-up) for a calibrated period of time. Inputs from the engine coolant temperature (ECT) sensor or cylinder head temperature (CHT) sensor, intake air temperature (IAT) sensor, mass air flow (MAF) sensor, vehicle speed, fuel level input (FLI) and fuel tank pressure (FTP) sensor are required to enable the EVAP leak check monitor.

During the EVAP leak check monitor repair verification drive cycle, clearing the continuous diagnostic trouble codes (DTCs) and resetting the emission monitors information in the powertrain control module (PCM) bypasses the minimum soak time required to complete the monitor. The EVAP leak check monitor does not run if the key is turned off after clearing the continuous DTCs and resetting the emission monitors information in the PCM. The EVAP leak check monitor does not run if a MAF sensor concern is present. The EVAP leak

check monitor does not initiate until the heated oxygen sensor (HO2S) monitor is complete.

If the vapor generation is high on some vehicle enhanced EVAP systems, where the monitor does not pass, the result is treated as a no test. Therefore, the test is complete for the day.

Some vehicle applications have an engine off natural vacuum (EONV) check as part of the EVAP leak check monitor.

ENGINE ON EVAP LEAK CHECK MONITOR

The engine on EVAP leak check monitor is executed by the individual components of the enhanced EVAP system as follows:

1. The EVAP canister purge valve, also known as the vapor management valve (VMV), is used to control the flow of vacuum from the engine and create a target vacuum on the fuel tank.
2. The canister vent (CV) solenoid is used to seal the EVAP system from the atmosphere. It is closed by the PCM (100% duty cycle) to allow the EVAP canister purge valve to obtain the target vacuum on the fuel tank.
3. The FTP sensor is used by the engine on EVAP leak check monitor to determine if the target vacuum necessary to carry out the leak check on the fuel tank is reached. Some vehicle applications with the engine on EVAP leak check monitor use a remote inline FTP sensor. Once the target vacuum on the fuel tank is achieved, the change in fuel tank vacuum over a calibrated period of time determines if a leak exists.
4. If the initial target vacuum cannot be reached, DTC P0455 (gross leak detected) is set. The engine on EVAP leak check monitor aborts and does not continue with the leak check portion of the test.

   For some vehicle applications, if the initial target vacuum cannot be reached after a refueling event and the purge vapor flow is excessive, DTC P0457 (fuel cap off) is set. If the initial target vacuum cannot be reached and the purge flow is too small, DTC P1443 (no purge flow condition) is set.

   If the initial target vacuum is exceeded, a system flow concern exists and DTC P1450 (unable to bleed-up fuel tank vacuum) is set. The engine on EVAP leak check monitor aborts and does not continue with the leak check portion of the test.

   If the vacuum increase is quicker than expected, a blocked fuel vapor tube is suspected and if confirmed after an intrusive test, DTC P144A is set.

   If the target vacuum is obtained on the fuel tank, the change in the fuel tank vacuum (bleed-up) is calculated for a calibrated period of time. The calculated change in fuel tank vacuum is compared to a calibrated threshold for a leak from a hole (opening) of 1.016 mm (0.040 inch) in the enhanced EVAP system. If the calculated bleed-up is less than the calibrated threshold, the enhanced EVAP system passes. If the calibrated bleed-up exceeds the calibrated threshold, the test aborts. The test can be repeated up to 3 times.

   If the bleed-up threshold is still being exceeded after 3 tests, a vapor generation test must be carried out before DTC P0442 (small leak detected) is set. This is accomplished by returning the enhanced EVAP system to atmospheric pressure by closing the EVAP canister purge valve and opening the CV solenoid.

Once the FTP sensor observes the fuel tank is at atmospheric pressure, the CV solenoid closes and seals the enhanced EVAP system.

The fuel tank pressure build-up, over a calibrated period of time is compared to a calibrated threshold for pressure build-up due to vapor generation.

If the fuel tank pressure build-up exceeds the threshold, the leak test results are invalid due to vapor generation. The engine on EVAP leak check monitor attempts to repeat the test again.

If the fuel tank pressure build-up does not exceed the threshold, the leak test results are valid and DTC P0442 is set.

5. If the 1.016 mm (0.40 inch) test passes, the test time is extended to allow the 0.508 mm (0.020 inch) test to run.

   The calculated change in fuel vacuum over the extended time is compared to a calibrated threshold for a leak from a 0.508 mm (0.020 inch) hole (opening).

   If the calculated bleed-up exceeds the calibrated threshold, the vapor generation test is run. If the vapor generation test passes (no vapor generation), an internal flag is set in the PCM to run a 0.508 mm (0.020 inch) test at idle (vehicle stopped).

   On the next start following a long engine off period, the enhanced EVAP system is sealed and evacuated for the first 10 minutes of operation.

   If the appropriate conditions are met, a 0.508 mm (0.020 inch) leak check is conducted at idle.

   If the test at idle fails, a DTC P0456 is set. There is no vapor generation test with the idle test.

6. The MIL is activated for DTCs P0442, P0455, P0456, P0457, P1443, and P1450 (or P0446) after 2 occurrences of the same concern and for DTC P144A after a sufficient number of completions. The MIL can also be activated for any enhanced EVAP system component DTCs in the same manner. The enhanced EVAP system component DTCs P0443, P0452, P0453, and P1451 are tested as part of the CCM.

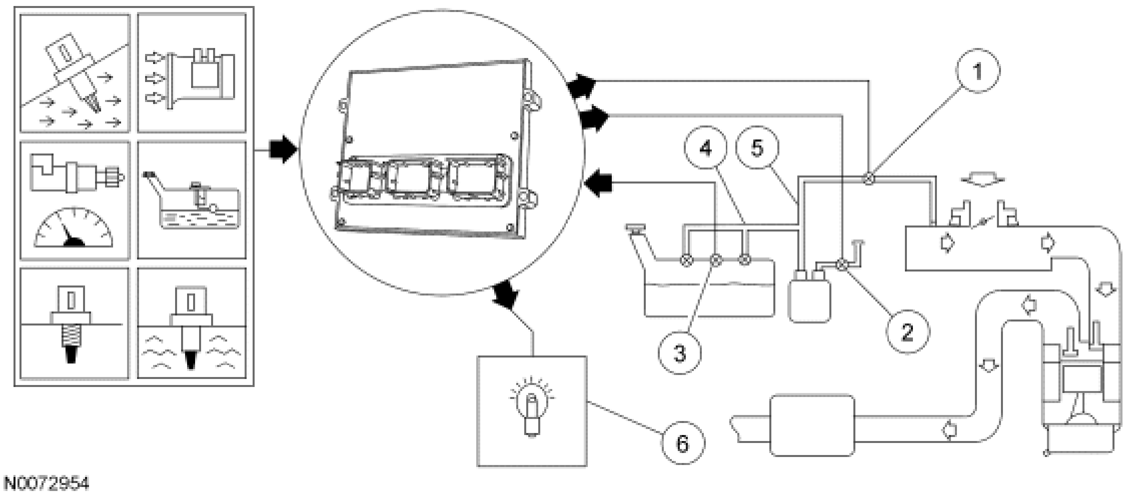


Fig. 101: Evaporative Emission (EVAP) Leak Check Monitor
Courtesy of FORD MOTOR CO.

ENGINE OFF NATURAL VACUUM (EONV) EVAP LEAK CHECK MONITOR

The EONV EVAP leak check monitor is executed during key off, after the engine on EVAP leak check monitor is completed. The EONV EVAP leak check monitor determines a leak is present when the naturally occurring change in fuel tank pressure or vacuum does not exceed a calibrated limit during a calibrated amount of time. A separate, low power consuming, microprocessor in the PCM manages the EONV leak check. The engine off EVAP leak check monitor is executed by the individual components of the enhanced EVAP system as follows:

1. The EVAP canister purge valve, also known as the vapor management valve (VMV), is normally closed at key off.
2. The normally open canister vent (CV) remains open for a calibrated amount of time to allow the fuel tank pressure to stabilize with the atmosphere. During this time period the FTP sensor is monitored for an increase in pressure. If pressure remains below a calibrated limit the CV is closed by the PCM (100% duty cycle) and seals the EVAP system from the atmosphere.
3. The FTP sensor is used by the EONV EVAP leak check monitor to determine if the target pressure or vacuum necessary to complete the EONV EVAP leak check monitor on the fuel tank is reached. Some vehicle applications with the EONV EVAP leak check monitor use a remote inline FTP sensor. If the target pressure or vacuum on the fuel tank is achieved within the calibrated amount of time, the test is complete.
4. The EONV EVAP leak check monitor uses the naturally occurring change in fuel tank pressure as a means to detect a leak in the EVAP system. At key off, a target pressure and vacuum is determined by the PCM. These target values are based on the fuel level and the ambient temperature at key off. As the fuel tank temperature increases, the pressure in the tank increases and as the temperature decreases a vacuum develops. If a leak is present in the EVAP system the fuel tank pressure or vacuum does not exceed the target value during the testing time period. The EONV EVAP leak check monitor begins at key off.

   After key off the normally open canister vent (CV) remains open for a calibrated amount of time to allow the fuel tank pressure to stabilize with the atmosphere. During this time period the FTP sensor is monitored for an increase in pressure. If pressure remains below a calibrated limit the CV is closed by the PCM (100% duty cycle) and seals the EVAP system from the atmosphere.

If the pressure on the fuel tank decreases after the EVAP system is sealed, the EONV EVAP leak check monitor begins to monitor the fuel tank pressure. When the target vacuum is exceeded within the calibrated amount of time the test completes and the fuel tank pressure and time since key off information is stored. If the target vacuum is not reached in the calibrated amount of time, a leak is suspected and the fuel tank pressure and time since key off information is stored.

If the pressure on the fuel tank increases after the EVAP system is sealed, but does not exceed the target pressure within a calibrated amount of time the CV is opened to allow the fuel tank pressure to again stabilize with the atmosphere. After a calibrated amount of time the CV is closed by the PCM and seals the EVAP system. When the fuel tank pressure exceeds either the target pressure or vacuum within the calibrated amount of time the test completes and the fuel tank pressure and time since key off information is stored. If the target pressure or vacuum is not reached in the calibrated amount of time, a leak is suspected and the fuel tank pressure and time since key off information is stored.

When a leak is suspected, the PCM uses the stored fuel tank pressure and time since key off information from an average run of 4 tests to suspect a leak. Some vehicles use an alternative method of a single run of 5 tests to determine the presence of a leak. If a leak is still suspected after 2 consecutive runs of 4 tests, (8 total tests) or 1 run of 5 tests, DTC P0456 is set and the MIL is illuminated.

5. The EONV EVAP leak check monitor is controlled by a separate low power consuming microprocessor inside the PCM. The fuel level indicator, fuel tank pressure, and battery voltage are inputs to the microprocessor. The microprocessor outputs are the CV solenoid and the stored test information. If the separate microprocessor is unable to control the CV solenoid or communicate with other processors DTC P260F is set.
6. The MIL is activated for DTCs P0456 and P260F. The MIL can also be activated for any enhanced EVAP system component DTCs in the same manner. The enhanced EVAP system component DTCs P0443, P0446, P0452, P0453, and P1451 are tested as part of the CCM.

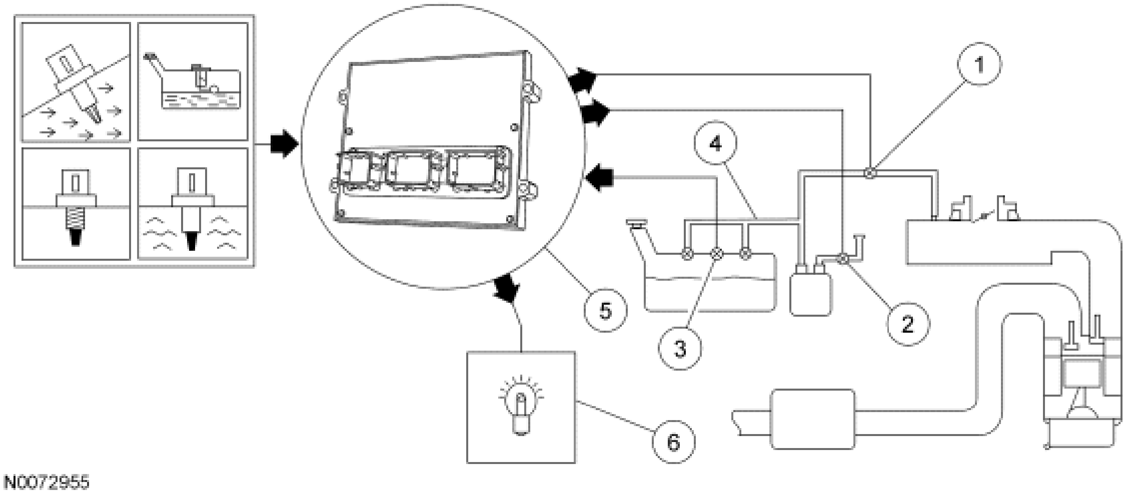


Fig. 102: EONV EVAP Leak Check Monitor
Courtesy of FORD MOTOR CO.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM MONITOR - DIFFERENTIAL PRESSURE FEEDBACK EGR AND EGR SYSTEM MODULE

(ESM)

The EGR system monitor is an on-board strategy designed to test the integrity and flow characteristics of the EGR system. The monitor is activated during EGR system operation and after certain base engine conditions are satisfied. Input from the engine coolant temperature (ECT) or cylinder head temperature (CHT), intake air temperature (IAT), throttle position (TP), and crankshaft position (CKP) sensors is required to activate the monitor. Once activated, the EGR system monitor carries out each of the tests described below during the engine modes and conditions indicated. Some of the EGR system monitor tests are also carried out during an on-demand self-test.

1. The differential pressure feedback EGR sensor and circuit are continuously tested for opens and shorts. The monitor checks for the differential pressure feedback EGR circuit voltage to exceed the maximum or minimum allowable limits.

   The diagnostic trouble codes (DTCs) associated with this test are P0405 and P0406.

2. The EGR vacuum regulator solenoid is continuously tested for opens and shorts. The monitor looks for an EVR circuit voltage that is inconsistent with the EVR circuit commanded output state.

   The DTC associated with this test is P0403.

3. The test for a stuck open EGR valve or EGR flow at idle is continuously carried out at idle (TP sensor indicating closed throttle). The monitor compares the differential pressure feedback EGR circuit voltage at idle to the differential pressure feedback EGR circuit voltage stored during key on engine off (KOEO) to determine if EGR flow is present at idle.

   The DTC associated with this test is P0402.

4. The differential pressure feedback EGR sensor hoses are tested once per drive cycle for disconnect and plugging. The test is carried out with the EGR valve closed and during a period of acceleration. The powertrain control module (PCM) momentarily commands the EGR valve closed. The monitor looks for the differential pressure feedback EGR sensor voltage to be inconsistent for a no flow voltage. A voltage increase or decrease during acceleration while the EGR valve is closed may indicate a concern with a signal hose during this test.

   The DTCs associated with this test are P1405 and P1406 (differential pressure feedback EGR systems only).

5. The EGR flow rate test is carried out during a steady state when the engine speed and load are moderate and the EGR vacuum regulator duty cycle is high. The monitor compares the actual differential pressure feedback EGR circuit voltage to a desired EGR flow voltage for that state to determine if the EGR flow rate is acceptable or insufficient. This is a system test and may trigger a DTC for any concern causing the EGR system to not operate correctly.

   The DTC associated with this test is P0401. DTC P1408 is similar to P0401 but is carried out during key on engine running (KOER) self-test conditions.

6. The MIL is activated after one of the above tests fails on 2 consecutive drive cycles.

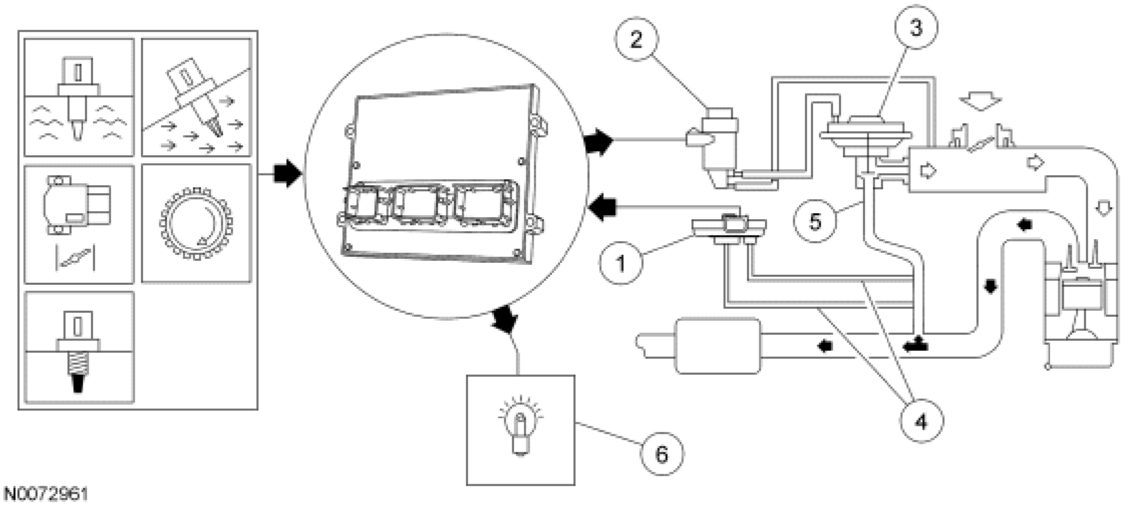


Fig. 103: EGR System Monitor - Differential Pressure Feedback EGR
Courtesy of FORD MOTOR CO.

FUEL SYSTEM MONITOR

The fuel system monitor is an on-board strategy designed to monitor the fuel control system. The fuel control system uses fuel trim tables stored in the powertrain control module (PCM) keep alive memory (KAM) to compensate for the variability that occurs in fuel system components due to normal wear and aging. Fuel trim tables are based on air mass. During closed-loop fuel control, the fuel trim strategy learns the corrections needed to correct a biased rich or lean fuel system. The correction is stored in the fuel trim tables. The fuel trim has 2 means of adapting: long term fuel trim and a short term fuel trim. Refer to **POWERTRAIN CONTROL SOFTWARE**, Fuel Trim. Long term fuel trim relies on the fuel trim tables and short term fuel trim refers to the desired air/fuel ratio parameter called LAMBSE. LAMBSE is calculated by the PCM from the heated oxygen sensor (HO2S) inputs and helps maintain a 14.7:1 air/fuel ratio during closed-loop operation. Short term fuel trim and long term fuel trim work together. If the HO2S indicates the engine is running rich, the PCM corrects the rich condition by moving the short term fuel trim into the negative range, less fuel to correct for a rich combustion. If after a certain amount of time the short term fuel trim is still compensating for a rich condition, the PCM learns this and moves the long term fuel trim into the negative range to compensate and allow the short term fuel trim to return to a value near 0%. Inputs from the engine coolant temperature (ECT) or cylinder head temperature (CHT), intake air temperature (IAT), mass air flow (MAF) sensors are required to activate the fuel trim system, which in turn activates the fuel system monitor. Once activated, the fuel system monitor looks for the fuel trim tables to reach the adaptive clip (adaptive limit) and LAMBSE to exceed a calibrated limit. The fuel system monitor stores the appropriate DTC when a concern is detected as described below.

1. The HO2S detects the presence of oxygen in the exhaust and provides the PCM with feedback indicating air/fuel ratio.
2. A correction factor is added to the fuel injector pulse width calculation and the mass air flow calculation, according to the long and short term fuel trims as needed to compensate for variations in the fuel system.
3. When deviation in the LAMBSE parameter increases, air/fuel control suffers and emissions increase. When LAMBSE exceeds a calibrated limit and the fuel trim table has clipped, the fuel system monitor

sets a DTC as follows:

The DTCs associated with the monitor detecting a lean shift in fuel system operation are P0171 (Bank 1) and P0174 (Bank 2).

The DTCs associated with the monitor detecting a rich shift in fuel system operation are P0172 (Bank 1) and P0175 (Bank 2).

4. The MIL is activated after a concern is detected on 2 consecutive drive cycles.

Typical fuel system monitor entry conditions:

- RPM range greater than idle
- Air mass range greater than 5.67 g/sec (0.75 lb/min)
- Purge duty cycle of 0%

Typical fuel monitor thresholds:

- Lean Condition Concern: LONGFT greater than 25%, SHRTFT greater than 5%
- Rich Condition Concern: LONGFT less than 25%, SHRTFT less than 10%

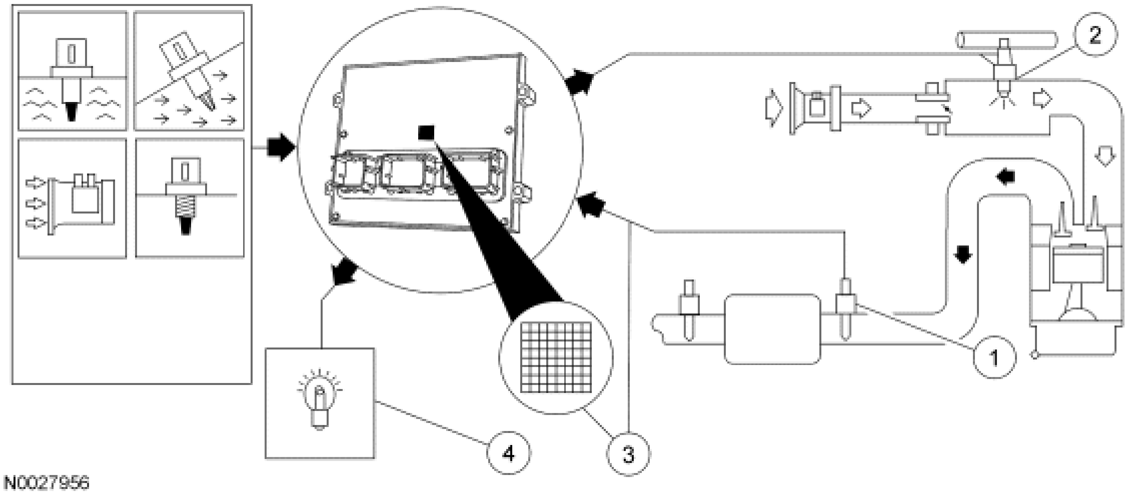


Fig. 104: Fuel System Monitor
Courtesy of FORD MOTOR CO.

HEATED OXYGEN SENSOR (HO2S) MONITOR

The HO2S monitor is an on-board strategy designed to monitor the HO2Ss for concerns or deterioration which can affect emissions. The fuel control or stream 1 HO2S are checked for correct output voltage and response rate. Response rate is the time it takes to switch from lean to rich or rich to lean. Stream 2 HO2Ss are used for catalyst monitoring, and stream 3 HO2Ss used for fore-aft oxygen sensor (FAOS) control are also monitored for correct output voltage. A stream 3 HO2S is only available on the Focus PZEV and Fusion/Milan 2.3L PZEV. Vehicles with universal HO2Ss use the stream 2 sensors for FAOS control. Input is required from the camshaft

position (CMP), crankshaft position (CKP), engine coolant temperature (ECT) or cylinder head temperature (CHT), fuel rail pressure temperature (FRPT), fuel tank pressure (FTP), intake air temperature (IAT), mass air flow (MAF), manifold absolute pressure (MAP), and throttle position (TP) sensors and the vehicle speed sensor (VSS) to activate the HO2S monitor. The fuel system monitor and misfire detection monitor must also have completed successfully before the HO2S monitor is enabled.

1. The HO2S senses the oxygen content in the exhaust flow. The typical HO2S outputs a voltage between 0 and 1.0 volt. Lean of stoichiometric, air/fuel ratio of approximately 14.7:1, the HO2S generates a voltage between 0 and 0.45 volt. Rich of stoichiometric, the HO2S generates a voltage between 0.45 and 1.0 volt. The current required to maintain the universal HO2S at 0.45 volt is used by the PCM to calculate the air/fuel ratio. The HO2S monitor evaluates the HO2Ss for correct function.
2. The time between HO2S switches is monitored after vehicle startup and during closed loop fuel conditions. Excessive time between switches or no switches since startup indicates a concern. Since lack of switching concerns can be caused by HO2S concerns or by shifts in the fuel system, DTCs are stored that provide additional information for the lack of switching concern. Different DTCs indicate whether the sensor always indicates lean, rich, or disconnected. The HO2S signal is also monitored for high voltage, in excess of 1.1 volts. An over-voltage condition is caused by a HO2S heater or battery power short to the HO2S signal line.

   A functional test of the rear HO2Ss (Stream 2 or Stream 3 [Focus PZEV, Fusion/Milan 2.3L PZEV]) is done during normal vehicle operation. The peak rich and lean voltages are continuously monitored. Voltages that exceed the calibrated rich and lean thresholds indicate a functional sensor. If the voltages have not exceeded the thresholds after a long period of vehicle operation, the air/fuel ratio may be forced rich or lean in an attempt to get the rear sensor to switch. This situation normally occurs only with a green, less than 804.7 km (500 mi), catalyst. If the sensor does not exceed the rich and lean peak thresholds, a concern is indicated.
3. The MIL is activated after a concern is detected on 2 consecutive drive cycles.
4. Some partial zero emission vehicles (PZEV) use 3 HO2Ss. The front sensor (HO2S11) is the primary fuel control sensor. The next sensor downstream in the exhaust is used to monitor the light-off catalyst (HO2S12). The last sensor downstream in the exhaust (HO2S13) is used for very long term fuel trim in order to optimize catalyst efficiency (FAOS control).

The HO2S monitor DTCs can be categorized as follows:

- P0030, P0050 - HO2S heater control (universal HO2S)
- P0040, P0041 - Swapped HO2S connectors
- P0053, P0054, P0055, P0059, P0060 - HO2S heater resistance
- P0130, P0150 - HO2S circuit concerns (universal HO2S)
- P0132, P0138, P0144, P0152, P0158 - HO2S circuit high voltage
- P0133, P0139, P0153, P0159 - HO2S slow response rate
- P0134, P0154 - HO2S circuit no activity detected (universal HO2S)
- P0135, P0141, P0155, P0161, P0147 - HO2S heater circuit
- P1127 - Downstream HO2S not running in on-demand self-test
- P2096, P2097, P2098, P2099 - Post catalyst fuel trim (universal HO2S)

- P2195, P2196, P2197, P2198, P2270, P2271, P2272, P2273, P2274, P2275 - HO2S lack of switching

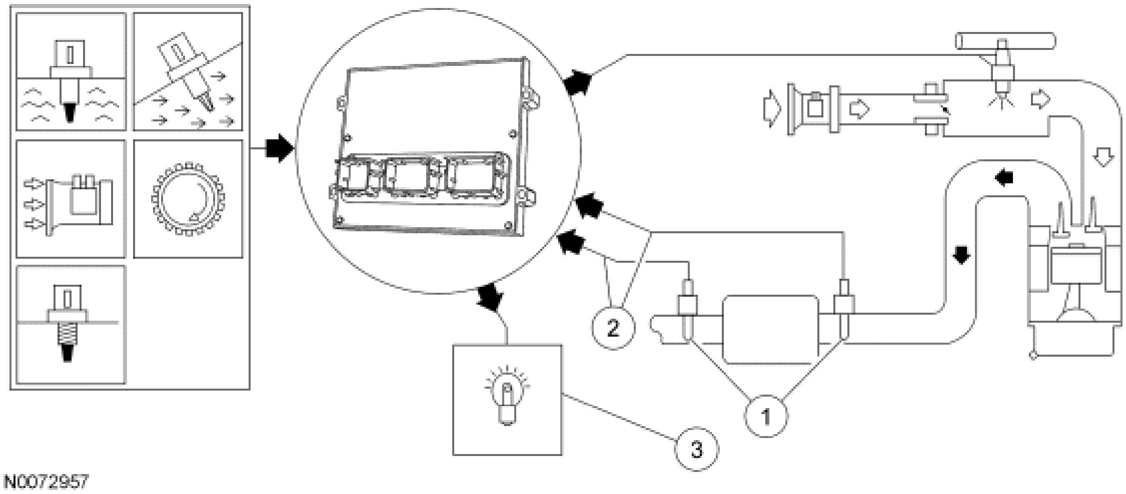


Fig. 105: Heated Oxygen Sensor (HO2S) Monitor
Courtesy of FORD MOTOR CO.

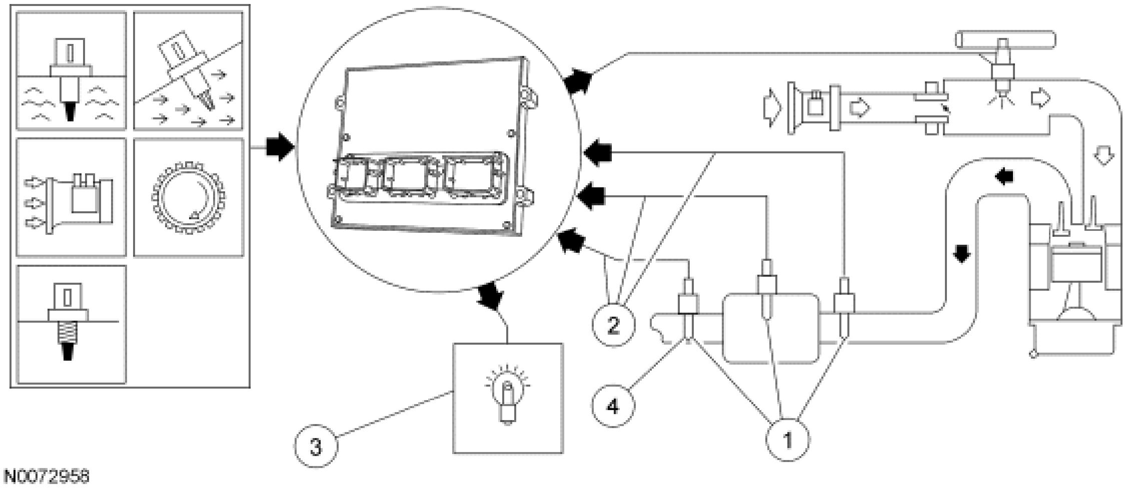


Fig. 106: Heated Oxygen Sensor (HO2S) Monitor - 3 Sensor
Courtesy of FORD MOTOR CO.

MISFIRE DETECTION MONITOR

The misfire detection monitor is an on-board strategy designed to monitor engine misfire and identify the specific cylinder in which the misfire has occurred. Misfire is defined as lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or any other cause. The misfire detection monitor is enabled only when certain base engine conditions are first satisfied. Input from the engine coolant temperature (ECT) or cylinder head temperature (CHT), intake air temperature (IAT), mass air flow (MAF) sensors is required to enable the monitor. The misfire detection monitor is also carried out during an on-demand self-test.

1. The powertrain control module (PCM) synchronized ignition spark is based on information received from

the crankshaft position (CKP) sensor. The CKP signal generated is also the main input used in determining cylinder misfire.

2. The input signal generated by the CKP sensor is derived by sensing the passage of teeth from the crankshaft position wheel mounted on the end of the crankshaft.
3. The input signal to the PCM is then used to calculate the time between CKP edges and the crankshaft rotational velocity and acceleration. By comparing the accelerations of each cylinder event, the power loss of each cylinder is determined. When the power loss of a particular cylinder is sufficiently less than a calibrated value and other criteria are met, then the suspect cylinder is determined to have misfired.
4. The malfunction indicator lamp (MIL) is activated after one of the above tests fail on 2 consecutive drive cycles.

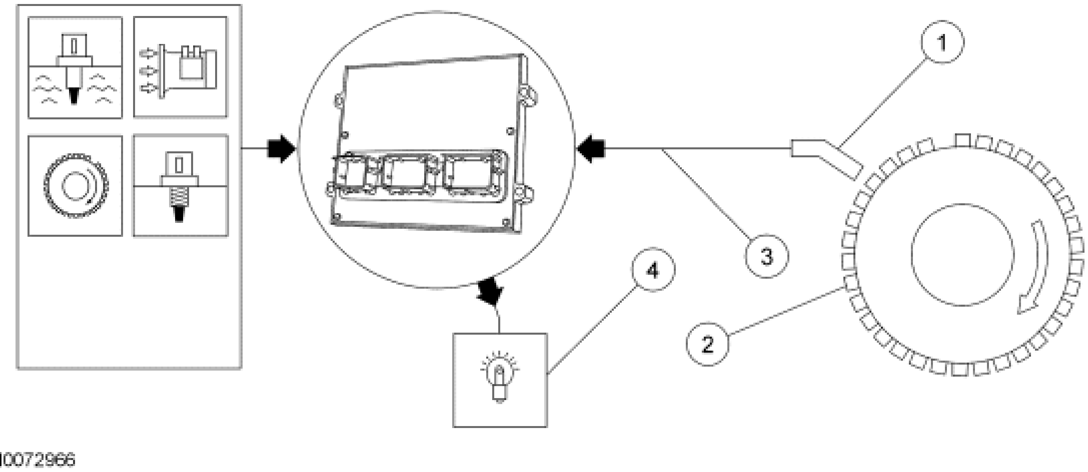


Fig. 107: Misfire Detection Monitor
Courtesy of FORD MOTOR CO.

Misfire Monitor Operation - There are 2 different misfire monitoring systems used: a low data rate (LDR) and a high data rate (HDR). The LDR system is capable of meeting the federal test procedure monitoring requirements on most engines and is capable of meeting the full-range of misfire monitoring requirements on 4-cylinder engines. The HDR system is capable of meeting the full-range of misfire monitoring requirements on 6-cyliner and 8-cylinder engines. The HDR on these engines meets the full-range of misfire phase-in requirements specified in the OBD regulations. The PCM software allows for detection of any misfires that occur 6 engine revolutions after initially cranking the engine. This meets the OBD requirement to identify misfires within 2 engine revolutions after exceeding the warm drive, idle RPM.

Low Data Rate System (LDR) - The LDR misfire monitor uses a low data rate CKP signal which indicates one position reference at 10 degrees before top dead center (BTDC) for each cylinder event. The PCM uses the CKP signal to calculate the crankshaft speed and acceleration for each cylinder. The crankshaft acceleration is then processed to detect a sporadic, single-cylider misfire patterns or multi-cylinder misfire patterns. The changes in overall engine RPM are removed by subtracting the median engine acceleration over a complete engine cycle. The resulting deviant cylinder acceleration values are used in evaluating misfire. Refer to the Generic Misfire Processing for more information.

High Data Rate System (HDR) - The HDR misfire monitor uses a high data rate CKP signal which

indicates18 position references per crankshaft revolution. This high resolution signal is processed using 2 different algorithms. The first algorithm is optimized to detect hard misfires on one or more continuously misfiring cylinders. The low pass filter filters the high-resolution crankshaft velocity signal to remove some of the crankshaft torsional vibrations that degrade signal to noise. Two low pass filters are used to enhance detection capability - a base filter and a more aggressive filter to enhance single-cylinder capability at higher RPM. This significantly improves detection capability for continuous misfires on single cylinders up to red line. The second algorithm, called pattern cancellation, is optimized to detect low rates of misfire. The algorithm learns the normal pattern of cylinder accelerations from the mostly good firing events and is then able to accurately detect deviations from that pattern. Both the hard misfire algorithm and the pattern cancellation algorithm produce a deviant cylinder acceleration value, which is used in evaluating misfire in the General Misfire Algorithm Processing part below. Due to the high data processing requirements, the HDR algorithms could not be implemented in the PCM microprocessor. They are implemented in a separate chip in the PCM called an AICE chip. The PCM microprocessor communicates with the AICE chip using a dedicated serial communication link. The AICE chip sends the cylinder acceleration values back to the PCM microprocessor for additional processing as described below. Lack of serial communication between the AICE chip and the PCM microprocessor, or an inability to synchronize the crankshaft or camshaft sensors inputs sets a DTC. DTC P0606 is set if there is a lack of serial communication between the AICE chip and the PCM microprocessor. DTC P1336 is set if there is an inability to synchronize the crank or camshaft sensor inputs. This change was made to improve diagnosis. DTC P0606 generally results in PCM replacement while DTC P1336 points to a lack of synchronization between the camshaft position (CMP) and CKP sensors. Profile correction software is used to learn and correct for mechanical inaccuracies in crankshaft tooth spacing under de-fueled engine conditions (requires 3 decelerations from 97 to 64 km/h (60 to 40 mph) with no-braking after the keep alive memory (KAM) has been reset). If the KAM has been reset, the PCM microprocessor initiates a special routine which computes correction factors for each of the 18 (or 20) position references and sends these correction factors back to the AICE chip to be used for subsequent misfire signal processing. These learned corrections improve the high RPM capability of the monitor. The misfire monitor is not active until a profile has been learned.

Generic Misfire Processing - The acceleration that a piston undergoes during a normal firing event is directly related to the amount of torque that cylinder produces. The calculated piston/cylinder acceleration value(s) are compared to a misfire threshold that is continuously adjusted based on inferred engine torque. Deviant accelerations exceeding the threshold are conditionally labeled as misfires. The calculated deviant acceleration value(s) are also evaluated for noise. Normally, misfire results in a nonsymmetrical loss of cylinder acceleration. Mechanical noise, such as rough roads at high RPM with light load conditions, will produce symmetrical acceleration variations. Cylinder events that indicate excessive deviant accelerations of this type are considered noise. Noise-free deviant acceleration exceeding a given threshold is labeled a misfire. The number of misfires are counted over a continuous 200 revolution and 1,000 revolution period. The revolution counters are not reset if the misfire monitor is temporarily disabled such as for negative torque mode. At the end of the evaluation period, the total misfire rate and the misfire rate for each individual cylinder is computed. The misfire rate is evaluated every 200 revolution period (Type A) and compared to a threshold value obtained from an engine speed/load table. This misfire threshold is designed to prevent damage to the catalyst due to sustained excessive temperature 871°C (1,600°F) for Pt/Pd/Rh conventional wash coat, 899°C (1,650°F) for Pt/Pd/Rh advanced wash coat and 982°C (1,800°F) for Pd-only high tech wash coat. If the misfire threshold is exceeded and the catalyst temperature model calculates a catalyst mid-bed temperature that exceeds the catalyst damage threshold, the MIL blinks at a 1 Hz rate while the misfire is present. If the threshold is again exceeded on a subsequent driving cycle, the MIL is illuminated. If a single cylinder is indicated to

be consistently misfiring in excess of the catalyst damage criteria, the fuel injector to that cylinder may be shut off for a period of time to prevent catalyst damage. Up to 2 cylinders may be disabled at the same time. This fuel shut-off feature is used on many 8-cylinder engines and some 6-cylinder engines. It is never used on a 4-cylinder engine. The misfire rate is also evaluated every 1,000 revolution period and compared to a single (type B) threshold value to indicate if the emission-threshold exceeded, which can be either a single 1,000 over-rev event from startup or 4 subsequent 1,000 over-rev events on a drive cycle after start-up. Many vehicles will set DTC P0316 if the type B threshold is exceeded during the first 1,000 revolutions after engine startup. This DTC is stored in addition to the normal P03xx DTC that indicates the misfiring cylinder. If the misfire is detected but it can not be attributed to a specific cylinder, a P0300 is stored.

Profile Correction - Profile correction software is used to learn and correct for mechanical inaccuracies in the crankshaft position wheel tooth spacing. Since the sum of all the angles between the crankshaft teeth must equal 360 degrees, a correction factor can be calculated for each misfire sample interval that makes all the angles between individual teeth equal. To prevent any fueling or combustion differences from affecting the correction factors, learning is done during deceleration-fuel cutout. The correction factors are learned during closed-throttle, non-braking, de-fueled decelerations in the 97 to 64 km/h (60 to 40 mph) range after exceeding 97 km/h (60 mph) (likely to correspond to a freeway exit condition). In order to minimize the learning time for the correction factors, a more aggressive deceleration-fuel cutout strategy may be used when the conditions for learning are present. The corrections are typically learned in a single deceleration, but can be learned during up to 3 such decelerations. The mature correction factors are the average of a selected number of samples. A low data rate misfire system will typically learn 4 such corrections in this interval, while a high data rate system will learn 36 or 40 in the same interval (data is actually processed in the AICE chip). In order to assure the accuracy of these corrections, a tolerance is placed on the incoming values such that an individual correction factor must be repeatable within the tolerance during learning. This is to reduce the possibility of learning corrections on rough road conditions which could limit misfire detection capability and to help isolate misfire diagnoses from other crankshaft velocity disturbances. Since inaccuracies in the wheel tooth spacing can produce a false indication of misfire, the misfire monitor is not active until the corrections are learned. In the event of battery disconnection or loss of keep alive memory (KAM), the correction factors are lost and must be relearned. If the software is unable to learn a profile after three, 97 to 64 km/h (60 to 40 mph) deceleration cycles, DTC P0315 is set.

Misfire Monitor Specifications - Misfire monitor operation: DTCs P0300 to P0310 (random and specific cylinder misfire), P1336 (crankshaft/camshaft sensor range/performance), P0606 (control module processor), P0315 (crankshaft position system variation not learned), P0316 (misfire detected on startup [first 1000 revolutions]). The monitor execution is continuous, misfire rate calculated every 200 or 1,000 revolutions. The monitor does not have a specific sequence. The CKP and CMP sensors have to be operating correctly to run the monitor. The monitoring duration is the entire driving cycle (see disablement conditions below).

Typical misfire monitor entry conditions: Entry condition minimum/maximum time since engine start-up is 0 seconds, engine coolant temperature is -7°C to 121°C (20°F to 250°F), RPM range is (full-range misfire certified, with 2 revolution delay) 2 revolutions after exceeding 150 RPM below drive idle RPM to red line on tach or fuel cutoff, profile correction factors are learned in KAM, and the fuel tank level is greater than 15%.

Typical misfire temporary disablement conditions: Closed throttle deceleration (negative torque, engine

being driven), Fuel shut-off due to vehicle-speed limiting or engine-RPM limiting mode, and a high rate of change of torque (heavy throttle tip-in or tip out)

The profile learning operation includes DTC P0315 - unable to learn profile in three, 97 to 64 km/h (60 to 40 mph) decelerations; monitor execution is once per KAM reset; The monitor sequence: profile must be learned before the misfire monitor is active; The CKP and CMP sensors are required to be OK; no AICE communication errors, CKP/CMP signals must be synchronized. The monitoring duration is 10 cumulative seconds in conditions (a maximum of three, 97 to 64 km/h (60 to 40 mph) de-fueled decelerations).

Typical profile learning entry conditions: Entry conditions from minimum to maximum: Engine in deceleration-fuel cutout mode for 4 engine cycles, the brakes are not applied, the engine RPM is 1,300 to 3,700 RPM, the change is less than 600 RPM, the vehicle speed is 48 to 112 km/h (30 to 70 mph), and the learning tolerance is 1%.

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM MONITOR

The PCV monitor consists of a modified PCV system design. The PCV valve is installed into the rocker cover using a quarter-turn cam-lock design to prevent accidental disconnection. High retention force molded plastic lines are used from the PCV valve to the intake manifold. The diameter of the lines and the intake manifold entry fitting are increased so that inadvertent disconnection of the lines after a vehicle is repaired causes either an immediate engine stall or does not allow the engine to be restarted. In the event that the vehicle does not stall if the line between the intake manifold and PCV valve is inadvertently disconnected, the vehicle has a large vacuum leak that causes the vehicle to run lean at idle. This illuminates the MIL after 2 consecutive driving cycles and stores one or more of the following DTCs: Lack of HO2S sensor switches, bank 1 (P2195), Lack of HO2S sensor switches bank 2 (P2197), fuel system lean, bank 1 (P0171) or fuel system lean, bank 2 (P0174).

For additional PCV information, refer to **POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM**.

SECONDARY AIR INJECTION (AIR) SYSTEM MONITOR

The secondary air injection (AIR) system monitor is an on-board strategy designed to monitor the correct function of the secondary air injection system. The AIR monitor for the secondary air injection pump system consists of 2 monitor circuits: an AIR circuit to diagnose concerns with the primary circuit side of the AIR relay, and an AIR monitor circuit to diagnose concerns with the secondary circuit side of the AIR relay. A functional check is also carried out that tests the ability of the AIR system to inject air into the exhaust. The functional flow test relies on the mass air flow (MAF) sensor to determine the presence of air flow. The monitor check for specific changes in MAF input with the secondary AIR pump ON compared to secondary AIR pump OFF for failure detection. The integrity of the secondary AIR pump, inlet house, outlet house and related secondary AIR mechanical components are all checked during the functional flow test. The monitor is enabled during AIR system operation and only after certain base engine conditions are first satisfied. Input is required from the engine coolant temperature (ECT) or cylinder head temperature (CHT), mass air flow / intake air temperature (MAF/IAT), crankshaft position (CKP) sensors and the HO2S monitor test must also have passed without a fault detection to enable the AIR monitor. The AIR monitor is also activated during on-demand self-test.

1. On the primary side of the AIR relay, open and short circuit concerns are detected during normal

operation by the PCM output driver. This circuit energizes the relay and the vacuum-operated check and solenoid control valves.

The DTC associated with this test is P0412.

2. On the secondary side of the AIR relay, the AIR monitor circuit is held low by the resistance path through the secondary AIR pump when the secondary AIR pump is off. If the AIR monitor circuit is high there is either an open circuit to the PCM from the pump or there is power supplied to the secondary AIR pump. If the AIR monitor is low when the secondary AIR pump is commanded on, there is either an open circuit from the AIR relay or the AIR relay has failed to supply power to the secondary AIR pump.

   The DTCs associated with this test are P2257 and P2258.

3. The functional flow test is done when the secondary AIR pump is normally commanded on. The flow test relies on the MAF sensor for air meter flow changes during secondary AIR pump transitions and the heated oxygen sensor for exhaust rich/lean information. The flow test consist of three diagnostic tests:
   - Secondary AIR pump flow test - Compares the change in the air meter flow during secondary AIR pump transitions (ON/OFF) to a calibrated (expected) air flow table within the PCM. Associated DTC P0491 (Bank 1) and P0492 (Bank 2).
   - Inlet hose test - When the inlet hose is off, the secondary AIR pump still flows the same amount of air into the exhaust, but it is drawing air from the atmosphere instead of through the MAF sensor. This lack of expected air flow through the MAF fails the secondary AIR pump flow test. The engine fuel control system is still fueling for the air meter, therefore the excess air that is going into the exhaust causes the exhaust air fuel ratio to be lean. To set an inlet hose concern DTC P0410, the pump flow test must fail and the exhaust air fuel ratio must indicate too lean.
   - Outlet hose test - When the outlet hose is off, the secondary AIR pump flows more air than anticipated, since the exhaust back pressure is no longer impacting the secondary AIR pump air flow. The MAF sensor indicates excess air is drawn through the system. During this failure mode, engine air fuel ratio is reduced to protect the engine from running too rich. But since the outlet hose is disconnected, secondary air is not delivered to the exhaust system, causing the exhaust air fuel ratio to be rich at idle. To set the outlet hose concern DTC P2448 (Bank 1) and P2449 (Bank 2), the secondary AIR pump on flow test must indicate excess air flow and exhaust air fuel ratio too rich.
4. The MIL is activated after one of the above tests fail on 2 consecutive drive cycles.

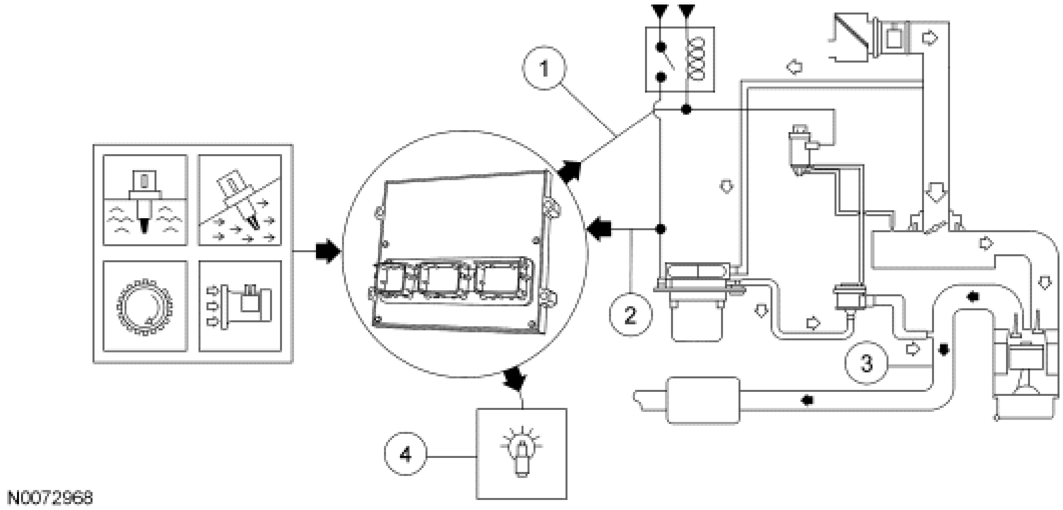


Fig. 108: Secondary AIR System Monitor
Courtesy of FORD MOTOR CO.

THERMOSTAT MONITOR

The thermostat monitor is designed to verify correct thermostat operation. This monitor is executed once per drive cycle and has a monitor run duration of 300-800 seconds. If a concern is present, DTC P0125 or P0128 is set and the malfunction indicator lamp (MIL) is illuminated.

The monitor checks the engine coolant temperature (ECT) or cylinder head temperature (CHT) sensor to warm up in a predictable manner when the engine is generating sufficient heat. A timer is initialized while the engine is at moderate load and the vehicle speed is above a calibrated limit. The target timer value is based on ambient air temperature at start-up. If the timer exceeds the target time and ECT or CHT has not warmed up to the target temperature, a concern is indicated. The test runs if the start-up intake air temperature from the intake air temperature (IAT) sensor is at, or below the target temperature. A 2-hour engine off soak time is also required to enable the monitor and to prevent erasing of any pending DTCs during a hot soak. This soak time feature also prevents false-passes of the monitor when the engine coolant temperature rises after the engine is turned off during a short engine off soak period.

The target temperature is calibrated to -11°C (20°F) the thermostat regulating temperature. For a typical 90°C (195°F) thermostat, the target temperature would be calibrated to 79°C (175°F). Some vehicle calibrations may lower the target temperature to less than 27°C (50°F) for vehicles that do not warm-up to thermostat regulating temperatures in the 11°C (20°F) to 27°C (50°F) ambient temperature range.

1. Inputs: ECT or CHT, IAT, engine LOAD (from MAF sensor) and vehicle speed input.

   Typical monitor entry conditions:

   - vehicle speed greater than 24 km/h (15 mph)
   - intake air temperature at start-up is between -7°C (20°F) and target thermostat temperature
   - engine load greater than 30%
   - engine off (soak) time greater than 2 hours

2. Output: MIL.

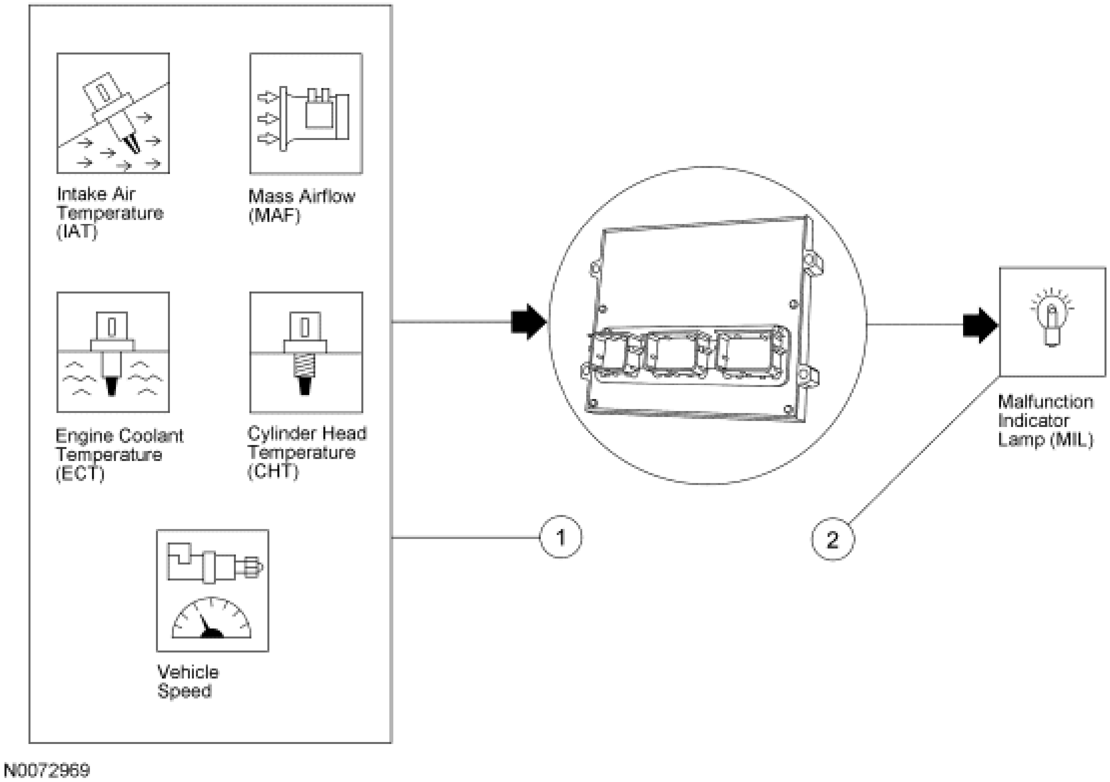


Fig. 109: Thermostat Monitor
Courtesy of FORD MOTOR CO.

VARIABLE CAMSHAFT TIMING (VCT) MONITOR

The VCT output driver in the powertrain control module (PCM) is checked electrically for opens and shorts. The VCT system is checked functionally by monitoring the closed loop camshaft position error correction. If the correct camshaft position cannot be maintained and the system has an advance or retard error greater than the calibrated threshold, a VCT control concern is indicated.

For additional information, refer to **VARIABLE CAMSHAFT TIMING (VCT) SYSTEM**.

2008 ENGINE PERFORMANCE

Diagnostic Methods - Gasoline Engines

DIAGNOSTIC METHODS

OVERVIEW

The Diagnostic Methods Section provides information on routine diagnostic tasks.

When following powertrain diagnostics on vehicles with on board diagnostics (OBD), the system may be checked by an off-board tester referred to as a scan tool. This part contains information for carrying out diagnostics with a scan tool. A scan tool has certain generic capabilities that are standard across the automotive industry in the United States and Canada. All functions are selected from a menu. Refer to the instruction article provided by the tool manufacturer.

DIAGNOSTIC TOOLS

Below is an equipment list with corresponding part numbers:

REQUIRED EQUIPMENT:

- Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool with functionality described under Scan Tool Setup and Functionality.
- Rotunda Smoke Machine, Fuel Evaporative Emission System Tester 218-00001 (522) or equivalent.

RECOMMENDED EQUIPMENT:

- Rotunda Vacuum/Pressure Tester 164-R0253 or equivalent. Range 0-101.3 kPa (0-30 in-Hg.) Resolution 3.4 kPa (1 in-Hg.)
- Rotunda Vacuum Tester 014-R1054 or equivalent. Range 0-101.3 kPa (0-30 in-Hg.)
- Rotunda 73III Automotive Meter 105-R0057 or equivalent. Input impedance 10 Megaohm minimum.
- Spark Tester D81P-6666-A (303-D037) or equivalent.
- Non-powered test lamp.

OPTIONAL EQUIPMENT:

- Rotunda Fuel (Gasoline) pressure test kit 134-R0087 or equivalent. (Use tool manufacturer's instructions.)

SCAN TOOL SETUP AND FUNCTIONALITY

Connect the scan tool to the data link connector (DLC) for communication with the vehicle.

The DLC is located in the driver side compartment under the steering column. It is attached to the instrument

panel and accessible from the driver seat.

The DLC is rectangular in design and capable of accommodating up to 16 terminals. The connector has keying features to allow easy connection.

The required scan tool functions are described below:

- monitor, record, and playback of parameter identification (PIDs)
- freeze frame PID data
- diagnostic test modes; self-test, clear diagnostic trouble codes (DTCs)
- output test mode
- resetting keep alive memory (KAM)
- diagnostic monitoring test results (mode 6) for on board diagnostic (OBD) on board monitors
- on-board system readiness (OBD monitor completion status)

Some of these functions are described. Refer to the scan tool manufacturer's instruction article for specific information on scan tool setup and operation.

INTERNATIONAL STANDARDS ORGANIZATION (ISO) 14229 DIAGNOSTIC TROUBLE CODE (DTC) DESCRIPTIONS

The ISO 14229 DTC is a set of common requirements for diagnostic systems. The scan tool displays a failure type and a status type with the DTC. The types display additional information on the scan tool for the condition that set the DTC. For a list of failure type descriptions, refer to**POWERTRAIN CONTROL SOFTWARE** , International Standards Organization (ISO) 14229 Diagnostic Trouble Code (DTC) Descriptions.

VEHICLE CHECK/PREPARATION

Before using the scan tool to carry out any test, refer to the important Safety Notice located at the beginning of this article and the necessary visual checks listed below.

VISUAL CHECKS

- Inspect the air cleaner and inlet duct.
- Check all engine vacuum hoses for damage, leaks, cracks, kinks, and proper routing.
- Check the electronic engine control (EEC) system wiring harness for proper connections, bent or broken pins, corrosion, loose wires, and proper routing.
- Check the powertrain control module (PCM), sensors, and actuators for physical damage.
- Check the engine coolant for proper level and mixture.
- Check the transmission fluid level and quality.
- Make all necessary repairs before continuing with the quick test. Refer to**QUICK TEST**.

VEHICLE PREPARATION

- Carry out all safety steps required to start and run vehicle tests. Apply the parking brake, place the gear selector lever firmly into the PARK position on automatic transmission vehicles or NEUTRAL on manual transmission vehicles, and block the drive wheels.
- Turn off all electrical loads such as radios, lamps, A/C, blower, and fans.
- Start the engine (if the engine runs) and bring it up to the normal operating temperature before running the quick test.

QUICK TEST DESCRIPTION

QUICK TEST

The quick test is divided into 3 specialized tests:

Key On Engine Off (KOEO) On-Demand Self-Test
Key On Engine Running (KOER) On-Demand Self-Test
Continuous Memory Self-Test

The quick test checks the integrity and function of the electronic engine control (EEC) system and outputs the test results when requested by the scan tool. The quick test also provides a quick check of the powertrain control system, and is usually carried out at the start of each diagnostic procedure with all accessories off. The quick test is also carried out at the end of most pinpoint tests for verification of the repair and to make sure no other concerns are incurred while repairing a previous concern. A system pass is displayed when no diagnostic trouble codes (DTCs) are output and a scan tool communication error does not exist. System pass means that hardware monitored by the powertrain control module (PCM) is functioning within the normal operating limits. Only a system pass, a DTC, or an incomplete on board diagnostic (OBD) drive cycle (P1000) is displayed.

For applications that use a stand-alone transmission control module (TCM) the PCM does not output TCM DTCs. For TCM self-test and diagnostics, refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .

KEY ON ENGINE OFF (KOEO) ON-DEMAND SELF-TEST

The KOEO on-demand self-test is a functional test of the PCM carried out on-demand with the key on and the engine off. This test carries out checks on certain sensor and actuator circuits. A concern must be present at the time of testing for the KOEO self-test to detect the concern. When a concern is detected, a DTC is output on the data link at the end of the test as requested by the scan tool.

KEY ON ENGINE RUNNING (KOER) ON-DEMAND SELF-TEST

The KOER on-demand self-test is a functional test of the PCM carried out on-demand with the key on, the engine running and the vehicle stopped. A check of certain inputs and outputs is made during operating conditions and at a normal operating temperature. The brake pedal position, transmission control, and the power steering tests are part of the KOER on-demand self-test and must be carried out during this operation if applicable. These are described below. A concern must be present at the time of testing for the KOER on-demand self-test to detect the concern. When a concern is detected, a DTC is output on the data link at the end of the test as requested by the scan tool.

Brake Pedal Position (BPP) Test

The BPP test checks the ability of the EEC system to detect a change of state in the BPP switch. The brake pedal is briefly applied and released on all vehicles equipped with a BPP input. This is done during a KOER on-demand self-test.

Power Steering Pressure (PSP) Test

The PSP test checks the ability of the EEC system to detect a change in the power steering system fluid pressure. The steering wheel is briefly turned at least 1/4 of a revolution on vehicles equipped with a PSP switch or sensor. This is done during a KOER on-demand self-test.

Transmission Control Switch (TCS) Test

The TCS test checks the ability of the EEC system to detect a change of state in the TCS. The switch is briefly cycled on all vehicles equipped with a TCS input. This is done during a KOER on-demand self-test.

CONTINUOUS MEMORY SELF-TEST

The continuous memory self-test is a functional test of the PCM carried out under any condition (engine running or off) with the key on. Unlike the KOEO and KOER self-tests, which can only be activated on-demand, the continuous self-test is always active. A concern does not need to be present when accessing continuous memory self-test DTCs, making the test valuable when diagnosing intermittent concerns. The vehicle may need to be driven or the on board diagnostic (OBD) drive cycle completed to allow the PCM to detect a concern. Refer to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** for more information. When a concern is stored in memory, a DTC is output on the data link when requested by the scan tool.

There are two types of continuous DTCs. The first type is an emission-related code which illuminates the malfunction indicator lamp (MIL) in the instrument cluster. The second is a non-emission related, non-MIL code which does not illuminate the cluster indicator.

For emission-related MIL codes, the PCM stores the DTC in continuous memory when a concern is detected for the first time. At this point the DTC does not illuminate the MIL and is now considered a pending code. The purpose of pending codes is to assist in repair verification by reporting a pending DTC after one drive cycle. If the same concern is detected after the next ignition start-run cycle, the emission-related MIL code illuminates the MIL. The MIL remains on even if the concern is intermittent. The MIL is extinguished if the concern is not present through 3 consecutive drive cycles or if the concern is fixed and the DTCs are cleared. Also, an emission-related pending MIL and any non-emission related, non-MIL DTCs are erased after approximately 40 vehicle warm-up cycles or if the DTCs are cleared.

Any scan tool that meets OBD requirements can access the continuous memory to retrieve emission-related MIL DTCs. However, not all scan tools access pending and non-emission related, non-MIL DTCs in the same way.

During most diagnostic procedures in this article, it is required that all DTCs be retrieved and cleared. Consult the instruction article from the tool manufacturer for specific instructions.

CLEAR THE CONTINUOUS DIAGNOSTIC TROUBLE CODES (DTCS) AND

RESET THE EMISSION MONITORS INFORMATION IN THE POWERTRAIN CONTROL MODULE (PCM)

DESCRIPTION

All on board diagnostics (OBD) scan tools support the clearing of continuous DTCs and resetting of emission monitors information in the PCM.

The clearing of the continuous DTCs allows the scan tool to command the PCM to clear/reset all emission-related diagnostic information. While carrying out this operation DTC P1000 is stored in the PCM until all the OBD system monitors or components have been tested to satisfy a drive cycle without any other concerns occurring. For more information about a drive cycle, refer to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE**.

The following events occur when the continuous DTCs and the emission monitors information is cleared from the PCM:

- the number of DTCs is reset
- the DTCs are cleared
- the freeze frame data is cleared
- the diagnostic monitoring test results are reset
- the status of the OBD system monitors is reset
- DTC P1000 is set

RESETTING THE KEEP ALIVE MEMORY (KAM)

DESCRIPTION

Resetting the KAM returns the powertrain control module (PCM) memory to its default setting. Adaptive learning contents such as adaptive airflow, idle speed, refueling event, and fuel trim are included. Clear the continuous diagnostic trouble codes (DTCs) in the PCM and reset the emission monitors information, is part of a KAM reset. Refer to **CLEAR THE CONTINUOUS DIAGNOSTIC TROUBLE CODES (DTCS) AND RESET THE EMISSION MONITORS INFORMATION IN THE POWERTRAIN CONTROL MODULE (PCM)**. Both can be useful in post-repair testing.

After the KAM has been reset, the vehicle may exhibit certain driveability concerns. It is necessary to allow the engine to idle at normal operating temperature with the air conditioning (A/C) OFF for 2 minutes. Then drive the vehicle to allow the PCM to learn the values for optimum driveability and performance.

This function may not be supported by all scan tools. Refer to the scan tool manufacturer's instruction article.

If an error message is received or the scan tool does not support this function, disconnecting the battery ground cable for a minimum of 5 minutes may be used as an alternative procedure.

ON-BOARD SYSTEM READINESS (OSR) TEST

DESCRIPTION

All on board diagnostic (OBD) scan tools display the on-board system readiness (OSR) test. The OSR displays the supported monitors on the vehicle and the status of all monitors (complete or not complete) at that time. Fuel, misfire, and comprehensive component monitors (CCMs) run continuously and always display YES status. Clearing the continuous diagnostic trouble codes (DTCs) and resetting the emission monitors information in the powertrain control module (PCM), or resetting the keep alive memory (KAM) causes the non-continuous monitors to change to a NO status.

A detailed description of completing the OBD monitors is found. Refer to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE**.

OUTPUT STATE CONTROL (OSC)

DESCRIPTION

WARNING: **Safety must be observed when using OSC. Failure to follow these instructions may result in personal injury.**

The OSC aids in diagnosing output actuators associated with the powertrain control module (PCM) for the engine. This mode allows the technician to command the individual actuator state. For example: the output can be enabled or disabled, the duty cycle or the angle of the output can be increased or decreased. The OSC is used to help test the electrical, hydraulic or mechanical components of the vehicle. This function is supported by the vehicle strategy but may not be present on all vehicles or available on all scan tools.

Retrieve the continuous codes and carry out a key on, engine off (KOEO) and key on, engine running (KOER) on-demand self-test before using any OSC. Any diagnostic trouble codes (DTCs) related to the transmission range (TR) sensor, output shaft sensor (OSS) or the vehicle speed sensor (VSS) must be fixed or the PCM does not allow the OSC to operate.

The OSC has 2 options for operation, the Bench Mode and the Drive Mode. The Bench Mode is functional only when the vehicle gear selector is in the PARK or NEUTRAL position. The Bench Mode may be used when the engine is on (running) or off (not running).

Each OSC function has a unique set of vehicle operating requirements that the technician is required to meet before operating the OSC. If the vehicle requirements are not met while commanding the OSC value, an error message appears. When the error message is received, OSC is canceled.

To confirm that the scan tool sent the OSC value and the PCM has accepted the OSC substitution, a corresponding parameter identification (PID) for each OSC parameter must be monitored.

One Touch Integrated Start System - Some vehicles are equipped with one touch integrated start system. It may be necessary to disable the one touch integrated start system to carry out diagnostic procedures that require extended cranking. Connect the scan tool, access the PCM and select the one touch integrated start system control PID to disable the system.

OUTPUT TEST MODE (OTM)

DESCRIPTION

WARNING: **Safety must be observed when using OTM.**

- **When all outputs are on, the electric fuel pump is briefly energized. Make sure the fuel system is intact and is not being repaired at this time.**
- **When low speed or high speed fan control(s) are turned on, make sure the fan blades are clear of any obstruction.**
- **Failure to follow these instructions may result in personal injury.**

The OTM aids in diagnosing output actuators associated with the powertrain control module (PCM). This mode allows the technician to energize and de-energize most of the system output actuators on command. When entering OTM, the outputs can be turned off and on without activating the fan control. The low and high speed fan controls may be turned on separately without energizing the other outputs. This function is supported by each vehicle strategy and may not be available on all scan tools.

As a safety precaution, OTM defaults to the off state after 10 minutes, and the fuel pump off state after approximately 7-10 seconds. OTM also turns off after the vehicle is started or after cycling the key off then on.

PARAMETER IDENTIFICATION (PID)

DESCRIPTION

The PID mode allows access to powertrain control module (PCM) information. This includes analog and digital signal inputs and outputs along with calculated values and the system status. There are 2 types of PID lists available and both are used throughout this article. The first is the generic (J1979) OBD PID list. This is a standard set of PIDs that all scan tools must be able to access. The second is a Ford-specific (J2190) list which can be accessed by an appropriate scan tool. When accessing any of these PIDs, the values are continuously updated. The generic or Ford PID list provides definitions and values in appropriate units. For more information, refer to the Society of Automotive Engineers (SAE) document J2205.

Generic OBD PID List

An X in the Freeze Frame column denotes both a mode 1 and mode 2 PID (real time and freeze frame).

Freeze Frame	Acronym	Description	Measurement Units
X	AAT	Ambient Air Temperature	Degrees
X	AIR	Secondary Air Status	On/Off
X	APP_D	Accelerator Pedal Position D	%
X	APP_E	Accelerator Pedal Position E	%
X	APP_F	Accelerator Pedal Position F	%
X	CATEMP11	Catalyst Temperature Bank 1, Sensor	Degrees

		1	
X	CATEMP12	Catalyst Temperature Bank 1, Sensor 2	Degrees
X	CATEMP21	Catalyst Temperature Bank 2, Sensor 1	Degrees
X	CATEMP22	Catalyst Temperature Bank 2, Sensor 2	Degrees
	CLR_DST	Distance since codes cleared	Km
	CCNT	Continuous DTC Counter	Unitless
X	ECT	Engine Coolant Temperature	Degrees
X	EGR_PCT	Commanded EGR	%
X	EGR_ERR	EGR Error	%
X	EVAP_PCT	Commanded Evaporative Purge	%
X	EVAP_VP	Evaporative System Vapor Pressure	Pa
X	EQ_RAT	Commanded Equivalence Ratio	Unit
X	FUEL SYS1	Fuel System Feedback Control Status-Bank 1	OL/CL/OL DRIVE[a] /OL FAULT/ CL FAULT
X	FUEL SYS2	Fuel System Feedback Control Status-Bank 2	OL/CL/OL DRIVE[a] /OL FAULT/ CL FAULT
	IAT	Intake Air Temperature	Degrees
X	LOAD[b]	Calculated Engine Load	%
X	LOAD_ABS	Absolute Load Value	%
X	LONGFT1	Current Bank 1 Fuel Trim Adjustment (kamref1) From Stoichiometric Which Is Considered Long Term	%
X	LONGFT2	Current Bank 2 Fuel Trim Adjustment (kamref2) From Stoichiometric Which Is Considered Long Term	%
X	MAF	Mass Air Flow Rate	gm/s-lb/min
	MIL_DIST	Distance traveled with MIL on	Kilometer
X	O2S11	Bank 1 Upstream Oxygen Sensor (11)	Volts
X	O2S12	Bank 1 Downstream Oxygen Sensor (12)	Volts
X	O2S13	Bank 1 Downstream Oxygen Sensor (13)	Volts
X	O2S21	Bank 2 Upstream Oxygen Sensor (21)	Volts
X	O2S22	Bank 2 Downstream Oxygen Sensor	Volts

		(22)	
X	O2S23	Bank 2 Downstream Oxygen Sensor (23)	Volts
	OBDSUP	On Board Diagnostic System	OBD II OBD I OBD Combination of or None
X	PTO	Power Take-Off Status	On/Off
X	RPM	Revolutions per Minute	RPM
X	RUNTM	Run time	Seconds
X	SHRTFT1	Current Bank Fuel Trim Adjustment (lambse1) From Stoichiometric Which Is Considered Short Term	%
X	SHRTFT2	Current Bank 2 Fuel Trim Adjustment (lambse1) From Stoichiometric Which Is Considered Short Term	%
X	SPARKADV	Spark Advance Requested	Degrees
X	SPARK_ACT	Spark Advance Actual	Degrees
X	TAC_PCT	Commanded Throttle Actuator	%
X	TP	Throttle Position	%
X	TP_R	Relative Throttle Position	%
	WARM_UPS	Number of warm ups since codes cleared	Units
X	VSS	Vehicle Speed Sensor	km/h-mph
CL = Closed loop using HO2S(s) as feedback for fuel control. OL DRIVE = Open loop due to driving conditions (heavy acceleration). OL FAULT = Open loop due to fault with all upstream HO2S sensors. CL FAULT = Closed loop fuel control, but fault with one upstream HO2S sensor on dual bank vehicles.			

[a] OL = Open loop, have not satisfied conditions for closed loop.

[b] Percent engine load adjusted for atmospheric pressure.

Ford PID List

NOTE: This is not a complete list of Ford PIDs available. This is a list of Ford PIDs in this article.

Acronym	Description	Ford Units
ACCS	Air Conditioning Cycling Switch Input	On/Off
ACP	A/C Pressure Transducer Sensor	Volts
ACP	A/C Pressure Transducer Sensor	kPa/psi
ACP_PRESS	A/C Pressure Transducer Sensor	DCV/psi
ACP_PSI	A/C Pressure Transducer Sensor	psi
AIR	Secondary AIR Pump Control	On/Off
AIR_F	Secondary AIR Fault Indicator	Yes/No
AIRM	Secondary AIR Pump Monitor	On/Off
APP	Accelerator Pedal Position	%
APP1	Accelerator Pedal Position 1	Volts
APP2	Accelerator Pedal Position 2	Volts
APP3	Accelerator Pedal Position 3	Volts
APP_MAXDIFF	Maximum Difference between APP1 and APP2	Degrees
APP_MODE	Accelerator Pedal Position Mode	Pedal position
AXLE	Axle Ratio	Ratio
B+	Battery Voltage	DCV
BARO	Barometric Pressure Sensor	Frequency
BOO	Brake Pedal Position (BPP) Switch	On/Off
BOO1	Brake Pedal Position (BPP) Switch	On/Off
BOO2	Brake Pedal Switch (BPS)	On/Off
BPA	Brake Pedal Switch (BPS)	On/Off
BPP/BOO	Brake Pedal Position (BPP) Switch	On/Off
CAT_EVAL	Catalyst Evaluated	Yes/No
CCS	Coast Clutch Solenoid Control	On/Off
CHT	Cylinder Head Temperature Input	Degrees
CHT	Cylinder Head Temperature Input	Volts
CLRDIST	Distance Since DTCs Cleared	Miles
CLRWRMUP	Number of Warm-ups Since DTCs Cleared	Count
CMPFM	Camshaft Position Sensor Fault Mode	Yes/No
CMPFM2	Camshaft Position Sensor 2 Fault Mode	Yes/No
CMP_F	Camshaft Position Sensor Fault Mode	Yes/No
CPP	Clutch Pedal Position Switch Input	On/Off
CPP/PNP	Clutch Pedal Position/Park Neutral Position Switch	On/Off

	Input	
DECHOKE	Crank Fueling Disabled	Yes/No
DPFEGR	Differential Pressure Feedback EGR Input	Volts
DRIVECNT	Number of Successful Key Cycles and Engine Starts	Count
DTCCNT	Total Number of Fault Codes	Count
ECT	Engine Coolant Temperature Input	Degrees
ECT	Engine Coolant Temperature Input	Volts
ECT_ACT	Engine Coolant Temperature	Degrees F
ECT_DSD	Engine Coolant Temperature Desired	Degrees F
EGRMC1	EGR Motor Control Output Command	On/Off
EGRMC2	EGR Motor Control Output Command	On/Off
EGRMC3	EGR Motor Control Output Command	On/Off
EGRMC4	EGR Motor Control Output Command	On/Off
EGRMDSD	Electric EGR Motor Commanded in Steps	On/Off
EGRPCT	Commanded EGR	%
EGRVR	EGR Valve Vacuum Control	%
EGR_EVAL	EGR Evaluated	Yes/No
EGR_STEP	EGR Valve Motor Position	Position
EOT	Engine Oil Temperature Sensor Input	Degrees
EOT	Engine Oil Temperature Sensor Input Volts	Volts
EOT_F	Engine Oil Temperature Sensor Fault	Fault/No Fault
EPC	Electronic Pressure Control	kPa/PSI
EPC V	Electronic Pressure Control	Volts
ETC_ACT	Electronic Throttle Control Actual	Degrees
ETC_DSD	Electronic Throttle Control Desired	Degrees
ETC_TRIM	Electronic Throttle Control Trim	Degrees
EVAP020C	Evaporative Emissions Monitor	Yes/No
EVAP020D	Evaporative Emissions Monitor	Allow/ Disallow
EVAP020R	Evaporative Emissions Monitor	Ready/ Not Ready
EVAPCPF	Evaporative Emissions Canister Purge Fault	Yes/No
EVAPCV	Evaporative Emissions Canister Purge Vent Control	%
EVAPCV_F	Evaporative Emissions Canister Purge Vent Fault	Yes/No
EVAPPDC	Evaporative Emissions Canister Purge Solenoid Duty Cycle	Hz/%
EVAPSOAK	Evaporative Emissions Monitor Soak Conditions are Met	Yes/No
EVAPSTA	Evaporative Emissions Monitor Completed Cycle	Status
EVAP_EVAL	Evaporative Emissions Monitor Evaluated	Yes/No
EVMV	Electronic Vapor Management Valve Commanded Current	Current (mA)
FANDC	Variable Speed Fan Duty Cycle	%
FANSS	Fan Speed Sensor Signal	RPM

FANVAR	Variable Speed Fan Output	%
FANVAR_F	Variable Speed Fan Output Fault	Fault/No Fault
FCIL	Fuel Cap Indicator Light	On/Off
FLI	Fuel Level Indicator Input	%
FP	Fuel Pump Duty Cycle	%
FPM	Fuel Pump Secondary Monitor	%
FPM	Fuel Pump Secondary Monitor	On/Off
FRP	Fuel Rail Pressure Input	kPa/PSI
FRP	Fuel Rail Pressure Input	Volts
FRP_DSD	Fuel Rail Pressure Desired	PSI
FRT	Fuel Rail Temperature	Degrees
FRT	Fuel Rail Temperature Voltage	Volts
FTP	Fuel Tank Pressure Input	kPa/in-H2O
FTP	Fuel Tank Pressure Input	Volts
FTP_H2O	Fuel Tank Pressure Input	in-H2O
FUELPW1	Injector Pulse Width Bank 1	Milliseconds
FUELPW2	Injector Pulse Width Bank 2	Milliseconds
FUELSYS	Fuel System Status	Open/Closed Loop
FUELSYS1	Fuel System Status Bank 1	Open/Closed Loop
GEAR	Transmission Gear Status	Gear
GENCMD	Generator Command	Yes/No
GENMON	Generator Field Signal Monitor	%
HFC	High Speed Fan Control	On/Off
HTR11	Bank 1 Sensor 1 HO2S Heater Control	On/Off
HTR11F	Bank 1 Sensor 1 HO2S Heater Circuit Fault	Yes/No
HTR12	Bank 1 Sensor 2 HO2S Heater Control	On/Off
HTR12F	Bank 1 Sensor 2 HO2S Heater Circuit Fault	Yes/No
HTR13	Bank 1 Sensor 3 HO2S Heater Control	On/Off
HTR13F	Bank 1 Sensor 3 HO2S Heater Circuit Fault	Yes/No
HTR21	Bank 2 Sensor 1 HO2S Heater Control	On/Off
HTR21F	Bank 2 Sensor 1 HO2S Heater Circuit Fault	Yes/No
HTR22	Bank 2 Sensor 2 HO2S Heater Control	On/Off
HTR22F	Bank 2 Sensor 2 1 HO2S Heater Circuit Fault	Yes/No
HTRCM11	Bank 1 Sensor 1 O2S Heater Circuit Current	Amps
HTRCM12	Bank 1 Sensor 2 O2S Heater Circuit Current	Amps
HTRCM21	Bank 2 Sensor 1 O2S Heater Circuit Current	Amps
HTRCM22	Bank 2 Sensor 2 O2S Heater Circuit Current	Amps
HTRX1	HO2S Sensor 1 (Upstream) Heater Control	On/Off
HTRX2	HO2S Sensor 2 (Downstream) Heater Control	On/Off
HO2S11	Bank 1 Sensor 1 HO2S Input	Volts
HO2S12	Bank 1 Sensor 2 HO2S Input	Volts
HO2S13	Bank 1 Sensor 3 HO2S Input	Volts
HO2S21	Bank 2 Sensor 1 HO2S Input	Volts
HO2S22		

	Bank 2 Sensor 2 HO2S Input	Volts
IAC	Idle Air Control	%
IAT	Intake Air Temperature Input	Degrees
IAT	Intake Air Temperature Input Volts	Volts
IAT2	Intake Air Temperature Sensor 2 Input	Degrees
IAT2	Intake Air Temperature Sensor 2 Input	Volts
IGN_R/S	Ignition Switch Run/Start	On/Off
IMRC	Intake Manifold Runner Control	On/Off
IMRC_F	Intake Manifold Runner Control Fault	Yes/No
IMRC1M	Intake Manifold Runner Control Monitor Input Bank 1	Volts
IMRCM	Intake Manifold Runner Control Monitor Input Bank 1	Volts
IMTV	Intake Manifold Tuning Valve Control	%
INJ1F-8F	Fuel Injector Primary Fault (Cylinders 1-8)	Yes/No
INJ9F-10F	Fuel Injector Primary Fault (Cylinders 9 and 10)	Yes/No
INJPWR_M	Injectors Circuit Voltage Monitor	DCV
ISS	Input Shaft Speed	Hz/RPM
KNOCK1	Knock Sensor 1 Signal	N/A
KNOCK2	Knock Sensor 2 Signal	N/A
LFC	Low Speed Fan Control	On/Off
LOAD	Calculated Engine Load	%
LONGFT	Long Term Fuel Trim	%
LONGFT1	Long Term Fuel Trim Bank 1	%
LOOP_CONTRL	Fuel System Status	Open/Closed Loop
LONGFT2	Long Term Fuel Trim Bank 2	%
MAF	Mass Airflow Rate Input	gm/s
MAF	Mass Airflow Rate Input	Volts
MAP	Intake Manifold Absolute Pressure	Hz
MAP	Intake Manifold Absolute Pressure (Analog)	Volts
MFC	Medium Speed Fan Control	On/Off
MIL	Malfunction Indicator Lamp Control	On/Off
MIL_DIS	Distance Since MIL was Activated	Miles
MISFIRE	Misfire Status	Yes/No
MP_LRD	Learned Misfire Correction Profile	Yes/No
NM	Number of Misfires	Count
O2BANK1	Bank 1 O2S Status	Rich/Lean
O2BANK2	Bank 2 O2S Status	Rich/Lean
O2S11	Bank 1 Sensor 1 O2S Input	DCV
O2S12	Bank 1 Sensor 2 O2S Input	DCV
O2S21	Bank 2 Sensor 1 O2S Input	DCV
O2S22	Bank 2 Sensor 2 O2S Input	DCV
O2S_EVAL	Oxygen Sensor Circuits Evaluated	Yes/No

O2SHTR_EVAL	Oxygen Sensor Heater Circuits Evaluated	Yes/No
OD_CANCL	Overdrive Cancel Function	On/Off
OSS	Output Shaft Speed	RPM
OSS_SRC	Output Shaft Speed	RPM
OTS_STAT	One Touch Integrated Start System Status	Enabled/Disabled
PATSENABL	Passive Anti-Theft System Status	Enabled/Disabled
PCVHC	Positive Crankcase Ventilation Heater Control	Percent
PSP	Power Steering Pressure Switch Input	High/Low
PSP	Power Steering Pressure Input	Volts
PSP_V	Power Steering Pressure Input	Volts
PTO	Power Take Off Status Input	On/Off
PTOLOAD	Power Take Off Engage Input	Yes/No
PTOIR_V	Power Take Off RPM Select Input	Volts
PTOIL	Power Take Off Indicator Lamp Output	On/Off
RPM	Engine Speed Based Upon CKP Input	RPM
RPMDSD	RPM Desired	RPM
REV	Transmission Reverse Switch Input	On/Off
SCB	Supercharger Bypass Control	On/Off
SHRTFT	Short Term Fuel Trim	%
SHRTFT1	Short Term Fuel Trim Bank 1	%
SHRTFT2	Short Term Fuel Trim Bank 2	%
SPARKADV	Spark Advance Desired	Degrees
SPKDUR_1-8	Spark Duration (Cylinders 1-8)	MS
SS1	Shift Solenoid 1 Control	On/Off
SS2	Shift Solenoid 2 Control	On/Off
SS3	Shift Solenoid 3 Control	On/Off
SS4	Shift Solenoid 4 Control	On/Off
STRT_RLY	Starter Relay	Enabled/Disabled.
TCC	Torque Converter Clutch Control	%
TCIL	Transmission Control Indicator Lamp Clutch Control Status	On/Off
TCS	Transmission Control Switch (TCS)	On/Off
TCSS	Transfer Case Speed Sensor	RPM
TFT	Transmission Fluid Temperature Input	DCV/ Degrees
TFTV	Transmission Fluid Temperature Input	Volts
TORQUE	Net Torque Into Torque Converter	Nm
TP	Throttle Position Input	Volts
TP_MAXDIFF	Maximum Angle Difference between TP1 and TP2	Degrees
TP1	Throttle Position 1 Voltage	Volts
TP2	Throttle Position 2 Voltage	Volts
TR	Transmission Selector Position Input Status	Position
TR1	Transmission Range Sensor 1	Open/Closed
TR2	Transmission Range Sensor 2	Open/Closed

TR3	Transmission Range Sensor 3	Open/Closed
TR4	Transmission Range Sensor 4	Open/Closed
TR V	Transmission Selector Position Input Status	Volts
TR D	Transmission Selector Position Input Status (Digital)	Binary
TRIP_CNT	OBD II Trips Completed	Count
TSS	Turbine Shaft Speed/Input Shaft Speed	RPM
TSS/ISS	Turbine Shaft Speed/Input Shaft Speed	RPM
TSS_SRC	Turbine Shaft Speed/Input Shaft Speed	RPM
VCTADV	Variable Cam Timing Advance	Degrees
VCTADV2	Variable Cam Timing Advance 2	Degrees
VCTADVERR	Variable Cam Timing Advance Error	Degrees
VCTADVERR2	Variable Cam Timing Advance 2 Error	Degrees
VCTDC	Variable Cam Timing Advance Duty Cycle	%
VCTDC2	Variable Cam Timing Advance Duty Cycle	%
VCT_SYS	Variable Cam Timing System Status	Open Loop/ Closed Loop
VOLTDSD	Desired Voltage	Volts
VPWR	Vehicle Power Voltage	Volts
VREF	Vehicle Reference Voltage	Volts
VSS	Vehicle Speed	km/h-mph
WAC/ACCR	A/C Clutch Command	On/Off
WAC_F	WOT A/C Primary Circuit Fault	Yes/No

FREEZE FRAME DATA

DESCRIPTION

Freeze frame data allows access to emission-related values from specific generic parameter identification (PIDs). These values are stored when an emission-related diagnostic trouble code (DTC) is stored in continuous memory. This provides a snapshot of the conditions that were present when the DTC was stored. Once one set of freeze frame data is stored, this data remains in memory even if another emission-related DTC is stored, with the exception of misfire or fuel system DTCs. Once freeze frame data for a misfire or fuel system DTC is stored, it overwrites any previous data, and freeze frame data is no longer overwritten. When a DTC associated with the freeze frame data is erased or the DTCs are cleared, new freeze frame data can be stored again. In the event of multiple emission-related DTCs in memory, always note the DTC for the freeze frame data.

FREEZE FRAME DATA TABLE

Acronym	Description	Measurement Units
AAT	Ambient Air Temperature	Degrees
AIR	Secondary Air Status	
APP_D	Accelerator Pedal Position D	%
APP_E	Accelerator Pedal Position E	%
APP_F	Accelerator Pedal Position F	%
BARO	Barometric Pressure	kPa

CATTEMP11	Catalyst Temperature Bank 1, Sensor 1	Degrees
CATTEMP21	Catalyst Temperature Bank 2, Sensor 1	Degrees
CLRDIST	Distance Since Codes Cleared	Km
ECT	Engine Coolant Temperature	Degrees
EQ_RAT	Commanded Equivalence Ratio	Unit
EQ_RAT11	Lambda Value Bank 1, Sensor 1	Unit
EQ_RAT21	Lambda Value Bank 2, Sensor 1	Unit
EVAPPCT	Commanded Evaporative Purge	%
EVAPVP	Evaporative System Vapor Pressure	Pa
FLI	Fuel Level Input	%
FRP	Fuel Rail Pressure	kPa
FUELSYS1	Open/Closed Loop 1	OL/CL/OL DRIVE/OL FAULT/CL FAULT
FUELSYS2	Open/Closed Loop 2	OL/CL/OL DRIVE/OL FAULT/CL FAULT
IAT	Intake Air Temperature	Degrees
LFT1	Long Term Fuel Bank 1	%
LFT2	Long Term Fuel Bank 2	%
LOAD	Calculated Load Value	%
MAF	Mass Air Flow Rate	g/s
MAP	Manifold Absolute Pressure	kPa
O2S11	Bank 1 Upstream Oxygen Sensor (11)	Volts/mA
O2S12	Bank 1 Downstream Oxygen Sensor (12)	Volts
O2S21	Bank 2 Upstream Oxygen Sensor (21)	Volts/mA
O2S22	Bank 2 Downstream Oxygen Sensor (22)	Volts
RPM	Engine RPM	RPM
RUNTM	Run Time	Seconds
SFT1	Short Term Fuel Bank 1	%
SFT2	Short Term Fuel Bank 2	%
SPARKADV	Spark Advance	Degrees
TAC_PCT	Commanded Throttle Actuator	%
TP	Absolute Throttle Position	%
TP_REL	Relative Throttle Position	%
VS	Vehicle Speed	km/h-mph
WARMUPS	Number of Warm-ups Since Code Cleared	Units

Some unique PIDs are stored in the keep alive memory (KAM) of the powertrain control module (PCM) to help in diagnosing the root cause of misfires. These PIDs are collectively called misfire freeze frame (MFF) data. These parameters are separate from the generic freeze frame data that is stored for every MIL code. They are used for misfire diagnosis only. The MFF data could be more useful for misfire diagnosis than the generic freeze frame data. It is captured at the time of the highest misfire rate, and not when the DTC is stored at the end of a 200 or 1,000 revolution block. (Generic freeze frame data for misfire can be stored minutes after the misfire actually occurred.)

NOTE: MFF PIDs are supported on all vehicles, but may not be available on all scan tools because enhanced PID access may vary by scan tool manufacturer.

MISFIRE FREEZE-FRAME PIDS

PID Name	Description	Measurement Units
MFF RPM	Engine RPM at the time of misfire	RPM
MFF LOAD	Engine load at the time of misfire	%
MFF VSS	Vehicle speed at the time of misfire	km/h-mph
MFF IAT	Intake air temperature at the time of misfire	Degrees
MFF SOAK	Engine-off soak time at the time of misfire	Time
MFF RNTM	Engine running time at the time of misfire	Time
MFF EGR	EGR DPFE sensor at the time of misfire	Volts
MFF TP	Throttle Position at time of misfire	Volts
MFF TRIP	Number of driving cycles at the time of misfire (at least one 1,000 rev block)	Number of Trips
MFF PNP	1= in DRIVE during the time of misfire	Mode
MP LRN	1= Misfire wheel profile learned in KAM	Yes/No

FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)

DESCRIPTION

The EEPROM is contained in an integrated circuit internal to the powertrain control module (PCM). The EEPROM contains the vehicle strategy including calibration information specific to the vehicle, and is capable of being programmed or flashed repeatedly.

As part of the calibration there is an area referred to as the vehicle identification (VID) block. The VID block is programmed when installing a new PCM as described under Programming the VID Block for a Replacement PCM. Failure to carry out this procedure may generate DTCs P1635 or P1639. The VID block in an existing

PCM can also be tailored to accommodate various hardware or parameter changes made to the vehicle since production. Failure to carry out this procedure properly may generate DTC P1635, Tire/Axle Ratio out of Acceptable Range. An incorrect tire/axle ratio is one of the main causes for DTC P1639. This is described under Making Changes to the VID Block and also under Making Changes to the PCM Calibration. The VID block contains many items used by the strategy for a variety of functions. Some of these items include the vehicle identification number (VIN), octane adjust, fuel octane, fuel type, vehicle speed limit, tire size, axle ratio, the presence of speed control, and 4-wheel drive electronic shift-on-the-fly (ESOF) versus manual shift-on-the-fly (MSOF). Only items applicable to the vehicle hardware and supported by the VID block is displayed on the scan tool.

When changing items in the VID block, the strategy places range limits on certain items such as tire and axle ratio. The number of times the VID block may be reconfigured is limited. When this limit is reached, the scan tool displays a message indicating the need to flash the PCM again to reset the VID block.

Programming can be carried out by a local Ford dealer or any non-Ford facility. Refer to the scan tool manufacturer's instruction article for details.

PROGRAMMING THE VID BLOCK FOR A REPLACEMENT PCM

A new PCM contains the latest strategy and calibration level for a particular vehicle. However, the VID block is blank and needs programming. There are 2 procedures available. The first is an automatic data transfer from the old PCM to the new PCM, and the second is manual data entry into the new PCM.

Automatic data transfer is carried out if the old PCM is capable of communicating. This is done by using a scan tool to retrieve data from the old PCM before removing it from the vehicle. The stored data can then be downloaded to the new PCM after it has been installed.

Carry out manual data entry if the old module is damaged or incapable of communicating. Remove and install a new PCM. Using a compatible scan tool, select and carry out the module/parameter programming, referring to the scan tool manufacturer's instruction article. Make certain that all parameters are included. Failure to properly program tire size in revolutions per mile, (rev/mile equals 63,360 divided by the tire circumference in inches), axle ratio, 4x4/4x2, and/or MSOF/ESOF may result in DTCs P1635 and P1639. You may be instructed to contact the As-Built Data Center for the information needed to manually update the VID block with the scan tool. Contact the center only if the old PCM cannot be used or the data is corrupt. For Ford and Lincoln Mercury technicians, contact your National Hotline or the Professional Technician Society (PTS) website for As-Built data listed under the Service Publications Index. Non-Ford technicians use the Motorcraft® website at www.motorcraft.com. From the Motorcraft® homepage, use the search function to find the Module Programming or As-Built Data.

For Ford and Lincoln Mercury technicians, check the Programmable Module Installation link on the PTS website for quick Programmable Module data information by vehicle.

MAKING CHANGES TO THE VID BLOCK

A PCM which is programmed may require changes to be made to certain VID information to accommodate the vehicle hardware. Refer to Module Reprogramming on the scan tool.

MAKING CHANGES TO THE PCM CALIBRATION

At certain times, the entire EEPROM needs to be completely reprogrammed. This is due to changes made to the strategy or calibration after production, or the need to reset the VID block because it has reached its limit. Refer to Module Reprogramming on the scan tool.

DIAGNOSTIC MONITORING TEST RESULTS - MODE 6

Mode 6 allows access to the results of on board diagnostic (OBD) monitor diagnostic test results. The test values are stored at the time of the particular monitor completion. Refer to mode 6 on the scan tool for test information.

ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE

DESCRIPTION OF ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE

The following procedure is designed to execute and complete the OBD monitors and to clear the Ford P1000, I/M readiness code. To complete a specific monitor for repair verification, follow steps 1 through 4, then continue with the step described by the appropriate monitor found under the OBD Monitor Exercised column. For the EVAP/secondary AIR monitor to run, the ambient air temperature must be between 4.4 to 37.8°C (40 to 100°F), and the altitude below 2,438 meters (8,000 feet). If the P1000 code must be cleared in these conditions, the powertrain control module (PCM) must detect them once (twice on some applications) before the EVAP monitor can be bypassed and diagnostic trouble code (DTC) P1000 is cleared. The EVAP bypassing procedure is described in the following drive cycle.

The OBD drive cycle is carried out using a scan tool. Refer to the manufacturer's instruction article for each described function.

A detailed description for clearing the DTCs is found. Refer to **CLEAR THE CONTINUOUS DIAGNOSTIC TROUBLE CODES (DTCS) AND RESET THE EMISSION MONITORS INFORMATION IN THE POWERTRAIN CONTROL MODULE (PCM)**.

DRIVE CYCLE RECOMMENDATIONS

WARNING: **Strict observance of posted speed limits and attention to driving conditions are mandatory when proceeding through the following drive cycles. Failure to follow these instructions may result in personal injury.**

1. Most OBD monitors complete more readily using a steady foot driving style during cruise or acceleration modes. Operating the throttle in a smooth fashion minimizes the time required for monitor completion.
2. The fuel tank level should be between 1/2 and 3/4 full with 3/4 full being the most desirable.
3. The evaporative monitor can operate only during the first 30 minutes of engine operation. When executing the procedure for this monitor, stay in part throttle mode and drive in a smooth fashion to minimize fuel slosh.
4. When bypassing the EVAP engine soak times, the PCM must remain powered (key ON) after clearing the continuous DTCs and relearning emission diagnostic information.

For best results, follow each of the following steps as accurately as possible:

OBD Monitor Exercised	Drive Cycle Procedure	Purpose of Drive Cycle Procedure
Drive Cycle Preparation	**NOTE:** **To bypass the EVAP soak timer (normally 6 hours), the PCM must remain powered after clearing the continuous DTCs and resetting the emission monitors information in the PCM.**	Bypasses the engine soak timer. Resets the OBD monitor status.
	1. Install the scan tool. Turn the key on with the engine off. Cycle the key off, then on. If needed, select the appropriate vehicle and engine qualifier. Clear the continuous DTCs and reset the emission monitors information in the PCM.	
	2. Begin to monitor the following PIDs (if available): ECT, EVAPDC, FLI and TP MODE. Start the vehicle without returning the key to the OFF position.	
	3. Idle the vehicle for 15 seconds. Drive at 64 km/h (40 mph) until the engine coolant temperature (ECT) is at least 76.7°C (170°F).	Executes SEC AIR flow check monitor (if applicable).
Prep for Monitor Entry	4. Is the intake air temperature (IAT) between 4.4 to 37.8°C (40 to 100°F)? If not, complete the following steps, but note that step 14 is required to bypass the EVAP/secondary AIR monitor and clear DTC P1000.	Engine warm-up and provides IAT input to the PCM.
HEGO	5. Cruise at 64 km/h (40 mph) for at least 5 minutes.	Executes the HO2S monitor.
EVAP	6. Cruise at 64 to 89 km/h (40 to 55 mph) for 10 minutes (avoid sharp turns and hills). NOTE: To initiate the monitor, the throttle should be at part throttle, EVAPDC must be greater than 75%, and FLI must be between 15 and 85%, and for fuel tanks over 25 gallons FLI must be between 30 and 85%.	Executes the EVAP monitor if the IAT is between 4.4 to 37.8°C (40 to 100°F).
Catalyst	7. Drive in stop and go traffic conditions. Include 5 different constant cruise speeds, ranging from 32 to 89 km/h (20 to 55 mph) over a	Executes the catalyst monitor.

	10 minute period.	
EGR	8. From a stop, accelerate to 72 km/h (45 mph) at 1/2 to 3/4 throttle. Repeat 3 times.	Executes the EGR monitor.
SEC AIR/CCM (Engine)	9. Bring the vehicle to a stop. Idle with the transmission in drive (neutral for M/T) for 2 minutes.	Executes the idle air control (IAC) portion of the comprehensive component monitor (CCM) and the SEC AIR functional check (if applicable).
CCM (Transmission)	10. For M/T, accelerate from 0 to 81 km/h (0 to 50 mph), and continue to step 12. For A/T, from a stop and in overdrive, moderately accelerate to 81 km/h (50 mph) and cruise for at least 15 seconds. Stop the vehicle and repeat without overdrive to 64 km/h (40 mph) cruising for at least 30 seconds. While at 64 km/h (40 mph), activate the overdrive, accelerate to 81 km/h (50 mph) and cruise for at least 15 seconds. Stop for at least 20 seconds and repeat step 10 five times.	Executes the transmission portion of the CCM.
Misfire and Fuel Monitors	11. From a stop, accelerate to 97 km/h (60 mph). Decelerate at closed throttle to 64 km/h (40 mph) (no brakes). Repeat this 3 times.	Allows learning for the misfire monitor.
Readiness Check	12. Access the On-Board System Readiness (OBD monitor status) function on the scan tool. Determine whether all non-continuous monitors have completed. If not, go to step 13.	Determines if any monitor has not completed.
Pending Code Check and EVAP Monitor Bypass Check	13. With the scan tool, check for pending codes. Conduct the normal repair procedures for any pending code concern. Otherwise, repeat any incomplete monitor. If the EVAP monitor or SEC AIR monitor is not complete and the IAT was out of the 4.4 to 37.8°C (40 to 100°F) temperature range in step 4, or the altitude is over 2438 m (8000 ft.), the EVAP bypass procedure must be followed. Go to Step 14.	Determines if a pending code is preventing the clearing of DTC P1000.
EVAP Monitor Bypass	14. Park the vehicle for a minimum of 8 hours. Repeat steps 2 through 11. Do not repeat step 1.	Allows the bypass counter to increment to 2.

INTERMITTENT DIAGNOSTIC TECHNIQUES

Intermittent diagnostic techniques help find and isolate the root cause of intermittent concerns associated with the electronic engine control (EEC) system. The information is organized to help find the concern and carry out the repair. The process of finding and isolating an intermittent concern starts with recreating a fault symptom, accumulating powertrain control module (PCM) data, and comparing that data to typical values, then analyzing the results. Refer to the scan tool manufacturer's instruction article for the functions described below.

Before proceeding, be sure that:

- Customary mechanical system tests and inspections do not reveal a concern. NOTE: Mechanical component conditions can make a PCM system react abnormally.
- Technical Service Bulletins (TSBs) and On-line Automotive Service Information System (OASIS) messages, if available, are reviewed.
- Quick Test and associated diagnostic subroutines have been completed without finding a concern, and the symptom is still present.

RECREATING THE FAULT

Recreating the concern is the first step in isolating the cause of the intermittent symptom. A thorough investigation should start with the customer information worksheet located in the back of this article. If freeze frame data is available, it may help in recreating the conditions at the time of a malfunction indicator lamp diagnostic trouble code (MIL DTC). Listed below are some of the conditions for recreating the concern:

CONDITIONS TO RECREATE FAULT

Engine Type Conditions	Non-Engine Type Conditions
Engine Temperature	Ambient Temperature
Engine RPM	Moisture Conditions
Engine Load	Road Conditions (smooth-bumpy)
Engine idle/accel/deceleration	

ACCUMULATING PCM DATA

PCM data can be accumulated in a number of ways. This includes circuit measurements with a digital multimeter (DMM) or scan tool parameter identification (PID) data. Acquisition of PCM PID data using a scan tool is one of the easiest ways to gather information. Gather as much data as possible when the concern is occurring to prevent improper diagnosis. Data should be accumulated during different operating conditions and based on the customer description of the intermittent concern. Compare this data with the known good data values located **TYPICAL DIAGNOSTIC REFERENCE VALUES** . This requires recording data in 4 conditions for comparison: 1) KOEO, 2) Hot Idle, 3) 48 km/h (30 mph), and 4) 89 km/h (55 mph).

COMPARING PCM DATA

After the PCM values are acquired, it is necessary to determine the concern area. This typically requires the comparison of the actual values from the vehicle to the typical values from the Section 6 **TYPICAL DIAGNOSTIC REFERENCE VALUES** . The charts apply to different vehicle applications (engine, model,

transmission).

Analyzing PCM Data

Look for abnormal events or values that are clearly incorrect. Inspect the signals for abrupt or unexpected changes. For example, during a steady cruise most of the sensor values should be relatively stable. Sensors such as throttle position (TP), mass air flow (MAF), and RPM that change abruptly when the vehicle is traveling at a constant speed are clues to a possible concern area.

Look for an agreement in related signals. For example, if the APP1, APP2, or APP3, is changed during acceleration, a corresponding change should occur in idle air control (IAC), RPM, and SPARK ADV PID.

Make sure the signals act in proper sequence. An increase in RPM after the TP1 and TP2 is increased is expected. However, if the RPM increases without a TP1 and TP2 change, a concern may exist.

Scroll through the PID data while analyzing the information. Look for sudden drops or spikes in the values.

ADAPTIVE FUEL DIAGNOSTIC TROUBLE CODE (DTC) DIAGNOSTIC TECHNIQUES

The Adaptive Fuel DTC Diagnostic Techniques help isolate the root cause of the adaptive fuel concern. Before proceeding, attempt to verify if any driveability concerns are present. These diagnostic aids are meant as a supplement to the pinpoint test steps. For a description of fuel trim, refer to**POWERTRAIN CONTROL SOFTWARE** , Fuel Trim.

Obtain Freeze Frame Data

Freeze frame data is helpful in duplicating and diagnosing adaptive fuel concerns. The data (a snapshot of certain parameter identification (PID) values recorded at the time the DTC is stored in Continuous Memory) is helpful to determine how the vehicle was being driven when the concern occurred, and is especially useful on intermittent concerns. Freeze frame data, in many cases, helps to isolate possible areas of concern as well as rule out others. Refer to **FREEZE FRAME DATA** for a more detailed description of this data.

Using the LONGFT1 and LONGFT2 (Dual Bank Engines) PIDs

The LONGFT1/2 PIDs are useful for diagnosing fuel trim concerns. A negative PID value indicates that fuel is being reduced to compensate for a rich condition. A positive PID value indicates that fuel is being increased to compensate for a lean condition. It is important to know that there is a separate LONGFT value that is used for each RPM/load point of engine operation. When viewing the LONGFT1/2 PIDs, the values may change a great deal as the engine is operating at different RPM and load points. This is because the fuel system may have learned corrections for fuel delivery concerns that can change as a function of engine RPM and load. The LONGFT1/2 PIDs display the fuel trim currently being used at that RPM and load point. Observing the changes in LONGFT1/2 can help when diagnosing fuel system concerns. For example:

- A contaminated mass air flow (MAF) sensor results in matching LONGFT1/2 correction values that are negative at idle (reducing fuel), but positive (adding fuel) at higher RPM and loads.
- LONGFT1 values that differ greatly from LONGFT2 values rule out concerns that are common for both

banks (for example, fuel pressure concerns, MAF sensor, etc. can be ruled out).

- Vacuum leaks result in large rich corrections (positive LONGFT1/2 value) at idle, but little or no correction at higher RPM and loads.
- A plugged fuel filter results in no correction at idle, but large rich corrections (positive LONGFT1/2 value) at high RPM and load.

Resetting Long Term Fuel Trims

Long term fuel trim corrections are reset by resetting the keep alive memory (KAM). Refer to **RESETTING THE KEEP ALIVE MEMORY (KAM)**. After making a fuel system repair, the KAM must be reset. For example, if dirty/plugged injectors cause the engine to run lean and generate rich long term corrections, installing new injectors and not resetting the KAM causes the engine to run very rich. The rich correction eventually leans out during closed loop operation, but the vehicle may have poor driveability and high CO emissions while it is learning.

DTCs P0171/P0174 System Too Lean Diagnostic Aids

NOTE: **If the system is lean at certain conditions, then the LONGFT PID would be a positive value at those conditions, indicating that increased fuel is needed.**

The ability to identify the type of lean condition causing the concern is crucial to a correct diagnosis.

Air Measurement System

With this condition, the engine runs rich or lean of stoichiometric (14.7:1 air/fuel ratio) if the powertrain control module (PCM) is not able to compensate enough to correct for the condition. One possibility is that the mass of air entering the engine is actually greater than what the MAF sensor is indicating to the PCM. For example, with a contaminated MAF sensor, the engine runs lean at higher RPM because the PCM delivers fuel for less air than is actually entering the engine. Examples:

- The MAF sensor measurement is inaccurate due to a corroded connector, contaminated or dirty connector. A contaminated MAF sensor typically results in a rich system at low airflow (PCM reduces fuel) and a lean system at high airflow (PCM increases fuel).

Vacuum Leaks/Unmetered Air

With this condition, the engine runs lean of stoichiometric (14.7:1 air/fuel ratio) if the PCM is not able to compensate enough to correct for the condition. This condition is caused by unmetered air entering the engine, or due to a MAF concern. In this situation, the volume of air entering the engine is actually greater than what the MAF sensor is indicating to the PCM. Vacuum leaks are normally most apparent when high manifold vacuum is present (for example, during idle or light throttle). If freeze frame data indicates that the concern occurred at idle, a check for vacuum leaks/unmetered air is the best starting point. Examples:

- loose, leaking, or disconnected vacuum lines
- intake manifold gaskets, or O-rings
- throttle body gaskets

- brake booster
- air inlet tube
- stuck/frozen/aftermarket positive crankcase valve (PCV)
- unseated engine oil dipstick.

Insufficient Fueling

With this condition, the engine runs lean of stoichiometric (14.7:1 air/fuel ratio) if the PCM is not able to compensate enough to correct for the condition. This condition is caused by a fuel delivery system concern that restricts or limits the amount of fuel being delivered to the engine. This condition is normally apparent as the engine is under a heavy load and at high RPM, when a higher volume of fuel is required. If the freeze frame data indicates that the concern occurs under a heavy load and at higher RPM, a check of the fuel delivery system (checking fuel pressure with engine under a load) is the best starting point. Examples:

- low fuel pressure (fuel pump, fuel filter, fuel leaks, restricted fuel supply lines)
- fuel injector concerns

Exhaust System Leaks

In this type of condition, the engine runs rich of stoichiometric (14.7:1 air/fuel ratio) because the fuel control system is adding fuel to compensate for a perceived (not actual) lean condition. This condition is caused by oxygen (air) entering the exhaust system from an external source. The HO2S reacts to this exhaust leak by increasing fuel delivery. This condition causes the exhaust gas mixture from the cylinder to be rich. Examples:

- exhaust system leaks upstream or near the HO2S
- cracked/leaking HO2S boss
- inoperative secondary air injection system

DTCs P0172/P0175 System Too Rich Diagnostic Aids

NOTE:	**If the system is rich at certain conditions, then the LONGFT PID would be a negative value at that airflow, indicating that decreased fuel is needed.**

System rich concerns are caused by fuel system concerns, although the MAF sensor and base engine (for example, engine oil contaminated with fuel) should also be checked.

Air Measurement System

With this condition, the engine runs rich or lean of stoichiometric (14.7:1 air/fuel ratio) if the PCM is not able to compensate enough to correct for the condition. One possibility is that the mass of air entering the engine is actually less than what the MAF sensor is indicating to the PCM. For example, with a contaminated MAF sensor, the engine runs rich at idle because the PCM delivers fuel for more air than is actually entering the engine. Examples:

- MAF sensor measurement inaccurate due to a corroded connector, contamination/dirt. A contaminated

MAF sensor typically results in a rich system at low airflow (PCM reduces fuel) and a lean system at high airflow (PCM increases fuel).

Fuel System

With this condition, the engine runs rich of stoichiometric (14.7:1 air/fuel ratio), if the PCM is not able to compensate enough to correct for the condition. This situation causes a fuel delivery system that is delivering excessive fuel to the engine.

Examples:

- fuel pressure regulator causes excessive fuel pressure (system rich at all airflow), fuel pressure is intermittent, going to pump deadhead pressure, then returning to normal after the engine is turned off and restarted.
- fuel pulse dampener diaphragm ruptured (fuel leaking into the intake manifold, system rich at lower airflow).
- fuel injector leaks (injector delivers extra fuel).
- EVAP canister purge valve leak (if the canister is full of vapors, introduces extra fuel).
- fuel rail pressure (FRP) sensor (electronic returnless fuel systems) concern causes the sensor to indicate a lower pressure than actual. The PCM commands a higher duty cycle to the fuel pump driver module (FPDM), causing high fuel pressure (system rich at all airflow).

Air Inlet System

A restriction within any of the following components may be significant enough to affect the ability of the PCM adaptive fuel control.

- air inlet tube
- air cleaner element
- air cleaner assembly
- resonators
- clean air tube

Base Engine

Engine oil contaminated with fuel can contribute to a rich-running engine.

2008 ENGINE PERFORMANCE

Introduction - Gasoline Engines

INTRODUCTION

NOTE:	**The descriptions and specifications contained in this article were in effect at the time this article was approved for publication. Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design without notice and without incurring obligation.**

IMPORTANT SAFETY NOTICE

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them helps to establish reliability.

There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

NOTE, NOTICE, CAUTION AND WARNING

As you read through this article, you may come across a NOTE, NOTICE, CAUTION or WARNING. Each one is used for a specific purpose. A NOTE calls attention to unique, additional or essential information related to the subject procedure. A NOTICE or CAUTION identifies a hazard that could damage the vehicle or property. A WARNING identifies a hazard that could result in personal injury or death to yourself or others. Some general WARNINGS that you should follow when you work on a vehicle are listed below.

- ALWAYS WEAR SAFETY GLASSES FOR EYE PROTECTION.
- KEEP SOLVENTS AWAY FROM IGNITION SOURCES. SOLVENTS MAY BE FLAMMABLE AND COULD IGNITE OR EXPLODE IF NOT HANDLED CORRECTLY.
- USE SAFETY STANDS WHENEVER A PROCEDURE REQUIRES YOU TO BE UNDER THE VEHICLE.
- MAKE SURE THAT THE IGNITION SWITCH IS ALWAYS IN THE OFF POSITION, UNLESS OTHERWISE REQUIRED BY THE PROCEDURE.
- SET THE PARKING BRAKE WHEN WORKING ON THE VEHICLE. IF YOU HAVE AN AUTOMATIC TRANSMISSION, SET IN PARK UNLESS INSTRUCTED OTHERWISE FOR A SPECIFIC OPERATION. IF YOU HAVE A MANUAL TRANSMISSION, IT SHOULD BE IN REVERSE (ENGINE OFF) OR NEUTRAL (ENGINE ON) UNLESS INSTRUCTED OTHERWISE FOR A SPECIFIC OPERATION. PLACE WOOD BLOCKS (4" X 4" OR LARGER) OR WHEEL CHOCKS AGAINST THE FRONT AND REAR SURFACES OF THE TIRES TO HELP PREVENT THE VEHICLE FROM MOVING.
- OPERATE THE ENGINE ONLY IN A WELL-VENTILATED AREA TO AVOID THE DANGER OF

CARBON MONOXIDE POISONING.

- KEEP YOURSELF AND YOUR CLOTHING AWAY FROM MOVING PARTS WHEN THE ENGINE IS RUNNING, ESPECIALLY THE DRIVE BELTS.
- TO PREVENT SERIOUS BURNS, AVOID CONTACT WITH HOT METAL PARTS SUCH AS THE RADIATOR, EXHAUST MANIFOLD, TAIL PIPE, THREE-WAY CATALYTIC CONVERTER AND MUFFLER.
- DO NOT SMOKE WHILE WORKING ON A VEHICLE.
- TO AVOID INJURY, ALWAYS REMOVE RINGS, WATCHES, LOOSE HANGING JEWELRY AND LOOSE CLOTHING BEFORE BEGINNING TO WORK ON A VEHICLE.
- WHEN IT IS NECESSARY TO WORK UNDER THE HOOD, KEEP HANDS AND OTHER OBJECTS CLEAR OF THE COOLING FAN BLADES!

PREFACE

This article provides a step-by-step approach for diagnosing driveability, emission, and powertrain control system symptoms. Before beginning diagnosis, it may be helpful to reference any Technical Service Bulletins (TSBs) or On-line Automotive Service Information System (OASIS) information when this is available. TSB/OASIS information is available on either the Professional Technician Society (PTS) or Motorcraft® website.

NOTE: **For the diesel engines, refer to the appropriate Diesel Powertrain Control/Emissions Diagnosis Manual to continue diagnosis. For the Escape Hybrid or Mariner Hybrid, refer to the Escape Hybrid, Mariner Hybrid Powertrain Control/Emissions Diagnosis Manual to continue diagnosis.**

This article is used in conjunction with the Workshop Manual and Wiring Diagrams. The Workshop Manuals are used to provide additional diagnostic or component removal and installation information. The Wiring Diagrams are used to provide vehicle specific wiring information, component, connector, and splice locations.

The following is a description of the information contained in each part of this article.

Description and Operation

This part contains description and operation information on powertrain control systems and components and provides the technician with a general knowledge of the powertrain control system. Use this part when general information about the powertrain control system is desired.

Diagnostic Methods

This part contains information on specific diagnostic tasks that are used during diagnosis. Descriptions of specific diagnostic methods are included, as well as detailed instructions on how to access or carry out the task.

Symptom Charts

All diagnosis begins in the **SYMPTOM CHARTS** article with QT Powertrain Control Module (PCM) Quick Test. If the PCM Quick Test is completed and no diagnostic trouble codes (DTCs) are retrieved, the technician

is directed to the **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** . The No Diagnostic Trouble Codes (DTCs) Present Symptom Chart Index contains the list of symptoms addressed in this article, and directs the technician to the appropriate chart in the **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHARTS** . If no PCM DTCs are present and the vehicle symptom is not listed in the No Diagnostic Trouble Codes (DTCs) Present Symptom Chart Index, the technician should go to the appropriate Workshop Manual part to continue diagnosis.

Powertrain Diagnostic Trouble Code (DTC) Charts and Descriptions

This part contains the Diagnostic Trouble Code (DTC) Charts and Descriptions. These charts and descriptions are referenced if a DTC is retrieved in the **SYMPTOM CHARTS** article. Also included are the list of possible causes and diagnostic aids.

Pinpoint Tests

All pinpoint tests are included. Never enter a pinpoint test unless directed there. When directed to a pinpoint test, always read the information included at the beginning of the pinpoint test.

Reference Values

This part contains the Typical Diagnostic Reference Values charts. The technician is directed to these charts from Pinpoint Test Z in the **PINPOINT TESTS** article.

HOW TO USE THE DIAGNOSTIC PROCEDURES

- Use the information about the vehicle driveability or emission concerns to attempt to verify/recreate the symptom. Look for any vehicle modifications or aftermarket items that may contribute to the symptom. A check of any applicable TSBs or OASIS messages may be useful if this information is available.
- Go to the **SYMPTOM CHARTS** article, QT Powertrain Control Module (PCM) Quick Test. Carry out the PCM quick test steps. Follow any notes as directed.
- If the PCM quick test is completed, no DTCs were retrieved, and no special notes applied, go to the **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .
- Select the symptom that best describes the vehicle symptom (for multiple symptoms select the one that is most evident). Go to the **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHARTS** as indicated. If no PCM DTCs are present and the vehicle symptom is not listed in the No Diagnostic Trouble Codes (DTCs) Present Symptom Chart Index, go to the appropriate Workshop Manual part to continue diagnosis.
- The No Diagnostic Trouble Codes (DTCs) Present Symptom Charts contain areas to be tested for diagnosis of the vehicle symptom. The chart is arranged to place the higher probability or easiest to test items toward the top of the chart. However, the technician is not required to follow this order due to reasons such as variations in vehicle type, vehicle repair history, or technician experience.
  - The System/Component column indicates the areas that are tested. This column may also contain a quick system/component test.
  - The Reference column indicates where to go for the System/Component testing. All references are to the beginning of a pinpoint test in the **PINPOINT TESTS** article of this article unless noted otherwise. If referred to a pinpoint test in this article or a Workshop Manual part, go to the procedures. Follow the directions given in those procedures, including directions to other tests or

parts. If a damaged part is found, repair as directed. If no concern is found, and diagnosis in that area is complete, return to the **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHARTS** to continue to the next item.

  - If a quick system/component test is in the System/Component column, the Reference column indicates where to go if the test failed.

- During diagnosis, if directed to test a system/component that is not contained on that vehicle, go to the next step.
- If the No Diagnostic Trouble Codes (DTCs) Present Symptom Chart for the vehicle symptom is completed and no concern is found, return to the **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to address the next most prominent symptom. If all diagnosis is complete and no concern is found, it may be helpful to refer to **PINPOINT TEST Z - INTERMITTENT** to continue diagnosis.
- The installation of any new component that affects the PCM adaptive learning strategies (adaptive airflow, idle speed, refueling event, or fuel trim) requires the reset of keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** to reset the KAM.
- After any repair, reconnect any components and remove any test equipment. Verify that the vehicle is operating correctly and the original complaint is no longer present. If a DTC was present, clear the DTCs and repeat the self-test to verify the repair.
- If a symptom is determined to be intermittent, a careful visual and physical underhood inspection of connectors, wiring harnesses, vacuum lines, and components is required. The Customer Information Worksheet may contain more detailed symptom information. Before an in-depth diagnosis begins, start the engine and wiggle wires, tap on components while listening for an indication of a concern (such as an RPM change or a relay clicking).

Information about engine conditions is stored when a DTC that illuminates the malfunction indicator lamp (MIL) is set. This information is called freeze frame data and may be helpful in diagnosing intermittent concerns. Refer to**FREEZE FRAME DATA** for additional information.

WHAT'S NEW IN THIS ARTICLE

The following is a list of changes to this article for 2008:

New Vehicles:

- Taurus with new 3.5L 4V engine
- Taurus X with new 3.5L 4V engine
- Sable with new 3.5L 4V engine

Deleted Vehicles:

- Five Hundred
- Freestyle
- Montego
- Freestar
- Monterey

Other Changes:

- Focus available with 2.0L engine and new international standards organization (ISO) 14229 software only. The 2.3L engine is not available.
- Sable, Taurus, and Taurus X vehicles equipped with a new universal heated oxygen sensor (HO2S) for the 3.5L 4V PZEV engine.
- Sable, Taurus, and Taurus X vehicles equipped with a mechanical returnless fuel system (MRFS).

ACRONYMS AND DEFINITIONS

NOTE: This acronyms and definitions listing contains technical terms applicable to Ford Motor Company products. It is not intended to be an all-inclusive dictionary of components and their functions. If a detailed description of a particular system or component is desired, refer to the applicable part within this PC/ED article or refer to the Workshop Manual for additional information regarding the specific vehicle being repaired.

2V: Two valves per engine cylinder

3V: Three valves per engine cylinder

4V: Four valves per engine cylinder

4WD: Four Wheel Drive

ABS: Antilock Braking System

A/C: Air Conditioning

A/CC: Air Conditioning Clutch

A/CCR: Air Conditioning Clutch Control Relay

ACCS: Air Conditioning Cycling Switch

ACET: Air Conditioning Evaporator Temperature

ACP: Air Conditioning Pressure

ACPSW: Air Conditioning Pressure Switch

A/D: Analog-to-Digital. Analog-to-Digital signal conversion.

APP: Accelerator Pedal Position

BARO: Barometric Pressure

BJB: Battery Junction Box

BPP: Brake Pedal Position

BPS: Brake Pedal Switch

BTDC: Before Top Dead Center

CAC: Charge Air Cooler. A device which lowers the temperature of pressurized intake air.

CAN: Controller Area Network

CCM: Comprehensive Component Monitor

CF: Cooling Fan

CHT: Cylinder Head Temperature

CKP: Crankshaft Position

CL: Closed Loop. An operating condition or mode which enables operation based on sensor feedback.

CMCV: Charge Motion Control Valve

CMP: Camshaft Position

CO: Carbon Monoxide. A colorless, odorless, and toxic gas that is a component of auto exhaust emissions.

CO_2 : Carbon Dioxide. A colorless, odorless gas that is a normal by-product of the combustion of fuel.

COP: Coil On Plug. Ignition coil on plug assembly.

CPP: Clutch Pedal Position

CPU: Central Processing Unit

CTO: Clean Tach Output. Signal used to drive the instrument panel tachometer.

CV: Canister Vent Solenoid. A solenoid which seals the evaporative emission (EVAP) system from the atmosphere during the EVAP monitor test.

CVT: Continuously Variable Transmission

DBA: Driver Brake Application

DC: 1. Direct Current. Electric current flowing in one direction. 2. Duty Cycle. The voltage measurement of ON time versus the full cycle period, expressed in percent.

DEPS: Dual Equal Phase Shifting

DIPS: Dual Independent Phase Shifting

DLC: Data Link Connector. SAE standard J1962 connector providing access to vehicle diagnostic information.

DMM: Digital Multimeter

DRI: Deposit Resistant Injector

DTM: Diagnostic Test Mode. A level of capability in an OBD system.

DTC: Diagnostic Trouble Code. An alpha/numeric identifier for a concern identified by the OBD system.

E10: Fuel containing 10% ethanol

E85: Fuel containing 85% ethanol

EATC: Electronic Automatic Temperature Control

ECM: Electronic Control Module

ECT: Engine Coolant Temperature

EEC: Electronic Engine Control

EEGR: Electric Exhaust Gas Recirculation

EEPROM: Electrically Erasable Programmable Read-Only Memory

EGR: Exhaust Gas Recirculation

EI: Electronic Ignition

EMD: Engine Manufacturers Diagnostics

EMI: Electromagnetic Interference. Usually caused by ignition voltage spikes, solenoids, relay operation,

or noisy generator contacts.

EONV: Engine Off Natural Vacuum

EOT: Engine Oil Temperature

EPS: Exhaust Phase Shifting

E-Quizzer: Enhanced Quizzer

ERFS: Electronic Returnless Fuel System

ESM: EGR System Module

ESOF: Electronic Shift-on-the-Fly

ETB: Electronic Throttle Body

ETBTACM: Electronic Throttle Body Throttle Actuator Control Motor

ETBTPS: Electronic Throttle Body Throttle Position Sensor

ETC: Electronic Throttle Control

ETCREF: Electronic Throttle Control Reference Voltage

ETCRTN: Electronic Throttle Control Return

EVAPCP: Evaporative Canister Purge Valve. A valve which controls the venting of fuel vapor from the evaporative emissions canister into the intake manifold for combustion.

FAOS: Fore-Aft Oxygen Sensor

FC: Fan Control

FCIL: Fuel Cap Indicator Lamp. Indicates that the fuel filler cap is not correctly installed.

FEPS: Flash EEPROM Programming Signal. An 18-volt DC signal input from the scan tool used by the PCM to initiate programming.

FFV: Flexible Fuel Vehicle

FLI: Fuel Level Input. Provides information on the amount of liquid fuel in the fuel tank. Used by the EVAP monitor to calculate the fuel tank vapor volume. Displayed as a percentage.

FMEM: Failure Mode Effects Management. Operating strategy that maintains limited vehicle function in the event of a PCM or EEC component failure.

FP: Fuel Pump

FPC: Fuel Pump Control

FPDM: Fuel Pump Driver Module. A module that controls the electric fuel pump.

FPM: Fuel Pump Monitor

FRP: Fuel Rail Pressure

FRPT: Fuel Rail Pressure Temperature

FSS: Fan Speed Sensor

FTP: Fuel Tank Pressure

FWD: Front Wheel Drive

GND: Ground

GPM: 1. Grams per Mile. 2. Gallons per Minute.

H: Hydrogen

HC: 1. Hydrocarbon. A by-product of combustion and a component of auto exhaust emissions. 2. High

Compression.

HDR: High Data Rate

HLOS: Hardware Limited Operating Strategy. A mode of operation where the PCM uses fixed values in response to internal PCM concerns in place of output commands.

HO2S: Heated Oxygen Sensor. Provides information on rich or lean exhaust conditions to the PCM.

Hz: Hertz. Cycles per second.

IAC: Idle Air Control. Electrical control of throttle bypass air.

IAT: Intake Air Temperature

IAT2: Intake Air Temperature 2. Used on supercharged vehicles.

IDM: Ignition Diagnostic Monitor

IFS: Inertia Fuel Shut-Off

I/M: Inspection/Maintenance

IMRC: Intake Manifold Runner Control. Controls or modifies airflow in the intake air system.

IMRCM: Intake Manifold Runner Control Monitor. Monitors the IMRC circuits for concerns.

IMTV: Intake Manifold Tuning Valve. Controls airflow through runners in a split intake manifold.

INJ: Injector

IPC: Independent Plausibility Checker

IPS: Intake Phase Shifting

ISO: International Standards Organization

KAM: Keep Alive Memory. A portion of the memory within the PCM that must have power even when the vehicle is not operating.

KAPWR: Keep Alive Power. A dedicated and unswitched power circuit that maintains KAM.

KOEO Self-Test: Key On Engine Off self-test. A test of the EEC system conducted by the PCM with power applied and the engine at rest.

KOER Self-Test: Key On Engine Running self-test. A test of the EEC system conducted by the PCM with the engine running and the vehicle at rest.

Km/h: Kilometers per Hour

kPa: Kilopascals. Unit of pressure. 3.386 kPa equals 1 (in-Hg).

KS: Knock Sensor

L: Liters. The unit of volume in the metric measuring system. One liter equals 1.06 quarts.

LDR: Low Data Rate

LONGFT: Long-Term Fuel Trim. Fuel flow adjustment determined by the PCM.

LOS: Limited Operating Strategy

MAF: Mass Air Flow

MAP: Manifold Absolute Pressure. The internal pressure of the intake manifold.

MFF: Misfire Freeze Frame

MIL: Malfunction Indicator Lamp. An indicator lamp alerting the driver of an emission related concern.

MRFS: Mechanical Returnless Fuel System

MSOF: Manual Shift-on-the-Fly

N: Nitrogen

NMOG: Non-Methane Organic Gases

NO_X : Oxides of Nitrogen. Gasses formed at high combustion temperatures.

OASIS: On-line Automotive Service Information System

OHC: Overhead Cam. An engine configuration that uses a single camshaft positioned above the valves.

OL: Open Loop. An operating condition based on instructions not modified by PCM feedback.

OSC: Output State Control

OSR: On-Board System Readiness

OTM: Output Test Mode

PATS: Passive Anti-Theft System

PCM: Powertrain Control Module

PCM-VSO: Powertrain Control Module - Vehicle Speed Output

PCV: Positive Crankcase Ventilation

PCVTE: Positive Crankcase Ventilation Thermal Extension

Pd: Palladium

PDJB: Power Distribution Junction Box

PID: Parameter Identification. Identifies an address in the PCM memory which contains operating information.

PIP: Profile Ignition Pickup. Provides crankshaft position information for ignition synchronization.

PPM: Parts per Million. A measure used in emission analysis.

PS: Pressure Switch

PSP: Power Steering Pressure. Indicates the pressure in the power steering system.

PSPT: Power Steering Pressure Transducer

Pt: Platinum

PTO: Power Take-Off

PTS: Professional Technician Society

PWM: Pulse Width Modulation. Controls the intensity of an output by varying the signal duty cycle.

PWR GND: Power Ground. The main ground circuit in the EEC system.

RAM: Random Access Memory. Memory into which information can be written as well as read.

RFI: Radio Frequency Interference

Rh: Rhodium

ROM: Read-Only Memory. Computer memory that can be accessed and used, but not altered.

RPM: Revolutions Per Minute

RWD: Rear Wheel Drive

SAE: Society of Automotive Engineers

SCB: Supercharger Bypass

SFI: Sequential Multiport Fuel Injection. A multiport fuel delivery system in which each injector is individually energized and timed relative to its cylinder intake event.

SHRTFT: Short-Term Fuel Trim. Fuel flow adjustment in response to the HO2S sensor(s) input during closed-loop operation.

SIG RTN: Signal Return. A dedicated sensor ground circuit that is common to 2 or more sensors.

SJB: Smart Junction Box

SMR: Starter Motor Request

TAC: Throttle Actuator Control

TACM: Throttle Actuator Control Motor

TCM: Transmission Control Module

TCSS: Transfer Case Speed Sensor

TDC: Top Dead Center

TP: Throttle Position

TPPC: Throttle Plate Position Controller

TSB: Technical Service Bulletin. Notifies technician of any known vehicle concerns, procedures, or general repair information.

TWC: Three-Way Catalytic

VBPWR: Vehicle Buffered Power. A PCM-supplied power source that supplies regulated voltage.

VCM: Vehicle Communication Module

VCT: Variable Camshaft Timing

VECI: Vehicle Emission Control Information

VID: Vehicle Identification

VIN: Vehicle Identification Number. A unique identification number given to every vehicle produced. Includes information about the year, model, engine, and plant origin of the vehicle.

VMV: Vapor Management Valve

VPWR: Vehicle Power. A switched circuit that provides power to the EEC system. Compare to battery voltage (B+).

VR: Variable Reluctance

VREF: Reference Voltage. A dedicated circuit that provides an approximately 5.0 volt signal used as a reference by certain sensors.

WAC: Wide Open Throttle Air Conditioning Cutoff

WOT: Wide Open Throttle. A condition of maximum airflow through the throttle body.

Transmissions:

NOTE: **The automatic transmission naming convention is as follows:**

- **The first character, a number, is the number of forward gears.**
- **The second character, either the letter F or R, represents front (transaxle) or rear (transmission) wheel drive.**
- **The next set of characters, a grouping of numbers, represents the design torque capacity of the transmission/transaxle.**
- **The last character, if used, is one of the following:**

- **E for electronic shift**
- **N for non-synchronous shift**
- **S for synchronous shift**
- **W for wide ratio**

As an example, for the 4F27E transaxle, the number of forward gears is 4, the character F indicates front transaxle, 27 represents 270 ft-lbs of torque capacity and the character E represents an electronic shift.

A/T: Automatic Transmission

CCS: Coast Clutch Solenoid

EPC: Electronic Pressure Control

ESS: Electronic Shift Scheduling

ISS: Intermediate/Input Shaft Speed Sensor

M/T: Manual Transmission/Transaxle

OCS: Overdrive Cancel Switch

OSS: Output Shaft Speed. Indicates the rotational speed of the transmission output shaft.

PNP: Park/Neutral Position switch.

REVERSE or REV: Transmission Reverse Switch Input

SSA/SSB/SSC/SSD/SSE: Shift solenoids. Devices in an automatic transmission that control the shifting by varying fluid flow when commanded by the PCM.

SS1/SS2/SS3: Shift solenoids. Devices in an automatic transmission that control the shifting by varying fluid flow when commanded by the PCM.

TCC: Torque Converter Clutch. When energized, causes a mechanical engagement and disengagement of the torque converter clutch.

TCIL: Transmission Control Indicator Lamp. Indicates that the TCS has been activated.

TCS: Transmission Control Switch. Modifies the operation of electronically controlled transmissions.

TFT: Transmission Fluid Temperature. Indicates the temperature of transmission fluid.

TR: Transmission Range. The range in which the transmission is operating.

TSS: Turbine Shaft Speed. Indicates the rotational speed of the transmission turbine shaft.

VSS: Vehicle Speed Sensor. A magnetic pickup device that generates an AC signal that is proportional to the vehicle speed.

VSOUT: Vehicle Speed Output. A pulse width modulated vehicle speed signal.

2008 ENGINE PERFORMANCE

Pinpoint Tests - Gasoline Engines

PINPOINT TEST A: NO START

INTRODUCTION

WARNING: **Stop this test at the first sign of a fuel leak and repair as required.**

No open flame. No smoking during fuel delivery checks.

Failure to follow these instructions may result in personal injury.

This pinpoint test is intended to diagnose the following:

- spark (as related to electronic engine control)
- powertrain control module (PCM) (12A650)

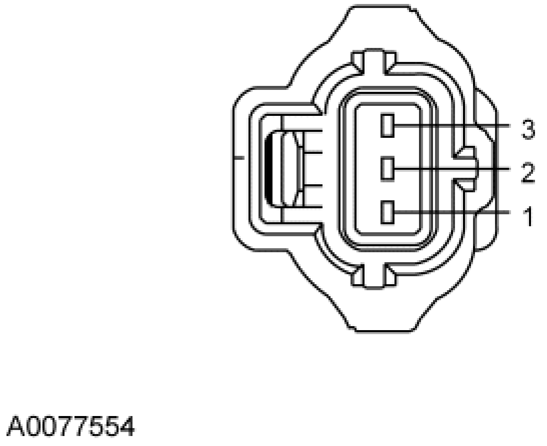


Fig. 1: Throttle Position (TP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

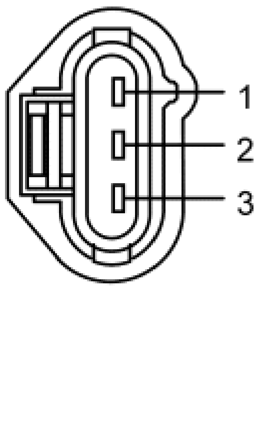


Fig. 2: Throttle Position (TP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Ranger 2.3L	A	1 3	SIGRTN VREF
All other vehicles	B	3 1	SIGRTN VREF

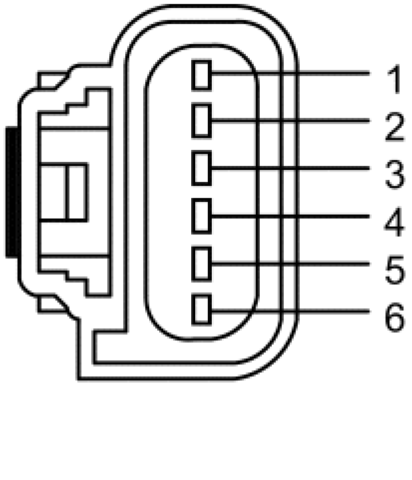


Fig. 3: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

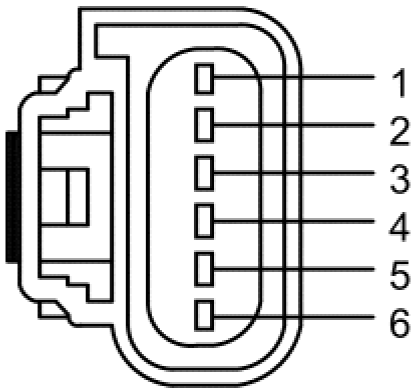


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Fig. 4: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - B
Courtesy of FORD MOTOR CO.

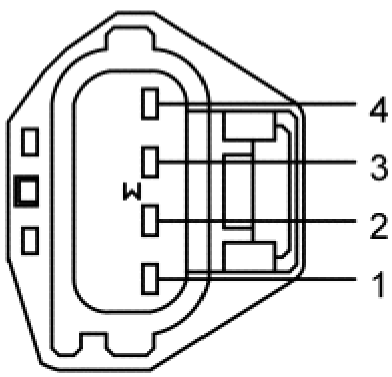

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Fig. 5: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus, Taurus X	A	2 3	ETCRTN ETCREF

Fusion 2.3L, Milan 2.3L	B	3 5	ETCRTN ETCREF
Fusion 3.0L, Milan 3.0L	B	4 5	ETCRTN ETCREF
All other vehicles	C	3 2	ETCRTN ETCREF

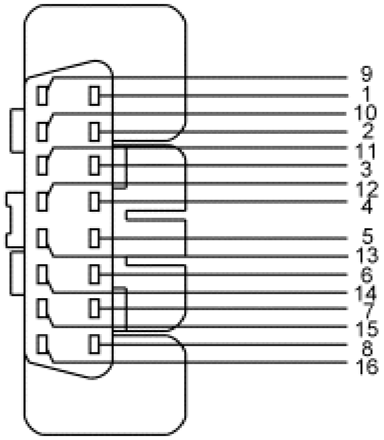

Fig. 6: Data Link Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
13	FEPS (Flash EEPROM Programming Signal)

TEST PROCEDURE

A1 ATTEMPT TO CRANK THE ENGINE

NOTE: **Verify the inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to the Owner's Literature for location.**

- **Does the engine crank?**

Yes	No
GO to A2.	REFER to the **STARTING SYSTEM - GASOLINE ENGINES -- E-SERIES** and diagnose the engine does not crank symptom.

A2 IDENTIFY THE TYPE OF NO START

NOTE: **The purpose of this test step is to identify intermittent no starts in order to**

determine the proper repair procedure.

- **Does the vehicle start?**

Yes	No
The vehicle has an intermittent no start. refer to **PINPOINT TEST Z**.	GO to A3.

A3 DETERMINE THE THROTTLE TYPE

- **Is the vehicle equipped with electronic throttle control?**

Yes	No
GO to A5.	GO to A4.

A4 CHECK THE VREF VOLTAGE TO TP SENSOR

- Key in OFF position.
- TP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) TP Sensor Connector, Harness Side	(-) TP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to A6.	refer to **PINPOINT TEST C**.

A5 CHECK VREF VOLTAGE TO ETBTPS SENSOR

- Key in OFF position.
- ETBTPS connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
ETCREF	ETCRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to A6.	refer to **PINPOINT TEST C**.

A6 CHECK THE FLASH EEPROM PROGRAMMING SIGNAL (FEPS) CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- TP Sensor connector connected.
- ETBTPS connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) DLC, Harness Side	(-) Vehicle Battery
FEPS - Pin 13	Negative terminal

- **Is the voltage less than 9 V?**

Yes	No
GO to A7.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

A7 CHECK THE RPM IN THE PCM

NOTE: **Connect the scan tool to a reliable voltage source that is powered with the key in the START position (such as directly to the vehicle battery). Also verify that the vehicle battery is fully charged.**

NOTE: **Normal engine cranking speed is between 150 RPM and 350 RPM.**

- Access the PCM and monitor the RPM PID.
- Crank the engine while viewing the RPM PID.
- **Is the RPM between 150 RPM - 350 RPM?**

Yes	No
GO to A8.	For base engine concerns, REFER to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** - General Information and diagnose difficult starting symptom. For all others, GO to JD2.

A8 CHECK FOR CKP AND CMP SYNCHRONIZATION

- Access the PCM and monitor the SYNC PID.
- Crank the engine while viewing the SYNC PID.
- **Does the SYNC PID read YES?**

Yes	No
GO to A9.	GO to JD2.

A9 CHECK THE PCM DRIVER SIGNAL TO THE COILS

NOTE: **Test lamp bulb filament wattages vary widely. The intensity and duration of blinking depends on the test lamp being used.**

- Connect a test lamp between B+ and each coil driver circuit at the harness connector.
- Crank the engine.
- **Does the test lamp blink consistently for each coil driver (1 blink per engine revolution)?**

Yes	No
GO to A10.	For coil-on-plug (COP) ignition testing, GO to JB2. For coil pack ignition testing, GO to JC2.

A10 CHECK THE FUEL PRESSURE

WARNING: **The fuel system remains pressurized when the engine is not running. To prevent injury or fire, use caution when working on the fuel system.**

Refer to the fuel system WARNING information at the beginning of Pinpoint Test HC.

Failure to follow these instructions may result in personal injury.

NOTE: **While activating the fuel pump on an electronic returnless fuel system a brief pressure spike may occur.**

- Key in OFF position.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.
- Connect the fuel pressure gauge to the Schrader valve using the appropriate fuel pressure test hose and adaptor.
- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Activate the fuel pump to obtain maximum fuel pressure.
- **Is the fuel pressure within specification (refer to the fuel pressure chart in Pinpoint Test HC)?**

Yes	No
GO to A11.	refer to **PINPOINT TEST HC**.

A11 CHECK THE FUEL PRESSURE LEAKDOWN

- Key ON, engine OFF.

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Activate the fuel pump to obtain maximum fuel pressure.
- Exit output test mode.
- Monitor the fuel pressure.
- Verify the fuel pressure remains within 34 kPa (5 psi) of the maximum pressure for 1 minute after turning the pump off.
- **Does fuel pressure remain within 34 kPa (5 psi)?**

Yes	No
GO to A12.	refer to **PINPOINT TEST HC**.

A12 CHECK THE FUEL INJECTORS FOR VOLTAGE

NOTE: **A no start condition typically exists only if greater than half of the fuel injectors are without voltage. Check at least 2 fuel injectors, 1 on each bank on V type engines.**

- Key in OFF position.
- Disconnect 2 fuel injectors.
- Key ON, engine OFF.
- Measure the VPWR voltage at each fuel injector harness connector.
- **Is the voltage greater than 10 volts?**

Yes	No
GO to A13.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

A13 CHECK THE FUEL INJECTORS' ABILITY TO DELIVER FUEL

- Cycle the key several times to charge the fuel system.
- Disable the fuel pump.
- Monitor the fuel pressure gauge while cranking the engine for at least 5 seconds.
- **Is there a pressure drop greater than 34 kPa (5 psi) while cranking the engine?**

Yes	No
The electronic engine control (EEC) system is not the cause of the no start. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to A14.

A14 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.

- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST B: POWERTRAIN CONTROL MODULE (PCM) POWER RELAY

INTRODUCTION

NOTE: The IGN START/RUN and ground circuits, or the B+ and VPWR circuits may be reversed in the harness connector. Refer to the Wiring Diagrams article Electronic Engine Control Cell for schematic and connector information.

This pinpoint test is intended to diagnose the following:

- harness circuits: B+, IGN START/RUN, INJPWRM, ISP-R, PCMRC, VPWR and GND
- PCM power relay (12A646)
- PCM (12A650)

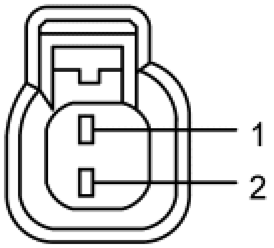

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Fig. 7: Injector (INJ) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Fusion 3.0L, Milan 3.0L	A	1	VPWR
All other vehicles	A	2	VPWR

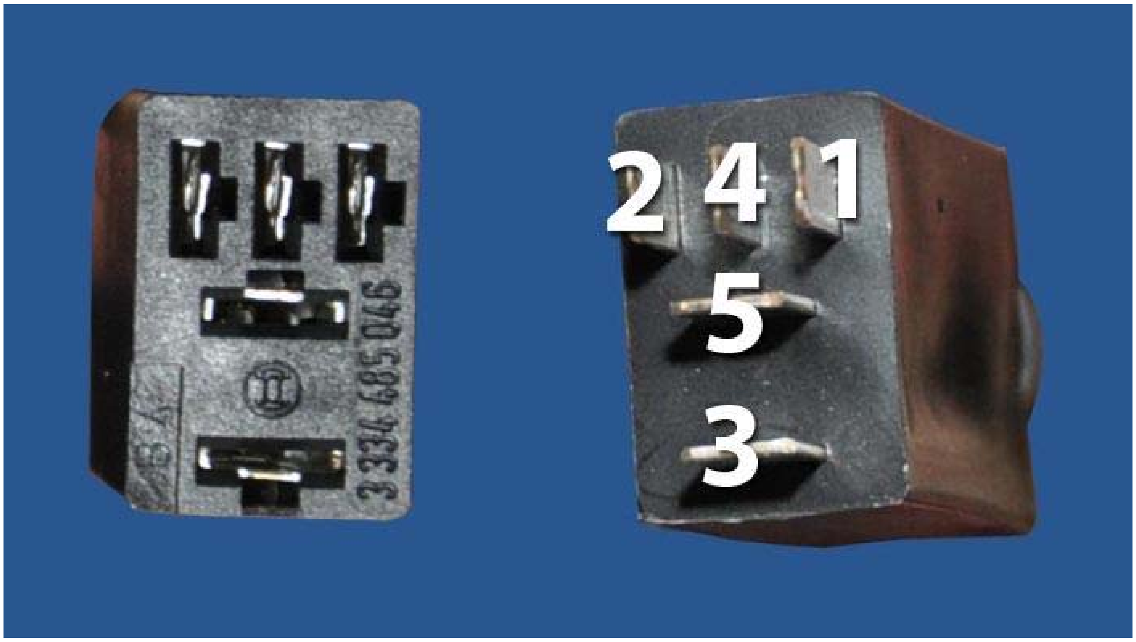

Fig. 8: Powertrain Control Module Power (PCM Power) Relay Connector - A
Courtesy of FORD MOTOR CO.

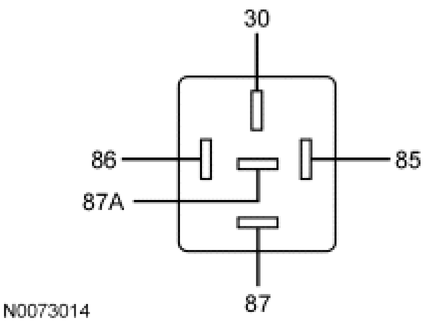

Fig. 9: Powertrain Control Module Power (PCM Power) Relay Connector - B
Courtesy of FORD MOTOR CO.

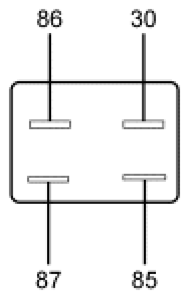

Fig. 10: Powertrain Control Module Power (PCM Power) Relay Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Escape/Mariner, Grand Marquis	A	5 2 1 3	VPWR GND IGN START/RUN B+
Expedition, F-Super Duty, Fusion, Milan, MKZ, Navigator, Sable, Taurus, Taurus X	B	87 86 30, 85	VPWR PCMRC B+
Explorer, Explorer Sport Trac, Mountaineer	B	87 85 30, 86	VPWR PCMRC B+
F-150, Mark LT	A	5 1 2, 3	VPWR PCMRC B+
Focus	A	3 2 1, 5	VPWR PCMRC B+
Mustang	C	87 85 30, 86	VPWR PCMRC B+
All other vehicles	B	87 85 86 30	VPWR GND IGN START/RUN B+

Vehicle	Connector	Pin	Circuit
Edge, MKX,	190 Pin	B33 B51, B52, B53	INJPWRM VPWR

Sable, Taurus, Taurus X		B7 B8	ISP-R PCMRC
Escape/Mariner	150 (50-50-50) Pin	B35, B36	VPWR
Expedition, Navigator	140 Pin	B33 B51, B52, B53 B7 B8	INJPWRM VPWR ISP-R PCMRC
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B35, B36 B46 B37	VPWR ISP-R PCMRC
F-150 4.6L, F-150 5.4L, Mark LT	190 Pin	B51, B52, B53 B17 B40	VPWR ISP-R PCMRC
F-150 4.2L	190 Pin	B33 B51, B52, B53 B17 B40	INJPWRM VPWR ISP-R PCMRC
F-Super Duty	170 Pin	E23 B35, B36 B31 B37	INJPWRM VPWR ISP-R PCMRC
Focus	190 Pin	B21 B67, B68 B42 B38	INJPWRM VPWR ISP-R PCMRC
Fusion, Milan, MKZ	140 Pin	B45 B51, B52 B37 B35	INJPWRM VPWR ISP-R PCMRC
Mustang	170 Pin	E23 B35, B36 B46 B37	INJPWRM VPWR ISP-R PCMRC
All other vehicles	170 Pin	B35, B36	VPWR

TEST PROCEDURE

B1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Is DTC P0685, P0689, or P0690 present?**

Yes	No
For DTCs P0685 or P0690, GO to B8. For DTC P0689, GO to B11.	GO to B2.

B2 CHECK THE B+ AND IGN START/RUN VOLTAGE TO PCM POWER RELAY

- Key in OFF position.
- PCM Power Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Power Relay Connector, Harness Side	(-)
B+	Ground
IGN START/RUN	Ground

- **Are the voltages greater than 10 V?**

Yes	No
For Crown Victoria, Grand Marquis, E-Series, Escape/Mariner, Ranger, and Town Car, GO to B6. For all others, GO to B3.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B3 CHECK THE PCMRC CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Power Relay Connector, Harness Side	(-) PCM Connector, Harness Side
PCMRC	PCMRC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to B4.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B4 CHECK THE PCMRC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)

PCMRC	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to B5.

B5 CHECK THE ISP-R VOLTAGE AT THE PCM HARNESS CONNECTOR

- Key in OFF position.
- PCM Power Relay connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ISP-R	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to B7.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B6 CHECK THE PCM POWER RELAY GROUND CIRCUIT FOR AN OPEN

- Measure the voltage between:

(+) PCM Power Relay Connector, Harness Side	(-) PCM Power Relay Connector, Harness Side
B+	GND

- **Is the voltage greater than 10 V?**

Yes	No
GO to B7.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B7 CHECK FOR AN OPEN VPWR CIRCUIT BETWEEN THE PCM AND POWER RELAY

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Power Relay Connector, Harness	

Side	(-) PCM Connector, Harness Side
VPWR	VPWR

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new PCM Power relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B8 DTCS P0685 OR P0690: CHECK THE PCMRC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- PCM Power Relay connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
PCMRC	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to B9.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

B9 CHECK THE ISP-R CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ISP-R	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to B10.

B10 CHECK THE INJPWRM CIRCUIT FOR AN OPEN IN THE HARNESS

- INJ connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) INJ Connector, Harness Side
INJPWRM	VPWR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to B12.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B11 DTC P0689: CHECK THE ISP-R VOLTAGE AT THE PCM HARNESS CONNECTOR

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ISP-R	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to B12.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

B12 CHECK FOR CORRECT PCM OPERATION

- Key in OFF position.
- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST C: REFERENCE VOLTAGE (VREF)

INTRODUCTION

WARNING: Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.

This pinpoint test is intended to diagnose the following:

- harness circuits: ETCREF, ETCRTN, SIGRTN and VREF
- accelerator pedal position (APP) sensor (9F836)
- air conditioning pressure (ACP) transducer sensor (19D594)
- differential pressure feedback exhaust gas recirculation (EGR) sensor (9J460)
- EGR system module (ESM) (9Y456)
- fuel rail pressure temperature (FRPT) sensor (9G756)
- fuel tank pressure (FTP) sensor (9C052)
- manifold absolute pressure (MAP) sensor (9F479)
- power steering pressure (PSP) sensor (3N824)
- throttle position (TP) sensor (9B989)
- powertrain control module (PCM) (12A650)

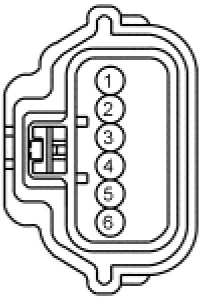

Fig. 11: Accelerator Pedal Position (APP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

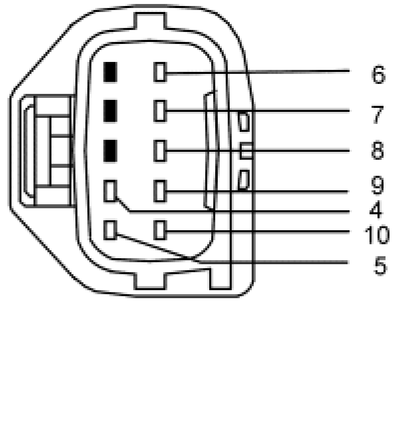

Fig. 12: Accelerator Pedal Position (APP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

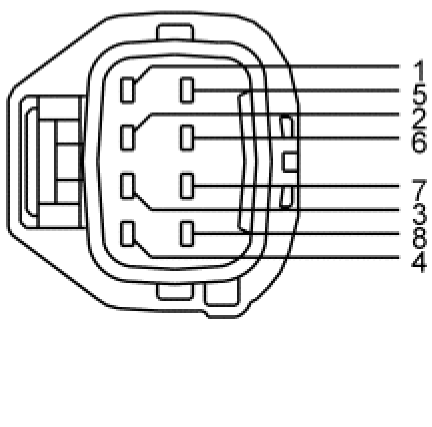

Fig. 13: Accelerator Pedal Position (APP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Focus	A	3, 4 1, 6	ETCRTN ETCREF
Fusion, Milan, MKZ	B	6, 9 10, 8	ETCRTN ETCREF
All other vehicles	C	1, 3 6, 7	ETCRTN ETCREF

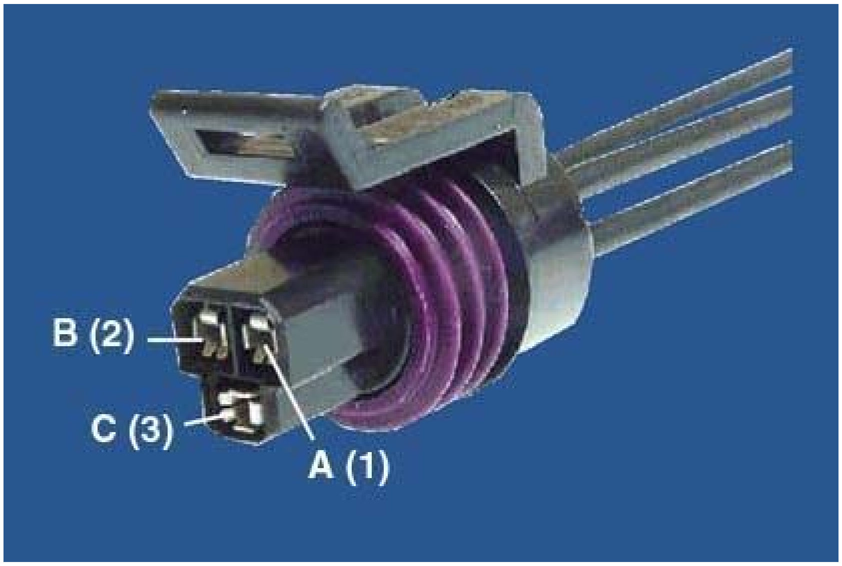

Fig. 14: Air Conditioning Pressure (ACP) Transducer Sensor Connector - A
Courtesy of FORD MOTOR CO.

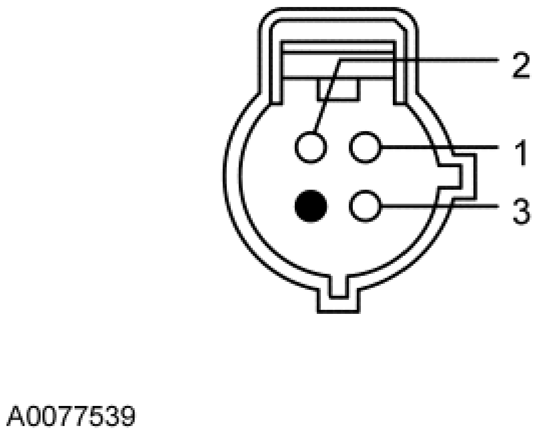

Fig. 15: Barometric Pressure (BARO) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Fusion, Milan, MKX, MKZ	A	1 2	SIGRTN VREF
All other vehicles	B	1 2	SIGRTN VREF

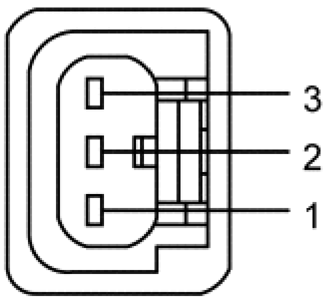

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Fig. 16: Differential Pressure Feedback EGR Sensor Connector - A
Courtesy of FORD MOTOR CO.

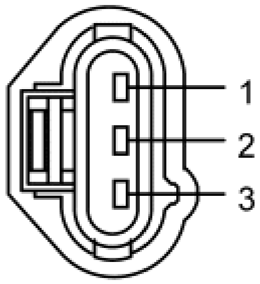

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Fig. 17: Differential Pressure Feedback EGR Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Vehicles equipped with a tube mounted differential pressure feedback EGR sensor	A	1 2	VREF SIGRTN
All other vehicles	B	3 2	VREF SIGRTN

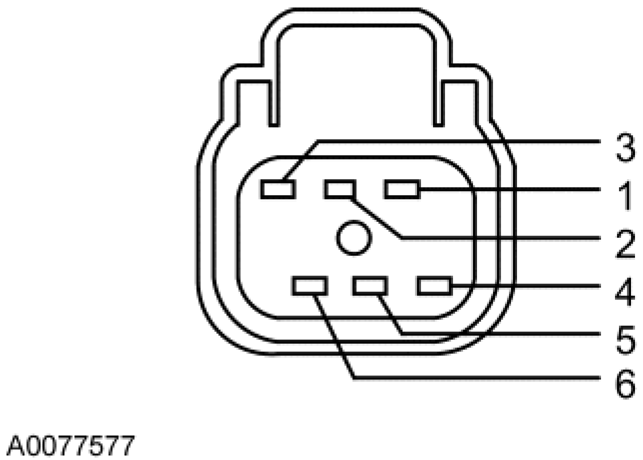


Fig. 18: EGR System Module (ESM) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
6	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

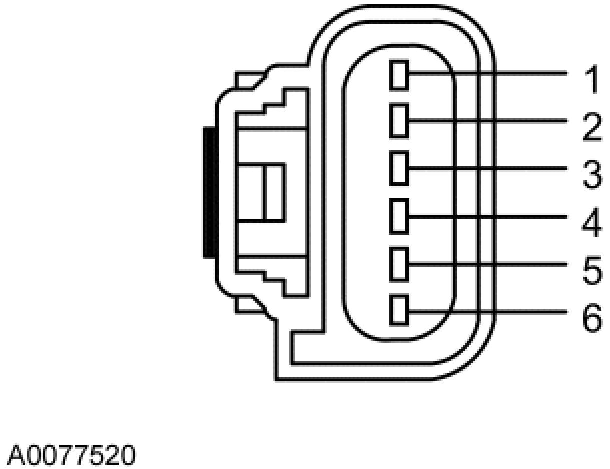
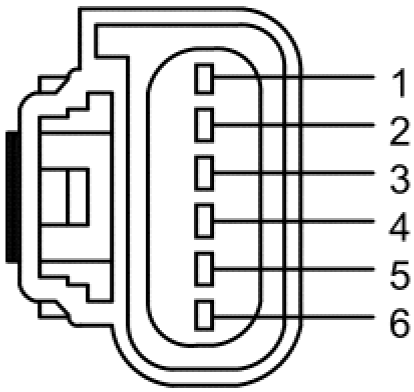


Fig. 19: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.



A0094772

Fig. 20: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - B
Courtesy of FORD MOTOR CO.

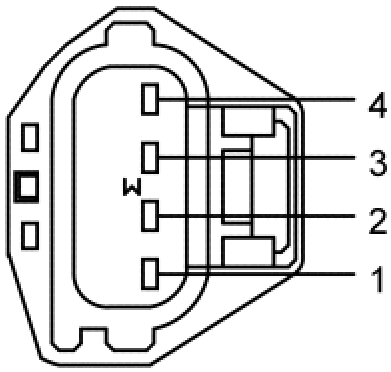


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Fig. 21: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus, Taurus X	A	2 3	ETCRTN ETCREF

Fusion 2.3L, Milan 2.3L	B	3 5	ETCRTN ETCREF
Fusion 3.0L, Milan 3.0L	B	4 5	ETCRTN ETCREF
All other vehicles	C	3 2	ETCRTN ETCREF

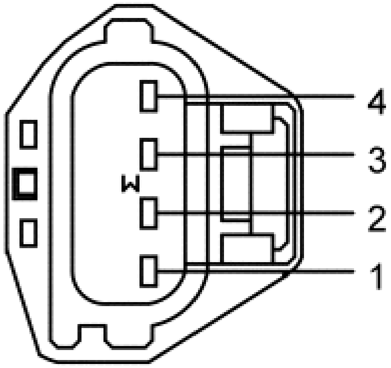

Fig. 22: Fuel Rail Pressure Temperature (FRPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	VREF (Reference Voltage)
4	SIGRTN (Signal Return)

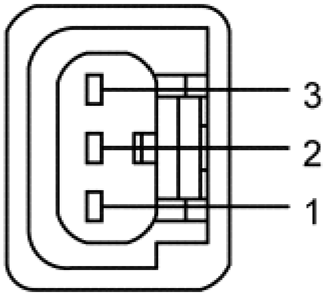

Fig. 23: Differential Pressure Feedback EGR Sensor Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	VREF (Reference Voltage)
2	SIGRTN (Signal Return)

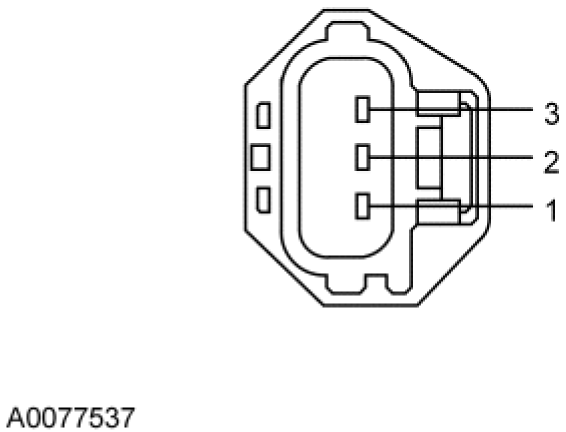

Fig. 24: Manifold Absolute Pressure (MAP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

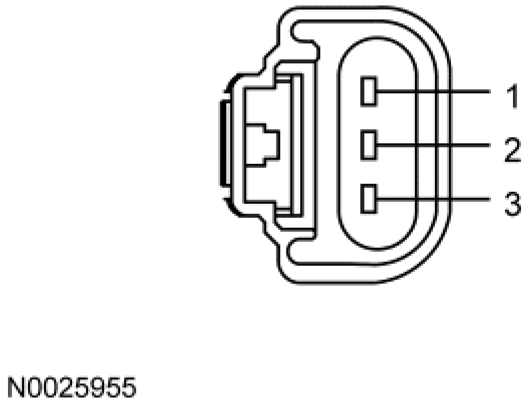

Fig. 25: Manifold Absolute Pressure (MAP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

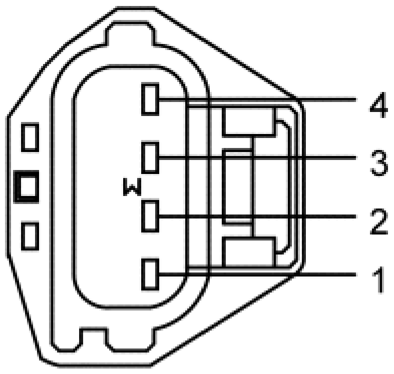

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Fig. 26: Manifold Absolute Pressure (MAP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 3.0L	A	3 1	SIGRTN VREF
Fusion 3.0L, Milan 3.0L	B	2 3	SIGRTN VREF
All other vehicles	C	4 2	SIGRTN VREF

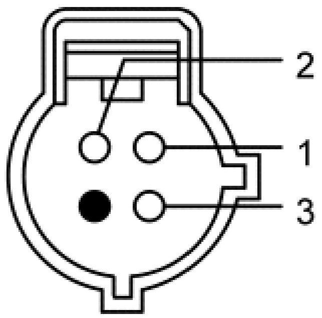

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Fig. 27: Barometric Pressure (BARO) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	VREF (Reference Voltage)

1	SIGRTN (Signal Return)

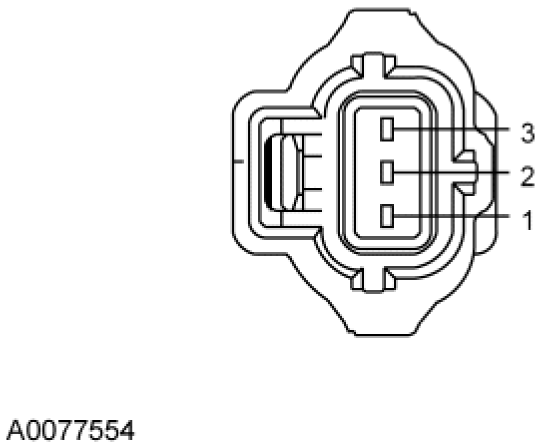

Fig. 28: Throttle Position (TP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

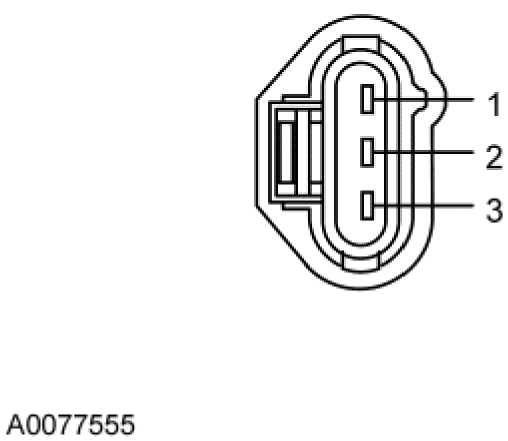

Fig. 29: Throttle Position (TP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Ranger 2.3L	A	3 1	VREF SIGRTN
All other vehicles	B	1 3	VREF SIGRTN

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Mustang, Town Car	170 Pin	B35, B36 B41, E58, T41 B41, B6, E59 B40, E57 B24, B4, E66	VPWR SIGRTN ETCRTN VREF ETCREF
E-Series, F-Super Duty	170 Pin	B35, B36 B41, E58, T41 B18, B6, E59 B40, E57 B16, B4, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Escape/Mariner	150 (50-50-50) Pin	B35, B36 B41, E41, T41 B40, E40	VPWR SIGRTN VREF
Expedition, Navigator	140 Pin	B51, B52, B53 B58, E58 B59, B65, E59 E57 B21, B28, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B35, B36 B41, E58, T41 B43, B6, E59 B40, E57 B24, B4, E66	VPWR SIGRTN ETCRTN VREF ETCREF
F-150, Mark LT	190 Pin	B51, B52, B53 B58, E58, T43 B58, B59, E59 B29, E57 B21, B28, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Focus	190 Pin	B67, B68 B58, E64, T40 B44, B60, E60 B52, B66, E63 B45, B61, E59	VPWR SIGRTN ETCRTN VREF ETCREF
Fusion, Milan, MKZ	140 Pin	B51, B52 B58, E58 B59, B60, E59 B33, E57 B21, B28, E66	VPWR SIGRTN ETCRTN VREF ETCREF
Ranger	170 Pin	B35, B36 B41, E58, T41 B40, E57	VPWR SIGRTN VREF
All other vehicles	190 Pin	B51, B52, B53 B58, E58 B59, B65, E59 B29, B64	VPWR SIGRTN ETCRTN VREF

		B21, B28, E66	ETCREF

SENSORS CONNECTED TO VREF/ETCREF

Applications	TP or ETC	APP	Differential Pressure Feedback EGR or ESM	FTP	ACP	PSPT	FRPT	MAP
Crown Victoria/Grand Marquis	ETC	X	X	X	X		X	
Edge/MKX	ETC	X		X	X			
Escape/Mariner - 2.3L	TP			X			X	X
Escape/Mariner - 3.0L	TP		X	X			X	X
E-Series - 4.6L/5.4L	ETC	X	X	X			X	
E-Series - 6.8L	ETC	X		X			X	
Expedition/Navigator	ETC	X		X				
Explorer/Explorer Sport Trac/Mountaineer	ETC	X	X	X			X	
F-150 - 4.2L	ETC	X	X	X			X	
F-150 - 4.6L	ETC	X	X	X		X	X	
F-150 - 5.4L/Mark LT	ETC	X		X		X	X	
F-Super Duty	ETC	X		X			X	
Focus	ETC	X		X		X		X
Fusion/Milan/MKZ	ETC	X		X	X			X
Mustang - 4.0L	ETC	X	X	X	X		X	
Mustang - 4.6L	ETC	X		X			X	
Mustang - 5.4L	ETC	X	X	X			X	
Ranger - 2.3L	TP			X				X
Ranger - 3.0L/4.0L	TP		X	X				
Taurus/Taurus X/Sable	ETC	X		X	X			
Town Car	ETC	X	X	X	X		X	

NOTE:

- **ETCREF and ETCRTN are internally bussed within the PCM and are dedicated circuits for the APP sensor and the electronic throttle body TP sensor only. Refer to the Wiring Diagrams article Electronic Engine Controls Cell for schematic and connector information.**

TEST PROCEDURE

C1 CHECK THE REFERENCE VOLTAGE TO SIGRTN/ETCRTN

NOTE: **Diagnostic trouble codes (DTCs) P0642 and P0643 are set due to VREF circuit concerns only. When diagnosing DTC P0642 or P0643, follow the**

path for VREF concerns.

- Key in OFF position.
- Disconnect the suspect sensor.
- Key ON, engine OFF.
- For ETCREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-) Suspect Sensor Connector, Harness Side
ETCREF	ETCRTN

- For VREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-) Suspect Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to C19.	GO to C2.

C2 CHECK THE REFERENCE VOLTAGE TO GROUND

- For ETCREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
ETCREF	Ground

- For VREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to C18.	GO to C3.

C3 CHECK THE REFERENCE VOLTAGE WITH ALL SENSORS DISCONNECTED

NOTE: **Refer to the Sensors Connected To VREF/ETCREF Chart at the beginning of this pinpoint test and the Wiring Diagrams article Electronic Engine Controls Cell to identify the sensors connected to VREF/ETCREF.**

- Key in OFF position.
- Disconnect all of the sensors connected to the VREF/ETCREF circuit.
- Key ON, engine OFF.
- Measure the voltage at the sensor disconnected in C1.
- For ETCREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
ETCREF	Ground

- For VREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For electronic throttle control (ETC) concerns, GO to C8. For all other VREF concerns, GO to C10.	GO to C4.

C4 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR AN OPEN

- Key in OFF position.
- Disconnect the PCM.
- For ETCREF concerns.
- Measure the resistance between:

(+) Suspect Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ETCREF	ETCREF

- For VREF concerns.
- Measure the resistance between:

(+) Suspect Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	VREF

- **Is the resistance less than 5 ohms?**

Yes	No
GO to C5.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

C5 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO GROUND

- For ETCREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ETCREF	ETCRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
ETCREF	Ground

- For VREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
VREF	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to C6.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

C6 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO VPWR

- For ETCREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ETCREF	VPWR

- For VREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	VPWR

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to C7.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

C7 CHECK THE REFERENCE VOLTAGE FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- For ETCREF concerns.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ETCREF	Ground

- For VREF concerns.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
VREF	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to C20.

C8 CHECK THE REFERENCE VOLTAGE WITH THE ELECTRONIC THROTTLE CONTROL CONNECTED

NOTE: If this sensor was used for the ETCREF measurement in C3, GO to C9.

- Key in OFF position.
- Connect the electronic throttle body throttle position sensor (ETBTPS).
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
ETCREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
The concern is intermittent. refer to **PINPOINT TEST Z**.	INSTALL a new ETBTPS. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C9 CHECK THE REFERENCE VOLTAGE WITH THE APP SENSOR CONNECTED

- Key in OFF position.
- Connect the APP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
ETCREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
The concern is intermittent. refer to **PINPOINT TEST Z**.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C10 CHECK THE REFERENCE VOLTAGE WITH THE TP SENSOR CONNECTED

NOTE: If this sensor was used for the VREF measurement in C3, GO to C11.

- Key in OFF position.
- Connect the TP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to C11. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C11 CHECK THE REFERENCE VOLTAGE WITH THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a differential pressure feedback EGR sensor or if this sensor was used for the VREF measurement in C3, GO to C12.**

- Key in OFF position.
- Differential Pressure Feedback EGR Sensor connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to C12. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C12 CHECK THE REFERENCE VOLTAGE WITH THE ESM CONNECTED

NOTE: **If the vehicle is not equipped with an ESM or if this sensor was used for the VREF measurement in C3, GO to C13.**

- Key in OFF position.
- Connect the ESM.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to C13. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C13 CHECK THE REFERENCE VOLTAGE WITH THE MAP SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a MAP sensor or if this sensor was used for the VREF measurement in C3, GO to C14.**

- Key in OFF position.
- Connect the MAP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to C14. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new MAP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C14 CHECK THE REFERENCE VOLTAGE WITH THE FRPT SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a FRPT sensor or if this sensor was used for the VREF measurement in C3, GO to C15.**

- Key in OFF position.
- Connect the FRPT sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to C15. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new FRPT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C15 CHECK THE REFERENCE VOLTAGE WITH THE FTP SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a FTP sensor or if this sensor was used for the VREF measurement in C3, GO to C16.**

- Key in OFF position.
- Connect the FTP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to C16. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

C16 CHECK THE REFERENCE VOLTAGE WITH THE ACP TRANSDUCER SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with an ACP transducer sensor or if this sensor was used for the VREF measurement in C3, GO to C17.**

- Key in OFF position.
- Connect the ACP transducer sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For additional sensors disconnected, GO to C17. For no additional sensors disconnected, refer to **PINPOINT TEST Z**.	INSTALL a new Air Conditioning Pressure (ACP) Transducer Sensor. CLEAR the DTCs. REPEAT the self-test.

C17 CHECK THE REFERENCE VOLTAGE WITH THE PSP SENSOR CONNECTED

- Key in OFF position.
- Connect the PSP sensor.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
The concern is intermittent. refer to **PINPOINT TEST Z**.	INSTALL a new PSP sensor. CLEAR the DTCs. REPEAT the self-test.

C18 CHECK THE SIGRTN OR ETCRTN CIRCUIT(S) FOR AN OPEN

NOTE: **Refer to the Wiring Diagrams article Electronic Engine Controls Cell for specific vehicle application and pin locations.**

- Key in OFF position.
- Disconnect the PCM.
- For ETCRTN concerns.
- Measure the resistance between:

(+) Suspect Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ETCRTN	ETCRTN

- For SIGRTN concerns.
- Measure the resistance between:

(+) Suspect Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
SIGRTN	SIGRTN

- **Is the resistance less than 5 ohms?**

Yes	No
GO to C20.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

C19 CHECK THE SUSPECT SENSOR FOR AN INTERNAL SHORT

- Clear the KOEO, KOER, and continuous DTCs.
- Key in OFF position.
- Connect the suspect sensor.
- Key ON, engine OFF.
- Carry out the PCM self-test.
- **Is the concern still present?**

Yes	No
INSTALL a new sensor for the sensor in question. CLEAR the DTCs. REPEAT the self-test.	The concern is intermittent. refer to **PINPOINT TEST Z**.

C20 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DA: INTAKE AIR TEMPERATURE (IAT) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- integrated mass air flow/intake air temperature (MAF/IAT) sensor (12B579)
- harness circuits: IAT and SIGRTN
- powertrain control module (PCM) (12A650)

Voltage values calculated for VREF equal 5 volts. These values can vary by 15% due to sensor and VREF variations.

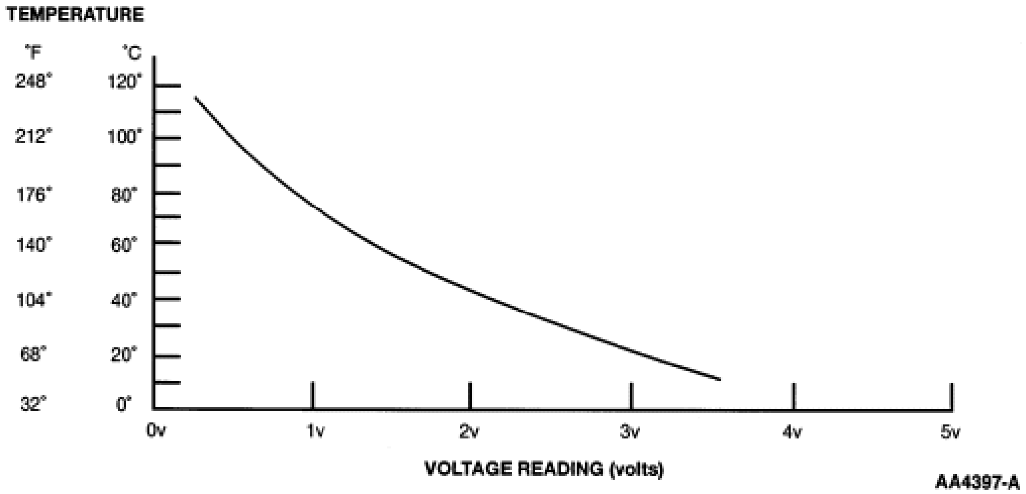

Fig. 30: Temperature Sensor Temperature To Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	**°F**	**Voltage**	**Resistance (K ohms)**
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

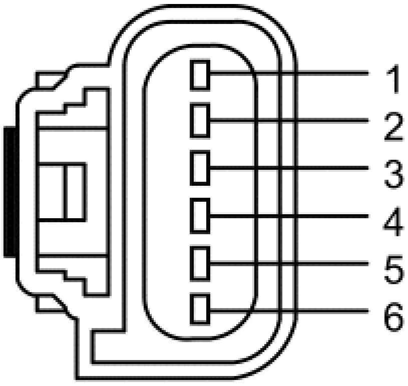

Fig. 31: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	MAF RTN (Mass Air Flow Return)
2	SIGRTN (Signal Return)
1	IAT (Intake Air Temperature)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Town Car	170 Pin	T41 E22	SIGRTN IAT
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B58 B43	SIGRTN IAT
Escape/Mariner 3.0L	150 (50-50-50) Pin	B41 B20	SIGRTN IAT
Escape/Mariner 2.3L	150 (50-50-50) Pin	B41 B39	SIGRTN IAT
Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	B58 B43	SIGRTN IAT
F-150, Mark LT	190 Pin	E58 E22	SIGRTN IAT

Focus	190 Pin	B58 B47	SIGRTN IAT
All other vehicles	170 Pin	E58 E22	SIGRTN IAT

TEST PROCEDURE

DA1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0111, P0112, P0113, P0114, or P1112 present?**

Yes	No
For DTC P0111, GO to DA12. For KOEO and KOER DTC P0112, GO to DA6. For KOEO and KOER DTC P0113, GO to DA2. For continuous memory DTCs P0112, P0113 or P1112, GO to DA9. For DTC P0114, GO to DA9.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DA2 DTC P0113: CHECK THE IAT SIGNAL CIRCUIT

NOTE: The DTC indicates the sensor signal is greater than the self-test maximum.

- MAF/IAT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAF/IAT Sensor Connector, Harness Side	(-)
IAT - Pin 1	Ground

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to DA3.	GO to DA4.

DA3 CHECK THE IAT SENSOR RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Component Side	(-) MAF/IAT Sensor Connector, Component Side
IAT - Pin 1	SIGRTN - Pin 2

- **Is the resistance between 1K - 500K ohms?**

Yes	No
GO to DA4.	INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DA4 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IAT - Pin 1	IAT
SIGRTN - Pin 2	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DA5.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DA5 CHECK THE SIGNAL FOR A SHORT TO VOLTAGE IN HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAF/IAT Sensor Connector, Harness Side	(-)
IAT - Pin 1	Ground

- **Is the voltage greater than 1 V?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to DA14.

DA6 DTC P0112: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

NOTE: The DTC indicates the sensor signal is less than the self-test minimum.

- MAF/IAT Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the IAT PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DA7.

DA7 CHECK THE IAT CIRCUIT FOR A SHORT TO MAF RTN

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
IAT - Pin 1	MAF RTN - Pin 4

- **Is the resistance less than 5 ohms?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to DA8.

DA8 CHECK THE IAT CIRCUIT FOR A SHORT TO GROUND

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
IAT	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
IAT	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DA14.	REPAIR the short circuit. CLEAR the DTCs.

	REPEAT the self-test.

DA9 SELF-TEST DTCS P0112, P0113, P0114 OR P1112: INTERMITTENT CHECK

- Key ON, engine OFF.
- Access the PCM and monitor the IAT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
- **Is there a large change in the voltage reading?**

Yes	No
DISCONNECT and INSPECT the connector. If OK, INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DA10.

DA10 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

- Access the PCM and monitor the IAT PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there a large change in the voltage reading?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DA11.

DA11 CHECK THE PCM AND VEHICLE HARNESS CONNECTORS

- Key in OFF position.
- PCM connector disconnected.
- MAF/IAT Sensor connector disconnected.
- **Are the connectors and terminals OK?**

Yes	No
The concern is not present at this time. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DA12 DTC P0111: CHECK THE RESISTANCE OF THE IAT SENSOR WITH THE ENGINE OFF

NOTE: **Verify the engine temperature is at ambient temperature before continuing with this test.**

- Key in OFF position.
- IAT Sensor connector disconnected.
- Measure the resistance between:

(+) IAT Sensor Connector, Component Side	(-) IAT Sensor Connector, Component Side
IAT	SIGRTN

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
GO to DA13.	INSTALL a new IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DA13 DTC P0111: CHECK THE RESISTANCE OF THE IAT SENSOR

NOTE: **Verify the engine is at operating temperature before taking the IAT reading.**

- IAT Sensor connector connected.
- Run the engine until the engine temperature stabilizes.
- Key in OFF position.
- IAT Sensor connector disconnected.
- Measure the resistance between:

(+) IAT Sensor Connector, Component Side	(-) IAT Sensor Connector, Component Side
IAT	SIGRTN

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
The concern is not present at this time. CARRY OUT the OBD drive cycle to determine if fuel, HO2S, catalyst and misfire monitors can be executed. REFER to On Board Diagnostic (OBD) Drive Cycle. REPEAT the PCM self-test if necessary.	INSTALL a new IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DA14 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DC: MASS AIR FLOW (MAF) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- mass air flow (MAF) sensor (12B579)
- harness circuits: MAF SIG, MAF RTN, vehicle power (VPWR), power ground (PWRGND), IAT and SIGRTN
- powertrain control module (PCM) (12A650)

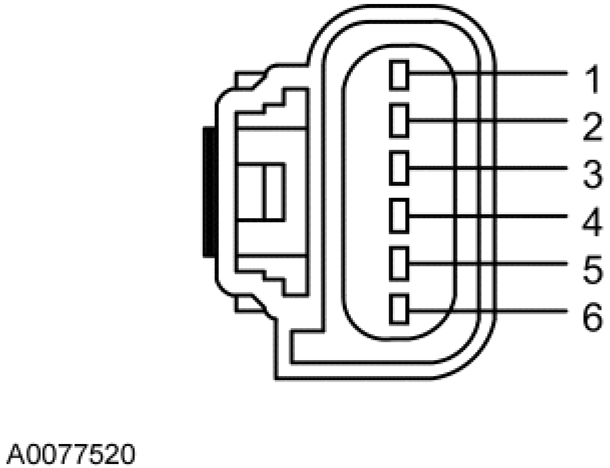

Fig. 32: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	IAT (Intake Air Temperature)
2	SIGRTN (Signal Return)
4	MAF RTN (Mass Air Flow Return)
3	MAF (Mass Air Flow)
5	PWRGND (Power Ground)
6	VPWR (Vehicle Power)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B41 B42	MAF MAF RTN
Escape/Mariner	150 (50-50-50) Pin	B32 B43	MAF MAF RTN
Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	B41 B42	MAF MAF RTN
F-150, Mark LT	190 Pin	E25 E26	MAF MAF RTN
Focus	190 Pin	B40 B41	MAF MAF RTN
All other vehicles	170 Pin	E25 E26	MAF MAF RTN

TEST PROCEDURE

DC1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0102, P0103, P0104, P1100, or P1101 present?**

Yes	No
For KOER and continuous memory DTC P0102, P0104, GO to DC5. For DTC P0103, GO to DC21. For KOEO DTC P1101, GO to DC7. For KOER and continuous memory DTC P1101, GO to DC2. For continuous memory DTC P1100, GO to DC19.	For all other symptoms without DTCs, GO to DC27.

DC2 DTC P1101: CHECK FOR MAF SENSOR CONTINUOUS MEMORY DTCS

- Retrieve continuous memory DTCs.
- **Is a continuous memory MAF DTC present with the KOER DTC P1101?**

Yes	No
GO to DC3.	GO to DC5.

DC3 VERIFY CONTINUOUS MEMORY DTC P0102

- **Is a continuous memory DTC P0102 present with the KOER DTC P1101?**

Yes	No
GO to DC5.	GO to DC4.

DC4 VERIFY CONTINUOUS MEMORY DTC P0103

- **Is a continuous memory DTC P0103 present with the KOER DTC P1101?**

Yes	No
GO to DC21.	All other continuous memory DTCs: DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DC5 KOER AND CONTINUOUS MEMORY DTCS P0102, P0104 OR P1101: CHECK THE INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS, AND DAMAGE

- Key in OFF position.
- Check the air inlet system (air cleaner, housing, duct work) for obstructions or blockage.
- Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in the air outlet tube, and worn gaskets between the MAF sensor and the air cleaner assembly. Check the throttle body bore for sludge. Verify the MAF sensor is connected. Repair as necessary.
- **Are there any concerns found during the visual inspection?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DC6.

DC6 CHECK THE MAF PID

- Access the PCM and monitor the RPM PID.
- Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle.
- Access the PCM and monitor the MAF PID.
- **Is the voltage less than 0.23 V?**

Yes	No
GO to DC9.	GO to DC7.

DC7 CHECK THE MAF SIGNAL SENT TO THE PCM

NOTE: **DTC P1101 can be generated by a low charged vehicle battery or the garage exhaust ventilation system. Charge the battery as necessary, then remove the ventilation system and properly vent to the outside atmosphere. Check the air inlet system (air cleaner, housing, duct work) for obstructions or blockage. Repeat the KOEO self-test.**

- Key in OFF position.
- MAF/IAT Sensor connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the MAF PID.
- **Is the voltage less than 0.2 V?**

Yes	No
GO to DC8.	GO to DC9.

DC8 CHECK THE MAF SIGNAL SENT TO THE PCM

- Key ON, engine running.
- Access the PCM and monitor the MAF PID.
- **Is the voltage between 0.46 - 2.44 V?**

Yes	No
Unable to identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to DC9.

DC9 CHECK THE VPWR TO THE MAF SENSOR

- Key in OFF position.
- MAF/IAT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 6	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No

GO to DC10.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC10 CHECK THE PWRGND CIRCUIT TO THE MAF SENSOR

- Measure the voltage between:

(+) Vehicle Battery	(-) MAF/IAT Sensor Connector, Harness Side
Positive terminal	PWRGND - Pin 5

- **Is the voltage greater than 10 V?**

Yes	No
GO to DC11.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC11 CHECK FOR SHORTS BETWEEN THE CIRCUITS IN THE MAF HARNESS

- Key in OFF position.
- MAF/IAT Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF - Pin 3	PWRGND - Pin 5
MAF - Pin 3	MAF RTN - Pin 4
MAF - Pin 3	SIGRTN - Pin 2
MAF - Pin 3	IAT - Pin 1

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DC12.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DC12 CHECK THE MAF RTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF RTN	MAF RTN - Pin 4

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DC13.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC13 CHECK THE MAF RTN CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF RTN - Pin 4	PWRGND - Pin 5

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DC14.	REPAIR the short circuit to GND. CLEAR the DTCs. REPEAT the self-test.

DC14 CHECK THE MAF CIRCUIT FOR A SHORT TO PWRGND IN THE PCM

- PCM connector connected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF - Pin 3	PWRGND - Pin 5

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DC15.	GO to DC31.

DC15 CHECK THE MAF CIRCUIT VOLTAGE CYCLING INTEGRITY

- Key ON, engine OFF.
- Access the PCM and monitor the MAF PID.
- Connect a 5 amp fused jumper wire between the following:

Point A MAF/IAT Sensor Connector, Harness Side	Point B MAF/IAT Sensor Connector, Harness Side
MAF RTN - Pin 4	PWRGND - Pin 5
MAF - Pin 3	VPWR - Pin 6

- Record the PID reading while both jumpers are installed.
- Remove the VPWR jumper while observing the MAF PID.

- **Does the MAF PID change from greater than 4.50 volts to less than 0.26 volt when the VPWR jumper is removed?**

Yes	No
INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to DC16.

DC16 CHECK THE MAF CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF	MAF - Pin 3

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DC17.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC17 CHECK THE PWRGND CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) Vehicle Battery
PWRGND - Pin 5	Negative terminal

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DC18.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC18 CHECK THE MAF RTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF RTN	MAF RTN - Pin 4

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DC31.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC19 DTC P1100: CHECK THE MAF CIRCUIT FOR INTERMITTENT VOLTAGE TO THE PCM

- Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in the air outlet tube, and worn gaskets between the MAF sensor and the air cleaner assembly. Verify the MAF sensor is connected.
- Key ON, engine running.
- Access the PCM and monitor the MAF PID.
- If idle is not stable, refer to **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .
- Access the PCM and monitor the RPM PID.
- Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle.
- Lightly tap on the MAF sensor and wiggle the harness connector to simulate road shock.
- **Does the MAF PID go below 0.23 volt or above 4.6 volts?**

Yes	No
INSPECT the MAF/IAT sensor connector. If OK, INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to DC20.

DC20 CHECK THE MAF CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

- Key ON, engine running.
- Access the PCM and monitor the MAF PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Does the MAF PID go below 0.23 volt or above 4.6 volts?**

Yes	No
REPAIR as necessary. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	Unable to duplicate or identify the concern at this time. CLEAR the DTCs. REPEAT the self-test.

DC21 DTC P0103: CHECK THE MAF SENSOR SCREEN FOR CONTAMINATION

NOTE: DTC P0103 can be generated by foreign material blocking the MAF sensor screen, causing an air flow restriction.

- Check the MAF sensor screen for contamination or blockage.
- Check the air cleaner element and air tubes for proper installation and sealing.
- **Are any concerns present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DC22.

DC22 DTC P0103: CHECK THE MAF SENSOR SIGNAL HIGH INPUT TO THE PCM

- Key ON, engine OFF.
- Access the PCM and monitor the MAF PID.
- **Is the voltage greater than 2.44 V?**

Yes	No
GO to DC23.	GO to DC25.

DC23 CHECK THE MAF SENSOR SIGNAL SENT TO THE PCM

- Key in OFF position.
- MAF/IAT Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A MAF/IAT Sensor Connector, Harness Side	Point B MAF/IAT Sensor Connector, Harness Side
MAF RTN - Pin 4	PWRGND - Pin 5

- Key ON, engine OFF.
- Access the PCM and monitor the MAF PID.
- **Is the voltage less than 0.1 V?**

Yes	No
CHECK the MAF/IAT sensor electrical connector for damage, corrosion, and water ingress. If OK, INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to DC24.

DC24 CHECK THE MAF CIRCUIT FOR A SHORT TO VOLTAGE

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
MAF	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to DC26.	REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.

DC25 CHECK THE MAF SIGNAL SENT TO THE PCM

- Key ON, engine running.
- Access the PCM and monitor the RPM PID.
- Monitor the MAF signal voltage while increasing the engine RPM from idle to approximately 2,500 RPM, and then back to idle.
- Access the PCM and monitor the MAF PID.
- **Is the voltage between 0.23 - 4.6 V?**

Yes	No
This is an intermittent concern. refer to **PINPOINT TEST Z**.	GO to DC23.

DC26 VERIFY THE IDLE CONCERN

- PCM connector connected.
- MAF/IAT Sensor connector connected.
- Key ON, engine running.
- **Is an idle concern present?**

Yes	No
DISREGARD DTC P0103 at this time. The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose unique idle concerns.	GO to DC31.

DC27 SYMPTOMS WITHOUT DTCS: CHECK THE CONDITIONS RELATED TO THE MAF SENSOR

- Check the air inlet system (air cleaner, housing, duct work) for obstructions or blockage.
- Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in the air outlet tube, and worn gaskets between the MAF sensor and the air cleaner assembly. Verify the MAF sensor is connected.
- **Is a concern present?**

Yes	No
REPAIR as necessary. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to DC28.

DC28 DTCS P0171, P0172, P0174, P0175, P2195, P2196, P2197 OR P2198: CHECK THE FUNCTIONALITY OF THE MAF SENSOR

NOTE: **A MAF PID value of less than 0.6 volt may indicate an incorrectly installed air cleaner or a leak in the air inlet system.**

- Key ON, engine running.
- Allow the engine to stabilize at the correct operating temperature.
- Access the PCM and monitor the MAF PID.
- Check that the MAF PID at idle and NEUTRAL is not greater than 30% of the normal MAF listed in the **REFERENCE VALUES** article, Reference Values or not greater than 1.3 volts.
- **Is the PID value within the expected range?**

Yes	No
GO to DC30.	GO to DC29.

DC29 CHECK TO ISOLATE THE MAF SENSOR FROM A LEAN DRIVEABILITY OCCURRENCE

NOTE: **Due to increasingly stringent emission/OBD requirements, a fuel system DTC on some vehicles can be generated without a noticeable driveability concern with or without the MAF sensor disconnected. Under these conditions, if the MAF PID indicates a MAF sensor concern, install a new MAF sensor. Refer to the ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES .**

- Key in OFF position.
- MAF/IAT Sensor connector disconnected.
- Key ON, engine running.
- Drive the vehicle on the road.
- **Is the lean driveability symptom (lack of power, spark knock/detonation, buck/jerk or hesitation/surge on acceleration) gone?**

Yes	No
INSTALL a new MAF/IAT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to DC30.

DC30 VERIFY THE DTC

- **Are any of the following DTCs present:**

  P0171, P0172, P0174, P0175, P2195, P2196, P2197, or P2198?

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose performance while driving concerns.

DC31 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DD: FUEL RAIL PRESSURE TEMPERATURE (FRPT) SENSOR

INTRODUCTION

WARNING: **Vehicle fuel systems are pressurized even when the engine is not running. To avoid fire or personal injury, disable the fuel delivery system and relieve fuel system pressure before removing any fuel system**

component. Refer to the fuel system information at the beginning of pinpoint HC. Failure to follow these instructions may result in personal injury.

NOTE: **With the engine running, the FRP PID value may be 48-70 kPa (7-10 psi) higher than a fuel pressure reading taken with a mechanical gauge.**

This pinpoint test is intended to diagnose the following:

- fuel rail pressure temperature (FRPT) sensor (9G756)
- harness circuits: FRP and FRT
- powertrain control module (PCM) (12A650)

FRPT SENSOR VOLTAGE AND PRESSURE SPECIFICATIONS

Voltage	Pressure (kPa)	Pressure (psi)
4.5	482	70
3.9	413	60
3.4	344	50
2.8	275	40
2.2	207	30
1.6	138	20
1.1	69	10
0.5	0	0

FRPT SENSOR TEMPERATURE, VOLTAGE, AND RESISTANCE SPECIFICATIONS

Temperature		Sensor	
°C	°F	Volts	K Ohms
100	212	0.47	2.073
95	203	0.54	2.405
90	194	0.61	2.800
85	185	0.70	3.273
80	176	0.80	3.840
75	167	0.92	4.524
70	158	1.06	5.351
65	149	1.21	6.356
60	140	1.38	7.584
55	131	1.56	9.091
50	122	1.77	10.949
45	113	1.99	13.252
40	104	2.23	16.123
35	95	2.48	19.720
30	86	2.74	24.253

25	77	3.00	30.000
20	68	3.26	37.332
15	59	3.50	46.745
10	50	3.73	58.911
5	41	3.95	74.745
0	32	4.13	95.501

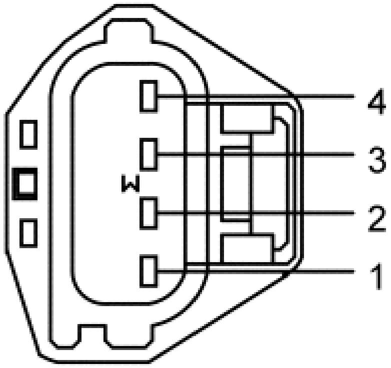

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Fig. 33: Fuel Rail Pressure Temperature (FRPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
3	FRT (Fuel Rail Temperature)
1	FRP (Fuel Rail Pressure)
4	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	E40 E28 E41 E37	VREF FRT SIGRTN FRP
F-150, Mark LT	190 Pin	E57 E19 E58 E32	VREF FRT SIGRTN FRP
All other vehicles	170 Pin	E57 E19 E58	VREF FRT SIGRTN

		E32	FRP

TEST PROCEDURE

DD1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0180, P0181, P0182, P0183, P0190, P0191, P0192 or P0193 present?**

Yes	No
For DTC P0180, GO to DD24. For DTC P0181, GO to DD26. For continuous memory DTCs P0182 or P0183, GO to DD2. For KOEO and KOER DTCs P0182 or P0183, GO to DD17. For continuous memory DTC P0190, GO to DD3. For DTC P0191, GO to DD11. For continuous memory DTCs P0192 or P0193, GO to DD16. For KOEO and KOER DTCs P0192 or P0193, GO to DD3.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DD2 CHECK THE FRPT AND PCM CONNECTORS FOR DAMAGE

- Key ON, engine OFF.
- Access the PCM and monitor the FRT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
  - Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM
- Check the FRPT and PCM connectors for damage and corrosion.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary.	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DD3 CONTINUOUS MEMORY DTC P0190, KOEO AND KOER DTCS P0192 AND P0193: CHECK THE FRPT SENSOR FOR FUEL LEAKS

NOTE: Repair any fuel pump DTCs prior to this test.

- Key ON, engine running.

- Idle the engine for 2 minutes.
- Inspect the FRPT vacuum hose between the intake manifold and the FRPT sensor for air leaks and correct connection.
- Key in OFF position.
- Remove the vacuum hose from the FRPT.
- Inspect the FRPT and vacuum hose for traces of fuel.
- **Is any fuel present?**

Yes	No
INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DD4.

DD4 CHECK THE VREF AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Connect the vacuum hose to the FRPT.
- FRPT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 4

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
For DTC P0190, GO to DD12. For DTC P0192, GO to DD5. For DTC P0193, GO to DD7.	refer to **PINPOINT TEST C**.

DD5 INDUCE A HIGH VOLTAGE ON THE FRPT CIRCUIT

- Key in OFF position.
- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
VREF - Pin 2	FRP - Pin 1

- Key ON, engine OFF.

- Access the PCM and monitor the FRP PID.
- **Is the voltage greater than 4.5 V?**

Yes	No
INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DD6.

DD6 CHECK THE FRP CIRCUIT FOR A SHORT TO FRT, SIGRTN, AND GND IN THE HARNESS

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRP	SIGRTN
FRP	FRT

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
FRP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DD28.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD7 CHECK THE FRP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
FRP	FRP - Pin 1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DD8.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DD8 CHECK THE FRP CIRCUIT FOR A SHORT TO VREF AND FRT IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRP	VREF
FRP	FRT

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DD9.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD9 CHECK THE FRP CIRCUIT FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-)
FRP - Pin 1	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to DD10.

DD10 INDUCE A LOW VOLTAGE ON THE FRPT CIRCUIT

- Key in OFF position.
- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
FRP - Pin 1	SIGRTN - Pin 4

- Key ON, engine OFF.

- Access the PCM and monitor the FRP PID.
- **Is the voltage less than 0.01 V?**

Yes	No
INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DD28.

DD11 DTC P0191: CHECK FOR FUEL PUMP DTCS

- Carry out the self-test.
- **Are DTCs P1233, P1234, P1235, P1236, P1237 or P1238 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to DD12.

DD12 INSPECT ALL THE VACUUM HOSES CONNECTED TO THE INTAKE MANIFOLD FOR LEAKS

- Key in OFF position.
- FRPT Sensor connector connected.
- Key ON, engine running.
- Allow the engine idle to stabilize.
- Inspect all the vacuum hoses connected to the intake manifold for leaks.
- **Are any vacuum hose concerns present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DD13.

DD13 CHECK THE FRPT CONNECTOR FOR DAMAGE OR CORROSION

- Key in OFF position.
- FRPT Sensor connector disconnected.
- Inspect the sensor, wiring, and connector for damage, corrosion, or water intrusion.
- **Is a concern present?**

Yes	No

REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DD14.

DD14 CHECK THE FRP PID

NOTE: **The fuel pressure is likely to increase after the fuel pressure is relieved with the system closed. The rate and amount of the fuel pressure increase is dependent upon the ambient air and fuel temperatures.**

NOTE: **Prepare to record the FRP PID value within 5 seconds after the engine is shut off and also after the fuel pressure is relieved.**

- FRPT Sensor connector connected.
- Key ON, engine running.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the FRP PID.
- Key in OFF position.
- Key ON, engine OFF.
- Record the FRP PID value within 5 seconds of the key off.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.
- Disable the fuel pump.
- Key ON, engine OFF.
- Record the FRP PID value within 5 seconds of carrying out the fuel system pressure release procedure.
- **Is the difference between the recorded FRP PID values greater than 34 kPa (5 psi)?**

Yes	No
refer to **PINPOINT TEST HC**.	GO to DD15.

DD15 COMPARE THE FRP PID TO THE MECHANICAL GAUGE

NOTE: **Most mechanical gauges are referenced to atmospheric pressure. The FRPT sensor is referenced to manifold pressure. In order to make a valid comparison, the engine must be off.**

NOTE: **The vehicle may exhibit a long crank until the fuel system is pressurized.**

- Key in OFF position.
- Connect a mechanical fuel pressure gauge.
- Key ON, engine OFF.
- Monitor the mechanical gauge.

- Access the PCM and monitor the FRP PID.
- Compare the FRP PID value to the mechanical gauge.
- Key in OFF position.
- Pressurize the fuel system. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Key ON, engine running.
- Allow the fuel pressure to stabilize.
- Key in OFF position.
- Key ON, engine OFF.
- Compare the FRP PID value to the mechanical gauge.
- **Are the FRP PID values within 34 kPa (5 psi) of the mechanical gauge readings?**

Yes	No
GO to DD28.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DD16 CONTINUOUS MEMORY DTCS P0192 AND P0193: CHECK THE FRPT CIRCUIT FOR AN INTERMITTENT CONCERN

NOTE: Repair any fuel pump DTCs prior to this test.

- Key ON, engine OFF.
- Access the PCM and monitor the FRP PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
  - Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM
- Check the FRPT connector for damage or corrosion.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

DD17 KOEO AND KOER DTCS P0182 OR P0183: CHECK THE RESISTANCE OF THE FRPT

SENSOR

- Key in OFF position.
- FRPT Sensor connector disconnected.
- Measure the resistance between:

(+) FRPT Sensor Connector, Component Side	(-) FRPT Sensor Connector, Component Side
FRT - Pin 3	SIGRTN - Pin 4

- **Is the resistance between 2K - 96K ohms?**

Yes	No
GO to DD18.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DD18 CHECK THE FRPT FOR INTERNAL SHORTS

- Measure the resistance between:

(+) FRPT Sensor Connector, Component Side	(-)
FRT - Pin 3	Ground

- Measure the resistance between:

(+) FRPT Sensor Connector, Component Side	(-) FRPT Sensor Connector, Component Side
FRT - Pin 3	FRP - Pin 1
FRT - Pin 3	VREF - Pin 2

- **Are the resistances greater than 10K ohms?**

Yes	No
For DTC P0182, GO to DD19. For DTC P0183, GO to DD21.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DD19 CHECK THE FRT CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRT	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
FRT	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DD20.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD20 FRPT SENSOR: INDUCE A HIGH VOLTAGE ON THE FRT CIRCUIT

- PCM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the FRT PID.
- **Is the voltage greater than 4.5 V?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to DD28.

DD21 CHECK THE FRT AND SIG RTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
FRT	FRT - Pin 3
SIGRTN	SIGRTN - Pin 4

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DD22.	REPAIR the open circuit. CLEAR the DTCs.

	REPEAT the self-test.

DD22 CHECK THE FRT SIGNAL FOR A SHORT TO VREF AND FRP

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRT	VREF
FRT	FRP

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DD23.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DD23 FOR THE FRPT SENSOR INDUCE A LOW VOLTAGE ON THE FRT CIRCUIT

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
FRT - Pin 3	SIGRTN - Pin 4

- Key ON, engine OFF.
- Access the PCM and monitor the FRT PID.
- **Is the voltage less than 0.2 V?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to DD28.

DD24 DTC P0180: CHECK FOR THE PRESENCE OF DTC P0182 OR P0183

- Key ON, engine OFF.
- Carry out the self-test.
- **Are DTCs P0182 or P0183 present?**

Yes	No
GO to DD17.	GO to DD25.

DD25 CHECK THE FRT CIRCUIT FOR AN INTERMITTENT CONCERN

- PCM connector connected.

- Access the PCM and monitor the FRT PID.
- Carry out a thorough wiggle test on the FRPT sensor harness.
- **Is the FRT signal stable?**

Yes	No
GO to DD27.	ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DD26 KOEO AND KOER DTC P0181: CHECK THE FRT PID

NOTE: Allow vehicle temperatures to stabilize prior to temperature sensor tests.

- Key ON, engine OFF.
- The normal test range is 0°C to 100°C (32°F to 212°F).
- Access the PCM and monitor the FRT PID.
- **Is the voltage between 0.4 - 4.5 V?**

Yes	No
GO to DD27.	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DD27 COMPARE THE PIDS AFTER STABILIZING THE VEHICLE TEMPERATURE

- Access the PCM and monitor the FRT, CHT and ECT PIDs.
- **Are the temperature PIDs nearly equal in value?**

Yes	No
The concern is not present at this time. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

DD28 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No

INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DF: VEHICLE SPEED CIRCUIT (VSC) CHECK

INTRODUCTION

WARNING: **Strict observance of posted speed limits and driving conditions is mandatory when proceeding through the following drive cycles.**

Failure to follow these instructions may result in personal injury.

This pinpoint test is intended to diagnose the following:

- harness circuits: VSC
- powertrain control module (PCM) (12A650)

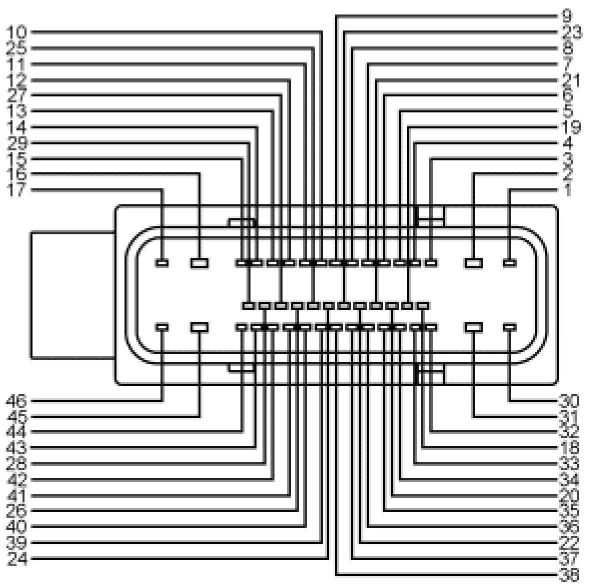

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Fig. 34: Anti-lock Brake System (ABS) Module Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
21	VSC (Vehicle Speed Circuit)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
170 Pin	B29	VSC

TEST PROCEDURE

DF1 DTCS P0500, P0503, P1500, P1501 AND P1502: CHECK THE VEHICLE SPEED CIRCUIT FOR INTERMITTENT CONCERNS

NOTE: The PCM detected an error in the vehicle speed information received from the ABS control module. This test step checks for the recurrence of this vehicle speed error.

- Key ON, engine OFF.
- Clear the DTCs.
- Gradually increase the vehicle speed to 80 km/h (50 mph).
- Coast to an idle and stop the vehicle.
- Key in OFF position.
- Key ON, engine OFF.
- Retrieve the continuous memory DTCs.
- **Are DTCs P0500, P0503, P1500, P1501 or P1502 present?**

Yes	No
The vehicle speed input is incorrect. GO to DF2.	The vehicle speed input is correct. The concern that produced the original DTC may be intermittent. GO to DF5.

DF2 CHECK THE VSC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Anti-lock Brake System (ABS) Module connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
VSC - Pin B29	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to DF3.	GO to DF6.

DF3 CHECK FOR AN OPEN VSC BETWEEN THE PCM AND THE ABS CONTROL MODULE

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Anti-lock Brake System (ABS) Module Connector, Harness Side
VSC - Pin B29	VSC - Pin 21

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DF4.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to DF7.

DF4 CHECK THE VSC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
VSC - Pin B29	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
REFER to the **VEHICLE DYNAMIC SYSTEMS - - E-SERIES** to continue diagnosis of the ABS control module, speed sensors and wheel speed sensor harness circuits. If these components are working properly, GO to DF8.	GO to DF6.

DF5 VISUAL INSPECTION

NOTE: Refer to the Wiring Diagrams article for harness, module, and connector locations.

- Key in OFF position.
- Visually inspect the VSC circuit harness and connectors at the PCM, ABS, and other VSC user modules for damage, loose connections, loose grounds, or incorrect routing.
- **Does the visual inspection reveal a concern?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. GO to DF7.	Unable to duplicate or identify the concern at this time. REFER to the **VEHICLE DYNAMIC SYSTEMS -- E-SERIES** to continue diagnosis of the ABS control module, speed sensors and wheel speed sensor harness circuits.

DF6 VERIFY IF THE VSC IS SHORTED IN THE HARNESS OR ANOTHER MODULE

- Key in OFF position.
- Determine which, if any, modules are connected to the VSC. Refer to the Wiring Diagrams article. If no other modules are connected to the VSC, go to the YES Action To Take.
- One at a time, disconnect the modules associated with the VSC. After disconnecting each module, test again for a short circuit. (Refer to test step that sent you here). Repeat until each associated module is disconnected or the short circuit is eliminated.
- **Does the short circuit remain after all associated modules are disconnected?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test. GO to DF7.	REFER to the Workshop article for further diagnosis of the appropriate module. GO to DF7.

DF7 VSC REPAIR VERIFICATION DRIVE CYCLE

NOTE: Warm the engine to a normal operating temperature before continuing.

NOTE: Carry out the VSC drive cycle at least 3 times as described below.

- Automatic Transmission Drive Cycle:
  - Place the transmission range selector lever in DRIVE range
  - Accelerate heavily to 56 km/h (35 mph)
  - Coast down to an idle and stop the vehicle
  - Cycle the key OFF and ON
- Manual Transmission Drive Cycle:
  - Accelerate moderately to 64 km/h (40 mph), while shifting from first to second gear
  - Coast down to an idle and stop the vehicle
  - Cycle the key OFF and ON
- Key in OFF position.
- Key ON, engine OFF.
- Retrieve the continuous memory DTCs.
- **Are DTCs P0500, P0503, P1500, P1501 or P1502 present?**

Yes	No
REFER to the **VEHICLE DYNAMIC SYSTEMS - - E-SERIES** to continue diagnosis of the ABS control module, speed sensors and wheel speed sensor harness circuits. If these components are working properly, GO to DF8.	The repair has been verified.

DF8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DG: KNOCK SENSOR (KS)

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- knock sensors KS1, KS2 (12A699)
- harness circuits: KS1+, KS1-, KS2+, and KS2-
- powertrain control module (PCM) (12A650)

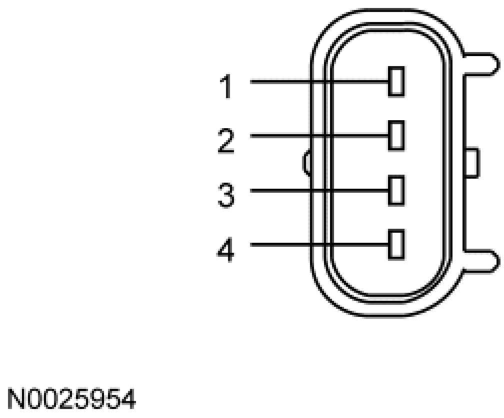

Fig. 35: Knock Sensor 1 (KS1) Connector - A
Courtesy of FORD MOTOR CO.

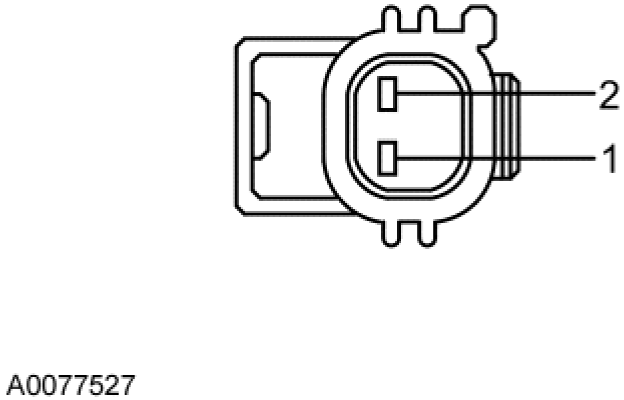

Fig. 36: Knock Sensor 1 (KS1) Connector - A
Courtesy of FORD MOTOR CO.

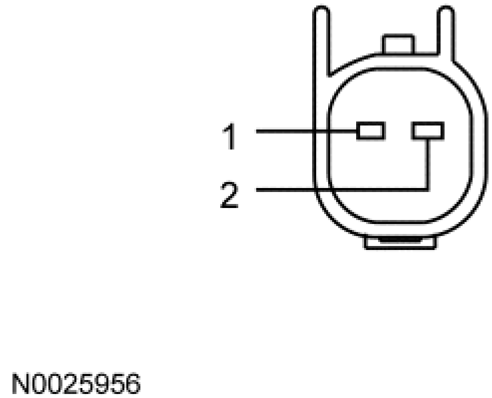

Fig. 37: Knock Sensor 1 (KS1) Connector - C
Courtesy of FORD MOTOR CO.

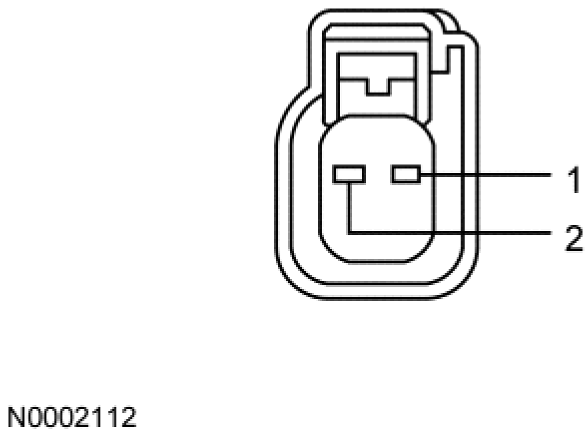

Fig. 38: Knock Sensor 1 (KS1) Connector - D
Courtesy of FORD MOTOR CO.

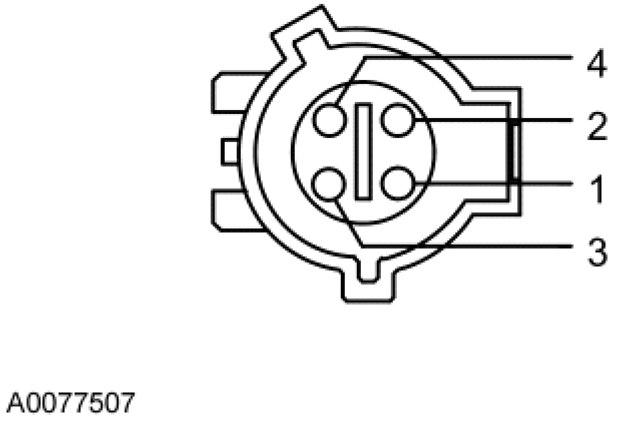

Fig. 39: Knock Sensor 1 (KS1) Connector - E
Courtesy of FORD MOTOR CO.

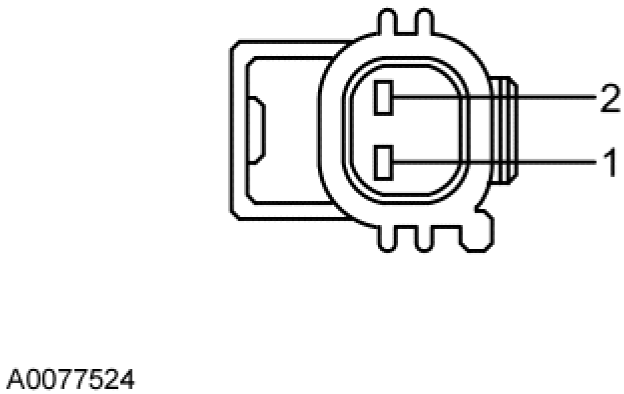

Fig. 40: Knock Sensor 1 (KS1) Connector - F
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, F-Super Duty 6.8L, MKX, Sable, Taurus, Taurus X	A	3 4 1 2	KS2+ KS2- KS1+ KS1-
Escape/Mariner, Fusion 2.3L, Milan 2.3L	B	1 2	KS1+ KS1-

Expedition, Navigator	C	1 2	KS1+ KS1-
F-150 4.2L, Ranger 3.0L	D	1 2	KS1+ KS1-
F-150 5.4L, F-Super Duty 5.4L, Mark LT	C	2 1	KS1+ KS1-
Fusion 3.0L, Milan 3.0L, Ranger 2.3L	B	2 1	KS1+ KS1-
MKZ	A	1 2	KS1+ KS1-
Mountaineer 4.6L	E	1 2	KS1+ KS1-
Mustang 4.6L	E	3 4	KS1+ KS1-
All other vehicles	F	2 1	KS1+ KS1-

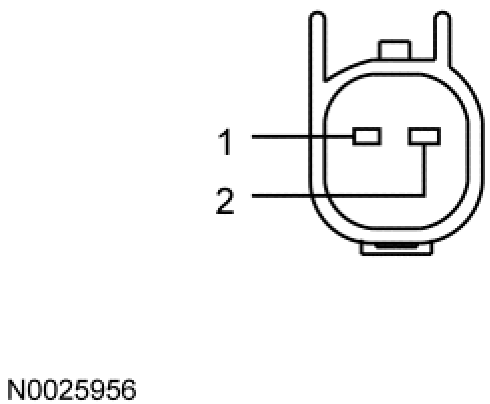

Fig. 41: Knock Sensor 2 (KS2) Connector - A
Courtesy of FORD MOTOR CO.

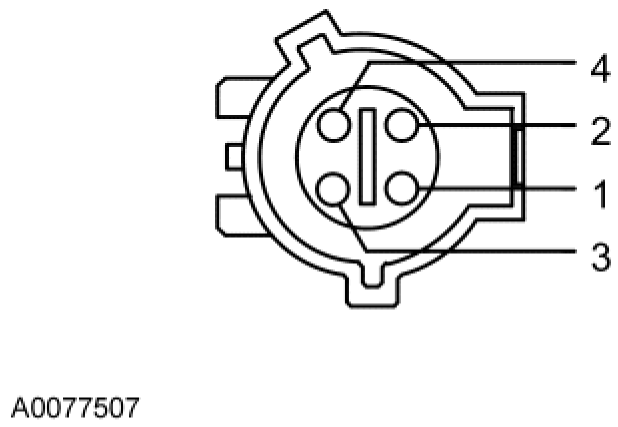

Fig. 42: Knock Sensor 2 (KS2) Connector - B
Courtesy of FORD MOTOR CO.

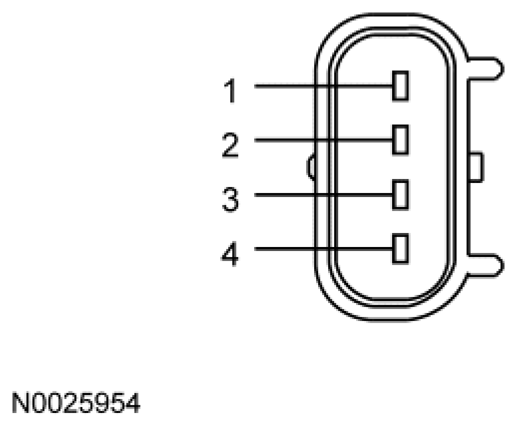

Fig. 43: Knock Sensor 2 (KS2) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition, F-Super Duty 5.4L, Navigator	A	1 2	KS2+ KS2-
F-150, Mark LT	A	2 1	KS2+ KS2-
Mustang	B	1 2	KS2+ KS2-
All other vehicles	C	3 4	KS2+ KS2-

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	E31 E30 E49 E48 B29, B64 B51	KS2+ KS2- KS1+ KS1- VREF VPWR
Escape/Mariner	150 (50-50-50) Pin	E32 E20 E40 B35	KS1+ KS1- VREF VPWR
Expedition, MKZ, Navigator	140 Pin	E31 E30 E49 E48 E57 B51	KS2+ KS2- KS1+ KS1- VREF VPWR
F-150 4.6L, F-150 4.2L	190 Pin	E49 E48 E57 B51	KS1+ KS1- VREF VPWR
F-150 5.4L, Mark LT	190 Pin	E31 E30 E49 E48 E57 B51	KS2+ KS2- KS1+ KS1- VREF VPWR
F-Super Duty, Mustang 4.6L	170 Pin	E31 E30 E49 E48 E57 B35	KS2+ KS2- KS1+ KS1- VREF VPWR
Focus	190 Pin	E46 E47 E63 B67	KS1+ KS1- VREF VPWR
Fusion, Milan	140 Pin	E49 E48 E57 B51	KS1+ KS1- VREF VPWR
All other vehicles	170 Pin	E49 E48 E57	KS1+ KS1- VREF

		B35	VPWR

TEST PROCEDURE

DG1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0325, P0326, P0330, or P0331 present?**

Yes	No
For KOER and continuous memory DTCs P0325, P0326, P0330 and P0331, GO to DG2.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DG2 KOER AND CONTINUOUS MEMORY DTCS P0325, P0326, P0330 AND P0331: CHECK THE INTERNAL RESISTANCE OF THE KS

- KS connector disconnected.
- Measure the resistance between:

(+) KS Connector, Component Side	(-) KS Connector, Component Side
Suspect KS+	Suspect KS-

- **Is the resistance between 4.39M - 5.35M ohms?**

Yes	No
GO to DG3.	INSTALL a new KS. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DG3 CHECK THE KS+ CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS+	Suspect KS+

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DG4.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DG4 CHECK THE KS- CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS-	Suspect KS-

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DG5.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DG5 CHECK THE KS+ CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) Vehicle Battery
Suspect KS+	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DG6.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DG6 CHECK THE KS- CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) Vehicle Battery
Suspect KS-	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DG7.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DG7 CHECK THE KS+ CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS+	VPWR
Suspect KS+	VREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DG8.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DG8 CHECK THE KS- CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS-	VREF
Suspect KS-	VPWR

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DG9.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DG9 CHECK THE KS+ CIRCUIT FOR INTERMITTENT CONCERNS

NOTE: Carefully wiggle all accessible wiring and connectors associated with the KS circuit.

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS+	Suspect KS+

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DG10.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DG10 CHECK THE KS- CIRCUIT FOR INTERMITTENT CONCERNS

NOTE: Carefully wiggle all accessible wiring and connectors associated with the KS circuit.

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect KS-	Suspect KS-

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DG11.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DG11 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DH: THROTTLE POSITION (TP) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- TP sensor (9B989)
- binding or sticking throttle linkage
- harness circuits: TP, SIGRTN, VREF, VPWR, and PWRGND
- powertrain control module (PCM) (12A650)

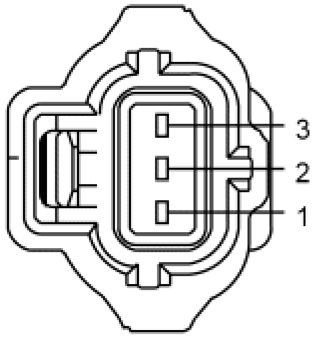

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Fig. 44: Throttle Position (TP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

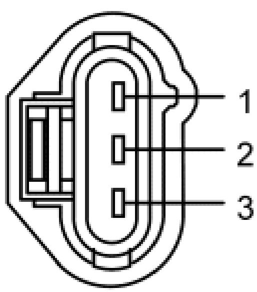

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Fig. 45: Throttle Position (TP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Ranger 2.3L	A	2 1 3	TP SIGRTN VREF
All other vehicles	B	2 3 1	TP SIGRTN VREF

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	E41 B47, B48, B49, B50 B40, E40 B35, B36 E19	SIGRTN PWRGND VREF VPWR TP
Ranger	170 Pin	E58 B47, B48, B49, B50 B40, E57 B35, B36 E61	SIGRTN PWRGND VREF VPWR TP

TEST PROCEDURE

DH1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0068, P0121, P0122, P0123, P1120, or P1124 present?**

Yes	No
For DTC P0068, GO to DH18. For DTC P0121, GO to DH24. For KOEO and KOER DTC P0122, GO to DH14. For continuous memory DTC P0122, GO to DH13. For DTC P0123, GO to DH9. For DTC P1120, GO to DH4. For DTC P1124, GO to DH2.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DH2 KOEO AND KOER DTC P1124: CHECK FOR ANY OTHER DTCS

- Key ON, engine OFF.
- Check for KOEO and KOER DTCs.
- **Is DTC P0405 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to DH3.

DH3 CHECK FOR A STUCK THROTTLE PLATE OR LINKAGE

- Key in OFF position.
- Visually inspect the throttle linkage and throttle plate for binding or sticking.
- Verify the throttle plate and linkage is at closed throttle position.
- **Does the throttle move freely and return to a closed throttle position?**

Yes	No
The throttle plate and linkage are OK. GO to DH9.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DH4 DTC P1120: CHECK THE TP CIRCUIT FOR FRAYED WIRES OR CORROSION ON THE CONNECTORS

- Key in OFF position.
- Carry out a visual inspection of the pins on the harness connector at the TP sensor for corrosion.
- Carry out a visual inspection of the harness wires between the TP sensor and the PCM for insulation fraying and corrosion.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DH5.

DH5 CHECK FOR A STUCK TP SENSOR

- Key ON, engine OFF.
- Slowly move the throttle from the closed throttle position to the wide open throttle position and observe the TP PID.
- Access the PCM and monitor the TP PID.
- **Is the voltage greater than 4.5 V?**

Yes	No
GO to DH22.	GO to DH6.

DH6 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE TP SENSOR HARNESS CONNECTOR

- TP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) TP Sensor Connector, Harness Side	(-) TP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to DH7.	refer to **PINPOINT TEST C**.

DH7 CHECK THE TP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TP Sensor Connector, Harness Side
TP	TP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DH8.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DH8 CHECK THE TP SENSOR VOLTAGE TO THE PCM

- PCM connector connected.
- TP Sensor connector connected.
- Key ON, engine running.
- Idle the engine for 2 minutes.
- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- Slowly move the throttle from the closed throttle position to the wide open throttle position and observe the TP PID.
- **Is the voltage between 0.17 - 0.49 V?**

Yes	No
INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	If DTC P1120 is still present, GO to DH22.

DH9 DTC P0123 OR DTC P1124: INDUCE THE OPPOSITE TP SENSOR VOLTAGE

- TP Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- **Is the voltage less than 0.17 V?**

Yes	No
GO to DH10.	GO to DH11.

DH10 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE TP SENSOR VEHICLE HARNESS CONNECTOR

- Key ON, engine OFF.
- Measure the voltage between:

(+) TP Sensor Connector, Harness Side	(-) TP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST C**.

DH11 CHECK THE CIRCUIT FOR A SHORT TO VREF AND VPWR IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VPWR	TP
VREF	TP

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DH12.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DH12 CHECK FOR AN INTERMITTENT SHORT TO VOLTAGE IN THE TP CIRCUIT

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VPWR	TP
VREF	TP

- Observe the digital multimeter (DMM) for an indication of a concern while shaking, wiggling, and bending the TP circuit between the TP sensor and the PCM.
- **Is a concern present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs.	GO to DH26.

REPEAT the self-test.	

DH13 CONTINUOUS MEMORY DTC P0122: CHECK THE TP CIRCUIT FOR AN INTERMITTENT CONCERN

- Key ON, engine OFF.
- Clear the PCM DTCs.
- Key ON, engine running.
- Retrieve the continuous memory DTCs.
- **Is DTC P0122 present?**

Yes	No
GO to DH14.	refer to **PINPOINT TEST Z**.

DH14 KOEO AND KOER DTC P0122: CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE TP SENSOR VEHICLE HARNESS CONNECTOR

- Key in OFF position.
- TP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) TP Sensor Connector, Harness Side	(-) TP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to DH15.	refer to **PINPOINT TEST C**.

DH15 CHECK THE TP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TP Sensor Connector, Harness Side
TP	TP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DH16.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DH16 CHECK THE TP CIRCUIT FOR A SHORT TO PWRGND OR SIGRTN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
TP	PWRGND
TP	SIGRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DH17.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DH17 INDUCE THE OPPOSITE TP SENSOR VOLTAGE

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A TP Sensor Connector, Harness Side	Point B TP Sensor Connector, Harness Side
VREF	TP

- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- **Is the voltage greater than 4.65 V?**

Yes	No
INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DH26.

DH18 DTC P0068: CHECK THE RATIONALITY BETWEEN THE TP AND MAF SENSORS

- Attempt to start the engine.
- **Does the engine start?**

Yes	No
GO to DH19.	CHECK for major leaks, cracks and openings between the MAF sensor and the throttle body. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. If OK, refer to **PINPOINT TEST A**.

DH19 CHECK THE TP SENSOR FOR MECHANICAL OPERATION

- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- Slowly move the throttle from the closed throttle position to the wide open throttle position and observe the TP PID.
- **Is the voltage between 0.49 - 4.65 V?**

Yes	No
GO to DH20.	INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DH20 CHECK THE TP SENSOR SIGNAL HIGH VERSUS THE ENGINE LOAD WHILE DRIVING THE VEHICLE

- Key ON, engine running.
- Access the PCM and monitor the TP PID.
- Access the PCM and monitor the LOAD PID.
- Drive the vehicle, exercising the throttle and TP sensor.
- **Is the TP PID greater than 2.44 volts and the LOAD PID less than 30%?**

Yes	No
LISTEN for air noise around the MAF sensor and throttle body while the engine is running. REPAIR as necessary. If OK, INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DH21.

DH21 CHECK THE TP SENSOR SIGNAL LOW VERSUS THE ENGINE LOAD WHILE DRIVING THE VEHICLE

- Key ON, engine running.
- Access the PCM and monitor the TP PID.
- Access the PCM and monitor the LOAD PID.
- Drive the vehicle while exercising the throttle and TP sensor near higher gears (preferably overdrive).
- **Is the TP PID less than 0.24 volt and the LOAD PID greater than 55%?**

Yes	No
If continuous memory DTC P0068 is present, INSTALL a new MAF sensor. REFER to the	Unable to duplicate or identify the concern at this time.

ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES . CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

DH22 CHECK FOR AN INTERMITTENT TP SIGNAL

- Key ON, engine running.
- Access the PCM and monitor the TP PID.
- Increase the engine speed to 1,500 RPM for 10 seconds.
- Lightly tap on the TP sensor and wiggle the harness connector to simulate road shock.
- **Is the voltage between 0.49 V - 4.65 V?**

Yes	No
GO to DH23.	INSPECT the TP sensor connector. REPAIR as necessary. If OK, INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DH23 CHECK THE TP SENSOR HARNESS FOR INTERMITTENT OPENS OR SHORTS

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- Grasp the vehicle harness closest to the TP sensor connector.
- Shake and bend a small section of the harness all the way to the bulkhead.
- Wiggle, shake, and bend the harness from the bulkhead to the PCM.
- **Is the voltage between 0.49 V - 4.65 V?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DH24 DTC P0121: CHECK FOR OBSTRUCTION OR STICKING CONCERNS

NOTE: **Do not attempt to clean the throttle bore and plate area. Cleaning damages the throttle body assembly.**

NOTE: **Conditions of sticking or obstruction can either be within the cables or throttle body assembly.**

- Disconnect the accelerator cable and speed control cable from the throttle body linkage.

- Rotate the throttle body linkage.
- **Does the throttle body rotate freely without a sticking, binding, or grabbing condition?**

Yes	No
INSPECT the cable(s). REPAIR as necessary. REPEAT the self-test. If DTC P0121 is still present, GO to DH25.	INSTALL a new throttle body assembly. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DH25 CHECK THE FUNCTIONALITY OF THE THROTTLE POSITION SENSOR

- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- While slowly pressing the accelerator from the closed throttle position to the wide open throttle position, observe the TP PID.
- **Does the TP PID display a smooth reading during accelerator movement?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DH26 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DJ: AIR CONDITIONING EVAPORATOR TEMPERATURE (ACET) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- ACET sensor (19C734)
- harness circuits: ACET and SIGRTN
- powertrain control module (PCM) (12A650)

AIR CONDITIONING EVAPORATOR TEMPERATURE (ACET) SENSOR

°C	°F	Voltage	Resistance (K ohms)
100	212	0.47	2.08
90	194	0.61	2.8
80	176	0.80	3.84
70	158	1.05	5.34
60	140	1.37	7.55
50	122	1.77	10.93
40	104	2.23	16.11
30	86	2.74	24.25
20	68	3.26	37.34
10	50	3.73	58.99
0	32	4.14	95.85
-10	14	4.45	160.31
-20	-4	4.66	276.96

These values can vary by 15% due to sensor and VREF variations. Voltage values calculated for VREF are equal to 5 volts.

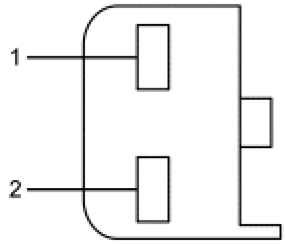

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Fig. 46: Powertrain Control Module (PCM) (12A650)
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	SIGRTN (Signal Return)
2	ACET (Air Conditioning Evaporator Temperature)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
140 Pin	B33, E57 B58, E58 B53	VREF SIGRTN ACET

TEST PROCEDURE

DJ1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0537, P0538, P1436, or P1437 present?**

Yes	No
For KOEO and KOER DTCs P0538 or P1437, GO to DJ2. For KOEO and KOER DTCs P0537 or P1436, GO to DJ6. For continuous memory DTCs P0537, P0538, P1436 or P1437, GO to DJ9.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DJ2 KOEO AND KOER DTCS P0538 OR P1437: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- ACET Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A ACET Sensor Connector, Harness Side	Point B ACET Sensor Connector, Harness Side
ACET - Pin 2	SIGRTN - Pin 1

- Check for self-test DTCs.
- **Are DTCs P0537 or P1436 present?**

Yes	No
INSTALL a new ACET sensor. CLEAR the DTCs. REPEAT the self-test.	GO to DJ3.

DJ3 CHECK THE ACET AND SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) ACET Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ACET - Pin 2	ACET - Pin B53
SIGRTN - Pin 1	SIGRTN - Pin B58, E58

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DJ4.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DJ4 CHECK THE ACET CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) ACET Sensor Connector, Harness Side	(-)
ACET - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to DJ5.	REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

DJ5 CHECK THE ACET CIRCUIT FOR A SHORT TO VREF IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ACET - Pin B53	VREF - Pin E57

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DJ10.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DJ6 KOEO AND KOER DTCS P0537 OR P1436: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- ACET Sensor connector disconnected.
- Carry out the KOEO self-test.
- **Are DTCs P0538 or P1437 present?**

Yes	No
INSTALL a new ACET sensor. CLEAR the DTCs. REPEAT the self-test.	GO to DJ7.

DJ7 CHECK THE ACET CIRCUIT(S) FOR A SHORT TO SIGRTN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) ACET Sensor Connector, Harness Side	(-) ACET Sensor Connector, Harness Side
ACET - Pin 2	SIGRTN - Pin 1

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DJ8.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DJ8 CHECK THE ACET CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) ACET Sensor Connector, Harness Side	(-)
ACET - Pin 2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DJ10.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DJ9 CONTINUOUS MEMORY DTCS P0537, P0538, P1436 OR P1437: CHECK THE ACET AND SIGRTN CIRCUIT FOR AN INTERMITTENT CONCERN

NOTE: **The voltage should be between 4.5 and 5.5 volts. The voltage reading changes suddenly when a concern is detected. For P0537/P1436, a sudden change could indicate a short to ground. For P0538/P1436, a sudden change could indicate an open ACET or SIGRTN circuit.**

- ACET Sensor connector disconnected.
- Inspect the connectors for signs of damage, water intrusion, or corrosion.
- Measure the voltage between:

(+) ACET Sensor Connector, Harness Side	(-) ACET Sensor Connector, Harness Side
ACET - Pin 2	SIGRTN - Pin 1

- Key ON, engine OFF.

- While monitoring the voltage reading on the digital multimeter (DMM), wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- Key in OFF position.
- **Is there any change in the voltage reading, or is a concern found?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DJ10 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins.
  - corrosion.
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DK: ACCELERATOR PEDAL POSITION (APP) SENSOR

INTRODUCTION

NOTE: After clearing an APP sensor diagnostic trouble code (DTC) to verify a repair or an intermittent concern, apply the accelerator pedal before carrying out the self-test. Take 10 seconds to carry out a full sweep of the accelerator pedal from fully released to fully applied and back to fully released.

This pinpoint test is intended to diagnose the following:

- accelerator pedal position (APP) sensor (9F836)
- harness circuits: ETCRTN, SIGRTN, ETCREF, APP1, APP2, and APP3
- powertrain control module (PCM) (12A650)

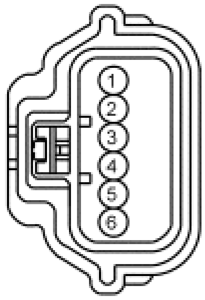

Fig. 47: Accelerator Pedal Position (APP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

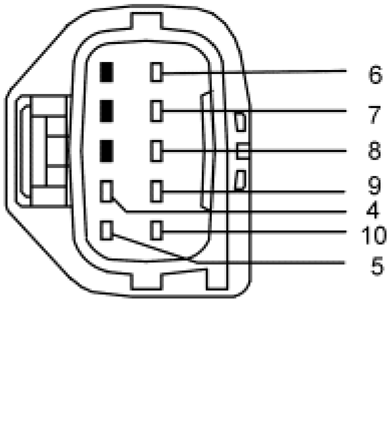

Fig. 48: Accelerator Pedal Position (APP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

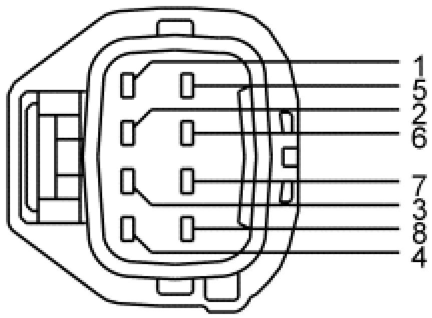

Fig. 49: Accelerator Pedal Position (APP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Focus	A	5 2 3, 4 1, 6	APP2 APP1 ETCRTN ETCREF
Fusion, Milan, MKZ	B	4 5 7 6, 9 10, 8	APP3 APP2 APP1 ETCRTN ETCREF
All other vehicles	C	8 5 2 1, 3 6, 7	APP3 APP2 APP1 ETCRTN ETCREF

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Mustang, Town Car	170 Pin	B41, B6, E59 B24, B4, E66 B35, B36 B28 B17 B5	ETCRTN ETCREF VPWR APP3 APP2 APP1
E-Series, F-Super Duty	170 Pin	B18, B6, E59 B16, B4, E66 B35, B36	ETCRTN ETCREF VPWR

		B28 B17 B5	APP3 APP2 APP1
Expedition, Navigator	140 Pin	B59, B65, E59 B21, B28, E66 B51, B52, B53 B27 B26 B25	ETCRTN ETCREF VPWR APP3 APP2 APP1
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B43, B6, E59 B24, B4, E66 B35, B36 B28 B17 B5	ETCRTN ETCREF VPWR APP3 APP2 APP1
F-150, Mark LT	190 Pin	B58, B59, E59 B21, B28, E66 B51, B52, B53 B27 B26 B25	ETCRTN ETCREF VPWR APP3 APP2 APP1
Focus	190 Pin	B44, B60, E60 B45, B61, E59 B67, B68 B29 B28	ETCRTN ETCREF VPWR APP2 APP1
Fusion, Milan, MKZ	140 Pin	B59, B60, E59 B21, B28, E66 B51, B52 B27 B26 B25	ETCRTN ETCREF VPWR APP3 APP2 APP1
All other vehicles	190 Pin	B59, B65, E59 B21, B28, E66 B51, B52, B53 B27 B26 B25	ETCRTN ETCREF VPWR APP3 APP2 APP1

TEST PROCEDURE

DK1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P1575, P2104, P2121, P2122, P2123, P2126, P2127, P2128, P2131, P2132, P2133, or P2138 present?**

Yes	No

For DTC P1575, GO to DK2. For all others, GO to DK4.	For a lack/loss of power, GO to DK3. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DK2 DTC P1575: REPEAT THE KOEO SELF-TEST

NOTE: Make sure the accelerator pedal is not applied during the KOEO self-test.

- Key ON, engine OFF.
- Carry out the KOEO self-test.
- **Are any DTCs present other than P1575?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to DK3.

DK3 CHECK THE ACCELERATOR PEDAL FOR OBSTRUCTION

- Key ON, engine OFF.
- Press the accelerator pedal fully to the floor and release.
- **Does the pedal move freely to the floor and back?**

Yes	No
GO to DK4.	ISOLATE and REPAIR the obstruction. CLEAR the DTCs. REPEAT the self-test.

DK4 CHECK THE APP SENSOR SIGNAL VOLTAGE RANGES FOR THE ACCELERATOR PEDAL FULLY APPLIED AND RELEASED POSITIONS

- Access the PCM and monitor the APP1, APP2 and APP3 PIDs.
- Press the accelerator pedal fully to the floor and release.

ACCELERATOR PEDAL FULLY APPLIED VOLTAGE VALUES

Vehicle	APP1	APP2	APP3
E-Series	0.73 - 1.28	3.03 - 4.55	2.59 - 3.89
Expedition, Navigator	0.79 - 2.09	2.75 - 4.33	2.26 - 3.73
Explorer, Explorer Sport Trac, Mountaineer	0.60 - 1.57	3.07 - 4.50	2.57 - 3.89
F-150, Mark LT	0.60 - 1.57	3.07 - 4.50	2.57 - 3.89
F-Super Duty	0.28 - 0.97	3.45 - 4.71	2.95 - 4.10
Focus	3.69 - 4.60	1.75 - 2.40	-
Fusion, Milan, MKZ	1.20 - 2.50	2.50 - 3.94	2.00 - 3.33
All others	0.48 - 1.76	2.95 - 4.62	2.43 - 4.02

ACCELERATOR PEDAL FULLY RELEASED VOLTAGE VALUES

Vehicle	APP1	APP2	APP3
Focus	0.70 - 0.90	0.30 - 0.50	-
All vehicles	3.43 - 4.69	1.13 - 1.88	0.64 - 1.28

- **Are all APP signals out of range for the pedal fully applied and released positions?**

Yes	No
GO to DK5.	For continuous memory DTCs P2121 and P2126 with P2131, GO to DK24. For all others, GO to DK5.

DK5 CHECK THE VREF VOLTAGE TO APP SENSOR

- Key in OFF position.
- APP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
ETCREF	ETCRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
For E-Series, Explorer, Explorer Sport Trac, F-150, Mark LT, and Mountaineer, GO to DK6. For F-Super Duty, GO to DK7. For Fusion, Milan, and MKZ, GO to DK10. For Focus with DTC P2122, P2123, or P2138, GO to DK12. For Focus with DTC P2127 or P2128, GO to DK16. For all others, GO to DK11.	refer to **PINPOINT TEST C**.

DK6 E-SERIES, EXPLORER, EXPLORER SPORT TRAC, F-150, MARK LT, MOUNTAINEER: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: **Make sure the accelerator pedal is fully released when taking the resistance measurements.**

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	550	1,390
APP1	ETCRTN	1,030	2,590
APP1	APP2	2,125	5,335
APP1	APP3	1,930	4,845
APP2	ETCREF	1,785	4,480
APP2	ETCRTN	1,475	3,705
APP2	APP3	2,520	6,330
APP3	ETCREF	1,620	4,070
APP3	ETCRTN	1,135	2,860
ETCREF	ETCRTN	780	1,955
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No
For DTCs P2121, P2122 or P2123 alone or in combination, GO to DK12. For DTCs P2126, P2127 or P2128 alone or in combination, GO to DK16. For DTCs P2131, P2132 or P2133 alone or in combination, GO to DK20. For DTC P2104 alone, GO to DK30. For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to DK24.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.

DK7 F-SUPER DUTY: CHECK THE ACCELERATOR PEDAL CONFIGURATION AND APP SENSOR HOUSING

- Check the configuration of the accelerator pedal and determine the color of the APP sensor housing.
- **Is the vehicle equipped with an adjustable accelerator pedal?**

Yes	No
GO to DK8.	For F-Super Duty with a fixed accelerator pedal and a white APP sensor housing, GO to DK9. For all others, GO to DK11.

DK8 F-SUPER DUTY WITH ADJUSTABLE ACCELERATOR PEDAL: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: Make sure the accelerator pedal is fully released when taking the resistance measurements.

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	550	1,390
APP1	ETCRTN	1,030	2,590
APP1	APP2	2,125	5,335
APP1	APP3	1,930	4,845
APP2	ETCREF	1,785	4,480
APP2	ETCRTN	1,475	3,705
APP2	APP3	2,520	6,330
APP3	ETCREF	1,620	4,070
APP3	ETCRTN	1,135	2,860
ETCREF	ETCRTN	780	1,955
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No
For DTCs P2121, P2122 or P2123 alone or in combination, GO to DK12. For DTCs P2126, P2127 or P2128 alone or in combination, GO to DK16. For DTCs P2131, P2132 or P2133 alone or in combination, GO to DK20. For DTC P2104 alone, GO to DK30. For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to DK24.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.

DK9 F-SUPER DUTY WITH FIXED ACCELERATOR PEDAL AND WHITE APP SENSOR HOUSING: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: Make sure the accelerator pedal is fully released when taking the resistance measurements.

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	1,080	1,865
APP1	ETCRTN	1,535	2,860
APP1	APP2	2,820	5,225
APP1	APP3	2,775	5,205
APP2	ETCREF	1,995	3,700
APP2	ETCRTN	1,625	3,170
APP2	APP3	3,000	5,835
APP3	ETCREF	1,985	3,735
APP3	ETCRTN	1,440	2,870
ETCREF	ETCRTN	805	1,500
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No
For DTCs P2121, P2122 or P2123 alone or in combination, GO to DK12. For DTCs P2126, P2127 or P2128 alone or in combination, GO to DK16. For DTCs P2131, P2132 or P2133 alone or in combination, GO to DK20. For DTC P2104 alone, GO to DK30. For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to DK24.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.

DK10 FUSION, MILAN, MKZ: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: **Make sure the accelerator pedal is fully released when taking the resistance measurements.**

- Key in OFF position.
- APP Sensor connector disconnected.

- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	650	1,340
APP1	ETCRTN	1,210	2,470
APP1	APP2	2,430	4,960
APP1	APP3	2,390	4,880
APP2	ETCREF	2,020	4,120
APP2	ETCRTN	1,650	3,380
APP2	APP3	3,000	6,130
APP3	ETCREF	2,010	4,110
APP3	ETCRTN	1,450	2,970
ETCREF	ETCRTN	900	1,840
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No
For DTCs P2121, P2122 or P2123 alone or in combination, GO to DK12. For DTCs P2126, P2127 or P2128 alone or in combination, GO to DK16. For DTCs P2131, P2132 or P2133 alone or in combination, GO to DK20. For DTC P2104 alone, GO to DK30. For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to DK24.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.

DK11 ALL OTHERS: CHECK THE APP SENSOR FOR THE CORRECT RESISTANCE

NOTE: **Make sure the accelerator pedal is fully released when taking the resistance measurements.**

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor	(-) APP Sensor		

Connector, Component Side	Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APP1	ETCREF	600	1,370
APP1	ETCRTN	720	1,660
APP1	APP2	1,300	2,960
APP1	APP3	1,250	2,860
APP2	ETCREF	750	1,720
APP2	ETCRTN	660	1,520
APP2	APP3	1,230	2,810
APP3	ETCREF	710	1,640
APP3	ETCRTN	580	1,340
ETCREF	ETCRTN	200	470
ETCREF	ETCREF	0	10
ETCRTN	ETCRTN	0	10

- **Are all the resistances within specifications?**

Yes	No
For DTCs P2121, P2122 or P2123 alone or in combination, GO to DK12. For DTCs P2126, P2127 or P2128 alone or in combination, GO to DK16. For DTCs P2131, P2132 or P2133 alone or in combination, GO to DK20. For DTC P2104 alone, GO to DK30. For a lack/loss of power, the concern is elsewhere. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction. For all others, GO to DK24.	INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.

DK12 CHECK THE APP1 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- APP Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APP1	APP1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DK13.	REPAIR the open circuit. CLEAR the DTCs.

	REPEAT the self-test.

DK13 CHECK THE APP1 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) Vehicle Battery
APP1	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DK14.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK14 CHECK THE APP1 CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP1	ETCRTN
APP1	ETCREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DK15.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK15 CHECK THE APP1 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) APP Sensor Connector, Harness Side	(-) Vehicle Battery
APP1	Negative terminal

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to DK24.

DK16 CHECK THE APP2 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.

- APP Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APP2	APP2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DK17.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DK17 CHECK THE APP2 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APP2	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DK18.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK18 CHECK THE APP2 CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP2	ETCRTN
APP2	ETCREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DK19.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK19 CHECK THE APP2 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APP2	Negative terminal

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to DK25.

DK20 CHECK THE APP3 CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APP3	APP3

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DK21.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DK21 CHECK THE APP3 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APP3	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DK22.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK22 CHECK THE APP3 CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP3	ETCRTN
APP3	ETCREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DK23.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK23 CHECK THE APP3 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APP3	Negative terminal

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to DK26.

DK24 CHECK FOR THE APP1 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Key in OFF position.
- PCM connector disconnected.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP1	APP2
APP1	APP3
APP1	ETCREF
APP1	ETCRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DK27.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK25 CHECK FOR THE APP2 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP2	APP1
APP2	APP3

APP2	ETCREF
APP2	ETCRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DK27.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK26 CHECK FOR THE APP3 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP3	APP1
APP3	APP2
APP3	ETCREF
APP3	ETCRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DK27.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DK27 CHECK THE APP SENSOR CIRCUITS FOR AN INTERMITTENT CONCERN

- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APP1	APP1
APP2	APP2
APP3	APP3

- **Are the resistances less than 5 ohms?**

Yes	No
For Focus, GO to DK28. For all others, GO to DK30.	ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DK28 CHECK FOR DTCS

- PCM connector connected.
- Key ON, engine OFF.
- Carry out the KOEO self-test.
- **Are DTCs P2122 and P2127 present?**

Yes	No
GO to DK29.	GO to DK30.

DK29 SIMULATE THE OPPOSITE SIGNAL

- Key in OFF position.
- Connect a 5 amp fused jumper wire between the following:

Point A APP Sensor Connector, Harness Side	Point B APP Sensor Connector, Harness Side
ETCREF	APP1
ETCREF	APP2

- Key ON, engine OFF.
- Access the PCM and monitor the APP1 and APP2 PIDs.
- **Are the voltages greater than 4.5 V?**

Yes	No
INSTALL a new APP sensor. REFER to the **ACCELERATION CONTROL -- E-SERIES** to INSTALL a new accelerator pedal. CLEAR the DTCs. REPEAT the self-test.	GO to DK30.

DK30 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DL: CYLINDER HEAD TEMPERATURE (CHT) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- cylinder head temperature (CHT) sensor (6G004)
- harness circuits: CHT, VREF, and SIGRTN
- powertrain control module (PCM) (12A650)

On applications that do not use an engine coolant temperature (ECT) sensor, the CHT sensor is used to determine the engine coolant temperature. To cover the entire temperature range of both the CHT and ECT sensors, the PCM has a dual switching resistor circuit on the CHT input. A graph showing the temperature switching from the COLD END line to the HOT END line, with increasing temperature and back with decreasing temperature is included. Note the temperature to voltage overlap zone. Within this zone it is possible to have either a COLD END or HOT END voltage at the same temperature. For example, at 90°C (194°F) the voltage could read either 0.60 volt or 3.71 volts. Refer to the table for the temperature to voltage expected values.

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

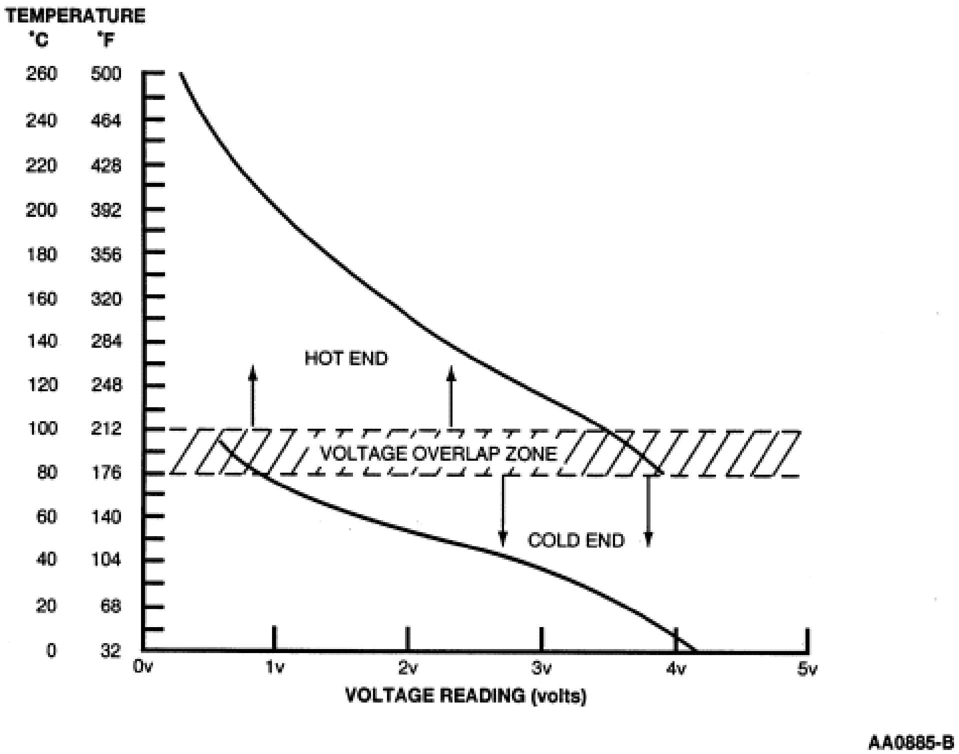

Fig. 50: Cylinder Head Temperature Sensor Voltage Graph
Courtesy of FORD MOTOR CO.

CYLINDER HEAD TEMPERATURE SENSOR EXPECTED VALUES

Temperature		CHT Sensor Values		
°C	°F	Cold End (volts)	Hot End (volts)	Resistance (K ohms)
-40	-40	4.89	-	965.808
-30	-22	4.81	-	513.019
-20	-4	4.67	-	283.664
-10	14	4.45	-	162.584
0	32	4.14	-	96.255
10	50	3.73	-	59.175
20	68	3.26	-	37.387
30	86	2.74	-	24.215
40	104	2.23	-	16.043
50	122	1.76	-	10.85
60	140	1.36	-	7.487
70	158	1.04	-	5.268
80	176	0.79	3.99	3.775
85	185	0.69	3.86	3.215
90	194	0.60	3.71	2.75
95	203	0.53	3.56	2.361
100	212	0.46	3.41	2.034
110	230	-	3.07	1.523
120	248	-	2.74	1.155
130	266	-	2.41	0.8866
140	284	-	2.10	0.6891
150	302	-	1.81	0.5417
160	320	-	1.55	0.4301
170	338	-	1.33	0.3449
180	356	-	1.13	0.2791
190	374	-	0.96	0.2278
200	392	-	0.82	0.1875
210	410	-	0.70	0.155
220	428	-	0.60	0.130
230	446	-	0.51	0.109
240	464	-	0.44	0.092
250	482		0.35	0.078
260	500		0.33	0.067

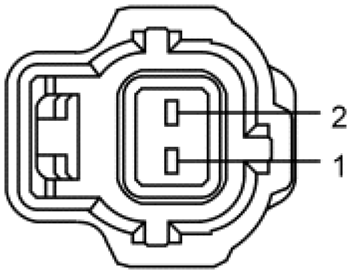

Fig. 51: Cylinder Head Temperature (CHT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	CHT (Cylinder Head Temperature)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B29, B64 E58 E41	VREF SIGRTN CHT
Escape/Mariner	150 (50-50-50) Pin	E40 E41 E33	VREF SIGRTN CHT
Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	E57 E58 E41	VREF SIGRTN CHT
F-150, Mark LT	190 Pin	E57 E58 E41	VREF SIGRTN CHT
Focus	190 Pin	E63 E64 E15	VREF SIGRTN CHT
All other vehicles	170 Pin	E57 E58	VREF SIGRTN

		E41	CHT

TEST PROCEDURE

DL1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0116, P0119, P0125, P0128, P1116, P1285, P1288, P1289, P128A, P1290, or P1299 present?**

Yes	No
For DTCs P1116 or P1288, GO to DL2. For KOEO and KOER DTCs P1289 or P1290, GO to DL8. For continuous memory DTCs P0119, P1289, P128A, or P1290, GO to DL15. For KOEO or continuous memory DTC P1299, GO to DL21. For continuous memory DTCs P0125 or P0128, GO to DL22. For continuous memory DTC P0116, GO to DL24. For DTC P1285, GO to DL18.	For Temperature Warning Indicator Lamp or Gauge (applications with CHT sensor only) symptom, GO to DL29. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DL2 SELF-TEST DTCS P1288 OR P1116: CHECK THE COOLING SYSTEM

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- The DTC indicates the temperature sensor is out of self-test range. The engine is not at normal operating temperature.
- Check the vehicle coolant level.
- **Is the cooling system OK?**

Yes	No
GO to DL3.	REFER to the **ENGINE COOLING -- E-SERIES** , for loss of coolant diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL3 CHECK IF THE VEHICLE ENGINE STARTS

- Attempt to start the engine.
- **Does the engine start and run normally?**

Yes	No
GO to DL6.	GO to DL4.

DL4 CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to DL5.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL5 CHECK THE CIRCUIT FROM THE MODULE TO THE COMPONENT

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- CHT Sensor connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the CHT PID.
- Using the data collected from the previous step, compare temperature resistance measured at the sensor to the PID temperature voltage measured at the PCM.
- **Does the measured value at the sensor agree with measured PID value at the PCM?**

Yes	No
The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** , for further direction.	GO to DL12.

DL6 CHECK THE CHT SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Carry out the PCM self-test.
- **Are DTCs P1116 or P1288 present?**

Yes	No
GO to DL7.	The engine temperature was not stabilized. REPAIR any other DTCs as necessary.

DL7 CHECK THE RESISTANCE OF THE CHT SENSOR

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- The vehicle must be at normal operating temperature.
- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to DL31.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL8 DTCS P1289 OR P1290: ACCESS THE CHT PID AND CHECK THE VOLTAGE

- Key ON, engine OFF.
- Access the PCM and monitor the CHT PID.
- **Is the voltage less than 0.2 V?**

Yes	No
GO to DL9.	GO to DL10.

DL9 CHECK FOR A GROUNDED CIRCUIT

- CHT Sensor connector disconnected.
- Key ON, engine OFF.

- Access the PCM and monitor the CHT PID.
- **Is the voltage greater than 4.6 V?**

Yes	No
INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DL14.

DL10 CHECK THE CHT CIRCUIT FOR A SHORT TO VOLTAGE

- CHT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CHT Sensor Connector, Harness Side	(-)
CHT - Pin 1	Ground

- **Is the voltage greater than 5.5 V?**

Yes	No
REPAIR the short circuit to PWR. CHECK the CHT sensor for damage. GO to DL11.	GO to DL11.

DL11 CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

NOTE: **Refer to the chart at the beginning of this test for the resistance specifications.**

- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to DL12.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** .

	CLEAR the DTCs. REPEAT the self-test.

DL12 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CHT - Pin 1	CHT
SIGRTN - Pin 2	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DL13.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DL13 CHECK THE SENSOR SIGNAL FOR A SHORT TO VREF

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
CHT	VREF

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DL31.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DL14 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
CHT	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
CHT	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DL31.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DL15 DTCS P0119, P1289, P1290 OR P128A: INTERMITTENT CHECK

- Key ON, engine OFF.
- Access the PCM and monitor the CHT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
- **Is there a large change in the voltage reading?**

Yes	No
DISCONNECT and INSPECT the connector. If OK, INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DL16.

DL16 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

- Access the PCM and monitor the CHT PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there a large change in the voltage reading?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DL17.

DL17 CHECK THE PCM AND VEHICLE HARNESS CONNECTORS

- PCM connector disconnected.
- CHT Sensor connector disconnected.
- **Are the connectors and terminals OK?**

Yes	No
GO to DL31.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL18 SELF-TEST DTC P1285: EARLY WARNING OF ENGINE OVERHEAT CONDITION

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

NOTE: **If the electric cooling fan does not operate, return toDIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for electric cooling fan DTC. Return toNO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX for symptom diagnosis.**

- An engine overheat condition is sensed by the CHT sensor.
- Check the cooling system for:
  - correct coolant level
  - internal or external coolant leaks
  - blockage of the radiator
  - cooling fan operation
- **Is the cooling system OK?**

Yes	No
GO to DL19.	REFER to the **ENGINE COOLING -- E-SERIES** , for loss of coolant diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL19 CHECK THE OPERATION OF THE CYLINDER HEAD TEMPERATURE SENSOR

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Carry out the self-test.
- **Is DTC P1285 present?**

Yes	No
GO to DL20.	An engine overheat temperature was not detected. REPAIR any other DTCs as necessary.

DL20 CHECK THE RESISTANCE OF THE CHT SENSOR

NOTE: **Refer to the chart at the beginning of this test for the resistance specifications.**

- The vehicle must be at normal operating temperature.
- Key in OFF position.

- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to DL31.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL21 SELF-TEST DTC P1299: INDICATES AN ENGINE OVERHEAT CONDITION

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

NOTE: **Refer toDIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for possible causes and additional DTC description information.**

- Check the engine coolant level.
- **Is the engine coolant fill level correct?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the engine overheating condition. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the loss of coolant. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL22 SELF-TEST DTCS P0125 OR P0128: CHECK THE ENGINE COOLANT LEVEL

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

NOTE: **DTC P0125 or P0128 indicates the engine coolant temperature has not**

achieved the required engine operation temperature level, since start-up within a specified amount of time.

- Check the engine coolant level.
- **Is the engine coolant fill level correct?**

Yes	No
GO to DL23.	REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the loss of coolant. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL23 CHECK THE SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Access the PCM and monitor the CHT PID.
- **Is the temperature greater than 77°C (170.6°F)?**

Yes	No
The test is complete. CLEAR the DTCs. REPEAT the self-test.	REFER to the **ENGINE COOLING -- E-SERIES** to diagnosis engine not reaching normal operating temperature. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL24 DTC P0116: CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

NOTE: **Verify the engine temperature is at ambient room temperature before continuing with this test. A soak period of 6 hours may be required. Refer toDIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for information concerning P0116.**

- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
GO to DL25.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL25 DTC P0116: CHECK THE RESISTANCE OF THE CHT SENSOR

NOTE: Verify the engine is at operating temperature before taking the CHT reading.

- CHT Sensor connector connected.
- Run the engine until the engine temperature stabilizes.
- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
The concern is not present at this time. CARRY OUT the OBD drive cycle to determine if fuel, HO2S, catalyst and misfire monitors can be executed. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . REPEAT the PCM self-test if necessary.	INSTALL a new CHT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DL26 DTC P0298: ENGINE OIL OVER TEMPERATURE CONDITION

NOTE: The engine oil temperature protection strategy in the PCM has been activated. This protects the engine against mechanical damage due to overheating. Refer toDIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for possible causes and additional DTC description information.

- Check for an overheating condition and base engine concerns.
- **Are there any overheating or base engine concerns?**

Yes	No

ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DL27.

DL27 CHECK FOR CHT DTCS

- Carry out the self-test.
- **Are DTCs P1285, P1288, P1289 or P1299 present?**

Yes	No
DISREGARD the engine oil temperature (EOT) diagnostic trouble code (DTC) at this time. ADDRESS the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to DL28.

DL28 ROAD TEST THE VEHICLE AND MONITOR FOR ENGINE OVER TEMPERATURE

- Access the freeze frame data (if available) and record the DTC malfunction conditions.
- Access the PCM and monitor the CHT PID.
- Test drive the vehicle and allow the engine to reach normal operating temperature.
- Observe CHT PID.
- **Does the engine overheat?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheat symptom. REPAIR as necessary. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time.

DL29 ENGINE TEMPERATURE WARNING INDICATOR LAMP ON OR TEMPERATURE GAUGE INDICATES HOT, BUT ENGINE IS NOT OVERHEATING

NOTE: The PCM self-test must be carried out prior to entering this pinpoint test.

- **Was the PCM self-test carried out prior to entering this pinpoint test?**

Yes	No
GO to DL30.	The concern is elsewhere. RETURN to**PINPOINT TEST QT** for further direction.

DL30 ENGINE TEMPERATURE INDICATOR LAMP ON OR TEMPERATURE GAUGE INDICATES HOT WITH NO DTCS

NOTE: The engine temperature warning indicator (gauge or lamp) is a warning

system that gives the driver information during an engine overheating condition. The PCM monitors the CHT sensor and determines if fail-safe cooling mode is needed. If fail-safe cooling mode is needed, the PCM sends a controller area network (CAN) message to the instrument cluster to signal an overheating condition. This causes the instrument cluster indicator to illuminate and forces the temperature gauge to the H (hot) zone. DTC P1285 is stored in the PCM.

NOTE: **For Engine Temperature Warning Indicator system problems, refer to the INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES .**

- PCM connector disconnected.
- Key ON, engine OFF.
- **Does the engine temperature warning indicator lamp turn OFF (prove out) and\or the temperature gauge return to the normal zone with the PCM disconnected?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheat symptom. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	REFER to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** to diagnose the incorrect temperature gauge. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL31 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DM: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- manifold absolute pressure (MAP) sensor (9F479)
- harness circuits: MAP, SIGRTN, VREF
- powertrain control module (PCM) (12A650)

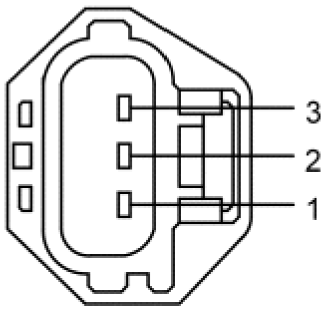

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Fig. 52: Manifold Absolute Pressure (MAP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

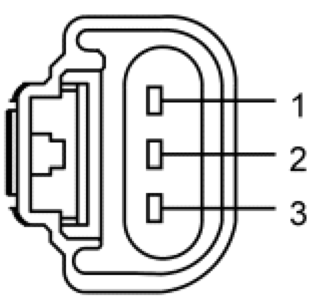

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Fig. 53: Manifold Absolute Pressure (MAP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

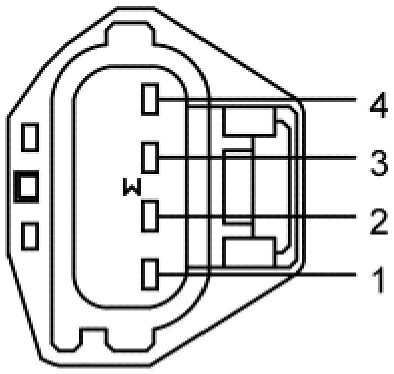

Fig. 54: Manifold Absolute Pressure (MAP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 3.0L	A	2 3 1	MAP SIGRTN VREF
Fusion 3.0L, Milan 3.0L	B	1 2 3	MAP SIGRTN VREF
All other vehicles	C	1 4 2	MAP SIGRTN VREF

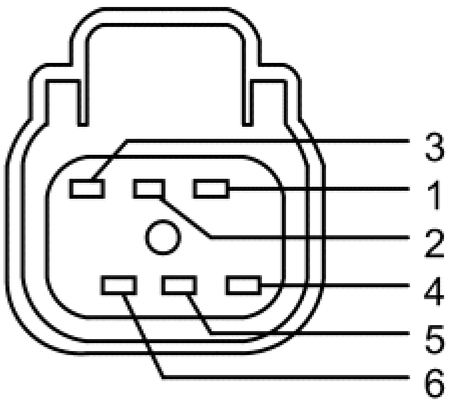

Fig. 55: EGR System Module (ESM) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	VPWR (Vehicle Power)
3	MAP (Manifold Absolute Pressure)
6	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B35, B36 B40, E40 B41, E41, T41 E23	VPWR VREF SIGRTN MAP
F-150	190 Pin	B51, B52, B53 B29, E57 B58, E58, T43 E62	VPWR VREF SIGRTN MAP
Focus	190 Pin	B67, B68 B52, B66, E63 B58, E64, T40 E40	VPWR VREF SIGRTN MAP
Fusion, Milan	140 Pin	B51, B52 B33, E57 B58, E58 E62	VPWR VREF SIGRTN MAP
All other vehicles	170 Pin	B35, B36 B40, E57 B41, E58, T41 E62	VPWR VREF SIGRTN MAP

TEST PROCEDURE

DM1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0106, P0107, P0108, P0109, P012B, P012C, P012D, or P012E present?**

Yes	No
For vehicles with an EGR system module (ESM), KOEO, KOER DTCs P0107, P0108, P012C, or P012D. GO to DM2. For vehicles without an EGR system module (ESM), any DTC P0106, KOEO, KOER DTCs P0107 or P0108, GO to DM20. For vehicles with an EGR system module (ESM) continuous memory DTCs P0107, P0108, P012C, P012D or KOEO P0109, or P012E. GO to DM14.	For all others, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

For vehicles without an EGR system module (ESM) continuous memory DTCs P0107, P0108, or KOEO P0109, GO to DM26. For vehicles with an EGR system module (ESM) DTC P0106, or P012B. GO to DM15.	

DM2 DTCS P0107 AND P0108: MONITOR THE MAP PID

- Key ON, engine running.
- Carry out the KOER self-test.
- Access the PCM and monitor the MAP PID.
- **Is the voltage between 0.05 - 4.95 V?**

Yes	No
VERIFY the PCM is at the latest calibration level. REPROGRAM if necessary. If the PCM is at the latest calibration level, the concern is not present at this time.	GO to DM3.

DM3 VERIFY HARNESS AND CONNECTOR INTEGRITY

- Key in OFF position.
- ESM connector disconnected.
- Carry out a thorough visual inspection of the connector, pins and wires attaching to the pins.
- **Are there any concerns with the wiring or the ESM connection?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DM4.

DM4 MONITOR THE MAP PID

- ESM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- **Is the voltage between 0.05 - 4.95 V?**

Yes	No
The concern is not present at this time. CLEAR the DTCs. REPEAT the self-test.	GO to DM5.

DM5 DETERMINE THE PRESENT MAP PID VOLTAGE

- Access the PCM and monitor the MAP PID.
- **Is the voltage less than 0.05 V?**

Yes	No
GO to DM6.	GO to DM9.

DM6 KOEO AND KOER DTC P0107: CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ESM HARNESS CONNECTOR

- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 6

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to DM7.	refer to **PINPOINT TEST C**.

DM7 CHECK THE MAP CIRCUIT FOR A SHORT TO SIGRTN AND GND IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) ESM Connector, Harness Side	(-)
MAP - Pin 3	Ground

- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP - Pin 3	SIGRTN - Pin 6

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DM8.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM8 INDUCE THE OPPOSITE MAP SENSOR VOLTAGE TO SIMULATE A HIGH CONDITION

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A ESM Connector, Harness Side	Point B ESM Connector, Harness Side

MAP - Pin 3	VREF - Pin 2

- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- **Is the voltage greater than 4.6 V?**

Yes	No
INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DM27.

DM9 KOEO AND KOER DTC P0108: CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ESM HARNESS CONNECTOR

- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 6

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to DM10.	refer to **PINPOINT TEST C**.

DM10 CHECK THE MAP AND SIGRTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP	MAP - Pin 3
SIGRTN	SIGRTN - Pin 6

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DM11.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DM11 CHECK THE MAP CIRCUIT FOR A SHORT TO VREF IN THE HARNESS

- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP - Pin 3	VREF - Pin 2

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DM12.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM12 CHECK THE MAP CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP - Pin 3	VPWR - Pin 4

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DM13.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM13 INDUCE THE OPPOSITE MAP SENSOR VOLTAGE TO SIMULATE A LOW CONDITION

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A ESM Connector, Harness Side	Point B ESM Connector, Harness Side
MAP - Pin 3	SIGRTN - Pin 6

- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- **Is the voltage less than 0.1 V?**

Yes	No
INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DM27.

DM14 DTCS P0107, P0108 AND P0109: CHECK THE MAP CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- Carry out a thorough wiggle test on the ESM harness.
- Lightly tap on the ESM and wiggle the harness connector to simulate road shock.
- **Does a sudden change in voltage occur while monitoring the PID?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DM15 DTC P0106: MAP RANGE/PERFORMANCE

NOTE: **If MAP DTC(s) P0107, P0108 or P0109 are present, diagnose those DTC(s) first. If any mass air flow (MAF) sensor related DTCs are present, diagnose those DTCs prior to diagnosing MAP DTC P0106. Disregard any DTC(s) generated as a result of this test.**

- Key in OFF position.
- ESM connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A ESM Connector, Harness Side	Point B ESM Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN - Pin 6	SIGRTN - Pin 6

- Key ON, engine running.
- Measure the voltage between:

(+) ESM Connector, Component Side	(-) Vehicle Battery
MAP - Pin 3	Negative terminal

- **Is the voltage between 1 - 2 V?**

Yes	No
GO to DM19.	GO to DM16.

DM16 CHECK THE MAP CIRCUIT FOR AN OPEN IN THE ESM HARNESS

- Key in OFF position.
- Remove the jumper wires.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP	MAP - Pin 3

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DM17.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DM17 CHECK THE MAP CIRCUIT FOR A SHORT IN THE ESM HARNESS

- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) ESM Connector, Harness Side
MAP - Pin 3	SIGRTN - Pin 6
MAP - Pin 3	VREF - Pin 2
MAP - Pin 3	VPWR - Pin 4

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DM18.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM18 KOEO AND KOER MAP VOLTAGE

NOTE: The MAP PID should change by at least 1.5 volts from key on engine off to key on engine running.

- Key in OFF position.
- ESM connector connected.
- PCM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- Record the KOEO MAP voltage.
- Key ON, engine running.
- Access the PCM and monitor the MAP PID.
- Record the KOER MAP voltage.
- **Does the MAP PID value change?**

Yes	No
GO to DM19.	CHECK the MAP hose for freezing or obstructions. If OK, INSTALL a new ESM. REFER to the

	ENGINE EMISSION CONTROL -- E-SERIES . CLEAR the DTCs. REPEAT the self-test.

DM19 COMPARE ACTUAL MAP VOLTAGE TO MAP PID VOLTAGE

- Key in OFF position.
- ESM connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A ESM Connector, Harness Side	Point B ESM Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN - Pin 6	SIGRTN - Pin 6
MAP - Pin 3	MAP - Pin 3

- Measure the voltage between:

(+) ESM Connector, Harness Side	(-)
MAP - Pin 3	Ground

- Record the actual MAP voltage values at key on engine off, idle, 1,000 and 2,000 RPM.
- Access the PCM and monitor the MAP PID.
- Record the MAP PID voltage values at key on engine off, idle, 1,000 and 2,000 RPM.
- **Does the MAP PID voltage stay within 0.5 volt of the actual MAP voltage?**

Yes	No
The concern is not present at this time. CLEAR the DTCs. REPEAT the self-test.	CARRY OUT a visual inspection. CHECK for loose connections, and damaged or corroded pins. WIGGLE the harness, attempting to RECREATE the concern. CLEAR the DTCs. REPEAT the self-test.

DM20 KOEO AND KOER DTCS P0106, P0107 AND P0108: CHECK THE VOLTAGE BETWEEN VREF AND SIGRTN AT THE MAP SENSOR

- MAP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAP Sensor Connector, Harness Side	(-) MAP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No

GO to DM22.	GO to DM21.

DM21 CHECK FOR VREF VOLTAGE AT THE SENSOR

- Measure the voltage between:

(+) MAP Sensor Connector, Harness Side	(-) Vehicle Battery
VREF	Negative terminal

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
REPAIR the open SIGRTN circuit. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST C**.

DM22 CHECK MAP SIGNAL VOLTAGE AT THE SENSOR

- Measure the voltage between:

(+) MAP Sensor Connector, Harness Side	(-) MAP Sensor Connector, Harness Side
MAP	SIGRTN

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to DM24.	GO to DM23.

DM23 CHECK THE MAP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) MAP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
MAP	MAP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DM24.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DM24 CHECK THE MAP CIRCUIT FOR A SHORT TO VOLTAGE OR SIGRTN IN THE HARNESS

- Key in OFF position.

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
MAP	VREF
MAP	SIGRTN
MAP	VPWR

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DM25.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DM25 INDUCE THE OPPOSITE SIGNAL

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A MAP Sensor Connector, Harness Side	Point B MAP Sensor Connector, Harness Side
MAP	SIGRTN

- Access the PCM and monitor the MAP PID.
- **Is the voltage less than 0.1 V?**

Yes	No
INSTALL a new MAP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DM27.

DM26 DTCS P0107, P0108 AND P0109: CHECK THE MAP CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- Carry out a thorough wiggle test on the MAP harness.
- Lightly tap on the MAP and wiggle the harness connector to simulate road shock.
- **Does a sudden change in voltage occur while monitoring the PID?**

Yes	No
GO to DM20.	Unable to duplicate or identify the concern at this time.

	refer to **PINPOINT TEST Z**.

DM27 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DP: OUTPUT SHAFT SPEED (OSS) SENSOR/VEHICLE SPEED SENSOR (VSS)/TRANSFER CASE SPEED SENSOR (TCSS)

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- OSS/VSS/TCSS (7F293/7M101/7H103)
- harness circuits: OSS/VSS, TCSS, and SIGRTN
- powertrain control module (PCM) (12A650)

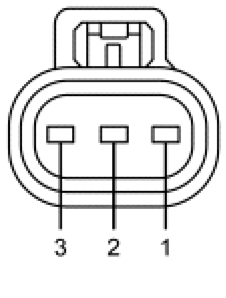

Fig. 56: Output Shaft Sensor/Vehicle Speed Sensor (OSS/VSS) Connector - A

Courtesy of FORD MOTOR CO.

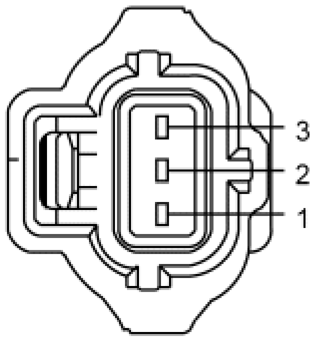

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Fig. 57: Output Shaft Sensor/Vehicle Speed Sensor (OSS/VSS) Connector - B
Courtesy of FORD MOTOR CO.

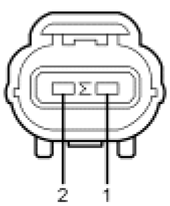

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Fig. 58: Output Shaft Sensor/Vehicle Speed Sensor (OSS/VSS) Connector - C
Courtesy of FORD MOTOR CO.

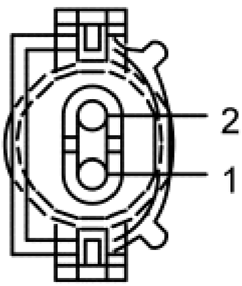

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Fig. 59: Output Shaft Sensor/Vehicle Speed Sensor (OSS/VSS) Connector - D
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
F-Super Duty	A	3 2 1	SIGRTN OSS/VSS VPWR
Focus	B	2 1 3	OSS/VSS PWRGND VPWR
Fusion 2.3L, Milan 2.3L	C	2 1	SIGRTN OSS/VSS
Mustang	D	2 1	SIGRTN OSS/VSS
All other vehicles	D	1 2	SIGRTN OSS/VSS

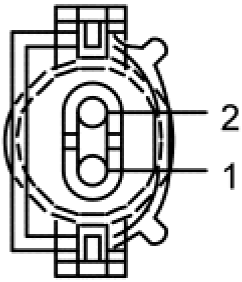

Fig. 60: Output Shaft Sensor/Vehicle Speed Sensor (OSS/VSS) Connector - D
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	TCSS (Transfer Case Speed Sensor)
1	SIGRTN (Signal Return)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B35 B47, B48, B49, B50 B41, E41, T41	VPWR PWRGND SIGRTN

		T4	OSS/VSS
F-150 4.2L	190 Pin	B51 B67, B68, B69, B70 B58, E58, T43 T14	VPWR PWRGND SIGRTN OSS/VSS
F-Super Duty, Mustang, Ranger	170 Pin	B35 B47, B48, B49, B50 B41, E58, T41 T3	VPWR PWRGND SIGRTN OSS/VSS
Focus	190 Pin	B67 B69, B70 B58, E64, T40 T2	VPWR PWRGND SIGRTN OSS/VSS
Fusion, Milan	140 Pin	B51 B67, B68, B69 B58, E58 B65	VPWR PWRGND SIGRTN OSS/VSS
All other vehicles	190 Pin	B51 T16 B67, B68, B69, B70 B58, E58, T43	VPWR TCSS PWRGND SIGRTN

TEST PROCEDURE

DP1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

NOTE: **For vehicles with automatic transmission and output shaft speed (OSS) sensor DTCs, refer to the DIAGNOSTIC METHODS -- GASOLINE ENGINES .**

- **Are DTCs P0500, P0503, P0720, P0721, P0722, P0723, P1500, P1501, P1502 or P1900 present?**

Yes	No
For DTCs P0500, P0503, P1500, P1501 or P1502, with manual shift transfer case, GO to DP16. For DTCs P0500, P0720, P0721, P0722, P0723, P1502 or P1900, with a manual transmission or an electronic shift transfer case, GO to DP2. For DTCs P0503 or P1500, with a manual transmission or an electronic shift transfer case, GO to DP13. For DTC P1501, with a manual transmission or an electronic shift transfer case, GO to DP12.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DP2 DTCS P0500, P0720, P0721, P0722, P0723, P1502 AND P1900: VERIFY THE DRIVE CYCLE

- Access the PCM and monitor the OSS PID.
- Access the PCM and monitor the VSS PID.
- Drive the vehicle.
- Monitor the PID in all transmission gear ranges while increasing and decreasing the speed.
- **Does the PID reading increase and decrease with engine and vehicle speed?**

Yes	No
GO to DP3.	GO to DP4.

DP3 VISUAL INSPECTION

- OSS/VSS connector disconnected.
- Inspect the OSS/VSS harness for damage.
- Inspect the OSS/VSS vehicle harness connector for damage and proper seating.
- If possible, carry out a wiggle test.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

DP4 VERIFY THE TYPE OF OSS/VSS SENSOR

NOTE: The variable reluctance (VR) sensors have 2-wire connectors, Hall-effect sensors have 3-wire connectors.

- Key in OFF position.
- Inspect for a Hall-effect or a VR type of OSS/VSS sensor.
- **Is this a Hall-effect type OSS/VSS sensor?**

Yes	No
GO to DP5.	GO to DP7.

DP5 CHECK VOLTAGE TO THE OSS/VSS SENSOR

- Key in OFF position.
- OSS/VSS connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) OSS/VSS Connector, Harness Side	(-) Vehicle Battery
VPWR	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to DP6.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DP6 CHECK THE VPWR GROUND TO THE OSS/VSS SENSOR

- Key in OFF position.
- Measure the resistance between:

(+) OSS/VSS Connector, Harness Side	(-) Vehicle Battery
PWRGND	Negative terminal

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DP7.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DP7 CHECK THE OSS/VSS CIRCUIT FOR A SHORT TO VREF AND VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- OSS/VSS connector disconnected.
- Measure the voltage between:

(+) OSS/VSS Connector, Harness Side	(-) Vehicle Battery
OSS/VSS	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to DP8.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DP8 CHECK THE OSS/VSS CIRCUIT(S) FOR AN OPEN IN THE HARNESS

NOTE: Hall-effect sensors are not equipped with a SIGRTN circuit. Disregard the SIGRTN measurement.

- Key in OFF position.
- PCM connector disconnected.
- OSS/VSS connector disconnected.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) OSS/VSS Connector, Harness Side
OSS/VSS	OSS/VSS
SIGRTN	SIGRTN
PWRGND	PWRGND

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DP9.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DP9 CHECK THE OSS/VSS CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) OSS/VSS Connector, Harness Side	(-) OSS/VSS Connector, Harness Side
OSS/VSS	PWRGND

- **Is the resistance greater than 10K ohms?**

Yes	No
For Hall-effect sensors, GO to DP10. For VR sensors, GO to DP11.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DP10 CHECK THE OSS/VSS SIGNAL OUTPUT TO THE PCM, HALL-EFFECT TYPE SENSOR

NOTE: The opposite wheel must be held stationary.

- PCM connector disconnected.
- Raise the vehicle to allow for the rotation of the front drive wheels.
- Key ON, engine OFF.
- Transmission gear selector in NEUTRAL.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
OSS/VSS	PWRGND

- The voltage should rise above 5 volts and fall below 1 volt in a regular cycle. Observe several cycles.
- **Does the OSS/VSS output voltage rise and fall as specified?**

Yes	No
GO to DP22.	REMOVE the OSS/VSS sensor and inspect the target wheel. REPAIR as necessary. If OK, INSTALL a new OSS/VSS sensor. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DP11 CHECK THE RESISTANCE OF THE OSS/VSS SENSOR

- Measure the resistance between:

(+) OSS/VSS Connector, Component Side	(-) OSS/VSS Connector, Component Side
OSS/VSS	SIGRTN

- **Is the resistance between 170 - 270 ohms (VSS) or 400 - 1.25K ohms (OSS)?**

Yes	No
GO to DP22.	REMOVE the OSS/VSS sensor and inspect the target wheel. REPAIR as necessary. If OK, INSTALL a new OSS/VSS sensor. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DP12 KOER DTC P1501: CHECK THE VSS PID FOR AN INPUT SIGNAL

- Key ON, engine running.
- Access the PCM and monitor the VSS PID.
- Observe the VSS input to the PCM.
- Increase the engine speed, not greater than 2,000 RPM, several times while observing the VSS PID.
- **Is the reading on the PID less than 5 km/h (3 mph)?**

Yes	No
Unable to duplicate or identify the concern at this time. REFER to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** for possible causes and additional DTC description information. If DTC P1501 still exists, refer to **PINPOINT TEST Z**.	GO to DP15.

DP13 DTCS P0503 AND P1500: INSPECT THE VSS AND THE CIRCUIT FOR AN INTERMITTENT

- Visually inspect the VSS and harness circuits for any potential failures.
- Use the following check list for reference:
  - loose wires/connectors
  - pushed out connector pins

  - damaged wiring harness insulation
  - incorrect harness routing
  - incorrect VSS mounting
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DP14.

DP14 CHECK THE PCM VSS PID FOR AN INPUT SIGNAL

NOTE: For scan tools which have a data record feature, record the data for future playback to help identify any variations.

- Access the PCM and monitor the VSS PID.
- Drive the vehicle at several steady state speeds above and below 50 km/h (30 mph).
- **Are there any indicators of a noisy or intermittent signal with the VSS PID?**

Yes	No
GO to DP15.	Unable to duplicate or identify the concern at this time. REPAIR any other DTCs. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

DP15 CHECK THE VSS HARNESS ROUTING

NOTE: Refer to Pinpoint Test Schematic and Connectors at the beginning of this pinpoint test.

- Check the VSS harness routing:
  - Verify the harness is not routed adjacent to any high current wires such as ignition wires or generator wiring.
  - Verify the VSS harness is shielded and grounded, if applicable.
- Measure the resistance of the VSS harness.
- **Is a concern present?**

Yes	No
REPAIR as necessary.	Unable to duplicate or identify the concern at this time. REFER to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** for possible causes and additional DTC description information. refer to **PINPOINT TEST Z**.

DP16 DTCS P0500, P0503, P1500, P1501 AND P1502: VISUAL INSPECTION OF TCSS

NOTE: **The TCSS provides the rotational speed of the output shaft of the transfer case.**

The PCM uses this information to control the powertrain behavior and on some applications it is used as the source for the vehicle speed information.

- TCSS connector disconnected.
- Inspect the TCSS vehicle harness connector for damage and proper seating.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DP17.

DP17 CHECK THE RESISTANCE OF THE TCSS

- Measure the resistance between:

(+) TCSS Connector, Component Side	(-) TCSS Connector, Component Side
SIGRTN - Pin 1	TCSS - Pin 2

- **Is the resistance between 1K - 1.25K ohms?**

Yes	No
GO to DP18.	INSTALL a new TCSS. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DP18 CHECK THE TCSS SENSOR OUTPUT

NOTE: **The opposite wheel must be held stationary.**

- With the vehicle in NEUTRAL and the parking brake off, position it on a hoist. Refer to the **JACKING AND LIFTING -- E-SERIES** for the locations of the lifting points.
- Raise the vehicle.
- Measure the frequency between:

(+) TCSS Connector, Component Side	(-) TCSS Connector, Component Side
SIGRTN - Pin 1	TCSS - Pin 2

- Monitor the TCSS signal while rotating the driven wheel as fast as possible.
- **Does the frequency reading increase and decrease with the wheel speed?**

Yes	No
GO to DP19.	REMOVE the TCSS and inspect the target wheel. REPAIR as necessary. If OK, INSTALL a new TCSS sensor. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DP19 CHECK THE TCSS CIRCUIT(S) FOR A SHORT TO GROUND AND VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- TCSS connector disconnected.
- Measure the voltage between:

(+) TCSS Connector, Harness Side	(-)
TCSS - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to DP20.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DP20 CHECK THE CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TCSS Connector, Harness Side
TCSS	TCSS - Pin 2
SIGRTN	SIGRTN - Pin 1

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DP21.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DP21 CHECK THE HARNESS FOR A SHORT TO GROUND

- Measure the resistance between:

(+) TCSS Connector, Harness Side	(-) TCSS Connector, Harness Side
SIGRTN - Pin 1	TCSS - Pin 2

- Measure the resistance between:

(+) TCSS Connector, Harness Side	(-)
TCSS - Pin 2	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DP22.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DP22 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DR: CAMSHAFT POSITION (CMP) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- camshaft position (CMP) sensor (6B288)
- harness circuits: CMP, CMP2, SIGRTN, VBPWR, VRSRTN, and VRSRTN2
- powertrain control module (PCM) (12A650)

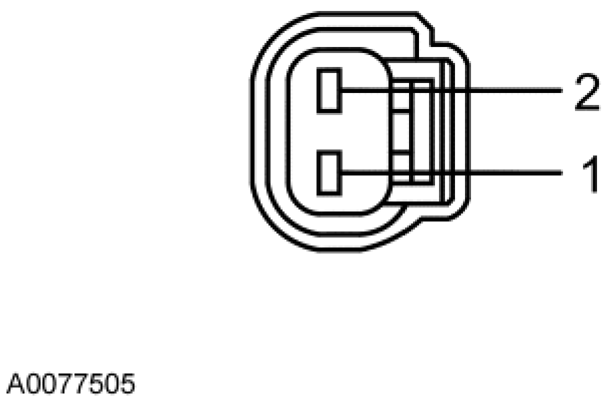

Fig. 61: Camshaft Position (CMP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

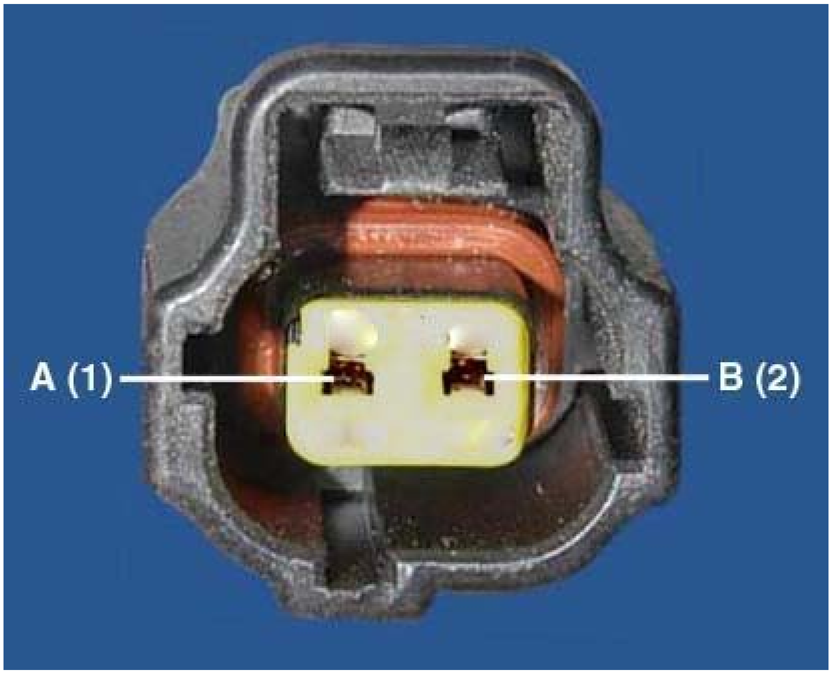

Fig. 62: Camshaft Position (CMP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

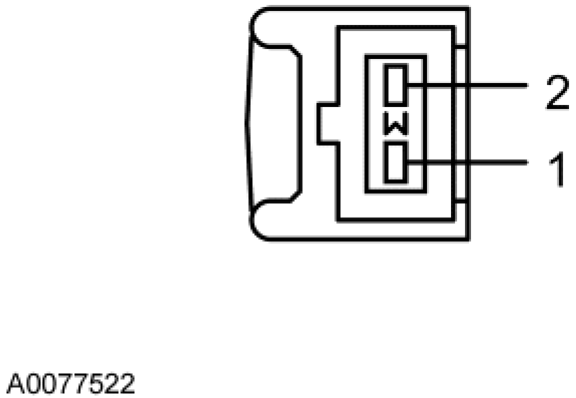

Fig. 63: Camshaft Position (CMP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

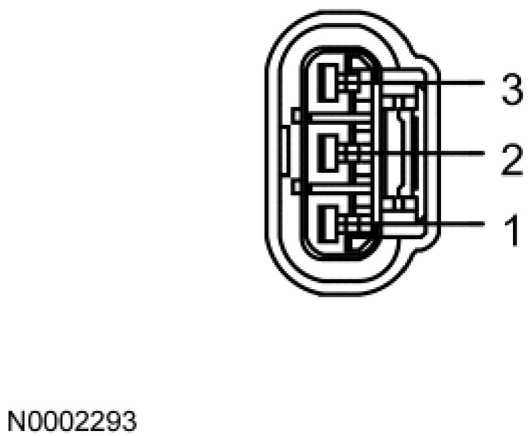

Fig. 64: Camshaft Position (CMP) Sensor Connector - D
Courtesy of FORD MOTOR CO.

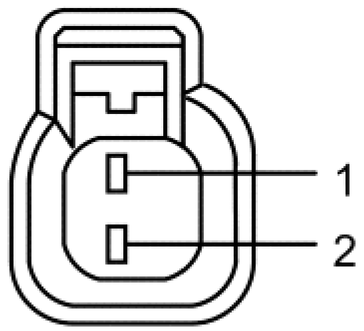

Fig. 65: Camshaft Position (CMP) Sensor Connector - E
Courtesy of FORD MOTOR CO.

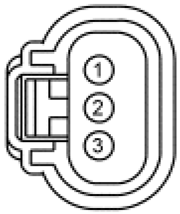

Fig. 66: Camshaft Position (CMP) Sensor Connector - F
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Expedition, F-150 4.6L, F-150 5.4L, Mark LT, MKX, MKZ, Navigator, Sable, Taurus,	A	1 2	VRSRTN CMP

Taurus X			
Escape/Mariner 2.3L, Ranger 2.3L	B	1 2	SIGRTN CMP
Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, Mustang 4.0L, Ranger 4.0L	C	2 1	SIGRTN CMP
Fusion 2.3L, Milan 2.3L	D	1 3 2	VBPWR SIGRTN CMP
Fusion 3.0L, Milan 3.0L	E	2 1	VRSRTN CMP
F-150 4.2L	D	3 1 2	PWRGND VPWR CMP
Focus	F	1 3 2	VBPWR SIGRTN CMP
All other vehicles	A	1 2	SIGRTN CMP

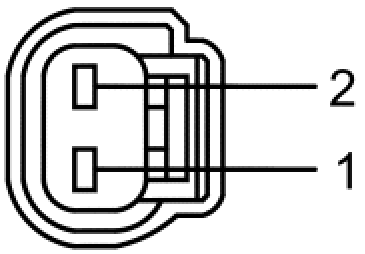

Fig. 67: Camshaft Position 2 (CMP2) Sensor Connector - A
Courtesy of FORD MOTOR CO.

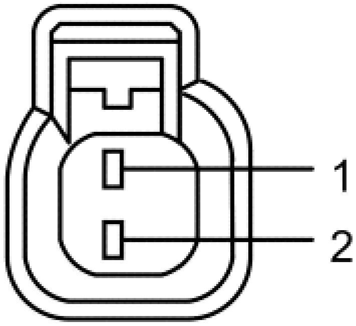

Fig. 68: Camshaft Position 2 (CMP2) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, MKX, MKZ, Sable, Taurus, Taurus X	A	1 2	VRSRTN CMP2
Expedition, F-150 5.4L, Mark LT, Navigator	A	1 2	VRSRTN2 CMP2
Fusion 3.0L, Milan 3.0L	B	2 1	VRSRTN CMP2
All other vehicles	A	1 2	SIGRTN CMP2

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	E44 E42 E45	CMP2 VRSRTN CMP
Escape/Mariner	150 (50-50-50) Pin	E41 E25	SIGRTN CMP
Expedition, Navigator	140 Pin	E5 E44	VRSRTN2 CMP2

		E4 E45	VRSRTN CMP
Explorer 4.6L, Explorer Sport Trac 4.6L, F-Super Duty 5.4L, Mountaineer 4.6L, Mustang 4.6L	170 Pin	E44 E58 E45	CMP2 SIGRTN CMP
F-150 4.6L	190 Pin	E4 E45	VRSRTN CMP
F-150 4.2L	190 Pin	E45	CMP
F-150 5.4L, Mark LT	190 Pin	E5 E44 E4 E45	VRSRTN2 CMP2 VRSRTN CMP
Focus	190 Pin	E64 E8	SIGRTN CMP
Fusion 3.0L, Milan 3.0L, MKZ	140 Pin	E44 E33 E45	CMP2 VRSRTN CMP
Fusion 2.3L, Milan 2.3L	140 Pin	E58 E45	SIGRTN CMP
All other vehicles	170 Pin	E58 E45	SIGRTN CMP

TEST PROCEDURE

DR1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0340, P0344, P0345, or P0349 present?**

Yes	No
For DTCs P0340, P0344, P0345 or P0349, GO to DR2.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DR2 CONTINUOUS MEMORY DTCS P0340, P0344, P0345 AND P0349: CHECK IF THE ENGINE STARTS

- Attempt to start the engine.
- **Does the engine start?**

Yes	No
GO to DR3.	RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

DR3 CLEAR AND ATTEMPT TO RETRIEVE THE DTC

NOTE: **If DTCs P0340, P0344, P0345, or P0349 are present, ignition, alternator noise, RFI and CKP concerns should be considered.**

NOTE: **For vehicles with variable camshaft timing (VCT), concerns with the engine oil level, oil filter, oil contamination, or the VCT system may cause camshaft positioning errors.**

- Key ON, engine OFF.
- Clear the PCM DTCs.
- Key ON, engine running.
- Increase engine speed to greater than 1,500 RPM for 10 seconds. Repeat this 3 times.
- Retrieve the continuous memory DTCs.
- **Are DTCs P0340, P0344, P0345 or P0349 present?**

Yes	No
GO to DR4.	refer to **PINPOINT TEST Z**.

DR4 CHECK THE GENERATOR FOR EXCESSIVE ELECTRICAL NOISE

NOTE: **If the generator/regulator is electrically noisy, the noise decreases when the B+ connector is disconnected.**

- PCM connector connected.
- CMP Sensor connector connected.
- Key ON, engine running.
- Monitor the generator for an audible electric noise.
- Key in OFF position.
- Generator/regulator B+ connector disconnected.
- Key ON, engine running.
- With the engine running, determine if the generator is still noisy.
- **Does the noise remain constant when the B+ connector is disconnected?**

Yes	No
For continuous memory DTCs P0340 or P0344, GO to DR5. For continuous memory DTCs P0345 or P0349, GO to DR13.	REFER to the **GENERATOR AND REGULATOR -- E-SERIES** to diagnose the generator is noisy symptom.

DR5 DETERMINE THE CMP SENSOR PHYSICAL TYPE

- Key in OFF position.
- **Is the CMP sensor a synchronizer (gear driven) type?**

Yes	No
GO to DR6.	GO to DR7.

DR6 VERIFY THE CORRECT INSTALLATION OF THE CMP SENSOR

NOTE: A CMP sensor identifies the cylinder 1 power stroke. A sensor that is improperly installed/indexed can identify the wrong cylinder as 1, produce a tip-in hesitation and generate DTC P0340.

- **Is the CMP sensor installed correctly?**

Yes	No
GO to DR7.	INSTALL the CMP sensor correctly. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** for the Camshaft Synchronizer removal and installation procedures. CLEAR the DTCs. REPEAT the self-test.

DR7 DETERMINE THE CMP SENSOR ELECTRONIC TYPE

NOTE: The variable reluctance (VR) sensors have 2-wire connectors, Hall-effect sensors have 3-wire connectors.

- **Is the CMP sensor a VR type?**

Yes	No
GO to DR8.	The CMP sensor is a Hall-effect type. GO to DR19.

DR8 CONTINUOUS MEMORY DTCS P0340 AND P0344: CHECK THE CMP SENSOR RESISTANCE

- Key in OFF position.
- CMP Sensor connector disconnected.
- Measure the resistance between:

(+) CMP Sensor Connector, Component Side	(-) CMP Sensor Connector, Component Side
CMP	SIGRTN
CMP	VRSRTN

Vehicle	Minimum Resistance (ohms)	Maximum Resistance (ohms)

Edge, MKX	586	2,033
F-150 4.6L	1,978	5,590
F-150, Mark LT	205	579
MKZ	586	2,033
Taurus, Taurus X, Sable	586	2,033
All others	250	1,000

- **Is the resistance within specification?**

Yes	No
GO to DR9.	INSTALL a new CMP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DR9 CHECK THE CMP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CMP Sensor Connector, Harness Side	(-) Vehicle Battery
CMP	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to DR10.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR10 CHECK THE CMP AND SIGRTN OR VRSRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CMP Sensor Connector, Harness Side
CMP	CMP
SIGRTN	SIGRTN
VRSRTN	VRSRTN

- **Are the resistances less than 5 ohms?**

Yes	No

GO to DR11.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR11 CHECK FOR A SHORT IN THE HARNESS BETWEEN THE PCM AND THE CMP SENSOR

- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) CMP Sensor Connector, Harness Side
CMP	SIGRTN
CMP	VRSRTN

- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) Vehicle Battery
CMP	Negative terminal
SIGRTN	Negative terminal
VRSRTN	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DR12.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR12 CHECK THE CMP SENSOR OUTPUT

- Key in OFF position.
- Generator/regulator B+ connector connected.
- CMP Sensor connector disconnected.
- Key ON, engine running.
- Digital multimeter (DMM) on low voltage AC scale.
- Measure the voltage between:

(+) CMP Sensor Connector, Component Side	(-) CMP Sensor Connector, Component Side
CMP	SIGRTN
CMP	VRSRTN

- Run the engine at approximately 2,500 RPM.
- **Is the voltage greater than 0.25 V?**

Yes	No
For Edge,	INSTALL a new CMP sensor. REFER to the

Expedition, Explorer 4.6L, Explorer Sport Trac 4.6L, F-150 5.4L, F-Super Duty 5.4L, Fusion, Mark LT, Milan, MKX, MKZ, Mountaineer 4.6L, Mustang 4.6L, Navigator, Sable, Taurus, and Taurus X, GO to DR25. For all others, GO to DR26.	**ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DR13 CONTINUOUS MEMORY DTCS P0345 AND P0349: CHECK THE CMP2 SENSOR RESISTANCE

- Key in OFF position.
- CMP2 Sensor connector disconnected.
- Measure the resistance between:

(+) CMP2 Sensor Connector, Component Side	(-) CMP2 Sensor Connector, Component Side
CMP2	SIGRTN
CMP2	VRSRTN
CMP2	VRSRTN2

Vehicle	Minimum Resistance (ohms)	Maximum Resistance (ohms)
Edge, MKX	586	2,033
F-150, Mark LT	205	579
MKZ	586	2,033
Taurus, Taurus X, Sable	586	2,033
All others	250	1,000

- **Is the resistance value(s) within specifications?**

Yes	No
GO to DR14.	INSTALL a new CMP2 sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** .

	CLEAR the DTCs. REPEAT the self-test.

DR14 CHECK THE CMP2 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CMP2 Sensor Connector, Harness Side	(-) Vehicle Battery
CMP2	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to DR15.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR15 CHECK THE CMP2 AND SIGRTN, VRSRTN, OR VRSRTN2 CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CMP2 Sensor Connector, Harness Side
CMP2	CMP2
SIGRTN	SIGRTN
VRSRTN	VRSRTN
VRSRTN2	VRSRTN2

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DR16.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR16 CHECK FOR A SHORT IN THE HARNESS BETWEEN THE PCM AND THE CMP2 SENSOR

- Measure the resistance between:

(+) CMP2 Sensor Connector, Harness Side	(-) CMP2 Sensor Connector, Harness Side
CMP2	SIGRTN
CMP2	VRSRTN
CMP2	VRSRTN2

- Measure the resistance between:

(+) CMP2 Sensor Connector, Harness Side	(-) Vehicle Battery
CMP2	Negative terminal
SIGRTN	Negative terminal
VRSRTN	Negative terminal
VRSRTN2	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DR17.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR17 CHECK FOR A SHORT BETWEEN THE CMP AND THE CMP2 CIRCUITS

- CMP Sensor connector disconnected.
- CMP2 Sensor connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
CMP	CMP2

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DR18.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR18 CHECK THE CMP2 SENSOR OUTPUT

- Key in OFF position.
- Generator/regulator B+ connector connected.
- CMP2 Sensor connector disconnected.
- Key ON, engine running.
- DMM on low voltage AC scale.
- Measure the voltage between:

(+) CMP2 Sensor Connector, Component Side	(-) CMP2 Sensor Connector, Component Side
CMP2	SIGRTN
CMP2	VRSRTN
CMP2	VRSRTN2

- Run the engine at approximately 2,500 RPM.
- **Is the voltage greater than 0.25 V?**

Yes	No
For Edge, Expedition, Explorer 4.6L, Explorer Sport Trac 4.6L, F-150 5.4L, F-Super Duty 5.4L, Fusion, Mark LT, Milan, MKX, MKZ, Mountaineer 4.6L, Mustang 4.6L, Navigator, Sable, Taurus, and Taurus X, GO to DR25. For all others, GO to DR26.	INSTALL a new CMP2 sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DR19 CONTINUOUS MEMORY DTCS P0340 AND P0344: CHECK THE VOLTAGE TO THE CMP SENSOR

- CMP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CMP Sensor Connector, Harness Side	(-) Vehicle Battery
VPWR	Negative terminal
VBPWR	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to DR20.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR20 CHECK THE PWRGND OR SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the voltage between:

(+) Vehicle Battery	(-) CMP Sensor Connector, Harness Side

Positive terminal	PWRGND
Positive terminal	SIGRTN

- **Is the voltage greater than 10 V?**

Yes	No
GO to DR21.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR21 CHECK THE CMP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CMP Sensor Connector, Harness Side	(-) Vehicle Battery
CMP	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to DR22.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR22 CHECK FOR AN OPEN CIRCUIT BETWEEN THE PCM AND CMP SENSOR

- Key in OFF position.
- CMP Sensor connector disconnected.
- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CMP	CMP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DR23.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DR23 CHECK THE CMP CIRCUIT FOR A SHORT TO PWRGND OR SIGRTN IN THE HARNESS

NOTE: **The measurement may be taken at the PCM or CMP connector, whichever is easier to access.**

- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) CMP Sensor Connector, Harness Side
CMP	PWRGND
CMP	SIGRTN

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DR24.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DR24 CHECK THE CMP SENSOR FOR CORRECT OPERATION

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A CMP Sensor Connector, Harness Side	Point B CMP Sensor Connector, Component Side
VPWR	VPWR
VBPWR	VBPWR
SIGRTN	SIGRTN
PWRGND	PWRGND

- Key ON, engine running.
- DMM on low voltage DC scale.
- Measure the voltage between:

(+) CMP Sensor Connector, Component Side	(-) Vehicle Battery
CMP	Negative terminal

- **Does the voltage switch between LOW (less than 2 volts DC) and HIGH (greater than 8 volts DC)?**

Yes	No
GO to DR26.	INSTALL a new CMP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DR25 CHECK THE VARIABLE CAMSHAFT TIMING (VCT) SYSTEM

NOTE: Only diagnose the bank indicated by the DTC.

- Check the VCT system for correct operation.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DR26.

DR26 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DS: AIR CONDITIONING PRESSURE (ACP) TRANSDUCER SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- ACP transducer sensor (19D594)
- harness circuits: ACP, VREF, SIGRTN
- powertrain control module (PCM) (12A650)

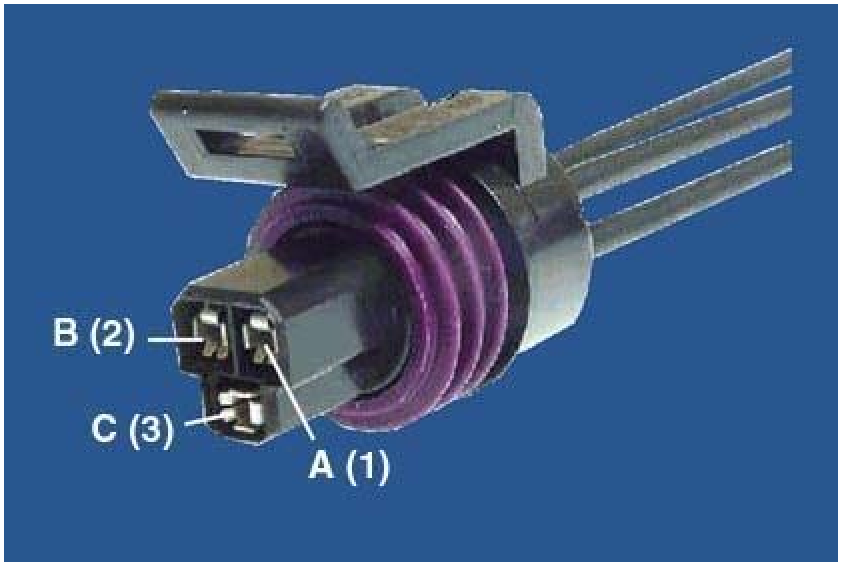

Fig. 69: Air Conditioning Pressure (ACP) Transducer Sensor Connector - A
Courtesy of FORD MOTOR CO.

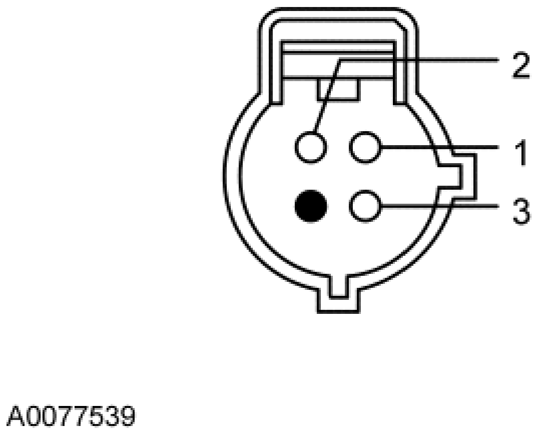

Fig. 70: Barometric Pressure (BARO) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Fusion, Milan, MKX, MKZ	A	3 1 2	ACP SIGRTN VREF
All other vehicles	B	3 1 2	ACP SIGRTN VREF

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Mustang, Town Car	170 Pin	B40, E57 B35 B47 B26	VREF VPWR PWRGND ACP
Expedition, Navigator	140 Pin	E57 B51 B67 B19	VREF VPWR PWRGND ACP
Explorer, Explorer Sport Trac	170 Pin	B40, E57 B35 B47 B18	VREF VPWR PWRGND ACP
F-150	190 Pin	B29, E57 B51 B67 B10	VREF VPWR PWRGND ACP
Focus	190 Pin	B52, B66, E63 B67 B69 B31	VREF VPWR PWRGND ACP
Fusion, Milan, MKZ	140 Pin	B33, E57 B51 B67 B63	VREF VPWR PWRGND ACP
All other vehicles	190 Pin	B29, B64 B51 B67 B37	VREF VPWR PWRGND ACP

TEST PROCEDURE

DS1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0532, P0533, P1461, P1462, or P1463 present?**

Yes	No
For DTC P0533, P1461, GO to DS2. For DTC P0532, P1462, GO to DS8. For DTC P1463, GO to DS17.	For symptoms without DTCs, GO to DS19. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DS2 DTC P0533, P1461: CHECK THE ACP PID

- Key ON, engine OFF.
- Access the PCM and monitor the ACP_PRESS PID.

- **Is the voltage less than 4.9 V?**

Yes	No
The ACP transducer sensor voltage is now below maximum. To determine if an intermittent condition exists, GO to DS16.	GO to DS3.

DS3 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ACP TRANSDUCER SENSOR VEHICLE HARNESS CONNECTOR

- Air Conditioning Pressure (ACP) Transducer Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to DS4.	refer to **PINPOINT TEST C**.

DS4 CHECK THE ACP CIRCUIT FOR A SHORT TO VREF

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
ACP	VREF

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DS5.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DS5 CHECK THE ACP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-)
ACP	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to DS6.	REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.

DS6 CHECK FOR AN OPEN ACP CIRCUIT IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ACP	ACP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DS7.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DS7 CHECK THE PCM

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	Point B Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
ACP	SIGRTN

- Key ON, engine OFF.
- Access the PCM and monitor the ACP_PRESS PID.
- **Is the voltage less than 4.9 V?**

Yes	No
INSTALL a new Air Conditioning Pressure (ACP) Transducer Sensor. CLEAR the DTCs. REPEAT the self-test.	GO to DS23.

DS8 DTC P0532, P1462: CHECK THE ACP PID

- Key ON, engine OFF.

- Access the PCM and monitor the ACP_PRESS PID.
- **Is the voltage greater than 0.15 V?**

Yes	No
The ACP transducer sensor voltage is now above the minimum. To determine if an intermittent condition exists, GO to DS16.	GO to DS9.

DS9 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ACP TRANSDUCER SENSOR VEHICLE HARNESS CONNECTOR

- Air Conditioning Pressure (ACP) Transducer Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to DS10.	refer to **PINPOINT TEST C**.

DS10 SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- Key in OFF position.
- Connect a 5 amp fused jumper wire between the following:

Point A Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	Point B Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
VREF	ACP

- Key ON, engine OFF.
- Access the PCM and monitor the ACP_PRESS PID.
- **Is the voltage greater than 4 V?**

Yes	No
INSTALL a new Air Conditioning Pressure (ACP) Transducer Sensor. CLEAR the DTCs. REPEAT the self-test.	GO to DS11.

DS11 CHECK THE ACP CIRCUIT FOR A SHORT TO GND

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-)
ACP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DS12.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DS12 CHECK THE ACP CIRCUIT FOR A SHORT TO SIGRTN

- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
ACP	SIGRTN

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DS13.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DS13 CHECK THE ACP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ACP	ACP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DS14.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DS14 CHECK FOR THE A/C CLUTCH TO ENGAGE

- PCM connector connected.
- Air Conditioning Pressure (ACP) Transducer Sensor connector connected.

- Key ON, engine running.
- While listening for the A/C clutch to engage, turn the A/C on. Repeat if necessary.
- **Does the A/C engage when the A/C is turned on?**

Yes	No
GO to DS23.	GO to DS15.

DS15 VERIFY THE A/C SYSTEM FUNCTION, INCLUDING THE REFRIGERANT CHARGE

- Restore the vehicle.
- Verify the A/C system function, including the refrigerant charge. Refer to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** .
- **Does the A/C system have the correct refrigerant charge and if so does the A/C system function correctly?**

Yes	No
GO to DS23.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

DS16 CHECK THE ACP CIRCUIT FOR AN INTERMITTENT CONCERN

NOTE: A concern is indicated by a sudden change in voltage.

- Key ON, engine OFF.
- Access the PCM and monitor the ACP PID.
- Observe the ACP PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the ACP, SIGRTN, and VREF wires between the ACP sensor and PCM
  - Lightly tap on the ACP transducer sensor to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DS17 DTC P1463: VERIFY THE A/C CLUTCH CAN DISENGAGE

- Turn the A/C and defroster OFF.
- Key ON, engine running.
- Verify the A/C clutch can disengage.

- **Is the A/C clutch disengaged?**

Yes	No
GO to DS18.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is always on symptom.

DS18 CHECK FOR VOLTAGE AND GROUND TO THE A/C CLUTCH USING A NON-POWERED TEST LAMP

NOTE: If voltage and ground to the A/C clutch have already been checked or the A/C clutch can be heard clicking on when the A/C is turned on, go to the question at the end of this test step.

- Key in OFF position.
- A/CCS Switch connector disconnected.
- Connect a jumper wire in the A/C low pressure cycling switch harness connector to complete the circuit.
- A/CC Assembly connector disconnected.
- Connect a non-powered test lamp between the voltage pin and ground pin at the A/C clutch harness connector.
- Key ON, engine running.
- Turn the A/C on, and wait 15 seconds.
- Monitor the test lamp.
- Connect the A/C clutch and A/C cycling switch when done testing.
- **Does the lamp illuminate, or can the A/C clutch be heard clicking on?**

Yes	No
GO to DS19.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

DS19 DETERMINE IF A SUFFICIENT A/C PRESSURE CHANGE CAN BE DETECTED BY THE ACP PID

- Key ON, engine running.
- Turn the A/C and defroster OFF.
- Access the PCM and monitor the ACP PID.
- Turn the A/C and defroster OFF.
- Five seconds after A/C clutch engagement, note the voltage. If the clutch does not engage, follow

the NO answer instructions.

- **Does the PCM-ACP PID change more than 0.3 volt within 5 seconds of clutch engagement?**

Yes	No
The ACP transducer sensor and the PCM can detect a sufficient change in the A/C pressure. For symptom without DTC P1463, REFER to the **SYMPTOM CHARTS** article, Symptom Charts. For all others, REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.	GO to DS20.

DS20 CHECK THE A/C SYSTEM PRESSURE AND PRESSURE CHANGE

- Key in OFF position.
- Install an A/C system manifold gauge set and check the A/C system high pressure reading.
- Turn the A/C and defroster OFF.
- Key ON, engine running.
- Note the A/C high pressure reading.
- While monitoring the A/C system high pressure reading, turn the A/C on. Five seconds after clutch engagement, note the pressure (the pressure should increase).
- A/C and defroster OFF.
- **Does the A/C high pressure reading change more than 207 kPa (30 psi) within 5 seconds of clutch engagement?**

Yes	No
GO to DS21.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

DS21 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE ACP TRANSDUCER SENSOR VEHICLE HARNESS CONNECTOR

- Key in OFF position.
- Air Conditioning Pressure (ACP) Transducer Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to DS22.	refer to **PINPOINT TEST C**.

DS22 CHECK THE ACP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) Air Conditioning Pressure (ACP) Transducer Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ACP	ACP

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new Air Conditioning Pressure (ACP) Transducer Sensor. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DS23 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DT: POWER STEERING PRESSURE (PSP) SENSOR

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to**

follow these instructions may result in personal injury.

This pinpoint test is intended to diagnose the following:

- PSP sensor (3K215)
- harness circuit(s): PSP, SIGRTN and VREF
- powertrain control module (PCM) (12A650)

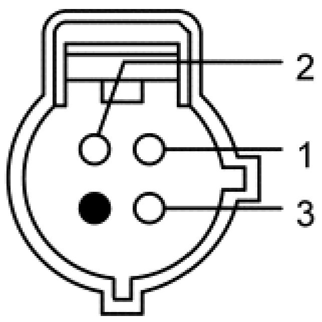

Fig. 71: Barometric Pressure (BARO) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
3	PSP (Power Steering Pressure)
1	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Focus	190 Pin	T29	PSP
All other vehicles	190 Pin	E24	PSP

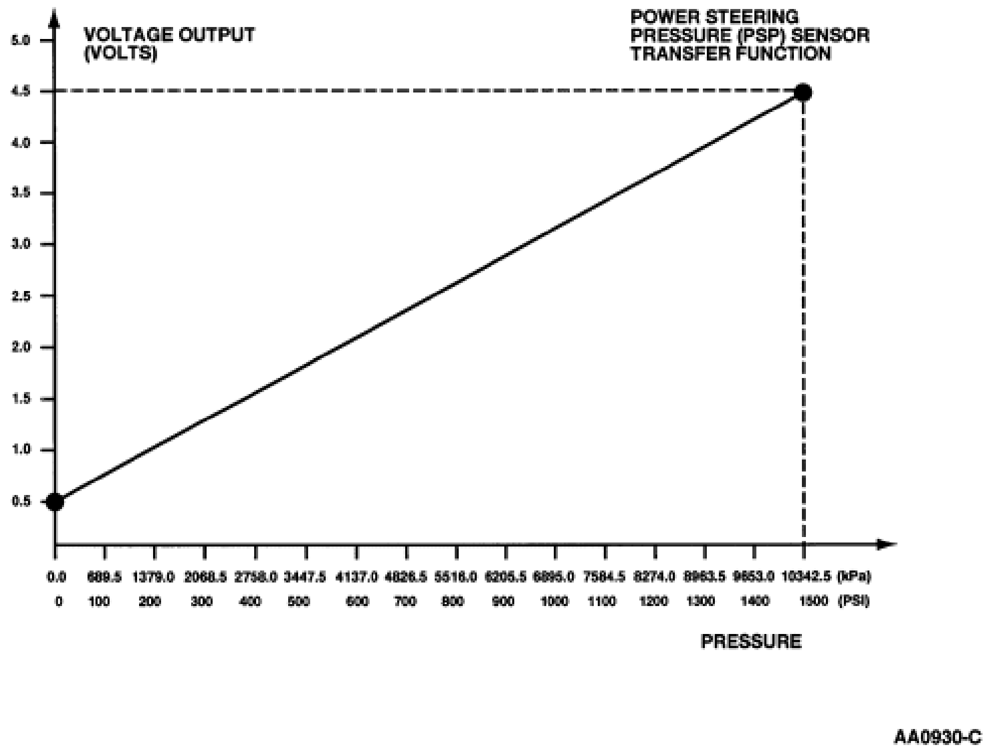

Fig. 72: Power Steering Pressure Sensor Voltage To Pressure Graph
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

DT1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0552, P0553, or P1550 present?**

Yes	No
For KOEO and KOER DTCs P0552 or P0553, GO to DT4. For continuous memory DTCs P0552 or P0553, GO to DT8. For KOEO and KOER DTC P1550, GO to DT2.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DT2 DTC P1550: MAKE SURE THE STEERING WHEEL IS TURNED

- **Did you turn the steering wheel at least one half turn within 20 seconds of starting the KOER self-test?**

Yes	No
If there are any symptoms with the power steering system (for example, lack of power assist), REFER to the **STEERING SYSTEM - GENERAL**	REPEAT the KOER self-test.

INFORMATION -- E-SERIES to diagnosis the lack of assist or inconsistent assist of steering system. If no symptoms are present with the power steering system, GO to DT3.	

DT3 CHECK THE VOLTAGE BETWEEN VREF AND SIGRTN AT THE PSP SENSOR

- PSP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PSP Sensor Connector, Harness Side	(-) PSP Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 1

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to DT4.	refer to **PINPOINT TEST C**.

DT4 CHECK THE PSP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PSP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
PSP - Pin 3	PSP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DT5.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DT5 CHECK THE PSP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PSP Sensor Connector, Harness Side	(-)
PSP - Pin 3	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to DT6.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DT6 CHECK THE PSP CIRCUIT FOR A SHORT TO VREF, SIGRTN AND GND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PSP Sensor Connector, Harness Side	(-) PSP Sensor Connector, Harness Side
PSP - Pin 3	VREF - Pin 2
PSP - Pin 3	SIGRTN - Pin 1

- Measure the resistance between:

(+) PSP Sensor Connector, Harness Side	(-)
PSP - Pin 3	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DT7.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DT7 CHECK THE SENSOR OPERATION

- Connect a 5 amp fused jumper wire between the following:

Point A PSP Sensor Connector, Harness Side	Point B PSP Sensor Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN - Pin 1	SIGRTN - Pin 1
PSP - Pin 3	PSP - Pin 3

- Start engine and allow to idle.
- Measure the voltage between:

(+) PSP Sensor Connector, Component Side	(-)
PSP - Pin 3	Ground

- Observe the voltage while turning the steering wheel at least 1/2 turn right and left.
- **Is the voltage reading between 0.3 and 4.7 volts and does the voltage change when the steering wheel is turned?**

Yes	No
GO to DT9.	INSTALL a new PSP sensor. CLEAR the DTCs. REPEAT the self-test.

DT8 CONTINUOUS MEMORY DTCS P0552 OR P0553: CHECK THE POWER STEERING PRESSURE SENSOR CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Key ON, engine OFF.
- Access the PCM and monitor the PSP PID.
- Observe the PSP PID for an indication of a concern while carrying out the following. (a concern is indicated by a sudden change in the voltage):
  - Shake, wiggle, and bend the PSP, VREF, SIGRTN circuit(s).
  - Lightly tap on the power steering pressure sensor to simulate road shock.
- **Is a concern indicated?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DT9 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DU: INTAKE AIR TEMPERATURE 2 (IAT2) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- intake air temperature 2 (IAT2) sensor (12A697)

- harness circuits: IAT2 and SIGRTN
- powertrain control module (PCM) (12A650)

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

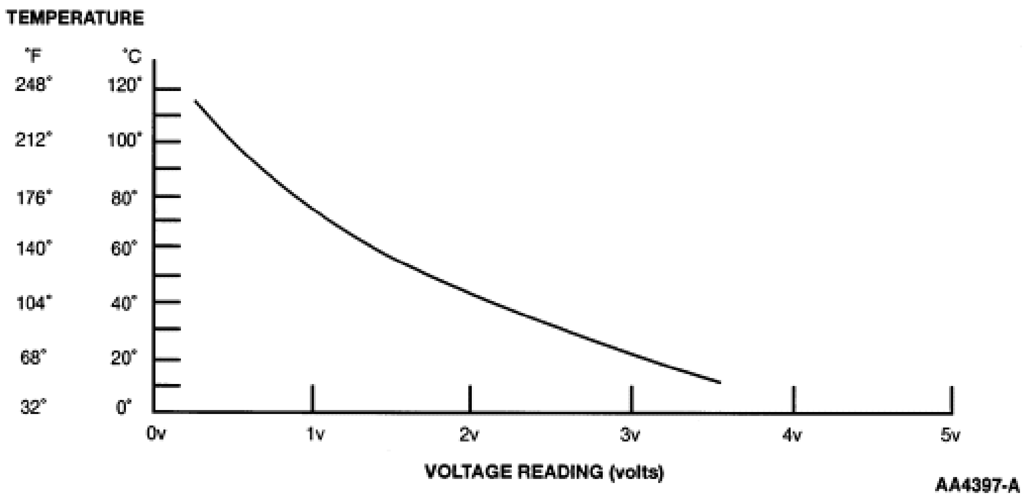

Fig. 73: Temperature Sensor Temperature To Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

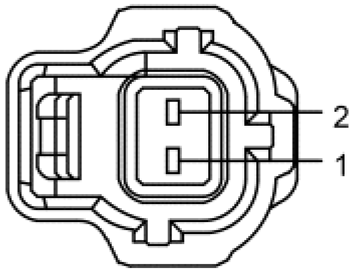

Fig. 74: Canister Vent (CV) Solenoid Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	IAT2 (Intake Air Temperature 2)

Connector	Pin	Circuit
170 Pin	B41, E58, T41 B40, E57 E27	SIGRTN VREF IAT2

TEST PROCEDURE

DU1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0097, P0098, P0127, P1114, or P1115 present?**

Yes	No
For DTCs P0097 or P1114, GO to DU4. For DTCs P0098 or P1115, GO to DU2. For DTC P0127, GO to DU6.	For all others, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DU2 CHECK FOR AN OPPOSITE SIGNAL TO THE PCM

- The DTC indicates the sensor signal is greater than the self-test maximum.
- IAT2 Sensor connector disconnected.
- Key ON, engine OFF.
- Connect a 5 amp fused jumper wire between the following:

Point A IAT2 Sensor Connector, Harness	

Side	Point B IAT2 Sensor Connector, Harness Side
IAT2 - Pin 1	SIGRTN - Pin 2

- Access the PCM and monitor the IAT2 PID.
- **Is the voltage less than 0.2 V?**

Yes	No
INSTALL a new IAT2 sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DU3.

DU3 CHECK THE SENSOR SIGNAL FOR A SHORT TO VREF

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
IAT2 - Pin E27	VREF - Pin B40, E57

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DU10.	REPAIR the short circuit to VREF. CLEAR the DTCs. REPEAT the self-test.

DU4 DTC P1114: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- The DTC indicates the sensor signal is less than the self-test minimum.
- IAT2 Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the IAT2 PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
INSTALL a new IAT2 sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DU5.

DU5 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- Key in OFF position.

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
IAT2 - Pin E27	SIGRTN - Pin B41, E58, T41

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
IAT2 - Pin E27	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DU10.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DU6 DTC P0127: CHECK CHARGE AIR COOLER PUMP (CAC) OPERATION

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- **Does the CAC pump run?**

Yes	No
GO to DU7.	DIAGNOSE the charge air cooler (CAC) pump. GO to KP9.

DU7 CHECK THE CHARGE AIR COOLER (CAC) SYSTEM

- Check the CAC system for low fluid level, cracked, blocked or misrouted coolant lines, cracked or blocked heat exchanger.
- **Is a concern present?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** , Supercharger Cooling to diagnose a loss of coolant. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DU8.

DU8 SIMULATE THE HIGH IAT2 SIGNAL TO THE PCM

- Key ON, engine OFF.
- Access the PCM and monitor the IAT2 PID.
- Observe the PID while disconnecting the IAT2 sensor.
- **Is the voltage greater than 4.2 V?**

Yes	No
GO to DU9.	GO to DU10.

DU9 SIMULATE THE LOW IAT2 SIGNAL TO THE PCM

- Key in OFF position.
- IAT2 Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A IAT2 Sensor Connector, Harness Side	Point B IAT2 Sensor Connector, Harness Side
IAT2 - Pin 1	SIGRTN - Pin 2

- Key ON, engine OFF.
- Access the PCM and monitor the IAT2 PID.
- **Is the voltage less than 0.2 V?**

Yes	No
CONNECT the sensor and GO to the **REFERENCE VALUES** article, Reference Values. COMPARE the IAT2 PID to reference values under different road test conditions. If the sensor is not in range, INSTALL a new IAT2 sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DU10.

DU10 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DV: THROTTLE BODY ASSEMBLY ELECTRONIC THROTTLE CONTROL (ETC)

INTRODUCTION

WARNING: **Substantial opening and closing torque is applied by this system. To prevent injury, be careful to keep fingers away from throttle mechanism when actuated. Failure to follow these instructions may result in personal injury.**

NOTE: The voltage of the TP2 circuit and PID reaches a limit of approximately 4.5 volts at approximately 45 degrees of throttle angle.

This pinpoint test is intended to diagnose the following:

- electronic throttle body (ETB) (9F991)
- electronic throttle body throttle position sensor (ETBTPS) (9E928)
- harness circuits: ETCRTN, ETCREF, TP1, TP2, TACM+, and TACM-
- powertrain control module (PCM) (12A650)

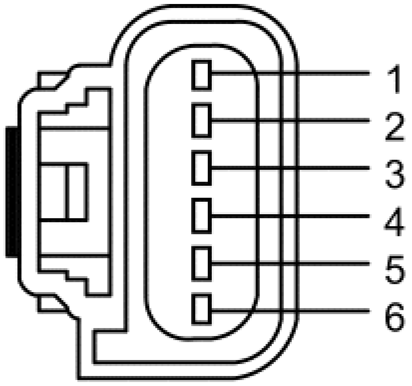

Fig. 75: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

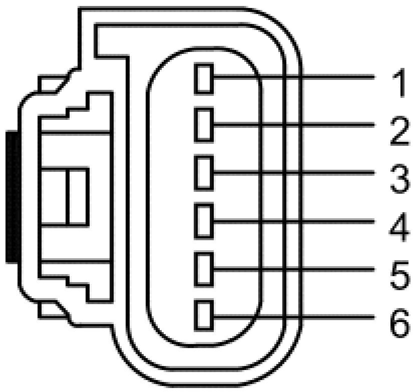

Fig. 76: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - B
Courtesy of FORD MOTOR CO.

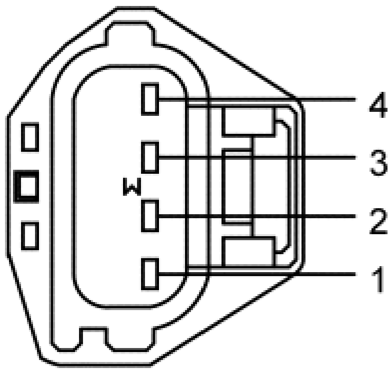

Fig. 77: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus, Taurus X	A	4 1 2 3	TP2 TP1 ETCRTN ETCREF

Fusion 2.3L, Milan 2.3L	B	4 6 3 5	TP2 TP1 ETCRTN ETCREF
Fusion 3.0L, Milan 3.0L	B	6 3 4 5	TP2 TP1 ETCRTN ETCREF
All other vehicles	C	1 4 3 2	TP2 TP1 ETCRTN ETCREF

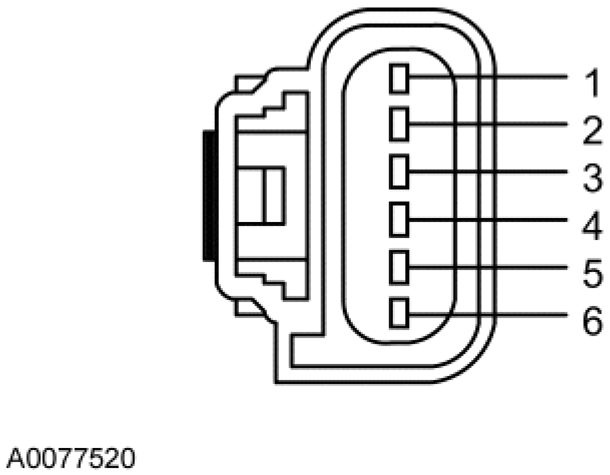

Fig. 78: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

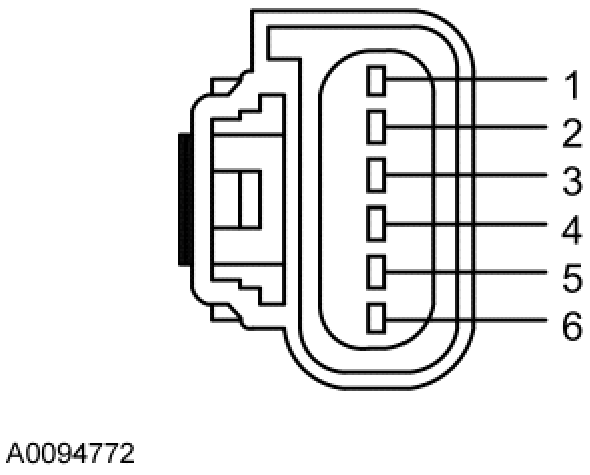

Fig. 79: Electronic Throttle Body Throttle Actuator Control Motor (ETBTACM) Connector - B

Courtesy of FORD MOTOR CO.

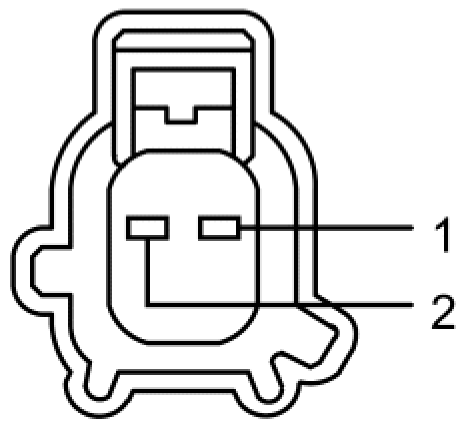

Fig. 80: Electronic Throttle Body Throttle Actuator Control Motor (ETBTACM) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus, Taurus X	A	6 5	TACM- TACM+
Fusion 2.3L, Milan 2.3L	B	2 1	TACM- TACM+
Fusion 3.0L, Milan 3.0L	B	1 2	TACM- TACM+
All other vehicles	C	2 1	TACM- TACM+

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Mustang, Town Car	170 Pin	B24, B4, E66 B41, B6, E59 B35 B47 E51	ETCREF ETCRTN VPWR PWRGND TACM-

		E34 E60 E61	TACM+ TP2 TP1
E-Series, F-Super Duty	170 Pin	B16, B4, E66 B18, B6, E59 B35 B47 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
Expedition, Navigator	140 Pin	B21, B28, E66 B59, B65, E59 B51 B67 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B24, B4, E66 B43, B6, E59 B35 B47 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
F-150, Mark LT	190 Pin	B21, B28, E66 B58, B59, E59 B51 B67 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
Focus	190 Pin	B45, B61, E59 B44, B60, E60 B67 B69 E51 E34 E45 E44	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1
Fusion, Milan, MKZ	140 Pin	B21, B28, E66 B59, B60, E59 B51 B67	ETCREF ETCRTN VPWR PWRGND

		E51 E34 E60 E61	TACM- TACM+ TP2 TP1
All other vehicles	190 Pin	B21, B28, E66 B59, B65, E59 B51 B67 E51 E34 E60 E61	ETCREF ETCRTN VPWR PWRGND TACM- TACM+ TP2 TP1

TEST PROCEDURE

DV1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: Diagnose and repair ETBTPS circuit DTCs before addressing DTC P0068.

- **Are DTCs P0068, P0121, P0122, P0123, P0221, P0222, P0223, P1124, P2100, P2101, P2107, P2111, P2112, or P2135 present?**

Yes	No
For DTC P0068, GO to DV12. For DTCs P0121, P0122, P0123, P0221, P0222, P0223, P2111, or P2112, GO to DV3. For DTC P1124, GO to DV2. For DTC P2100, GO to DV19. For DTC P2101, GO to DV27. For DTC P2107, GO to DV18. For Fusion and Milan with DTC P2135, GO to DV6. For all others with DTC P2135, GO to DV7.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DV2 DTC P1124: REPEAT THE KOEO OR KOER SELF-TEST

NOTE: Make sure the accelerator pedal is not applied during the KOEO and KOER self-tests.

- Key ON, engine OFF.
- Carry out the self-test.
- **Are any DTCs present other than P1124?**

Yes	No
DISREGARD the current diagnostic trouble code	GO to DV3.

(DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	

DV3 CHECK THE THROTTLE POSITION (TP) OPEN AND CLOSED VOLTAGES

NOTE: Certain failure mode effects management (FMEM) operating strategies maintain limited vehicle function in the event of a PCM, harness, or component concern and may prevent the throttle plate from opening. If the throttle plate does not open, follow the NO answer.

- Key ON, engine OFF.
- Access the PCM and monitor the TP1 and TP2 PIDs.
- Press the accelerator pedal to the floor and release.

ELECTRONIC THROTTLE CONTROL THROTTLE POSITION SENSOR SIGNAL VOLTAGES

Accelerator Pedal Position	TP1	TP2
Pedal fully released	3.7 - 4.7	0.3 - 1.9
Pedal fully applied	0.7 - 2.9	4.1 - 4.7

- **Are both PIDs within the chart ranges?**

Yes	No
For DTCs P2111 or P2112, GO to DV4. For all others, GO to DV17.	GO to DV4.

DV4 CHECK FOR OBSTRUCTION OF THE THROTTLE BODY

WARNING: **Substantial opening and closing torque is applied by this system. To prevent injury, be careful to keep fingers away from throttle mechanism when actuated. Failure to follow these instructions may result in personal injury.**

- Key in OFF position.
- Remove the inlet tube from the throttle body.
- Visually inspect for throttle plate obstructions or engine deposits.
- Slowly, push the throttle plate to wide open and release.
- **Does the throttle plate move freely to wide open and back?**

Yes	No
For continuous memory DTCs P0121, P0122, P0123, P0221, P0222, or P0223 alone or together,	ISOLATE and REPAIR the obstruction. CLEAR the DTCs. REPEAT the self-test.

GO to DV5. For DTCs P2111, P2112 or continuous memory DTCs P2100, P2101, or P2107 alone or together, GO to DV19. For Fusion and Milan with all other DTCs, GO to DV6. For all others, GO to DV7.	

DV5 CHECK THE VREF VOLTAGE TO TP

- ETBTPS connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
ETCREF	ETCRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
For Fusion and Milan, GO to DV6. For all others, GO to DV7.	refer to **PINPOINT TEST C**.

DV6 FUSION, MILAN: CHECK THE RESISTANCE OF THE ETBTPS

NOTE: Do not move the throttle plate during the resistance measurement. Measure the sensor resistance with the throttle plate at the default position.

- Key in OFF position.
- ETBTPS connector disconnected.
- For Fusion 2.3L and Milan 2.3L, measure the resistance between:

(+) ETBTPS Connector, Component Side	(-) ETBTPS Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
ETCREF	ETCRTN	2,000	4,000

- For Fusion 3.0L and Milan 3.0L, measure the resistance between:

(+) ETBTPS Connector, Component Side	(-) ETBTPS Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
TP1	ETCREF	380	987

TP1	ETCRTN	665	1,890
TP2	ETCREF	608	1,932
TP2	ETCRTN	390	1,187
ETCREF	ETCRTN	475	1,365

- **Are all the resistances within specifications?**

Yes	No
GO to DV8.	INSTALL a new ETB. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test.

DV7 ALL OTHERS: CHECK THE RESISTANCE OF THE ETBTPS

NOTE: **Do not move the throttle plate during the resistance measurement. Measure the sensor resistance with the throttle plate at the default position.**

- ETBTPS connector disconnected.
- Measure the resistance between:

(+) ETBTPS Connector, Component Side	(-) ETBTPS Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
TP1	ETCREF	700	1,800
TP1	ETCRTN	1,300	2,800
TP2	ETCREF	1,000	2,400
TP2	ETCRTN	500	1,500
ETCREF	ETCRTN	700	2,100

- **Are all the resistances within the specifications?**

Yes	No
GO to DV8.	For E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus, and

	Taurus X, INSTALL a new ETB. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test. For all others, INSTALL a new ETBTPS. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** to INSTALL a new TP sensor. CLEAR the DTCs. REPEAT the self-test.

DV8 CHECK THE TP1 AND TP2 CIRCUITS FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-)
TP1	Ground
TP2	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to DV9.

DV9 CHECK THE TP1 AND TP2 CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) PCM Connector, Harness Side
TP1	TP1
TP2	TP2

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DV10.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DV10 CHECK THE TP1 AND TP2 CIRCUITS FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) Vehicle Battery
TP1	Negative terminal
TP2	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DV11.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV11 CHECK THE TP CIRCUITS FOR A SHORT TOGETHER

- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
TP1	TP2
TP1	ETCREF
TP1	ETCRTN
TP2	ETCREF
TP2	ETCRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DV14.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV12 DTC P0068: CHECK FOR DTCS

- Carry out the self-test.
- **Are DTCs P0121, P0122, P0123, P0221, P0222, P0223 or P2135 present?**

Yes	No
For DTCs P0121, P0122, P0123, P0221, P0222, and P0223, GO to DV3. For Fusion and Milan with DTC P2135, GO to DV6. For all others with DTC P2135, GO to DV7.	GO to DV13.

DV13 CHECK FOR INLET AIR LEAKS

- Check the air inlet system for leaks.
- Listen for air noise around the mass air flow (MAF) sensor and throttle body while the engine is running.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DV14.

DV14 CHECK FOR A TP2 SIGNAL HIGH VERSUS LOAD WHILE DRIVING THE VEHICLE

- ETBTPS connector connected.
- PCM connector connected.
- Key ON, engine running.
- Access the PCM and monitor the TP2 PID.
- Access the PCM and monitor the LOAD PID.
- Drive the vehicle while exercising the throttle and ETCTP sensor and accessing the PIDS.
- **Is the TP2 PID greater than 2.44 volts and the LOAD PID less than 30%?**

Yes	No
GO to DC5.	GO to DV15.

DV15 CHECK FOR A TP2 SIGNAL LOW VERSUS LOAD WHILE DRIVING THE VEHICLE

- Key ON, engine running.
- Access the PCM and monitor the TP2 PID.
- Access the PCM and monitor the LOAD PID.
- Drive the vehicle while exercising the throttle and ETCTP sensor and accessing the PIDS.
- **Is the TP2 PID less than 0.24 volt and the LOAD PID greater than 55%?**

Yes	No
GO to DV16.	GO to DV17.

DV16 CHECK FOR SELF-TEST DTCS

NOTE: After retrieving the continuous memory DTCs, diagnose any non-ETC related DTCs before continuing.

- Key ON, engine OFF.
- Clear the DTCs.
- Drive the vehicle while exercising the throttle.
- Retrieve the continuous memory DTCs.
- **Are any DTCs present?**

Yes	No
For continuous memory DTC P0068, CHECK the MAF sensor and connector for damage and corrosion. REPAIR as necessary.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

CLEAR the DTCs. REPEAT the self-test. For E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, Fusion, Milan, MKX, MKZ, Sable, Taurus, and Taurus X with DTC P2135, INSTALL a new ETB. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test. For all others with DTC P2135, INSTALL a new ETBTPS. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** to INSTALL a new TP sensor. CLEAR the DTCs. REPEAT the self-test. For all others, GO to DV17.	

DV17 CHECK THE TP CIRCUITS FOR AN INTERMITTENT CONCERN

- Access the PCM and monitor the TP1 and TP2 PIDs.
- Wiggle, shake, and bend the harness from the TP to the PCM.
- **Are the voltages between 0.49 - 4.65 V?**

Yes	No
GO to DV29.	REPAIR as necessary. If DTC P2100 or P2101 is present, GO to DV19.

DV18 DTC P2107: CHECK FOR OTHER SELF-TEST DTCS

NOTE: **The DTC P2107 may set when a failure mode effects management (FMEM) action is taken. If the FMEM DTC P2110 is present with other DTCs, diagnose the other DTCs before diagnosing the DTC P2110.**

- Key ON, engine OFF.
- Check for self-test DTCs.
- **Are any DTCs present other than P2107 and P2110?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	For DTC P2110, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** and diagnose the DTC. For DTC P2107, GO to DV23.

DV19 VISUALLY INSPECT THE ETB

NOTE: **Make sure the ETB harness connector is properly connected.**

- Key in OFF position.
- Inspect the ETB for damaged housing, harness connector, and harness.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DV20.

DV20 CHECK THE TACM FOR A SHORT OR OPEN

- ETBTACM connector disconnected.
- Measure the resistance between:

(+) ETBTACM Connector, Component Side	(-) ETBTACM Connector, Component Side
TACM+	TACM-

- **Is the resistance between 1 ohm - 900 ohms?**

Yes	No
GO to DV21.	INSTALL a new ETB. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test.

DV21 CHECK THE TACM HARNESS FOR AN OPEN

- PCM connector disconnected.
- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) PCM Connector, Harness Side
TACM+	TACM+
TACM-	TACM-

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DV22.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DV22 CHECK THE TACM+ AND TACM- CIRCUITS FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-)
TACM+	Ground
TACM-	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DV23.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV23 CHECK THE HARNESS FOR A SHORT TO GND, PWR, ETCREF, AND ETCRTN

- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) PCM Connector, Harness Side
TACM+	PWRGND
TACM+	VPWR
TACM+	ETCRTN
TACM+	ETCREF
TACM-	PWRGND
TACM-	ETCRTN
TACM-	VPWR
TACM-	ETCREF

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DV24.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV24 CHECK FOR TACM HARNESS CIRCUITS SHORTED TOGETHER

- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) ETBTACM Connector, Harness Side
TACM+	TACM-

- **Is the resistance greater than 10K ohms?**

Yes	No
For DTCs P2111 or P2112, GO to DV25. For all others, GO to DV26.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DV25 CHECK FOR AN INTERMITTENT CONCERN

- ETBTACM connector connected.
- PCM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the TP1 and TP2 PIDs.
- Wiggle, shake, and bend the harness from the TP to the PCM.
- **Are the voltages between 0.49 - 4.65 V?**

Yes	No
GO to DV26.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DV26 CHECK FOR SELF-TEST CODES

- ETBTACM connector connected.
- PCM connector connected.
- Key ON, engine OFF.
- Carry out the self-test.
- **Is DTC P2101 present?**

Yes	No
GO to DV27.	GO to DV29.

DV27 CHECK FOR PROPER TACM+ WIRING IN THE HARNESS CONNECTOR

- Key in OFF position.
- ETBTACM connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) PCM Connector, Harness Side
TACM+	TACM+

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DV28.	REPAIR the open circuit. WIRE the TACM harness connector per the TACM and PCM connector diagrams. CLEAR the DTCs. REPEAT the self-test.

DV28 CHECK FOR PROPER TACM- WIRING IN THE HARNESS CONNECTOR

- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) PCM Connector, Harness Side
TACM-	TACM-

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DV30.	GO to DV29.

DV29 CHECK THE REPAIR THROUGH PROCEDURE

- Key ON, engine OFF.
- Record and clear the DTCs.
- Cycle the accelerator pedal to the floor and back several times.
- Check for self-test DTCs.
- **Are any ETC system related DTCs present?**

Yes	No
GO to DV30.	refer to **PINPOINT TEST Z**.

DV30 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DW: HEATED OXYGEN SENSOR (HO2S)

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

WARNING: While conducting tests on a hot engine take all safety precautions to prevent skin contact with hot engine components. Failure to follow these instructions may result in personal injury.

This pinpoint test is intended to diagnose the following:

- HO2S/O2S (9F472)
- HO2S/O2S (9G444)
- harness circuits: HO2S, HO2S Heater, VPWR, and SIGRTN
- powertrain control module (PCM) (12A650)

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

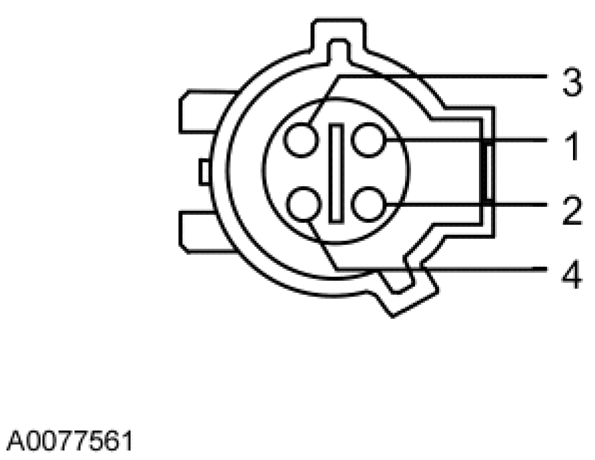

Fig. 81: Heated Oxygen Sensor-Front (HO2S-Front) Connector - A
Courtesy of FORD MOTOR CO.

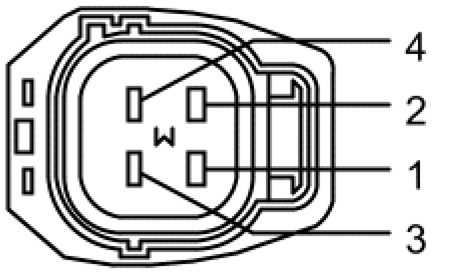

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Fig. 82: Heated Oxygen Sensor-Front (HO2S-Front) Connector - B
Courtesy of FORD MOTOR CO.

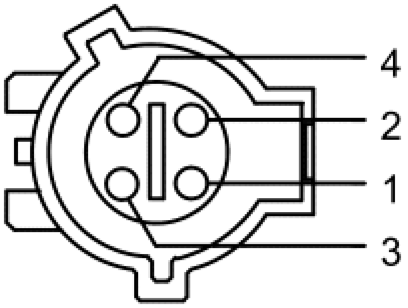

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Fig. 83: Heated Oxygen Sensor-Front (HO2S-Front) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, F-150, Grand Marquis, Mark LT, Mustang, Ranger, Town Car	A	2 4 3 1	VPWR SIGRTN HO2S Signal HO2S Heater
Focus	B	1 3 4	VPWR SIGRTN HO2S Signal

		2	HO2S Heater
All other vehicles	C	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

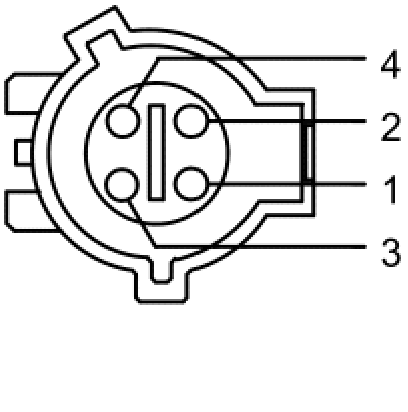

Fig. 84: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - A
Courtesy of FORD MOTOR CO.

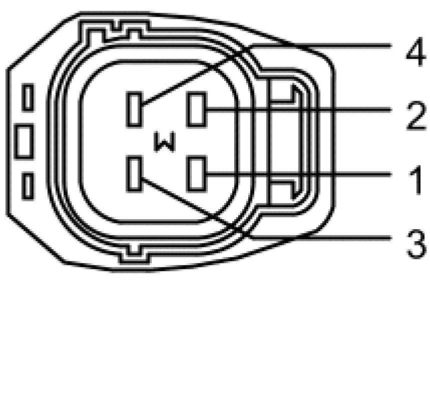

Fig. 85: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - B
Courtesy of FORD MOTOR CO.

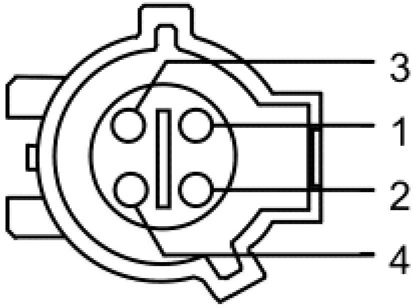

Fig. 86: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner, F-150, Mark LT	A	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater
Focus	B	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater
All other vehicles	C	2 4 3 1	VPWR SIGRTN HO2S Signal HO2S Heater

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, E-Series 5.4L Cutaway or stripped chassis	170 Pin	E28 E69 E29 E70 T24 T47 T25 T48 B14 B38 B35, B36	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 HO2S13 HTR13 VPWR

		B41, E58, T41	SIGRTN
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	E29 E69 E28 E70 E23 E1 E24 E2 B51, B52, B53 B58, E58	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN
Escape/Mariner 3.0L	150 (50-50-50) Pin	E30 E49 E26 E48 T24 T47 T25 T48 B35, B36 B41, E41, T41	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN
Escape/Mariner 2.3L	150 (50-50-50) Pin	E30 E49 T24 T47 B35, B36 B41, E41, T41	HO2S11 HTR11 HO2S12 HTR12 VPWR SIGRTN
Expedition, Navigator	140 Pin	E29 E69 E28 E70 B39 B10 B40 B11 B51, B52, B53 B58, E58	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN
F-150, Mark LT	190 Pin	E29 E69 E28 E70 T22 T1 T21 T12 B51, B52, B53 B58, E58, T43	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN

F-Super Duty 6.8L Narrow frame	170 Pin	E28 E69 E29 E70 B14 B38 B35, B36 B41, E58, T41	HO2S11 HTR11 HO2S21 HTR21 HO2S13 HTR13 VPWR SIGRTN
Focus 2.0L PZEV	190 Pin	E11 E52 T16 T18 T7 T25 B67, B68 B58, E64, T40	HO2S11 HTR11 HO2S12 HTR12 HO2S13 HTR13 VPWR SIGRTN
Focus 2.0L	190 Pin	E11 E52 T16 T18 B67, B68 B58, E64, T40	HO2S11 HTR11 HO2S12 HTR12 VPWR SIGRTN
Fusion 3.0L, Milan 3.0L, MKZ	140 Pin	E28 E69 E29 E70 E3 E23 E4 E24 B51, B52 B58, E58	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN
Fusion 2.3L, Milan 2.3L	140 Pin	E28 E69 E3 E23 B51, B52 B58, E58	HO2S11 HTR11 HO2S12 HTR12 VPWR SIGRTN
Fusion 2.3L PZEV, Milan 2.3L PZEV	140 Pin	E28 E69 E3 E23 E5 E25 B51, B52 B58, E58	HO2S11 HTR11 HO2S12 HTR12 HO2S13 HTR13 VPWR SIGRTN
Ranger 2.3L	170 Pin	E28	HO2S11

		E69 T24 T47 B35, B36 B41, E58, T41	HTR11 HO2S12 HTR12 VPWR SIGRTN
All other vehicles	170 Pin	E28 E69 E29 E70 T24 T47 T25 T48 B35, B36 B41, E58, T41	HO2S11 HTR11 HO2S21 HTR21 HO2S12 HTR12 HO2S22 HTR22 VPWR SIGRTN

TEST PROCEDURE

DW1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0040, P0041, P0053, P0054, P0055, P0059, P0060, P0132, P0133, P0135, P0138, P0139, P0141, P0144, P0147, P0152, P0153, P0155, P0158, P0159, P0161, or P1127 present?**

Yes	No
For DTCs P0040 or P0041, GO to DW2. For DTCs P0053, P0054, P0055, P0059 or P0060, GO to DW14. For DTCs P0132, P0138, P0144, P0152 or P0158, GO to DW20. For DTCs P0133 or P0153, GO to DW3. For DTCs P0135, P0139, P0141, P0147, P0155, P0159 or P0161, GO to DW9. For DTC P1127, GO to DW19.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DW2 KOER DTCS P0040 AND P0041: CROSSED SENSOR WIRES

- Key in OFF position.
- Check the vehicle repair history.
- Verify the HO2S connectors are connected to the correct engine bank.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DW3 CONTINUOUS MEMORY DTCS P0133 AND P0153: CARRY OUT THE KOER SELF-

TEST

- Engine at normal operating temperature.
- Carry out the KOER self-test.
- **Are DTCs P0040, P0041 or P1127 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to DW4.

DW4 CHECK THE HO2S RESPONSE TEST RESULTS

- Key ON, engine OFF.
- Access the diagnostic monitoring test results for the HO2S11 and HO2S21.
- **Is the indicated value greater than the minimum threshold?**

Yes	No
CLEAR the DTCs. GO to DW3.	GO to DW5.

DW5 CHECK FOR UNMETERED AIR LEAKS

NOTE: Fuel calculations can be affected by unmetered air leaks.

- Carefully inspect the following areas for potential air leaks:
  - hoses connecting to the mass air flow (MAF) sensor assembly
  - hoses connecting to the throttle body
  - intake manifold gasket leaks
  - PCV system
  - the vacuum lines are disconnected
  - improperly seated engine oil dipstick, tube or oil fill cap
  - exhaust leaks at flanges and gaskets
- **Are any air leaks present?**

Yes	No
REPAIR the source of the air leak. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DW6.

DW6 CHECK THE HO2S CIRCUIT CONTINUITY

NOTE: HO2S is displayed as O2S on the scan tool.

- HO2S connector disconnected.
- Check the connector (both halves) for any water contamination.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1 V?**

Yes	No
INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DW7.

DW7 CHECK THE HO2S CIRCUIT(S) FOR AN OPEN IN THE HARNESS

NOTE: A vehicle hoist may be required to access the HO2S harness.

- Key in OFF position.
- Remove the jumper wire(s).
- Visually inspect the HO2S harness for exposed wiring, water contamination, corrosion, and proper assembly.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DW8.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DW8 CHECK THE HO2S CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	VPWR

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DW9.	GO to DW12.

DW9 DTCS P0135, P0139, P0141, P0147, P0155, P0159 OR P0161: CHECK FOR A SOURCE OF POTENTIAL HO2S CONTAMINATION

- Investigate the following items as potential sources of HO2S contamination:
  - use of unapproved silicon sealers
  - fuel contaminated by silicon additives
  - excessive oil consumption
  - glycol leaking internally in the engine
  - lead-contaminated fuel
  - short drive cycles in cold weather
  - use of unapproved cleaning agents
- **Is a concern present?**

Yes	No
REPAIR the source of the contamination. CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DW10.

DW10 VISUALLY INSPECT THE HO2S HARNESS

- PCM connector connected.
- Visually inspect the HO2S harness for exposed wiring, water contamination, corrosion, and proper assembly.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	For DTCs P0139 or P0159, GO to DW11. For all others, GO to DW12.

DW11 CHECK THE EXHAUST SYSTEM FOR LEAKS AND MODIFICATIONS

- Check for leaks in the exhaust system.
- Visually inspect the vehicle for aftermarket accessories and performance modifications.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DW25.

DW12 CHECK THE HO2S AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

NOTE: **Verify the harness pins are in the proper location.**

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DW13.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DW13 CARRY OUT THE KOEO ON DEMAND SELF-TEST

- Key ON, engine OFF.
- Carry out the KOEO self-test.
- **Are DTCs P0135, P0141, P0147, P0155 or P0161 present?**

Yes	No
GO to DW14.	GO to DW15.

DW14 DTCS P0053, P0054, P0055, P0059 AND P0060: CHECK FOR VPWR IN THE HARNESS

NOTE: **If DTCs P0053, P0054, P0055, P0059, or P0060 are present, test their related circuits individually.**

- Key in OFF position.
- HO2S connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HO2S Connector, Harness Side	(-) HO2S Connector, Harness Side
VPWR	SIGRTN

- **Is the voltage greater than 10 V?**

Yes	No
GO to DW15.	REPAIR the open circuit. CHECK the fuses. CLEAR the DTCs. REPEAT the self-test.

DW15 CHECK THE HO2S HEATER FOR SHORTS IN THE HARNESS

NOTE: **If DTCs P0053, P0054, P0055, P0059, or P0060 are present, test their related circuits individually.**

- Key in OFF position.
- HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) Vehicle Battery
HO2S Heater	Negative terminal

- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Heater	VPWR
HO2S Heater	SIGRTN
HO2S Heater	HO2S Signal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DW16.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DW16 CHECK THE HO2S HEATER CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Heater	HO2S Heater

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DW17.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DW17 CHECK THE INTERNAL RESISTANCE OF THE HO2S HEATER

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Heater	VPWR

- **Is the resistance between 3 - 30 ohms?**

Yes	No
GO to DW18.	INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DW18 CHECK THE HO2S HEATER CIRCUIT FOR AN INTERNAL SHORT TO SIGRTN OR GND

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Heater	SIGRTN

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) Vehicle Battery
HO2S Heater	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DW25.	INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DW19 KOER DTC P1127: EXHAUST TEMPERATURE OUT OF RANGE

NOTE: Address all other DTCs before proceeding.

- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the HO2S Heater PID.
- **Is the PID state ON?**

Yes	No
CARRY OUT the KOER self-test.	RUN the engine until the PID indicates ON. CARRY OUT the KOER self-test.

DW20 DTCS P0132, P0138, P0144, P0152 AND P0158: VISUALLY INSPECT THE HO2S HARNESS

NOTE: Disconnect the suspect HO2S harness connector. Only the suspect HO2S needs to be diagnosed.

- Key in OFF position.
- HO2S connector disconnected.
- Visually inspect the HO2S harness.
  - check the connector (both halves) for contamination
  - make sure the connector pins are fully seated
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DW21.

DW21 CHECK THE HO2S SIGNAL LEVEL TOO HIGH

- HO2S connector connected.
- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage less than 1.1 V?**

Yes	No
GO to DW22.	GO to DW23.

DW22 CARRY OUT A THOROUGH WIGGLE TEST ON THE HO2S HARNESS

- Key in OFF position.

- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.
- Carry out a thorough wiggle test on the HO2S harness.
- **Does the voltage change during the wiggle test?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

DW23 CHECK THE HO2S SIGNAL FOR A SHORT TO VPWR INSIDE THE SENSOR

- Key in OFF position.
- HO2S connector disconnected.
- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage less than 1.1 V?**

Yes	No
INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DW24.

DW24 CHECK THE HO2S CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HO2S Connector, Harness Side	(-)
HO2S Signal	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to DW25.

DW25 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.

- Visually inspect for:
    - pushed out pins
    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DX: ENGINE COOLANT TEMPERATURE (ECT) SENSOR

INTRODUCTION

NOTE: **Engine coolant temperature must be greater than 10°C (50°F) to pass the KOEO self-test and greater than 82°C (180°F) to pass the KOER self-test. to accomplish this, the engine must be at normal operating temperature.**

This pinpoint test is intended to diagnose the following:

- engine coolant temperature (ECT) sensor (12A648)
- harness circuits: ECT and SIGRTN
- powertrain control module (PCM) (12A650)

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

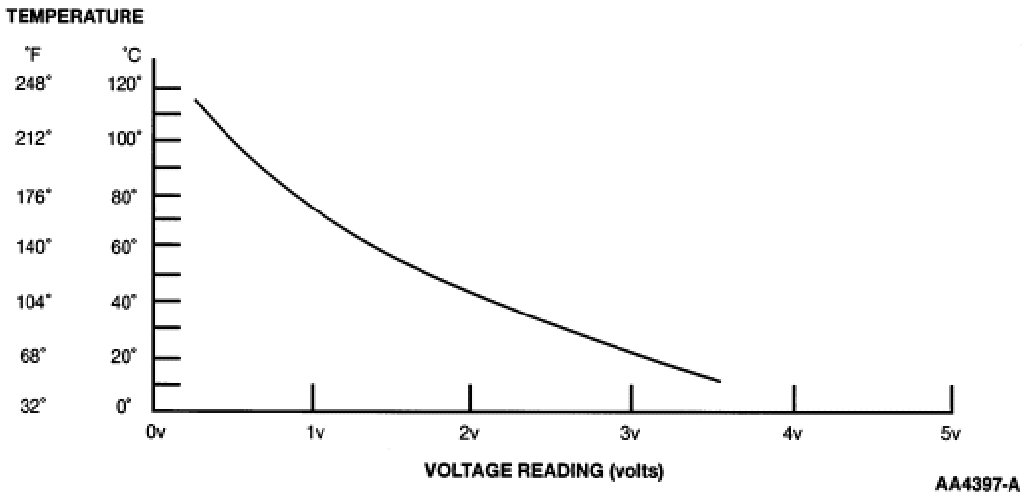

Fig. 87: Temperature Sensor Temperature To Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

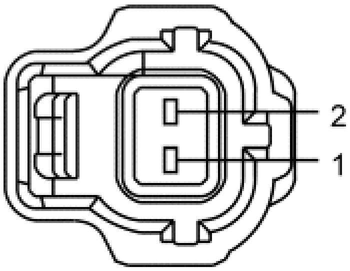

Fig. 88: Engine Coolant Temperature (ECT) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	ECT (Engine Coolant Temperature)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	E40 E41 E21	VREF SIGRTN ECT
Fusion, Milan	140 Pin	E57 E58 E18	VREF SIGRTN ECT
All other vehicles	170 Pin	E57 E58 E18	VREF SIGRTN ECT

TEST PROCEDURE

DX1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0116, P0117, P0118, P0119, P0125, P0128, P0217, P1116, or P1117 present?**

Yes	No
For continuous memory DTC P0116, GO to DX14. For KOEO and KOER DTC P0117, GO to DX12. For continuous memory DTCs P0117, P0118,	For all others, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

P0119, or P1117, GO to DX16. For KOEO and KOER DTC P0118, GO to DX8. For continuous memory DTCs P0125, or P0128, GO to DX19. For DTC P0217, GO to DX21. For KOEO and KOER DTC P1116, GO to DX2.	

DX2 DTC P1116: CHECK THE COOLING SYSTEM

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- The DTC indicates the temperature sensor is out of self-test range. The engine is not at normal operating temperature.
- Check the vehicle coolant level.
- **Is the cooling system OK?**

Yes	No
GO to DX3.	REFER to the **ENGINE COOLING -- E-SERIES** , for loss of coolant diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX3 CHECK IF THE VEHICLE ENGINE STARTS

- Attempt to start the engine.
- **Does the engine start and run normally?**

Yes	No
GO to DX6.	GO to DX4.

DX4 CHECK THE RESISTANCE OF THE ECT SENSOR WITH THE ENGINE OFF

NOTE: **Refer to the chart at the beginning of this test for the resistance specifications.**

- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side

ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to DX5.	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX5 CHECK THE CIRCUIT FROM THE MODULE TO THE COMPONENT

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- ECT Sensor connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the ECT PID.
- Using the data collected from the previous step, compare temperature resistance measured at the sensor to the PID temperature voltage measured at the PCM.
- **Does the measured value at the sensor agree with the measured PID voltage value at the PCM?**

Yes	No
RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to DX10.

DX6 CHECK THE ECT SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.
- Verify the upper radiator hose is hot and the cooling system is pressurized.
- Repeat the KOER self-test.
- **Is DTC P1116 present?**

Yes	No
GO to DX7.	The engine temperature was not stabilized. REPAIR any other DTCs as necessary.

DX7 CHECK THE RESISTANCE OF THE ECT SENSOR

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- The vehicle must be at normal operating temperature.

- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to DX25.	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX8 DTC P0118: CHECK THE ECT SIGNAL CIRCUIT

- The DTC indicates the sensor signal is greater than the self-test maximum.
- ECT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ECT Sensor Connector, Harness Side	(-) ECT Sensor Connector, Harness Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to DX9.	GO to DX10.

DX9 CHECK THE RESISTANCE OF THE ECT SENSOR WITH THE ENGINE OFF

NOTE: **Refer to the chart at the beginning of this test for the resistance specifications.**

- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to DX11.	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX10 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) ECT Sensor Connector, Harness Side
ECT	ECT - Pin 1
SIGRTN	SIGRTN - Pin 2

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DX25.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DX11 CHECK THE SENSOR SIGNAL FOR A SHORT TO VREF

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ECT	VREF

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DX25.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DX12 DTC P0117: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- The DTC indicates the sensor signal is less than the self-test minimum.
- Possible causes:
  - grounded circuit in the harness
  - incorrect harness connections
  - damaged sensor
  - damaged PCM

- ECT Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the ECT PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DX13.

DX13 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ECT	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
ECT	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DX25.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DX14 DTC P0116: CHECK THE RESISTANCE OF THE ECT SENSOR WITH THE ENGINE OFF

NOTE: **Verify the engine temperature is at ambient room temperature before continuing with this test. A soak period of 6 hours may be required. Refer toDIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for information concerning P0116.**

NOTE: **Refer to the chart at the beginning of this test for the resistance specifications.**

- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
GO to DX15.	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX15 DTC P0116: CHECK THE RESISTANCE OF THE ECT SENSOR

NOTE: **Refer to the chart at the beginning of this test for the resistance specifications.**

NOTE: **Verify the engine is at operating temperature before taking the ECT reading.**

- ECT Sensor connector connected.
- Run the engine until the engine temperature stabilizes.
- Key in OFF position.
- ECT Sensor connector disconnected.
- Measure the resistance between:

(+) ECT Sensor Connector, Component Side	(-) ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

- **Is the resistance within specification?**

Yes	No
The concern is not present at this time. CARRY OUT the OBD drive cycle to determine if fuel, HO2S, catalyst and misfire monitors can be executed. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DX16 DTCS P0117, P0118, P0119 OR P1117: INTERMITTENT CHECK

- Key ON, engine OFF.
- Access the PCM and monitor the ECT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock

- Wiggle the sensor connector
- **Is there a large change in the voltage reading?**

Yes	No
DISCONNECT and INSPECT the connector. If OK, INSTALL a new ECT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DX17.

DX17 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

- Access the PCM and monitor the ECT PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there a large change in the voltage reading?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DX18.

DX18 CHECK THE PCM AND VEHICLE HARNESS CONNECTORS

- Key in OFF position.
- PCM connector disconnected.
- ECT Sensor connector disconnected.
- **Are the connectors and terminals OK?**

Yes	No
The concern is not present at this time. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX19 DTCS P0125 OR P0128: CHECK THE ENGINE COOLANT LEVEL

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- The DTC indicates the engine coolant temperature has not achieved the required engine operation temperature level, since start-up within a specified amount of time.

- Possible causes:
    - insufficient warm up time
    - leaking or stuck-open thermostat
    - low engine coolant
- Check the engine coolant level.
- **Is the engine coolant fill level correct?**

Yes	No
GO to DX20.	REFER to the **ENGINE COOLING -- E-SERIES** , for loss of coolant diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX20 CHECK THE SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Access the PCM and monitor the ECT PID.
- **Is the temperature greater than 77°C (170.6°F)?**

Yes	No
The test is complete. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	REFER to the **ENGINE COOLING -- E-SERIES** for cooling system diagnosis. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX21 DTC P0217: INDICATES AN ENGINE OVERHEAT CONDITION

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- Check the engine coolant level.
- **Is the engine coolant fill level correct?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheating condition. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the loss of coolant. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DX22 DTC P0298: ENGINE OIL OVER TEMPERATURE CONDITION

NOTE: The engine oil temperature protection strategy in the PCM is activated. This protects the engine against mechanical damage due to overheating.

- Check for an overheating condition and base engine concerns.
- **Are there any overheating or base engine concerns?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DX23.

DX23 CHECK FOR ECT DTCS

- Carry out the self-test.
- **Are DTCs P0117, P0118, P1116 or P1117 present?**

Yes	No
DISREGARD the engine oil temperature (EOT) diagnostic trouble code (DTC) at this time. ADDRESS the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to DX24.

DX24 ROAD TEST THE VEHICLE AND MONITOR FOR ENGINE OVER TEMPERATURE

- Access the freeze frame data (if available) and record the DTC concern conditions.
- Access the PCM and monitor the ECT PID.
- Test drive the vehicle and allow the engine to reach normal operating temperature.
- Observe the ECT PID.
- **Does the engine overheat?**

Yes	No
REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheat symptom. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. CLEAR the DTCs. REPEAT the self-test.

DX25 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DY: ENGINE OIL TEMPERATURE (EOT) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- engine oil temperature (EOT) sensor (12A648)
- harness circuits: EOT and SIGRTN
- powertrain control module (PCM) (12A650)

Engine oil temperature must be greater than 10°C (50°F) to pass the KOEO self-test and greater than 66°C (150°F) to pass the KOER self-test.

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

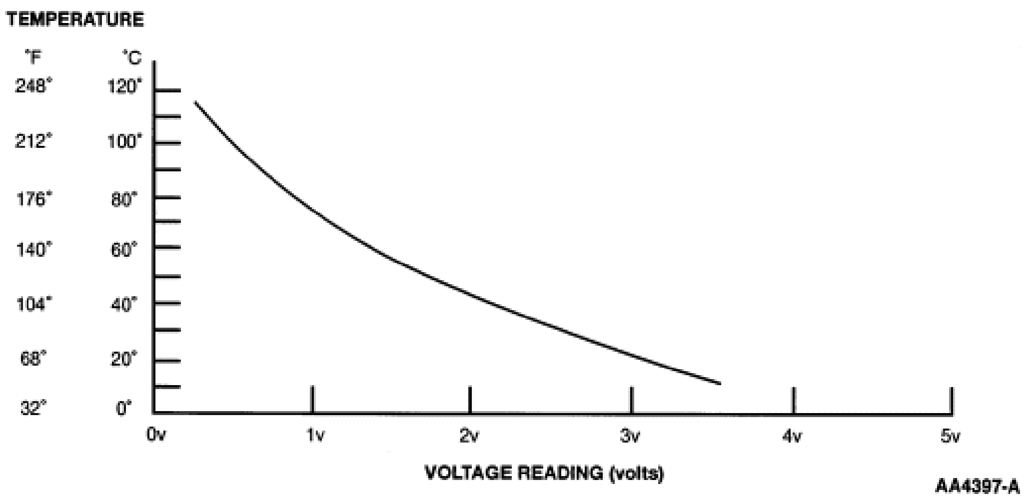

Fig. 89: Temperature Sensor Temperature To Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55

100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

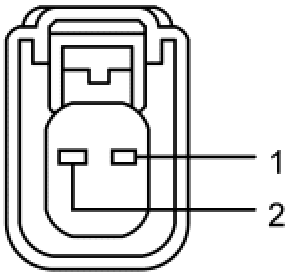

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Fig. 90: Engine Oil Temperature (EOT) Sensor Connector - A
Courtesy of FORD MOTOR CO.

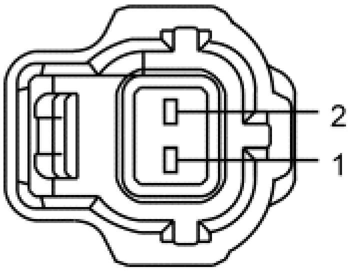

Fig. 91: Engine Oil Temperature (EOT) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Mustang	A	2 1	SIGRTN EOT
All other vehicles	B	2 1	SIGRTN EOT

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
170 Pin	E58 B35 E57 E27	SIGRTN VPWR VREF EOT

TEST PROCEDURE

DY1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0196, P0197, P0198, P0298, or P1184 present?**

Yes	No
For DTCs P0196 or P1184, GO to DY2. For DTCs P0197 or P0198, GO to DY3. For continuous memory DTC P0298, GO to DY14.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DY2 DTCS P0196 OR P1184: CHECK THE EOT SENSOR OPERATION

NOTE: Before continuing with this pinpoint test, verify the engine oil condition and level are within specification.

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Carry out the self-test.
- **Are DTCs P0196 or P1184 present?**

Yes	No
GO to DY3.	The engine temperature was not stabilized. REPAIR any other DTCs as necessary.

DY3 DTCS P0196, P0197, P0198, P1184 OR P0298: CHECK THE TEMPERATURE SENSOR SIGNAL

- Key ON, engine OFF.
- Access the PCM and monitor the EOT PID.
- **Is the voltage less than 0.3 V?**

Yes	No
GO to DY4.	GO to DY6.

DY4 SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- Key ON, engine OFF.
- EOT Sensor connector disconnected.
- Access the PCM and monitor the EOT PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
INSTALL a new EOT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DY5.

DY5 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- PCM connector disconnected.
- Measure the resistance between:

(+) EOT Sensor Connector, Harness Side	(-) EOT Sensor Connector, Harness Side
EOT	SIGRTN

- Measure the resistance between:

(+) EOT Sensor Connector, Harness Side	(-) Vehicle Battery
EOT	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DY18.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DY6 CHECK FOR HIGH EOT SENSOR VOLTAGE

- Access the PCM and monitor the EOT PID.
- **Is the voltage greater than 4.2 V?**

Yes	No
GO to DY7.	GO to DY11.

DY7 CHECK THE EOT CIRCUIT VOLTAGE

- EOT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) EOT Sensor Connector, Harness Side	(-) EOT Sensor Connector, Harness Side
EOT	SIGRTN

- **Is the voltage greater than 4.2 V?**

Yes	No
GO to DY8.	GO to DY10.

DY8 CHECK THE RESISTANCE OF THE EOT SENSOR WITH THE ENGINE OFF

- Key in OFF position.
- EOT Sensor connector disconnected.
- Measure the resistance between:

(+) EOT Sensor Connector, Component Side	(-) EOT Sensor Connector, Component Side
EOT	SIGRTN

- Refer to the chart at the beginning of this test for the resistance specifications.
- **Is the resistance within specification?**

Yes	No
GO to DY9.	INSTALL a new EOT sensor. REFER to the

	ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES . CLEAR the DTCs. REPEAT the self-test.

DY9 CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORTS TO PWR

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EOT - Pin E27	VREF - Pin E57
EOT - Pin E27	VPWR - Pin B35

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DY18.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DY10 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) EOT Sensor Connector, Harness Side
EOT - Pin E27	EOT
SIGRTN - Pin E58	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DY18.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DY11 INTERMITTENT CHECK

- Key ON, engine OFF.
- Access the PCM and monitor the EOT PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock
  - Wiggle the sensor connector
- **Is there a large change in the voltage reading?**

Yes	No
DISCONNECT and INSPECT the connector. REPAIR as necessary. If OK, INSTALL a new EOT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to DY12.

DY12 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

- Access the PCM and monitor the EOT PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there a large change in the voltage reading?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DY13.

DY13 CHECK THE RESISTANCE OF THE EOT SENSOR WITH THE ENGINE RUNNING

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Measure the resistance between:

(+) EOT Sensor Connector, Component Side	(-) EOT Sensor Connector, Component Side
EOT	SIGRTN

- **Is the resistance within specification for the given engine temperature?**

Yes	No
The concern is not present at this time. refer to **PINPOINT TEST Z**.	INSTALL a new EOT sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

DY14 DTC P0298: ENGINE OIL OVER TEMPERATURE CONDITION

NOTE: The engine oil temperature protection strategy in the PCM has been activated. This protects the engine against mechanical damage due to overheating.

- Check for an overheating condition and base engine concerns.

- **Are there any overheating or base engine concerns?**

Yes	No
ISOLATE the concern. REPAIR as necessary. REFER to the **ENGINE COOLING -- E-SERIES** to diagnose the overheat symptom. CLEAR the DTCs. REPEAT the self-test.	GO to DY15.

DY15 CHECK FOR EOT SENSOR HARDWARE

- The engine oil temperature protection strategy in the PCM can be activated with or without an EOT sensor.
- **Does the vehicle have a EOT sensor?**

Yes	No
GO to DY3.	GO to DY16.

DY16 IDENTIFY THE CUSTOMER'S DRIVING HABITS

- Identify the customers driving habits.
- Access the freeze frame data (if available) and record the DTC concern conditions.
- **Does the vehicle appear to have been driven in an incorrect transmission gear or at high RPM for an extended period?**

Yes	No
ADVISE the customer that improper transmission gear selection and high RPM for an extended period initializes the engine protection strategy. CLEAR the DTCs. REPEAT the self-test.	GO to DY17.

DY17 TYPE OF ENGINE COOLANT SENSOR

NOTE: **When an oil temperature sensor is not present, the PCM uses an oil algorithm to infer actual temperature based on input from the engine temperature sensor.**

- **Is the vehicle equipped with cylinder head temperature (CHT) sensor?**

Yes	No
GO to DL26.	GO to DX22.

DY18 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins

 - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DZ: UNIVERSAL HEATED OXYGEN SENSOR (HO2S)

INTRODUCTION

WARNING: **While conducting tests on a hot engine take all safety precautions to prevent skin contact with hot engine components. Failure to follow these instructions may result in personal injury.**

NOTE: Only diagnose the suspect universal HO2S indicated by the DTC.

This pinpoint test is intended to diagnose the following:

- universal HO2S (9Y460)
- harness circuits: UO2S, UO2SGREF, UO2SHTR, UO2SPC, UO2SPCT, and VPWR
- powertrain control module (PCM) (12A650)

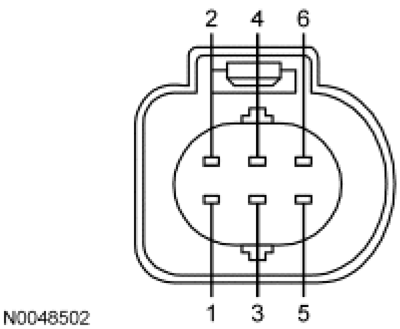

Fig. 92: Universal Heated Oxygen Sensor (HO2S)
Courtesy of FORD MOTOR CO.

Pin	Circuit
5	UO2SPCT (Universal Oxygen Sensor Pumping Current Trim)
1	UO2SPC (Universal Oxygen Sensor Pumping

	Current)
4	VPWR (Vehicle Power)
2	UO2SGREF (Universal Oxygen Sensor Ground Reference)
6	UO2S (Universal Oxygen Sensor)
3	UO2SHTR (Universal Oxygen Sensor Heater)

Pin	Circuit
E18	UO2S11 (Universal Oxygen Sensor Bank 1, Sensor 1)
E20	UO2S21 (Universal Oxygen Sensor Bank 2, Sensor 1)
E19	UO2SGREF11 (Universal Oxygen Sensor Ground Reference Bank 1, Sensor 1)
E21	UO2SGREF21 (Universal Oxygen Sensor Ground Reference Bank 2, Sensor 1)
E69	UO2SHTR11 (Universal Oxygen Sensor Heater Bank 1, Sensor 1)
E70	UO2SHTR21 (Universal Oxygen Sensor Heater Bank 2, Sensor 1)
E4	UO2SPC11 (Universal Oxygen Sensor Pumping Current Bank 1, Sensor 1)
E6	UO2SPC21 (Universal Oxygen Sensor Pumping Current Bank 2, Sensor 1)
E5	UO2SPCT11 (Universal Oxygen Sensor Pumping Current Trim Bank 1, Sensor 1)
E7	UO2SPCT21 (Universal Oxygen Sensor Pumping Current Trim Bank 2, Sensor 1)

TEST PROCEDURE

DZ1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0030, P0040, P0050, P0053, P0059, P0130, P0133, P0134, P0135, P0150, P0153, P0154, P0155, P1127, P2096, P2097, P2098, or P2099 present?**

Yes	No
For DTCs P0030 or P0050, GO to DZ2. For DTC P0040, GO to DZ5. For DTCs P0053, P0059, P0135 or P0155, GO to DZ6. For DTCs P0130 or P0150, GO to DZ11. For DTCs P0133 or P0153, GO to DZ15. For DTCs P0134 or P0154, GO to DZ18. For DTC P1127, GO to DZ19. For DTCs P2096, P2097, P2098 or P2099, GO to DZ20.	For symptoms without DTCs, GO to DZ23. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DZ2 DTCS P0030 AND P0050: CHECK FOR MISFIRE CONCERNS AND AFTERMARKET EQUIPMENT

- Key in OFF position.
- Check for the following:
  - misfire concern
  - non-factory or aftermarket equipment that may increase the exhaust temperature
- Universal HO2S connector disconnected.
- Check the universal HO2S connector for damage or corrosion.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DZ3.

DZ3 CHECK THE UO2SHTR CIRCUIT FOR A SHORT TO VOLTAGE

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Universal HO2S Connector, Harness Side	(-)
UO2SHTR - Pin 3	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to DZ4.

DZ4 CHECK THE UO2S, UO2SGREF, UO2SHTR CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2S - Pin 6	UO2S
UO2SGREF - Pin 2	UO2SGREF
UO2SHTR - Pin 3	HO2S Heater

- **Are the resistances less than 5 ohms?**

Yes	No
INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ5 DTC P0040: CROSSED SENSOR WIRES

- Key in OFF position.
- Check the vehicle repair history.
- Verify the connectors are connected to the correct engine bank.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

DZ6 DTCS P0053, P0059, P0135 AND P0155: CHECK FOR VPWR IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Universal HO2S Connector, Harness Side	(-)
VPWR - Pin 4	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to DZ7.	REPAIR the open circuit. CHECK the fuses. CLEAR the DTCs. REPEAT the self-test.

DZ7 CHECK THE UO2SHTR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness	

Side	(-) PCM Connector, Harness Side
UO2SHTR - Pin 3	UO2SHTR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DZ8.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ8 CHECK THE UO2SHTR CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) Vehicle Battery
UO2SHTR - Pin 3	Negative terminal

- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) Universal HO2S Connector, Harness Side
UO2SHTR - Pin 3	UO2S - Pin 6
UO2SHTR - Pin 3	UO2SGREF - Pin 2
UO2SHTR - Pin 3	UO2SPC - Pin 1
UO2SHTR - Pin 3	UO2SPCT - Pin 5
UO2SHTR - Pin 3	VPWR - Pin 4

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to DZ9.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DZ9 CHECK THE INTERNAL RESISTANCE OF THE UNIVERSAL HO2S HEATER

- Measure the resistance between:

(+) Universal HO2S Connector, Component Side	(-) Universal HO2S Connector, Component Side
VPWR - Pin 4	UO2SHTR - Pin 3

- **Is the resistance between 1.8 - 9 ohms?**

Yes	No
GO to DZ10.	INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS -**

	GASOLINE ENGINES -- E-SERIES . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ10 CHECK THE UO2SHTR CIRCUIT FOR AN INTERNAL SHORT TO GROUND

- Measure the resistance between:

(+) Universal HO2S Connector, Component Side	(-)
UO2SHTR - Pin 3	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to DZ25.	INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ11 DTCS P0130 AND P0150: CHECK THE UO2S AND UO2SGREF CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2S - Pin 6	UO2S
UO2SGREF - Pin 2	UO2SGREF

- **Are the resistances less than 5 ohms?**

Yes	No
GO to DZ12.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ12 CHECK THE UO2S, UO2SGREF, UO2SPC, AND UO2SPCT CIRCUITS FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	**(-)**
UO2S - Pin 6	Ground
UO2SGREF - Pin 2	Ground
UO2SPC - Pin 1	Ground
UO2SPCT - Pin 5	Ground

- **Are the resistances greater than 10K ohms?**

Yes	**No**
GO to DZ13.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DZ13 CHECK THE UO2S, UO2SGREF, UO2SPC, AND UO2SPCT CIRCUITS FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) Universal HO2S Connector, Harness Side	**(-)**
UO2S - Pin 6	Ground
UO2SGREF - Pin 2	Ground
UO2SPC - Pin 1	Ground
UO2SPCT - Pin 5	Ground

- **Is any voltage present?**

Yes	**No**
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to DZ14.

DZ14 CHECK THE UO2SGREF CIRCUIT FOR VOLTAGE

- Key in OFF position.
- PCM connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Universal HO2S Connector, Harness Side	**(-)**
UO2SGREF - Pin 2	Ground

- **Is the voltage between 2.4 - 2.6 V?**

Yes	No
INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DZ25.

DZ15 DTCS P0133 AND P0153: CARRY OUT THE KOER SELF-TEST

- Engine at normal operating temperature.
- Carry out the KOER self-test.
- **Are any DTCs present other than P0133 or P0153?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to DZ16.

DZ16 CHECK FOR A SOURCE OF POTENTIAL CONTAMINATION

- Investigate the following items as potential sources of universal HO2S contamination:
  - use of unapproved silicon sealers
  - fuel contaminated by silicon additives
  - excessive oil consumption
  - glycol leaking internally in the engine
  - lead-contaminated fuel
  - short drive cycles in cold weather
  - use of unapproved cleaning agents
- **Is a concern present?**

Yes	No
REPAIR the source of the contamination. CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DZ17.

DZ17 CHECK THE UNIVERSAL HO2S RESPONSE TEST RESULTS

- Key ON, engine OFF.
- Access the diagnostic monitoring test results for the HO2S11 and HO2S21.

- **Is the indicated value greater than the minimum threshold?**

Yes	No
Unable to duplicate or identify the concern at this time. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ18 DTCS P0134 AND P0154: CHECK THE UO2SPC CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SPC - Pin 1	UO2SPC

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ19 KOER DTC P1127: EXHAUST TEMPERATURE OUT OF RANGE

NOTE: Address all other DTCs before proceeding.

- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the HTR11 and HTR21 PIDs.
- **Are the PID states ON?**

Yes	No

CARRY OUT the KOER self-test.	RUN the engine until the PID indicates ON. CARRY OUT the KOER self-test.

DZ20 DTCS P2096, P2097, P2098 AND P2099: VISUALLY INSPECT THE UPSTREAM AND DOWNSTREAM HO2S CONNECTORS

- Key in OFF position.
- HO2S connector disconnected.
- Universal HO2S connector disconnected.
- Check for a loose connection, and damaged or corroded terminals.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DZ21.

DZ21 CHECK FOR LEAKS IN THE EXHAUST SYSTEM

- Visually inspect the exhaust system for the following:
  - exhaust leaks at flanges and gaskets
  - HO2Ss not tightened to specification
  - physical exhaust system concerns
  - aftermarket exhaust
  - punctures or cracks in the catalytic converter
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to DZ22.

DZ22 CHECK FOR POTENTIAL SENSOR CONTAMINATION CONCERNS

- Investigate the following items as potential sources of universal HO2S contamination:
  - use of unapproved silicon sealers
  - fuel contaminated by silicon additives
  - excessive oil consumption
  - glycol leaking internally in the engine
  - lead-contaminated fuel
  - short drive cycles in cold weather
  - use of unapproved cleaning agents
- **Is a concern present?**

Yes	No

REPAIR the source of the contamination. CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DZ25.

DZ23 CHECK THE UO2SPCT CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SPCT - Pin 5	UO2SPCT

- **Is the resistance less than 5 ohms?**

Yes	No
GO to DZ24.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DZ24 CHECK THE RESISTANCE OF THE CURRENT TRIM RESISTOR IN THE UNIVERSAL HO2S

- Measure the resistance between:

(+) Universal HO2S Connector, Component Side	(-) Universal HO2S Connector, Component Side
UO2SPCT - Pin 5	UO2SPC - Pin 1

- **Is the resistance between 25 - 330 ohms?**

Yes	No
The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** for further direction.	INSTALL a new Universal HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ25 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.

- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST EM: EMISSION COMPLIANCE

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

NOTE: Canada and some states or metropolitan areas in the United States require periodic emission, or inspection/maintenance (I/M) tests. All Ford products are designed to pass these tests. If a Ford product fails an I/M test, it is probably because 1) the engine or catalyst temperature was not warm and stabilized before the test, or 2) the vehicle had idled excessively before the test.

If any new emission components are installed, carry out the following steps before repeating the I/M test procedure:

- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- To relearn some basic adaptive learning (trim) values, run the engine at 2,500 RPM for 1 minute and idle the engine for 2 minutes.

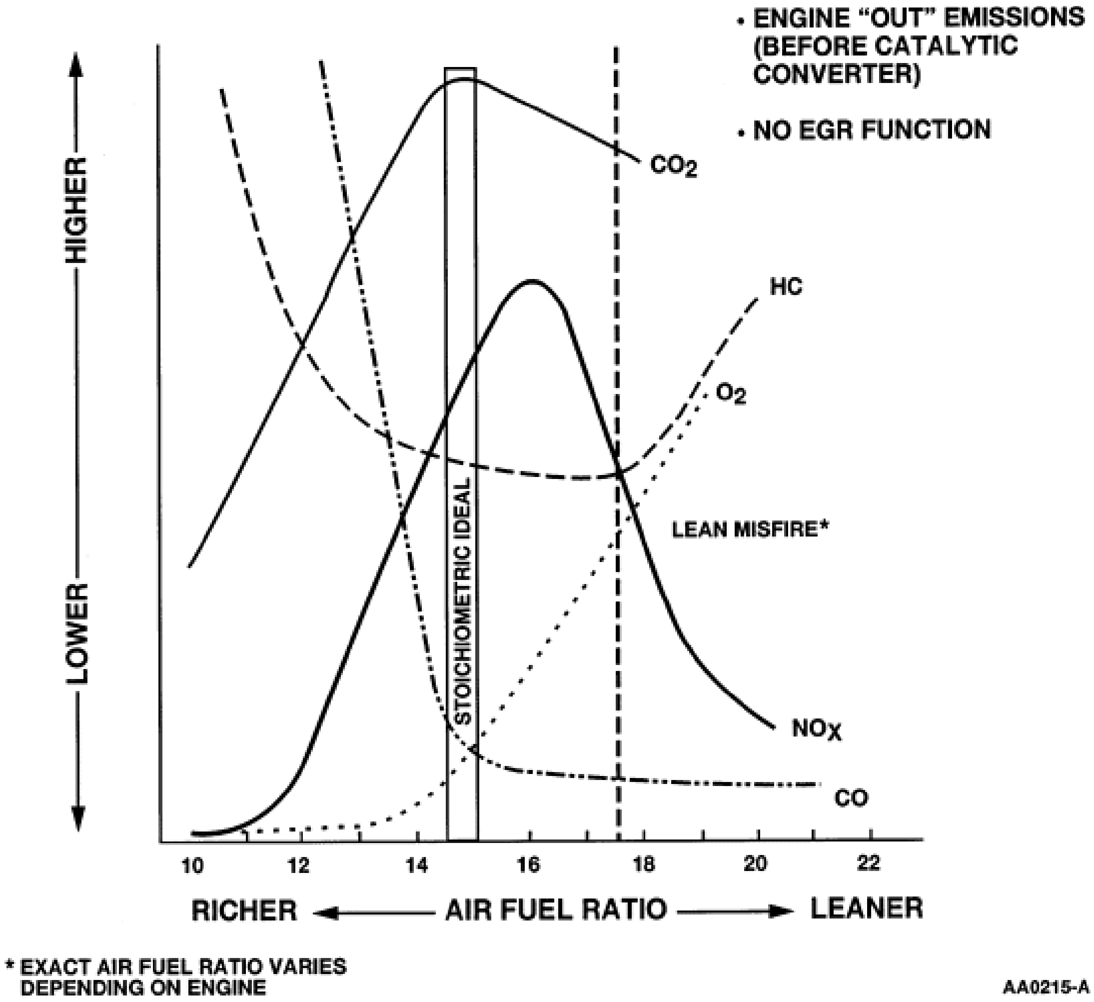

Fig. 93: Exhaust Gas Analysis Chart
Courtesy of FORD MOTOR CO.

Verifying an Excessive Grams Per Mile (GPM) Indication Using a Parts Per Million (PPM) Reading.

For vehicle gas reading(s) that are excessive, compare the actual GPM reading to the gas cut point level needed to pass testing. This gives an indication of how much the PPM reading has to be reduced (if the actual reading is twice the cut point, the baseline reading has to be cut in half or more).

Example:

- The actual HC produced by a vehicle is 1.6 gpm. The cut point for HC in this example is 0.8 gpm. The actual reading is twice the cut point.
- The HC reading obtained for the same vehicle during the baseline drive averages 440 ppm. In order for this vehicle to pass the I/M test, the HC reading from the verification trip must be at least half of the baseline reading, or an average of 220 ppm or less.
- This method only gives a general idea of how much the PPM reading needs to be reduced in order for the vehicle to pass an I/M test that calculates GPM. This test is not exact. Experience still has to be used to

determine if the emission readings are reduced enough for the vehicle to pass the I/M test.

TEST PROCEDURE

EM1 ANALYZE THE I/M TEST REPORT

- Analyze the I/M test report for data entry errors.
  - model
  - model year
  - correct calibration, if included on the report
  - correct test weight, if included on the report (this number is less than the vehicle's GVW)
- Analyze the I/M test report results.
  - identify high and low gas readings.
  - for reports that include a drive trace, identify during which mode the gas(es) failed. Be aware that if all gases were high early then decreased, the catalyst may have been cool when testing began.
- **Has the I/M test report been analyzed?**

Yes	No
GO to EM2.	REPEAT the test step.

EM2 EVAP SYSTEM LEAK OR PURGE FLOW TEST (IF THESE TESTS WERE CARRIED OUT)

- **Does the vehicle fail only an EVAP system leak or purge flow test (if these tests are carried out)?**

Yes	No
This is an EVAP concern only. GO to EM22.	GO to EM3.

EM3 BASELINE THE VEHICLE

NOTE: Baselining the vehicle exhaust gas readings is important so the baseline readings can be used for comparison after any repair is made.

- Baseline the vehicle using an exhaust gas analyzer. If the vehicle must be driven, be certain any baseline drive used is repeatable. The same drive cycle will be used to verify any repair.
- During the baseline, check for any related symptoms that may be present, such as driveability, transmission shifting or exhaust smoke concerns.
- **Has the vehicle been baselined?**

Yes	No
GO to EM4.	REPEAT the test step.

EM4 SYMPTOM CHECKS

- Check if any of the following symptoms are present:
  - transmission concerns
  - idle concerns
  - driveability concerns
  - exhaust smoke
  - cooling system concerns
- **Are any of the symptoms present?**

Yes	No
CARRY OUT the PCM Quick Test. REFER to the **SYMPTOM CHARTS** article, QT: Step 1: Powertrain Control Module (PCM) Quick Test. REFER to the Exhaust Gas Analysis Chart at the beginning of this pinpoint test. After any repair, GO to EM26.	GO to EM5.

EM5 PRELIMINARY CHECKS

- Carry out the following checks:
  - vacuum lines for leaks and blockages
  - electrical connections
  - proper scheduled maintenance
  - Ford authorized emission controls and components installed on the vehicle
  - intake air tube and air cleaner concerns such as obstructions, leaks, or a dirty air cleaner element
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to EM26.	GO to EM6.

EM6 CARRY OUT THE PCM QUICK TEST

- Carry out the PCM Quick Test to access any PCM DTCs. For the procedure information, refer to**PINPOINT TEST QT** .
- **Is a concern present?**

Yes	No
FOLLOW the Quick Test direction. After any repair, GO to EM26.	GO to EM7.

EM7 CHECK FOR EXCESSIVE CARBON MONOXIDE (CO) LEVELS

- **Does the vehicle have excessive CO levels?**

Yes	No
Excessive CO levels indicate the engine is running rich. GO to EM10.	GO to EM8.

EM8 CHECK FOR EXCESSIVE HYDROCARBON (HC) LEVELS

- **Does the vehicle have excessive HC levels?**

Yes	No
Excessive HC levels with low to normal CO levels indicate the engine is running lean. GO to EM16.	GO to EM9.

EM9 CHECK FOR EXCESSIVE OXIDES OF NITROGEN (NOX) LEVELS

- **Does the vehicle have excessive NOx levels?**

Yes	No
GO to EM20.	VERIFY the test step results.

EM10 HIGH CO LEVELS: CHECK THE HC LEVELS

- **Does the vehicle have excessive HC levels?**

Yes	No
CHECK for the engine running rich and incomplete combustion. GO to EM11.	GO to EM12.

EM11 CHECK THE SECONDARY IGNITION SYSTEM

- For ignition coil on plug (COP) equipped vehicles, GO to JB2 and follow the pinpoint test direction.
- For ignition coil pack equipped vehicles, GO to JC2 and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to EM26.	GO to EM12.

EM12 CHECK THE FUEL DELIVERY SYSTEM FOR CONCERNS SUCH AS HIGH FUEL PRESSURE AND THE ABILITY TO HOLD PRESSURE

- refer to **PINPOINT TEST HC** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to EM26.	GO to EM13.

EM13 CHECK FOR VACUUM LEAKS/OBSTRUCTION IN THE PCV SYSTEM (SUCH AS OIL CAP, PCV VALVE, HOSES, CUT GROMMETS, VALVE COVER BOLT TORQUE/GASKET LEAK)

- GO to HG2 and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to EM26.	GO to EM14.

EM14 CHECK THE EXHAUST SYSTEM

- GO to HF2 and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to EM26.	GO to EM15.

EM15 CHECK THE BASE ENGINE

- Check for base engine concerns. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** .
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to EM26.	GO to EM27.

EM16 HIGH HC WITH A NORMAL TO LOW CO LEVEL

- Check the fuel delivery system for concerns. refer to **PINPOINT TEST HC** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No

FOLLOW the pinpoint test direction. After any repair, GO to EM26.	GO to EM17.

EM17 CHECK THE SECONDARY IGNITION

- For ignition coil on plug (COP) equipped vehicles, GO to JB2 and follow the pinpoint test direction.
- For ignition coil pack equipped vehicles, GO to JC2 and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to EM26.	GO to EM18.

EM18 CHECK FOR VACUUM LEAKS/OBSTRUCTION IN THE PCV SYSTEM (SUCH AS OIL CAP, PCV VALVE, HOSES, CUT GROMMETS, VALVE COVER BOLT TORQUE/GASKET LEAK)

- GO to HG2 and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to EM26.	GO to EM19.

EM19 CHECK THE BASE ENGINE

- Check for base engine concerns such as intake manifold leaks, improper compression, or valvetrain or camshaft damage. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** to carry out the intake manifold vacuum test, compression test, and valve train analysis.
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to EM26.	GO to EM27.

EM20 HIGH NOX WITH NORMAL TO LOW HC AND CO LEVELS: CHECK THE BASE ENGINE

- Check for base engine concerns such as excessive carbon build up in the combustion chamber. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** to diagnose the abnormal combustion.
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to EM26.	GO to EM21.

EM21 ADDITIONAL CHECKS

- Check the following:
  - transmission torque converter clutch operation
  - cooling system concerns such as an aftermarket front fascia covering the intake air or intake air system modifications
  - engine running lean concerns such as vacuum leaks or low fuel pressure
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to EM26.	GO to EM27.

EM22 EVAP SYSTEM CONCERN: PRELIMINARY CHECKS

- Analyze the I/M test report to determine when the concern is present. Attempt to verify the concern.
- Check the following:
  - fuel filler cap
  - capless fuel tank filler pipe (if equipped)
  - EVAP system lines/hoses for proper connections, damage or blockage
  - fuel vapor storage canister damage
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to EM25.	GO to EM23.

EM23 CARRY OUT THE PCM QUICK TEST

- Carry out the PCM Quick Test to access any PCM DTCs. For the procedure information, refer to**PINPOINT TEST QT** .
- **Is a concern present?**

Yes	No
FOLLOW the Quick Test direction. After any repair, GO to EM25.	GO to EM24.

EM24 EVAP SYSTEM CHECK

- Check the EVAP system for leaks. Refer to the **EVAPORATIVE EMISSIONS -- E-SERIES** to carry out the evaporative emission system leak test.
- **Is a concern present?**

Yes	No
REPAIR as necessary. After any repair, GO to EM25.	VERIFY the test step results. If all the test steps are OK, refer to **PINPOINT TEST Z**. For additional symptoms, REFER to the **SYMPTOM CHARTS** article. After any repair, GO to EM25.

EM25 EVAP SYSTEM REPAIR VERIFICATION

- Confirm the vehicle repair.
- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . Be aware that this will set DTC P1000 and reset the On-Board System Readiness test.
- To relearn some basic adaptive learning (trim) values, run the engine at 2,500 RPM for 1 minute and idle the engine for 2 minutes.
- Carry out the PCM Quick Test to access any PCM DTCs. For the procedure information, refer to**PINPOINT TEST QT** .
- Carry out the EVAP system leak test and flow check.
- **Does the vehicle pass the EVAP system leak test and flow check?**

Yes	No
SAVE any repair documentation that may be required by local/federal laws. RETURN the vehicle to the customer.	The original concern was not repaired, or another concern exists. GO to EM1.

EM26 REPAIR AND VERIFICATION

NOTE: **If the vehicle needs to be driven for the baseline test, it may be necessary to drive the vehicle first up to 8 km (5 miles) to relearn some additional adaptive learning (trim) values. Also, during the baseline make sure to use the same drive mode that was used for the original baseline test.**

- Confirm the vehicle repair.
- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . Be aware that this will set DTC P1000 and reset the On-Board System Readiness test.
- To relearn some basic adaptive learning (trim) values, run the engine at 2,500 RPM for 1 minute and idle the engine for 2 minutes.
- Carry out the PCM Quick Test to access any PCM DTCs. For the procedure information, refer

to**PINPOINT TEST QT** . Repair any other DTCs.

- Carry out the baseline test using the exhaust gas analyzer.
- For I/M 240 emission testing areas:
  - Refer to the beginning of this pinpoint test for information on verifying an excessive grams per mile indication using a parts per million (PPM) reading.
- All others (original gas concentrations reported in parts per million):
  - Verify the gas levels are within the acceptable range
- **Are all gases within the acceptable range?**

Yes	No
SAVE any repair documentation that may be required by local/federal laws. RETURN the vehicle to the customer.	The gas level is still high, or another gas level is above the acceptable range. GO to EM1.

EM27 CATALYST DELTA TEMPERATURE TEST

- Complete all previous testing.
- Run the engine for 2 minutes at 2,500 RPM to heat the exhaust system.
- Key in OFF position.
- Disconnect and ground 1 spark plug wire from each cylinder bank (for coil-on-plug applications, disconnect the coil connector).
- Run the engine at approximately 1,000 RPM.
- Disconnect the IAC valve and maintain 1,000 RPM (if equipped).
- Measure the surface temperature at both the inlet and outlet of each catalytic converter.
- Compare the difference in temperature between the inlet and outlet readings of each catalytic converter.
- **Does each catalytic converter have a difference of more than 28°C (50°F) between its inlet and outlet reading?**

Yes	No
The catalytic converter(s) is operating correctly. CONNECT the spark plug wire(s) and the IAC (if equipped). CLEAR the DTCs. VERIFY the test step results. If all test steps are OK, refer to **PINPOINT TEST Z**. For additional symptoms, REFER to the **SYMPTOM CHARTS** article. After any repair, GO to EM26.	For catalytic converter(s) that have less than 28°C (50°F) difference, testing indicates the catalytic converter(s) is not working. REPEAT the test to verify the results. If the temperature difference is still less than required, INSTALL a new catalytic converter. After any repair, GO to EM26.

PINPOINT TEST FB: POWER TAKE OFF (PTO)

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- PTO switch
- harness circuit: PTO, PTOIL
- powertrain control module (PCM) (12A650)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
170 Pin	B7 B42 B9 B26	PTORPM PTOIL PTOENG PTO

TEST PROCEDURE

FB1 PTO INDICATOR LAMP

- **Did you come to this pinpoint test for an always on/ never on PTO indicator?**

Yes	No
GO to FB7.	GO to FB2.

FB2 PTO NOT WORKING CORRECTLY: CHECK THE PTO INDICATOR LAMP OPERATION

NOTE: The following conditions must be met before the PTO engages:

- **Engine at normal operating temperature**
- **Accelerator pedal is released**
- **TFT within normal operating temperature**
- **Parking brake is applied**
- **Brake pedal is released**
- **Automatic transmission is in the PARK position**
- **Manual transmission - the clutch pedal is released**

NOTE: This step requires operating the PTO component. Refer to the aftermarket manufacturer for the PTO operating instructions. Follow all safety precautions.

- Key ON, engine running.
- Activate the PTO switch.

- **Does the PTO indicator illuminate?**

Yes	No
GO to the aftermarket PTO mechanical manual.	GO to FB3.

FB3 CHECK THE INTEGRITY OF THE PTO SWITCH AND THE PTO SWITCH CIRCUIT

- Access the PCM and monitor the PTO PID.
- Cycle the PTO switch, from off to on to off.
- **Does the PTO PID change state?**

Yes	No
GO to FB4.	REPAIR the PTO circuit or switch as necessary. CLEAR the DTCs. REPEAT the self-test.

FB4 CHECK THE PTO LOAD PID STATE IN THE PCM

- Access the PCM and monitor the PTOLOAD PID.
- Cycle the PTO switch,
- **Does the PTO LOAD PID change state?**

Yes	No
GO to FB5.	REPAIR the PTO ENG circuit or switch as necessary. CLEAR the DTCs. REPEAT the self-test.

FB5 CHECK THE PTOIR_V PID STATE IN THE PCM

NOTE: **The PTOIR_V PID represents an analog input which reflects the user requested engine speed.**

- Access the PCM and monitor the PTOIR_V PID.
- Cycle the PTO switch,
- **Does the PTOIR_V PID change state?**

Yes	No
GO to FB6.	REPAIR the PTO RPM circuit or switch as necessary. CLEAR the DTCs. REPEAT the self-test.

FB6 CHECK THE PTOIL PID STATE IN THE PCM

- Access the PCM and monitor the PTOIL PID.
- Cycle the PTO switch,
- **Does the PTOIL PID change state?**

Yes	No
GO to FB7.	VERIFY no DTCs are present. VERIFY the vehicle conditions in step FB2 are correct for PTO operation.

FB7 PTO INDICATOR LAMP ALWAYS OFF OR ON: CHECK THE PTOIL_F PID

- Access the PCM and monitor the PTOIL_F PID.
- **Is a concern present?**

Yes	No
REPAIR the circuit as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to the aftermarket PTO mechanical manual.

PINPOINT TEST FD: BRAKE PEDAL INPUTS

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- brake pedal position (BPP) (13480)
- brake pedal switch (BPS) (9F924), (9C872)
- harness circuits: B+, BPP, BPS
- powertrain control module (PCM) (12A650)

Refer to the Wiring Diagrams article for specific vehicle application and pin locations.

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Town Car	170 Pin	B9	BPS
E-Series, F-Super Duty	170 Pin	E65 B8	BPS BPP
Escape/Mariner	150 (50-50-50) Pin	B8	BPP
Expedition, Fusion, Milan, MKZ, Navigator	140 Pin	B47 B46	BPS BPP
Explorer, Explorer Sport Trac, Mountaineer, Mustang	170 Pin	B9 B8	BPS BPP

Focus	190 Pin	B46 B13	BPS BPP
Ranger	170 Pin	B8	BPP
All other vehicles	190 Pin	B47 B46	BPS BPP

TEST PROCEDURE

FD1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0504, P0572, P0573, P0703, P1572, or P1703 present?**

Yes	No
For KOEO or continuous memory DTCs P0504, P0572, P0573, P0703, P1703 and continuous memory DTC P1572, GO to FD3. For KOER DTCs P0703, or P1703, GO to FD2.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

FD2 KOER DTCS P0703 AND P1703: VERIFY THE BRAKE PEDAL WAS APPLIED

- **Was the brake pedal applied and released during the KOER self-test?**

Yes	No
GO to FD3.	REPEAT the KOER self-test. APPLY and RELEASE the brake pedal during the KOER test. CLEAR the DTCs. REPEAT the self-test.

FD3 DTCS P0572, P0573, P0703, P1572 AND P1703: CHECK THE OPERATION OF THE STOPLAMP

- Key ON, engine OFF.
- Apply and release the brake pedal and check the stop lamp operation.
- **Do the stoplamp operate correctly?**

Yes	No
For Crown Victoria, Grand Marquis, Sable, Taurus, Taurus X, and Town Car, GO to FD4. For all others, GO to FD5.	REFER to the **EXTERIOR LIGHTING -- E-SERIES** to diagnose the inoperative stoplamp. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

FD4 CHECK THE BRAKE SWITCH OPERATION

- Key ON, engine OFF.
- Access the PCM and monitor the BPP_BOO PID.

- Apply and release the brake pedal while monitoring the brake position PID.
- **Does the PID cycle ON and OFF?**

Yes	No
GO to FD6.	REFER to the **MODULE COMMUNICATIONS NETWORK -- E-SERIES** to diagnose the powertrain control module (PCM) not responding to the scan tool. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

FD5 CHECK FOR BPP CIRCUIT CYCLING

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Apply and release the brake pedal while monitoring the voltage.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
BPP	Ground

- **Is voltage less than 1 volt with the brake pedal released and greater than 10 volts with the brake pedal fully applied?**

Yes	No
For Ranger, GO to FD7. For all others, GO to FD6.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

FD6 CHECK FOR BPS CIRCUIT CYCLING

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Apply and release the brake pedal while monitoring the voltage.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
BPS	Ground

- **Is voltage greater than 10 volts with the brake pedal released and less than 1 volt with the brake pedal fully applied?**

Yes	No
GO to FD7.	REFER to the **SPEED CONTROL -- E-SERIES** .

	CARRY OUT the diagnostic steps for DTC P1703 to continue diagnose.

FD7 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST FF: POWER STEERING PRESSURE (PSP) SWITCH

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- power steering pressure (PSP) Switch (3N824)
- harness circuits: PSPSW and SIGRTN
- powertrain control module (PCM) (12A650)

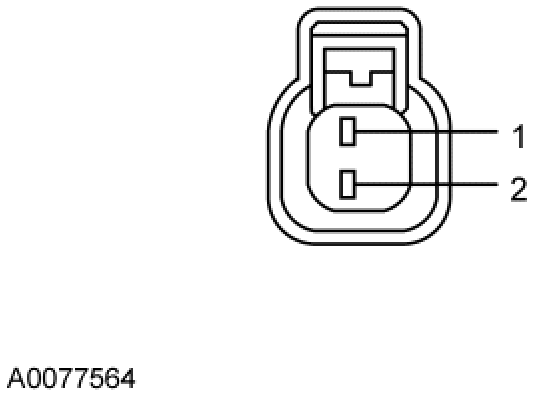

Fig. 94: Positive Crankcase Ventilation Thermal Extension -Harness Side (PCVTE-Harness Side)
Courtesy of FORD MOTOR CO.

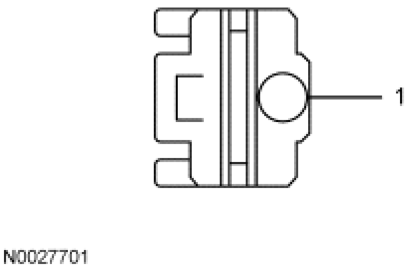

Fig. 95: Power Steering Pressure (PSP) Switch Connector - B
Courtesy of FORD MOTOR CO.

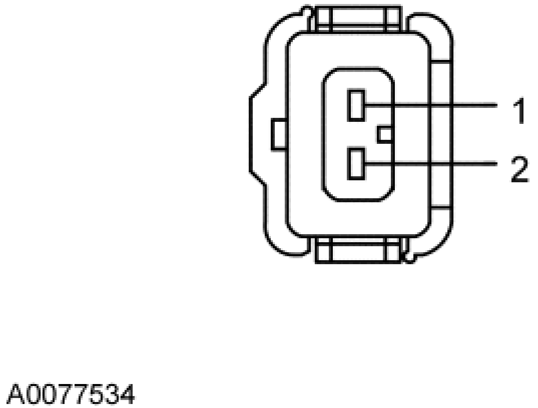

Fig. 96: Power Steering Pressure (PSP) Switch Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Fusion 3.0L, Grand Marquis, Milan 3.0L, Town Car	A	2 1	SIGRTN PSPSW
Edge, Fusion 2.3L, Milan 2.3L, MKX, MKZ	B	1	PSPSW
Ranger	C	2 1	SIGRTN PSPSW
All other vehicles	C	1 2	SIGRTN PSPSW

The PSP and SIGRTN circuits may be reversed in the harness connector. Refer to the Wiring Diagrams article for schematic and connector information.

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, MKX	190 Pin	B17	PSPSW
Explorer, Explorer Sport Trac, Mountaineer	170 Pin	B41 B27	SIGRTN PSPSW
Fusion 3.0L, Milan 3.0L	140 Pin	E58 E65	SIGRTN PSPSW
Fusion 2.3L, Milan 2.3L, MKZ	140 Pin	E65	PSPSW
Ranger	170 Pin	B41 B34	SIGRTN PSPSW
Sable, Taurus, Taurus X	190 Pin	E41 B17	SIGRTN PSPSW
All other vehicles	170 Pin	E58 B34	SIGRTN PSPSW

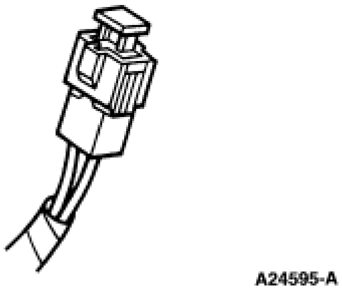

Fig. 97: Shorting Bar For Harness Circuit Without PSP Switch (Typical)
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

FF1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P1650 or P1651 present?**

Yes	No
For KOEO DTC P1650, GO to FF3. For KOER DTC P1650, GO to FF2. For continuous memory DTC P1651, GO to FF7.	For all others, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

FF2 KOER DTC P1650: CARRY OUT TURNING THE STEERING WHEEL ONE HALF TURN

- **Did you turn the steering wheel at least one half turn within 20 seconds of starting the KOER self-test?**

Yes	No
GO to FF3.	CARRY OUT the KOER self-test.

FF3 DTC P1650: CHECK THE PSP PID

- Key ON, engine running.
- Access the PCM and monitor the PSP PID.
- Turn the steering wheel back and forth.
- **Does the PID state change?**

Yes	No
GO to FF7.	GO to FF4.

FF4 CHECK THE PSP CIRCUITS TO THE PSP SWITCH FOR CYCLING

- Key in OFF position.
- PSP Switch connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the PSP PID.

- For Fusion/Milan 2.3L, Edge/MKX or MKZ,
- Connect a 5 amp fused jumper wire between the following:

Point A PSP Switch Connector, Harness Side	Point B
PSPSW	Ground

- For all others,
- Connect a 5 amp fused jumper wire between the following:

Point A PSP Switch Connector, Harness Side	Point B PSP Switch Connector, Harness Side
PSPSW	SIGRTN

- Remove the jumper wire(s).
- **Does the PID state change?**

Yes	No
INSTALL a new PSP switch. CLEAR the DTCs. REPEAT the self-test.	GO to FF5.

FF5 CHECK THE PSP AND SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PSP Switch Connector, Harness Side
PSPSW	PSPSW
SIGRTN	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to FF6.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

FF6 CHECK THE PSP CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Measure the resistance between:

(+) PSP Switch Connector, Harness Side	(-)
PSPSW	Ground

- Measure the resistance between:

(+) PSP Switch Connector, Harness Side	(-) PSP Switch Connector, Harness Side
PSPSW	SIGRTN

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to FF8.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

FF7 DTC P1651: CHECK THE PSP CIRCUIT(S) FOR INTERMITTENT CONCERNS

NOTE: **Be aware that P1651 could be set if the vehicle is towed with the engine running, or if a power steering hydraulic concern is present.**

- Key ON, engine OFF.
- Access the PCM and monitor the PSP PID.
- Check for open circuits while carrying out the following (a concern is indicated by a sudden change in the PCM-PSP PID):
  - Shake, wiggle, and bend the PSP and SIGRTN circuit(s).
  - Lightly tap on the PSP to simulate road shock
- PSP Switch connector disconnected.
- Check the PSP circuit for a short to ground. Shake, wiggle and bend the PSP circuits.
- **Is a concern present?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	CONNECT the PSP switch. Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

FF8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY**	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

(EEPROM) , Programming the VID Block for a Replacement PCM.	

PINPOINT TEST H: FUEL CONTROL

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

WARNING: **While conducting tests on a hot engine take all safety precautions to prevent skin contact with hot engine components. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- HO2S/O2S (9F472)
- HO2S/O2S (9G444)
- fuel injector(s) (9F593)
- harness circuits: HO2S, HO2S Heater, VPWR, and SIGRTN
- vacuum systems
- powertrain control module (PCM) (12A650)

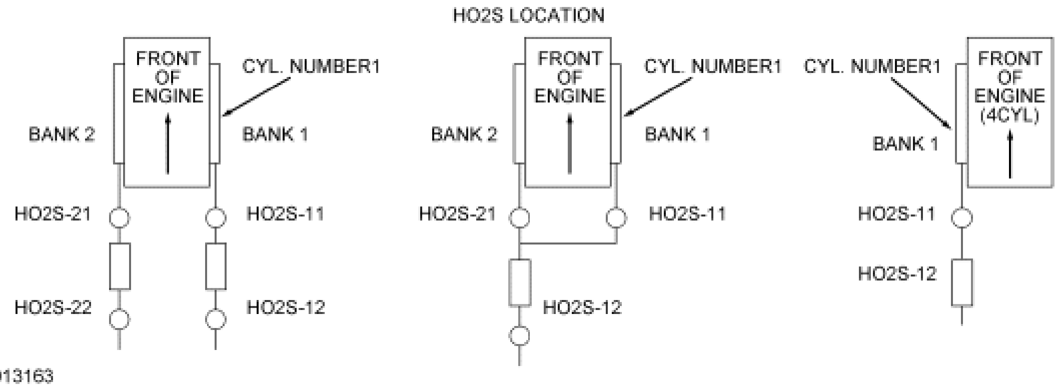

Fig. 98: Identifying HO2S Location (1 Of 2)
Courtesy of FORD MOTOR CO.

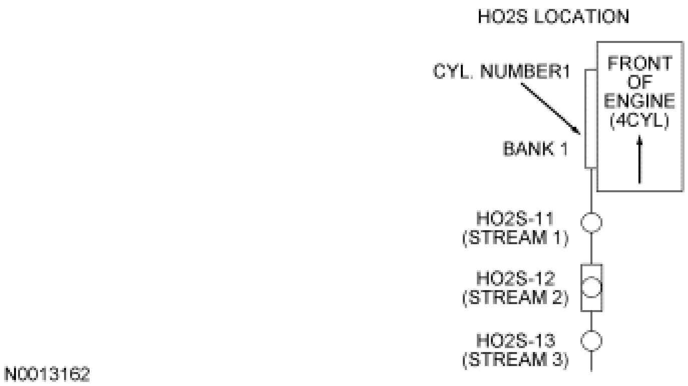

Fig. 99: Identifying HO2S Location (2 Of 2)
Courtesy of FORD MOTOR CO.

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

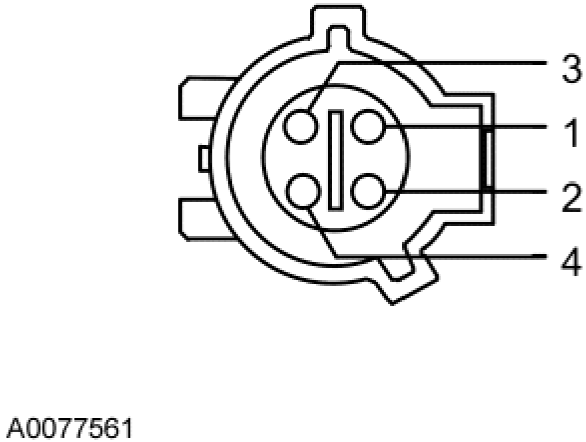

Fig. 100: Heated Oxygen Sensor-Front (HO2S-Front) Connector - A
Courtesy of FORD MOTOR CO.

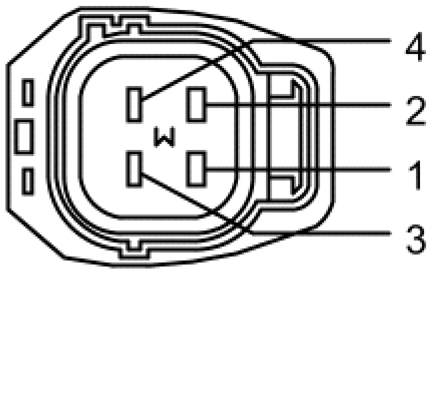

Fig. 101: Heated Oxygen Sensor-Front (HO2S-Front) Connector - B
Courtesy of FORD MOTOR CO.

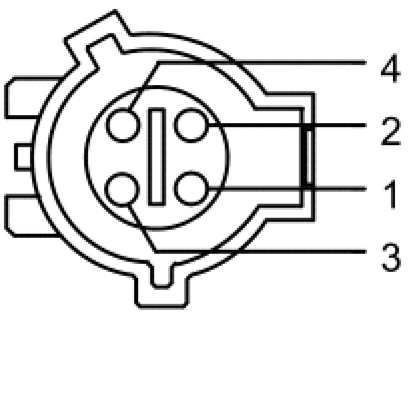

Fig. 102: Heated Oxygen Sensor-Front (HO2S-Front) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, F-150, Grand Marquis, Mark LT, Mustang, Ranger, Town Car	A	2 4 3 1	VPWR SIGRTN HO2S Signal HO2S Heater
Focus	B	1 3 4	VPWR SIGRTN HO2S Signal

		2	HO2S Heater
All other vehicles	C	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

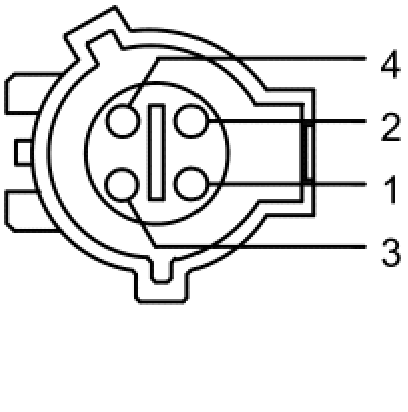

Fig. 103: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - A
Courtesy of FORD MOTOR CO.

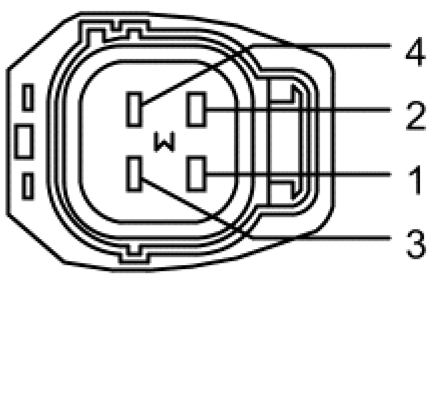

Fig. 104: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - B
Courtesy of FORD MOTOR CO.

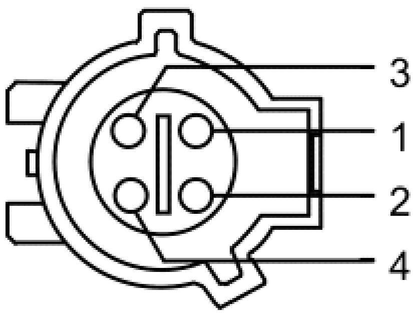

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Fig. 105: Heated Oxygen Sensor-Rear (HO2S-Rear) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner, F-150, Mark LT	A	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater
Focus	B	1 3 4 2	VPWR SIGRTN HO2S Signal HO2S Heater
All other vehicles	C	2 4 3 1	VPWR SIGRTN HO2S Signal HO2S Heater

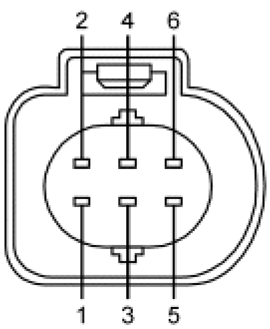

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Fig. 106: Universal Oxygen Sensor
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	UO2SPC (Universal Oxygen Sensor Pumping

	Current)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, E-Series 5.4L Cutaway or stripped chassis	170 Pin	T48 E70 B38 T47 E69 T25 E29 B14 T24 E28 B35 B41, E58, T41	HTR22 HTR21 HTR13 HTR12 HTR11 HO2S22 HO2S21 HO2S13 HO2S12 HO2S11 VPWR SIGRTN
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	E2 E70 E1 E69 E24 E28 E23 E29 B51 B58, E58	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN
Escape/Mariner 3.0L	150 (50-50-50) Pin	T48 E48 T47 E49 T25 E26 T24 E30 B35 B41, E41, T41	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN
Escape/Mariner 2.3L	150 (50-50-50) Pin	T47 E49 T24 E30 B35 B41, E41, T41	HTR12 HTR11 HO2S12 HO2S11 VPWR SIGRTN
Expedition, Navigator	140 Pin	B11 E70 B10 E69	HTR22 HTR21 HTR12 HTR11

		B40 E28 B39 E29 B51 B58, E58	HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN
F-150, Mark LT	190 Pin	T12 E70 T1 E69 T21 E28 T22 E29 B51 B58, E58, T43	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN
F-Super Duty 6.8L Narrow frame	170 Pin	E70 B38 E69 E29 B14 E28 B35 B41, E58, T41	HTR21 HTR13 HTR11 HO2S21 HO2S13 HO2S11 VPWR SIGRTN
Focus 2.0L PZEV	190 Pin	T25 T18 E52 T7 T16 E11 B67 B58, E64, T40	HTR13 HTR12 HTR11 HO2S13 HO2S12 HO2S11 VPWR SIGRTN
Focus 2.0L	190 Pin	T18 E52 T16 E11 B67 B58, E64, T40	HTR12 HTR11 HO2S12 HO2S11 VPWR SIGRTN
Fusion 3.0L, Milan 3.0L, MKZ	140 Pin	E24 E70 E23 E69 E4 E29 E3 E28 B51	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR

		B58, E58	SIGRTN
Fusion 2.3L, Milan 2.3L	140 Pin	E23 E69 E3 E28 B51 B58, E58	HTR12 HTR11 HO2S12 HO2S11 VPWR SIGRTN
Fusion 2.3L PZEV, Milan 2.3L PZEV	140 Pin	E25 E23 E69 E5 E3 E28 B51 B58, E58	HTR13 HTR12 HTR11 HO2S13 HO2S12 HO2S11 VPWR SIGRTN
Ranger 2.3L	170 Pin	T47 E69 T24 E28 B35 B41, E58, T41	HTR12 HTR11 HO2S12 HO2S11 VPWR SIGRTN
Sable PZEV, Taurus PZEV, Taurus X PZEV	190 Pin	E6 E4 B51 B58, E58	UO2SPC21 UO2SPC11 VPWR SIGRTN
All other vehicles	170 Pin	T48 E70 T47 E69 T25 E29 T24 E28 B35 B41, E58, T41	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 VPWR SIGRTN

TEST PROCEDURE

H1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0171, P0172, P0174, P0175, P2195, P2196, P2197, P2198, P2270, P2271, P2272, P2273, P2274, or P2275 present?**

Yes	No
For DTCs P2270, P2271, P2272, P2273, P2274 or P2275, GO to H32. For DTCs P0171, P0174, P2195 or P2197, GO to	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

H2. For DTCs P0172, P0175, P2196 or P2198, GO to H7.	

H2 DTCS P0171, P0174, P2195 OR P2197: LEAN SYSTEM DTCS

NOTE: Do not clear the DTCs or reset the keep alive memory (KAM).

- Access the PCM and record the engine coolant temperature (ECT) PID from the freeze frame data. The freeze frame data is used to recreate the concern.
- Retrieve and record the self-test DTCs.
- **Are any DTCs present other than the following: P0171, P0174, P2195 or P2197?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to H3.

H3 CARRY OUT A VISUAL INSPECTION ON THE INTAKE AIR SYSTEM AND ALL VACUUM HOSES

- Key in OFF position.
- Check the intake air system for leaks, obstructions, and damage.
- Inspect the entire length of all the vacuum hoses for:
  - proper connections
  - damage or cracks
  - damaged or cracked vacuum tees
- Verify the integrity of the positive crankcase ventilation (PCV) system.
- Verify the proper PCV valve part number.
- **Is a concern present?**

Yes	No
GO to H6.	GO to H4.

H4 CHECK FOR THE PRESENCE OF A VACUUM LEAK

NOTE: Fuel trim values at idle are more sensitive to a vacuum leak. The vacuum leak (unmetered air) represents a larger portion of the total air flow at idle than at part throttle.

NOTE: The barometric pressure (BARO) PID is not a recommended PID to monitor when diagnosing a vacuum leak. Barometric pressure is calculated during

high engine load, when the vacuum leak represents a small portion of the total air flow.

NOTE: **When calculating the total fuel correction in the following steps, if LONGFT1 equals +13% and SHRTFT1 equals +23%, the total fuel correction for bank 1 equals +36%. If LONGFT2 equals +24% and SHRTFT2 equals -3% the total fuel correction for bank 2 equals +21%.**

NOTE: **If the freeze frame ECT PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT PID. If the freeze frame ECT PID is not available, maintain the engine coolant temperature between 82° C - 101°C (180°F - 215°F) and the intake air temperature less than 46°C (115°F).**

- Key ON, engine running.
- Access the PCM and monitor the ECT, CHT and IAT PIDs.
- Access the PCM and monitor the LONGFT1, SHRTFT1, LONGFT2 and SHRTFT2 PIDs.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Mathematically add and record the LONGFT PID value to the SHRTFT PID value for each bank, for a total fuel correction at idle.
- Increase the engine speed to 3,500 RPM for 10 seconds. For vehicles with electronic throttle control (ETC), increase the engine speed to the maximum RPM without activating RPM limiting.

  Record the LONGFT1, SHRTFT1, LONGFT2, and SHRTFT2 PID values.

- Mathematically add and record the LONGFT PID value to the SHRTFT PID value for each bank, for a total fuel correction at 3,500 RPM or the maximum allowable RPM for vehicles with ETC.
- **Is the total fuel correction value difference, between idle and 3,500 RPM or the maximum allowable RPM for vehicles with ETC, less than 15 percent?**

Yes	No
No vacuum leak is present. For DTCs P0171 or P0174, GO to H16. For Sable, Taurus, and Taurus X PZEVs with DTCs P2195 or P2197, GO to H15. For all other vehicles with DTCs P2195 or P2197, GO to H9.	GO to H5.

H5 LOCATE THE VACUUM LEAK

NOTE: **Do not clamp or pinch a hard plastic hose. Use a vacuum cap or equivalent to restrict the hose.**

NOTE: **Restricting the EVAP vapor hose while the EVAP emission canister is**

purging may shift the SHRTFT. Carry out a visual inspection as necessary.

NOTE: **When monitoring for a decrease in the SHRTFT PIDs in the following steps, if SHRTFT1 equals +15% and the hose is restricted, SHRTFT1 decreases to -7%. The total decrease in the SHRTFT PIDs equals 22%.**

- Locate the vacuum tees for the intake air and PCV systems.
- Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs.
- Restrict the vacuum lines one at a time for 30 seconds. If a vacuum leak is present, the SHRTFT PID values decrease as the hose is restricted.
- **Is the decrease in the SHRTFT PIDs greater than 15 percent when one of the vacuum hoses is restricted?**

Yes	No
GO to H6.	INSPECT the intake air system for a vacuum leak in the intake manifold or intake gaskets. REPAIR as necessary. For repair verification, GO to H6.

H6 VACUUM LEAK REPAIR VERIFICATION

NOTE: **If the freeze frame ECT PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT PID. If the freeze frame ECT PID is not available, maintain the engine coolant temperature between 82°C - 101°C (180°F - 215°F) and the intake air temperature less than 46°C (115°F).**

- Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Record the SHRTFT1 and SHRTFT2 PID values.
- Key in OFF position.
- Repair the vacuum leak.
- Key ON, engine running.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Access the PCM and monitor the SHRTFT1 and SHRTFT2 PIDs.
- Compare the recorded SHRTFT PID values, prior to the vacuum leak repair, to the current SHRTFT PID values.
- **Is the decrease in the SHRTFT PIDs greater than 15 percent?**

Yes	No
RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY**	A vacuum leak is still present. GO to H5.

(KAM) . REPEAT the self-test.	

H7 DTCS P0172, P0175, P2196 OR P2198: RICH SYSTEM DTCS

NOTE: Do not clear the DTCs or reset the keep alive memory (KAM).

- Access the PCM and record the freeze frame data.
- Retrieve and record the self-test DTCs.
- **Are any DTCs present other than the following: P0172, P0175, P2196 or P2198?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to H8.

H8 INSPECT THE ENTIRE INTAKE AIR SYSTEM FOR DEBRIS, BLOCKAGE OR OTHER DAMAGE

- Check the intake air system for obstructions, restrictions, and damage.
- Check the throttle plate for obstructions or sludge.
- Check the air filter element and housing for blockage.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	For DTCs P0172 or P0175, GO to H16. For Sable, Taurus, and Taurus X PZEVs with DTCs P2196 or P2198, GO to H15. For all other vehicles with DTCs P2196 or P2198, GO to H13.

H9 CHECK THE HO2S AND SIGRTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Disconnect the HO2S related to the current DTC.
- PCM connector disconnected.
- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to H10.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

H10 CHECK THE HO2S CIRCUIT FOR A SHORT TO SIGRTN IN THE HARNESS

- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	SIGRTN

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to H11.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H11 CHECK THE HO2S CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-)
HO2S Signal	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to H12.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H12 HO2S CIRCUIT TEST (WITH LEAN DTCS)

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1.3 V?**

Yes	No
GO to H16.	GO to H42.

H13 HO2S CIRCUIT TEST (WITH RICH DTCS)

- Disconnect the HO2S related to the current DTC.
- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage less than 0.2 V?**

Yes	No
GO to H16.	GO to H14.

H14 CHECK THE HO2S CIRCUIT FOR A SHORT TO THE VPWR OR HEATER IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	HO2S Heater
HO2S Signal	VPWR

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to H42.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H15 CHECK THE UO2SPC CIRCUIT FOR AN OPEN IN THE HARNESS

NOTE: Only the suspect UO2S needs to be diagnosed.

- Key in OFF position.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SPC - Pin 1	UO2SPC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to H16.	REPAIR the open circuit. CLEAR the DTCs.

	REPEAT the self-test.

H16 CHECK THE FUEL PRESSURE

WARNING: **When checking the fuel system remember that the fuel system may still be pressurized when the engine is switched off. Always follow the instructions related to fuel system pressure relief. All fuel handling safety precautions must be observed. Failure to follow these instructions may result in personal injury.**

NOTE: **For vehicle specific fuel pressure ranges, refer to the Fuel System Specification Chart in pinpoint test HC.**

- Remove the jumper wire(s).
- HO2S connector connected.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.
- Mechanical fuel pressure gauge connected.
- Pressurize the fuel system. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Key ON, engine running.
- Allow the fuel pressure to stabilize.
- Key in OFF position.
- Key ON, engine running.
- Access the PCM and control the FP PID.
- Run the fuel pump to obtain maximum fuel pressure.
- **Is the fuel pressure within range for the vehicle being diagnosed?**

Yes	No
GO to H17.	refer to **PINPOINT TEST HC**.

H17 CHECK THE FUEL SYSTEM FOR PRESSURE STABILITY - FAST LEAKDOWN

NOTE: **When the fuel pump is commanded off, the fuel pressure may substantially decrease and then stabilize.**

NOTE: **During output state control, the fuel pump stays commanded on for only about 5 seconds.**

- Key in OFF position.
- Key ON, engine OFF.

- Access the PCM and control the FP PID.
- Run the fuel pump to obtain maximum fuel pressure.
- Command the fuel pump off.
- Allow the fuel pressure to stabilize.
- Record the stabilized reading.
- Monitor the fuel pressure for 10 seconds.
- **Does the fuel pressure remain within 34 kPa (5 psi) of the recorded reading after 10 seconds?**

Yes	No
GO to H19.	GO to H18.

H18 CHECK FOR AN EXTERNAL FUEL LEAK

- Inspect the fuel tank, lines, and filler pipe for a fuel leak.
- **Is a concern present?**

Yes	No
REPAIR as necessary. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**. CLEAR the DTCs. REPEAT the self-test.	GO to H26.

H19 CHECK THE FUEL SYSTEM FOR PRESSURE STABILITY - SLOW LEAKDOWN

- Continue to monitor the fuel pressure for 1 minute.
- **Does the fuel pressure remain within 34 kPa (5 psi) of the recorded reading (MRFS) or greater than 275 kPa (40 psi) (ERFS) after 1 minute?**

Yes	No
GO to H20.	GO to HC13.

H20 CHECK THE SEPARATION LEVEL OF THE ETHANOL/WATER MIXTURE AND GASOLINE IN THE FUEL

NOTE: **This step requires the use of a locally obtained 200 ml beaker and a 25 ml graduated cylinder.**

NOTE: **After approximately 3 minutes of standing, the ethanol and water mixes together and settles to the bottom of the 25 ml graduated cylinder. The gasoline rises to the top.**

- Fill the 200 ml beaker with 5 ml of clean water.
- Use the pressure relief valve on the mechanical fuel gauge to drain 22 ml of fuel into an approved

clean container.

- Pour 20 ml of fuel from the approved clean container into the 25 ml graduated cylinder.
- Add enough water from the 200 ml beaker to the 25 ml graduated cylinder to bring the total volume of liquid to 24 ml.
- Insert a stopper plug in the opening of the 25 ml graduated cylinder.
- Firmly hold the stopper in place and shake the 25 ml graduated cylinder to mix the water and fuel.
- Allow the liquid to stand and separate for approximately 3 minutes.
- Record the separation level from the 25 ml graduated cylinder where the ethanol/water mixture and gasoline meet.
- **Did the ethanol/water mixture and gasoline separate?**

Yes	No
GO to H21.	COMPLETE all steps before continuing. The ethanol/water mixture will separate from the gasoline. If the fuel does not appear to separate, then the fuel is either 100% ethanol or a mixture of ethanol and water.

H21 CALCULATE THE PERCENTAGE OF ETHANOL IN THE FUEL

NOTE: Use the illustration as an example for calculating the percentage of ethanol in the following steps. If the separation level is at 14 ml the calculation becomes; 14 minus 4, then multiply by 5 to equal 50. The percentage of ethanol in the fuel is 50%.

- Key in OFF position.
- Take the recorded separation level from the previous step and subtract the amount of water added.
- Multiply the new value by 5. This new value is the percentage of ethanol in the fuel.

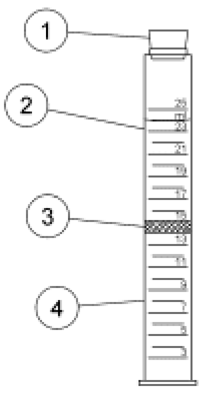

Fig. 107: Calculating Ethanol In Fuel
Courtesy of FORD MOTOR CO.

Item Number	Description

1	Stopper
2	Gasoline
3	Separation Point at 14 ml
4	Ethanol/Water Mixture

- Record the calculated percentage of ethanol in the fuel.
- **Is any ethanol present in the fuel?**

Yes	No
For flex fuel vehicles, GO to H22. For all others, GO to H25.	GO to H26.

H22 COMPARE THE FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

NOTE: **When determining if the FF_INF PID value is within 50% of the calculated percentage of ethanol, if the calculated percentage of ethanol value is 40% then the PID value should be between 0 - 90%. The PID value cannot be less than zero.**

- Key ON, engine OFF.
- Access the PCM and monitor the FF_INF PID.
- Compare the FF_INF PID to the calculated percentage of ethanol.
- **Is the FF_INF PID value within 50% of the calculated percentage of ethanol?**

Yes	No
GO to H26.	GO to H23.

H23 RESET THE PERCENT ETHANOL PARAMETER IN THE PCM

NOTE: **Certain customer fueling practices such as only fueling with small amounts of fuel or repeatedly switching between gasoline and an ethanol blend greater than E15 may prevent the PCM from learning the correct ethanol content in the fuel.**

- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- Key ON, engine running.
- Access the PCM and monitor the FF_LRND PID.
- Drive the vehicle approximately 11.3 km (7 miles) or until the FF_LRND PID indicates yes.
- **Is the PID state YES?**

Yes	No

GO to H24.	GO to H42.

H24 COMPARE THE UPDATED FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the FF_INF PID.
- **Is the FF_INF PID value within 50% of the calculated percentage of ethanol?**

Yes	No
RETURN the vehicle to the customer. ADVISE the customer of the correct fueling practices when using flex fuel. REFER to the Owner's Literature for additional information. ADVISE the customer to continue to use the same fuel for the next 2-3 refuels. This practice helps to verify the PCM is learning the correct percentage of ethanol in the fuel.	A fuel system concern may be present, which prevents the PCM from learning the correct percentage of ethanol in the fuel, GO to HC13.

H25 DETERMINE IF THE PERCENTAGE OF ETHANOL IN THE FUEL IS LESS THAN 25%

- Check the recorded calculated percentage of ethanol in the fuel.
- **Is the calculated percentage of ethanol in the fuel less than 25%?**

Yes	No
GO to H26.	REPAIR as necessary. ADVISE the customer of the correct fuel type required for this vehicle. REFER to the Owner's Literature for additional information. CLEAR the DTCs. REPEAT the self-test.

H26 FLOW TEST

- Key in OFF position.
- PCM connector connected.
- Flow test the injector using the fuel injector tester.
- **Is the flow rate for each injector within specification?**

Yes	No
For DTCs P0171, P0172, P0174 or P0175, GO to DC28. For DTCs P2195 or P2197, GO to H27. For DTCs P2196 or P2198, GO to H28.	INSTALL a new fuel injector. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H27 CHECK THE HO2S OUTPUT VOLTAGE

- HO2S connector disconnected.
- Visually inspect the HO2S circuit for exposed wiring, contamination, corrosion and correct assembly. Repair as necessary.
- Measure the voltage between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Signal	SIGRTN

- Increase the engine speed to 2,000 RPM for 3 minutes.
- Carry out the KOER self-test.
- Monitor the signal voltage during the self-test.
- **Is the voltage greater than 0.5 volt at any time during the self-test?**

Yes	No
GO to H30.	INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H28 ATTEMPT TO RETRIEVE DTC P2195 OR P2197

- HO2S connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B Vehicle Battery
HO2S Signal	Negative terminal

- Carry out the KOER self-test.
- **Are DTCs P2195 or P2197 present?**

Yes	No
GO to H29.	GO to H42.

H29 HO2S VOLTAGE CHECK

- Key in OFF position.
- Remove the jumper wire(s).
- HO2S connector disconnected.
- Key ON, engine running.
- Increase the engine speed to 2,000 RPM for 30 seconds.

- Measure the voltage between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Signal	SIGRTN

- Carry out the KOER self-test.
- Monitor the signal voltage during the self-test.
- **Is the voltage less than 0.4 volt at any time during the self-test?**

Yes	No
GO to H30.	INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H30 CARRY OUT A THOROUGH WIGGLE TEST ON THE HO2S HARNESS

- Key in OFF position.
- HO2S connector connected.
- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the HO2S Signal PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **While monitoring the HO2S PID, does the HO2S stop switching?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to H31.

H31 TEST DRIVE THE VEHICLE WHILE MONITORING THE HO2S PID FOR SWITCHING

- Access the PCM and monitor the HO2S Signal PID.
- Access the PCM and monitor the FUELSYS PID.
- Start the engine and let idle until the vehicle goes into the closed loop fuel condition.
- Drive the vehicle in a manner consistent with the freeze frame data in an attempt to simulate the original concern.
- **Does the HO2S PID switch?**

Yes	No
GO to DC28.	INSTALL a new HO2S. REFER to the

	ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H32 DTCS P2270, P2272, P2271, P2273, P2274 OR P2275: HO2S LACK OF SWITCHES STUCK LEAN OR RICH

NOTE: Address all continuous memory ignition and misfire DTCs before any KOER HO2S DTCs.

- Key in OFF position.
- Visually inspect for:
  - pinched, shorted, and corroded wiring and pins
  - oil or water contamination
  - crossed sensor wires
  - contaminated or damaged sensor
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	For KOER DTCs P2270, P2271, P2272, P2273, P2274 or P2275, GO to H34. For continuous memory DTCs P2270, P2271, P2272, P2273, P2274 or P2275, GO to H33.

H33 CHECK FOR KOER DTCS

- Key ON, engine OFF.
- Clear the DTCs.
- Key ON, engine running.
- Run the engine at approximately 2,000 RPM. Maintain the engine speed for 3 minutes.
- Retrieve the continuous memory DTCs.
- **Are DTCs P2270, P2271, P2272, P2273, P2274 or P2275 present?**

Yes	No
GO to H34.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

H34 CHECK THE HO2S SIGNAL LEVEL TOO HIGH

NOTE: Fuel calculations can be affected by unmetered air leaks.

- Key in OFF position.
- Carefully inspect the following areas for potential air leaks:
  - hoses connecting to the mass air flow (MAF) sensor assembly
  - hoses connecting to the throttle body
  - intake manifold gasket leaks
  - PCV system
  - the vacuum lines are disconnected
  - improperly seated engine oil dipstick, tube or oil fill cap
  - exhaust leaks at flanges and gaskets
- With the vehicle in NEUTRAL, position it on a hoist. Refer to the **JACKING AND LIFTING -- E-SERIES** for the locations of the lifting points.
- Visually inspect for:
  - exhaust leaks at flanges and gaskets
  - HO2S not tightened to specification
  - physical exhaust system concerns
  - aftermarket exhaust
  - punctures or cracks in the catalyst
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to H35.

H35 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE HO2S HARNESS

- PCM connector disconnected.
- Disconnect the HO2S harness connector.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
HO2S Signal	Negative terminal

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	SIGRTN
HO2S Signal	VPWR
HO2S Signal	HO2S Heater

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to H36.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H36 CHECK THE HO2S CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Heater	HO2S Heater
VPWR	VPWR
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to H37.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

H37 CHECK THE HO2S CIRCUIT VOLTAGE

- PCM connector connected.
- HO2S connector connected.
- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1.5 V?**

Yes	No
For partial zero emission vehicle (PZEV), GO to H40. For all others, GO to H39.	GO to H38.

H38 CHECK THE HO2S CIRCUIT VOLTAGE

- Key in OFF position.
- PCM connector connected.
- HO2S connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1.5 V?**

Yes	No
INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to H42.

H39 CHECK FOR OVER VOLTAGE IN THE PCM

- Key in OFF position.
- HO2S connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HO2S Connector, Harness Side	(-) Vehicle Battery
SIGRTN	Negative terminal
HO2S Signal	Negative terminal

- **Are the voltages less than 1.5 V?**

Yes	No
INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to H42.

H40 CHECK THE HO2S CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- HO2S connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	VPWR

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to H41.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

H41 CHECK THE HO2S CIRCUIT VOLTAGE

- PCM connector connected.
- HO2S connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.
- **Is the voltage greater than 1.5 V?**

Yes	No
INSTALL a new HO2S. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to H42.

H42 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins
    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HC: FUEL DELIVERY SYSTEM

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

WARNING: **The fuel system remains under pressure after the engine is off. Relieve pressure before repairing. Highly flammable mixtures are present. To release pressure from the fuel system, carry out the following:**

- **Connect Rotunda fuel pressure gauge 134-R0087 or equivalent.**
- **Gradually open the testing kit valve to relieve the fuel pressure in the vehicle fuel system and drain the fuel into a suitable container or return it to the fuel tank.**
- **To avoid unnecessary fuel spillage and fire hazard, any time fuel lines are disconnected, the ignition switch must be in the OFF position unless fuel pump operation is required for test purposes.**

Failure to follow these instructions may result in personal injury.

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.**

WARNING: Clean all fuel residue from the engine compartment. If not removed, fuel residue may ignite when the engine is returned to operation. Failure to follow this instruction may result in serious personal injury.

NOTE: Replacement fuel injectors may not be the same color as the original injectors in the vehicle. Verify the replacement injector is correct for the application by part number.

This pinpoint test is intended to diagnose the following:

- chassis components
- engine vacuum
- fuel pressure
- fuel supply line
- fuel supply
- fuel filter (9155)
- fuel injector(s) (9F593)
- fuel pump (9H307)

NOTE: With the engine running, the FRP PID value may be 48-70 kPa (7-10 psi) higher than a fuel pressure reading taken with a mechanical gauge.

NOTE: For fuel pressure specifications using a mechanical gauge, see FUEL PRESSURE SPECIFICATIONS .

FUEL SYSTEM SPECIFICATION CHART (KEY ON, ENGINE OFF VALUES)

Application	Fuel System Type	FRP PID Fuel Pressure (kPa)	FRP PID Fuel Pressure (psi)
Crown Victoria/Grand Marquis/Town Car	ERFS (1)	240-485	35-70
Edge/MKX	MRFS (2)	-	-
Escape/Mariner	ERFS (1)	240-485	35-70
E-Series	ERFS (1)	240-485	35-70
Expedition/Navigator	MRFS (2)	-	-
Explorer/Explorer Sport Trac/Mountaineer	ERFS (1)	240-485	35-70
F-150, Mark LT	ERFS (1)	240-485	35-70
F-Super Duty	ERFS (1)	240-485	35-70
Taurus/Taurus X/Sable	MRFS (2)	-	-
Focus	MRFS (2)	-	-
Fusion/Milan/MKZ	MRFS (2)	-	-
Mustang	ERFS (1)	240-485	35-70

Ranger	MRFS (2)	-	-

Fuel System Type Definitions:

(1) Electronic Returnless Fuel System (ERFS):

This type of fuel delivery system does not return fuel to the fuel tank by means of a return line. This system does not incorporate a mechanical pressure regulator. Pressure is controlled by continuously varying the fuel pump speed through the fuel pump driver module (FPDM). All vehicles equipped with ERFS use a fuel rail pressure temperature (FRPT) sensor.

(2) Mechanical Returnless Fuel System (MRFS):

This type of fuel delivery system does not return fuel to the fuel tank by means of a return line. Fuel pressure is controlled by a mechanical pressure regulator located on the fuel pump module in the fuel tank. Vehicles equipped with MRFS do not use a fuel rail pressure temperature (FRPT) sensor.

WARNING: **If you see or smell gasoline at any time other than during fueling, do not reset the inertia fuel shutoff (IFS) switch. Failure to follow these instructions may result in personal injury.**

- Key in OFF position.
- Check for fuel leaks in the engine compartment.
- If no leak is present, reset the IFS switch by pushing the reset button on the top of the switch. Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.
- In the closed position, the button can be pressed an additional 1.57 mm (1/16 in) against a spring.
- Key ON, engine OFF.
- Key in OFF position.
- Key ON, engine OFF.
- Key in OFF position.
- Check for leaking fuel.

TEST PROCEDURE

HC1 DTC P0148 OR SYMPTOMS WITHOUT DTCS: CHECK THE SYSTEM INTEGRITY

- Visually inspect the complete fuel delivery system for damage and leakage.

  Check the following:

  - fuel lines and connections
  - relays
  - fuel tank
  - fuel pump

    - fuel pressure regulator
    - fuel pulse damper
    - fuel rail at injectors
    - damaged connector pins
    - electrical connectors not fully engaged
- Verify the vehicle has followed the maintenance schedule. A new fuel filter should have been installed within the last 48,280 km (30,000 miles).
- Verify the inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.
- Verify the fuse integrity.
- Verify the battery is fully charged.
- Verify clean sufficient fuel.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HC2.

HC2 CHECK ALL SYSTEM RELATED DEVICES (SENSOR, DAMPER OR REGULATOR) FOR LEAKAGE

- Key in OFF position.
- FP connector connected.
- Remove the vacuum hose on each system device connected to the fuel rail.
- Inspect for the presence of fuel in the vacuum line of each device connected to the fuel rail.
- Key ON, engine running.
- Check for manifold vacuum at each system related component with a vacuum line.
- Key in OFF position.
- **Are all vacuum lines for system related devices indicating no fuel present?**

Yes	No
GO to HC3.	If the vacuum line connected to a component indicates that a fuel leak is present, INSTALL a new component. CLEAR the DTCs. REPEAT the self-test.

HC3 CHECK THE FUEL PRESSURE

- Key in OFF position.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.
- Mechanical fuel pressure gauge connected.
- Key ON, engine OFF.

- Pressurize the fuel system. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure to pressurize the fuel system.
- FP connector connected.
- Cycle the key several times to charge the fuel system.
- Compare the fuel pressure reading to the Fuel System Specification Chart.
- **Is the fuel pressure within range?**

Yes	No
GO to HC6.	GO to HC4.

HC4 CHECK THE FUEL PUMP GROUND CIRCUIT FOR AN OPEN IN THE HARNESS

NOTE: **Refer to the Wiring Diagrams article for schematic and connector information.**

- FP connector disconnected.
- Measure the voltage between:

(+) Vehicle Battery	(-) FP Connector, Harness Side
Positive terminal	FPGND

- **Is the voltage greater than 10 V?**

Yes	No
GO to HC5.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HC5 CHECK THE FUEL PUMP POWER CIRCUIT FOR AN OPEN IN THE HARNESS

NOTE: **During output state control, the fuel pump stays commanded on for only about 5 seconds.**

- Verify the inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.
- FP connector disconnected.
- Key ON, engine OFF.
- Access the PCM and control the FP PID.
- Be aware that output state control turns off the FP after a calibrated time. If this happens, command the outputs on again to continue testing.
- Measure the voltage between:

(+) FP Connector, Harness Side	(-) Vehicle Battery
FPPWR	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to HC12.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HC6 CHECK THE SEPARATION LEVEL OF THE ETHANOL/WATER MIXTURE AND GASOLINE IN THE FUEL

NOTE: **This step requires the use of a locally obtained 200 ml beaker and a 25 ml graduated cylinder.**

NOTE: **After approximately 3 minutes of standing, the ethanol and water mixes together and settles to the bottom of the 25 ml graduated cylinder. The gasoline rises to the top.**

- Fill the 200 ml beaker with 5 ml of clean water.
- Use the pressure relief valve on the mechanical fuel gauge to drain 22 ml of fuel into an approved clean container.
- Pour 20 ml of fuel from the approved clean container into the 25 ml graduated cylinder.
- Add enough water from the 200 ml beaker to the 25 ml graduated cylinder to bring the total volume of liquid to 24 ml.
- Insert a stopper plug in the opening of the 25 ml graduated cylinder.
- Firmly hold the stopper in place and shake the 25 ml graduated cylinder to mix the water and fuel.
- Allow the liquid to stand and separate for approximately 3 minutes.
- Record the separation level from the 25 ml graduated cylinder where the ethanol/water mixture and gasoline meet.
- **Did the ethanol/water mixture and gasoline separate?**

Yes	No
GO to HC7.	COMPLETE all steps before continuing. The ethanol/water mixture will separate from the gasoline. If the fuel does not appear to separate, then the fuel is either 100% ethanol or a mixture of ethanol and water.

HC7 CALCULATE THE PERCENTAGE OF ETHANOL IN THE FUEL

NOTE: **Use the illustration as an example for calculating the percentage of ethanol in the following steps. If the separation level is at 14 ml the**

calculation becomes; 14 minus 4, then multiply by 5 to equal 50. The percentage of ethanol in the fuel is 50%.

- Key in OFF position.
- Take the recorded separation level from the previous step and subtract the amount of water added.
- Multiply the new value by 5. This new value is the percentage of ethanol in the fuel.

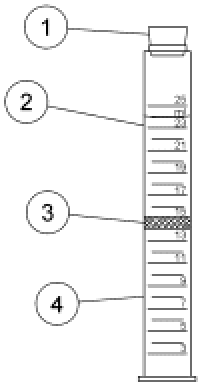

Fig. 108: Calculating Ethanol In Fuel
Courtesy of FORD MOTOR CO.

Item Number	Description
1	Stopper
2	Gasoline
3	Separation Point at 14 ml
4	Ethanol/Water Mixture

- Record the calculated percentage of ethanol in the fuel.
- **Is any ethanol present in the fuel?**

Yes	No
For flex fuel vehicles, GO to HC8. For all others, GO to HC11.	GO to HC12.

HC8 COMPARE THE FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

NOTE: **When determining if the FF_INF PID value is within 50% of the calculated percentage of ethanol, if the calculated percentage of ethanol value is 40% then the PID value should be between 0 - 90%. The PID value cannot be less than zero.**

- Key ON, engine OFF.
- Access the PCM and monitor the FF_INF PID.
- Compare the FF_INF PID to the calculated percentage of ethanol.

- **Is the FF_INF PID value within 50% of the calculated percentage of ethanol?**

Yes	No
GO to HC12.	GO to HC9.

HC9 RESET THE PERCENT ETHANOL PARAMETER IN THE PCM

NOTE:	Certain customer fueling practices such as only fueling with small amounts of fuel or repeatedly switching between gasoline and an ethanol blend greater than E15 may prevent the PCM from learning the correct ethanol content in the fuel.

- Reset the keep alive memory (KAM). Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- Key ON, engine running.
- Access the PCM and monitor the FF_LRND PID.
- Drive the vehicle approximately 11.3 km (7 miles) or until the FF_LRND PID indicates yes.
- **Is the PID state YES?**

Yes	No
GO to HC10.	GO to HC18.

HC10 COMPARE THE UPDATED FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the FF_INF PID.
- **Is the FF_INF PID value within 50% of the calculated percentage of ethanol?**

Yes	No
RETURN the vehicle to the customer. ADVISE the customer of the correct fueling practices when using flex fuel. REFER to the Owner's Literature for additional information. ADVISE the customer to continue to use the same fuel for the next 2-3 refuels. This practice helps to verify the PCM is learning the correct percentage of ethanol in the fuel.	A fuel system concern may be present, which prevents the PCM from learning the correct percentage of ethanol in the fuel, GO to HC12.

HC11 DETERMINE IF THE PERCENTAGE OF ETHANOL IN THE FUEL IS LESS THAN 25%

- Check the recorded calculated percentage of ethanol in the fuel.
- **Is the calculated percentage of ethanol in the fuel less than 25%?**

Yes	No
GO to HC12.	REPAIR as necessary. ADVISE the customer of the correct fuel type required for this vehicle. REFER to the Owner's Literature for additional information. CLEAR the DTCs. REPEAT the self-test.

HC12 CHECK THE FUEL PRESSURE LEAKDOWN

NOTE: When the fuel pump is commanded off, the fuel pressure may substantially decrease and then stabilize.

NOTE: During output state control, the fuel pump stays commanded on for only about 5 seconds.

- Mechanical fuel pressure gauge connected.
- Key ON, engine OFF.
- Access the PCM and control the FP PID.
- Run the fuel pump to obtain maximum fuel pressure.
- Command the fuel pump off.
- Allow the fuel pressure to stabilize.
- Record the stabilized reading.
- Monitor the fuel pressure for 1 minute.
- **Does the fuel pressure remain within 34 kPa (5 psi) of the recorded reading (MRFS) or greater than 275 kPa (40 psi) (ERFS) after 1 minute?**

Yes	No
For ERFS, GO to HC14. For MRFS, GO to HC15.	GO to HC13.

HC13 CHECK THE FUEL INJECTOR FLOW AND LEAKAGE

NOTE: Observe the Warnings, Cautions, and Notes.

- Check the fuel injectors for leakage and flow rate using the injector flow tester or other method such as inspecting the intake manifold for fuel.
- **Are the test results satisfactory?**

Yes	No
For ERFS, GO to HC14. For MRFS, GO to HC15.	INSTALL a new fuel injector as necessary. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . RESET the keep alive memory (KAM). REFER

	to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

HC14 COMPARE THE FRP PID TO THE MECHANICAL GAUGE

NOTE: Most mechanical gauges are referenced to atmospheric pressure. The FRPT sensor is referenced to manifold pressure. In order to make a valid comparison, the engine must be off.

NOTE: The vehicle may exhibit a long crank until the fuel system is pressurized.

- Key in OFF position.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure.
- Disable the fuel pump.
- Key ON, engine OFF.
- Monitor the mechanical gauge.
- Access the PCM and monitor the FRP PID.
- Compare the FRP PID value to the mechanical gauge.
- Key in OFF position.
- Pressurize the fuel system. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Key ON, engine running.
- Allow the fuel pressure to stabilize.
- Key in OFF position.
- Key ON, engine OFF.
- Compare the FRP PID value to the mechanical gauge.
- **Are the FRP PID values within 34 kPa (5 psi) of the mechanical gauge readings?**

Yes	No
GO to HC15.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of this pinpoint test. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HC15 MONITOR THE FUEL PRESSURE WHILE ROAD TESTING THE VEHICLE

WARNING: **Strict observance of posted speed limits and attention to driving**

conditions are mandatory when carrying out the road test. Failure to follow these instructions may result in personal injury.

NOTE: Some concerns may only be present during certain fuel level conditions. Determine the fuel level at the time of the concern. Access the information from the customer information worksheet and the customer.

- Key in OFF position.
- Securely route the mechanical gauge so that the gauge is viewable while road testing the vehicle.
- Key ON, engine running.
- Engine at normal operating temperature.
- Monitor the mechanical gauge.
- From a stop, accelerate to 89 km/h (55 mph) at full throttle. Repeat this 3 times.
- **Is the fuel pressure always greater than 240 kPa (35 psi)?**

Yes	No
For misfire DTC diagnosis, GO to HD8. For symptoms without DTCs, the concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** for further direction. For all others, unable to duplicate or identify the concern at this time.	GO to HC16.

HC16 CHECK THE FUEL SUPPLY LINE FOR RESTRICTION

NOTE: Observe the Warnings, Cautions, and Notes.

- Key in OFF position.
- Disconnect the fuel supply line at the fuel rail.
- Disconnect the fuel supply line at the fuel pump.
- Check the fuel supply line for restriction.
- Apply 21 to 34 kPa (3 to 5 psi) air pressure to the fuel supply line.
- **Does air flow freely through the line?**

Yes	No
INSTALL a new Fuel Filter assembly. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . GO to HC17.	REPAIR the cause of the restriction. CLEAR the DTCs. REPEAT the self-test.

HC17 VERIFY THE REPAIR

WARNING: **Strict observance of posted speed limits and attention to driving conditions are mandatory when carrying out the road test. Failure to follow these instructions may result in personal injury.**

- Key ON, engine running.
- Engine at normal operating temperature.
- Monitor the mechanical gauge.
- From a stop, accelerate to 89 km/h (55 mph) at full throttle. Repeat this 3 times.
- **Is the fuel pressure always greater than 240 kPa (35 psi)?**

Yes	No
The test is complete and no concerns are present.	INSTALL a new FP module. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HC18 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HD: MISFIRE DETECTION MONITOR

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

NOTE: **Mechanical noise caused by the front end accessory drive components, mechanically driven cooling fans, or rough roads at high RPM with light load conditions may produce a nonsymmetrical loss of cylinder acceleration, which**

may result in a misfire.

This pinpoint test is intended to diagnose the misfire detection monitor.

Clearing the powertrain control module (PCM) diagnostic trouble codes (DTCs) erases any PCM recorded freeze frame data. Make sure to record any PCM freeze frame information before proceeding. Refer to**FREEZE FRAME DATA** .

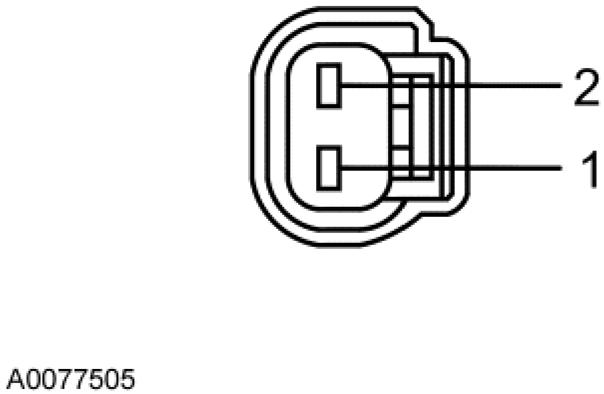

Fig. 109: Camshaft Position (CMP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

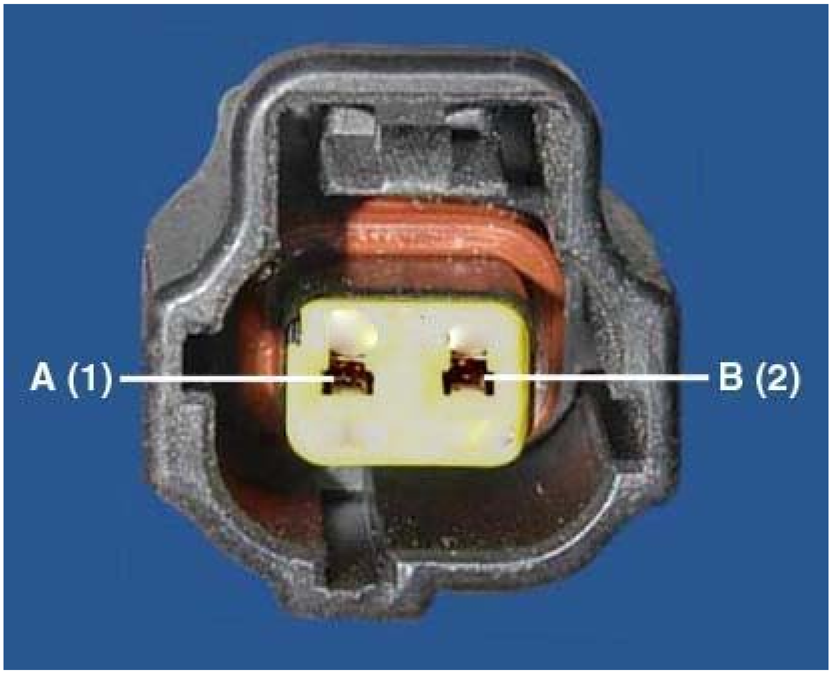

Fig. 110: Camshaft Position (CMP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

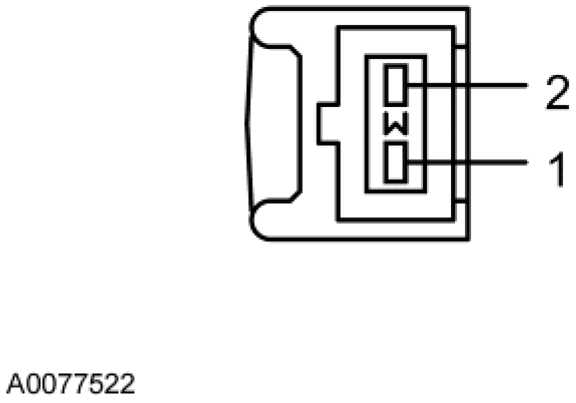

Fig. 111: Camshaft Position (CMP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

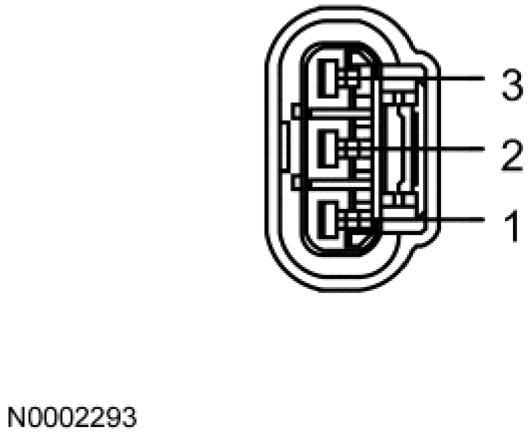

Fig. 112: Camshaft Position (CMP) Sensor Connector - D
Courtesy of FORD MOTOR CO.

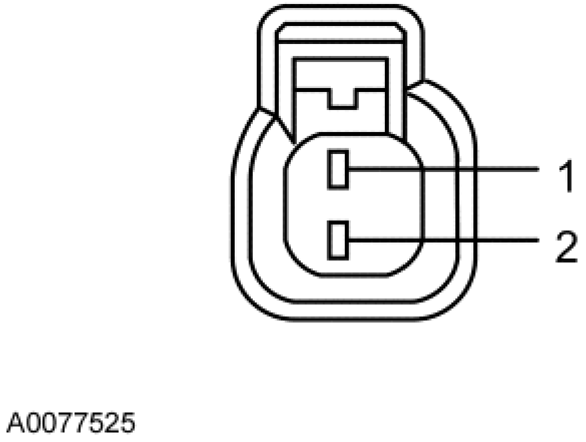

Fig. 113: Camshaft Position (CMP) Sensor Connector - E
Courtesy of FORD MOTOR CO.

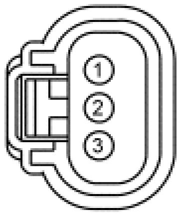

Fig. 114: Camshaft Position (CMP) Sensor Connector - F
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Expedition, F-150 4.6L, F-150 5.4L, Mark LT, MKX, MKZ, Navigator, Sable, Taurus,	A	2	CMP

Taurus X			
Escape/Mariner 2.3L, Ranger 2.3L	B	1 2	SIGRTN CMP
Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, Mustang 4.0L, Ranger 4.0L	C	2 1	SIGRTN CMP
Fusion 2.3L, Milan 2.3L	D	3 2	SIGRTN CMP
Fusion 3.0L, Milan 3.0L	E	1	CMP
F-150 4.2L	D	2 3 1	CMP PWRGND VPWR
Focus	F	3 2	SIGRTN CMP
All other vehicles	A	1 2	SIGRTN CMP

TEST PROCEDURE

HD1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310, P0315, or P0316 present?**

Yes	No
For DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310 or P0316, GO to HD2. For DTC P0315, GO to HD21.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HD2 DTCS P0300 THROUGH P0310 AND P0316: VIEW THE PCM MISFIRE FREEZE FRAME DATA

NOTE: **The misfire freeze frame data may be used to determine the operating conditions when the misfire DTC was set.**

- Retrieve and record any available misfire freeze frame data PID values from the PCM.
- Compare recorded freeze frame data PID values to the typical reference values in the **REFERENCE VALUES** article.
- **Are any values out of range?**

Yes	No

REFER to the table in Pinpoint Test Z to find corresponding circuit, and proceed with the intermittent diagnosis. refer to **PINPOINT TEST Z**.	GO to HD3.

HD3 CHECK FOR OTHER NON-MISFIRE CONTINUOUS MEMORY DTCS

- Retrieve all continuous memory DTCs.
- **Are there any non-misfire continuous memory DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to HD4.

HD4 CHECK FOR ANY KOEO SELF-TEST DTCS

- Carry out the KOEO self-test.
- **Are any KOEO DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to HD5.

HD5 CHECK FOR ANY KOER DTCS

- Carry out the KOER self-test.
- **Are any KOER DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to HD6.

HD6 CHECK THE IGNITION SYSTEM FOR CONCERNS

- For ignition coil on plug (COP) equipped vehicles, refer to **PINPOINT TEST JB** and follow the pinpoint test direction.
- For ignition coil pack equipped vehicles, refer to **PINPOINT TEST JC** and follow the pinpoint test direction.
- **Is an ignition related concern present?**

Yes	No

REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HD7.

HD7 CHECK THE FUEL SYSTEM FOR CONCERNS

- refer to **PINPOINT TEST HC** and follow the pinpoint test direction.
- **Is a fuel system related concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HD8.

HD8 CHECK THE VACUUM SYSTEM

NOTE: Some vacuum leaks can be heard.

- Visually inspect the vacuum hoses for signs of damage or deterioration. A collapsed vacuum hose may cause a blockage to one of the various actuators or sensors. If a blockage is found remove the blockage or install new parts as necessary.
- **Is the vehicle vacuum system OK?**

Yes	No
For vehicles equipped with a differential pressure feedback EGR system, GO to HD9. For vehicles equipped with an electric EGR (EEGR) system, GO to HD10. For vehicles equipped with an EGR system module (ESM) EGR system, GO to HD11. For all others, GO to HD15.	REPAIR the vacuum system. CLEAR the DTCs. REPEAT the self-test.

HD9 MONITOR THE DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM RELATED PIDS

- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Access the PCM and monitor the DPFEGR PID.
- Access the PCM and monitor the EGRVR PID.
- Record the PID values with the engine idling.
- Key ON, engine OFF.
- Record the PID values with the engine off.
- Compare the recorded PID values to the typical reference values in the **REFERENCE VALUES** article.
- **Are any values out of range?**

Yes	No
refer to **PINPOINT TEST HE** and diagnose the EGR system.	GO to HD12.

HD10 MONITOR THE EEGR SYSTEM RELATED PIDS

- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Access the PCM and monitor the EGRMC1F, EGRMC2F, EGRMC3F and EGRMC4F PIDs.
- Access the PCM and monitor the MAP PID.
- Record the PID values with the engine idling.
- Key ON, engine OFF.
- Record the PID values with the engine off.
- Compare the recorded PID values to the typical reference values in the **REFERENCE VALUES** article.
- **Are any values out of range?**

Yes	No
refer to **PINPOINT TEST KD** and diagnose the EGR system.	GO to HD13.

HD11 MONITOR THE ESM SYSTEM RELATED PIDS

- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Access the PCM and monitor the DPFEGR PID.
- Access the PCM and monitor the EGRVR PID.
- Access the PCM and monitor the MAP PID.
- Record the PID values with the engine idling.
- Key ON, engine OFF.
- Record the PID values with the engine off.
- Compare the recorded PID values to the typical reference values in the **REFERENCE VALUES** article.
- **Are any values out of range?**

Yes	No
refer to **PINPOINT TEST HH** and diagnose the EGR system.	GO to HD14.

HD12 RECREATE THE MISFIRE SYMPTOM WITH THE DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM DISABLED

NOTE: The PCM may store EGR system related DTCs during this procedure.

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Key in OFF position.
- EGR Vacuum Regulator Solenoid connector disconnected.
- Access the misfire freeze frame data (if available) and record the operating conditions.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Recreate the misfire symptom using the freeze frame and customer information.
- **Can the symptom be recreated?**

Yes	No
GO to HD15.	REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** for more EGR system information. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HD13 RECREATE THE MISFIRE SYMPTOM WITH EEGR SYSTEM DISABLED

NOTE: The PCM may store EGR system related DTCs during this procedure.

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Key in OFF position.
- EEGR Assembly connector disconnected.
- Access the misfire freeze frame data (if available) and record the operating conditions.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Recreate the misfire symptom using the freeze frame and customer information.
- **Can the symptom be recreated?**

Yes	No
GO to HD15.	REMOVE and INSPECT the EEGR for signs of contamination, unusual wear, carbon deposits, binding or other damage. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** for more EGR system information. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HD14 RECREATE THE MISFIRE SYMPTOM WITH THE ESM SYSTEM DISABLED

NOTE: The PCM may store EGR system related DTCs during this procedure.

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Key in OFF position.
- ESM connector disconnected.
- Access the misfire freeze frame data (if available) and record the operating conditions.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Recreate the misfire symptom using the freeze frame and customer information.
- **Can the symptom be recreated?**

Yes	No
GO to HD15.	REMOVE and INSPECT the ESM for signs of contamination, unusual wear, carbon deposits, binding or other damage. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** for more EGR system information. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HD15 CHECK FOR BASE ENGINE CONCERNS

NOTE: The engine temperature may affect the results.

- This step determines if there are any base engine concerns that may have caused the misfire DTC or drive concern.
- Key in OFF position.
- Carry out the following tests in order to evaluate base engine integrity:
  - For vehicles equipped with mechanically driven cooling fans only, rotate the cooling fan by hand. The cooling fan should rotate freely, with no abnormal binding or interference. If binding or interference is present, remove any foreign materials or repair the cooling fan as necessary.
  - Refer to the **ACCESSORY DRIVE -- E-SERIES** and carry out checks in the Visual Inspection Chart.
  - Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** and carry out the Compression Test and Cylinder Leakage Detection.
  - Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** and carry out the Valve Train Analysis.
  - Visually inspect the positive crankcase ventilation (PCV) valve and tube for leaks.
  - Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** and carry out Component Tests.
- **Is a concern present?**

Yes	No
REPAIR as necessary. REFER to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to HD19.

HD16 DTC P1336: IDENTIFY THE CMP SENSOR TYPE

NOTE: The variable reluctance (VR) sensors have 2-wire connectors, Hall-effect sensors have 3-wire connectors.

- Identify which type of CMP sensor the vehicle uses.
- **Does the vehicle use a Hall-effect sensor?**

Yes	No
GO to HD17.	GO to HD18.

HD17 CHECK THE CMP SENSOR LOW RANGE OUTPUT VOLTAGE

- Key in OFF position.
- CMP Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A CMP Sensor Connector, Harness Side	Point B CMP Sensor Connector, Component Side
VPWR	VPWR
PWRGND	PWRGND

- Key ON, engine running.
- Digital multimeter (DMM) on low voltage DC scale.
- Measure the voltage between:

(+) CMP Sensor Connector, Component Side	(-) 12 Volt Vehicle Battery
CMP	Negative terminal

- **Does the voltage switch between LOW (less than 2 volts DC) and HIGH (greater than 8 volts DC)?**

Yes	No
A Hall-effect CMP sensor that is installed out of synchronization may produce a DTC. To verify the correct CMP sensor installation, REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** , Engine Synchronizer. If the CMP sensor is installed	INSTALL a new CMP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

properly, GO to HD19.	

HD18 CHECK THE CMP SENSOR OUTPUT VOLTAGE

- Key in OFF position.
- PCM connector connected.
- CMP Sensor connector disconnected.
- DMM on low voltage AC scale.
- Key ON, engine running.
- Measure the voltage between:

(+) CMP Sensor Connector, Component Side	(-) CMP Sensor Connector, Component Side
CMP	SIGRTN

- Run the engine at approximately 2,500 RPM.
- **Is the voltage greater than 0.25 V?**

Yes	No
GO to HD19.	INSTALL a new CMP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HD19 CHECK THE GENERATOR FOR EXCESSIVE ELECTRICAL NOISE

NOTE: **If the generator/regulator is electrically noisy, the noise decreases when the B+ connector is disconnected.**

- Key ON, engine running.
- Monitor the generator for an audible electric noise.
- Key in OFF position.
- Generator/regulator B+ connector disconnected.
- Key ON, engine running.
- With the engine running, determine if the generator is still noisy.
- **Does the noise remain constant when the B+ connector is disconnected?**

Yes	No
GO to HD20.	REFER to the **GENERATOR AND REGULATOR -- E-SERIES** and diagnose the generator is noisy symptom.

HD20 CHECK THE CKP HARNESS FOR INTERMITTENT CONCERNS

NOTE: Chafed CKP wires or other physical damage to the harness may cause an intermittent short in the CKP circuit.

- Key in OFF position.
- Visually check for chafed CKP wires or other physical damage to the CKP harness.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HD21.

HD21 DTC P0315: CHECK THE PHYSICAL CONDITION OF THE CRANKSHAFT PULSE WHEEL

NOTE: DTC P0315 is set when the PCM is unable to learn and correct for the mechanical variations in the crankshaft pulse wheel tooth spacing (the allowable correction tolerances are exceeded).

- Inspect the crankshaft pulse wheel for damaged teeth.
- Inspect the crankshaft pulse wheel for wobble.
- Check for a loose crankshaft pulse wheel.
- Check the CKP sensor for damage.
- **Are the CKP sensor and crankshaft pulse wheel OK?**

Yes	No
If the CKP is installed properly, GO to HD22.	REPAIR as necessary. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** and check for correct CKP sensor installation. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . COMPLETE the Misfire and Fuel Monitors drive cycle procedure to learn the profile. Refer to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . To verify the repair RECREATE the original conditions that set the misfire DTC or caused the symptom using the freeze frame data and customer information. MONITOR the cylinder misfire data in Mode 6 - On Board Test Results and VERIFY the misfire count is below 10. REFER to the scan tool manufacturer's article for specific information on the Mode 6 - On Board Test Results.

HD22 CHECK THE DAMPER AND PULLEY ASSEMBLY

NOTE: For engines that have damper mounted pulse rings, it may be necessary to remove the front cover or other components to observe the crank pulley.

- Observe the crank pulley for wobble.
- Examine the electronic ignition (EI) pulse ring fastened to the harmonic dampener.
- **Does the crank pulley wobble or is the pulse ring loose or damaged?**

Yes	No
INSTALL a new pulley or damper assembly. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . COMPLETE the Misfire and Fuel Monitors drive cycle procedure to learn the profile. Refer to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . To verify the repair RECREATE the original conditions that set the misfire DTC or caused the symptom using the freeze frame data and customer information. MONITOR the cylinder misfire data in Mode 6 - On Board Test Results and VERIFY the misfire count is below 10. REFER to the scan tool manufacturer's article for specific information on the Mode 6 - On Board Test Results.	GO to HD23.

HD23 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HE: EXHAUST GAS RECIRCULATION (EGR) SYSTEMS

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- differential pressure feedback exhaust gas recirculation (EGR) sensor (9J460)
- EGR valve (9D460) (9D475)
- EGR vacuum regulator solenoid (9J459)
- orifice tube assembly (9D477)
- differential pressure feedback EGR sensor pressure hoses
- vacuum lines
- harness circuits: VREF, DPFE, SIGRTN, EVR, VPWR, VREF and PWRGND
- powertrain control module (PCM) (12A650)

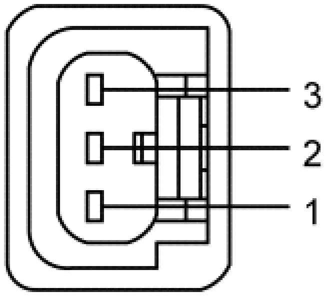

Fig. 115: Differential Pressure Feedback EGR Sensor Connector - A
Courtesy of FORD MOTOR CO.

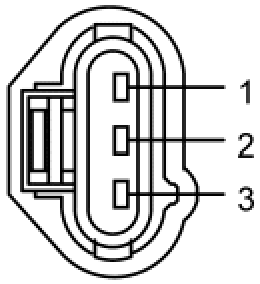

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Fig. 116: Differential Pressure Feedback EGR Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Vehicles equipped with a tube mounted differential pressure feedback EGR sensor	A	3 2 1	DPFE SIGRTN VREF
All other vehicles	B	1 2 3	DPFE SIGRTN VREF

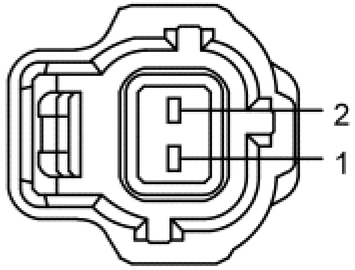

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Fig. 117: EGR Vacuum Regulator Solenoid Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	EVR (EGR Vacuum Regulator)

1	VPWR (Vehicle Power)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B47 E27 E40 E41 E44	PWRGND EVR VREF SIGRTN DPFE
Ranger	170 Pin	B47 E63 E57 E58 E21	PWRGND EVR VREF SIGRTN DPFE

TEST PROCEDURE

HE1 CHECK FOR DTCS

- **Are DTCs P0401, P0402, P0403, P0405, P0406, P1405, P1406, P1408, or P1409 present?**

Yes	No
For DTCs P0401 and P1408, GO to HE36. For DTC P0402, GO to HE13. For KOEO and KOER DTCs P0403 and P1409, GO to HE59. For continuous memory DTCs P0403 and P1409, GO to HE64. For DTC P0405, GO to HE2. For DTC P0406, GO to HE6. For DTC P1405, GO to HE27. For DTC P1406, GO to HE31.	For symptoms without DTCs, GO to HE57. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HE2 DTC P0405: DETERMINE THE PRESENT DPFEGR PID VOLTAGE

NOTE: Depending on the application, verify a prior repair has not resulted in the differential pressure feedback EGR sensor being installed backwards or the vacuum hoses being installed on the opposite ports.

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage less than 0.05 V?**

Yes	No
GO to HE3.	An intermittent concern is suspected in the EGR

	system. GO to HE12.

HE3 CHECK THE VREF AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Differential Pressure Feedback EGR Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to HE4.	refer to **PINPOINT TEST C**.

HE4 CHECK THE DPFE CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
DPFE	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
DPFE	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HE5.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE5 INDUCE THE OPPOSITE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR VOLTAGE

- PCM connector connected.
- Key ON, engine OFF.

- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage between 4 - 5.5 V?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	GO to HE66.

HE6 DTC P0406: DETERMINE THE PRESENT DPFEGR PID VOLTAGE

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage greater than 4 V?**

Yes	No
GO to HE7.	An intermittent concern is suspected in the EGR system. GO to HE12.

HE7 CHECK THE VREF VOLTAGE TO THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR

- Key in OFF position.
- Differential Pressure Feedback EGR Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to HE8.	refer to **PINPOINT TEST C**.

HE8 CHECK THE DPFE AND SIGRTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
DPFE	DPFE
SIGRTN	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to HE9.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE9 CHECK THE DPFE CIRCUIT FOR A SHORT TO VREF

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	DPFE

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HE10.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE10 CHECK THE DPFE CIRCUIT FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- Measure the voltage between:

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-) Vehicle Battery
DPFE	Negative terminal

- **Is the voltage less than 0.2 V?**

Yes	No
GO to HE11.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE11 CHECK THE DPFEGR PID

- Key in OFF position.
- PCM connector connected.

- Connect a 5 amp fused jumper wire between the following:

Point A Differential Pressure Feedback EGR Sensor Connector, Harness Side	Point B
DPFE	Ground

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the DPFEGR PID greater than 4.5 V with the jumper wire removed and is the DPFEGR PID less than 0.1 V with the jumper wire installed?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. CLEAR the DTCs. REPEAT the self-test.	GO to HE66.

HE12 CARRY OUT A THOROUGH WIGGLE TEST ON THE DIFFERENTIAL PRESSURE FEEDBACK EGR HARNESS

- Access the PCM and monitor the DPFEGR PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there any change in the voltage reading, or is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

HE13 DTCS P0402 AND P1405: CHECK FOR SIMULTANEOUS PRESENCE

- **Is DTC P0402 present with DTC P1405?**

Yes	No
GO to HE28.	GO to HE14.

HE14 DTC P0402: CHECK FOR EGR FLOW AT IDLE WITH THE EGR VACUUM HOSE DISCONNECTED

NOTE: **A pinched or plugged EGR vacuum hose can trap vacuum between the EGR vacuum regulator solenoid and EGR valve, not allowing the EGR valve to close.**

NOTE: **Disregard DTC P1408 if it is generated as a result of carrying out the KOER self-test with the EGR vacuum source hose disconnected.**

- Trace each vacuum hose from the EGR vacuum regulator solenoid and verify each hose is connected correctly.
- Verify the EGR vacuum hose is not pinched or plugged and is routed correctly.
- Disconnect and plug the vacuum hose connected to the EGR valve.
- Carry out the KOER self-test.
- **Does KOER DTC P0402 appear or are you unable to run the KOER self-test due to an engine stall or no start?**

Yes	No
INSPECT the pressure hoses for correct routing, pinching, icing or other blockage. If OK, REMOVE and INSPECT the EGR valve and tube for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. GO to HE15.	CONNECT the EGR valve vacuum hose. GO to HE16.

HE15 CARRY OUT THE KOER SELF-TEST

- Clear the DTCs.
- Carry out the KOER self-test.
- **Is DTC P0402 present?**

Yes	No
GO to HE18.	The test is complete and no concerns are found. CLEAR the DTCs. REPEAT the self-test.

HE16 CHECK FOR EGR FLOW AT IDLE WITH THE EGR VACUUM HOSE CONNECTED

- Key in OFF position.
- Connect the EGR valve vacuum hose.
- Carry out the KOER self-test.
- **Does KOER DTC P0402 appear or are you unable to run the KOER self-test due to an engine stall or no start?**

Yes	No
GO to HE17.	INSPECT the pressure hoses for pinching, icing or other blockage. REPAIR as necessary. GO to HE23.

HE17 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.

- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release vacuum.
  - The DPFEGR PID voltage must be between 0.2 and 1.3 volt with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	GO to HE18.

HE18 CHECK EGR FLOW AT IDLE WITH THE EGR VACUUM REGULATOR HARNESS CONNECTOR OFF

- Differential Pressure Feedback EGR Sensor connector connected.
- Disconnect the vacuum hose at the EGR valve and connect the hose to the vacuum gauge.
- Start the engine.
- EGR Vacuum Regulator Solenoid connector disconnected.
- Observe the vacuum gauge:
  - The EGR valve requires vacuum greater than 5.4 kPa (1.6 in-Hg) to begin to open.
  - If the vacuum reading remains greater than 5.4 kPa (1.6 in-Hg) after the EGR vacuum regulator solenoid is disconnected, a concern may be present in the EGR vacuum regulator solenoid.
- **Does the EGR vacuum remain greater than 5.4 kPa (1.6 in-Hg) at idle after the EGR vacuum regulator is disconnected?**

Yes	No
GO to HE19.	GO to HE20.

HE19 INSPECT THE EGR VACUUM REGULATOR SOLENOID VENT FOR BLOCKAGE

NOTE: When the EGR valve is closed, the EGR vacuum regulator solenoid vacuum is vented through the solenoid vent to the atmosphere. A plugged EGR vacuum regulator solenoid vent does not allow EGR vacuum to vent to the atmosphere.

- Key in OFF position.
- Remove the EGR vacuum regulator solenoid vent cap.
- Remove the filter and inspect for blockage or icing.
- **Is the EGR vacuum regulator solenoid vent or vent filter plugged or restricted?**

Yes	No
REPAIR the vent, or if not repairable, INSTALL a new EGR vacuum regulator solenoid. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE20 CHECK THE EGR VACUUM REGULATOR SOLENOID COIL RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) EGR Vacuum Regulator Solenoid Connector, Component Side	(-) EGR Vacuum Regulator Solenoid Connector, Component Side
VPWR - Pin 1	EVR - Pin 2

- **Is the resistance between 26 - 40 ohms?**

Yes	No
GO to HE21.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE21 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
EVR	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HE22.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE22 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR SHORT TO VREF

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EVR	VREF

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HE66.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE23 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402.	GO to HE24.

CLEAR the DTCs. REPEAT the self-test.	

HE24 CHECK THE EGR VALVE OPERATION

NOTE: Typical sensor voltage with no EGR flow is between 0.25 volt and 1.3 volts.

NOTE: A higher voltage at idle may be due to a non-seating or heavily carbon EGR valve pintle.

NOTE: DPFEGR PID voltage must increase as the valve opens and decrease as the valve closes. A slow return voltage is an indication of a binding or slow closing EGR valve.

- Differential Pressure Feedback EGR Sensor connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Disconnect the vacuum hose at the EGR valve and plug the hose.
- Connect the vacuum pump to the EGR valve.
- Start the engine.
- Observe the DPFEGR PID at idle and compare it to the KOEO voltage.
- Apply just enough vacuum to the EGR valve to open it without stalling the engine.
- Quickly release the vacuum.
- Repeat this 3 times.
- Observe the DPFEGR PID.
- **Does the DPFEGR PID voltage indicate an open, binding or slow closing EGR valve?**

Yes	No
REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HE25.

HE25 CARRY OUT A THOROUGH WIGGLE TEST ON THE EGR VACUUM REGULATOR HARNESS

NOTE: An intermittent short to GND in the EGR vacuum regulator circuit causes the vacuum applied to the EGR valve to be higher than normal when the short is present. The vacuum available at the EGR valve at idle is normally below 3.4 kPa (1.6 in-Hg) for the valve to begin to open.

NOTE: A concern is indicated by a sudden jump in the vacuum reading during the

wiggle test.

- Key in OFF position.
- Remove the vacuum pump.
- Connect the vacuum gauge to the EGR valve vacuum hose.
- Connect a vacuum gauge to the EGR valve vacuum hose using a vacuum tee.
- Key ON, engine running.
- Observe the vacuum gauge.
  - Lightly tap on the EGR vacuum regulator solenoid.
  - Carry out a thorough wiggle test on the EGR vacuum regulator harness.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	CONNECT the vacuum hose(s). GO to HE26.

HE26 INSPECT THE EGR VACUUM REGULATOR SOLENOID AND VACUUM HOSES FOR PLUGGING

- Key in OFF position.
- Remove the EGR vacuum regulator solenoid vent cap.
- Remove the filter and inspect for blockage or icing.
- Inspect the pressure hoses for pinching, icing or other blockage.
- **Is the EGR vacuum regulator solenoid vent or vent filter plugged or restricted?**

Yes	No
REPAIR, or if not repairable, INSTALL a new EGR vacuum regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

HE27 DTC P1405: INSPECT THE UPSTREAM PRESSURE HOSE CONNECTIONS

- Inspect the upstream hose at the differential pressure feedback EGR sensor and orifice tube assembly for a disconnect or a poor connection.

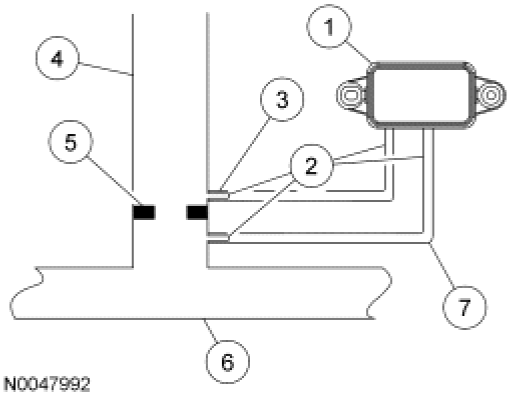


Fig. 118: Typical Differential Pressure Feedback EGR System
Courtesy of FORD MOTOR CO.

TYPICAL DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM

Item Number	Description
1	Differential Pressure Feedback EGR Sensor
2	Pickup Tubes
3	Upstream Pressure Hose
4	To EGR Valve
5	Orifice Tube Assembly
6	Exhaust Manifold
7	Downstream Pressure Hose

- **Is vacuum hose off or poorly connected?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HE28.

HE28 INSPECT THE UPSTREAM PRESSURE HOSE FOR PLUGGING

NOTE: It is essential that only the correct Ford replacement pressure hose be used.

- Visually inspect the upstream pressure hose routing. The hose must not be pinched or have dips in it where water could settle or freeze.
- Remove the upstream pressure hose and carefully inspect for plugging, water, or leaks.
- **Is a concern present?**

Yes	No
REPAIR or INSTALL a new pressure hose as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HE29.

HE29 CHECK THE ORIFICE TUBE ASSEMBLY AND THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR

- Inspect the upstream connection on the differential pressure feedback EGR sensor for damage or plugging at the sensor.
- Inspect the exhaust manifold side pressure tube at the orifice tube assembly for plugging or damage.
- **Is the differential pressure feedback EGR sensor or orifice tube assembly plugged or damaged?**

Yes	No
REPAIR or INSTALL a new Differential Pressure Feedback EGR sensor or orifice tube assembly as necessary. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	GO to HE30.

HE30 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure	refer to **PINPOINT TEST Z**.

feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	

HE31 DTC P1406: INSPECT THE DOWNSTREAM PRESSURE HOSE CONNECTIONS

NOTE: **If the concern is currently present, DTC P1408 appears when running the KOER self-test.**

- Verify the EGR valve is securely attached and exhaust gases are not leaking from the sealing surface.
- Inspect the downstream hose at the differential pressure feedback EGR sensor and orifice tube assembly for a disconnect or a poor connection.

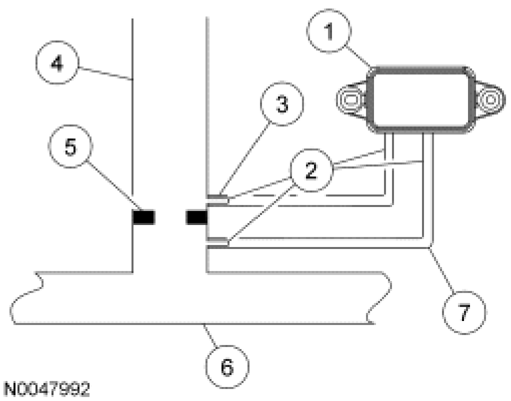


Fig. 119: Typical Differential Pressure Feedback EGR System
Courtesy of FORD MOTOR CO.

TYPICAL DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM

Item Number	Description
1	Differential Pressure Feedback EGR Sensor
2	Pickup Tubes
3	Upstream Pressure Hose
4	To EGR Valve
5	Orifice Tube Assembly
6	Exhaust Manifold
7	Downstream Pressure Hose

- **Is vacuum hose off or poorly connected?**

Yes	No

REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HE32.

HE32 INSPECT THE DOWNSTREAM PRESSURE HOSE FOR PLUGGING

NOTE: It is essential that only the correct Ford replacement pressure hose be used.

- Visually inspect the downstream pressure hose routing.
- Remove the upstream pressure hose and carefully inspect for plugging, water, or leaks.
- **Is a concern present?**

Yes	No
REPAIR or INSTALL a new pressure hose as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HE33.

HE33 CHECK THE ORIFICE TUBE ASSEMBLY AND THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR

- Inspect the connections at the differential pressure feedback EGR sensor for plugging or damage.
- Inspect the intake manifold side pressure tube at the orifice tube assembly for plugging or damage.
- **Is the differential pressure feedback EGR sensor or orifice tube assembly plugged or damaged?**

Yes	No
REPAIR or INSTALL a new Differential Pressure Feedback EGR sensor or orifice tube assembly as necessary. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	GO to HE34.

HE34 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.

- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
GO to HE35.	refer to **PINPOINT TEST Z**.

HE35 CHECK THE DPFE CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
DPFE	DPFE
SIGRTN	SIGRTN
VREF	VREF

- **Are the resistances greater than 5 ohms?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.

HE36 DTC P0401: CARRY OUT THE KOER SELF-TEST

- Carry out the KOER self-test.
- **Does DTC P1408 appear?**

Yes	No

GO to HE37.	GO to HE53.

HE37 KOER AND CONTINUOUS MEMORY DTC P1408: RETRIEVE CONTINUOUS MEMORY DTCS

NOTE: If any DTC other than P1406 appears, note the DTC and refer toDIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS after carrying out this pinpoint test.

- Retrieve all continuous memory DTCs.
- **Is DTC 1406 present?**

Yes	No
GO to HE31.	GO to HE38.

HE38 INSPECT THE DIFFERENTIAL PRESSURE FEEDBACK EGR PRESSURE HOSES

- Inspect the pressure hoses for a reverse connection at the differential pressure feedback EGR sensor or at the orifice tube assembly.
- Inspect the hoses for incorrect routing.
- Inspect both hoses for leaks and blockage.
- Inspect the differential pressure feedback EGR sensor and orifice tube assembly for blockage or damage at the pick-up tubes.

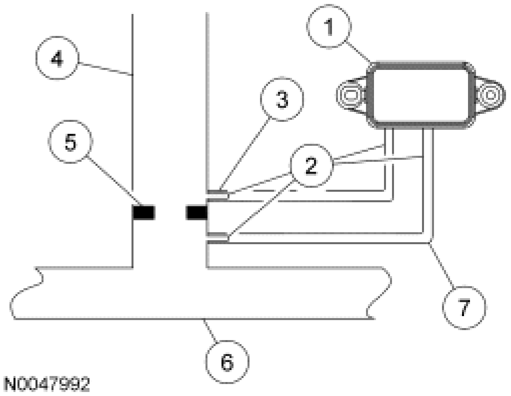


Fig. 120: Typical Differential Pressure Feedback EGR System
Courtesy of FORD MOTOR CO.

TYPICAL DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM

Item Number	Description
1	Differential Pressure Feedback EGR Sensor
2	Pickup Tubes
3	Upstream Pressure Hose
4	To EGR Valve
5	Orifice Tube Assembly

6	Exhaust Manifold
7	Downstream Pressure Hose

- **Is a concern present?**

Yes	No
REPAIR or INSTALL a new pressure hose as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HE39.

HE39 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	CONNECT all the hoses. GO to HE40.

HE40 CHECK THE VREF VOLTAGE TO THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR

- Key in OFF position.

- Differential Pressure Feedback EGR Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to HE41.	refer to **PINPOINT TEST C**.

HE41 CHECK THE DPFE CIRCUIT FOR A SHORT TO VREF

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	DPFE

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HE42.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE42 CARRY OUT THE KOER SELF-TEST WHILE MONITORING THE EGR VACUUM

NOTE: **Since the EGR vacuum hose is disconnected, ignore the DTCs during this KOER self-test.**

- PCM connector connected.
- Differential Pressure Feedback EGR Sensor connector connected.
- Disconnect the vacuum hose at the EGR valve and connect the hose to the vacuum gauge.
- Carry out the KOER self-test.
- Monitor the vacuum gauge. Approximately 30 seconds into the test, EGR flow will be requested for a few seconds. Vacuum at this time should increase to greater than 5.4 kPa (1.6 in-Hg) to open the valve.
- **Does the vacuum increase to 10 kPa (3.0 in-Hg) or greater at any time during the KOER self-test?**

Yes	No
GO to HE43.	GO to HE44.

HE43 CHECK THE EGR VALVE FUNCTION BY APPLYING VACUUM WITH THE HAND PUMP

- Key in OFF position.
- Disconnect the vacuum hose at the EGR valve and plug the hose.
- Connect the vacuum pump to the EGR valve.
- Key ON, engine running.
- Access the PCM and monitor the RPM PID.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds. If the engine wants to stall, increase the engine speed to approximately 1,000 RPM and hold steady.
- Monitor for the following:
  - The EGR valve starts opening at about 5.4 kPa (1.6 in-Hg) vacuum, indicated by an increasing DPFEGR PID voltage.
  - The DPFEGR PID voltage increases until the valve is fully open. The DPFEGR PID voltage must read at least 2.5 volts with full vacuum applied.
  - The DPFEGR PID voltage remains steady with steady vacuum. If voltage drops within a few seconds, the EGR valve or vacuum source may be leaking.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate the EGR valve is operating as described in the test step?**

Yes	No
GO to HE47.	GO to HE44.

HE44 PHYSICALLY INSPECT ALL VACUUM LINES BETWEEN THE EGR VALVE, EGR VACUUM REGULATOR AND VACUUM SOURCE

- Key in OFF position.
- Inspect all vacuum lines for leaks, kinks, pinches, disconnects, blockage, misrouting or physical damage of any type.
- Inspect the EGR vacuum regulator for cracks or other physical damage.
- **Is a concern present?**

Yes	No
REPAIR as necessary. If the EGR vacuum regulator is damaged, INSTALL a new EGR vacuum regulator. REFER to the **ENGINE EMISSION CONTROL --**	GO to HE45.

E-SERIES . CLEAR the DTCs. REPEAT the self-test.	

HE45 PHYSICALLY INSPECT THE EGR VALVE

- Remove and inspect the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage.
- **Is a concern present?**

Yes	No
REPAIR as necessary. If repair is not possible, INSTALL a new EGR valve. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to HE46.

HE46 CHECK THE ENGINE VACUUM

- EGR vacuum regulator vacuum hoses disconnected.
- Connect a hand held vacuum gauge to the vacuum source.
- Key ON, engine running.
- Engine warm and at idle.
- Observe the vacuum gauge.
- **Is the vacuum gauge steadily reading at least 51 kPa (15 in-Hg)?**

Yes	No
GO to HE47.	ISOLATE the base engine concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HE47 CHECK THE VPWR VOLTAGE TO THE EGR VACUUM REGULATOR SOLENOID

- Key in OFF position.
- EGR Vacuum Regulator Solenoid connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) EGR Vacuum Regulator Solenoid Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 1	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No

GO to HE48.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE48 CHECK THE EGR VACUUM REGULATOR SOLENOID COIL RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) EGR Vacuum Regulator Solenoid Connector, Component Side	(-) EGR Vacuum Regulator Solenoid Connector, Component Side
VPWR - Pin 1	EVR - Pin 2

- **Is the resistance between 26 - 40 ohms?**

Yes	No
GO to HE49.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE49 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
EVR	Negative terminal

- **Is the voltage greater than 1 V?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to HE50.

HE50 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) EGR Vacuum Regulator Solenoid Connector, Harness Side
EVR	EVR - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HE51.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE51 INSPECT THE EGR SYSTEM FOR LEAKS, RESTRICTIONS AND POOR CONNECTIONS

- EGR Vacuum Regulator Solenoid connector connected.
- PCM connector connected.
- Visually inspect the EGR system for signs of intermittent failure.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HE52.

HE52 CHECK THE EGR VACUUM REGULATOR SOLENOID VACUUM FLOW BY GROUNDING THE EVR CIRCUIT

NOTE: If the EGR vacuum regulator does not react within 2 seconds, an EGR vacuum regulator concern may be present.

- Disconnect the vacuum hose at the EGR valve and connect the hose to the vacuum gauge.
- Key ON, engine running.
- Engine warm and at idle.
- Connect a 5 amp fused jumper wire between the following:

Point A EGR Vacuum Regulator Solenoid Connector, Harness Side	Point B Vehicle Battery
EVR - Pin 2	Negative terminal

- **Does the vacuum gauge indicate 13.5 kPa (4.0 in-Hg) or greater within 2 seconds?**

Yes	No
GO to HE66.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE53 INSPECT THE DIFFERENTIAL PRESSURE FEEDBACK EGR PRESSURE HOSES

- Visually inspect the upstream pressure hose routing.
- Visually inspect the downstream pressure hose routing.

- Inspect for a reversed connection at the differential pressure feedback EGR sensor or orifice tube assembly.
- The hose must not be pinched or have dips in it where water could settle or freeze.
- Inspect both hoses for leaks and blockage.
- Inspect the differential pressure feedback EGR sensor and orifice tube assembly for blockage or damage at the pick-up tubes.

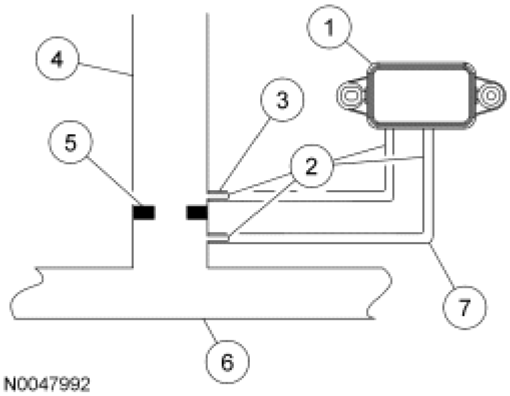


Fig. 121: Typical Differential Pressure Feedback EGR System
Courtesy of FORD MOTOR CO.

TYPICAL DIFFERENTIAL PRESSURE FEEDBACK EGR SYSTEM

Item Number	Description
1	Differential Pressure Feedback EGR Sensor
2	Pickup Tubes
3	Upstream Pressure Hose
4	To EGR Valve
5	Orifice Tube Assembly
6	Exhaust Manifold
7	Downstream Pressure Hose

- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HE54.

HE54 CHECK THE EGR VALVE FUNCTION BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Key ON, engine OFF.

- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. After installing the new differential pressure feedback EGR sensor, TURN the key to the ON position for approximately 5 seconds before starting. This allows the PCM to calibrate itself to the new differential pressure feedback EGR sensor. Failure to do this may result in an incorrect DTC P0402. CLEAR the DTCs. REPEAT the self-test.	CONNECT all the hoses. GO to HE55.

HE55 CHECK THE EGR VALVE FUNCTION BY APPLYING VACUUM WITH THE HAND PUMP

- Disconnect the vacuum hose at the EGR valve and plug the hose.
- Connect the vacuum pump to the EGR valve.
- Key ON, engine running.
- Access the PCM and monitor the RPM PID.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds. If the engine wants to stall, increase the engine speed to approximately 1,000 RPM and hold steady.
- Monitor for the following:
  - The EGR valve starts opening at about 5.4 kPa (1.6 in-Hg) vacuum, indicated by an increasing DPFEGR PID voltage.
  - The DPFEGR PID voltage increases until the valve is fully open. The DPFEGR PID voltage must read at least 2.5 volts with full vacuum applied.
  - The DPFEGR PID voltage remains steady with steady vacuum. If voltage drops within a few seconds, the EGR valve or vacuum source may be leaking.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.

- **Does the DPFEGR PID voltage indicate the EGR valve is operating as described in the test step?**

Yes	No
GO to HE56.	REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. If OK, REMOVE and INSPECT the EGR valve and tube for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HE56 INSPECT THE EGR VACUUM SIGNAL SUPPLY FOR AN INTERMITTENT CONCERN

- Key in OFF position.
- Remove the vacuum hose from the EGR valve and connect to a vacuum gauge.
- Key ON, engine running.
- Connect a 5 amp fused jumper wire between the following:

Point A EGR Vacuum Regulator Solenoid Connector, Harness Side	Point B Vehicle Battery
EVR - Pin 2	Negative terminal

- The solenoid is full ON.
- Vacuum gauge should read above 13.5 kPa (4 in-Hg).
- Observe the vacuum gauge.
- Look for a concern while carrying out the following checks:
  - Lightly tap on the EGR vacuum regulator solenoid.
  - Carry out a thorough wiggle test on the EGR vacuum regulator harness.
  - Inspect the EGR vacuum signal supply for an intermittent concern.
  - Inspect the EGR vacuum regulator solenoid and vacuum hoses for plugging.
  - A concern is indicated by a sudden drop in the vacuum reading.
- **Is a concern indicated?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. Note: In cold climates, the EGR valve may temporarily freeze shut and thaw when the engine warms. refer to **PINPOINT TEST Z**.

HE57 EGR DIAGNOSIS BY SYMPTOM: CHECK FOR EGR FLOW WITH THE EGR VACUUM HOSE DISCONNECTED AND PLUGGED

- Carry out the KOER self-test. Repair any other DTCs.
- Possible causes for EGR flow at idle with no related DTCs:
  - EGR valve not fully seating
  - EGR vacuum regulator solenoid vent restricted
  - Damaged EGR vacuum regulator solenoid
- Disconnect and plug the vacuum hose connected to the EGR valve.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Note the voltage.
- Key ON, engine running.
- With the engine at idle, observe the DPFEGR PID voltage. Compare to engine OFF voltage.
- An increase in voltage at idle indicates the differential pressure feedback EGR sensor is sensing EGR flow.
- **Is the DPFEGR PID voltage greater at idle by 0.15 V than with the engine off?**

Yes	No
REMOVE and INSPECT the EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Inspect the EGR vacuum regulator solenoid and vacuum hoses for plugging. INSPECT the EGR vacuum regulator solenoid vent for blockage. GO to HE58.

HE58 DETERMINE THE EGR VALVE VACUUM SUPPLY

- **Is a concern present in the EGR valve vacuum supply?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE59 DTCS P0403 AND P1409: CHECK THE EGR VACUUM REGULATOR SOLENOID COIL RESISTANCE

- Key in OFF position.
- EGR Vacuum Regulator Solenoid connector disconnected.
- Measure the resistance between:

(+) EGR Vacuum Regulator Solenoid Connector, Component Side	(-) EGR Vacuum Regulator Solenoid Connector, Component Side

VPWR - Pin 1	EVR - Pin 2

- **Is the resistance between 26 - 40 ohms?**

Yes	No
GO to HE60.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HE60 CHECK THE VPWR VOLTAGE TO EGR VACUUM REGULATOR SOLENOID

- Key ON, engine OFF.
- Measure the voltage between:

(+) EGR Vacuum Regulator Solenoid Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 1	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to HE61.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE61 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) EGR Vacuum Regulator Solenoid Connector, Harness Side
EVR	EVR - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HE62.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HE62 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.

- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
EVR	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to HE63.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE63 CHECK THE EGR VACUUM REGULATOR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EVR	PWRGND

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HE66.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HE64 CHECK FOR THE PRESENCE OF KOER DTCS P0403 OR P1409

- Carry out the KOER self-test.
- **Are DTCs P0403 or P1409 present?**

Yes	No
GO to HE59.	GO to HE65.

HE65 CARRY OUT A THOROUGH WIGGLE TEST ON THE EGR VACUUM REGULATOR HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EVR	PWRGND

- Lightly tap on the EGR vacuum regulator solenoid. Wiggle the EGR vacuum regulator solenoid connector. Carry out a thorough wiggle test on the harness. A concern is indicated by a voltage drop during the wiggle test.
- **Is the voltage greater than 10 V?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

HE66 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HF: CATALYST EFFICIENCY MONITOR AND EXHAUST SYSTEMS

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- catalytic converter
- exhaust system

TEST PROCEDURE

HF1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0420 or P0430 present?**

Yes	No
GO to HF2.	For symptoms without DTCs, GO to HF6. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HF2 CHECK FOR OTHER DTCS

NOTE: **Internal deterioration of a catalytic converter is usually caused by abnormal engine operation upstream of the catalyst. Events that can produce higher than normal temperatures in the catalyst are particularly suspect. For example, misfiring can cause higher than normal catalyst operating temperatures.**

NOTE: **Make sure the customer has not:**

- **refueled the vehicle with leaded gasoline.**
- **noticed a high vehicle oil consumption. An engine that consumes oil at a high rate deposits high levels of phosphorus on the catalyst and reduces the catalyst efficiency.**

- Check for self-test DTCs.
- **Are any DTCs present other than the following: P0420, P0430?**

Yes	No
GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** for pinpoint test direction and REPAIR the misfire DTCs. CLEAR the DTCs. REPEAT the self-test.	GO to HF3.

HF3 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

NOTE: **Check the HO2S electrical connectors to make sure the correct HO2S is connected to the correct electrical connector. The electrical connectors are color coded to make sure the correct connection is made.**

If the electrical connection of the rear HO2S are interchanged/crossed, the catalyst efficiency monitor test fails.

- Visually inspect the HO2S harness connectors for any indication of crossed wiring.
- Visually inspect the harness for exposed wiring, corrosion and correct routing.
- Visually inspect the PCM connectors for damaged, or pushed out pins, corrosion and loose wires.
- **Are there any concerns with the wiring or the PCM connection?**

Yes	No

REPAIR as necessary. CLEAR the DTCs. CARRY OUT the catalyst monitor drive cycle to verify the repairs.	GO to HF4.

HF4 CHECK THE FUEL PRESSURE

WARNING: **The fuel system remains pressurized when the engine is not running. To prevent injury or fire, use caution when working on the fuel system. Failure to follow these instructions may result in personal injury.**

WARNING: **Before repairing or installing a new component in the fuel system, reduce the possibility of injury or fire by following the warning, caution, and handling directions in pinpoint test HC. refer to PINPOINT TEST HC. Failure to follow these instructions may result in personal injury.**

NOTE: Fuel pressure above specification can produce an abnormally rich air/fuel mixture. This rich air/fuel mixture can cause higher than normal catalyst operating temperatures.

NOTE: On electronic returnless fuel system (ERFS), the fuel pressure can be monitored by the scan tool using the fuel rail pressure (FRP) PID.

- Mechanical returnless fuel systems (MRFS):
  - If applicable, inspect the vacuum hose going to the fuel rail pulse damper for proper installation and cracks. Repair as necessary.
- Connect a Rotunda fuel pressure gauge or equivalent.
- Access the PCM and monitor the FRP PID.
- Start the engine. Record the fuel pressure.
- Compare the recorded fuel pressure reading to the Fuel System Specification Chart found at the beginning of Pinpoint Test HC. refer to **PINPOINT TEST HC**.
- Key in OFF position.
- **Is the fuel pressure within specifications?**

Yes	No
The fuel pressure is OK. If applicable, REMOVE the fuel pressure gauge. GO to HF5.	The fuel pressure is out of specification. GO to HC3.

HF5 CHECK FOR LEAKS IN THE EXHAUST SYSTEM

NOTE: If a catalyst is in series with a leaking exhaust system, it can fail the

catalyst efficiency monitor test.

- Inspect the exhaust system for leaks, cracks, loose connections, punctures, or non-factory modifications.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. CARRY OUT the catalyst monitor drive cycle to verify the repairs.	GO to HF10.

HF6 CHECK FOR RESTRICTIONS IN THE EXHAUST SYSTEM

NOTE: **A slight pressure in the exhaust system is normal, but excessive exhaust back pressure seriously affects engine operation.**

- Inspect the following for damage or restrictions:
  - front and rear exhaust pipes
  - catalytic converter
  - muffler and tailpipe assembly
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HF7.

HF7 CHECK FOR EXCESSIVE EXHAUST BACK PRESSURE

- The internal condition of exhaust system and its ability to flow can be checked with an exhaust back pressure tool.
- **Is an exhaust back pressure tester available?**

Yes	No
GO to HF8.	GO to HF9.

HF8 CHECK FOR EXCESSIVE EXHAUST BACK PRESSURE WITH EXHAUST BACK PRESSURE TOOL

NOTE: **Typical exhaust back pressure, when measured near the exhaust manifold and at normal engine operating temperature, should not exceed 20.7 kPa (3 psi) at idle and 55.2 kPa (8 psi) at wide open throttle (WOT) under load.**

- Install an exhaust back pressure tester and follow the tool manufacturer installation and testing

instructions.

- **Does the exhaust back pressure test indicate a restriction?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to the **SYMPTOM CHARTS** article Symptom Charts.	No indication of restrictions or leaks has been detected in the exhaust system. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to the **SYMPTOM CHARTS** article Symptom Charts.

HF9 CHECK MANIFOLD VACUUM FOR AN INDICATION OF EXCESSIVE EXHAUST SYSTEM RESTRICTION

NOTE: **When the engine is first started and is idled, the reading may be normal 51-74 kPa (15-22 in-Hg), but as the engine RPM is increased, the back pressure caused by a clogged exhaust system causes the needle to slowly drop to 0 kPa (0 in-Hg). The needle then may slowly rise. Excessive exhaust restriction causes the needle to drop to a low point even if the engine is only idling.**

- Attach a vacuum gauge to the intake manifold vacuum source.
- Observe the vacuum gauge while increasing the engine RPM.
- **Does the vacuum gauge indicate an exhaust restriction concern?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to the **SYMPTOM CHARTS** article Symptom Charts.	No indication of restrictions or leaks has been detected in the exhaust system. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to the **SYMPTOM CHARTS** article Symptom Charts.

HF10 CARRY OUT THE CATALYST MONITOR DRIVE CYCLE

- Carry out the catalyst monitor drive cycle. Refer to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .
- Retrieve the continuous memory DTCs.
- **Are DTCs P0420 or P0430 present?**

Yes	No
INSTALL a new catalyst between the monitored HO2S sensors, only for the bank referenced, (P0420 Bank 1), (P0430 Bank 2). Do not install a new unmonitored catalyst unless it is repaired as an assembly. REFER to the **EXHAUST SYSTEM -- E-SERIES** .	The test is complete and no concerns are present.

CLEAR the DTCs. REPEAT the self-test.	

PINPOINT TEST HG: POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

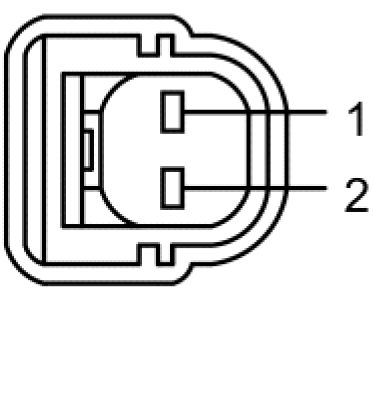
INTRODUCTION

This pinpoint test is intended to diagnose the following:

- positive crankcase ventilation (PCV) valve (6A666) and related vacuum lines
- electrically heated PCV valve (6A666) and heater circuit, both PCM and non-PCM controlled
- electrically heated PCV tube (9F624) and heater circuit, both PCM and non-PCM controlled
- powertrain control module (PCM) (12A650)
- PCV thermal extension harness (12A580)

NOTE: **For the electrically heated PCV system only, refer to <u>POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM</u> .**

Electrically Heated PCV



<u>Fig. 122: Positive Crankcase Ventilation Heated Fitting (PCVHF) Connector</u>
Courtesy of FORD MOTOR CO.

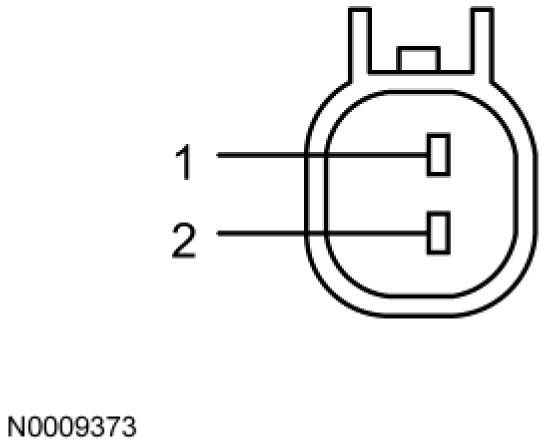


Fig. 123: Positive Crankcase Ventilation (PCV) Connector - B
Courtesy of FORD MOTOR CO.

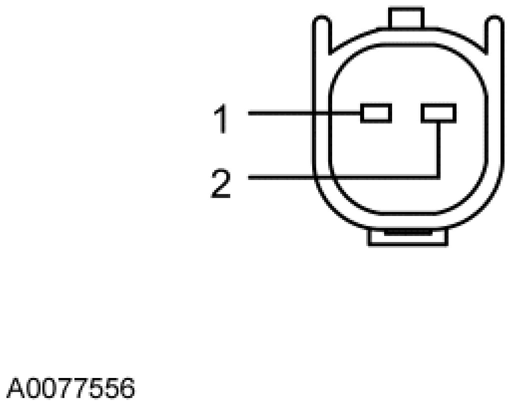


Fig. 124: Positive Crankcase Ventilation (PCV) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria (PCM controlled PCV heater), E-Series 6.8L (PCM controlled PCV heater), E-Series 4.6L (PCM controlled PCV heater), Explorer 4.0L (PCM controlled PCV heater), Explorer Sport Trac 4.0L (PCM controlled PCV heater), F-150 4.2L (PCM controlled PCV heater), F-150 4.6L (PCM controlled PCV heater), Fusion 3.0L (PCM controlled PCV heater),	A	1 2	PCVHC IGN START/RUN

Grand Marquis (PCM controlled PCV heater), Milan 3.0L (PCM controlled PCV heater), Mountaineer 4.0L (PCM controlled PCV heater), Mustang 4.0L (PCM controlled PCV heater), Mustang 5.4L (PCM controlled PCV heater), Town Car (PCM controlled PCV heater)			
Expedition (Non-PCM controlled heated PCV tube), F-150 5.4L (Non-PCM controlled heated PCV tube), Mark LT (Non-PCM controlled heated PCV tube), Navigator (Non-PCM controlled heated PCV tube)	B	2 1	GND IGN START/RUN
F-Super Duty 5.4L (PCM controlled heated PCV tube)	C	2 1	PCVHC IGN START/RUN
All other vehicles	A	1 2	GND IGN START/RUN

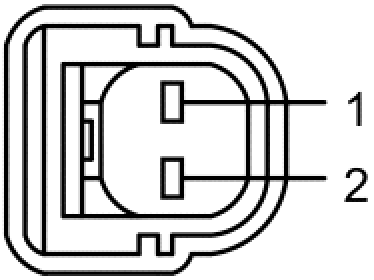


Fig. 125: Positive Crankcase Ventilation Heated Fitting (PCVHF) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	PCVHF (Positive Crankcase Ventilation Heated Fitting)
2	IGN START/RUN

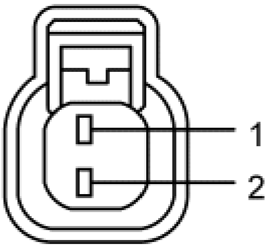


Fig. 126: Positive Crankcase Ventilation Thermal Extension -Harness Side (PCVTE-Harness Side)
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	GND (Ground)
1	IGN START/RUN

This table is only for vehicles equipped with a PCM controlled PCV heater.

Vehicle	Connector	Pin	Circuit
E-Series, F-Super Duty	170 Pin	E2	PCVHC
F-150	190 Pin	E3	PCVHC
Fusion, Milan	140 Pin	E2	PCVHC
Mustang 5.4L	170 Pin	E67	PCVHC
All other vehicles	170 Pin	E3	PCVHC

TEST PROCEDURE

HG1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- Check for DTCs P053A, P145E or P1489.
- **Are any of the above listed DTCs present?**

Yes	No
GO to HG5.	For all other symptoms without DTCs, GO to HG2.

HG2 VISUAL INSPECTION OF THE PCV VALVE

NOTE: If the PCV valve or tube is electrically heated, verify the electrical connection. On some applications the vehicle may be equipped with a thermal harness that only provides electrical continuity when the temperature is less than 5°C (40°F) +/- 4°C (+/- 7°F). Typically this harness is located close to the PCV valve or tube.

NOTE: If the PCV valve is water heated, verify the coolant hose and clip connections.

- Check the PCV valve, hoses and connections for leaks or restrictions.
- Verify the PCV valve maintenance schedule has been followed.
- Verify the proper PCV valve part number.
- Verify the PCV valve is clean.
- Verify the fresh air tube and related hoses are clean and routed correctly.
- **Is a concern present?**

Yes	No
REPAIR as necessary. VERIFY the symptom no longer exists.	For an electrically heated PCV tube, GO to HG4. For all others, GO to HG3.

HG3 STUCK PCV VALVE CHECK

- Disconnect the PCV valve from the valve cover.
- Shake the PCV valve.
- **Does the PCV valve rattle when shaken?**

Yes	No
REINSTALL the PCV valve. For PCV systems with electrical heating, GO to HG4. For PCV systems without electrical heating, GO to HG12.	The PCV valve is sticking. INSTALL a new PCV valve. VERIFY the symptom no longer exists.

HG4 CHECK FOR A PCM CONTROLLED PCV HEATER

NOTE: If a thermal extension harness is present then the PCV is non-PCM controlled. Refer to POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM .

- Check if the PCV heater is PCM controlled.
- **Is the PCV heater PCM controlled?**

Yes	No
GO to HG5.	GO to HG8.

HG5 CHECK THE HARNESS VOLTAGE TO THE PCM CONTROLLED PCV HEATER

- Suspect PCV connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCVHF Connector, Harness Side	(-)
IGN START/RUN - Pin 2	Ground

- Measure the voltage between:

(+) PCV Connector, Harness Side	(-)
IGN START/RUN	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to HG6.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HG6 CHECK THE HARNESS CIRCUIT TO THE PCM CONTROLLED PCV HEATER

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCVHF Connector, Harness Side
PCVHF	PCVHF - Pin 1

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCV Connector, Harness Side
PCVHC	PCVHC

- **Is the resistance greater than 5 ohms?**

Yes	No
GO to HG7.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HG7 CHECK THE RESISTANCE OF THE PCM CONTROLLED PCV VALVE OR TUBE HEATER

- Measure the resistance between:

(+) PCVHF Connector, Component Side	(-) PCVHF Connector, Component Side
IGN START/RUN - Pin 2	PCVHF - Pin 1

- Measure the resistance between:

(+) PCV Connector, Component Side	(-) PCV Connector, Component Side
IGN START/RUN	PCVHC

- **Is the resistance between 10 - 35 ohms?**

Yes	No
GO to HG13.	INSTALL a new PCV valve or tube. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HG8 CHECK THE VOLTAGE AND GROUND AT THE HARNESS ELECTRICALLY HEATED PCV VALVE OR TUBE NON-PCM CONTROLLED

- PCV connector disconnected.
- PCVTE-Harness Side connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCVTE-Harness Side, Harness Side	(-) PCVTE-Harness Side, Harness Side
IGN START/RUN - Pin 1	GND - Pin 2

- **Is the voltage greater than 10 V?**

Yes	No
For vehicles with a thermal extension harness, GO to HG10. For all others, GO to HG11.	GO to HG9.

HG9 CHECK THE VOLTAGE CIRCUIT

- PCV connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCV Connector, Harness Side	(-)
IGN START/RUN	Ground

- **Is the voltage greater than 10 V?**

Yes	No
REPAIR the open GND circuit. TEST the system for normal operation.	REPAIR the open PWR circuit TEST the system for normal operation.

HG10 VALVE RESISTANCE CHECK WITHOUT AN EXTENSION HARNESS

NOTE: On some applications the vehicle may be equipped with a thermal harness that only provides electrical continuity when the temperature is less than 5°C (40°F) +/- 4°C (+/- 7°F). Typically this harness is located close to the PCV valve or tube.

- Disconnect the thermal extension harness from the PCV valve.
- Measure the resistance between:

(+) PCV Connector, Component Side	(-) PCV Connector, Component Side
IGN START/RUN	PCVHC

- **Is the resistance between 10 - 35 ohms?**

Yes	No
INSTALL a new thermal extension harness PCV. TEST the system for normal operation.	INSTALL a new PCV.

HG11 CHECK THE RESISTANCE OF THE ELECTRICALLY HEATED PCV VALVE OR TUBE

- Measure the resistance between:

(+) PCV Connector, Component Side	(-) PCV Connector, Component Side
IGN START/RUN	GND

- **Is the resistance between 10 - 35 ohms?**

Yes	No
GO to HG12.	INSTALL a new PCV valve or tube. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** .

HG12 PCV SYSTEM CHECK

- Start the engine and warm it until engine temperature is stable.
- Disconnect the closure (fresh air) hose from the remote air cleaner or air outlet tube (the tube connecting the mass air flow sensor and the throttle body).
- Place a stiff piece of paper over the hose end. Wait 1 minute.
- **Does vacuum hold the paper in place?**

Yes	No
The PCV system is OK. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	CHECK for vacuum leaks/obstruction in the PCV system (such as oil cap, PCV valve, hoses, cut grommets, valve cover bolt torque/gasket leak). REFER to the vehicle emissions control information (VECI) label for PCV system components and routing. REPAIR as necessary.

HG13 CHECK IF A CONCERN OR DTC IS STILL PRESENT

- Connect the PCV system.
- Clear the DTCs.
- Carry out the self-test.
- **Is the concern or DTC is still present?**

Yes	No
GO to HG14.	Unable to duplicate or identify the concern at this time. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

HG14 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HH: EXHAUST GAS RECIRCULATION SYSTEM MODULE (ESM)

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- ESM (9Y456)
- orifice tube assembly (9D477)
- differential pressure feedback exhaust gas recirculation (EGR) sensor pressure hoses
- vacuum lines
- harness circuits: DPFE, SIGRTN, EVR, VPWR and VREF
- powertrain control module (PCM) (12A650)

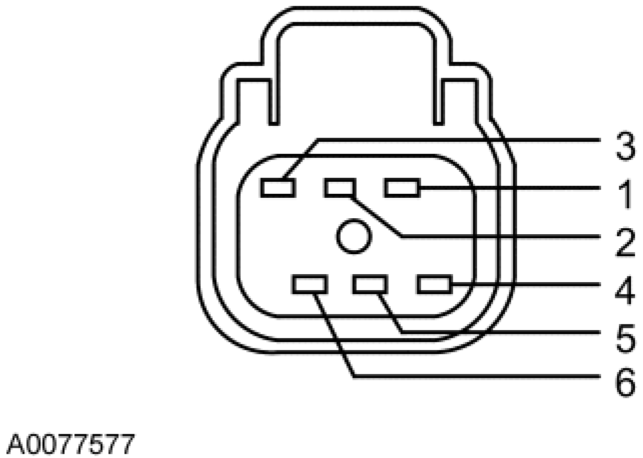


Fig. 127: EGR System Module (ESM) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	EVR (EGR Vacuum Regulator)
4	VPWR (Vehicle Power)
6	SIGRTN (Signal Return)
5	DPFE (Differential Pressure Feedback EGR)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series, F-Super Duty	170 Pin	E63 E58 E57 E58 E21	EVR SIGRTN VREF SIGRTN DPFE
F-150	190 Pin	E63 E58 B29, E57 B58, E58, T43	EVR SIGRTN VREF SIGRTN

		E21	DPFE
Mustang	170 Pin	E63 E58 B40, E57 B41, E58, T41 E21	EVR SIGRTN VREF SIGRTN DPFE
All other vehicles	170 Pin	E63 E58 E57 B41, E58, T41 E21	EVR SIGRTN VREF SIGRTN DPFE

TEST PROCEDURE

HH1 CHECK FOR DTCS

- **Are DTCs P0401, P0402, P0403, P0405, P0406, P1408, or P1409 present?**

Yes	No
For DTC P0401, GO to HH16. For DTC P0402, GO to HH12. For DTCs P0403 and P1409, GO to HH22. For DTC P0405, GO to HH2. For DTC P0406, GO to HH5. For DTC P1408, GO to HH17.	For symptoms without DTCs, GO to HH28. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HH2 DTC P0405: DETERMINE THE PRESENT DPFEGR PID VOLTAGE

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage less than 0.05 V?**

Yes	No
GO to HH3.	GO to HH11.

HH3 INDUCE THE OPPOSITE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR SIGNAL

- Key in OFF position.
- ESM connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage between 4 - 6 V?**

Yes	No
INSTALL a new Differential Pressure Feedback	GO to HH4.

EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	

HH4 CHECK THE DPFE CIRCUIT FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
DPFE	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
DPFE	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HH29.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH5 DTC P0406: DETERMINE THE PRESENT DPFEGR PID VOLTAGE

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage greater than 4 V?**

Yes	No
GO to HH6.	GO to HH11.

HH6 CHECK THE VREF VOLTAGE TO THE ESM

- Key in OFF position.
- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
VREF - Pin 2	Negative terminal

- **Is the voltage between 4 - 5.5 V?**

Yes	No
GO to HH7.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HH7 CHECK THE DPFE CIRCUIT FOR A SHORT TO VOLTAGE

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
DPFE - Pin 5	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to HH8.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH8 CHECK THE DPFE CIRCUIT FOR A SHORT TO VREF

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	DPFE

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HH9.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH9 CHECK THE DPFE AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) ESM Connector, Harness Side
DPFE	DPFE - Pin 5
SIGRTN	SIGRTN - Pin 6

- **Are the resistances less than 5 ohms?**

Yes	No

GO to HH10.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HH10 INDUCE THE OPPOSITE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR VOLTAGE

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A ESM Connector, Harness Side	Point B ESM Connector, Harness Side
DPFE - Pin 5	SIGRTN - Pin 6

- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- **Is the voltage less than 0.1 V?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to HH29.

HH11 CARRY OUT A THOROUGH WIGGLE TEST ON THE ESM HARNESS

- Access the PCM and monitor the DPFEGR PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- **Is there any change in the voltage reading, or is a concern found?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

HH12 DTC P0402: CHECK THE VREF VOLTAGE TO THE ESM

NOTE: **Diagnose and repair all circuit concern DTCs before diagnosing range/performance or flow concerns. For circuit concern DTC diagnosis, refer to DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS .**

- Key in OFF position.
- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
VREF - Pin 2	Negative terminal

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to HH13.	refer to **PINPOINT TEST C**.

HH13 SIMULATE THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR SIGNAL WITH A VACUUM PUMP

- Disconnect the downstream differential pressure feedback EGR sensor port hose at the ESM.
- Verify the hose and port are clear and free of obstructions.
- Connect a vacuum pump to the downstream differential pressure feedback EGR sensor port.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to HH14.

HH14 INSPECT THE EGR VACUUM REGULATOR SOLENOID VENT FOR BLOCKAGE

NOTE: **When the EGR valve is closed, the EGR vacuum regulator solenoid vacuum is vented through the solenoid vent to the atmosphere. A plugged EGR vacuum regulator solenoid vent does not allow EGR vacuum to vent to the atmosphere.**

- EGR vacuum regulator vacuum hoses disconnected.
- Connect a hand vacuum pump to the EGR vacuum regulator source port.
- Apply 34 to 51 kPa (10 to 15 in-Hg) vacuum.

- **Does the EGR vacuum regulator solenoid vacuum bleed off?**

Yes	No
GO to HH15.	INSTALL a new EGR vacuum regulator solenoid. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HH15 CHECK THE EGR VALVE FOR CARBON BUILD-UP

- Remove the ESM.
- Visually inspect the EGR valve and valve seat for correct seating, carbon build-up and debris.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time.

HH16 DTC P0401: CARRY OUT THE KOER SELF-TEST

NOTE: Diagnose and repair all circuit concern DTCs before diagnosing range/performance or flow concerns.

- Carry out the KOER self-test.
- **Is DTC P1408 present?**

Yes	No
GO to HH17.	GO to HH18.

HH17 DTC P1408: CHECK THE VREF VOLTAGE TO THE ESM

- Key in OFF position.
- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
VREF - Pin 2	Negative terminal

- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
GO to HH18.	refer to **PINPOINT TEST C**.

HH18 CHECK THE EGR VACUUM REGULATOR SOLENOID VACUUM

- ESM connector connected.
- Disconnect the EGR vacuum regulator vacuum source hose.
- Connect a vacuum gauge to the EGR vacuum regulator vacuum source hose.
- Key ON, engine running.
- Monitor the vacuum gauge.
- **Is the manifold vacuum greater than 34 kPa (10 in-Hg)?**

Yes	No
GO to HH19.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HH19 SIMULATE THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR SIGNAL WITH A VACUUM PUMP

- Key in OFF position.
- Disconnect the downstream differential pressure feedback EGR sensor port hose at the ESM.
- Verify the hose and port are clear and free of obstructions.
- Connect a vacuum pump to the downstream differential pressure feedback EGR sensor port.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
  - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the key ON and no vacuum applied.
  - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
  - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.
- **Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?**

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	CONNECT all the hoses. GO to HH20.

HH20 CHECK THE EGR VACUUM REGULATOR SOLENOID OPERATION

- Key ON, engine running.
- Engine at normal operating temperature.
- Allow the engine idle to stabilize.

- Access the PCM and monitor the RPM PID.
- Access output state control.
- Increase the EGR vacuum regulator duty cycle while monitoring the RPM PID.
- **Does the RPM decrease or the engine stall as the EGR vacuum regulator duty cycle is increased?**

Yes	No
Unable to duplicate or identify the concern at this time.	GO to HH21.

HH21 CHECK FOR THE PRESENCE OF CARBON BUILD-UP IN THE EGR PASSAGE

NOTE:	**In certain vehicle applications, carbon build-up may occur downstream of the ESM. An inspection is required to make sure the passage in the upper intake manifold plenum chamber behind the ESM is open to allow exhaust gas flow.**

- Key in OFF position.
- Remove the ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** .
- Disconnect the air inlet tube from the throttle body.
- Prop open the throttle body.
- Apply regulated shop air to the EGR port at the location where the ESM attaches to the upper intake manifold.
- **Is a restriction concern present?**

Yes	No
CLEAN the EGR port as necessary and INSTALL the ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HH22 DTCS P0403 AND P1409: CHECK THE EGR VACUUM REGULATOR SOLENOID OPERATION

- Key ON, engine running.
- Engine at normal operating temperature.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the RPM PID.
- Access output state control.
- Increase the EGR vacuum regulator duty cycle while monitoring the RPM PID.
- **Does the RPM decrease or the engine stall as the EGR vacuum regulator duty cycle is increased?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to HH23.

HH23 CHECK THE VPWR VOLTAGE TO THE EGR VACUUM REGULATOR SOLENOID

- Key in OFF position.
- ESM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ESM Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 4	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to HH24.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HH24 CHECK THE EGR VACUUM REGULATOR SOLENOID COIL RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) ESM Connector, Component Side	(-) ESM Connector, Component Side
VPWR - Pin 4	EVR - Pin 1

- **Is the resistance between 26 - 40 ohms?**

Yes	No
GO to HH25.	INSTALL a new EGR Vacuum Regulator solenoid. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HH25 CHECK THE EVR CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) ESM Connector, Harness Side	(-) PCM Connector, Harness Side
EVR - Pin 1	EVR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HH26.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HH26 CHECK THE EVR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
EVR	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to HH27.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH27 CHECK THE EVR CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
EVR	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HH29.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HH28 EGR DIAGNOSIS BY SYMPTOM: CHECK FOR EGR FLOW WITH THE EGR VACUUM REGULATOR VACUUM HOSE DISCONNECTED AND PLUGGED

NOTE: An increase in DPFEGR PID voltage at idle indicates EGR flow.

- Carry out the KOER self-test. Repair any other DTCs.
- Possible causes for EGR flow at idle with no related DTCs:
  - EGR valve not fully seating
  - EGR vacuum regulator solenoid vent restricted
  - Damaged EGR vacuum regulator solenoid

- Disconnect and plug the EGR vacuum regulator vacuum source hose.
- Key ON, engine OFF.
- Access the PCM and monitor the DPFEGR PID.
- Record the PID voltage.
- Key ON, engine running.
- With the engine at idle, observe the DPFEGR PID voltage. Compare to engine OFF voltage.
- **Is the idle DPFEGR PID voltage greater than 0.15 V when compared to the KOEO DPFEGR PID voltage?**

Yes	No
REMOVE and INSPECT the ESM for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. If no concerns are present, INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSPECT the EGR vacuum regulator solenoid vent for blockage. To continue symptom diagnosis, REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHARTS** .

HH29 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins
    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HK: VARIABLE CAMSHAFT TIMING (VCT)

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- VCT solenoid (6L713) or (6B297)

- spider assembly right bank (6C260), or left bank (6C261)
- harness circuits: VPWR and VCT
- powertrain control module (PCM) (12A650)

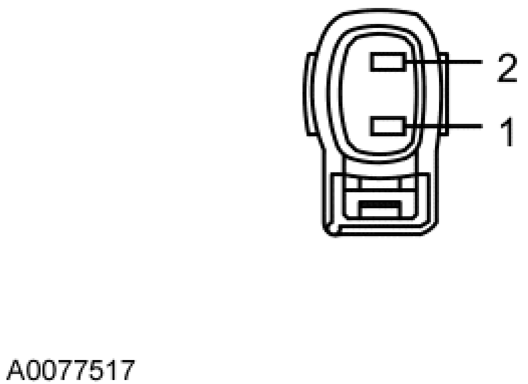


Fig. 128: Variable Camshaft Timing Bank 1 (VCT1) Solenoid Connector - A
Courtesy of FORD MOTOR CO.

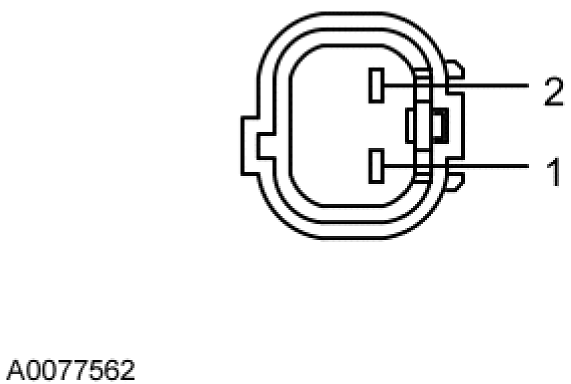


Fig. 129: Variable Camshaft Timing Bank 1 (VCT1) Solenoid Connector - B
Courtesy of FORD MOTOR CO.

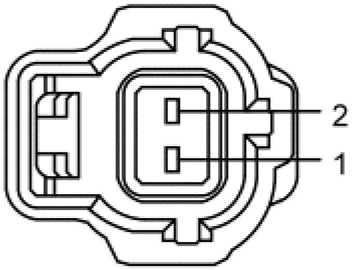


Fig. 130: Variable Camshaft Timing Bank 1 (VCT1) Solenoid Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Fusion 3.0L, Milan 3.0L, MKX, MKZ, Sable, Taurus, Taurus X	A	1 2	VPWR VCT1
Fusion 2.3L, Milan 2.3L	B	2 1	VPWR VCT1
All other vehicles	C	1 2	VPWR VCT1

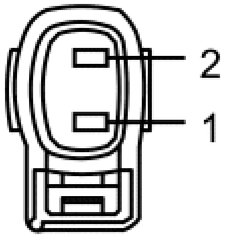


Fig. 131: Variable Camshaft Timing Bank 2 (VCT2) Solenoid Connector - A
Courtesy of FORD MOTOR CO.

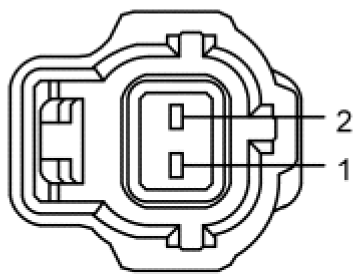


Fig. 132: Variable Camshaft Timing Bank 2 (VCT2) Solenoid Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, Fusion 3.0L, Milan 3.0L, MKX, MKZ, Sable, Taurus, Taurus X	A	1 2	VPWR VCT2
All other vehicles	B	1 2	VPWR VCT2

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Expedition, Navigator	140 Pin	B51, B52, B53 E68 E67	VPWR VCT2 VCT1
Explorer, Explorer Sport Trac, F-Super Duty, Mountaineer, Mustang	170 Pin	B35, B36 E68 E67	VPWR VCT2 VCT1
Fusion 3.0L, Milan 3.0L,	140 Pin	B51, B52 E68	VPWR VCT2

MKZ		E67	VCT1
Fusion 2.3L, Milan 2.3L	140 Pin	B51, B52 E67	VPWR VCT1
All other vehicles	190 Pin	B51, B52, B53 E68 E67	VPWR VCT2 VCT1

TEST PROCEDURE

HK1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0010, P0011, P0012, P0016, P0018, P0020, P0021, P0022, P052A, P052B, P052C or P052D present?**

Yes	No
For DTCs P0010 or P0020, GO to HK2. For DTCs P0011, P0012, P0021, P0022, P052A, P052B, P052C or P052D, GO to HK17. For DTCs P0016 and P0018 with or without P0011, P0012, P0021, P0022, P052A, P052B, P052C or P052D, GO to HK16.	For symptoms without DTCs, GO to HK17. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HK2 DTCS P0010 OR P0020: CHECK FOR VCT DTCS

NOTE: The engine should be at operating temperature before running the self-test.

- Clear the DTCs.
- Carry out the KOER self-test.
- **Are DTCs P0010 or P0020 present?**

Yes	No
For KOER DTC P0010, GO to HK4. For KOER DTC P0020, GO to HK10.	GO to HK3.

HK3 CARRY OUT A THOROUGH WIGGLE TEST ON THE VCT HARNESS

- Carry out a thorough wiggle test on the VCT harness.
- Carry out the KOER self-test.
- **Are DTCs P0010 or P0020 present?**

Yes	No
For KOER DTC P0010, GO to HK4. For KOER DTC P0020, GO to HK10.	refer to **PINPOINT TEST Z**.

HK4 CHECK THE VCT1 SOLENOID RESISTANCE

- Key in OFF position.
- VCT1 Solenoid connector disconnected.
- Measure the resistance between:

(+) VCT1 Solenoid Connector, Component Side	(-) VCT1 Solenoid Connector, Component Side
VCT1	VPWR

- **Is the resistance between 5 - 14 ohms?**

Yes	No
GO to HK5.	INSTALL a new VCT1 solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK5 CHECK THE VCT1 SOLENOID FOR INTERNAL SHORTS

- Measure the resistance between:

(+) VCT1 Solenoid Connector, Component Side	(-)
VCT1	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HK6.	INSTALL a new VCT1 solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK6 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) VCT1 Solenoid Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to HK7.	REPAIR the open circuit. CLEAR the DTCs.

	REPEAT the self-test.

HK7 CHECK THE VCT1 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) VCT1 Solenoid Connector, Harness Side	(-)
VCT1	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to HK8.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HK8 CHECK THE VCT1 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) VCT1 Solenoid Connector, Harness Side	(-) PCM Connector, Harness Side
VCT1	VCT1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HK9.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HK9 CHECK THE VCT1 CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Measure the resistance between:

(+) VCT1 Solenoid Connector, Harness Side	(-)
VCT1	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HK18.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HK10 DTC P0020: CHECK THE VCT2 SOLENOID RESISTANCE

- Key in OFF position.
- VCT2 Solenoid connector disconnected.
- Measure the resistance between:

(+) VCT2 Solenoid Connector, Component Side	(-) VCT2 Solenoid Connector, Component Side
VCT2	VPWR

- **Is the resistance between 5 - 14 ohms?**

Yes	No
GO to HK11.	INSTALL a new VCT2 solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK11 CHECK THE VCT2 SOLENOID FOR INTERNAL SHORTS

- Measure the resistance between:

(+) VCT2 Solenoid Connector, Component Side	(-)
VCT2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HK12.	INSTALL a new VCT2 solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK12 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) VCT2 Solenoid Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to HK13.	REPAIR the open circuit. CLEAR the DTCs.

	REPEAT the self-test.

HK13 CHECK THE VCT2 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) VCT2 Solenoid Connector, Harness Side	(-)
VCT2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to HK14.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HK14 CHECK THE VCT2 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) VCT2 Solenoid Connector, Harness Side	(-) PCM Connector, Harness Side
VCT2	VCT2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HK15.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HK15 CHECK THE VCT2 CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Measure the resistance between:

(+) VCT2 Solenoid Connector, Harness Side	(-)
VCT2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HK18.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HK16 CONTINUOUS DTCS P0016, P0018 WITH OR WITHOUT P0011, P0012, P0021, P0022, P052A, P052B, P052C, P052D: CHECK THE FUNCTIONALITY OF THE VCT SYSTEM

NOTE: **On 4.6L 3V and 5.4L 3V engines, the VCTADV PID indicates a positive value. For all others, the VCTADV PID indicates a negative value.**

- Engine at normal operating temperature.
- Clear the DTCs.
- For DTC P0016.
- Access the PCM and monitor the VCTADV PID.
- For DTC P0018.
- Access the PCM and monitor the VCTADV2 PID.
- Run the engine at idle for 1 minute while monitoring the VCTADV (P0016) or VCTADV2 (P0018) PID.
- Retrieve the continuous memory DTCs.
- **Are DTCs P0016 or P0018 present?**

Yes	No
For a VCTADV PID value between -16 and -46 degrees (2.3L, 3.5L), -14 and -36 degrees (3.0L), or 24 and 73 degrees (4.6L 3V, 5.4L 3V), INSTALL a new VCT solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test. For all others, REFER to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** , Timing Drive Components, to verify the engine timing.	Unable to duplicate or identify the concern at this time.

HK17 CONTINUOUS DTCS P0011, P0012, P0021, P0022, P052A, P052B, P052C OR P052D: CHECK THE OPERATION OF THE VCT SYSTEM

NOTE: **Some vehicles require higher RPMs and loads to actuate the VCT system than others. The VCTERR PID should be close to 0 whether actuating or not. During rapid VCT movements, the VCTERR PID may momentarily deviate from 0.**

- For DTCs P0011, P0012, P052A or P052B.
- Access the PCM and monitor the VCTADV PID.
- Access the PCM and monitor the VCTADVERR PID.
- For DTCs P0021, P0022, P052C or P052D.
- Access the PCM and monitor the VCTADV2 PID.
- Access the PCM and monitor the VCTADVERR2 PID.

- Drive the vehicle exercising the throttle to induce VCT movement.
- **Does the VCTADV PID indicate VCT movement while the VCTERR PID maintain close to 0?**

Yes	No
Unable to duplicate or identify the concern at this time.	INSTALL a new VCT solenoid. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HK18 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HM: SECONDARY AIR INJECTION (AIR) SYSTEM

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- secondary air injection system relay (14B192)
- electric air injection pump (9A486)
- secondary air injection bypass solenoid (9H465)
- harness circuits: B+, VPWR, AIR, AIRM, ground
- powertrain control module (PCM) (12A650)

- secondary air injection diverter valve (9F491)
- vacuum supply
- hoses

- partial restricted exhaust

Refer to the Wiring Diagrams article for schematic and connector information.

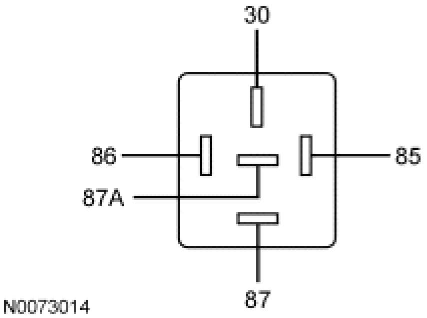


Fig. 133: Powertrain Control Module Power (PCM Power) Relay Connector - B
Courtesy of FORD MOTOR CO.

Pin	Circuit
86	AIR (Secondary Air Injection)
87	AIR_PWR (AIR Pump Power)
30	B+ (Battery Positive Voltage)
85	VPWR (Vehicle Power)

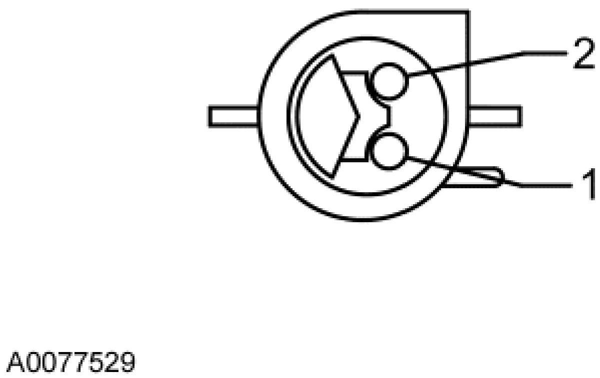


Fig. 134: Secondary Air Pump Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	AIR_PWR (AIR Pump Power)
1	AIR_GND (AIR Pump Ground)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Connector	Pin	Circuit
140 Pin	B58 B66 B67 B33 B51 B50 B1	SIGRTN CASE GND PWRGND VREF VPWR AIRM AIR

TEST PROCEDURE

HM1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Are DTCs P0410, P0412, P0491, P2257, P2258, or P2448 present?**

Yes	No
GO to HM2.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HM2 VISUALLY INSPECT THE SECONDARY AIR SYSTEM COMPONENTS AND HOSES

- Visually inspect the secondary AIR system components, connectors and hoses for:
  - damaged hoses
  - obstructions
  - exhaust damage
  - restricted secondary AIR pump inlet
  - water or ice
- **Are the secondary AIR system components and hoses OK?**

Yes	No
GO to HM3.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

HM3 CHECK THE VPWR VOLTAGE TO THE SECONDARY AIR RELAY

- Secondary AIR relay removed.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Secondary AIR Relay Connector, Harness Side	(-)
VPWR - Pin 85	Ground
B+ - Pin 30	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to HM4.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM4 CHECK THE SECONDARY AIR RELAY

- Key in OFF position.
- Carry out the relay component test. Refer to the Wiring Diagrams Cell 149 Component Testing.
- **Does the relay pass the component test?**

Yes	No
GO to HM5.	INSTALL a new secondary AIR relay. CLEAR the DTCs. REPEAT the self-test.

HM5 CHECK THE SECONDARY AIR PUMP GROUND CIRCUIT FOR AN OPEN IN THE HARNESS

- Secondary AIR Pump Motor connector disconnected.
- Measure the resistance between:

(+) Secondary Air Pump Connector, Harness Side	(-)
AIR_GND - Pin 1	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HM6.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM6 CHECK THE SECONDARY AIR PUMP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) Secondary AIR Relay Connector, Harness Side	(-) Secondary Air Pump Connector, Harness Side
AIR_PWR - Pin 87	AIR_PWR - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HM7.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM7 CHECK THE SECONDARY AIR CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Secondary AIR Relay Connector, Harness Side
AIR - Pin B1	AIR - Pin 86
AIRM - Pin B50	AIR_PWR - Pin 87

- **Are the resistances less than 5 ohms?**

Yes	No
GO to HM8.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM8 CHECK THE SECONDARY AIR MONITOR CIRCUIT AND THE SECONDARY AIR PUMP VOLTAGE CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
AIRM - Pin B50	Ground
AIR - Pin B1	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to HM9.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HM9 CHECK THE SECONDARY AIR MONITOR CIRCUIT AND THE SECONDARY AIR PUMP VOLTAGE CIRCUIT FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
AIRM - Pin B50	Ground
AIR - Pin B1	Ground

- **Is any voltage present?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.	GO to HM10.

HM10 MEASURE THE VACUUM AT THE SECONDARY AIR SOLENOID VALVE

CAUTION: Running the secondary AIR pump with OTM longer than 2 minutes may overheat and damage the secondary AIR pump. Refer to{Output Test Mode}.

- Key in OFF position.
- Secondary AIR relay installed.
- Secondary AIR Solenoid connector connected.
- PCM connector connected.
- Key ON, engine OFF.
- Connect a vacuum gauge to the control vacuum outlet at the secondary AIR valve.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Observe the vacuum gauge reading at the secondary AIR valve.
- Command the outputs OFF.
- Exit output test mode.
- **Is vacuum present at the secondary AIR diverter valve?**

Yes	No
GO to HM11.	INSTALL a new secondary AIR valve. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HM11 CHECK THE SECONDARY AIR PUMP OPERATION

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Disconnect the inlet hose from the secondary AIR valve.
- Command the outputs ON.
- Place your hand over the secondary AIR valve inlet hose.
- Command the outputs OFF.
- Exit output test mode.
- **Is there any air flow from the secondary AIR inlet valve hose?**

Yes	No
INSTALL a new secondary AIR valve. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSTALL a new secondary AIR pump. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST HU: INTAKE AIR SYSTEMS

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- accelerator cable linkage to throttle body (9C799)
- air cleaner assembly (including air cleaner element) (9600)
- air inlet tube (9F843)
- clean air tube hose and resonator (9R504) and (9F593)
- intake manifold runner control (IMRC) housing assembly (9U531), (9U524) and (9J447)
- IMRC actuator assembly (9J559)
- IMRC (9G730)
- intake manifold tuning valve (IMTV) (9L490)
- IMTV electric actuator assembly (9L490)
- speed control cable (9A825)
- throttle body assembly (9E926)
- harness circuits: IMRC, MONITOR, SIGNAL, SIGRTN, PWRGND, and VPWR
- harness circuits: IMTV, MONITOR, SIGNAL, and VPWR
- powertrain control module (PCM) (12A650)

IMRCM VOLTAGE VALUES

VEHICLE	IMRC OFF	IMRC ON
Focus, 2.0L	0	5
F-150 5.4L, Mark LT	5	0
All Others	2.5	0

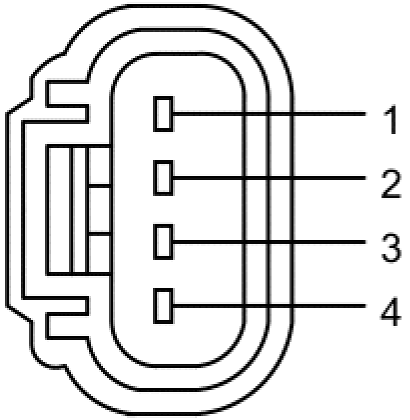


Fig. 135: Intake Manifold Runner Control (IMRC) Actuator Connector - A
Courtesy of FORD MOTOR CO.

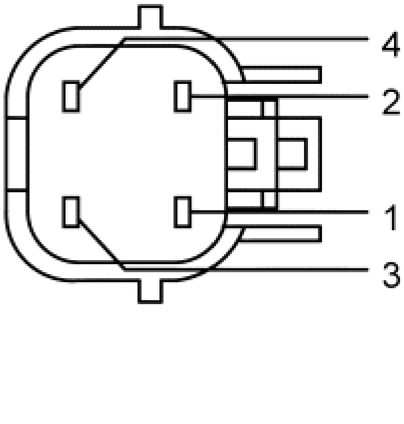


Fig. 136: Intake Manifold Runner Control (IMRC) Actuator Connector - B
Courtesy of FORD MOTOR CO.

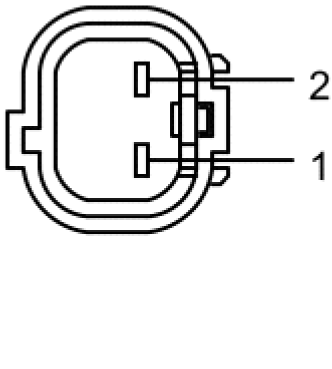


Fig. 137: Intake Manifold Runner Control (IMRC) Actuator Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition 5.4L, F-150 5.4L, F-Super Duty 5.4L, Mark LT 5.4L, Navigator 5.4L	A	4 3 2 1	IMRCM IMRC PWRGND VPWR
Explorer 4.6L, Explorer Sport Trac 4.6L, Mountaineer 4.6L, Mustang 4.6L	A	3 2 1	IMRC PWRGND VPWR

F-150 4.2L	B	4 1 2 3	IMRCM IMRC PWRGND VPWR
Focus	C	2 1	IMRC VPWR
Fusion 2.3L, Milan 2.3L	C	1 2	IMRC VPWR

For most vehicles the IMRCM is integrated into the IMRC connector.

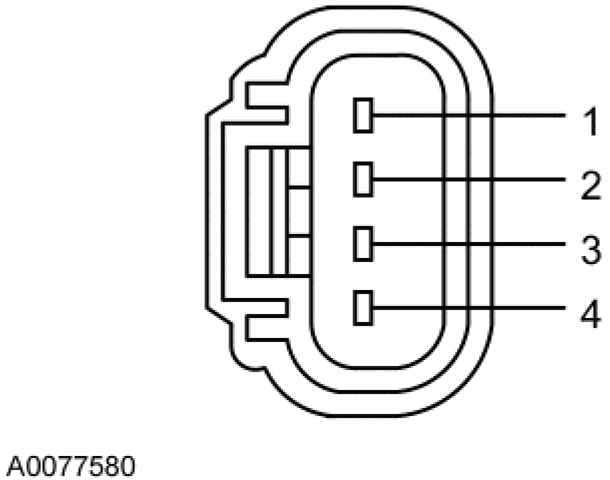


Fig. 138: Intake Manifold Runner Control Monitor (IMRCM) Sensor Connector - A
Courtesy of FORD MOTOR CO.

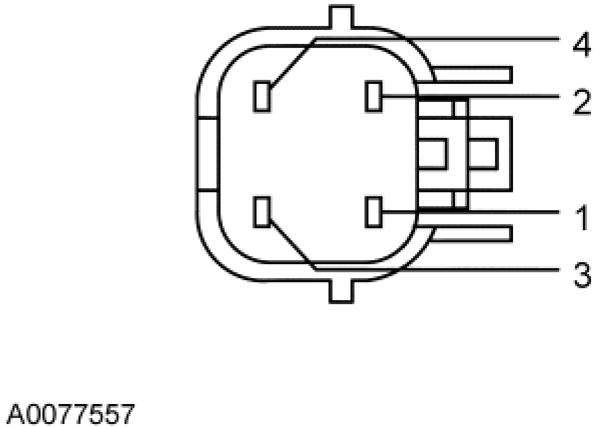


Fig. 139: Intake Manifold Runner Control Monitor (IMRCM) Sensor Connector - B
Courtesy of FORD MOTOR CO.

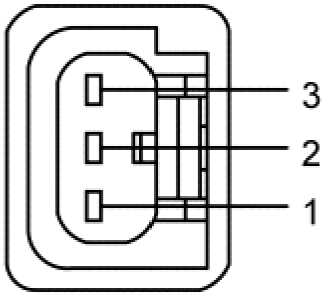


Fig. 140: Intake Manifold Runner Control Monitor (IMRCM) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition 5.4L, F-150 5.4L, F-Super Duty 5.4L, Mark LT 5.4L, Navigator 5.4L	A	2 1 4	PWRGND VPWR IMRCM
F-150 4.2L	B	2 3 4	PWRGND VPWR IMRCM
Focus	C	2 3 1	PWRGND VPWR IMRCM
Fusion 2.3L, Milan 2.3L	C	1	IMRCM

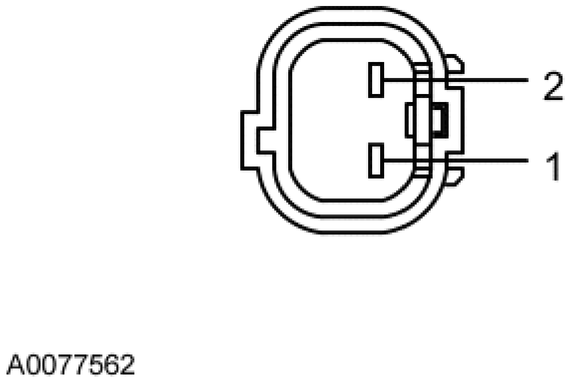


Fig. 141: Intake Manifold Tuning Valve (IMTV) Actuator Connector - A
Courtesy of FORD MOTOR CO.

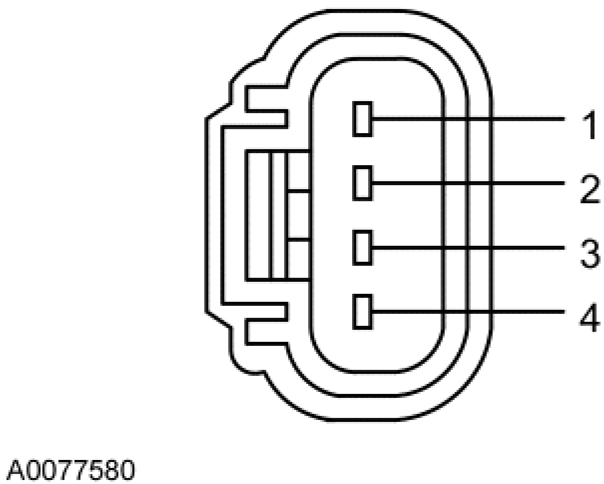


Fig. 142: Intake Manifold Tuning Valve (IMTV) Actuator Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Fusion 2.3L, Milan 2.3L	A	1 2	IMTV VPWR
F-Super Duty 6.8L	B	3 1	IMTV VPWR

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit

Escape/Mariner	150 (50-50-50) Pin	E41 E6 B47	SIGRTN IMTV PWRGND
Expedition, Navigator	140 Pin	E58 B67 E43 E50	SIGRTN PWRGND IMRCM IMRC
F-150, Mark LT	190 Pin	E58 B67 E43 E50	SIGRTN PWRGND IMRCM IMRC
F-Super Duty 5.4L	170 Pin	E58 B47 E43 E50	SIGRTN PWRGND IMRCM IMRC
F-Super Duty 6.8L	170 Pin	E58 E64 B47	SIGRTN IMTV PWRGND
Focus	190 Pin	E64 B69 E25 E22	SIGRTN PWRGND IMRCM IMRC
Fusion, Milan	140 Pin	E58 E64 B67 E43 E50	SIGRTN IMTV PWRGND IMRCM IMRC
All other vehicles	170 Pin	E58 B47 E50	SIGRTN PWRGND IMRC

TEST PROCEDURE

HU1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0505, P0506, P0660, P0663, P1512, P1513, P1516, P1517, P1518, P1519, P151A, P1520, P1537, P1538, P1549, P2004, P2005, P2006, P2007, P2008, P2014, P2015, P2019, P2020, P2070, or P2071 present?**

Yes	No
For DTCs P0505 or P0506, on vehicles with electronic throttle control (ETC), GO to HU51. For DTCs P0505 or P0506, on vehicles without ETC, GO to HU2. For DTCs P0660, P0663, P1549, P2070 or P2071,	For vehicles equipped with electronic throttle control (ETC) that have low idle concerns, difficulty starting, hesitation, loss of RPM, GO to HU51. For lack/loss of power, GO to HU42. For all other symptoms without DTCs, GO to HU2.

GO to HU42. For DTC P151A, Mustang 4.6L, Explorer 4.6L, Explorer Sport Trac 4.6L, and Mountaineer 4.6L. GO to HU18. For DTC P151A, all others, GO to HU17. For DTCs P1512, P1513, P1516, P1517, P1518, P1519, P1520, P1537, P1538, P2004, P2005, P2006, P2007, P2008, P2014, P2015, P2019 or P2020, GO to HU15.	

HU2 PART THROTTLE SYMPTOM

- **Are any part throttle concerns present?**

Yes	No
GO to HU7.	GO to HU3.

HU3 CHECK THE BASE IDLE SPEED

NOTE: The vehicle must be at operating temperature and at idle for a minimum of 1 minute.

- Key ON, engine running.
- Determine if the idle speed is incorrect. Refer to the **REFERENCE VALUES** article Typical Reference Value Charts, if necessary.
- Access the PCM and monitor the RPM PID.
- If equipped, read the vehicle tachometer.
- **Is vehicle idle speed correct?**

Yes	No
GO to HU5.	GO to HU4.

HU4 CHECK THE THROTTLE ARM CONTACTS

- Key in OFF position.
- Check that the throttle arm contacts the return stop.
- **Is the idle speed high?**

Yes	No
GO to HU9.	GO to HU10.

HU5 CHECK FOR BINDING OR STICKING IN THE THROTTLE SYSTEM

- Gently cycle the throttle from fully closed to fully open and back to fully closed. Check for sticking or binding during rotation.

- **Is a stick and bind condition present?**

Yes	No
GO to HU6.	GO to HU7.

HU6 ISOLATE THE BINDING AND/OR STICKING CONCERN

NOTE: **Do not attempt to clean the throttle bore and plate area. Cleaning damages the throttle body assembly.**

NOTE: **The sticking or binding condition can either be within the cables or throttle body assembly.**

- Disconnect the accelerator cable and speed control cable from the throttle body linkage.
- Rotate the throttle body linkage.
- **Does the throttle body rotate freely without a sticking, binding or grabbing condition?**

Yes	No
REPAIR the cable(s) causing the concern. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new throttle body assembly. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HU7 CHECK THE FUNCTIONALITY OF THE THROTTLE POSITION (TP) SENSOR

- Key ON, engine OFF.
- Access the PCM and monitor the TP PID.
- Gently cycle the throttle from fully closed to fully open and back to fully closed.
- **Does the TP PID display a smooth voltage reading?**

Yes	No
GO to HU8.	INSTALL a new TP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HU8 CHECK THE INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS AND DAMAGE

NOTE: **The Focus air cleaner element is integral to the air cleaner assembly. Inspect the air restriction gauge (if equipped) for a restriction indication.**

- Key in OFF position.

- Remove the air cleaner element. Check the air cleaner for blockage.
- Check for restrictions between the air inlet and the throttle body.
- **Are any restriction concerns present?**

Yes	No
REMOVE the restriction. INSTALL a new air cleaner element. Refer to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	REINSTALL the air cleaner element. GO to HU9.

HU9 CHECK THE POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

NOTE: A high idle may indicate an incorrect PCV valve size or a vacuum leak.

- Check that no cracks or leaks are present.
- Remove the PCV valve.
    - Verify a clean PCV valve.
    - Verify the proper PCV valve part number.
- **Are any PCV system concerns present?**

Yes	No
INSTALL a new PCV valve. REPAIR as necessary. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	For high idle, GO to HU13. For all others, CONNECT the PCV valve. GO to HU10.

HU10 CHECK THE IDLE AIR CONTROL (IAC) VALVE RESPONSE

- Key ON, engine running.
- The vehicle must be at operating temperature and at idle for a minimum of 1 minute.
- IAC connector disconnected.
- **Does the RPM drop or the engine stall?**

Yes	No
GO to HU12.	GO to HU11.

HU11 CHECK THE IAC VALVE RESPONSE

- **Is the idle speed high?**

Yes	No
GO to HU13.	INSTALL a new IAC. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-**

	SERIES . CLEAR the DTCs. REPEAT the self-test.

HU12 INSPECT THE THROTTLE BODY PLATE HOLE FOR PLUGGING

NOTE: **Only some applications have a throttle plate hole. If not equipped go to the SYMPTOM CHARTS article, Symptom Charts.**

- Key in OFF position.
- Remove the resonator from the throttle body assembly.
- Inspect the throttle plate hole for any restrictions.
- **Are any restriction concerns present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** , to diagnose performance while driving concerns.

HU13 CHECK FOR VACUUM LEAKS

- Listen for vacuum leaks.
- Inspect the entire intake air system from the mass air flow (MAF) sensor to the intake manifold for leaks such as:
  - cracked or punctured inlet air tube
  - loose connections on the inlet air tube at the air cleaner housing or throttle body
  - IAC valve assembly or gasket
  - EGR valve gasket leak to intake manifold
  - intake manifold assembly or gasket
  - EGR valve diaphragm or control solenoid
  - vacuum supply connectors and hose
- **Are any leaks present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HU14.

HU14 CHECK THE THROTTLE BODY FOR EXCESSIVE WEAR

- Key in OFF position.
- Remove the throttle body assembly. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** for removal and inspection.
- Check the following:

- excessive wear or grooving in the throttle bore
- misaligned or worn throttle plate
- excessive gap between the throttle bore and plate

- **Are any concerns present?**

Yes	No
INSTALL a new throttle body assembly. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** , to diagnose performance while driving concerns.

HU15 DTCS P1512, P1513, P1516, P1517, P1518, P1519, P1520, P1537, P1538, P2004, P2005, P2006, P2007, P2008, P2014, P2015, P2019 OR P2020: VISUAL INSPECTION

NOTE: **If unable to fully carry out the following inspections, answer NO to the question in this step.**

NOTE: **The IMRC return spring is strong on vacuum systems. Make sure the vacuum system operates correctly and the plates open and close fully. On vacuum operated systems the engine must run for 20 seconds to restore vacuum then return to KOEO for testing.**

Some IMRC electrical systems are driven in both directions by the solenoid and do not use a return spring. They can not be opened manually.

- Visually inspect the linkage for possible causes of binding or obstructions. Check the lever/linkage for movement. There may be some tension in one direction but there should be full travel.
- Manually open and close the IMRC plates at the intake manifold while checking for sticking or binding.
- **Is a mechanical concern present?**

Yes	No
GO to HU16.	For Explorer 4.6L, Explorer Sport Trac 4.6L, Mountaineer 4.6L, and Mustang 4.6L, GO to HU18. For all others, GO to HU17.

HU16 CHECK THE IMRC FOR MECHANICAL OPERATION

NOTE: **The IMRC return spring is strong - approximately 0.34 to 0.45 Nm (3 to 4 in-lb).**

NOTE: Some electric motor applications do not use a return spring and should move freely when open and closed.

- Disconnect the IMRC linkage or remove the actuator assembly from the manifold.
- Rotate the IMRC plate lever to fully open and to fully closed, contacting both limits.
- Check for sticking or binding during rotation.
- **Is a mechanical concern present?**

Yes	No
REPAIR as necessary or INSTALL a new IMRC. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	CONNECT the IMRC linkage. For Explorer 4.6L, Explorer Sport Trac 4.6L, Mountaineer 4.6L, and Mustang 4.6L, GO to HU18. For all others, GO to HU17.

HU17 DTC P151A: CHECK THE FUNCTIONALITY OF THE IMRC

WARNING: Keep fingers clear of the mechanism. Failure to follow these instructions may result in personal injury.

NOTE: The vehicle must be at operating temperature and at idle for a minimum of 1 minute.

- Key ON, engine running.
- Access the PCM and control the IMRC PID.
- Access the PCM and monitor the IMRC1M PID.
- Command IMRC ON then OFF.

IMRCM VOLTAGE VALUES

VEHICLE	IMRC OFF	IMRC ON
Focus, 2.0L	0	5
F-150 5.4L, Mark LT	5	0
All Others	2.5	0

- **Using the table for reference, do the IMRCM voltage values correctly change while the IMRC is cycled?**

Yes	No
refer to **PINPOINT TEST Z**.	GO to HU19.

HU18 CHECK THE FUNCTIONALITY OF BI-DIRECTIONAL IMRC

WARNING: **Keep fingers clear of the mechanism. Failure to follow these instructions may result in personal injury.**

NOTE: **The vehicle must be at operating temperature and at idle for a minimum of 1 minute.**

- Key ON, engine running.
- Access the PCM and control the IMRC PID.
- Access the PCM and monitor the IMRC_F PID.
- Command IMRC ON then OFF.
- **Do the IMRC values correctly change from off to on while the IMRC is cycled and is the IMRCF PID no?**

Yes	No
refer to **PINPOINT TEST Z**.	GO to HU19.

HU19 CHECK THE FUNCTIONALITY OF THE IMRC

WARNING: **Keep fingers clear of the mechanism. Failure to follow these instructions may result in personal injury.**

NOTE: **The vehicle must be at operating temperature and at idle for a minimum of 1 minute.**

- Key ON, engine running.
- Physically monitor the IMRC actuator.
- Access the PCM and control the IMRC PID.
- Command the outputs ON.
- **Do the IMRC levers cycle from fully closed and remain fully open while the outputs are on?**

Yes	No
GO to HU28.	GO to HU20.

HU20 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- IMRC Actuator connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRC Actuator Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to HU21.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU21 CHECK THE GROUND CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the voltage between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
VPWR	PWRGND

- **Is the voltage greater than 10 V?**

Yes	No
GO to HU22.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU22 VERIFY THE DRIVER CIRCUIT FUNCTION

- Connect a non-powered test lamp between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
VPWR	IMRC

- **Does the test lamp illuminate?**

Yes	No
GO to HU27.	GO to HU23.

HU23 VERIFY THE DRIVER CIRCUIT FUNCTION WHILE COMMANDING ON IMRC

- Key ON, engine running.
- Access the PCM and control the IMRC PID.
- Connect a non-powered test lamp between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
VPWR	IMRC

- Command the outputs ON.
- **Does the test lamp illuminate?**

Yes	No
GO to HU26.	GO to HU24.

HU24 CHECK THE IMRC CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) IMRC Actuator Connector, Harness Side	(-) PCM Connector, Harness Side
IMRC	IMRC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HU25.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU25 CHECK THE IMRC CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRC Actuator Connector, Harness Side	(-)
IMRC	Ground

- **Is the voltage less than 10 V?**

Yes	No
GO to HU53.	REPAIR the short circuit to voltage. CLEAR the DTCs. REPEAT the self-test.

HU26 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE IMRC HARNESS

- Key in OFF position.
- PCM connector connected.
- Measure the resistance between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
IMRC	IMRCM
IMRC	PWRGND

- **Are the resistances greater than 10K ohms?**

Yes	No
INSTALL a new IMRC actuator. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-**	GO to HU27.

SERIES as necessary. CLEAR the DTCs. REPEAT the self-test.	

HU27 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE IMRC HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
IMRC	IMRCM
IMRC	PWRGND

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to HU53.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test. GO to HU41.

HU28 CHECK THE IMRCM PID

- Key ON, engine OFF.
- Access the PCM and monitor the IMRC1M PID.
- **Is the IMRCM PID displaying either VREF or approximately 2.5 volts?**

Yes	No
GO to HU29.	GO to HU33.

HU29 CHECK THE IMRCM CIRCUIT FOR A SHORT TO VPWR

NOTE: **The vehicle must be at operating temperature and at idle for a minimum of 1 minute.**

- Key ON, engine running.
- Access the PCM and control the IMRC PID.
- Command the outputs ON.
- Access the PCM and monitor the IMRC1M PID.
- **Is the voltage less than 1 V?**

Yes	No
GO to HU35.	GO to HU35.

HU30 CHECK THE IMRCM CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key ON, engine OFF.

- IMRCM Sensor connector disconnected.
- Measure the voltage between:

(+) IMRCM Sensor Connector, Harness Side	(-)
IMRCM	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to HU31.	GO to HU32.

HU31 CHECK THE IMRCM CIRCUIT FOR A SHORT TO VOLTAGE IN THE CONTROL MODULE

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRCM Sensor Connector, Harness Side	(-)
IMRCM	Ground

- **Is the voltage greater than 10 V?**

Yes	No
REPAIR the short circuit to voltage. CLEAR the DTCs. REPEAT the self-test.	GO to HU53.

HU32 CHECK THE IMRCM CIRCUIT FOR A SHORT TO VPWR

- Key in OFF position.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Component Side	(-) IMRCM Sensor Connector, Component Side
IMRCM	VPWR

- **Is the resistance greater than 10K ohms?**

Yes	No
CHECK for an intermittent concern. refer to **PINPOINT TEST Z**.	INSTALL a new IMRCM sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test. GO to HU41.

HU33 CHECK THE IMRCM CIRCUIT FOR A SHORT TO GROUND

- Key ON, engine OFF.
- Access the PCM and monitor the IMRC1M PID.
- IMRCM Sensor connector disconnected.
- **Does voltage change from less than 1 volt to VREF when disconnecting the IMRCM harness connector?**

Yes	No
INSTALL a new IMRCM sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test. GO to HU41.	GO to HU34.

HU34 CHECK THE IMRCM CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) IMRCM Sensor Connector, Harness Side
IMRCM	PWRGND

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HU53.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test. GO to HU41.

HU35 CHECK THE MONITOR CIRCUIT RESPONSE

- IMRCM Sensor connector disconnected.
- Access the PCM and monitor the IMRC1M PID.
- Connect a 5 amp fused jumper wire between the following:

Point A IMRCM Sensor Connector, Harness Side	Point B
IMRCM	Ground

- **Does voltage change from less than 1 volt to VREF when disconnecting the IMRCM harness connector?**

Yes	No
GO to HU36.	GO to HU39.

HU36 CHECK THE PWRGND CIRCUIT FOR CONTINUITY TO CHASSIS GND

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector connected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) Vehicle Battery
PWRGND	Negative terminal

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HU37.	GO to HU38.

HU37 CHECK THE MONITOR CIRCUIT FOR AN INTERMITTENT OPEN

- PCM connector disconnected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IMRCM	IMRCM

- Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.
- **Is the resistance fluctuating while checking the harness?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to HU41.	INSTALL a new IMRCM sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test. GO to HU41.

HU38 CHECK THE HARNESS PWRGND CIRCUIT FOR CONTINUITY

- PCM connector disconnected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
PWRGND	PWRGND

- **Is the resistance less than 5 ohms?**

Yes	No

CHECK the circuit for an intermittent concern. refer to **PINPOINT TEST Z**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to HU41.

HU39 CHECK THE IMRCM CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IMRCM	IMRCM

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HU40.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to HU41.

HU40 CHECK THE MONITOR CIRCUIT FOR AN INTERMITTENT OPEN

- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IMRCM	IMRCM

- Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.
- **Is the resistance fluctuating while checking the harness?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test. GO to HU41.	GO to HU53.

HU41 VERIFY THE REPAIR

- Key ON, engine OFF.
- Clear the PCM DTCs.
- Access the PCM and monitor the IMRC and IMRC_F PIDs.
- Access the PCM and monitor the IMRC1M PID.
- Key ON, engine running.
- Drive the vehicle, obeying all traffic and safety laws.

- Safely carry out 3 acceleration runs from a stop or roll to between 3,000 and 4,000 RPM.
- Watch for any PID change.
- Carry out the PCM self-test.
- **Are any DTCs received?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	The test completed successfully.

HU42 DTCS P0660, P0663, P1549, P2070 OR P2071: VISUAL INSPECTION OF INTAKE MANIFOLD TUNING VALVE

- Inspect the component for signs of damage.
- Check the harness and connection.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HU43.

HU43 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- IMTV Actuator connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IMTV Actuator Connector, Harness Side	(-) Vehicle Battery
VPWR	Negative terminal

- **Is the voltage greater than 10.5 V?**

Yes	No
GO to HU44.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU44 CHECK THE IMTV CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) IMTV Actuator Connector, Harness Side	(-) PCM Connector, Harness Side
IMTV	IMTV

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HU45.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HU45 CHECK THE IMTV CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
IMTV	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HU46.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HU46 CHECK THE IMTV CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
IMTV	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to HU47.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HU47 CHECK THE IMTV DRIVER CIRCUIT WITH THE PCM CONNECTED

- IMTV Actuator connector disconnected.
- PCM connector connected.
- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) IMTV Actuator Connector, Harness Side	(-) IMTV Actuator Connector, Harness Side
VPWR	IMTV

- **Does the test lamp illuminate?**

Yes	No

GO to HU53.	GO to HU48.

HU48 CHECK THE IMTV PCM DRIVER CIRCUIT WHEN COMMANDED ON

- Connect a non-powered test lamp between:

(+) IMTV Actuator Connector, Harness Side	(-) IMTV Actuator Connector, Harness Side
VPWR	IMTV

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.
- **Does the test lamp illuminate?**

Yes	No
GO to HU49.	GO to HU53.

HU49 CHECK THE IMTV FOR DAMAGE

- Key in OFF position.
- Remove the IMTV. Refer to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** .
- Visually inspect the shutter for damage.
- Manually rotate the shutter.
- **Is a concern present?**

Yes	No
INSTALL a new IMTV actuator. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to HU50.

HU50 CHECK THE IMTV FOR FUNCTIONALITY WHEN COMMANDED ON

- IMTV Actuator connector connected.
- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.
- **Does the IMTV shutter rotate?**

Yes	No

The concern is an intermittent. refer to **PINPOINT TEST Z**.	INSTALL a new IMTV actuator. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** as necessary. CLEAR the DTCs. REPEAT the self-test.

HU51 PRELIMINARY DIAGNOSIS FOR DIAGNOSTIC TROUBLE CODES (DTCS) P0505 OR P0506

- Key ON, engine OFF.
- **Are any DTCs present other than P0505 or P0506?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to HU52.

HU52 MONITOR THE INTAKE AIR SYSTEM RELATED PIDS

NOTE: Verify that the vehicle has reached the normal engine coolant operating temperature of 77°C (170°F). Allow the engine to idle an additional 5 minutes.

NOTE: The ETC_TRIM PID may not be available on all vehicles.

- Access the PCM and monitor the ECT PID.
- Access the PCM and monitor the ETC_TRIM PID.
- Access the PCM and monitor the IACTRIM and IACKAM2 PIDs.
- Mathematically add and record the value of the IACTRIM PID to the IACKAM2 PID value, for the total IAC value at idle.
- **Is the ETC_TRIM PID angle equal to 3.5 degrees or is the total IAC value greater than 0.5 lb/min?**

Yes	No
INSTALL a new throttle body assembly. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** to INSTALL a new throttle body. CLEAR the DTCs. REPEAT the self-test.	RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

HU53 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins

    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HV: COOLING FAN CLUTCH

INTRODUCTION

WARNING: **To avoid the possibility of personal injury or damage to the vehicle, do not operate the engine until the fan blade has been first examined for possible cracks and separation. Failure to follow these instructions may result in personal injury or death.**

NOTE: **Before starting this pinpoint test, turn the clutch fan assembly by hand and check for mechanical binding around the fan shroud or surrounding components. If binding is present, correct the problem then continue with the pinpoint test. If no binding is present, start the engine and warm up to normal operating temperature then continue with the pinpoint test.**

This pinpoint test is intended to diagnose the following:

- cooling fan clutch
- harness circuits: fan speed sensor (FSS), FSS PWRGND, FSS VPWR, fan control variable (FCV), and FCV VPWR
- powertrain control module (PCM) (12A650)

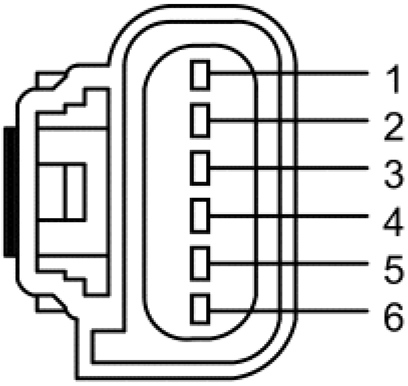


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Fig. 143: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	FSS (Fan Speed Sensor)
5	PWRGND (Power Ground)
2	VBPWR (Vehicle Buffered Power)
3	VPWR (Vehicle Power)
6	FCV (Fan Control Variable)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Pin	Circuit
Expedition, Navigator	B51, B52, B53 B45 B67, B68, B69, B70 B20 B48	VPWR FSS PWRGND VBPWR FCV
F-150	B51, B52, B53 E24 B67, B68, B69, B70 B20 B48	VPWR FSS PWRGND VBPWR FCV
All other vehicles	B35, B36 E24 B47, B48, B49, B50 E20 E7	VPWR FSS PWRGND VBPWR FCV

TEST PROCEDURE

HV1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0480, P0483 or P0528 present?**

Yes	No
For KOEO and KOER DTC P0480, GO to HV4. For KOEO and KOER DTCs P0483 or P0528, GO to HV2. For continuous memory DTCs P0480 or P0528, GO to HV10.	GO to HV2.

HV2 CHECK THE COOLING FAN CLUTCH FOR MECHANICAL BINDING

NOTE: The cooling fan clutch uses a viscous coupling. The viscous drag should be smooth during fan rotation. The amount of resistance is dependent upon the final cooling fan operational state before engine shutdown.

- Key in OFF position.
- Manually rotate the cooling fan.
- **Does the cooling fan clutch rotation feel rough or binding?**

Yes	No
INSTALL a new cooling fan clutch. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to HV3.

HV3 CHECK THE COOLING FAN CLUTCH OPERATION

- Key ON, engine running.
- Set the heater controls to OFF.
- Access the PCM and monitor the FANSS PID.
- **Does the FANSS PID indicate any RPM?**

Yes	No
GO to HV4.	GO to HV11.

HV4 KOEO AND KOER DTC P0480: CHECK THE COOLING FAN CLUTCH ACTUATOR VALVE SOLENOID RESISTANCE

NOTE: If necessary, install terminal adapters on the component side pins to carry out the resistance measurement.

- Key in OFF position.
- Cooling Fan Clutch connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Component Side	(-) Cooling Fan Clutch Connector, Component Side
FCV - Pin 6	VPWR - Pin 3

- **Is the resistance between 6 - 12 ohms?**

Yes	No
GO to HV5.	INSTALL a new cooling fan clutch. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HV5 CHECK THE COOLING FAN CLUTCH ACTUATOR VALVE SOLENOID RESISTANCE

- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Component Side	(-)
FCV - Pin 6	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HV6.	INSTALL a new cooling fan clutch. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HV6 CHECK THE VPWR VOLTAGE TO THE COOLING FAN CLUTCH ACTUATOR VALVE SOLENOID

- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
VPWR - Pin 3	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to HV7.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV7 CHECK THE FCV CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.

- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
FCV - Pin 6	FCV

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HV8.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV8 CHECK THE FCV CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FCV - Pin 6	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HV9.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HV9 CHECK THE FCV CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FCV - Pin 6	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to HV19.

HV10 CONTINUOUS MEMORY DTCS P0480 OR P0528: INTERMITTENT CHECK

NOTE: **Keep the coil arm of the cooling fan clutch secure while checking the wiring harness. If the coil arm rotates, faulty readings may occur.**

- Key ON, engine OFF.
- Access the PCM and monitor the FANSS PID.
- Access the PCM and monitor the FANVAR_F PID.
- While observing the PID wiggle, shake, and bend small sections of the wiring harness while working from the cooling fan clutch to the PCM.
- Check the cooling fan clutch and the PCM connectors for damage and corrosion.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary.	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HV11 KOEO AND KOER DTC P0528: CHECK THE VOLTAGE AND GROUND TO THE FSS SENSOR

- Cooling Fan Clutch connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) Cooling Fan Clutch Connector, Harness Side
VBPWR - Pin 2	PWRGND - Pin 5

- **Is the voltage greater than 10 V?**

Yes	No
GO to HV15.	GO to HV12.

HV12 CHECK THE VOLTAGE TO THE FSS SENSOR

- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
VBPWR - Pin 2	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to HV14.	GO to HV13.

HV13 CHECK THE VOLTAGE CIRCUIT TO THE FSS SENSOR FOR AN OPEN IN THE

HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
VBPWR - Pin 2	VBPWR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HV19.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV14 CHECK THE GROUND CIRCUIT TO THE FSS SENSOR FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
PWRGND - Pin 5	PWRGND

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HV19.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV15 CHECK THE FSS CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
FSS - Pin 4	FSS

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HV16.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HV16 CHECK THE FSS CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FSS - Pin 4	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HV17.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HV17 CHECK THE FSS CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FSS - Pin 4	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to HV18.

HV18 CHECK THE FUNCTIONALITY OF THE FSS CIRCUIT

- Key in OFF position.
- PCM connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FSS - Pin 4	Ground

- **Is the voltage greater than 10 V?**

Yes	No
INSTALL a new cooling fan clutch. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to HV19.

HV19 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins
    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HX: EVAPORATIVE EMISSION (EVAP) SYSTEM AND MONITOR

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

WARNING: **Before repairing or installing a new component in the fuel system, reduce the possibility of injury or fire by following the warning, caution, and handling directions in pinpoint test HC. Failure to follow these instructions may result in personal injury.**

NOTE: **Use this pinpoint test only when directed here.**

The use of a soap solution around the fuel filler cap or capless fuel tank filler pipe (if equipped) or the use of the hydrocarbon emission analyzer to determine an evaporative emission system leak is not recommended. The mandatory Rotunda Evaporative Emission System Leak Tester for On Board Diagnostic (OBD) (including the ultrasonic tester) and the Rotunda Vacutec 522 Leak Detector Smoke Machine are the only devices to be used at this time for

evaporative emission system leak detection.

When using the smoke machine, the fuel level in the fuel tank must be less than 85% full.

This pinpoint test is intended to diagnose the following:

- canister vent (CV) solenoid (9F945)
- fuel filler cap (9030)
- capless fuel tank filler pipe (9034)
- fuel tank pressure (FTP) sensor (9C052)
- EVAP canister purge (EVAPCP) valve (9C915). Also known as the vapor management valve (VMV).
- EVAP system leaks using the Rotunda Vacutec Leak Detector Smoke Machine.
- harness circuits: B+, CV, EVAPCP, FTP, FTPREF, SIGRTN, VPWR, VREF and CASE GND
- powertrain control module (PCM) (12A650)

For additional information on the EVAP system, refer to**EVAPORATIVE EMISSION (EVAP) SYSTEMS** , or the **EVAPORATIVE EMISSIONS -- E-SERIES** .

For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.

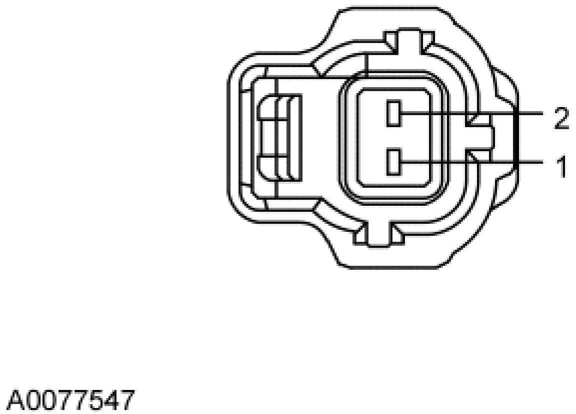


Fig. 144: Canister Vent (CV) Solenoid Connector - A
Courtesy of FORD MOTOR CO.

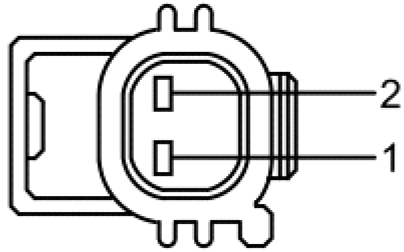


Fig. 145: Canister Vent (CV) Solenoid Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner, Explorer, Explorer Sport Trac, Mountaineer	A	2 1	KAPWR CANV
Mustang	B	2 1	CANV VPWR
All other vehicles	A	1 2	KAPWR CANV

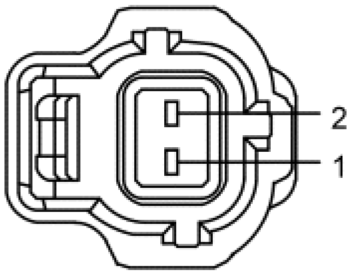


Fig. 146: EVAP Canister Purge (EVAPCP) Valve Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	EVAPCP (EVAP Canister Purge)
1	VPWR (Vehicle Power)

For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, FTPREF provides voltage to the FTP sensor instead of VREF.

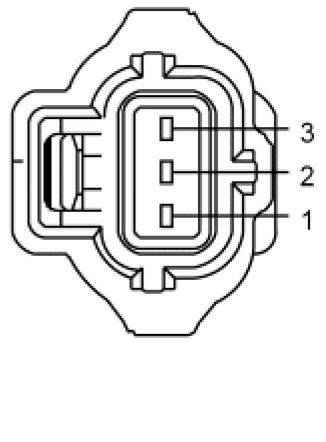


Fig. 147: Fuel Tank Pressure (FTP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

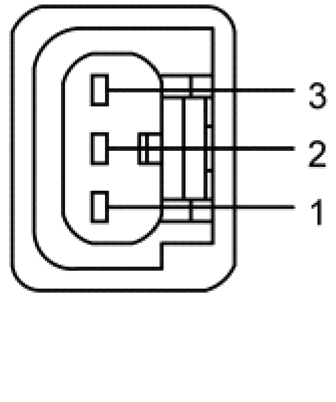


Fig. 148: Fuel Tank Pressure (FTP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series tank design, F-Super Duty tank design	A	3 1	FTP FTPREF

		2	SIGRTN
Mustang	B	3 2 1	FTP SIGRTN VREF
All other vehicles	B	3 1 2	FTP FTPREF SIGRTN

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series, F-Super Duty	170 Pin	B13 B3 B40 B41 B40 E1	CANV FTP FTPREF SIGRTN VREF EVAPCP
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B61 B44 B29 B58 B29, B64 B50	CANV FTP FTPREF SIGRTN VREF EVAPCP
Escape/Mariner	150 (50-50-50) Pin	B13 B9 B40 B41 B40 B34	CANV FTP FTPREF SIGRTN VREF EVAPCP
Expedition, Navigator	140 Pin	B61 B44 B29 B58 E57 B50	CANV FTP FTPREF SIGRTN VREF EVAPCP
F-150, Mark LT	190 Pin	B61 B44 B65 B58 B29 B50	CANV FTP FTPREF SIGRTN VREF EVAPCP
Focus	190 Pin	B20 B65 B66 B58 B52, B66	CANV FTP FTPREF SIGRTN VREF

		B55	EVAPCP
Fusion, Milan, MKZ	140 Pin	B61 B44 B29 B58 B33 B4	CANV FTP FTPREF SIGRTN VREF EVAPCP
Mustang	170 Pin	B13 B3 B41 B40 E6	CANV FTP SIGRTN VREF EVAPCP
All other vehicles	170 Pin	B13 B3 B40 B41 B40 E6	CANV FTP FTPREF SIGRTN VREF EVAPCP

TEST PROCEDURE

HX1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0442, P0443, P0446, P0451, P0452, P0453, P0455, P0456, P0457, P0460, P0461, P0462, P0463, P144A, P1450, P1451, or P260F present?**

Yes	No
For DTCs P0442 or P0456, GO to HX46. For DTC P0443, GO to HX2. For DTCs P0446 or P1451, GO to HX30. For DTC P0451, GO to HX39. For DTC P0452, GO to HX18. For DTC P0453, GO to HX23. For DTCs P0455 or P0457, GO to HX40. For DTC P0460, GO to HX38. For DTCs P0461 through P0463, GO to HX36. For DTC P144A, GO to HX49. For DTC P1450, GO to HX8. For DTC P260F, GO to HX50.	For symptoms without DTCs, GO to HX13. For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HX2 DTC P0443: CHECK THE PCM OUTPUT TO EVAP CANISTER PURGE VALVE

- Key in OFF position.
- EVAPCP Valve connector disconnected.
- Connect a non-powered test lamp between:

(+) EVAPCP Valve Connector, Harness Side	(-) EVAPCP Valve Connector, Harness Side

VPWR - Pin 1	EVAPCP - Pin 2

- Key ON, engine OFF.
- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.
- **Does the test lamp turn on and off when the output(s) is commanded on and off?**

Yes	No
GO to HX3.	GO to HX4.

HX3 CHECK THE EVAP CANISTER PURGE VALVE SOLENOID RESISTANCE

- Key in OFF position.
- EVAPCP Valve connector disconnected.
- Measure the resistance between:

(+) EVAPCP Valve Connector, Component Side	(-) EVAPCP Valve Connector, Component Side
EVAPCP - Pin 2	VPWR - Pin 1

- **Is the resistance between 2.5 - 7 ohms?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX4 CHECK THE VPWR VOLTAGE TO THE EVAP CANISTER PURGE VALVE

- Key ON, engine OFF.
- Measure the voltage between:

(+) EVAPCP Valve Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 1	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to HX5.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX5 CHECK THE EVAP CANISTER PURGE VALVE CIRCUIT FOR AN OPEN IN THE

HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) EVAPCP Valve Connector, Harness Side
EVAPCP	EVAPCP - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HX6.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX6 CHECK THE EVAP CANISTER PURGE VALVE CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
EVAPCP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HX7.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX7 CHECK THE EVAP CANISTER PURGE VALVE CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) EVAPCP Valve Connector, Harness Side	(-)
EVAPCP - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to HX54.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX8 DTC P1450: CHECK FOR VISUAL CAUSES OF EXCESSIVE FUEL TANK VACUUM

NOTE: If the CV solenoid and the fuel tank assemblies are not accessible during this step, refer to the EVAPORATIVE EMISSIONS -- E-SERIES and FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES for removal instructions.

- Check for kinks or bends in the fuel vapor hoses/tubes (EVAPCP outlet tube and EVAP canister tube).
- Visually inspect the EVAP canister inlet port, CV solenoid filter, and canister vent hose assembly for contamination or debris.
- Check the CV solenoid filter for blockage or contamination.
- **Is a concern present?**

Yes	No
REMOVE any contamination or debris around the fuel vapor hose/tubes and CV solenoid assembly. REMOVE kinks or bends in the EVAPCP outlet tube, EVAP canister tube, and canister vent hose assembly. CLEAR the DTCs. For repair verification, CARRY OUT the evaporative emission leak check monitor repair verification drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	GO to HX9.

HX9 CHECK THE FTP SENSOR VOLTAGE WITH THE FUEL FILLER CAP REMOVED OR THE CAPLESS FUEL TANK FILLER PIPE OPENED

NOTE: For vehicles with a capless fuel filler pipe, instead of removing the fuel filler cap, install the supplemental refueling adaptor provided with the vehicle to open the capless fuel tank filler pipe.

- Remove the fuel filler cap.
- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage between 2.4 - 2.8 V?**

Yes	No
GO to HX13.	GO to HX10.

HX10 CHECK FOR ANY OTHER DTCS

- Check for other 3-wire sensor DTCs (KOEO, KOER, or continuous memory) present with the DTC P1450.
- **Are any other DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to HX11.

HX11 CHECK THE VOLTAGE TO THE FTP SENSOR

- Key in OFF position.
- FTP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	SIGRTN
FTPREF	SIGRTN

- **Are the voltages between 4 - 6 V?**

Yes	No
INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. For repair verification, CARRY OUT the evaporative emission leak check monitor repair verification drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	GO to HX12.

HX12 CHECK THE FTPREF OR VREF AND SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	VREF
SIGRTN	SIGRTN
FTPREF	FTPREF

- **Are the resistances less than 5 ohms?**

Yes	No

GO to HX54.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX13 CHECK IF THE ENGINE IDLES

- Key ON, engine running.
- **Does the engine stall or is it unable to maintain idle?**

Yes	No
GO to HX14.	GO to HX15.

HX14 CHECK THE EVAP SYSTEM FOR A STUCK OPEN VALVE

- Key in OFF position.
- Disconnect the fuel vapor to intake manifold line at the EVAPCP valve and cap the line at the EVAPCP valve.
- Key ON, engine running.
- **Does the engine stall or is it unable to maintain idle?**

Yes	No
The EVAP system is not the cause of the symptom. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX15 CHECK FOR BLOCKAGE IN THE FUEL TANK VENT SYSTEM

NOTE: The CV is normally open and venting to the atmosphere.

- Access the PCM and monitor the EVMV PID.
- Access the PCM and monitor the FTP PID.
- Access the PCM and monitor the EVAPCV PID.
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV PID to a 1,000 mA.
- **Does the FTP sensor voltage drop below 2 volts when the EVAPCP valve is commanded fully open?**

Yes	No
CHECK for blockage in the vapor line to the CV solenoid. CHECK the CV solenoid filter for blockage or contamination. CHECK the carbon canister for blockage. If OK, INSTALL a new CV solenoid. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to HX16.

HX16 CHECK THE EVAP SYSTEM FOR A STUCK OPEN VALVE

- Key ON, engine running.
- Access the PCM and control the EVMV PID.
- Close the EVAPCP by commanding the EVMV PID to 0 mA.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- **Does the FTPV PID decrease, the engine RPM change, or the engine stall, as an indication that the EVAPCP valve is stuck open?**

Yes	No
INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to HX17.

HX17 EVAP CANISTER PURGE VALVE TEST

- Key ON, engine running.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- Access the PCM and control the EVMV PID.
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV PID to a 1,000 mA.
- **Does the FTP PID decrease, the engine RPM change, or the engine stall as an indication that the EVAPCP valve is opening?**

Yes	No
For DTC P1450, unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**. For all others, CHECK the EVAP system for leaks.	CHECK for blockages between the fuel tank, the EVAPCP valve, and the engine intake manifold. CHECK for obstructions in the EVAPCP valve diaphragm and ports. If OK, INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX18 DTC P0452: CHECK FOR FUEL TANK PRESSURE SENSOR CONNECTOR CONTAMINATION

- Key in OFF position.
- Visually check for liquid fuel contamination of the FTP sensor electrical connector.
- Check for a completely submerged FTP sensor (tank-mounted type only) in the liquid fuel. This can affect the correct FTP voltage reading.
- **Does the FTP sensor and its connector show any signs of fuel contamination?**

Yes	No

REPAIR as necessary. ADJUST the fuel tank overfill. CLEAR the DTCs. REPEAT the self-test.	GO to HX19.

HX19 CHECK FOR LOW FTP SENSOR VOLTAGE

NOTE: The FTP sensor voltage with no pressure/vacuum on the fuel tank is between 2.4 and 2.8 volts.

- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage less than 0.22 V?**

Yes	No
GO to HX20.	The concern that produced the DTC P0452 is intermittent. refer to **PINPOINT TEST Z**.

HX20 CHECK THE OPPOSITE INDUCED HIGH FTP SENSOR SIGNAL

- Key in OFF position.
- FTP Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A FTP Sensor Connector, Harness Side	Point B FTP Sensor Connector, Harness Side
VREF	FTP

- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage between 4 - 6 V?**

Yes	No
INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. REPEAT the self-test.	GO to HX21.

HX21 CHECK THE VREF VOLTAGE TO THE FTP SENSOR

- Remove the jumper wire(s).
- Key ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to HX22.	refer to **PINPOINT TEST C**.

HX22 CHECK THE FTP CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FTP	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
FTP	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HX54.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX23 DTC P0453: CHECK FOR HIGH FTP SENSOR VOLTAGE

NOTE: **The FTP sensor voltage with no pressure/vacuum on the fuel tank is between 2.4 and 2.8 volts.**

- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage greater than 4.5 V?**

Yes	No
GO to HX24.	The concern that produced the DTC P0453 is intermittent. refer to **PINPOINT TEST Z**.

HX24 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE FTP SENSOR VEHICLE HARNESS CONNECTOR

- Key in OFF position.
- FTP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the voltage between 4 - 6 V?**

Yes	No
GO to HX25.	refer to **PINPOINT TEST C**.

HX25 CHECK THE FTP CIRCUIT FOR A SHORT TO VOLTAGE

- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) Vehicle Battery
FTP	Negative terminal

- **Is the voltage less than 10 V?**

Yes	No
GO to HX27.	GO to HX26.

HX26 CHECK THE FTP CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
FTP	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to HX54.

HX27 CHECK THE FTP CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
FTP	FTP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HX28.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX28 CHECK THE FTP CIRCUIT FOR A SHORT TO VREF

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	FTP

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HX29.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX29 CHECK THE OPPOSITE INDUCED LOW FTP SIGNAL

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A FTP Sensor Connector, Harness Side	Point B FTP Sensor Connector, Harness Side
FTP	SIGRTN

- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage less than 0.1 V?**

Yes	No
INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. REPEAT the self-test.	GO to HX54.

HX30 DTCS P0446 OR P1451: CHECK THE PCM OUTPUT TO THE CV SOLENOID

NOTE: For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.

- Key in OFF position.
- CV Solenoid connector disconnected.
- Connect a non-powered test lamp between:

(+) CV Solenoid Connector, Harness Side	(-) CV Solenoid Connector, Harness Side
VPWR	CANV
KAPWR	CANV

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.
- **Does the test lamp turn on and off when the output(s) is commanded on and off?**

Yes	No
GO to HX31.	GO to HX32.

HX31 CHECK THE CV SOLENOID RESISTANCE

NOTE: For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.

- Key in OFF position.
- Measure the resistance between:

(+) CV Solenoid Connector, Component Side	(-) CV Solenoid Connector, Component Side
KAPWR	CANV
VPWR	CANV

- **Are the resistances between 48 - 65 ohms?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	INSTALL a new CV solenoid. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX32 CHECK THE VPWR VOLTAGE TO THE CV SOLENOID

NOTE: **For applications that use the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the CV solenoid instead of VPWR.**

- Measure the voltage between:

(+) CV Solenoid Connector, Harness Side	(-)
KAPWR	Ground
VPWR	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to HX33.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX33 CHECK THE CANV CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CV Solenoid Connector, Harness Side
CANV	CANV

- **Is the resistance less than 5 ohms?**

Yes	No
GO to HX34.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HX34 CHECK THE CANV CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

- Measure the resistance between:

(+) CV Solenoid Connector, Harness Side	(-) Vehicle Battery
CANV	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to HX35.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX35 CHECK THE CANV CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) CV Solenoid Connector, Harness Side	(-)
CANV	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to HX54.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

HX36 DTCS P0461, P0462 AND P0463: CHECK THE INSTRUMENT CLUSTER (IC) MODULE FOR DTCS

- Key ON, engine OFF.
- Carry out the IC self-test.
- **Are any DTCs present?**

Yes	No
REFER to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** to continue diagnosis.	GO to HX37.

HX37 CHECK THE FLI PID

- Key ON, engine running.
- Access the PCM and monitor the FLI PID.
- **Does the FLI PID match the fuel gauge?**

Yes	No
GO to HX38.	GO to HX54.

HX38 DTC P0460: CHECK FOR FUEL TANK FLOAT LEVEL RESPONSE

NOTE: **A dual-container (saddle type) fuel tank has 2 fuel level sensors. The FLI PID in the PCM is the average value of both fuel level sensors. Some dual-container tanks may require the fuel level to be greater 3/4 full before the fuel level equalizes.**

- Key ON, engine running.
- Access the PCM and monitor the FLI PID.
- Key in OFF position.

- If the fuel level is less than 1/4 (25% on FLI), add approximately 1/4 tank of fuel.
- If the fuel level is greater than 3/4 (75% on FLI), drain approximately 1/4 tank of fuel.
- Key ON, engine running.
- Access the PCM and monitor the FLI PID.
- **Does the FLI PID indicate a movement upward or downward as fuel is either added or drained?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	REFER to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** to diagnose the incorrect fuel gauge indication symptom.

HX39 DTC P0451: CHECK THE FTP SENSOR FOR CORRECT OPERATION

NOTE: **For vehicles with a capless fuel filler pipe, instead of removing the fuel filler cap, install the supplemental refueling adaptor provided with the vehicle to open the capless fuel tank filler pipe.**

- Key in OFF position.
- Remove the fuel filler cap.
- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the pressure between -0.42 and 0.42 kPa (-1.7 and 1.7 in-H2O)?**

Yes	No
CHECK for kinks or bends in the fuel vapor hoses/tubes between the fuel tank and dust separator. CHECK the EVAP canister ports and canister vent hose assembly for contamination or debris. CHECK the dust separator for blockage. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. CLEAR the DTCs. REPEAT the self-test.

HX40 DTCS P0455 OR P0457: CHECK THE FUEL FILLER CAP OF CAPLESS FUEL TANK FILLER PIPE

NOTE: **If the fuel filler cap or capless fuel tank filler pipe is suspected as an EVAP leak source during visual inspection, do not disturb the fuel filler cap or capless fuel tank filler pipe until the repair verification method is complete. If the repair verification method fails, reposition or install a new fuel filler cap and repeat the test. For vehicles with a capless fuel tank filler pipe, install and remove the supplemental refueling adaptor provided with the vehicle to reseal the capless fuel tank filler pipe and repeat the test. This**

action isolates the fuel filler cap or capless fuel tank filler pipe from the rest of the EVAP system as a potential concern.

- For vehicles with a fuel filler cap, visually inspect the fuel filler cap without initially disturbing it.
  - Verify the fuel filler cap tether is visible and free to move.
  - Check for missing or loose fuel filler cap.
  - Check the fuel filler cap for damage.
- For vehicles with a capless fuel tank filler pipe, visually inspect the capless fuel tank filler pipe inlet without initially disturbing it.
  - Check the capless fuel tank filler pipe inlet for an obstruction that prevents it from sealing.
  - Check the capless fuel tank filler pipe for damage.
- **Is a concern present?**

Yes	No
For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. REPAIR as necessary. GO to HX46.	GO to HX41.

HX41 CHECK FOR FLI DTCS

- Key ON, engine OFF.
- Carry out the self-test.
- **Are DTCs P0460, P0461, P0462 or P0463 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to HX42.

HX42 CHECK THE OPERATION OF THE FUEL GAUGE

NOTE: **A fuel gauge that always indicates a fuel level less than a 1/2 tank or always a full tank, may be caused by a fuel level input (FLI) concern.**

- Check operation of the fuel gauge.
- **Is the fuel gauge functioning properly?**

Yes	No
GO to HX43.	CHECK the functionality of the FLI circuit. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.

HX43 EVAPORATIVE EMISSION SYSTEM VISUAL INSPECTION

- Key in OFF position.
- Visually inspect for:
  - EVAP system lines/hoses (check for proper connections, damage or blockage)
  - loose fuel vapor hose/tube connections to the EVAP system components
  - blocked vacuum hose between the EVAPCP valve and the engine intake manifold
  - damaged fuel tank or fuel filler pipe
- **Are there any concerns found during the visual inspection?**

Yes	No
REPAIR as necessary. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to HX46.	GO to HX44.

HX44 CHECK THE FTP SENSOR VOLTAGE WITH THE FUEL FILLER CAP REMOVED OR THE CAPLESS FUEL TANK FILLER PIPE OPENED

NOTE: For vehicles with a capless fuel filler pipe, instead of removing the fuel filler cap, install the supplemental refueling adaptor provided with the vehicle to open the capless fuel tank filler pipe.

- Remove the fuel filler cap.
- Key ON, engine OFF.
- Access the PCM and monitor the FTP PID.
- **Is the voltage between 2.4 - 2.8 V?**

Yes	No
GO to HX45.	INSTALL a new FTP sensor. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. REPEAT the test and VERIFY the results. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to HX46.

HX45 EVAP CANISTER PURGE VALVE TEST

- Key in OFF position.
- Install the fuel filler cap or remove the supplemental refueling adaptor.
- Key ON, engine running.

- Access the PCM and monitor the EVAPCV PID.
- Access the PCM and monitor the EVMV PID.
- Access the PCM and monitor the FTP PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- While monitoring the FTP PID, ramp open the EVAPCP valve by incrementally commanding the EVMV PID to a 1,000 mA.
- **Does the FTP PID decrease, the engine RPM change, or the engine stall as an indication that the EVAPCP valve is opening?**

Yes	No
GO to HX46.	INSTALL a new EVAPCP valve. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . REPEAT the test and VERIFY the results. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to HX46.

HX46 DTCS P0442 OR P0456: HOOK UP THE SMOKE MACHINE (ROTUNDA VACUTEC)

NOTE: **Removing the Schrader valve from the test port permanently damages the valve.**

NOTE: **The smoke and air flow from the smoke machine will not pass through liquid fuel. Liquid fuel may be present in the fuel tank filler pipe.**

NOTE: **Some vehicles are not equipped with an evaporative emission test port. Use a suitable hose adapter in the following diagnostic procedures.**

- Key in OFF position.
- Connect the smoke machine power cables to the vehicle battery. Check to see that the smoke machine power indicator lamp is on, indicating a good battery contact.
- For vehicles not equipped with an evaporative emission test port:
    - Disconnect the fuel vapor to intake manifold line at the EVAPCP valve and cap the line.
    - Connect a suitable hose adapter to the fuel vapor to intake manifold connection at the EVAPCP valve.
- For vehicles equipped with an evaporative emission test port:
    - Locate the evaporative emission test port and remove the green cap. The cap is located on or close to the EVAPCP valve.
    - Install the EVAP test port adapter (provided with the Vacutec Smoke Machine) to the test port.
- **Is the smoke machine hook up complete?**

Yes	No
For leak detection, GO to HX47. For leak repair verification, GO to HX48.	REFER to the smoke machine operator article for additional instructions and for helpful tips.

HX47 CARRY OUT SMOKE MACHINE PHASE 2 - LEAK DETECTION SMOKE TEST

NOTE: **If the leak is not detected from the top, check the EVAP system for leaks from under the vehicle.**

- **Check the EVAP hoses, EVAPCP valve, CV solenoid, EVAP canister, fuel tank, fuel filler pipe, around the fuel tank area, and at the fuel filler cap or capless fuel tank filler pipe inlet.**
- **Wiggle the components and connections to simulate road bumps while looking for signs of leaking smoke.**

If the leak is in the fuel tank filler pipe between the check valve and the fuel filler cap or capless fuel tank filler pipe inlet, smoke under pressure may not reach the leak. If leaking smoke is not found, a thorough visual inspection of the fuel tank filler pipe and fuel filler cap or capless fuel tank filler pipe inlet should be done.

- Set the smoke machine to SMOKE.
- Remove the fuel filler cap or install the supplemental refueling adaptor.
- Connect the smoke supply hose nozzle tip into the EVAP service port or suitable hose adapter.
- Key ON, engine OFF.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- For vehicles not equipped with an evaporative emission test port:
    - Start the smoke machine and verify the connection at the EVAPCP valve is correct and not leaking
    - Open the EVAPCP valve by commanding the EVMV PID to 1,000 mA
- Start the smoke machine. If smoke does not exit the fuel tank filler pipe after the system is pressurized, command the EVAPCV PID open to allow air to purge the CV solenoid. Once smoke is seen at the CV solenoid, command the EVAPCV PID close.
    - Install the fuel filler cap or remove the supplemental refueling adaptor once smoke is observed exiting the fuel tank neck area.
    - Continue to smoke the system for 60 seconds to obtain pressure.
    - Press and release the remote starter button in intervals of approximately 15 seconds on and 15 seconds off while checking for exiting smoke.
    - Use the halogen spotlight provided with the smoke machine to follow the EVAP system path and look for smoke exiting at the source of the leak(s).
- **Is the source of the EVAP leak located?**

Yes	No
REPAIR as necessary. CONNECT all the disconnected components. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to HX48.	The test passed. CONNECT all the disconnected components. CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to HX48.

HX48 CARRY OUT THE SMOKE MACHINE PHASE 1 - LEAK VERIFICATION PRESSURE TEST

- Position the control lever located on the smoke machine to METER.
- Calibrate the smoke machine flow meter using the 0.020 (DTC P0456) or 0.040 (DTC P0442) standard as follows:
  - Insert the air supply hose (transparent hose) nozzle tip into the appropriate EVAP system standard located on the front of the smoke machine.
  - Press the remote starter button on the smoke machine. Observe the position of the flow meter indicator ball.
  - Position the flow meter red pointer flag so that it aligns with the measurement of the indicator ball.
  - Release the button and remove the air supply hose nozzle tip from the EVAP system standard.
- Connect the air supply hose (transparent hose) nozzle tip into the EVAP test port or suitable hose adapter.
- Key ON, engine OFF.
- Access the PCM and control the EVAPCV PID.
- Close the CV solenoid by commanding the EVAPCV PID to ON (100% duty cycle).
- For vehicles not equipped with an evaporative emission test port, open the EVAPCP valve by commanding the EVMV PID to 1,000 mA.
- Press the remote starter button on the smoke machine. Notice that the ball in the flow meter is all the way at the top. This indicates the system is being pressurized.
- Continue to press the remote starter button until the ball stops descending. Once the ball stops descending, observe if it is above or below the red pointer flag. If the measurement is below the indicator flag, the system has passed the pressure test. If the measurement is above the indicator flag, the EVAP system has an unacceptable leak.
- **Does the EVAP system pass the smoke machine leak verification pressure test?**

Yes	No
The test passed and no concerns are present. CLEAR the DTCs. REPEAT the self-test.	GO to HX47.

HX49 DTC P144A: CHECK FOR A BLOCKED FUEL VAPOR TUBE BETWEEN THE FTP SENSOR AND THE FUEL TANK

- Key in OFF position.

- Remove the fuel vapor tube assembly. Refer to the **EVAPORATIVE EMISSIONS -- E-SERIES** .
- Visually inspect the fuel vapor tube for a blockage between the FTP sensor and the connection to the fuel tank or fuel pump module.
- Visually inspect the connection at the fuel tank or fuel pump module for a blockage.
- Attempt to manually remove the blockage.
- **Is the blockage visible and can be removed?**

Yes	No
REMOVE the blockage. INSTALL the Fuel Vapor Tube assembly. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSTALL a new Fuel Vapor Tube assembly. REFER to the **EVAPORATIVE EMISSIONS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

HX50 DTC P260F: CHECK FOR THE PRESENCE OF ANY MODULE COMMUNICATION CONCERNS

- Key ON, engine OFF.
- Check for self-test DTCs in all of the vehicle modules.
- **Are any communication concerns or communication DTCs present?**

Yes	No
For communication concerns in the PCM, DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** . For communication concerns in other modules, REFER to the applicable Workshop article part to diagnose the communication DTC.	GO to HX51.

HX51 CHECK THE PERFORMANCE OF THE PROCESSOR

- Key in OFF position.
- Disconnect the battery and wait for 1 minute. Refer to the **BATTERY, MOUNTING AND CABLES -- E-SERIES** .
- Connect the battery.
- Key ON, engine running.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the FTP PID.
- **Is the pressure equal to 0 kPa (0 psi)?**

Yes	No
GO to HX53.	GO to HX52.

HX52 CHECK FOR SELF-TEST DTC P260F

- Idle the engine for 2 minutes.
- Carry out the self-test.
- **Is DTC P260F present?**

Yes	No
GO to HX53.	RETURN the vehicle to the customer.

HX53 CHECK THE PCM FOR THE LATEST CALIBRATION

- Program the PCM to the latest calibration.
- Key ON, engine running.
- Idle the engine for 2 minutes.
- Carry out the self-test.
- **Is DTC P260F present?**

Yes	No
GO to HX54.	RETURN the vehicle to the customer.

HX54 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins
    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HY: GENERATOR/REGULATOR SYSTEM

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- generator/regulator (10346)

- powertrain control module (PCM) (12A650)

TEST PROCEDURE

HY1 CHECK THE GENERATOR CIRCUITRY AND OPERATION

NOTE: **If the concern is still present after checking the generator circuitry in the workshop article, return to the PC/ED to continue generator diagnosis.**

- Check for any generator related DTCs. Refer to the **GENERATOR AND REGULATOR -- E-SERIES** to diagnose any generator related DTCs.
- **Is the charging system diagnosed and repaired in the GENERATOR AND REGULATOR -- E-SERIES ?**

Yes	No
The system is operating correctly at this time.	GO to HY2.

HY2 CHECK THE GENERATOR MONITOR SIGNAL

- Key ON, engine running.
- Access the PCM and monitor the GENMON PID.
- **Is the duty cycle between 5% and 97% and not excessively fluctuating?**

Yes	No
The system is operating correctly at this time.	GO to HY3.

HY3 CHECK FOR CORRECT PCM OPERATION

NOTE: **When the battery (or PCM) is disconnected and connected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The charging system set point may also vary. The vehicle may need to be driven to relearn its strategy.**

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH**	The system is operating correctly at this time. The

ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM) , Programming the VID Block for a Replacement PCM.	concern may have been caused by a loose or corroded connector.

PINPOINT TEST JB: SECONDARY IGNITION (COP)

INTRODUCTION

NOTE:	**A malfunctioning ignition system may cause high catalyst temperatures. Check the components next to the catalyst and muffler for heat damage.**

This pinpoint test is intended to diagnose the following:

- spark plugs (12405)
- secondary side of the coil

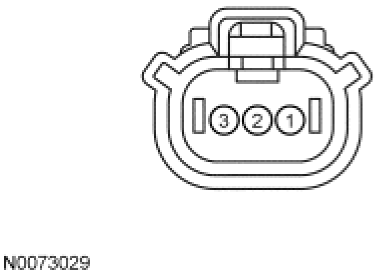


Fig. 149: Coil On Plug (COP) Connector - A
Courtesy of FORD MOTOR CO.

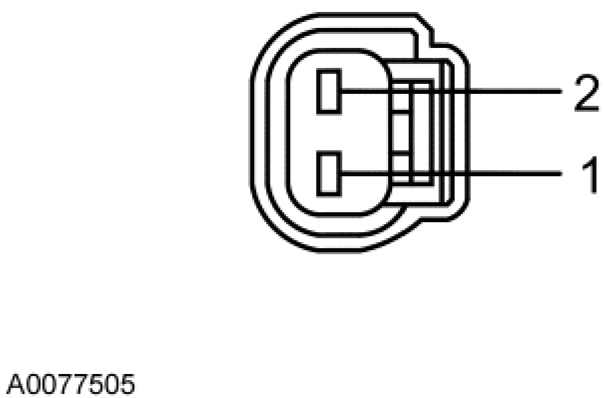


Fig. 150: Coil On Plug (COP) Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, MKX, MKZ, Taurus, Taurus X, Sable	A	3	IGN START/RUN
Escape/Mariner, Focus, Fusion, Milan, Mustang 5.4L	B	2	IGN START/RUN
All other vehicles	B	1	IGN START/RUN

Vehicle	Firing Order for Coil On Plug Applications
BASE, 4-cylinder applications	1 3 4 2
BASE, 6-cylinder applications	1 4 2 5 3 6
BASE, 8-cylinder applications	1 3 7 2 6 5 4 8
BASE, 10-cylinder applications	1 6 5 10 2 7 3 8 4 9

TEST PROCEDURE

JB1 CHECK FOR DTCS

- **Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310, or P050B present?**

Yes	No
For DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310 or P0316, GO to JB3. For DTC P050B, GO to JB13.	For symptoms without DTCs, GO to JB2. For all other DTCs, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

JB2 VISUAL INSPECTION OF THE IGNITION SYSTEM

- Visually inspect the engine compartment to make sure all coils are properly and securely connected.
- Examine all the wiring harnesses and connectors for damaged, burned, or overheated insulation, and loose or broken conditions.
- Make sure the vehicle battery is in good condition and all of the accessories are turned off.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to JB3.

JB3 DTC P0301 THROUGH P0310: MISFIRE ON CYLINDERS 1 THROUGH 10

- **Are DTCs P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, or P0310 present?**

Yes	No
For Edge, Escape/Mariner 3.0L, Explorer 4.6L, Explorer Sport Trac 4.6L, F-150 4.6L, F-150 5.4L, Fusion, Milan, MKX, Sable, Taurus, and Taurus X, GO to JB4. For all others, GO to JB5.	GO to JB6.

JB4 CHECK SPARK DURATION RELATIVENESS

- Monitor the spark duration PIDs.
- **Are the PIDs relative to each other?**

Yes	No
GO to JB10.	INSPECT the coil boot(s) for the missing cylinder (s). INSTALL a new coil boot(s) if necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** , Spark Plugs, and INSPECT the spark plug(s) for the missing cylinder (s). MEASURE the resistance of the spark plug(s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 ohms or higher than 20,000 ohms. If the coil boot(s) and spark plugs are OK, INSTALL a new COP(s) for the missing cylinders. CLEAR the DTCs. REPEAT the self-test.

JB5 CHECK FOR SPARK AT THE CYLINDER(S) INDICATED BY THE DTC(S)

- Key in OFF position.
- Disconnect the ignition coil(s) from the spark plug(s).
- Connect the Air Gap spark tester 303-D037 (D81P-6666-A) or its equivalent to the suspect coil.
- Crank the engine while the accelerator pedal is fully applied.
- Observe the spark tester while cranking the engine.
- **Is a bluish-white spark present?**

Yes	No
GO to JB8.	INSPECT the coil boot(s) for the missing cylinder (s). INSTALL a new coil boot(s) if necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** , Spark Plugs, and INSPECT the spark plug(s) for the missing cylinder (s). MEASURE the resistance of the spark plug(s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 ohms or higher than 20,000 ohms. GO to JB7.

JB6 CHECK FOR SPARK AT ALL CYLINDERS

- Key in OFF position.
- Disconnect the ignition coil(s) from the spark plug(s).
- Connect the Air Gap spark tester 303-D037 (D81P-6666-A) or its equivalent to the suspect coil.
- Crank the engine while the accelerator pedal is fully applied.
- Observe the spark tester at each cylinder while cranking the engine.
- **Is a bluish-white spark consistent between all cylinders?**

Yes	No
GO to JB8.	INSPECT the coil boot(s) for the missing cylinder (s). INSTALL a new coil boot(s) if necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** , Spark Plugs, and INSPECT the spark plug(s) for the missing cylinder (s). MEASURE the resistance of the spark plug(s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 ohms or higher than 20,000 ohms. RECORD the cylinder(s) with inconsistent spark. GO to JB7.

JB7 CHECK THE SECONDARY COIL RESISTANCE FOR THE MISSING CYLINDERS

- Key in OFF position.
- Suspect coil connector disconnected.
- Measure resistance between: Suspect coil connector, IGN START/RUN, component side and ignition coil spring, located in the ignition coil boot.
- **Is the resistance between 5,000 and 6,000 ohms?**

Yes	No
refer to **PINPOINT TEST Z**.	INSTALL a new COP. CLEAR the DTCs. REPEAT the self-test.

JB8 CHECK THE SPARK PLUGS

NOTE: **To determine the condition of the spark plugs, refer to the ENGINE - 4.6L AND 5.4L -- E-SERIES and carry out the Spark Plug Inspection.**

- Key in OFF position.
- Remove and inspect the plugs for damage, wear, carbon tracking or deposits and proper plug gap.
- **Are the plugs OK?**

Yes	No
GO to JB9.	REPAIR the plug(s). ADJUST the gap or INSTALL a new spark plug(s) as necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JB9 CHECK THE SPARK PLUG RESISTANCE

- Measure the spark plug resistance.
- **Is the resistance between 2,000 and 20,000 ohms?**

Yes	No
For Edge, Escape/Mariner 3.0L, Explorer 4.6L, Explorer Sport Trac 4.6L, F-150 4.6L, F-150 5.4L, Fusion, Milan, MKX, Sable, Taurus, and Taurus X, GO to JB14. For all others, GO to JB10.	INSTALL a new spark plug. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JB10 TEST DIRECTION FOR SYMPTOM CHARTS

- **Were you directed to this pinpoint test?**

Yes	No
RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to JB11.

JB11 TEST DIRECTION FOR PINPOINT TEST HD

- **Were you directed to this pinpoint test from pinpoint test step HD6?**

Yes	No

GO to HD7.	GO to JB12.

JB12 TEST DIRECTION FOR PINPOINT TEST A

- **Were you directed to this pinpoint test from pinpoint test step A8?**

Yes	No
GO to A9.	The concern is intermittent. refer to **PINPOINT TEST Z**.

JB13 DTC P050B: COLD START PERFORMANCE

- **Are any other codes besides P050B present?**

Yes	No
REPAIR all other powertrain related diagnostic trouble codes (DTCs) first.	GO to JB14.

JB14 CHECK THE SPARK CAPTURE CIRCUIT

- Access the PCM and monitor the IGNPCM_F PID.
- **Is a concern indicated?**

Yes	No
GO to JB16.	GO to JB15.

JB15 CHECK THE IGNITION TIMING PID

- Access the PCM and monitor the IGNX_F PIDs.
- **Is a concern indicated?**

Yes	No
Visually inspect the COP harness for damage, exposed wiring, water contamination, corrosion, and correct assembly. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to JB16.

JB16 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST JC: SECONDARY IGNITION (COIL PACK)

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- spark plugs (12405)
- spark plug wires (12280, 12281)

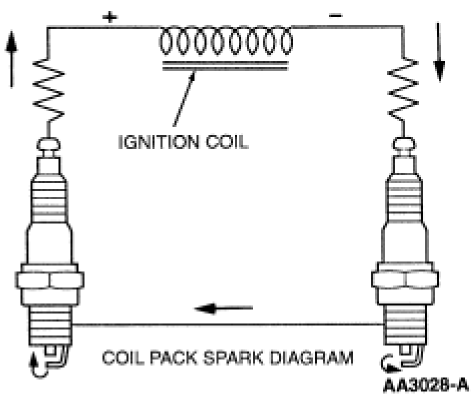


Fig. 151: Coil Pack Spark Diagram
Courtesy of FORD MOTOR CO.

Explorer 4.0L, Explorer Sport Trac 4.0L, F150 4.2L, Mountaineer 4.0L, Mustang 4.0L, Ranger.

TEST PROCEDURE

JC1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306 or P050B present?**

Yes	No
For DTCs P0301, P0302, P0303, P0304, P0305 or P0306, GO to JC13. For DTC P0300, GO to JC2. For DTC P050B, GO to JC18.	For all other DTCs, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

JC2 VISUAL INSPECTION OF THE IGNITION SYSTEM

- Visually inspect the engine compartment to make sure all coils and spark plug wires are properly

and securely connected.

- Examine all wiring harnesses and connectors for damaged, burned or overheated insulation and loose or broken conditions.
- Make sure the vehicle battery is in good condition and all accessories are turned off.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	For a coil pack using an engine analyzer, GO to JC3. For a coil pack not using an engine analyzer, GO to JC12.

JC3 CONNECT THE ENGINE ANALYZER

- Obtain an engine analyzer to diagnose concerns in the secondary side of the ignition system.
- **Is the engine analyzer connected?**

Yes	No
GO to JC4.	REPEAT Step JC2.

JC4 CHECK FOR THE IGNITION PATTERN

- Observe the pattern on a scope while cranking the engine.

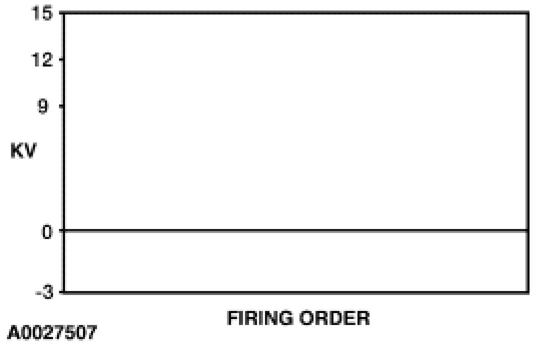


Fig. 152: Ignition Firing Pattern (No Spark)
Courtesy of FORD MOTOR CO.

- **Is the pattern flat, which indicates no spark on all cylinders?**

Yes	No
An IGN/START/RUN circuit concern. CHECK the condition of the related fuses/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the IGN START/RUN circuit for a short to ground. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to JC5.

JC5 CHECK FOR A NORMAL IGNITION PATTERN

NOTE: **Spark plugs may be fired more than once per combustion event. Multi-strike operating mode is RPM dependent.**

- Key ON, engine running. If no start, crank the engine.

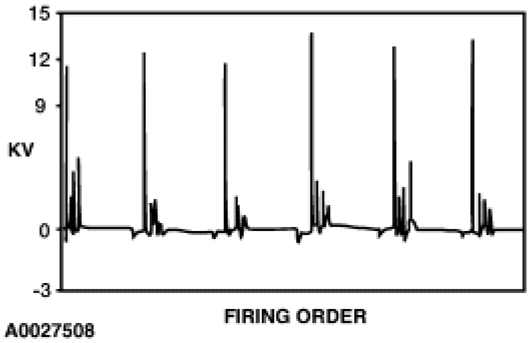


Fig. 153: Normal Ignition Firing Pattern
Courtesy of FORD MOTOR CO.

- **Are the patterns even and is the average value of spark plug firing voltage between 9 kV and 15 kV (higher during engine crank/no start)?**

Yes	No
refer to **PINPOINT TEST Z**.	GO to JC6.

JC6 IGNITION PATTERN EVALUATION

- **Is the ignition pattern normal?**

Yes	No
GO to JC7.	GO to JC8.

JC7 TEST DIRECTION

- **Were you directed to this pinpoint test from pinpoint test step A8?**

Yes	No
GO to A9.	GO to JC8.

JC8 CHECK FOR MISSING SPARK PATTERNS

- Observe for missing spark pattern.

Fig. 154: Identifying Missing Spark Pattern
Courtesy of FORD MOTOR CO.

- **Is the spark pattern inconsistent?**

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test. GO to JE2.	GO to JC9.

JC9 CHECK FOR A HIGH SPARK PLUG FIRING VOLTAGE

- Observe for a high spark plug firing voltage.

Fig. 155: Identifying High Spark Plug Firing Voltage
Courtesy of FORD MOTOR CO.

- **Is the average value of the spark plug firing voltage greater than 15 Kv?**

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire if the	GO to JC10.

resistance is greater than 7,000 ohms per 30.5 cm (1 foot). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	

JC10 CHECK FOR LOW SPARK PLUG FIRING VOLTAGE

- Check the spark plug firing voltage average pattern.

Fig. 156: Identifying Low Spark Plug Firing Voltage Pattern
Courtesy of FORD MOTOR CO.

- **Is there consistently low spark plug firing voltage or sloping spark line on one or more cylinders?**

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). MEASURE the resistance of the spark plug(s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 or higher than 20,000 ohms. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to JC11.

JC11 CHECK FOR EVENESS BETWEEN CYLINDERS

- Check the spark plug firing voltage average pattern.

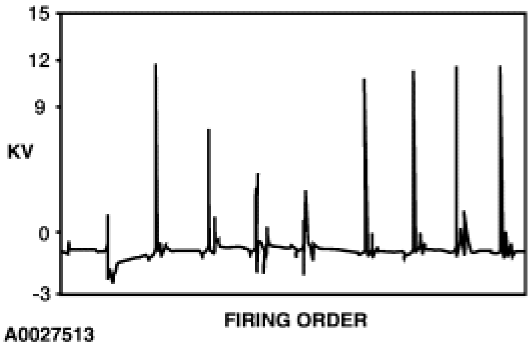


Fig. 157: Identifying Unevenness Between Cylinders Pattern
Courtesy of FORD MOTOR CO.

- **Is the evenness of spark plug firing voltage greater than 6 kV?**

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). CHECK for damaged spark plugs or narrow spark plug gaps. MEASURE the resistance of the spark plug(s). INSTALL a new spark plug(s) if the resistance is lower than 2,000 or higher than 20,000 ohms. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

JC12 DTCS P0301 THROUGH P0306: MISFIRE ON CYLINDERS 1 THROUGH 6

- **Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, or P0306 present?**

Yes	No
GO to JC13.	GO to JC14.

JC13 CHECK FOR SPARK AT THE CYLINDER(S) INDICATED BY THE DTC(S)

- Key in OFF position.
- Disconnect the spark plug wire(s) from the spark plug(s).
- Connect the Air Gap spark tester 303-D037 (D81P-6666-A) or its equivalent to a spark plug wire.
- Crank the engine while the accelerator pedal is fully applied.
- Check for spark while cranking the engine.
- **Is the bluish-white spark present?**

Yes	No
GO to JC16.	INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark

	plug wires. INSTALL a new spark plug wire(s) if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . If the spark plug wires are OK, GO to JC15.

JC14 CHECK FOR SPARK AT ALL CYLINDERS

- Key in OFF position.
- Disconnect the spark plug wire(s) from the spark plug(s).
- Connect the Air Gap spark tester 303-D037 (D81P-6666-A) or its equivalent to a spark plug wire.
- Crank the engine while the accelerator pedal is fully applied.
- Check for spark while cranking the engine.
- **Is the bluish-white spark present?**

Yes	No
GO to JC16.	INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire(s), if the resistance is greater than 7,000 ohms per 30.5 cm (1 foot). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . If the spark plug wires are OK, GO to JC15.

JC15 CHECK THE SECONDARY COIL RESISTANCE FOR THE MISSING CYLINDERS

NOTE: **Two adjacent coil towers share a common coil and are called a matched pair. For 6-tower coil pack (6 cylinder) applications, the matched pairs are 1 and 5, 2 and 6, and 3 and 4. For Mustang the matched pairs are 1 and 4, 2 and 5, and 3 and 6. For 4-tower coil pack (4 cylinder) applications, the matched pairs are 1 and 4, and 2 and 3.**

- Key in OFF position.
- Ignition coil pack disconnected.
- Disconnect spark plug wires from the coil pack.
- Measure the resistance of each matched pair.
- **Is the resistance between 9,500 and 15,500 ohms?**

Yes	No
refer to **PINPOINT TEST Z**.	INSTALL a new ignition coil pack. CLEAR the DTCs. REPEAT the self-test.

JC16 CHECK THE SPARK PLUGS

- Key in OFF position.
- Check for damaged spark plugs or narrow spark plug gaps.
- **Are the plugs OK?**

Yes	No
GO to JC17.	REPAIR the spark plug(s). ADJUST the gap or INSTALL a new spark plug(s) as necessary. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JC17 CHECK THE SPARK PLUG RESISTANCE

- Measure the spark plug resistance.
- **Is the resistance between 2,000 and 20,000 ohms?**

Yes	No
refer to **PINPOINT TEST Z**.	INSTALL a new spark plug(s). REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JC18 DTC P050B: COLD START PERFORMANCE

- **Are any other codes besides P050B present?**

Yes	No
REPAIR all other powertrain related diagnostic trouble codes (DTCs) first.	GO to JC19.

JC19 CHECK THE SPARK CAPTURE CIRCUIT

- Access the PCM and monitor the IGNPCM_F PID.
- **Is a concern indicated?**

Yes	No
GO to JC21.	GO to JC20.

JC20 CHECK THE IGNITION TIMING PID

- Access the PCM and monitor the IGNX_F PIDs.
- **Is a concern indicated?**

Yes	No
Visually inspect the coil pack harness for damage,	GO to JC21.

exposed wiring, water contamination, corrosion, and correct assembly. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	

JC21 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST JD: CRANKSHAFT POSITION (CKP) SENSOR

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- crankshaft position (CKP) sensor (6C315)
- harness circuits: CKP(+) and CKP(-)
- powertrain control module (PCM) (12A650)

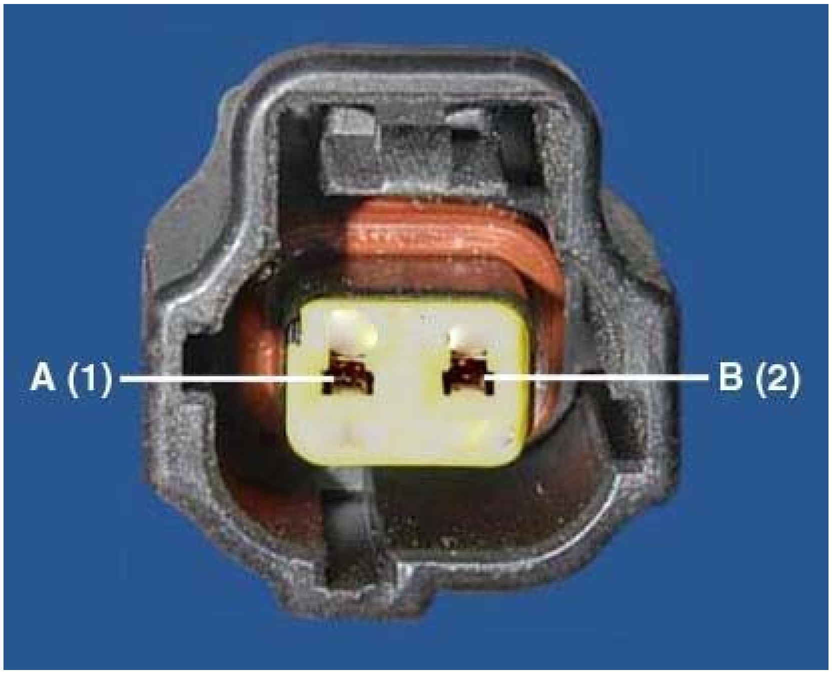


Fig. 158: Crankshaft Position (CKP) Sensor Connector - A
Courtesy of FORD MOTOR CO.

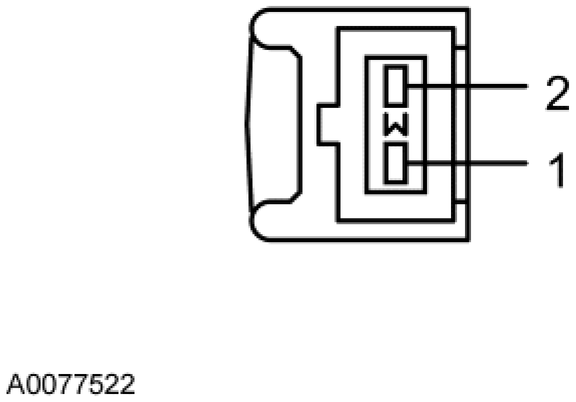


Fig. 159: Crankshaft Position (CKP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

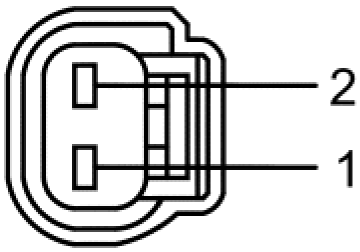


Fig. 160: Crankshaft Position (CKP) Sensor Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Focus, Fusion 2.3L, Milan 2.3L, Ranger 2.3L	A	2 1	CKP- CKP+
Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, Mustang 4.0L, Ranger 4.0L	B	2 1	CKP- CKP+
All other vehicles	C	1 2	CKP- CKP+

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, F-150, Mark LT, MKX, Sable, Taurus, Taurus X	190 Pin	E47 E46	CKP+ CKP-
Escape/Mariner	150 (50-50-50) Pin	E34 E45	CKP+ CKP-
Expedition, Fusion,	140 Pin	E47 E46	CKP+ CKP-

Milan, MKZ, Navigator			
Focus	190 Pin	E58 E42	CKP+ CKP-
All other vehicles	170 Pin	E47 E46	CKP+ CKP-

TEST PROCEDURE

JD1 CHECK THE CKP SENSOR SIGNAL SENT TO THE PCM

NOTE: The battery should be fully charged and the starting system should be functioning properly.

- Disable the inertia switch.
- Key ON, engine OFF.
- Access the PCM and monitor the RPM PID.
- Crank the engine.
- **Is the RPM greater than 150 RPM?**

Yes	No
For DTC P1336 with no start, refer to **PINPOINT TEST A**. For DTC P1336, GO to HD16. For all others, the CKP, PCM, and harness are working properly. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to JD2.

JD2 CHECK THE TIMING COVER, CKP SENSOR AND EXTERNAL TRIGGER WHEEL (OUTSIDE THE TIMING COVER) FOR OBVIOUS PHYSICAL DAMAGE

- Key in OFF position.
- Visually check the timing cover, CKP sensor and external trigger wheel (outside the timing cover) for obvious physical damage.
- **Do any parts appear physically damaged?**

Yes	No
REPAIR as necessary. RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to JD3.

JD3 CHECK FOR PROPER CKP BIAS VOLTAGES IN THE PCM

- CKP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CKP Sensor Connector, Harness Side	(-) Vehicle Battery
CKP+	Negative terminal
CKP-	Negative terminal

- **Are the voltages between 1 - 3 V?**

Yes	No
GO to JD4.	GO to JD6.

JD4 CHECK THE CKP SENSOR RESISTANCE

- Key in OFF position.
- Measure the resistance between:

(+) CKP Sensor Connector, Component Side	(-) CKP Sensor Connector, Component Side
CKP+	CKP-

- **Is the resistance between 250 - 1K ohms?**

Yes	No
GO to JD5.	INSTALL a new CKP sensor. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

JD5 CHECK THE CKP HARNESS SHIELD GROUND

NOTE: **The harness shield protects the CKP signal from electrical noise and is grounded at one end, typically near the PCM.**

NOTE: **Carry out the following resistance measurement between the CKP shield and the ground.**

- Measure the resistance between:

(+) CKP_SHLD Assembly Connector, Harness Side	(-)
CKP_SHLD	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to JD6.	REPAIR the open circuit. CHECK for a poor ground connection. CLEAR the DTCs. REPEAT the self-test.

JD6 CHECK FOR SHORT BETWEEN CKP(+) AND CKP(-) IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) CKP Sensor Connector, Harness Side	(-) CKP Sensor Connector, Harness Side
CKP+	CKP-

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to JD7.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

JD7 CHECK THE CKP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) CKP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CKP-	CKP-
CKP+	CKP+

- **Are the resistances less than 5 ohms?**

Yes	No
GO to JD8.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JD8 CHECK THE CKP CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) CKP Sensor Connector, Harness Side	(-) Vehicle Battery
CKP+	Negative terminal
CKP-	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to JD9.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

JD9 CHECK THE CKP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
CKP+	Negative terminal
CKP-	Negative terminal

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to JD10.

JD10 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST JE: INTEGRATED IGNITION COIL PACK A, B, OR C FAILURE

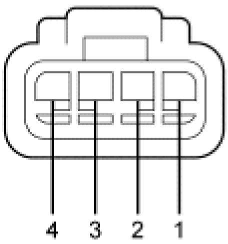
INTRODUCTION

This pinpoint test is intended to diagnose the following:

- ignition coil packs (12029)

- ignition coil harness
- IGN START/RUN circuit to coil packs
- powertrain control module (PCM) (12A650)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.



N0048012

Fig. 161: Coil Pack Assembly Connector - A
Courtesy of FORD MOTOR CO.

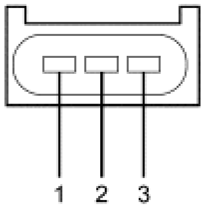


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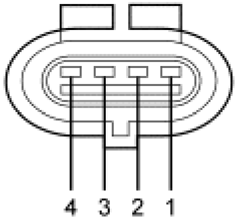
Fig. 162: Coil Pack Assembly Connector - B
Courtesy of FORD MOTOR CO.



N0048011

Fig. 163: Coil Pack Assembly Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
F-150	A	2 3 1	CD C CD B CD A

		4	IGN START/RUN
Ranger 2.3L	B	3 1 2	CD B CD A IGN START/RUN
Ranger 3.0L	A	2 1 3 4	CD C CD B CD A IGN START/RUN
Ranger 4.0L	C	3 4 2 1	CD C CD B CD A IGN START/RUN
All other vehicles	C	3 2 4 1	CD C CD B CD A IGN START/RUN

IGNITION COIL TO CYLINDER CORRELATION

Vehicle	Related DTC	Cylinder Number	Ignition Coil	Coil Driver (CD)	PCM Pin
2.3L Ranger	P0351	1	A	A	E17
	P0352	2	B	B	E12
	P0352	3	B	B	E12
	P0351	4	A	A	E17
3.0L/4.0L Ranger	P0351	1	A	A	E12
	P0353	2	C	C	E16
	P0352	3	B	B	E17
	P0352	4	B	B	E17
	P0351	5	A	A	E12
	P0353	6	C	C	E16
All others	P0351	1	A	A	E17
	P0353	2	C	C	E16
	P0352	3	B	B	E12
	P0352	4	B	B	E12
	P0351	5	A	A	E17
	P0353	6	C	C	E16

TEST PROCEDURE

JE1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0350, P0351, P0352, or P0353 present?**

Yes	No
GO to JE2.	For all other DTCs, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

JE2 DETERMINE WHICH COIL IS NOT FIRING PROPERLY

NOTE: **Electronic ignition engine timing is entirely controlled by the PCM. Electronic ignition timing is NOT adjustable. Do not attempt to check base timing. You will receive false readings.**

- Determine which coil is not firing properly using the information from Pinpoint Test JB or a DTC and the table at the beginning of this pinpoint test.
- Record the suspect cylinder, coil and PCM pin number from the table.
- **Is the suspect cylinder number, coil driver and PCM pin number recorded?**

Yes	No
GO to JE3.	To obtain the required information, REPEAT step JE2.

JE3 DTC P0351, P0352, P0353: CHECK IGN START/RUN VOLTAGE TO THE COIL PACK

- Suspect coil connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Coil Pack Assembly Connector, Harness Side	(-)
IGN START/RUN	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to JE4.	The IGN START/RUN has a circuit concern. CHECK the condition of the related fuses/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the IGN START/RUN circuit for a short to ground. REPAIR as necessary. CARRY OUT the misfire monitor drive cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.

JE4 CHECK THE FUNCTIONALITY OF THE SUSPECT COIL DRIVER (CD) CIRCUIT

- Key in OFF position.
- Connect a test lamp between IGN START/RUN and the suspect CD circuit (determined from the table) at the coil pack harness connector.
- Crank the engine while the accelerator pedal is fully applied.
- Observe the test lamp while cranking the engine.
- **Does the test lamp blink consistently?**

Yes	No
GO to JE8.	GO to JE5.

JE5 CHECK THE SUSPECT CD CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) Coil Pack Assembly Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect coil driver	Suspect coil driver

- **Is the resistance less than 5 ohms?**

Yes	No
GO to JE6.	REPAIR the open circuit. CARRY out the misfire monitor drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.

JE6 CHECK THE SUSPECT CD CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
Suspect coil driver	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CARRY out the misfire monitor drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.	GO to JE7.

JE7 CHECK THE SUSPECT CD CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
Suspect coil driver	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to JE9.	REPAIR the short circuit. CARRY out the misfire monitor drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.

JE8 CHECK THE SUSPECT COIL FOR DAMAGE

- Key in OFF position.
- Remove the spark plug wire from the suspect coil tower (as determined from the table).
- Connect the Air Gap Spark Tester 303-D037 (D81P-6666-A) or equivalent to the suspect spark plug wire.
- Crank the engine while the accelerator pedal is fully applied.
- Observe the spark tester while cranking the engine.
- **Is a bluish-white spark present?**

Yes	No
refer to **PINPOINT TEST Z**.	INSTALL a new coil pack as needed. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CARRY out the misfire monitor drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CLEAR the DTCs. REPEAT the self-test.

JE9 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No

INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST JF: INTEGRATED IGNITION COIL ON PLUG COIL A THROUGH J FAILURE

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- ignition coils (12029)
- ignition coil harness
- ignition coils relay
- powertrain control module (PCM) (12A650)

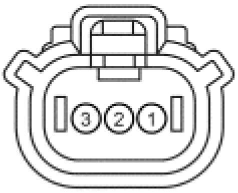


Fig. 164: Coil On Plug (COP) Connector - A
Courtesy of FORD MOTOR CO.

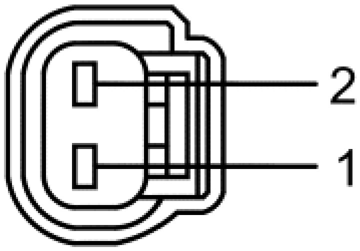


Fig. 165: Coil On Plug (COP) Connector - B

Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Edge, MKX, MKZ, Taurus, Taurus X, Sable	A	1 3	COP IGN START/RUN
Escape/Mariner, Focus, Fusion, Milan, Mustang 5.4L	B	1 2	COP IGN START/RUN
All other vehicles	B	2 1	COP IGN START/RUN

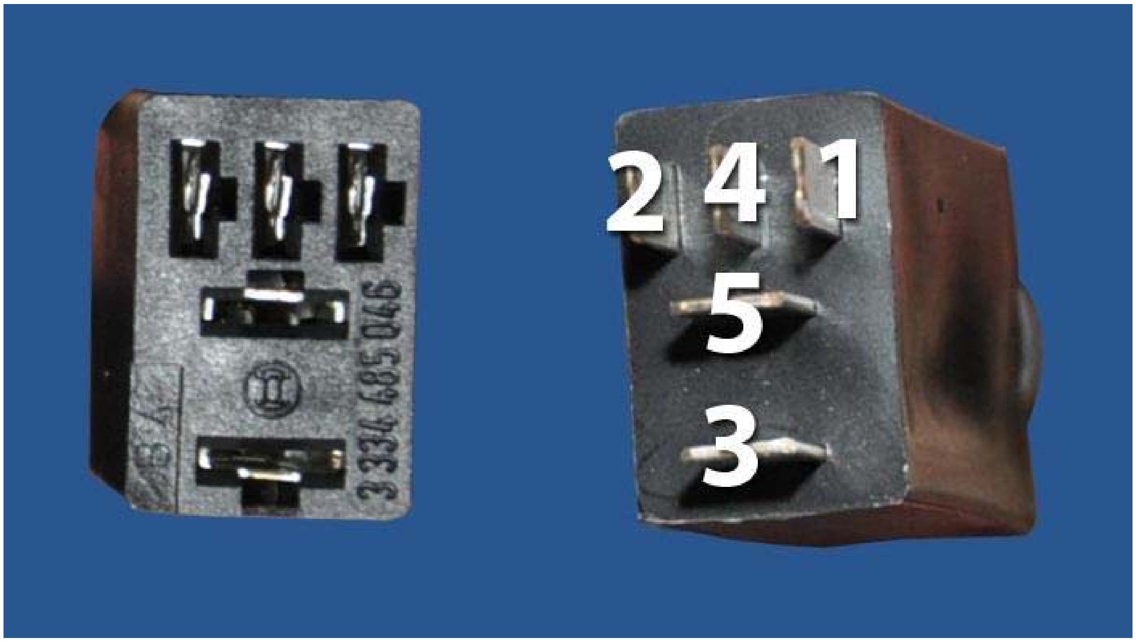


Fig. 166: Powertrain Control Module Power (PCM Power) Relay Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	GND (Ground)
2	IGN START/RUN
5	B+ (Battery Positive Voltage)
3	VPWR (Vehicle Power)

IGNITION COIL TO CYLINDER CORRELATION

				Coil	

Vehicle	Related DTC	Cylinder Number	Ignition Coil	Driver (CD)	PCM Pin
2.3L Escape, 2.3L Mariner	P0351	1	A	A	E1
	P0352	2	B	D	E12
	P0353	3	C	B	E24
	P0354	4	D	C	E35
Focus	P0351	1	A	A	E70
	P0352	2	B	D	E50
	P0353	3	C	B	E66
	P0354	4	D	C	E69
2.3L Fusion, 2.3L Milan	P0351	1	A	A	E17
	P0352	2	B	D	E11
	P0353	3	C	B	E12
	P0354	4	D	C	E16
6-Cylinder Applications	P0351	1	A	A	E17
	P0352	2	B	C	E16
	P0353	3	C	E	E15
	P0354	4	D	B	E12
	P0355	5	E	D	E11
	P0356	6	F	F	E10
3.0L Escape, 3.0L Mariner	P0351	1	A	A	E1
	P0352	2	B	C	E12
	P0353	3	C	E	E24
	P0354	4	D	B	E35
	P0355	5	E	D	E36
	P0356	6	F	F	E22
8-Cylinder Applications	P0351	1	A	A	E17
	P0352	2	B	D	E11
	P0353	3	C	B	E12
	P0354	4	D	G	E14
	P0355	5	E	F	E10
	P0356	6	F	E	E15
	P0357	7	G	C	E16
	P0358	8	H	H	E9
10-Cylinder Applications	P0351	1	A	A	E17
	P0352	2	B	E	E11
	P0353	3	C	G	E12
	P0354	4	D	I	E14
	P0355	5	E	C	E10
	P0356	6	F	B	E15
	P0357	7	G	F	E16

	P0358	8	H	H	E9
	P0359	9	I	J	E13
	P0360	10	J	D	E8

TEST PROCEDURE

JF1 DETERMINE WHICH COIL IS NOT FIRING PROPERLY

NOTE: Electronic ignition engine timing is entirely controlled by the PCM. Electronic ignition timing is NOT adjustable. Do not attempt to check base timing. You will receive false readings.

- Determine which coil is not firing properly using the information from Pinpoint Test JB or a DTC and the table at the beginning of this pinpoint test.
- Record the suspect cylinder, coil and PCM pin number from the table.
- **Is the suspect cylinder number, coil driver and PCM pin number recorded?**

Yes	No
GO to JF2.	REPEAT the test step to obtain the required information.

JF2 CHECK THE FUNCTIONALITY OF THE SUSPECT COIL DRIVER CIRCUIT

NOTE: This step may cause fuel pump related DTCs to set. Disregard any fuel pump related DTCs at this time.

NOTE: Test lamp bulb filament wattages vary widely. The intensity and duration of blinking depends on the test lamp being used.

- Key in OFF position.
- Suspect coil connector disconnected.
- Remove the fuel pump fuse to disable the fuel pump.
- Connect a non-powered test lamp between the IGN START/RUN and suspect coil driver, harness side.
- Observe the test lamp while cranking the engine.
- **Is the test lamp blinking consistently?**

Yes	No
GO to JF3.	GO to JF4.

JF3 CHECK THE FUNCTIONALITY OF THE SUSPECT COIL

- Key in OFF position.

- Carry out a visual inspection. Closely inspect the coil case and boot for carbon tracking, cracks and torn or improperly installed boots.
- Remove the suspect COP from the spark plug.
- Connect the Air Gap Spark Tester 303-DO37 (D81P-6666-A) or equivalent.
- Suspect coil connector connected.
- Crank the engine.
- Observe the spark tester while cranking the engine.
- **Is a bluish-white spark present?**

Yes	No
refer to **PINPOINT TEST Z**.	INSTALL a new suspect coil. If necessary, INSTALL a new spark plug. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JF4 CHECK THE IGN START/RUN VOLTAGE TO THE SUSPECT COIL

- Key ON, engine OFF.
- Suspect coil connector disconnected.
- Measure the voltage between:

(+) COP Connector, Harness Side	(-) Vehicle Battery
IGN START/RUN	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to JF5.	For Crown Victoria, Grand Marquis, and Town Car, GO to JF9. For all others, REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JF5 CHECK THE SUSPECT COIL DRIVER CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Suspect coil connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) COP Connector, Harness Side
Suspect coil driver	COP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to JF6.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JF6 CHECK THE SUSPECT COIL DRIVER CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
Suspect coil driver	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to JF7.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

JF7 CHECK THE SUSPECT COIL DRIVER CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
Suspect coil driver	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to JF12.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test. If the concern or DTC is still present, GO to JF8.

JF8 CHECK THE SUSPECT COIL FOR DAMAGE

- PCM connector connected.
- Connect the Air Gap Spark Tester 303-D037 (D81P-6666-A) or equivalent to the suspect coil.
- Crank the engine while the accelerator pedal is fully applied.
- Observe the spark tester while cranking the engine.
- **Is a bluish-white spark present?**

Yes	No
If necessary, INSTALL a new spark plug. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	INSTALL a new suspect coil. REFER to the **ENGINE IGNITION - 4.6L (2V) AND 5.4L (2V) -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

JF9 CHECK VPWR CIRCUIT CONTINUITY BETWEEN THE SUSPECT COIL AND IGNITION COILS RELAY

- Key in OFF position.
- Ignition Coils Relay connector disconnected.
- Measure the resistance between:

(+) Ignition Coils Relay Connector, Harness Side	(-) Suspect coil Connector, Harness Side
VPWR - Pin 3	IGN START/RUN

- **Is the resistance less than 5 ohms?**

Yes	No
GO to JF10.	REPAIR the open circuit. The open is between the splice and the ignition coils relay. CLEAR the DTCs. REPEAT the self-test.

JF10 CHECK THE B+ AND IGN START/RUN VOLTAGE TO IGNITION COILS RELAY

- Key ON, engine OFF.
- Measure the voltage between:

(+) Ignition Coils Relay Connector, Harness Side	(-)
B+ - Pin 5	Ground
IGN START/RUN - Pin 2	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to JF11.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JF11 CHECK THE IGNITION COILS RELAY GND CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the voltage between:

(+) Ignition Coils Relay Connector, Harness	(-) Ignition Coils Relay Connector, Harness

Side	Side
B+ - Pin 5	GND - Pin 1

- **Is the voltage greater than 10 V?**

Yes	No
INSTALL a new Ignition Coils relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

JF12 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KA: FUEL PUMP (FP) RELAY

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- fuel pump relay (9345)
- inertia fuel shutoff (IFS) switch (9341)
- harness circuits: B+, VPWR, FP, GND, FPM, and FP PWR
- powertrain control module (PCM) (12A650)

The VPWR and FP circuits may be reversed in the harness connector. Refer to the Wiring Diagrams article for schematic and connector information.

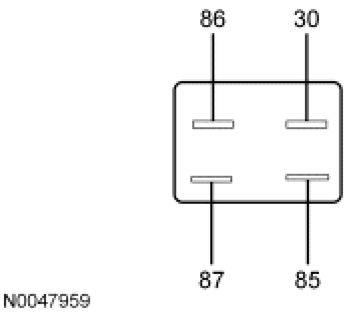


Fig. 167: Powertrain Control Module Power (PCM Power) Relay Connector - A
Courtesy of FORD MOTOR CO.

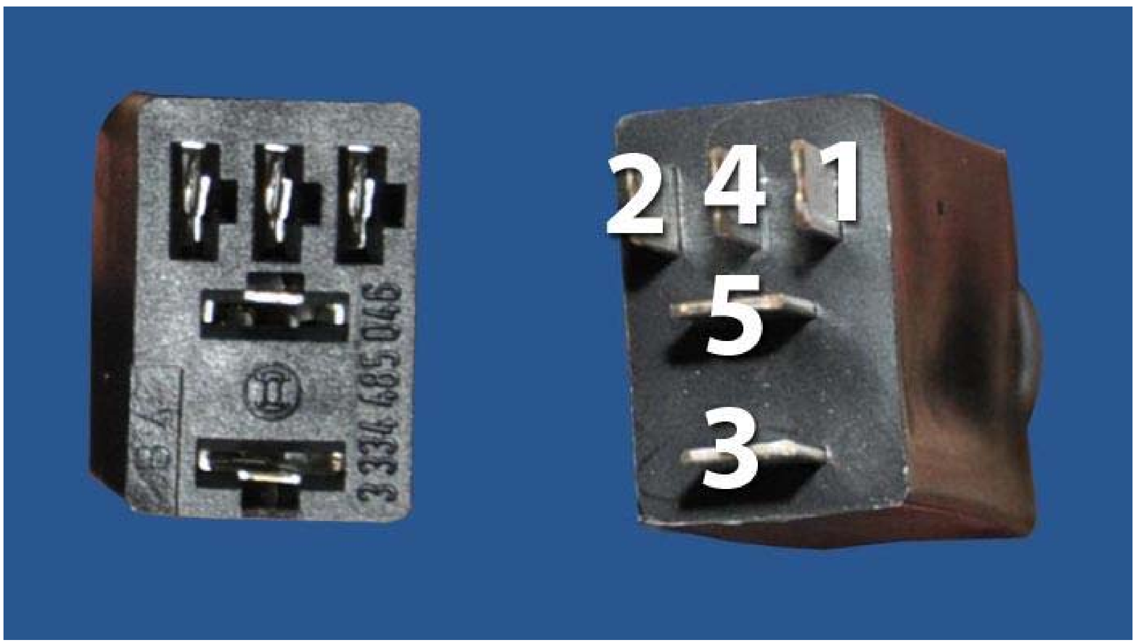


Fig. 168: Powertrain Control Module Power (PCM Power) Relay Connector - B
Courtesy of FORD MOTOR CO.

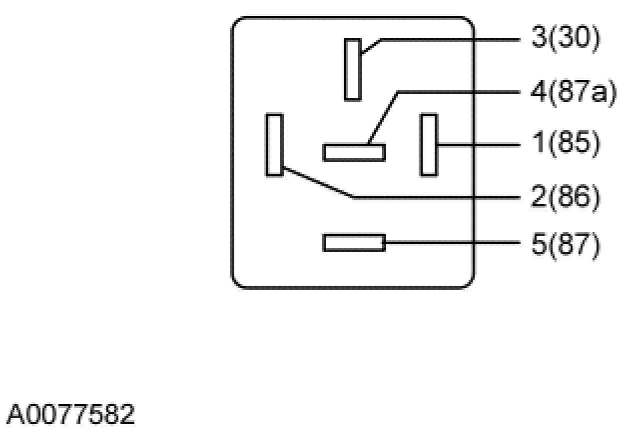


Fig. 169: Powertrain Control Module Power (PCM Power) Relay Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition, Focus, Navigator, Sable, Taurus, Taurus X	A	30 87 85 86	B+ FPPWR FP VPWR
Ranger	B	3 5 1 2	B+ FPPWR FP VPWR
All other vehicles	C	3 5 1 2	B+ FPPWR FP VPWR

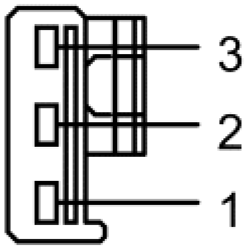


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Fig. 170: Inertia Fuel Shutoff (IFS) Switch Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	FPPWR-B (Fuel Pump Power - B)
2	FPPWR-A (Fuel Pump Power - A)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Expedition, Fusion,	140 Pin	B30 B62	FPM FP

Milan, MKZ, Navigator			
Focus	190 Pin	B32 B19	FPM FP
Ranger	170 Pin	B21 B12	FPM FP
All other vehicles	190 Pin	B30 B62	FPM FP

TEST PROCEDURE

KA1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0230, P0231, P0232, or P1641 present?**

Yes	No
For KOEO and KOER DTCs P0230 or P1641, GO to KA2. For continuous memory DTCs P0230 or P1641, GO to KA32. For KOEO and KOER DTC P0231, GO to KA24. For continuous memory DTC P0231, GO to KA31. For KOEO and KOER DTC P0232, GO to KA12. For continuous memory DTC P0232, GO to KA29.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KA2 KOEO AND KOER DTCS P0230 AND P1641: CHECK FOR THE PRESENCE OF DTC P0685 OR P0690

- Carry out the self-test.
- **Are DTCs P0685 or P0690 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to KA3.

KA3 CHECK THE VPWR VOLTAGE TO FUEL PUMP RELAY

- FP Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FP Relay Connector, Harness Side	(-)

VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KA4.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KA4 CHECK THE FUEL PUMP RELAY

- Key in OFF position.
- Carry out the FP relay component test. Refer to the Wiring Diagrams Cell 149 Component Testing.
- **Does the FP relay pass the component test?**

Yes	No
GO to KA5.	INSTALL a new FP relay. CLEAR the DTCs. REPEAT the self-test.

KA5 CHECK THE FP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FP Relay Connector, Harness Side	(-)
FP	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to KA6.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KA6 CHECK THE FUEL PUMP CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-)
FP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KA7.	REPAIR the short circuit. CLEAR the DTCs.

	REPEAT the self-test.

KA7 CHECK THE FUEL PUMP CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-) PCM Connector, Harness Side
FP	FP

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KA8.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KA8 CHECK FOR KOEO DTCS

- Carry out the KOEO self-test.
- **Are DTCs P0231 or P0232 present?**

Yes	No
GO to KA9.	GO to KA34.

KA9 CHECK THE FP PRIMARY CIRCUIT INSIDE THE PCM

- PCM connector connected.
- FP Relay connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the FP_F PID.
- **Is the PID state YES?**

Yes	No
GO to KA34.	GO to KA10.

KA10 CHECK THE FUEL PUMP PRIMARY CIRCUIT INSIDE THE PCM WHILE CRANKING THE ENGINE

- Access the PCM and monitor the FP_F PID.
- While observing the PID, crank the engine.
- **Does the PID display indicate a concern during crank?**

Yes	No
GO to KA34.	The fuel pump primary circuit is OK in the harness and PCM. GO to KA11.

KA11 IS DTC P0231 PRESENT IN THE KOEO SELF-TEST?

- Carry out the KOEO self-test.
- **Is DTC P0231 present?**

Yes	No
GO to KA24.	GO to KA12.

KA12 KOEO AND KOER DTC P0232: DOES THE ENGINE START?

- **Does the engine start?**

Yes	No
GO to KA13.	GO to KA18.

KA13 VERIFY THE FUEL PUMP IS OFF

- Key ON, engine OFF.
- Wait for 5 seconds.
- The fuel pump is located above the fuel tank. Listen for the sound of the fuel pump operating which can be heard from outside the vehicle.
- **Is fuel pump off with the key ON?**

Yes	No
GO to KA15.	GO to KA14.

KA14 CHECK FOR FUEL PUMP RELAY CONTACTS ALWAYS CLOSED

- FP Relay connector disconnected.
- Key ON, engine OFF.
- **Is fuel pump off with the key ON?**

Yes	No
INSTALL a new FP relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the short circuit. The short circuit is between the FPPWR and FPM circuits or in the INJPWRM circuit. CLEAR the DTCs. REPEAT the self-test.

KA15 CHECK THE FPM CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- FP Relay connector disconnected.
- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-) PCM Connector, Harness Side
FPPWR	FPM

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KA16.	REPAIR the open circuit. The concern is between the splice and the PCM. CLEAR the DTCs. REPEAT the self-test.

KA16 IS KOEO DTC P0231 PRESENT?

- Carry out the KOEO self-test.
- **Is DTC P0231 present?**

Yes	No
GO to KA34.	GO to KA17.

KA17 CHECK THE FPM PRIMARY CIRCUIT INSIDE THE PCM

- PCM connector connected.
- FP Relay connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- **Is the PID state OFF?**

Yes	No
The concern is not present at this time. The FPM circuit is OK in the harness and PCM. Disregard DTC P0232 at this time. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	GO to KA34.

KA18 CHECK IF THE INERTIA FUEL SHUTOFF (IFS) SWITCH IS TRIPPED

- **Is the IFS switch tripped?**

Yes	No
RESET the IFS switch. CLEAR the DTCs. REPEAT the self-test.	GO to KA19.

KA19 CHECK THE INERTIA FUEL SHUTOFF

- IFS Switch connector disconnected.
- Measure the resistance between:

(+) IFS Switch Connector, Component Side	(-) IFS Switch Connector, Component Side
FPPWR-A - Pin 2	FPPWR-B - Pin 1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KA20.	INSTALL a new IFS switch. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KA20 CHECK THE FP PWR CIRCUIT FOR AN OPEN IN THE HARNESS

- FP Relay connector disconnected.
- Measure the resistance between:

(+) IFS Switch Connector, Harness Side	(-) FP Relay Connector, Harness Side
FPPWR-A - Pin 2	FPPWR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KA21.	REPAIR the open circuit. CHECK for an open circuit between the IFS switch and the FPM splice. REFER to the Wiring Diagrams article for schematic and connector information. CLEAR the DTCs. REPEAT the self-test.

KA21 CHECK THE FUEL PUMP GROUND CIRCUIT FOR AN OPEN IN THE HARNESS

- FP connector disconnected.
- Measure the resistance between:

(+) FP Connector, Harness Side	(-)
FPGND	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KA22.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KA22 CHECK THE FP PWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FP Connector, Harness Side	(-) IFS Switch Connector, Harness Side
FPPWR	FPPWR-B - Pin 1

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KA23.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KA23 CHECK THE INTERNAL RESISTANCE OF THE FUEL PUMP

- Measure the resistance between:

(+) FP Connector, Harness Side	(-) FP Connector, Harness Side
FPPWR	FPGND

- **Is the resistance less than 10 ohms?**

Yes	No
The fuel pump circuit is OK in the harness and PCM. Disregard DTC P0232 at this time. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts for further direction.	INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KA24 KOEO AND KOER DTC P0231: IS KOEO DTC P0230 ALSO PRESENT?

- Carry out the KOEO self-test.
- **Is DTC P0230 present?**

Yes	No
GO to KA3.	GO to KA25.

KA25 DOES THE ENGINE START?

- **Does the engine start?**

Yes	No
GO to KA15.	GO to KA26.

KA26 CHECK IF THE IFS SWITCH IS TRIPPED

- **Is the IFS switch tripped?**

Yes	No
RESET the IFS switch. CLEAR the DTCs. REPEAT the self-test.	GO to KA27.

KA27 CHECK THE B+ CIRCUIT VOLTAGE TO THE FP RELAY

- FP Relay connector disconnected.

- Measure the voltage between:

(+) FP Relay Connector, Harness Side	(-)
B+	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KA28.	A B+ circuit concern is present. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link. CLEAR the DTCs. REPEAT the self-test.

KA28 CHECK THE FP PWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-)
FPPWR	Ground

- **Is the resistance less than 10 ohms?**

Yes	No
INSTALL a new FP relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. The open is between the splice and the FP relay. CLEAR the DTCs. REPEAT the self-test.

KA29 CONTINUOUS MEMORY DTC P0232: IS A CONTINUOUS DTC P0230 PRESENT?

- Retrieve the continuous memory DTCs.
- **Is DTC P0230 present?**

Yes	No
GO to KA33.	GO to KA30.

KA30 CHECK THE FUEL PUMP SECONDARY CIRCUITS FOR A CONCERN

NOTE: **Be aware that DTC P0232 could be set if the IFS switch is tripped then reset, or if voltage is supplied to the FP PWR circuit when the PCM expects the fuel pump to be off. The fuel pump prime procedure produces this.**

NOTE: **The FPM PID turns ON when a concern is present.**

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- Observe the FPM PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FPPWR circuit between the FP RLY and the FP
  - Shake, wiggle, and bend the FP GND
  - Shake, wiggle, and bend the FPM circuit between the PCM and the splice to the FPPWR circuit
  - Shake, wiggle, and bend the INJPWRM circuit between the PCM and the splice to the FPPWR circuit
  - Lightly tap on the FP, IFS, and FP RLY to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KA31 CONTINUOUS MEMORY DTC P0231: CHECK THE HARNESS

- PCM connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A PCM Connector, Harness Side	Point B
FP	Ground

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FPM	Ground

- The FP turns on and the voltage will be greater than 10 V.
- Check for an indication of a concern while carrying out the following. The voltage changes suddenly when a concern is present.
  - Shake, wiggle, and bend the B+ supply to the FP relay
  - Shake, wiggle, and bend the FP PWR circuit between the FP relay and the FPM splice
  - Lightly tap on the FP relay to simulate road shock
- Key in OFF position.
- Visually inspect the FP relay and its loom connector for damage and corrosion.
- **Is a concern present?**

Yes	No

ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KA32 CONTINUOUS MEMORY DTC P0230: CHECK FOR THE PRESENCE OF DTC P0685 OR P0690

- Carry out the self-test.
- **Are DTCs P0685 or P0690 present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to KA33.

KA33 CHECK THE FP PRIMARY CIRCUITS

NOTE: The PID indicates YES when a concern is present.

- Key ON, engine OFF.
- Wait for 5 seconds.
- Access the PCM and monitor the FP_F PID.
- Observe the FP_F PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FP circuit between the PCM and the FP relay
  - Shake, wiggle, and bend the VPWR circuit between the electronic engine control power relay and the FP relay
  - Lightly tap on the FP relay to simulate road shock
- Key in OFF position.
- Visually inspect the PCM connector and wires as far back as the main loom for damage.
- Visually inspect the FPR connector and wires as far back as the main loom for damage.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KA34 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion

- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KB: FUEL PUMP DRIVER MODULE

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- fuel pump driver module (FPDM) (9D370) and (9D372)
- FPDM power supply relay
- inertia fuel shutoff (IFS) switch (9341)
- harness circuits: B+, GND, FPC, FPM, FPM2, FP PWR, FP2PWR, FP RTN, FP2RTN, VPWR Fuel, VPWR Fuel 2, and PWRGND
- powertrain control module (PCM) (12A650)

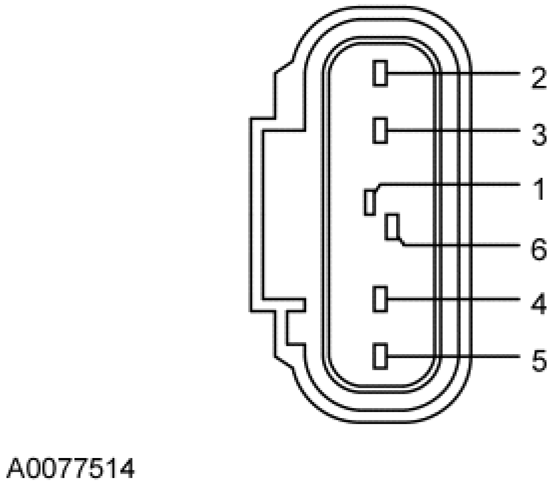

Fig. 171: Fuel Pump Driver Module (FPDM2) Connector

Courtesy of FORD MOTOR CO.

Pin	Circuit
2	FPRTN (Fuel Pump Return)
4	FPPWR (Fuel Pump Power)
6	FPC (Fuel Pump Command)
1	FPM (Fuel Pump Monitor)
3	PWRGND (Power Ground)
5	VPWR Fuel

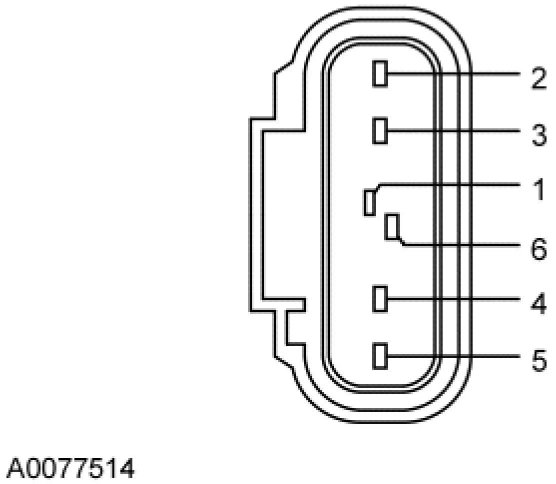

Fig. 172: Fuel Pump Driver Module 2 (FPDM2) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	FP2RTN (Fuel Pump 2 Return)
4	FP2PWR (Fuel Pump 2 Power)
6	FPC (Fuel Pump Command)
1	FPM2 (Fuel Pump Monitor 2 - Rear\Secondary Pump)
3	PWRGND (Power Ground)
5	VPWR Fuel 2

Refer to the Wiring Diagrams article for schematic and connector information. For F-150 and Mark LT, the FPDM PWR relay is integral to the PDJB.

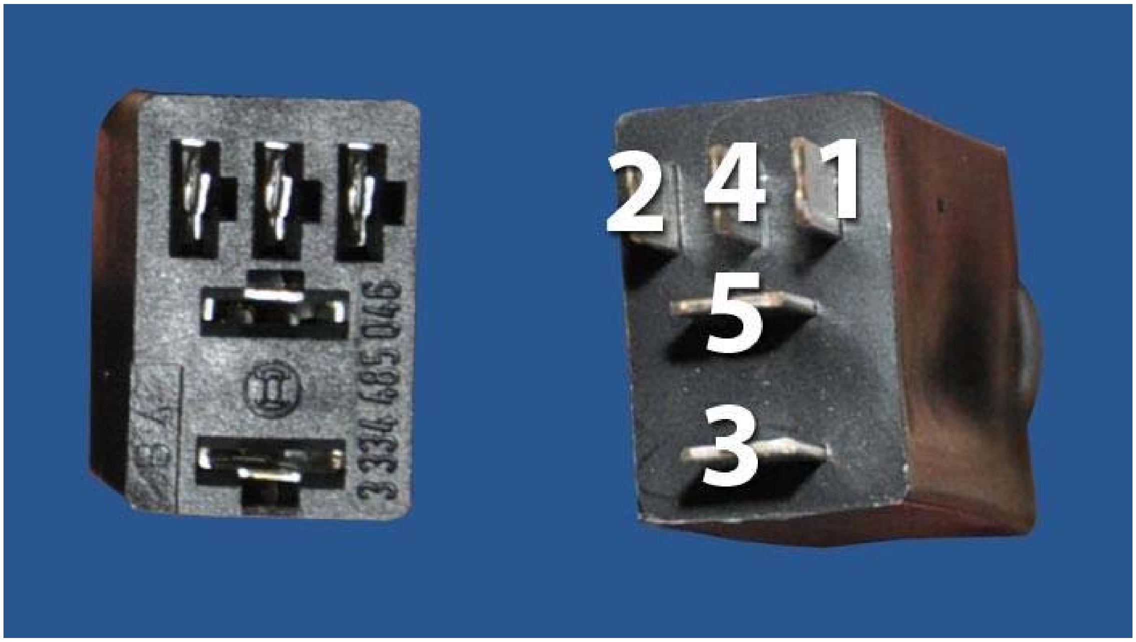

Fig. 173: Powertrain Control Module Power (PCM Power) Relay Connector - A
Courtesy of FORD MOTOR CO.

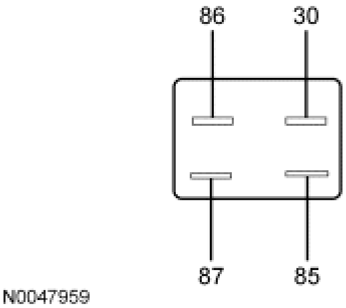

Fig. 174: Fuel Pump Driver Module Power (FPDM PWR) Relay Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Town Car	A	5 1 2 3	VPWR Fuel GND VPWR B+
Escape/Mariner, F-Super Duty	B	87 85 86 30	VPWR Fuel GND VPWR B+
All other vehicles	A	5 2 1 3	VPWR Fuel GND VPWR B+

Refer to the Wiring Diagrams article for schematic and connector information.

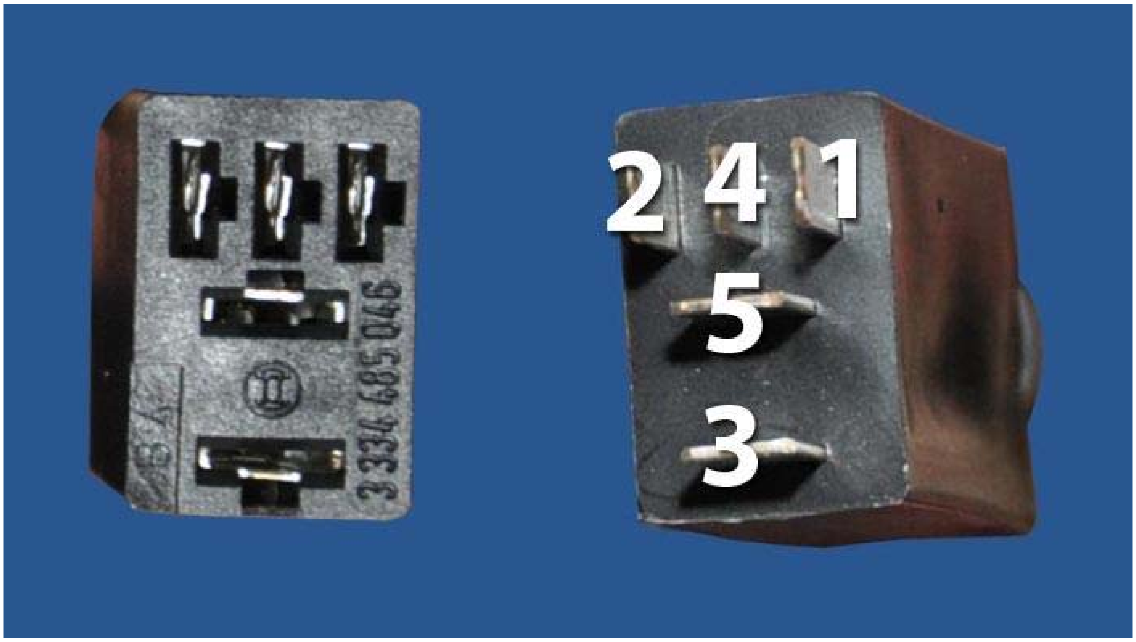

Fig. 175: Powertrain Control Module Power (PCM Power) Relay Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
5	VPWR Fuel 2
2	GND (Ground)
1	VPWR (Vehicle Power)
3	B+ (Battery Positive Voltage)

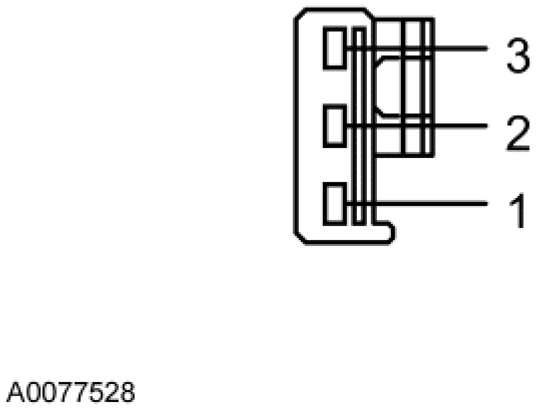

Fig. 176: Inertia Fuel Shutoff (IFS) Switch Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	VPWR Fuel - A
1	VPWR Fuel - B

This applies to applications with an FPDM PWR relay integral to the PDJB.

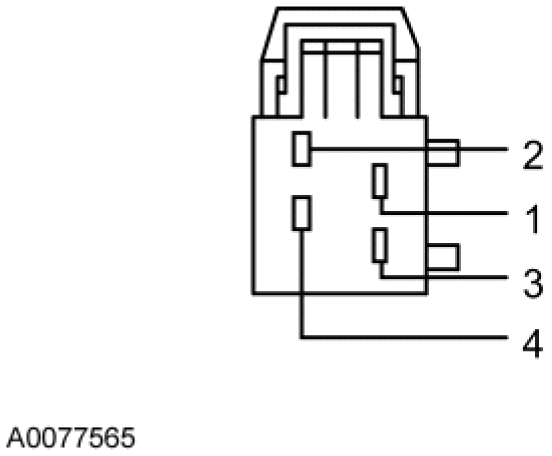

Fig. 177: Power Distribution Junction Box (PDJB) Connector - B
Courtesy of FORD MOTOR CO.

Pin	Circuit
3	VPWR Fuel

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B12 B21	FPC FPM
F-150, Mark LT	190 Pin	B62 B30	FPC FPM
Mustang 5.4L	170 Pin	T18 B12 B21	FPM2 FPC FPM
All other vehicles	170 Pin	B12 B21	FPC FPM

TEST PROCEDURE

KB1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P1233, P1234, P1235, P1236, P1237, P1238, or P1641 present?**

Yes	No
For DTC P1233, GO to KB2. For DTC P1234, GO to KB38. For DTCs P1235 or P1641, GO to KB20. For DTC P1236, GO to KB50. For DTC P1237, GO to KB26. For DTC P1238, GO to KB56.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KB2 DTC P1233: IS DTC P1233 PRESENT IN THE KOEO SELF-TEST?

NOTE: The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1233 applies to the FPDM mounted on the driver side of the luggage compartment.

- Carry out the KOEO self-test.
- **Is DTC P1233 present?**

Yes	No
GO to KB3.	The PCM is now receiving a signal from the FPDM. One possible cause of DTC P1233 is that the IFS switch was tripped, then reset. For a no start (engine cranks), DISREGARD the DTC at this time. RETURN to the **SYMPTOM CHARTS** article Symptom Charts and continue as directed. After repairing the no start, to diagnose the intermittent causes of P1233, GO to KB19. For all others, GO to KB19.

KB3 DOES THE ENGINE START?

NOTE: The Mustang 5.4L starts with 1 FPDM disabled.

- **Does the engine start?**

Yes	No
For Mustang 5.4L, GO to KB4. For all others, to check the FPM circuit, GO to KB15.	VERIFY the IFS switch is set (button pressed). If OK, GO to KB4.

KB4 CHECK THE VOLTAGE AND GROUND CIRCUITS TO THE FPDM

- FPDM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
VPWR Fuel - Pin 5	PWRGND - Pin 3

- **Is the voltage greater than 10 V?**

Yes	No
For Mustang 5.4L, to check the FPM circuit, GO to KB15. For all others, INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to KB5.

KB5 CHECK THE VOLTAGE TO THE FPDM

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
VPWR Fuel - Pin 5	Ground

- **Is the voltage greater than 10 V?**

Yes	No
REPAIR the open circuit. The FPDM ground circuit is open. CLEAR the DTCs. REPEAT the self-test.	There is no voltage to the FPDM. For F-150, and Mark LT, GO to KB11. For all others, GO to KB6.

KB6 CHECK THE B+ VOLTAGE TO THE FPDM POWER SUPPLY RELAY

- Key in OFF position.
- FPDM PWR Relay connector disconnected.
- Measure the voltage between:

(+) FPDM PWR Relay Connector, Harness Side	(-)
B+	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KB7.	A B+ circuit concern is present. CHECK the condition of the related fuse/fuse links. If OK,

	REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link. CLEAR the DTCs. REPEAT the self-test.

KB7 CHECK THE VPWR VOLTAGE TO THE FPDM POWER SUPPLY RELAY

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM PWR Relay Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KB8.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB8 CHECK FOR GROUND TO THE FPDM POWER SUPPLY RELAY

- Measure the resistance between:

(+) FPDM PWR Relay Connector, Harness Side	(-)
GND	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KB9.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB9 CHECK THE VPWR FUEL CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-) FPDM PWR Relay Connector, Harness Side
VPWR Fuel - Pin 5	VPWR Fuel

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new FPDM relay. CLEAR the DTCs.	GO to KB10.

REPEAT the self-test.	

KB10 ISOLATE THE OPEN IN THE FPDM CIRCUIT

- IFS Switch connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-) IFS Switch Connector, Harness Side
VPWR Fuel - Pin 5	VPWR Fuel - B - Pin 1

- Measure the resistance between:

(+) FPDM PWR Relay Connector, Harness Side	(-) IFS Switch Connector, Harness Side
VPWR Fuel	VPWR Fuel - A - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new IFS switch. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . VERIFY the IFS switch is set (button pressed). CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB11 CHECK THE FUEL PUMP FUSE

NOTE: These steps are for applications with a FPDM PWR relay integral to the PDJB.

- Key in OFF position.
- Check the FPDM power supply relay fuse. Refer to the Wiring Diagrams article for schematic and connector information.
- **Is the fuse OK?**

Yes	No
GO to KB12.	INSTALL a new fuse. CHECK the associated circuits for a short to ground before installing the fuse. CLEAR the DTCs. REPEAT the self-test.

KB12 CHECK FOR VOLTAGE TO THE IFS SWITCH

- IFS Switch connector disconnected.
- Key ON, engine OFF.

- Measure the voltage between:

(+) IFS Switch Connector, Harness Side	(-)
VPWR Fuel - A - Pin 2	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KB14.	GO to KB13.

KB13 CHECK THE VPWR FUEL CIRCUIT FOR AN OPEN BETWEEN THE IFS AND PDJB

- Key in OFF position.
- PDJB connector disconnected. Refer to the Wiring Diagrams article for schematic and connector information.
- Measure the resistance between:

(+) IFS Switch Connector, Harness Side	(-) PDJB Connector, Harness Side
VPWR Fuel - A - Pin 2	VPWR Fuel - Pin 3

- **Is the resistance less than 5 ohms?**

Yes	No
CHECK the fuel pump fuse. REPAIR as necessary. If OK, INSTALL a new FP RLY/PDJB. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB14 CHECK THE IFS FOR AN OPEN

- Key in OFF position.
- Measure the resistance between:

(+) IFS Switch Connector, Component Side	(-) IFS Switch Connector, Component Side
VPWR Fuel - A - Pin 2	VPWR Fuel - B - Pin 1

- **Is the resistance less than 5 ohms?**

Yes	No
REPAIR the open circuit. The VPWR fuel circuit is open. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new IFS switch. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB15 CHECK THE FPM CIRCUIT FOR AN OPEN IN THE HARNESS

- FPDM connector disconnected.

- PCM connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-) PCM Connector, Harness Side
FPM - Pin 1	FPM

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KB16.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB16 CHECK THE FPM CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FPM - Pin 1	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to KB17.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB17 CHECK THE FPM CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-)
FPM - Pin 1	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KB18.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB18 CHECK FOR FPM OUTPUT FROM THE FPDM

NOTE: **It is OK for the voltage to cycle below this range and then return within range.**

- FPDM connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FPM	Ground

- **Is the voltage between 0.02 - 1 V?**

Yes	No
GO to KB64.	INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB19 CHECK THE CIRCUITS THAT MAY CAUSE AN INTERMITTENT LOSS OF VOLTAGE TO THE FPDM

NOTE: **Be aware that P1233 could be set if the IFS switch is tripped then reset.**

NOTE: **With no concern present, the FPDM sends a 50% duty cycle (all OK) to the PCM on the FPM circuit. Depending on the scan tool type, the FPM PID may display 50%, or a random value that is fluctuating between 85% and 115%.**

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- Observe the FPM PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the PWRGND circuit to the FPDM
  - Shake, wiggle, and bend the VPWR fuel circuit to the FPDM
  - Shake, wiggle, and bend the FPM circuit between the FPDM and the PCM
  - Shake, wiggle, and bend the B+ and ground circuits to the FPDM power supply relay
  - Lightly tap on the IFS switch to simulate road shock
  - Lightly tap on the FPDM to simulate road shock
  - Lightly tap on the FPDM power supply relay to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB20 DTC P1235: IS DTC P1235 PRESENT IN THE KOEO SELF-TEST?

NOTE: The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1235 applies to the FPDM mounted on the driver side of the luggage compartment.

NOTE: For ETC applications, check if ETC DTC P2105 is present. An ETC system concern could cause P1235, and should be diagnosed first.

- Carry out the KOEO self-test.
- **Is DTC P1235 present?**

Yes	No
GO to KB21.	GO to KB25.

KB21 CHECK THE FPC CIRCUIT FOR AN OPEN IN THE HARNESS

- FPDM connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FPDM Connector, Harness Side
FPC	FPC - Pin 6

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KB22.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB22 CHECK THE FPC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- FPDM2 connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FPC - Pin 6	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to KB23.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB23 CHECK THE FPC CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-)
FPC - Pin 6	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KB24.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB24 CHECK THE FPC CIRCUIT IN THE FPDM

- FPDM connector connected.
- FPDM2 connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FPC	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KB64.	INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB25 CHECK THE FPC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

NOTE: With no concern present, the FPDM sends a 50% duty cycle (all OK) to the PCM on the FPM circuit. Depending on the scan tool type, the FPM PID may display 50%, or a random value that is fluctuating between 85% and 115%.

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- Observe the FPM PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FPC circuit between FPDM and the PCM
  - Lightly tap on the FPDM to simulate road shock

- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB26 DTC P1237: IS DTC P1237 PRESENT IN THE KOEO SELF-TEST?

NOTE: The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1237 applies to the FPDM mounted on the driver side of the luggage compartment.

- Carry out the KOEO self-test.
- **Is DTC P1237 present?**

Yes	No
GO to KB27.	DTC P1237 is possibly intermittent, GO to KB33.

KB27 DOES THE ENGINE START?

NOTE: The Mustang 5.4L starts with 1 FPDM disabled.

- FPDM2 connector disconnected.
- **Does the engine start?**

Yes	No
GO to KB36.	GO to KB28.

KB28 CHECK THE FPPWR, FPRTN AND INTERNAL FUEL PUMP CIRCUIT RESISTANCE

- Key in OFF position.
- FPDM connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
FPPWR - Pin 4	FPRTN - Pin 2

- **Is the resistance less than 10 ohms?**

Yes	No
GO to KB29.	ISOLATE the concern, GO to KB32.

KB29 CHECK THE FPRTN CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FPRTN - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to KB30.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB30 CHECK THE FPPWR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- FP connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-)
FPPWR - Pin 4	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KB31.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB31 CHECK FOR VOLTAGE TO FP

NOTE: **During output test mode, the fuel pump stays commanded on for only about 5 seconds.**

- FPDM connector connected.
- FP connector disconnected.
- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Measure the voltage between:

(+) FP Connector, Harness Side	(-) FP Connector, Harness Side
FPPWR	FPRTN

- **Is the voltage greater than 10 V?**

Yes	No
INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	VERIFY the vehicle battery was at a proper charge during the test. VERIFY the pump ON command did not time out before the voltage check was made. REPEAT as necessary. If OK, INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB32 ISOLATE THE OPEN CIRCUIT

- FP connector disconnected.
- Measure the resistance between:

(+) FP Connector, Harness Side	(-) FPDM Connector, Harness Side
FPPWR	FPPWR - Pin 4
FPRTN	FPRTN - Pin 2

- Measure the resistance between:

(+) FP Connector, Component Side	(-) FP Connector, Component Side
FPPWR	FPRTN

- **Is the resistance less than 10 ohms?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	REPAIR the open circuit. If the open is internal to the pump, INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB33 VERIFY THE DTC P1237 IS INTERMITTENT

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- **Is the FPM PID 75% (or varying between 250% and 400%)?**

Yes	No
A concern is present. GO to KB27.	CHECK for an intermittent concern, GO to KB34.

KB34 CHECK THE FPPWR AND FPRTN CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

NOTE: **With no concern present, the FPDM sends a 50% duty cycle (all OK) to the PCM on the FPM circuit. Depending on the scan tool type, the FPM PID may display 50%, or a random value that is fluctuating between 85% and 115%.**

- Key ON, engine OFF.
- Access the PCM and monitor the FPM PID.
- Observe the FPM PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FPPWR and FPRTN circuits between the FPDM and the FP
  - Lightly tap on the FP and FPDM to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to KB35.

KB35 CHECK THE FPPWR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

NOTE: **The lamp turns on when a concern is present.**

- Key in OFF position.
- FPDM connector disconnected.
- Connect a non-powered test lamp between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
FPPWR - Pin 4	VPWR Fuel - Pin 5

- Key ON, engine OFF.
- Observe the test lamp for an indication of a concern. Shake, wiggle, and bend the FPPWR circuit between the FPDM and the FP.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB36 CHECK THE FPPWR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- FPDM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FPPWR - Pin 4	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to KB37.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB37 CHECK THE FPRTN CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- FPDM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
VPWR Fuel - Pin 5	FPRTN - Pin 2

- **Is the voltage less than 1 V?**

Yes	No
INSTALL a new FPDM. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB38 DTC P1234: IS DTC P1234 PRESENT IN THE KOEO SELF-TEST?

NOTE: **The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1234 applies to the FPDM2 mounted on the passenger side of the luggage compartment.**

- Carry out the KOEO self-test.
- **Is DTC P1234 present?**

Yes	No
GO to KB39.	The PCM is now receiving a signal from FPDM2. One possible cause of DTC P1234 is that the IFS switch was tripped, then reset. GO to KB49.

KB39 CHECK THE VOLTAGE AND GROUND CIRCUITS TO THE FPDM2

- FPDM2 connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-) FPDM2 Connector, Harness Side
VPWR Fuel 2 - Pin 5	PWRGND - Pin 3

- **Is the voltage greater than 10 V?**

Yes	No
To check the FPM2 circuit, GO to KB45.	GO to KB40.

KB40 CHECK VOLTAGE TO FPDM2

- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-)
VPWR Fuel 2 - Pin 5	Ground

- **Is the voltage greater than 10 V?**

Yes	No
REPAIR the open circuit. The FPDM2 ground circuit is open. CLEAR the DTCs. REPEAT the self-test.	There is no voltage to the FPDM2. GO to KB41.

KB41 CHECK THE B+ VOLTAGE TO THE FPDM2 POWER SUPPLY RELAY

- Key in OFF position.
- FPDM2 PWR Relay connector disconnected.
- Measure the voltage between:

(+) FPDM2 PWR Relay Connector, Harness Side	(-)
B+ - Pin 3	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KB42.	A B+ circuit concern is present. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link. CLEAR the DTCs. REPEAT the self-test.

KB42 CHECK THE VPWR VOLTAGE TO THE FPDM2 POWER SUPPLY RELAY

- Measure the voltage between:

(+) FPDM2 PWR Relay Connector, Harness Side	(-)
VPWR - Pin 1	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KB43.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB43 CHECK FOR GROUND TO THE FPDM2 POWER SUPPLY RELAY

- Key in OFF position.
- Measure the resistance between:

(+) FPDM2 PWR Relay Connector, Harness Side	(-)
GND - Pin 2	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KB44.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB44 CHECK THE VPWR FUEL 2 CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-) FPDM2 PWR Relay Connector, Harness Side
VPWR Fuel 2 - Pin 5	VPWR Fuel 2 - Pin 5

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new FPDM2 PWR relay. CLEAR the DTCs. REPEAT the self-test.	GO to KB49.

KB45 CHECK THE FPM2 CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- FPDM2 connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-) PCM Connector, Harness Side
FPM2 - Pin 1	FPM2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KB46.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB46 CHECK THE FPM2 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-)
FPM2 - Pin 1	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to KB47.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB47 CHECK THE FPM2 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-)
FPM2 - Pin 1	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KB48.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB48 CHECK FOR FPM2 OUTPUT FROM THE FPDM2

NOTE: **It is OK for the voltage to cycle below this range and then return within range.**

- FPDM2 connector connected.
- Key ON, engine OFF.

- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FPM2	Ground

- **Is the voltage between 0.02 - 1 V?**

Yes	No
GO to KB64.	INSTALL a new FPDM2. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB49 CHECK CIRCUITS THAT MAY CAUSE AN INTERMITTENT LOSS OF VOLTAGE SUPPLY TO THE FPDM2

NOTE: Be aware that P1234 could be set if the IFS switch is tripped then reset.

NOTE: With no concern present, the FPDM2 sends a 50% duty cycle (all OK) to the PCM on the FPM2 circuit. Depending on the scan tool type, the FPM2 PID may display 50%, or a random value that is fluctuating between 85% and 115%.

- Key ON, engine OFF.
- Access the PCM and monitor the FPM2 PID.
- Observe the FPM2 PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the PWRGND circuit to the FPDM2
  - Shake, wiggle, and bend the VPWR fuel 2 circuit to the FPDM2
  - Shake, wiggle, and bend the FPM2 circuit between the FPDM2 and the PCM
  - Shake, wiggle, and bend the B+ and ground circuits to the FPDM2 power supply relay
  - Lightly tap on the IFS switch to simulate road shock
  - Lightly tap on the FPDM2 to simulate road shock
  - Lightly tap on the FPDM2 power supply relay to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB50 DTC P1236: IS DTC P1236 PRESENT IN THE KOEO SELF-TEST?

- The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1236 applies to the FPDM2 mounted on

the passenger side of the luggage compartment.

- Carry out the KOEO self-test.
- **Is DTC P1236 present?**

Yes	No
GO to KB51.	GO to KB55.

KB51 CHECK THE FPC CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- FPDM2 connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FPDM2 Connector, Harness Side
FPC	FPC - Pin 6

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KB52.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KB52 CHECK THE FPC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- FPDM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-)
FPC - Pin 6	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to KB53.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB53 CHECK THE FPC CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-)
FPC - Pin 6	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KB54.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB54 CHECK THE FPC CIRCUIT IN THE FPDM2

- FPDM2 connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FPC	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KB64.	INSTALL a new FPDM2. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB55 CHECK THE FPC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

NOTE: **With no concern present, the FPDM2 sends a 50% duty cycle (all OK) to the PCM on the FPM2 circuit. Depending on the scan tool type, the FPM2 PID may display 50%, or a random value that is fluctuating between 85% and 115%.**

- Key ON, engine OFF.
- Access the PCM and monitor the FPM2 PID.
- Observe the FPM2 PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FPC circuit between FPDM2 and the PCM
  - Lightly tap on the FPDM2 to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KB56 DTC P1238: IS DTC P1238 PRESENT IN THE KOEO SELF-TEST?

NOTE: **The Mustang 5.4L is equipped with 2 FPDMs. The DTC P1238 applies to the FPDM2 mounted on the passenger side of the luggage compartment.**

- Carry out the KOEO self-test.
- **Is DTC P1238 present?**

Yes	No
GO to KB57.	CHECK for an intermittent concern, GO to KB63.

KB57 CHECK THE FP2PWR, FP2RTN AND INTERNAL FUEL PUMP CIRCUIT RESISTANCE

- Key in OFF position.
- FPDM2 connector disconnected.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-) FPDM2 Connector, Harness Side
FP2PWR - Pin 4	FP2RTN - Pin 2

- **Is the resistance less than 10 ohms?**

Yes	No
GO to KB58.	ISOLATE the concern, GO to KB62.

KB58 CHECK THE FP2PWR AND FP2RTN CIRCUIT(S) FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- FP connector disconnected. Refer to the Wiring Diagrams article for schematic and connector information.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM2 Connector, Harness Side	(-)
FP2PWR - Pin 4	Ground
FP2RTN - Pin 2	Ground

- **Are the voltages less than 1 V?**

Yes	No
GO to KB59.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB59 CHECK THE FP2PWR AND FP2RTN CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-)
FP2PWR - Pin 4	Ground
FP2RTN - Pin 2	Ground

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to KB60.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB60 CHECK FOR A SHORT BETWEEN THE FP2PWR AND FP2RTN CIRCUITS

- Measure the resistance between:

(+) FPDM2 Connector, Harness Side	(-) FPDM2 Connector, Harness Side
FP2PWR - Pin 4	FP2RTN - Pin 2

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KB61.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KB61 CHECK FOR VOLTAGE TO THE FP

NOTE: **During output test mode, the fuel pump stays commanded on for only about 5 seconds.**

- FPDM2 connector connected.
- Key ON, engine OFF.
- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Measure the voltage between:

(+) FP Connector, Harness Side	(-) FP Connector, Harness Side
FP2PWR	FP2RTN

- **Is the voltage greater than 10 V?**

Yes	No
INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	VERIFY the vehicle battery was at a proper charge during the test. VERIFY the pump ON command did not time out before the voltage check was made. REPEAT as necessary. If OK, INSTALL a new FPDM2. REFER to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB62 ISOLATE THE OPEN CIRCUIT

- FP connector disconnected. Refer to the Wiring Diagrams article for schematic and connector information.
- Measure the resistance between:

(+) FP Connector, Harness Side	(-) FPDM2 Connector, Harness Side
FP2PWR	FP2PWR - Pin 4
FP2RTN	FP2RTN - Pin 2

- Measure the resistance between:

(+) FP Connector, Component Side	(-) FP Connector, Component Side
FP2PWR	FP2RTN

- **Is the resistance less than 10 ohms?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	REPAIR the open circuit. If the open is internal to the pump, INSTALL a new FP. REFER to the **FUEL TANK AND LINES - GASOLINE AND DIESEL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KB63 CHECK THE FP2PWR AND FP2RTN CIRCUIT FOR AN INTERMITTENT OPEN OR SHORTS

NOTE: **With no concern present, the FPDM2 sends a 50% duty cycle (all OK) to the PCM on the FPM2 circuit. Depending on the scan tool type, the FPM2 PID may display 50%, or a random value that is fluctuating between 85% and 115%.**

- Key ON, engine OFF.
- Access the PCM and monitor the FPM2 PID.

- Observe the FPM2 PID for an indication of a concern while carrying out the following:
  - Shake, wiggle, and bend the FP2PWR and FP2RTN circuits between the FPDM2 and the FP
  - Lightly tap on the FP and FPDM2 to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

KB64 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KD: ELECTRIC EXHAUST GAS RECIRCULATION (EEGR) SYSTEM

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- EEGR system
- EEGR stepper motor (9D475)
- harness circuits: EGRMC1, EGRMC2, EGRMC3, EGRMC4 and VPWR
- powertrain control module (PCM) (12A650)

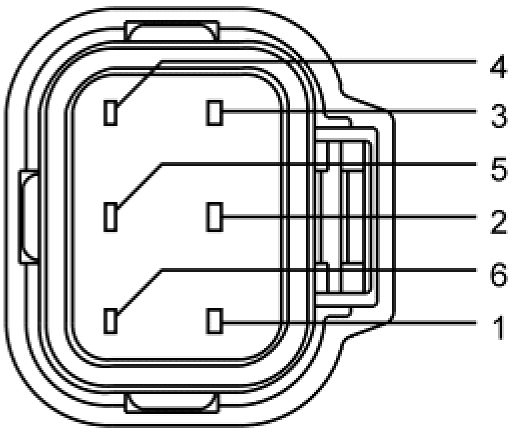

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Fig. 178: Electric Exhaust Gas Recirculation (EEGR) Assembly Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
6	EGRMC4 (EGR Motor Control 4)
4	EGRMC3 (EGR Motor Control 3)
3	EGRMC2 (EGR Motor Control 2)
1	EGRMC1 (EGR Motor Control 1)
5	VPWR (Vehicle Power)
2	VPWR (Vehicle Power)

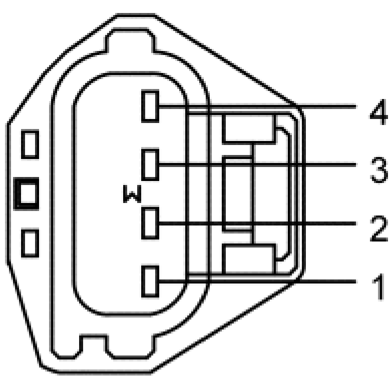

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Fig. 179: Electric Throttle Body Throttle Position Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit

1	MAP (Manifold Absolute Pressure)
4	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B35 E11 E10 E9 E8	VPWR EGRMC4 EGRMC3 EGRMC2 EGRMC1
Focus	190 Pin	B67 E56 E54 E37 E36	VPWR EGRMC4 EGRMC3 EGRMC2 EGRMC1
Ranger	170 Pin	B35 E56 E39 E13 E8	VPWR EGRMC4 EGRMC3 EGRMC2 EGRMC1
All other vehicles	140 Pin	B51 E9 E8 E7 E6	VPWR EGRMC4 EGRMC3 EGRMC2 EGRMC1

TEST PROCEDURE

KD1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0400, P0403, or P1408 present?**

Yes	No
For DTCs P0400 and P1408, GO to KD9. For DTC P0403, GO to KD2.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KD2 DTC P0403: EGR CONTROL CIRCUIT - CHECK THE CONNECTION OF THE EEGR HARNESS CONNECTOR TO THE EEGR

NOTE: **If the DTC is intermittent, wiggle the harness and connectors when taking measurements.**

- Check the connection of the EEGR harness connector to the EEGR.
- **Are the connector contacts clean and correctly seated?**

Yes	No
GO to KD3.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

KD3 CHECK FOR VPWR AT THE EEGR HARNESS CONNECTOR

- Key ON, engine OFF.
- EEGR Assembly connector disconnected.
- Measure the voltage between:

(+) EEGR Assembly Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 2	Negative terminal
VPWR - Pin 5	Negative terminal

- **Are the voltages greater than 10 V?**

Yes	No
GO to KD4.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KD4 CHECK THE EEGR CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) EEGR Assembly Connector, Harness Side	(-) PCM Connector, Harness Side
EGRMC1 - Pin 1	EGRMC1
EGRMC2 - Pin 3	EGRMC2
EGRMC3 - Pin 4	EGRMC3
EGRMC4 - Pin 6	EGRMC4

- **Are the resistances less than 5 ohms?**

Yes	No
GO to KD5.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KD5 CHECK THE EEGR CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) EEGR Assembly Connector, Harness	

Side	(-) Vehicle Battery
EGRMC1 - Pin 1	Negative terminal
EGRMC2 - Pin 3	Negative terminal
EGRMC3 - Pin 4	Negative terminal
EGRMC4 - Pin 6	Negative terminal

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to KD6.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KD6 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE EEGR HARNESS

NOTE: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EGRMC3	EGRMC1
EGRMC3	EGRMC2
EGRMC3	EGRMC4
EGRMC1	EGRMC2
EGRMC1	EGRMC4
EGRMC2	EGRMC4

- **Are the resistances greater than 10K ohms?**

Yes	No
GO to KD7.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KD7 CHECK THE EEGR CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) EEGR Assembly Connector, Harness Side	(-) Vehicle Battery
EGRMC1 - Pin 1	Negative terminal
EGRMC2 - Pin 3	Negative terminal
EGRMC3 - Pin 4	Negative terminal

EGRMC4 - Pin 6	Negative terminal

- **Are the voltages greater than 0.1 V?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to KD8.

KD8 CHECK THE EEGR COILS FOR AN OPEN

- Key in OFF position.
- Measure the resistance between:

(+) EEGR Assembly Connector, Component Side	(-) EEGR Assembly Connector, Component Side
EGRMC1 - Pin 1	VPWR - Pin 2
EGRMC2 - Pin 3	VPWR - Pin 2
EGRMC3 - Pin 4	VPWR - Pin 5
EGRMC4 - Pin 6	VPWR - Pin 5

- **Are the resistances between 15 - 24 ohms?**

Yes	No
GO to KD12.	INSTALL a new EEGR assembly. REFER to the **ENGINE EMISSION CONTROL -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KD9 DTCS P0400 AND P1408: CHECK FOR STUCK OR STICKY EGR VALVE OPERATION BY COMPARING ACTUAL MAP VOLTAGE TO MAP PID VOLTAGE

NOTE: **Repair the following DTCs first, if present: P0102, P0103, P0107, P0108, P1100, P1101.**

- Key in OFF position.
- MAP Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A MAP Sensor Connector, Harness Side	Point B MAP Sensor Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN - Pin 4	SIGRTN - Pin 4

- Key ON, engine running.

- Measure the voltage between:

(+) MAP Sensor Connector, Component Side	(-) Vehicle Battery
MAP - Pin 1	Negative terminal

- **Is the voltage between 1 - 2 V?**

Yes	No
GO to KD10.	CHECK the MAP harness for open and short circuits.

KD10 COMPARE ACTUAL MAP VOLTAGE TO MAP PID VOLTAGE EGR

- Key in OFF position.
- Remove the jumper wires.
- MAP Sensor connected.
- Record the actual MAP voltage values at KOEO, idle, 1,000 and 2,000 RPM.
- Key ON, engine OFF.
- Access the PCM and monitor the MAP PID.
- Note the MAP PID voltage.
- Key ON, engine running.
- Note the MAP PID voltage.
- Increase engine speed to 1,000 RPM.

  Note the MAP PID voltage.

- Increase engine speed to 2,000 RPM.

  Note the MAP PID voltage.

- **Does the MAP PID voltage stay within 0.5 V of the actual MAP voltage?**

Yes	No
The concern is not present at this time. Make sure the MAP sensor is correctly seated and the vacuum source is not blocked.	GO to KD11.

KD11 CARRY OUT THE KOER SELF-TEST

- **Is DTC P1408 retrieved again?**

Yes	No
INSTALL a new EEGR assembly. REFER to the **ENGINE EMISSION CONTROL**	REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART**

-- E-SERIES . CLEAR the DTCs. REPEAT the self-test.	**INDEX** .

KD12 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KE: IDLE AIR CONTROL (IAC) VALVE

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- idle air control (IAC) valve (9F715)
- harness circuits: IAC, PWR and B+ (IAC-RC)
- powertrain control module (PCM) (12A650)

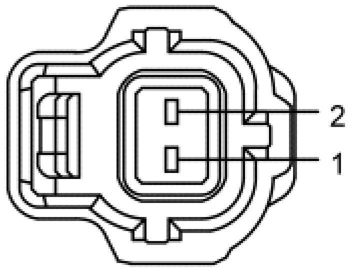

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Fig. 180: Idle Air Control (IAC) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	IAC (Idle Air Control)
1	PWR (POWER)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	E39	IAC
Ranger	170 Pin	E33	IAC

TEST PROCEDURE

KE1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0505, P0506, P0507, P0511, P1504, P1506, or P1507 present?**

Yes	No
For DTCs P0505, P0506, P0511, P1504 or P1507, GO to KE2. For DTCs P0507 or P1506, GO to KE15.	For all other symptoms without DTCs, GO to KE2.

KE2 DTCS P0505, P0506, P0511, P1504 OR P1507: CHECK FOR INLET AIR LEAKS (OR STARTS ONLY AT PART THROTTLE)

- With the engine running at idle (if possible), listen for vacuum leaks.
- Inspect the entire intake air system from the mass air flow (MAF) sensor to the intake manifold for leaks such as:
  - damaged or loose IAC air tubes.
  - cracked or punctured intake air tube.
  - loose intake air tube at the air cleaner housing or throttle body.
  - IAC valve or gasket seal.
  - EGR valve gasket seal.
  - vacuum supply connector and hose.
  - PCV valve, connectors and hoses.
- **Are any leaks present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to KE3.

KE3 CHECK FOR VOLTAGE TO THE IAC SOLENOID

NOTE: If EGR DTC P0402 is output during the self-test, diagnose it first before continuing with this pinpoint test.

- IAC connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IAC Connector, Harness Side	(-) Vehicle Battery
PWR - Pin 1	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to KE4.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KE4 CHECK THE RESISTANCE OF THE IAC VALVE

- Key in OFF position.
- IAC connector disconnected.
- Measure the resistance between:

(+) IAC Connector, Component Side	(-) IAC Connector, Component Side
PWR - Pin 1	IAC - Pin 2

- **Is the resistance between 6 ohms - 15 ohms?**

Yes	No
GO to KE5.	INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KE5 CHECK THE IAC VALVE FOR AN INTERNAL SHORT TO THE IAC CASE

- Measure the resistance between:

(+) IAC Connector, Component Side	(-) IAC Connector, Component Side
IAC - Pin 2	IAC Case

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KE6.	INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS -**

	GASOLINE ENGINES -- E-SERIES . CLEAR the DTCs. REPEAT the self-test.

KE6 CHECK THE IAC CIRCUIT FOR AN OPEN IN THE HARNESS

- IAC connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) IAC Connector, Harness Side	(-) PCM Connector, Harness Side
IAC - Pin 2	IAC

- **Is the resistance less than 5 ohms?**

Yes	No
For IAC-RC applications, GO to KE7. For all others, GO to KE8.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KE7 CHECK IAC-RC FOR VOLTAGE

- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
IAC-RC	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KE8.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KE8 CHECK THE IAC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
IAC	Negative terminal

- **Is the voltage less than 1 V?**

Yes	No
GO to KE9.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KE9 CHECK THE IAC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
IAC	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KE10.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KE10 CHECK FOR A DROP IN IDLE RPM WITH THE IAC DISCONNECTED

- PCM connector connected.
- IAC connector connected.
- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Transmission in PARK or NEUTRAL.
- Disconnect the IAC valve.
- **Does the RPM drop or the engine stall?**

Yes	No
GO to KE12.	GO to KE11.

KE11 CHECK FOR A STUCK IAC PINTLE

- Key in OFF position.
- Inspect the entire intake air system for debris, blockage or other damage.
- Remove and inspect the IAC valve and check the pintle movement.
- Check the air tubes (if equipped) for blockage or damage.
- Remove and inspect the air cleaner element for excessive dirt.
- **Is the IAC valve OK?**

Yes	No
GO to KE12.	INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KE12 VERIFY THE DTC

- **Is DTC P0511 or P1504 present in continuous memory or from the KOER self-test?**

Yes	No
GO to KE22.	GO to KE13.

KE13 CHECK THE IAC SIGNAL FROM THE PCM

NOTE: If stalling occurs, place a shim under the hard stop screw to maintain idle conditions.

NOTE: With the engine at normal operating temperature, closed throttle and all accessories off, the IAC duty cycle should be between approximately 22% and 65%.

- PCM connector connected.
- IAC connector connected.
- Key ON, engine running.
- Access the PCM and monitor the RPM PID.
- Access the PCM and monitor the IAC PID.
- Slowly increase the engine speed to 3,000 RPM and return to closed throttle. (Note: If closed throttle RPM is significantly higher than normal, ignore this step).
- **Is the percentage between 22 - 65%?**

Yes	No
GO to KE14.	INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KE14 VERIFY THE DTC

- **Is DTC P0506, P0511, P1504 or P1507 present in continuous memory?**

Yes	No
GO to KE20.	INSPECT the throttle body for damage. REPAIR as necessary. If OK, INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .

KE15 DTCS P0507 OR P1506: CHECK FOR INLET AIR LEAKS

- Key ON, engine running.
- With the engine running at idle, listen for vacuum leaks.
- Inspect the entire intake air system from the mass air flow (MAF) sensor to the intake manifold for

leaks such as:

  - damaged or loose IAC air tubes.
  - cracked or punctured intake air tube.
  - loose intake air tube at the air cleaner housing or throttle body.
  - IAC valve or gasket seal.
  - EGR valve gasket seal.
  - vacuum supply connector and hose.
  - PCV valve, connectors and hoses.
- **Are any leaks present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to KE16.

KE16 CHECK FOR EVAP DTCS

NOTE: EVAP system malfunctions can cause IAC DTCs or idle speed concerns.

- **Are any EVAP DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to KE17.

KE17 CHECK THE IAC VALVE FOR CORRECT FUNCTION

- Key ON, engine running.
- Bring the engine to normal operating temperature.
- Transmission in PARK or NEUTRAL.
- Disconnect the IAC Valve.
- **Does the RPM drop or the engine stall?**

Yes	No
GO to KE18.	INSPECT the throttle body for damage. REPAIR as necessary. If OK, INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . CLEAR the DTCs. REPEAT the self-test.

KE18 CHECK THE IAC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

NOTE: Refer to the PCM connector pin numbers in the beginning of this pinpoint test.

- Key in OFF position.
- Scan tool connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
IAC	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KE19.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KE19 VERIFY THE SYMPTOM

- **Is a fast idle symptom currently present?**

Yes	No
GO to KE22.	GO to KE20.

KE20 CHECK THE IAC SYSTEM FOR AN INTERMITTENT OPEN OR SHORT

- PCM connector connected.
- Key ON, engine running.
- Access the PCM and monitor the IAC PID.
- Access the PCM and monitor the RPM PID.
- With the engine at normal operating temperature, closed throttle and all accessories off, the IAC duty cycle should be between approximately 22% and 65%.
- Observe the PIDs while carrying out the following at idle:
  - Lightly tap on the and wiggle the harness connector to simulate road shock.
  - Grasp the vehicle harness closest to the IAC valve. Shake and bend a small section of the harness from the IAC to the bulkhead and from the bulkhead to the PCM.
- **Do the IAC or RPM PIDs suddenly change in value, indicating a concern?**

Yes	No
ISOLATE the concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to KE21.

KE21 VERIFY THE SYMPTOM

- **Is an idle quality, starting or stalling symptom currently present?**

Yes	No
INSTALL a new IAC valve. REFER to the **ELECTRONIC ENGINE CONTROLS - GASOLINE ENGINES -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose fast idle concerns.

KE22 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KF: FAN CONTROL (FC) RELAYS

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- LFC, MFC, HFC relays
- harness circuits: HFC, LFC, MFC, VPWR
- powertrain control module (PCM) (12A650)

Although the PCM output circuits are called low, medium and high fan control (FC), cooling fan operation is controlled by a combination of these outputs.

Refer to**ENGINE CONTROL COMPONENTS** .

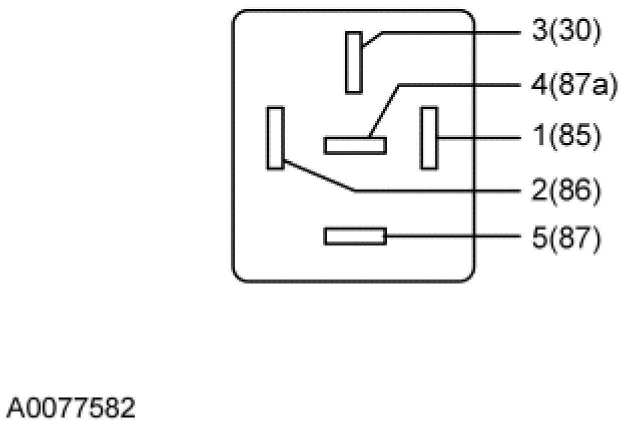

Fig. 181: Low Fan Control (LFC) Relay Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	LFC (Low Fan Control)
1	VPWR (Vehicle Power)

NOTE: The VPWR and LFC circuits may be reversed in the harness connector. Also, the LFC circuit may be wired to 2 separate relays. Refer to the Wiring Diagrams article for additional information.

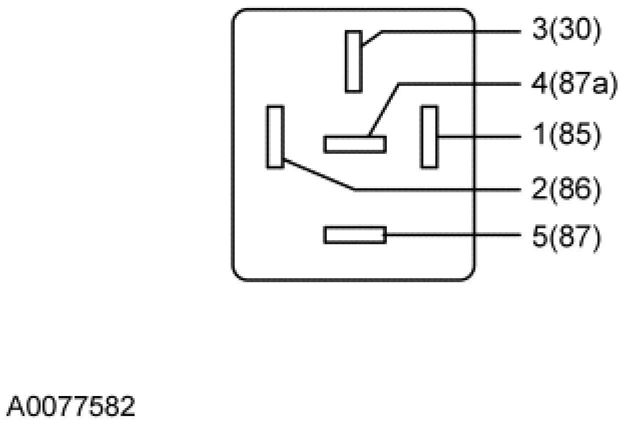

Fig. 182: Medium Fan Control (MFC) Relay Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	MFC (Medium Fan Control)
1	VPWR (Vehicle Power)

NOTE: The VPWR and MFC circuits may be reversed in the harness connector. Also, the MFC circuit may be wired to 2 separate relays. Refer to the Wiring Diagrams article for additional information.

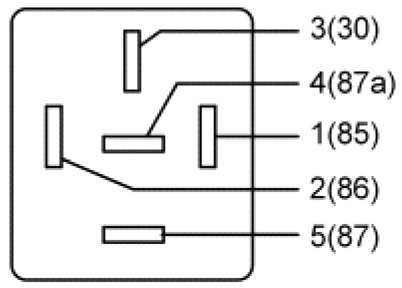

Fig. 183: High Fan Control (HFC) Relay Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	HFC (High Fan Control)
1	VPWR (Vehicle Power)

NOTE: The VPWR and HFC circuits may be reversed in the harness connector. Also, the HFC circuit may be wired to 2 separate relays. Refer to the Wiring Diagrams article for additional information.

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Pin	Circuit
Escape/Mariner 2.3L	B38 B17 B39	HFC MFC LFC
Focus	B18 B34	HFC LFC
Mustang	E4 E7	HFC LFC
Ranger	E7	LFC
All other vehicles	B38 B39	HFC LFC

TEST PROCEDURE

KF1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0480, P0481, P0482, P1474, P1477 or P1479 present?**

Yes	No
For KOEO and KOER DTCs P0480 or P1474, GO to KF3. For continuous memory DTCs P0480 or P1474, GO to KF36. For DTCs P0481, P0482, P1477 or P1479, GO to KF2.	For fans always on: components, GO to KF47. For fans always on: all others, GO to KF46. For cooling fan circuits, GO to KF47. For all others, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KF2 DTCS P0481, P0482, P1477 OR P1479: CHECK FOR THE PRESENCE OF THESE DTCS

- **Are DTCs P0481, P0482, P1477, or P1479 present? P0481 or P1479.**

Yes	No
For KOEO and KOER DTCs P0481 or P1479, Escape 3.0L, Mariner 3.0L. GO to KF27. For continuous memory DTCs P0481 or P1479, Escape 3.0L, Mariner 3.0L. GO to KF44. For KOEO and KOER DTCs P0481 or P1479, all others, GO to KF13. For continuous memory DTCs P0481 or P1479, all others, GO to KF38.	For KOEO and KOER DTCs P0482 or P1477, Focus, GO to KF18. For continuous memory DTCs P0482 or P1477, Focus, GO to KF42. For KOEO and KOER DTCs P0482 or P1477, all others, GO to KF8. For continuous memory DTCs P0482 or P1477, all others, GO to KF40.

KF3 KOEO AND KOER DTCS P0480 OR P1474: CHECK THE VPWR VOLTAGE TO THE LOW SPEED FC RELAY

- LFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) LFC Relay Connector, Harness Side	(-)
VPWR - Pin 1	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KF4.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF4 CHECK FOR LFC CIRCUIT CYCLING

- Key ON, engine OFF.

- Connect a non-powered test lamp between:

(+) LFC Relay Connector, Harness Side	(-) LFC Relay Connector, Harness Side
VPWR - Pin 1	LFC - Pin 2

- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new LFC relay. CLEAR the DTCs. REPEAT the self-test.	GO to KF5.

KF5 CHECK THE LFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Remove the test lamp.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) LFC Relay Connector, Harness Side	(-)
LFC - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to KF6.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF6 CHECK THE LFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) LFC Relay Connector, Harness Side	(-)
LFC - Pin 2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KF7.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF7 CHECK THE LFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) LFC Relay Connector, Harness Side	(-) PCM Connector, Harness Side
LFC - Pin 2	LFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KF59.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF8 KOEO AND KOER DTCS P0482 OR P1477: CHECK THE VPWR VOLTAGE TO THE MEDIUM SPEED FC RELAY

- MFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC Relay Connector, Harness Side	(-)
VPWR - Pin 1	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KF9.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF9 CHECK FOR MFC CIRCUIT CYCLING

- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) MFC Relay Connector, Harness Side	(-) MFC Relay Connector, Harness Side
VPWR - Pin 1	MFC - Pin 2

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No

INSTALL a new MFC relay. CLEAR the DTCs. REPEAT the self-test.	GO to KF10.

KF10 CHECK THE MFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Remove the test lamp.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC Relay Connector, Harness Side	(-)
MFC - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to KF11.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF11 CHECK THE MFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) MFC Relay Connector, Harness Side	(-)
MFC - Pin 2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KF12.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF12 CHECK THE MFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) MFC Relay Connector, Harness Side	(-) PCM Connector, Harness Side
MFC - Pin 2	MFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KF59.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF13 KOEO AND KOER DTCS P0481 OR P1479: CHECK THE VPWR VOLTAGE TO THE HIGH SPEED FC RELAY

- HFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC Relay Connector, Harness Side	(-)
VPWR - Pin 1	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KF14.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF14 CHECK FOR HFC CIRCUIT CYCLING

- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) HFC Relay Connector, Harness Side	(-) HFC Relay Connector, Harness Side
VPWR - Pin 1	HFC - Pin 2

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new HFC relay. CLEAR the DTCs. REPEAT the self-test.	GO to KF15.

KF15 CHECK THE HFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Remove the test lamp.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC Relay Connector, Harness Side	(-)
HFC - Pin 2	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to KF16.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF16 CHECK THE HFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) HFC Relay Connector, Harness Side	(-)
HFC - Pin 2	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KF17.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF17 CHECK THE HFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) HFC Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC - Pin 2	HFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KF59.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF18 KOEO AND KOER DTCS P0482 OR P1477: CHECK THE VPWR VOLTAGE TO THE MFC1 RELAY

NOTE: **This application has 2 relays wired to the MFC circuit. This procedure may call out MFC1 and MFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2.**

- MFC1 Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC1 Relay Connector, Harness Side	(-)

VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KF19.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF19 CHECK FOR MFC CIRCUIT CYCLING

- Connect a non-powered test lamp between:

(+) MFC1 Relay Connector, Harness Side	(-) MFC1 Relay Connector, Harness Side
VPWR	MFC

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new MFC1 relay at the end of diagnostics. Leave the relay disconnected. CLEAR the DTCs. REPEAT the self-test. GO to KF24.	Leave the test lamp connected. GO to KF20.

KF20 CHECK FOR MFC CIRCUIT CYCLING WITH THE MFC2 RLY DISCONNECTED

- Connect a non-powered test lamp between:

(+) MFC1 Relay Connector, Harness Side	(-) MFC1 Relay Connector, Harness Side
VPWR	MFC

- MFC2 Relay connector disconnected.
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new MFC2 relay. CLEAR the DTCs.	GO to KF21.

REPEAT the self-test.	

KF21 CHECK THE MFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC1 Relay Connector, Harness Side	(-)
MFC	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to KF22.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF22 CHECK THE MFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) MFC1 Relay Connector, Harness Side	(-)
MFC	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KF23.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF23 CHECK THE MFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) MFC1 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
MFC	MFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KF59.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF24 VERIFY THERE IS NOT AN OPEN IN THE CIRCUIT SPECIFIC TO THE MFC2 RELAY

- Access the PCM and monitor the MFC_F PID.
- Command the high speed fan ON.
- Command the outputs OFF.
- Command the low speed fan ON.
- Command the outputs OFF.
- **Does the PID indicate a concern (yes) when either the high or low speed cooling fan output is commanded on and off?**

Yes	No
GO to KF25.	INSTALL a new MFC relay. CLEAR the DTCs. REPEAT the self-test.

KF25 CHECK THE VPWR VOLTAGE TO THE MFC2 RELAY

- MFC2 Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC2 Relay Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KF26.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF26 CHECK THE MFC CIRCUIT BETWEEN THE MEDIUM SPEED FC RELAY(S)

- Key in OFF position.
- Measure the resistance between:

(+) MFC1 Relay Connector, Harness Side	(-) MFC2 Relay Connector, Harness Side
MFC	MFC

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new MFC relay(s). CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF27 KOEO AND KOER DTCS P0481 OR P1479: CHECK THE VPWR VOLTAGE TO THE HFC1 RELAY

NOTE: **This application has 2 relays wired to the HFC circuit. This procedure may call out HFC1 and HFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2.**

- HFC1 Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC1 Relay Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KF28.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF28 CHECK FOR HFC CIRCUIT CYCLING

- Connect a non-powered test lamp between:

(+) HFC1 Relay Connector, Harness Side	(-) HFC1 Relay Connector, Harness Side
VPWR	HFC

- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new HFC1 relay at the end of diagnostics. Leave the relay disconnected. CLEAR the DTCs. REPEAT the self-test. GO to KF33.	Leave the test lamp connected. GO to KF29.

KF29 CHECK FOR HFC CIRCUIT CYCLING WITH THE HFC2 RLY DISCONNECTED

- Connect a non-powered test lamp between:

(+) HFC1 Relay Connector, Harness Side	(-) HFC1 Relay Connector, Harness Side
VPWR	HFC

- HFC2 Relay connector disconnected.

- Command the low speed fan ON.
- Command the high speed fan ON.
- Command the outputs OFF.
- **Does the test lamp illuminate on and off when either the low or high speed cooling fan output is commanded on and off?**

Yes	No
INSTALL a new HFC2 relay. CLEAR the DTCs. REPEAT the self-test.	GO to KF30.

KF30 CHECK THE HFC CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC1 Relay Connector, Harness Side	(-)
HFC	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to KF31.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF31 CHECK THE HFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) HFC1 Relay Connector, Harness Side	(-)
HFC	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KF32.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KF32 CHECK THE HFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) HFC1 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KF59.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF33 VERIFY THERE IS NOT AN OPEN IN THE CIRCUIT SPECIFIC TO THE HFC2 RELAY

- Access the PCM and monitor the HFC_F PID.
- Command the high speed fan ON.
- Command the outputs OFF.
- Command the low speed fan ON.
- Command the outputs OFF.
- **Does the PID indicate a concern (yes) when either the high or low speed cooling fan output is commanded on and off?**

Yes	No
GO to KF34.	INSTALL a new HFC1 relay. CLEAR the DTCs. REPEAT the self-test.

KF34 CHECK THE VPWR VOLTAGE TO HFC2 RLY

- HFC2 Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC2 Relay Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KF35.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF35 CHECK THE HFC CIRCUIT BETWEEN THE HIGH SPEED FC RELAY(S)

- Key in OFF position.
- Measure the resistance between:

(+) HFC1 Relay Connector, Harness Side	(-) HFC2 Relay Connector, Harness Side
HFC	HFC

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new HFC relay(s). CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF36 CONTINUOUS MEMORY DTCS P0480 OR P1474: CHECK THE LFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: If the test lamp does not turn on, command the high speed fan on.

- A/C and defrost off.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- LFC Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) LFC Relay Connector, Harness Side	(-) LFC Relay Connector, Harness Side
VPWR - Pin 1	LFC - Pin 2

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
  - Shake, wiggle, and bend the LFC circuit(s).
  - Shake, wiggle, and bend the VPWR circuit to the LFC relay.
  - Inspect the LFC relay component for signs of damage.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to KF37.

KF37 CHECK THE LFC CIRCUIT FOR AN INTERMITTENT SHORT TO GROUND

- Key ON, engine OFF.
- Command the outputs OFF.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns on when a concern is detected.
  - Shake, wiggle, and bend the LFC circuit
  - Lightly tap on the LFC RLY to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KF38 CONTINUOUS MEMORY DTCS P0481 OR P1479: CHECK THE HFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: If the test lamp does not turn on, command the low speed fan ON.

- A/C and defrost off.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- HFC Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) HFC Relay Connector, Harness Side	(-) HFC Relay Connector, Harness Side
VPWR - Pin 1	HFC - Pin 2

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the high speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
    - Shake, wiggle, and bend the HFC circuit(s)
    - Shake, wiggle, and bend the VPWR circuit to the HFC relay
    - Lightly tap on the HFC RLY to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to KF39.

KF39 CHECK THE HFC CIRCUIT FOR AN INTERMITTENT SHORT TO GROUND

- Key ON, engine OFF.
- Command the outputs OFF.
- Observe the test lamp for an indication of a concern. Note that the lamp illuminates when a concern is detected. Wiggle, shake, and bend the HFC circuit(s). Shake, wiggle, and bend the PCM on both high speed FC relays.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KF40 CONTINUOUS MEMORY DTCS P0482 OR P1477: CHECK THE MFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: If the test lamp does not turn on, command the high speed fan on.

- A/C and defrost off.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- MFC Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) MFC Relay Connector, Harness Side	(-) MFC Relay Connector, Harness Side
VPWR - Pin 1	MFC - Pin 2

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
  - Shake, wiggle, and bend the MFC circuit(s).
  - Shake, wiggle, and bend the VPWR circuit to the MFC relay.
  - Inspect the MFC RLY component for signs of damage.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to KF41.

KF41 CHECK THE MFC CIRCUIT FOR AN INTERMITTENT SHORT TO GROUND

- Key ON, engine OFF.
- Command the outputs OFF.
- Observe the test lamp for an indication of a concern. Note that the lamp illuminates when a concern is detected. Wiggle, shake, and bend the HFC circuit(s). Shake, wiggle, and bend the PCM on both high speed FC relays.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KF42 CONTINUOUS MEMORY DTCS P0482 OR P1477: CHECK THE MFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: This application has 2 relays wired to the MFC circuit. This procedure may call out MFC1 and MFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2.

NOTE: If the test lamp does not turn on, command the high speed fan ON.

- AC and defroster OFF.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- MFC1 Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) MFC1 Relay Connector, Harness Side	(-) MFC1 Relay Connector, Harness Side
VPWR	MFC

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
  - Shake, wiggle, and bend the MFC circuit between the PCM and both medium speed FC relays
  - Shake, wiggle, and bend the VPWR circuit to both medium speed FC relays
  - Lightly tap on the medium speed FC relay that is still connected to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to KF43.

KF43 CHECK THE MFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key ON, engine OFF.
- Command the outputs OFF.
- Exit output test mode.

- Observe the test lamp for an indication of a concern. Note that the lamp illuminates when a concern is detected. Wiggle, shake, and bend the MFC circuit(s).
- Inspect the medium speed FC relay that is disconnected for intermittent concerns.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

KF44 CONTINUOUS MEMORY DTCS P0481 OR P1479: CHECK THE HFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO VOLTAGE

NOTE: **This application has 2 relays wired to the HFC circuit. This procedure may call out HFC1 and HFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2.**

NOTE: **If the test lamp does not turn on, command the high speed fan ON.**

- A/C and defroster OFF.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- HFC1 Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) HFC1 Relay Connector, Harness Side	(-) HFC1 Relay Connector, Harness Side
VPWR	HFC

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is detected.
  - Shake, wiggle, and bend the PCM and both high speed FC relays.
  - Shake, wiggle, and bend the VPWR circuit to both high speed FC relays
  - Lightly tap on the high speed FC relay that is still connected to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to KF45.

KF45 CHECK THE HFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key ON, engine OFF.
- Command the outputs OFF.
- Exit output test mode.
- Observe the test lamp for an indication of a concern. Note that the lamp illuminates when a concern is detected. Wiggle, shake, and bend the HFC circuit(s) between the PCM and on both high speed FC relays.
- Inspect the high speed FC relay that is disconnected for intermittent concerns.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

KF46 THE COOLING FAN ALWAYS RUNS (NO DTCS): VERIFY THE FAN IS NOT ON BECAUSE OF A/C HIGH PRESSURE SWITCH INPUT TO THE PCM

- Key ON, engine running.
- Access the PCM and monitor the ACP PID.
- **Is the PID state CLOSED?**

Yes	No
The PCM turns the fan on when the medium pressure, normally open contacts of the ACHP switch are closed. GO to KF57.	The input is OK. GO to KF47.

KF47 COOLING FAN CONCERN (NO DTCS): CHECK THE FAN CONTROL PRIMARY CIRCUITS

NOTE: Chose the PIDs below as appropriate, according to which circuits the vehicle has.

- Verify that the A/C is OFF.
- Verify engine temperature is below the temperature where the cooling fan comes on.
- Key ON, engine OFF.
- Access the PCM and monitor the LFC_F, MFC_F and HFC_F PIDs.
- **Does either PID indicate a concern?**

Yes	No
A concern is present in the primary circuit(s). GO to KF48.	For all except Ranger, the PCM primary circuit(s) is OK. To check for secondary wiring, REFER to the **ENGINE COOLING -- E-SERIES** ,

	for cooling system diagnosis. For Ranger: GO to KF50.

KF48 DOES THE LFCF PID INDICATE A CONCERN?

- **Does the LFCF PID indicate a concern?**

Yes	No
The low fan control (LFC) circuitry has a primary circuit concern. GO to KF3.	GO to KF49.

KF49 DOES THE MFCF PID INDICATE A CONCERN?

- **Does the MFCF PID indicate a concern?**

Yes	No
The medium fan control (MFC) primary circuitry has a circuit concern. For Focus, GO to KF18. For all others, GO to KF8.	The high fan control (HFC) primary circuitry has a circuit concern. For Escape 3.0L, and Mariner 3.0L, GO to KF27. For all others, GO to KF13.

KF50 IS THE SYMPTOM: COOLING FAN ALWAYS RUNS?

- **Is the symptom: cooling fan always runs?**

Yes	No
GO to KF56.	GO to KF51.

KF51 ELECTRIC COOLING FAN CONCERN (WITH NO DTCS): ELECTRIC COOLING FAN FUNCTIONAL CHECK

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- **Does the fan operate?**

Yes	No
All cooling fan circuit checks are OK. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts to continue diagnosis.	GO to KF52.

KF52 FAN INOPERATIVE: COMMAND THE LOW SPEED FAN ON AND CHECK FOR VOLTAGE TO THE CF

- Key in OFF position.

- CF Motor connector disconnected.
- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Measure the voltage between:

(+) CF Motor Connector, Harness Side	(-)
FAN PWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KF53.	GO to KF54.

KF53 CHECK THE GROUND CIRCUIT TO THE COOLING FAN

- Key in OFF position.
- Measure the resistance between:

(+) CF Motor Connector, Harness Side	(-)
GND	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new CF motor. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF54 CHECK THE B+ VOLTAGE TO THE FC RELAY

- FC Relay connector disconnected.
- Measure the voltage between:

(+) FC Relay Connector, Harness Side	(-)
B+	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KF55.	REPAIR the open circuit. There is a B+ circuit concern. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before replacing the fuse/fuse

	link. CLEAR the DTCs. REPEAT the self-test.

KF55 CHECK THE FAN PWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) FC Relay Connector, Harness Side	(-) CF Motor Connector, Harness Side
FAN PWR	FAN PWR

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new FC relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KF56 CHECK FOR FC RLY CONTACTS ALWAYS CLOSED

NOTE: Verify the A/C and defrost are off.

- FC Relay connector disconnected.
- Key ON, engine OFF.
- **Does the fan run with the key in the ON position?**

Yes	No
REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new FC relay. CLEAR the DTCs. REPEAT the self-test.

KF57 CHECK THE A/CHPSW (MEDIUM PRESSURE, NORMALLY OPEN CONTACTS)

- A/CHPSW connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the ACP PID.
- **Is the PID state CLOSED?**

Yes	No
GO to KF58.	CONNECT the A/CHPSW. REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** , to diagnose the A/C system pressure. If OK, INSTALL a new A/CHPSW. CLEAR the DTCs. REPEAT the self-test.

KF58 CHECK THE A/CPSW CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.

- PCM connector disconnected.
- Measure the resistance between:

(+) A/CHPSW Connector, Harness Side	(-)
A/CPSW	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
VERIFY the results of the previous test steps. RETURN to the **SYMPTOM CHARTS** article, Symptom Charts to continue diagnosis.	REPAIR the short circuit to GND. CLEAR the DTCs. REPEAT the self-test.

KF59 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KG: FUEL INJECTOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- fuel injector(s) (9F593)
- harness circuits: VPWR and INJ 1 - 10
- powertrain control module (PCM) (12A650)

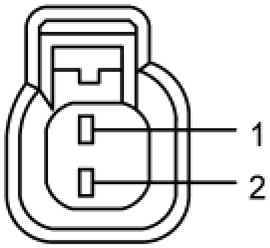

Fig. 184: Injector (INJ) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Fusion 3.0L, Milan 3.0L	A	2 1	INJ VPWR
All other vehicles	A	1 2	INJ VPWR

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, F-Super Duty 6.8L	170 Pin	E52 E35 E53 E36 E54 E37 E55 E38 E56 E39	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8 INJ9 INJ10
Edge, F-150 4.2L, MKX, Sable, Taurus, Taurus X	190 Pin	E52 E35 E53 E36 E54 E37	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
Escape/Mariner 3.0L	150 (50-50-50) Pin	E2 E5 E13	INJ1 INJ2 INJ3

		E4 E3 E15	INJ4 INJ5 INJ6
Escape/Mariner 2.3L	150 (50-50-50) Pin	E2 E3 E4 E5	INJ1 INJ2 INJ3 INJ4
Expedition, Navigator	140 Pin	E52 E35 E53 E36 E54 E37 E55 E38	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8
Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, Mustang 4.0L, Ranger 4.0L, Ranger 3.0L	170 Pin	E52 E35 E53 E36 E54 E37	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
F-150 4.6L, F-150 5.4L, Mark LT	190 Pin	E52 E35 E53 E36 E54 E37 E55 E38	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8
Focus	190 Pin	E1 E2 E3 E4	INJ1 INJ2 INJ3 INJ4
Fusion 3.0L, Milan 3.0L, MKZ	140 Pin	E52 E35 E53 E36 E54 E37	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
Fusion 2.3L, Milan 2.3L	140 Pin	E52 E35 E53 E36	INJ1 INJ2 INJ3 INJ4
Ranger 2.3L	170 Pin	E52 E35 E53	INJ1 INJ2 INJ3

		E36	INJ4
All other vehicles	170 Pin	E52 E35 E53 E36 E54 E37 E55 E38	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8

TEST PROCEDURE

KG1 DTCS P0201 THROUGH P0210 OR SYMPTOMS WITHOUT DTCS: CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

NOTE: **Disconnect the suspect fuel injector harness connector. Only the suspect injector needs to be diagnosed.**

NOTE: **On some vehicles, the injector voltage is only present when the fuel pump relay is energized. Measure the injector voltage within 2 seconds of the key ON.**

- Key in OFF position.
- INJ connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) INJ Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KG2.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KG2 CHECK THE INJ CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) INJ Connector, Harness Side
Suspect INJ	INJ

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KG3.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KG3 CHECK THE INJ CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) INJ Connector, Harness Side	(-)
INJ	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KG4.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KG4 CHECK THE INJ CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) INJ Connector, Harness Side	(-)
INJ	Ground

- **Is any voltage present?**

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to KG5.

KG5 CHECK THE RESISTANCE OF THE FUEL INJECTOR

- Key in OFF position.
- Measure the resistance between:

(+) INJ Connector, Component Side	(-) INJ Connector, Component Side
VPWR	INJ

- **Is the resistance between 11 - 18 ohms?**

Yes	No
GO to KG6.	INSTALL a new fuel injector. REFER to the **FUEL**

	SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES . RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

KG6 CHECK THE FUNCTIONALITY OF THE INJ CIRCUIT

- PCM connector connected.
- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) INJ Connector, Harness Side	(-) INJ Connector, Harness Side
VPWR	INJ

- Key ON, engine running.
- **Is the test lamp blinking?**

Yes	No
GO to KG7.	GO to KG8.

KG7 CARRY OUT A THOROUGH WIGGLE TEST ON THE FUEL INJECTOR HARNESS

- Key in OFF position.
- INJ connector connected.
- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the INJ_F PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the fuel injector to the PCM.
- **Are any injector values fluctuating in and out of range?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KG8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
    - pushed out pins
    - corrosion
- Connect all the PCM connectors and make sure they seat correctly.

- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KJ: SUPERCHARGER BYPASS CONTROL

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- supercharger bypass actuator
- vacuum hoses

TEST PROCEDURE

KJ1 CHECK FOR DTCS

NOTE: **DTCs P1227 and P1228 are for informational purposes only and are usually accompanied by other DTCs. If concerns are present with the mass air flow (MAF) sensor, the exhaust gas recirculation (EGR) valve, or the manifold absolute pressure (MAP) sensor, DTCs P1227 or P1228 may be set. Diagnose all other DTCs before diagnosing DTCs P1227 or P1228.**

- **Are DTCs P1227, or P1228 present?**

Yes	No
GO to KJ2.	For lack/loss of power, GO to KJ3. For all other symptoms without DTCs, GO to KJ2.

KJ2 DTCS P1227 OR P1228: VERIFY THE DTC

- Record and clear the DTCs.
- Drive the vehicle at normal operating temperature with the engine exceeding 2,000 RPM.
- Check for DTCs.
- **Are any other DTCs present?**

Yes	No
DISREGARD the current diagnostic trouble code	GO to KJ4.

(DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	

KJ3 CHECK THE IAT2 PID

WARNING: **To avoid personal injury do not unscrew the coolant pressure relief cap while the engine is operating or hot. The cooling system is under pressure. Steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in personal injury.**

- Key ON, engine running.
- Access the PCM and monitor the IAT2 PID.
- **Is the temperature greater than 110°C (230°F)?**

Yes	No
CHECK for low fluid level in the charge air cooler (CAC) system. CHECK for damaged CAC lines. REFER to the **ENGINE COOLING -- E-SERIES** , Supercharger Cooling to diagnose a loss of coolant.	GO to KJ4.

KJ4 CHECK THE SUPERCHARGER BYPASS ACTUATOR VACUUM HOSES

NOTE: **For vehicle specific vacuum hose routing, refer to the VECI label located in the front of the engine compartment.**

- Check for holes, cracks, bends or kinks in the vacuum lines going to the supercharger bypass actuator.
- Check for any disconnected hoses at the supercharger bypass actuator.
- **Are any concerns present?**

Yes	No
REPAIR or INSTALL new vacuum lines as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to KJ5.

KJ5 CHECK THE BYPASS VALVE ACTUATOR

NOTE: **Additional DTCs may set as a result of disconnecting the vacuum line in this step.**

- Visually inspect the bypass valve actuator for damage.
- Key in OFF position.

- Note the position of the supercharger bypass actuator linkage.
- Key ON, engine running.
- Note the position of the supercharger bypass actuator linkage.
- Disconnect the supercharger bypass actuator upper vacuum hose.
- **Does the supercharger bypass actuator linkage move when the engine is started, and return to the original position when the supercharger bypass actuator vacuum line is disconnected?**

Yes	No
The concern is not present at this time. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose lack/loss of power concerns.	INSTALL a new supercharger bypass actuator. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST KM: AIR CONDITIONING CLUTCH (A/CC) RELAY CIRCUIT

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- A/CC relay
- harness circuits: VPWR, A/CCR, A/CCS
- powertrain control module (PCM) (12A650)

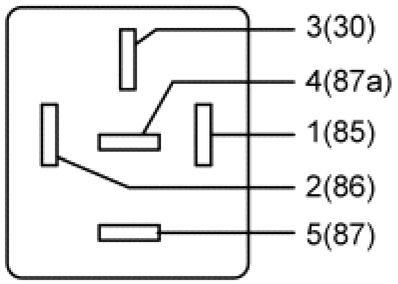

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Fig. 185: Air Conditioning Clutch (A/CC) Relay Connector - A
Courtesy of FORD MOTOR CO.

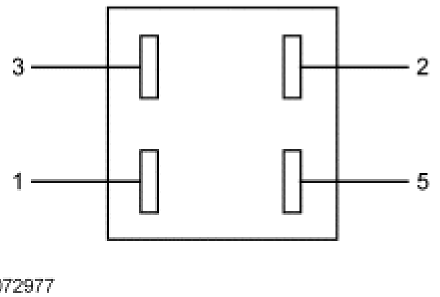


Fig. 186: Air Conditioning Clutch (A/CC) Relay Connector - B
Courtesy of FORD MOTOR CO.

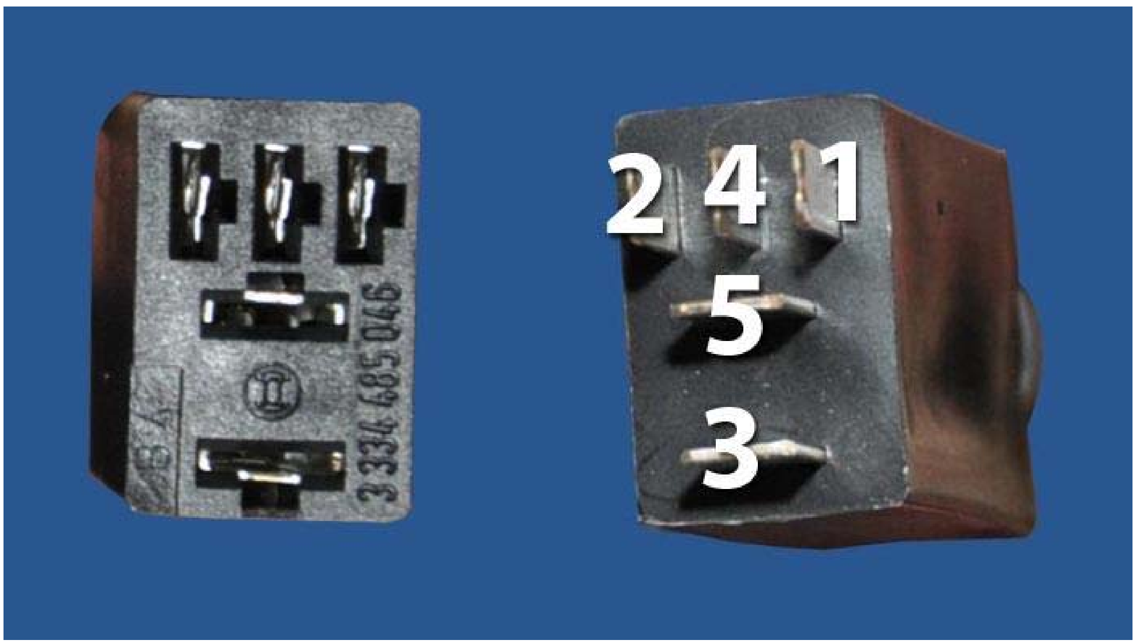


Fig. 187: Air Conditioning Clutch (A/CC) Relay Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition, F-150, Mark LT, Navigator	A	1 2	A/CCR VPWR
Focus	B	2 1	A/CCR VPWR
All other vehicles	C	1 2	A/CCR VPWR

The VPWR and A/CCR circuits may be reversed in the harness connector. Refer to the Wiring Diagrams article for additional information.

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series, F-Super Duty	170 Pin	E3	A/CCR
Edge, F-150, Mark LT, MKX, Sable, Taurus, Taurus X	190 Pin	B18	A/CCR
Escape/Mariner	150 (50-50-50) Pin	B25	A/CCR
Expedition, Navigator	140 Pin	B18	A/CCR
Focus	190 Pin	B2	A/CCR
Fusion, Milan, MKZ	140 Pin	B64	A/CCR
All other vehicles	170 Pin	B14	A/CCR

TEST PROCEDURE

KM1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Are DTCs P0534, P0645, P1460, P1464 or P1469 present?**

Yes	No
For KOEO and KOER DTCs P0645 or P1460, GO to KM2. For continuous memory DTCs P0645 or P1460, GO to KM10. For KOEO and KOER DTC P1464, GO to KM8. For continuous memory DTCs P0534 or P1469, GO to KM12.	For all others, GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KM2 KOEO AND KOER DTCS P1460 OR P0645: VERIFY THAT THE ACCS PID IS OFF

NOTE: **Verify the A/C and the defrost are off during KOEO/KOER self-tests. If the vehicle is not equipped with A/C, the A/CCR circuit is not used and DTC P1460/P0645 can be ignored.**

- Key ON, engine running.
- A/C and defroster OFF.
- Access the PCM and monitor the ACCS PID.
- **Is the PID state OFF?**

Yes	No
GO to KM3.	REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

KM3 CHECK THE VPWR VOLTAGE TO THE A/CC RELAY

- Key in OFF position.
- A/CC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) A/CC Relay Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KM4.	REPAIR the open circuit. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.

KM4 CHECK THE A/CC RELAY

- Key in OFF position.
- Carry out the A/CC relay component test. Refer to the Wiring Diagrams Cell 149 Component Testing.
- **Does the A/CC relay pass the component test?**

Yes	No
GO to KM5.	INSTALL a new A/CC relay. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. CLEAR the DTCs. REPEAT the self-test.

KM5 CHECK THE A/CCR (WAC) CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) A/CC Relay Connector, Harness Side	(-)

A/CCR	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to KM6.	REPAIR the short circuit. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.

KM6 CHECK THE A/CCR (WAC) CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) A/CC Relay Connector, Harness Side	(-)
A/CCR	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KM7.	REPAIR the short circuit. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.

KM7 CHECK THE A/CCR (WAC) CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) A/CC Relay Connector, Harness Side	(-) PCM Connector, Harness Side
A/CCR	A/CCR

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KM14.	REPAIR the open circuit. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.

KM8 KOEO AND KOER DTC P1464: VERIFY THE A/C AND DEFROST ARE OFF DURING THE SELF-TEST

- Verify the A/C and defrost are off during the self-test.
- **Are the A/C and defrost off during the self-test?**

Yes	No
GO to KM9.	Turn the A/C and defrost off. REPEAT the self-test where DTC P1464 was retrieved.

KM9 CHECK THE ACCS PID

- Key ON, engine OFF.
- A/C and defroster OFF.
- Access the PCM and monitor the ACCS PID.
- **Is the PID state ON?**

Yes	No
The ACCS PID indicates the PCM is being requested to turn the A/C on. REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.	The ACCS PID indicates that the ACCS input to the PCM is low. VERIFY the test step results. Turn off the A/C and defrost. REPEAT the self-test.

KM10 CONTINUOUS MEMORY DTCS P1460 OR P0645: CHECK THE A/CCR (WAC) CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

NOTE: If the vehicle is not equipped with A/C, the A/CCR circuit is not used and the P1460/P0645 can be ignored.

NOTE: The A/C clutch clicks on when a concern is present.

- Key ON, engine OFF.
- Check the A/CCR (WAC) circuit for short to ground while carrying out the following:
  - Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module
  - Lightly tap on the A/CC relay to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.	GO to KM11.

KM11 CHECK THE A/CCR (WAC) FOR AN OPEN OR SHORT CIRCUIT TO VOLTAGE

NOTE: The A/C clutch clicks off if a concern is present.

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Check the A/CCR (WAC) circuit for an open or short to voltage while carrying out the following:
  - Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module
  - Lightly tap on the A/CC relay to simulate road shock
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KM12 CONTINUOUS MEMORY DTCS P0534 OR P1469: CHECK FOR CAUSES OF FAST A/CCS CYCLING

- Check the following:
  - A/C system pressure
  - A/CCS cycle times

  REFER to the **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS -- E-SERIES** and diagnose the air conditioning (A/C) is inoperative/does not operate correctly symptom.

- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary.	GO to KM13.

KM13 CHECK FOR INTERMITTENT OPEN IN THE A/CCS CIRCUIT

NOTE: The ACCS PID turns off and on quickly when a concern is present, indicating an intermittent open.

- Key ON, engine OFF.
- Access the PCM and monitor the ACCS PID.
- Turn on the A/C switch.
- Check the A/CCR (WAC) circuit for an open or short to voltage while carrying out the following:
  - Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.
  - Lightly tap on the pressure switch (PS) (to simulate road shock).

- Inspect the A/CCS connector.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. START the engine. TURN on the A/C switch. WAIT for 15 seconds. TURN off the A/C switch. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

KM14 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KN: VARIABLE SPEED ELECTRIC COOLING FAN

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose the following:

- variable speed electric cooling fan (8T00)
- harness circuits: FCV, B+, GND
- powertrain control module (PCM) (12A650)

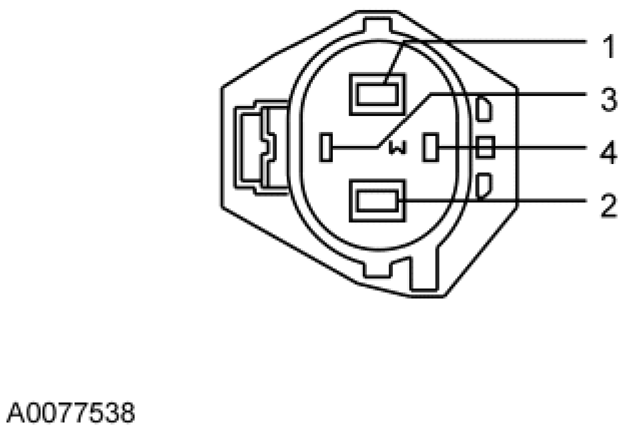


Fig. 188: Cooling Fan (CF) Motor Connector (1 Of 2)
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	FCV (Fan Control Variable)
2	GND (Ground)
1	B+ (Battery Positive Voltage)

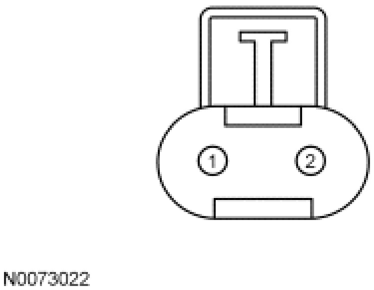


Fig. 189: Cooling Fan (CF) Motor Connector (2 Of 2)
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	GND (Ground)
2	VPWR (Vehicle Power)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Crown Victoria, Grand Marquis, Town Car	170 Pin	E7	FCV

Fusion, Milan, MKZ	140 Pin	B8	FCV
All other vehicles	190 Pin	B48	FCV

TEST PROCEDURE

KN1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Is DTC P0480 or P0483 present?**

Yes	No
For KOEO and KOER DTC P0480, GO to KN2. For continuous memory DTC P0480, GO to KN9. For continuous memory DTC P0483, GO to KN15.	For electric cooling fan(s) does not operate (low, medium, high or variable speed), GO to KN11.

KN2 KOEO AND KOER DTC P0480: CHECK THE B+ AND GND CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- CF Module connector disconnected.
- Rotate the fan by hand. The fan should rotate freely, with no abnormal binding. If binding is present, remove any foreign materials or install a new fan assembly as required.
- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-) CF Module Connector, Harness Side
B+ - Pin 1	GND - Pin 2

- **Is the voltage greater than 10 V?**

Yes	No
GO to KN4.	GO to KN3.

KN3 CHECK THE VOLTAGE TO THE COOLING FAN MODULE USING GROUND AS A REFERENCE

- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-)
B+ - Pin 1	Ground

- **Is the voltage greater than 10 V?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.	A B+ circuit concern is present. CHECK the condition of the related fuse/fuse links. If OK,

	REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link.

KN4 CHECK THE FCV CIRCUIT(S)

- Connect the 1.6K ohms resistor between the FCV and B+ circuits at the CF module harness connector (this simulates cooling fan circuitry).
- Key ON, engine OFF.
- Carry out the KOEO self-test.
- **Is DTC P0480 present?**

Yes	No
GO to KN6.	For Crown Victoria, Grand Marquis, and Town Car, GO to KN5. For all others, INSTALL a new CF module. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

KN5 CHECK THE COOLING FAN OPERATION

- CF Motor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A 12 Volt Vehicle Battery	Point B CF Motor Connector, Component Side
Positive terminal	VPWR - Pin 2

- Connect a 5 amp fused jumper wire between the following:

Point A Vehicle Battery	Point B CF Motor Connector, Component Side
Negative terminal	GND - Pin 1

- **Does the cooling fan motor operate correctly?**

Yes	No
INSTALL a new CF module. REFER to the **ENGINE COOLING -- E-SERIES** .	INSTALL a new Cooling Fan. REFER to the **ENGINE COOLING -- E-SERIES** .

KN6 CHECK THE FCV CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.

- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-)
FCV - Pin 4	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to KN7.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KN7 CHECK THE FCV CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) CF Module Connector, Harness Side	(-)
FCV - Pin 4	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KN8.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KN8 CHECK FOR AN OPEN CIRCUIT BETWEEN THE PCM AND COOLING FAN MODULE

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CF Module Connector, Harness Side
FCV	FCV - Pin 4

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KN16.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KN9 CONTINUOUS MEMORY DTC P0480: CHECK THE B+ AND GND CIRCUIT FOR AN INTERMITTENT CONCERN

- Key in OFF position.
- CF Module connector disconnected.
- Rotate the fan by hand. The fan should rotate freely, with no abnormal binding. If binding is present, remove any foreign materials or install a new fan assembly as required.

- Connect a non-powered test lamp between:

(+) CF Module Connector, Harness Side	(-) CF Module Connector, Harness Side
B+ - Pin 1	GND - Pin 2

- Observe the test lamp for an indication of a concern while carrying out the following. Note that the lamp turns off when a concern is present.
  - Shake, wiggle, and bend the B+ and GND circuits to the CF
  - Shake, wiggle, and bend the associated fuse
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to KN10.

KN10 CHECK THE FCV CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Connect the 1.6 K ohms resistor between the FCV and B+ circuits at the CF harness connector (this simulates cooling fan circuitry).
- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-)
FCV - Pin 4	Ground

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the digital multimeter (DMM) for an indication of a concern while shaking, wiggling, and bending the FCV circuit between the CF module and the PCM. Note that voltage changes suddenly when a concern is detected.
- Command the outputs OFF.
- Exit output test mode.
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	refer to **PINPOINT TEST Z**.

KN11 COOLING FAN MOTOR DOES NOT OPERATE (WITH NO DTCS): COMMAND THE FAN ON TO CHECK OPERATION

- Carry out the KOEO self-test.
- Listen to the fan.
- **Does the fan operate sometime during the KOEO self-test?**

Yes	No
The concern is elsewhere. RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** for further direction.	GO to KN12.

KN12 CHECK THE B+ AND GND CIRCUITS TO THE COOLING FAN MODULE

- Key in OFF position.
- CF Module connector disconnected.
- Rotate the fan by hand. The fan should rotate freely, with no abnormal binding. If binding is present, remove any foreign materials or install a new fan assembly as required.
- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-) CF Module Connector, Harness Side
B+ - Pin 1	GND - Pin 2

- **Is the voltage greater than 10 V?**

Yes	No
For Crown Victoria, Grand Marquis, and Town Car, GO to KN13. For all others, INSTALL a new CF module. REFER to the **ENGINE COOLING -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	GO to KN14.

KN13 CHECK THE COOLING FAN OPERATION

- CF Motor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A 12 Volt Vehicle Battery	Point B CF Motor Connector, Component Side
Positive terminal	VPWR - Pin 2

- Connect a 5 amp fused jumper wire between the following:

Point A Vehicle Battery	Point B CF Motor Connector, Component Side
Negative terminal	GND - Pin 1

- **Does the cooling fan motor operate correctly?**

Yes	No

INSTALL a new CF module. REFER to the **ENGINE COOLING -- E-SERIES** .	INSTALL a new Cooling Fan. REFER to the **ENGINE COOLING -- E-SERIES** .

KN14 CHECK THE VOLTAGE TO THE COOLING FAN MODULE USING GROUND AS A REFERENCE

- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-)
B+ - Pin 1	Ground

- **Is the voltage greater than 10 V?**

Yes	No
REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.	A B+ circuit concern is present. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link. CLEAR the DTCs. REPEAT the self-test.

KN15 CONTINUOUS MEMORY DTC P0483: CHECK FOR A COOLING FAN MOTOR OBSTRUCTION OR A COOLING FAN MOTOR MECHANICAL FAILURE

- **Is a cooling fan motor obstruction or a cooling fan motor mechanical failure present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	CLEAR the DTCs. REPEAT the self-test.

KN16 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KP: CHARGE AIR COOLER (CAC) PUMP

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- CAC pump relay (14B192)
- CAC pump (8501)
- harness circuits: CAC, VPWR and GND
- powertrain control module (PCM) (12A650)

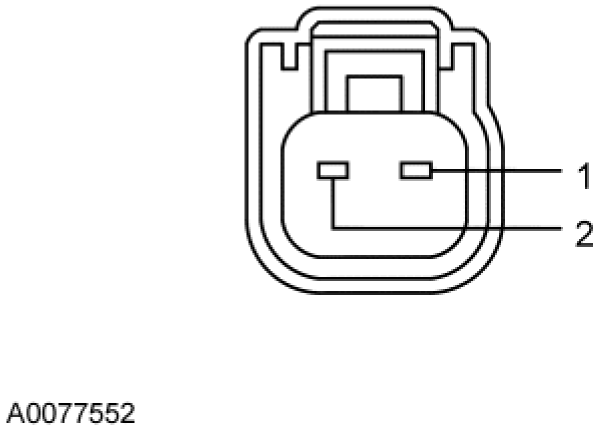


Fig. 190: Charge Air Cooler (CAC) Pump Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	GND (Ground)
1	PUMPPWR (Pump Power)

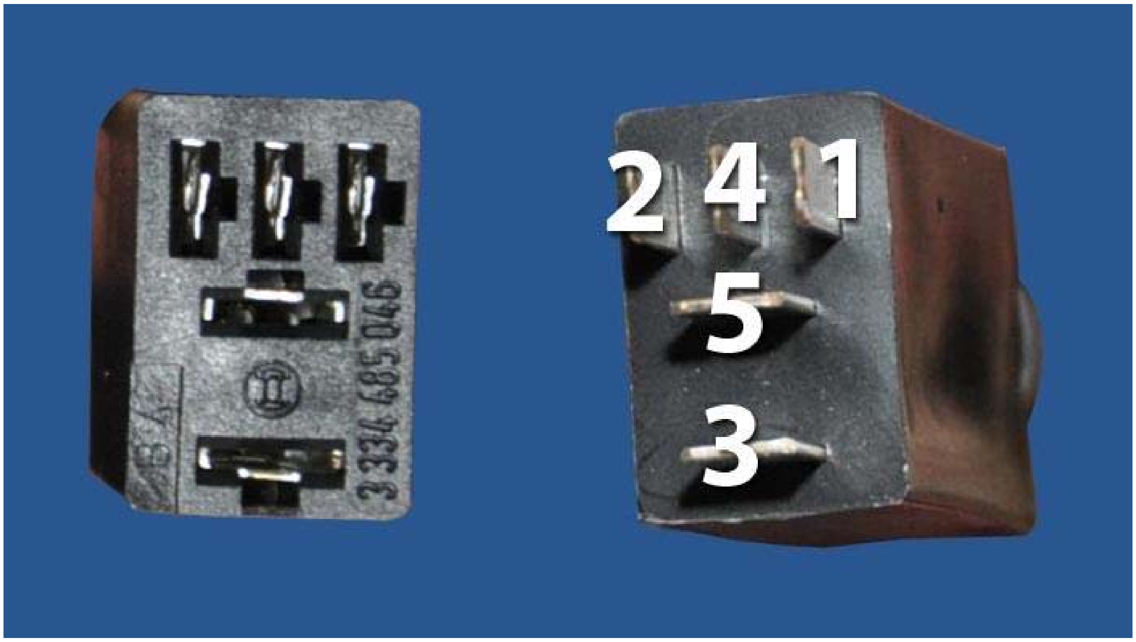


Fig. 191: Powertrain Control Module Power (PCM Power) Relay Connector - A
Courtesy of FORD MOTOR CO.

Pin	Circuit
5	PUMPPWR (Pump Power)
3	B+ (Battery Positive Voltage)
2	CAC (Charge Air Cooler)
1	VPWR (Vehicle Power)

Pin	Circuit
E64	CAC (Charge Air Cooler)

TEST PROCEDURE

KP1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

- **Is DTC P1229 present?**

Yes	No
For DTC P1229, GO to KP2.	For a boost gauge indicates higher than normal boost, GO to KP9.

KP2 DTC P1229: CHECK THE VOLTAGE TO THE CAC PUMP RELAY COIL

- Key in OFF position.
- CAC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CAC Relay Connector, Harness Side	(-)
VPWR - Pin 1	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KP3.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP3 CHECK THE CAC PUMP RELAY

- Key in OFF position.
- Remove the relay from the power distribution box.
- Measure the resistance between:

(+) CAC Relay Connector, Component Side	(-) CAC Relay Connector, Component Side
CAC - Pin 2	VPWR - Pin 1

- **Is the resistance between 65 - 100 ohms?**

Yes	No
GO to KP4.	INSTALL a new CAC relay. CLEAR the DTCs. REPEAT the self-test.

KP4 CHECK THE CAC PUMP RELAY

- Carry out the CAC pump relay component test. Refer to the Wiring Diagrams Cell 149 Component Testing.
- **Does the CAC pump relay pass the component test?**

Yes	No
GO to KP5.	INSTALL a new CAC relay. CLEAR the DTCs. REPEAT the self-test.

KP5 CHECK FOR AN OPEN CIRCUIT BETWEEN THE PCM AND THE CAC RELAY

- Key in OFF position.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CAC Relay Connector, Harness Side
CAC - Pin E64	CAC - Pin 2

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KP6.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP6 CHECK FOR A SHORT TO VOLTAGE BETWEEN THE PCM AND THE CAC RELAY

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
CAC - Pin E64	Negative terminal

- **Is the voltage less than 0.5 V?**

Yes	No
GO to KP7.	REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.

KP7 CHECK BETWEEN THE PCM AND THE CAC RELAY FOR A SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
CAC - Pin E64	Negative terminal

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to KP8.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KP8 CHECK THE SCICP PID

- PCM connector connected.
- Access the PCM and monitor the SCICP PID.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- **Is the SCICP PID on?**

Yes	No
If the CAC reservoir is full, there is no air flow blockage at the CAC radiator, the IAT2 and connecting circuits are not high resistance or open, CAC hoses are not reversed and DTC P1229 is	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

present in KOEO and KOER, GO to KP15.	

KP9 CHECK THE CAC FOR MECHANICAL OPERATION

- Key ON, engine OFF.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Observe the CAC pump.
- Command the outputs OFF.
- **Does the CAC pump run?**

Yes	No
CHECK for low fluid level in the CAC system. CHECK for cracked or incorrectly routed CAC lines or airflow blockage at the CAC radiator. REPAIR the system as necessary. If the symptom still exists, RETURN to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** to diagnose boost gauge indicates higher than normal boost.	GO to KP10.

KP10 CHECK THE VOLTAGE AND GROUND CIRCUITS AT THE CAC PUMP

- Charge Air Cooler (CAC) Pump connector disconnected.
- Enter output test mode. Refer to**OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Measure the voltage between:

(+) Charge Air Cooler (CAC) Pump Connector, Harness Side	(-) Charge Air Cooler (CAC) Pump Connector, Harness Side
PUMPPWR - Pin 1	GND - Pin 2

- **Is the voltage greater than 10 V?**

Yes	No
INSTALL a new Charge Air Cooler (CAC) Pump. REFER to the **ENGINE COOLING -- E-SERIES** , Supercharger Cooling. CLEAR the DTCs. REPEAT the self-test.	GO to KP11.

KP11 CHECK THE CAC VOLTAGE CIRCUIT TO GND

- Measure the voltage between:

(+) Charge Air Cooler (CAC) Pump	

Connector, Harness Side	(-) Vehicle Battery
PUMPPWR - Pin 1	Negative terminal

- **Is the voltage greater than 10 V?**

Yes	No
GO to KP12.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP12 CHECK THE INTEGRITY OF THE CAC PUMP GROUND CONNECTION

- Charge Air Cooler (CAC) Pump connector disconnected.
- Measure the resistance between:

(+) Charge Air Cooler (CAC) Pump Connector, Harness Side	(-) Vehicle Battery
GND - Pin 2	Negative terminal

- **Is the resistance less than 5 ohms?**

Yes	No
GO to KP13.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP13 CHECK THE VOLTAGE TO THE CAC PUMP RELAY

- CAC Relay connector disconnected.
- Measure the voltage between:

(+) CAC Relay Connector, Harness Side	(-)
B+ - Pin 3	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to KP14.	REPAIR the open circuit. CHECK the fuses. CLEAR the DTCs. REPEAT the self-test.

KP14 CHECK FOR AN OPEN CAC PUMP CIRCUIT

- Measure the resistance between:

(+) CAC Relay Connector, Harness Side	(-) Charge Air Cooler (CAC) Pump Connector, Harness Side
PUMPPWR - Pin 5	PUMPPWR - Pin 1

- **Is the resistance less than 5 ohms?**

Yes	No
INSTALL a new CAC pump relay. CLEAR the DTCs. REPEAT the self-test.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

KP15 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. refer to **PINPOINT TEST Z**.

PINPOINT TEST NC: IGNITION ENGINE SPEED INPUT CIRCUIT

INTRODUCTION

This pinpoint test is intended to diagnose the powertrain control module (PCM) (12A650).

TEST PROCEDURE

NC1 CONTINUOUS MEMORY DTC P0320: ERRATIC IGNITION

- Verify all 2-way radio installations. Carefully follow the manufacturer's installation instructions regarding the routing of the antenna and voltage leads.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to NC2.

NC2 NO START CONCERN

- **Is the customer complaint no start?**

Yes	No
refer to **PINPOINT TEST A**.	GO to NC3.

NC3 INTERMITTENT CONDITION

- **Is this an intermittent condition?**

Yes	No
refer to **PINPOINT TEST Z**.	refer to **PINPOINT TEST JD**.

PINPOINT TEST ND: ENGINE RPM\VEHICLE SPEED LIMITER REACHED

INTRODUCTION

NOTE: Enter this pinpoint test only when directed here.

TEST PROCEDURE

ND1 DTCS P0219, P0297 OR P1270: EXCESSIVE ENGINE RPM OR VEHICLE SPEED

- P0219 (engine over speed), P0297 (vehicle over speed) or P1270 DTCs indicate the vehicle was operated in a manner which caused the engine or vehicle speed to exceed a calibrated limit.
  - Excessive engine RPM in NEUTRAL or operated in the wrong transmission gear.
  - Excessive wheel slippage (water, ice, mud or snow).
  - Vehicle driven at a high rate of speed.
- **Was the vehicle operating in any of the above conditions?**

Yes	No
The on-board diagnostics (OBD) system is OK. RETURN the vehicle to customer with information about the DTC.	REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** . If there are no other symptoms, RETURN the vehicle to the customer with information about the DTC.

PINPOINT TEST QA: UNABLE TO ACTIVATE SELF-TEST/NETWORK COMMUNICATION ERROR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- unable to communicate with PCM
- unable to activate the PCM self-test.
- incorrect self-test procedure

- harness circuits: ISP-R, PCMRC, PWRGND and VPWR

VREF INFORMATION TABLE

Application	Engine	Measure the PCM VREF at:
Edge/MKX	All	ETBTPS
Escape/Mariner	All	TP Sensor or FRPT
Expedition/Navigator	All	ETBTPS
Focus	All	ETBTPS
Fusion/Milan/MKZ	All	ETBTPS
Ranger	All	TP Sensor
Taurus/Taurus X/Sable	All	ETBTPS
All Others	All	FRPT

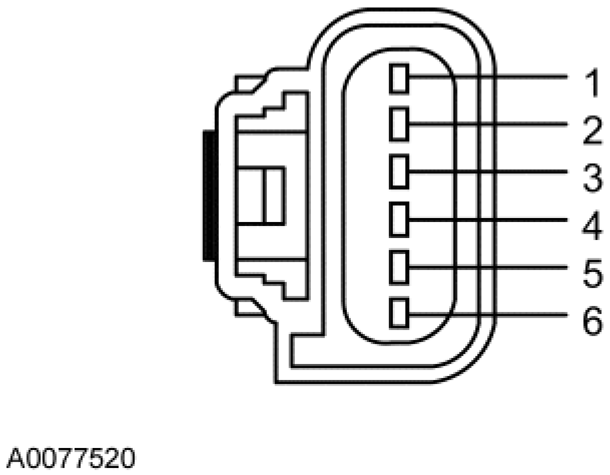


Fig. 192: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - A
Courtesy of FORD MOTOR CO.

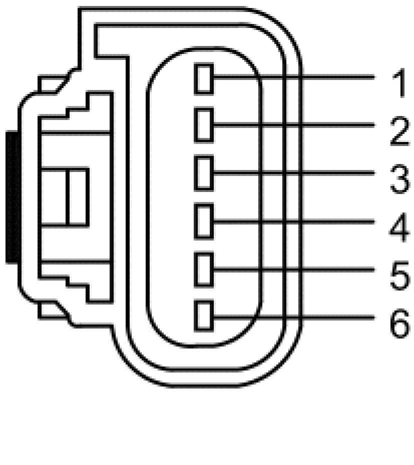


Fig. 193: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - B
Courtesy of FORD MOTOR CO.

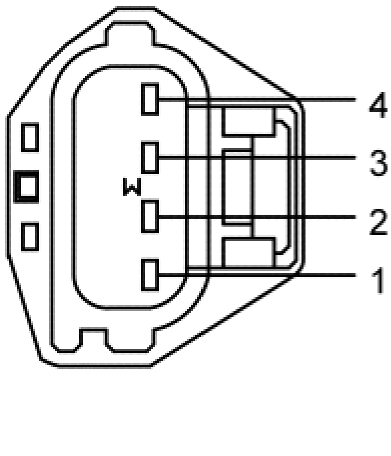
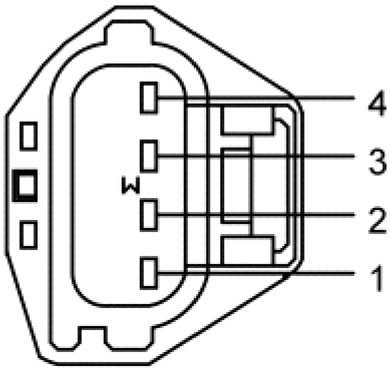


Fig. 194: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector - C
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 4.6L, Edge, F-150 4.2L, F-150 4.6L, Focus, MKX, MKZ, Sable, Taurus, Taurus X	A	2 3	ETCRTN ETCREF

Fusion 2.3L, Milan 2.3L	B	3 5	ETCRTN ETCREF
Fusion 3.0L, Milan 3.0L	B	4 5	ETCRTN ETCREF
All other vehicles	C	3 2	ETCRTN ETCREF



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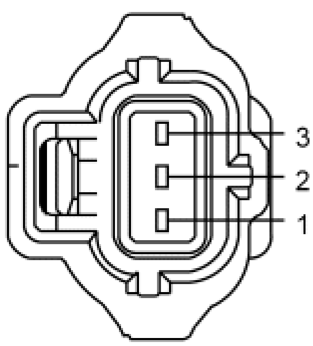
<u>Fig. 195: Fuel Rail Pressure Temperature (FRPT) Sensor Connector</u>
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	SIGRTN (Signal Return)
2	VREF (Reference Voltage)



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<u>Fig. 196: Throttle Position (TP) Sensor Connector - A</u>
Courtesy of FORD MOTOR CO.

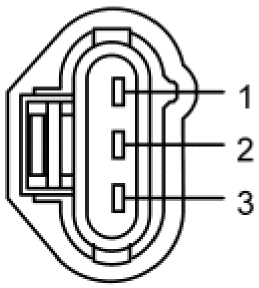


Fig. 197: Throttle Position (TP) Sensor Connector - B
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner 2.3L, Ranger 2.3L	A	1 3	SIGRTN VREF
All other vehicles	B	3 1	SIGRTN VREF

Vehicle	Connector	Pin	Circuit
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B67, B68, B69, B70 B51, B52, B53 B8 B7	PWRGND VPWR PCMRC ISP-R
Escape/Mariner	150 (50-50-50) Pin	B47, B48, B49, B50 B35, B36	PWRGND VPWR
Expedition, Navigator	140 Pin	B67, B68, B69, B70 B51, B52, B53 B8 B7	PWRGND VPWR PCMRC ISP-R
Explorer, Explorer Sport Trac, Mountaineer, Mustang	170 Pin	B47, B48, B49, B50 B35, B36 B37 B46	PWRGND VPWR PCMRC ISP-R
F-150, Mark LT	190 Pin	B67, B68, B69, B70 B51, B52, B53 B40 B17	PWRGND VPWR PCMRC ISP-R
F-Super Duty	170 Pin	B47, B48, B49, B50 B35, B36	PWRGND VPWR

		B37 B31	PCMRC ISP-R
Focus	190 Pin	B69, B70 B67, B68 B38 B42	PWRGND VPWR PCMRC ISP-R
Fusion, Milan, MKZ	140 Pin	B67, B68, B69 B51, B52 B35 B37	PWRGND VPWR PCMRC ISP-R
All other vehicles	170 Pin	B47, B48, B49, B50 B35, B36	PWRGND VPWR

TEST PROCEDURE

QA1 CARRY OUT A VEHICLE INSPECTION AND VERIFY THE SELF-TEST PROCEDURE

NOTE: **If the self-test or communication concern occurred after a failed or an aborted reprogram, the module may be blank. Attempt to reprogram the module again before continuing with this pinpoint test.**

- Visually inspect the following for obvious signs of electrical damage:
  - harness wiring
  - electrical connections
- Verify the correct procedure was used to activate the self-test for the scan tool. Refer to**SCAN TOOL SETUP AND FUNCTIONALITY** .
- **Was the correct self-test procedure used?**

Yes	No
GO to QA2.	REFER to**SCAN TOOL SETUP AND FUNCTIONALITY** .

QA2 CARRY OUT THE NETWORK TEST

- Key ON, engine OFF.
- Carry out the network test.
- **Do all modules indicate pass?**

Yes	No
REFER to Symptom Charts, **PINPOINT TEST QT** .	If only PCM indicates fail, GO to QA3. For network test or all other modules indicates fail, REFER to the **MODULE COMMUNICATIONS NETWORK -- E-SERIES** to diagnose The Powertrain Control Module (PCM) Does Not Respond To The Scan Tool Or No High Speed

	Controller Area Network (HS-CAN) Communication Symptom.

QA3 CHECK FOR VREF VOLTAGE AT A SENSOR

NOTE: **PCM voltage and ground can be determined by measuring VREF voltage at a sensor. Refer to the VREF Information Table at the beginning of this pinpoint test for the vehicle application and the applicable sensor to test.**

- Key in OFF position.
- Disconnect the applicable sensor.
- Key ON, engine OFF.
- Measure the voltage between the applicable sensor VREF circuit, harness side and the applicable sensor SIGRTN circuit, harness side.
- **Is the voltage between 4.5 - 5.5 V?**

Yes	No
REFER to the **MODULE COMMUNICATIONS NETWORK -- E-SERIES** to diagnose The Powertrain Control Module (PCM) Does Not Respond To The Scan Tool Or No High Speed Controller Area Network (HS-CAN) Communication Symptom.	For Crown Victoria, Grand Marquis, E-Series, Escape/Mariner, Ranger, and Town Car, GO to QA6. For all others, GO to QA4.

QA4 CHECK THE ISP-R VOLTAGE AT THE PCM HARNESS CONNECTOR

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ISP-R	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to QA5.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

QA5 CHECK THE PCM VPWR CIRCUITS FOR VOLTAGE

- Key in OFF position.
- Disconnect the PCM.

- Connect a 5 amp fused jumper wire between the following:

Point A PCM Connector, Harness Side	Point B
PCMRC	Ground

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
VPWR	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to QA7.	refer to **PINPOINT TEST B**.

QA6 CHECK THE PCM VPWR CIRCUITS FOR VOLTAGE

- Key in OFF position.
- Disconnect the PCM.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
VPWR	Ground

- **Are the voltages greater than 10 V?**

Yes	No
GO to QA7.	refer to **PINPOINT TEST B**.

QA7 CHECK THE PCM GROUND CIRCUITS FOR AN OPEN

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
PWRGND	Ground

- **Are the resistances less than 5 ohms?**

Yes	No
GO to QA8.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

QA8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the network test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST QB: DTCS P0603 OR P1633: KEEP ALIVE POWER (KAPWR)

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- battery terminal condition
- KAPWR wire routing
- harness circuit: KAPWR
- powertrain control module (PCM) (12A650)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Edge, F-150, Mark LT, MKX, Sable, Taurus, Taurus X	190 Pin	B54	KAPWR
Escape/Mariner	150 (50-50-50) Pin	B45	KAPWR
Expedition, Fusion, Milan, MKZ,	140 Pin	B54	KAPWR

Navigator			
Focus	190 Pin	B62	KAPWR
All other vehicles	170 Pin	B45	KAPWR

TEST PROCEDURE

QB1 CHECK THE 12-VOLT BATTERY TERMINALS

NOTE: **If the KAPWR is interrupted to the PCM when a breakout box is installed or the battery is disconnected, DTC P0603/P1633 can be generated on the first power-up.**

NOTE: **If DTC P0603 occurred right after or during an unsuccessful reprogramming of the PCM, clear the DTCs and repeat the PCM self-test. If DTC P0603 is retrieved again, continue with this pinpoint test.**

- Inspect the 12-volt battery cables for loose connections and for corrosion.
- **Are the 12-volt battery terminal connections in good condition?**

Yes	No
GO to QB2.	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

QB2 INSPECT THE ENGINE COMPARTMENT FOR CORRECT WIRE ROUTING

- Inspect the electronic engine control (EEC) system wiring for correct wire routing.
- Check the wiring routing to establish if any of the electrical connectors are being stressed due to poorly routed wiring. If necessary re-route and secure the wiring.
- Visually inspect the wiring and connectors.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to QB3.

QB3 CHECK KAPWR TO THE PCM

- Key in OFF position.
- PCM connector disconnected.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
KAPWR	Negative terminal

- While observing the multimeter, grasp the EEC harness and wiggle, shake or bend a small section while working from the battery to the PCM.
- **Is the voltage greater than 10 V?**

Yes	No
GO to QB4.	ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

QB4 CHECK FOR A REPEAT OF THE DTC

- PCM connector connected.
- Clear all DTCs that may have been caused by the PCM disconnect.
- Test drive the vehicle and allow the engine to reach normal operating temperature.
- Carry out the PCM self-test.
- **Is DTC P0603 or P1633 present?**

Yes	No
GO to QB5.	Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.

QB5 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST QC: DTC P1000: ON-BOARD DIAGNOSTIC (OBD) SYSTEMS READINESS TEST NOT COMPLETE

INTRODUCTION

NOTE: **Diagnostic trouble code (DTC) P1000 indicates that all the OBD monitors have not yet been successfully tested. In some areas, this DTC must be cleared to pass an inspection/maintenance test. The customer should be informed that the law specifies additional city and highway driving must be done to complete the check of the OBD system. This additional driving must occur before the vehicle is tested at the inspection/maintenance station. The amount of driving required varies with individual driving patterns. To complete this requirement in the shortest amount of time, refer to<u>ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE</u> .**

It is not necessary to clear DTC P1000 from the powertrain control module (PCM) by driving the vehicle unless it is requested by the customer to pass an inspection/maintenance test.

The only way DTC P1000 can be removed from memory is when all the OBD monitors are successfully completed.

DTC P1000 is set by the PCM under any of the following conditions.

- The vehicle is new from the factory and has not yet completed an OBD drive cycle.
- The battery or PCM is disconnected.
- An OBD monitor concern occurred before completion of an OBD drive cycle.
- The PCM DTCs have been cleared with a scan tool as part of a repair process.
- The PCM has been flashed and the vehicle has not yet completed an OBD drive cycle.
- DTC P1000 may not clear if the vehicle is equipped with a power take off (PTO) and the PTO is engaged or damaged.

TEST PROCEDURE

QC1 CONTINUOUS MEMORY DTC P1000: CHECK FOR ANY OTHER DTCS

NOTE: **Enter this pinpoint test only if DTC P1000 was retrieved from continuous memory. Ignore DTC P1000 in KOEO or KOER memory.**

- DTC P1000 indicates all of the OBD monitors have not yet been successfully tested.
- **Are any other DTCs received with P1000?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**<u>DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS</u>** .	GO to QC2.

QC2 CHECK FOR PTO

- **Is the vehicle equipped with PTO?**

Yes	No
GO to QC3.	GO to QC4.

QC3 CHECK THE PTO PID

- Key ON, engine running.
- Access the PCM and monitor the PTO PID.
- Cycle the PTO switch/actuator ON and OFF. (Follow the PTO aftermarket instructions).
- **Does the PTO PID cycle ON and OFF?**

Yes	No
GO to QC4.	GO to FB2.

QC4 REQUEST TO CLEAR DTC P1000

NOTE: An entire OBD drive cycle has not yet been completed to clear DTC P1000 from the PCM.

- **Has the customer requested DTC P1000 be cleared from the PCM memory?**

Yes	No
CARRY OUT an OBD drive cycle. REFER to**ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	INFORM the customer that if the law in your area requires additional driving in order to clear DTC P1000 from the PCM memory, it must be completed before an inspection/maintenance test.

PINPOINT TEST QD: DTC P1260: PASSIVE ANTI-THEFT SYSTEM

INTRODUCTION

NOTE: The passive anti-theft system (PATS) uses radio frequency identification technology to deter a drive away theft. Passive means that it does not require any activity from the user. The PATS uses a specially encoded ignition key. Each encoded ignition key contains a permanently installed electronic device called a transponder. Each transponder contains a unique electronic identification code. Each encoded ignition key must be programmed into the vehicle before it can be used to start the engine. DTC P1260 is stored any time the PCM disables the vehicle because of the PATS.

TEST PROCEDURE

QD1 CHECK FOR PATS DTCS

- Repair all PATS DTCs before P1260. Refer to the **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS) -- E-SERIES** for System Description, Operation and Self-Test.

- **Are all PATS DTCs diagnosed?**

Yes	No
GO to QD2.	REFER to the **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS) -- E-SERIES** to diagnose any PATS related DTCs.

QD2 CHECK FOR ANY OTHER POWERTRAIN DTCS

- Repair all powertrain DTCs other than P1260.
- **Are all other powertrain DTCs diagnosed?**

Yes	No
GO to QD3.	DISREGARD DTC P1260. DIAGNOSE all other powertrain DTCs. REFER to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

QD3 ATTEMPT TO START THE ENGINE

- Carry out a keep alive memory reset to clear DTC P1260. Refer to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- Attempt to start the engine.
- **Does the engine start?**

Yes	No
No system concerns exist at the present time. For intermittent no start or start stalls, CHECK for intermittent PATS concerns. (PATS cannot stall the engine after 1 second of operation). For intermittent stalls while driving, VERIFY scan tool-to-PCM communication during the concern. If a PCM communication error occurs, the possible causes are: loss of PWR or GND to the PCM, damaged PCM PWR relay, or a damaged EEC PWR diode. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	DTC P1260 is not the cause of the No Start. REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .

PINPOINT TEST QE: ELECTRONIC THROTTLE CONTROL (ETC) SYSTEM

INTRODUCTION

NOTE: **Diagnose and repair the following DTCs through DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS and the Workshop article respectively before entering this pinpoint test:**

- **P0715**
- **P0720**
- **P0731-P0735**
- **P0102-P0104**
- **P0321**
- **C1165**
- **U1027**

This pinpoint test is intended to diagnose the informational powertrain control module (PCM) diagnostic trouble codes (DTCs).

The informational DTCs are the result of limited operating strategy (LOS) or failure mode effects management (FMEM) operating strategy that maintains limited vehicle function in the event of a PCM, harness, or component concern.

Circuit DTCs can be accompanied by the informational DTCs, and should be diagnosed first. Informational DTCs without circuit DTCs may or may not indicate the actual concern and should be diagnosed as a symptom.

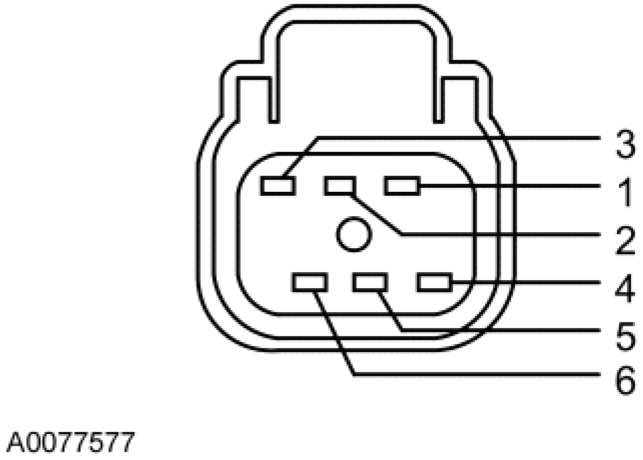


Fig. 198: EGR System Module (ESM) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
6	SIGRTN (Signal Return)
2	VREF (Reference Voltage)

TEST PROCEDURE

QE1 CHECK FOR DTCS

NOTE: For DTC P061B, make sure the air cleaner and air inlet are correctly seated and properly installed before continuing diagnosis.

- **Are any DTCs present other than the following: P0600, P060A, P060B, P060C, P060D, P061B, P061C, P061D, P061F, P062C, P1674, P2104, P2105, P2110, or U0300?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	For Focus with DTC P0600, GO to QE2. For all others with DTC P0600, GO to QE18. For DTCs P060A, P060C, P060D, P061D, P1674 or U0300, GO to QE2. For DTC P060B, GO to QE3. For DTC P061B, GO to QE13. For DTC P061C, GO to QE5. For DTC P061F, GO to QE7. For DTCs P062C, P2104, P2105 or P2110, GO to QE8.

QE2 DTCS P060A, P060C, P060D, P061D, P1674 OR U0300: CHECK THE PCM FOR THE LATEST CALIBRATION

- Program the PCM to the latest calibration.
- Key in OFF position.
- Key ON, engine OFF.
- Key in OFF position.
- Key ON, engine running.
- Use the customer information to recreate the concern.
- Carry out the self-test.
- **Are DTCs P060A, P060C, P060D, P061D, P1674 or U0300 present?**

Yes	No
GO to QE18.	The concern is not present at this time.

QE3 DTC P060B: CHECK FOR REFERENCE VOLTAGE CONCERNS

- Inspect the PCM harness for damage.
- Verify the correct operation of the sensors using ETCREF, VREF and related circuits. refer to **PINPOINT TEST C** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to QE4.

QE4 CHECK FOR AN INTERMITTENT CONCERN

- Clear the DTCs.
- Carry out the self-test.
- **Is DTC P060B present?**

Yes	No
GO to QE18.	The concern is not present at this time.

QE5 DTC P061C: CHECK THE CKP SENSOR FOR CORRECT OPERATION

- Verify correct operation of the CKP sensor and related circuits. refer to **PINPOINT TEST JD** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to QE6.

QE6 CHECK THE CMP SENSOR FOR CORRECT OPERATION

- Verify correct operation of the CMP sensor and related circuits. refer to **PINPOINT TEST DR** and follow the pinpoint test direction.
- **Is a concern present?**

Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to QE7.

QE7 DTC P061F: VERIFY THE CUSTOMER CONCERN

- Clear the DTCs.
- Use the customer information to recreate the concern.
- Carry out the self-test.
- **Are DTCs P061C or P061F present?**

Yes	No
GO to QE18.	The concern is not present at this time.

QE8 DTCS P062C, P2104, P2105 OR P2110: CHECK FOR DTCS IN OTHER VEHICLE MODULES

- Check for self-test DTCs in all of the vehicle modules.
- **Are any DTCs present?**

Yes	No
REFER to the applicable Workshop article part to diagnose the DTC.	GO to QE9.

QE9 CHECK FOR THE PRESENCE OF ANY MODULE COMMUNICATION CONCERNS

- Check for self-test DTCs in all of the vehicle modules.
- **Are any communication concerns or communication DTCs present?**

Yes	No
For communication concerns in the PCM, DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** . For communication concerns in other modules, REFER to the applicable Workshop article part to diagnose the communication DTC.	For DTC P062C, GO to QE16. For DTC P2104, GO to QE10. For DTC P2105, GO to QE11. For DTC P2110, GO to QE15.

QE10 DTC P2104: CHECK FOR THE PRESENCE OF PCM DTCS

- Clear the PCM DTCs.
- Check for self-test DTCs.
- **Are any DTCs present other than P2104?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	refer to **PINPOINT TEST DK**.

QE11 DTC P2105: CHECK FOR THE PRESENCE OF PCM DTCS

NOTE: **P2105 may be set in combination with other DTCs. Diagnose other DTCs first.**

- Clear the PCM DTCs.
- Check for self-test DTCs.
- **Are any DTCs present other than P2105?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to QE12.

QE12 CARRY OUT A VISUAL INSPECTION

- Key in OFF position.
- Visually inspect the following for obvious signs of damage:

  - ETB
  - PCM
- Check the harness for routing, alterations, incorrect shielding, or electrical interference from other systems. Make sure aftermarket wiring is not routed near the PCM.
- Verify aftermarket equipment does not generate radio frequency interference/electromagnetic interference (RFI/EMI).
- **Is a concern present?**

Yes	No
ISOLATE the concern and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to QE18.

QE13 DTC P061B: CHECK FOR THE PRESENCE OF PCM DTCS

NOTE: **An intermittent CKP sensor or harness concern may cause DTC P061B to set. Check for intermittent CKP sensor and harness concerns.**

- Clear the PCM DTCs.
- Check for self-test DTCs.
- **Are any DTCs present other than P061B?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	For Crown Victoria, E-Series 4.6L, Explorer 4.0L, Explorer Sport Trac 4.0L, F-150 4.2L, F-150 4.6L, F-Super Duty 6.8L, Grand Marquis, Mountaineer 4.0L, Mustang 4.0L, Mustang 5.4L, and Town Car, GO to QE14. For all others, CHECK for an intermittent concern with an ETC related harness or sensor. refer to **PINPOINT TEST Z**.

QE14 CHECK THE MAP INPUT FOR AN OFFSET SIGNAL

- Key in OFF position.
- Allow the vehicle to cool down.
- ESM connector disconnected.
- Measure the resistance between:

(+) ESM Connector, Component Side	(-) ESM Connector, Component Side
VREF - Pin 2	SIGRTN - Pin 6

- **Is the resistance greater than 2K ohms?**

Yes	No
For Crown Victoria, Grand Marquis, Explorer 4.0L, Explorer Sport Trac 4.0L, Mountaineer 4.0L, and Town Car, GO to QE16. For all others, CHECK for an intermittent concern with an ETC related harness or sensor. refer to **PINPOINT TEST Z**.	INSTALL a new ESM. REFER to the **ENGINE EMISSION CONTROL - - E-SERIES** . CLEAR the DTCs. REPEAT the self-test.

QE15 DTC P2110: CHECK FOR THE PRESENCE OF PCM DTCS

NOTE: P2110 sets in combination with other DTCs.

- Clear the PCM DTCs.
- Check for self-test DTCs.
- **Are any DTCs present other than P2110?**

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to QE18.

QE16 CHECK FOR ABS AND WHEEL SPEED SENSOR CONCERNS

NOTE: Refer to the REFERENCE VALUES article Reference Values for the typical diagnostic reference values.

- ESM connector connected.
- Key ON, engine running.
- Access the PCM and monitor the ISS_SRC, OSS_SRC and TSS PIDs.
- Access the PCM and monitor the VSS PID.
- Access the ABS and monitor the LF_WSPD, LR_WSPD, RF_WSPD and RR_WSPD PIDs.
- Road test the vehicle under various load conditions while comparing the PIDs. Check for signals that are intermittent or do not correspond.
- **Do the PID values correspond with the vehicle operating conditions?**

Yes	No
For Explorer 4.0L, Explorer Sport Trac 4.0L, F-150 5.4L, Mark LT, and Mountaineer 4.0L, GO to QE17. For all others, CHECK for an intermittent concern with an ETC related harness or sensor. refer to **PINPOINT TEST Z**.	REFER to the **VEHICLE DYNAMIC SYSTEMS -- E-SERIES** to diagnose any ABS concerns.

QE17 CHECK FOR A TRANSFER CASE MECHANICAL CONCERN

- Stop the vehicle.
- Select 4WD Low.
- **Does the vehicle shift into 4WD Low?**

Yes	No
CHECK for an intermittent concern with an ETC related harness or sensor. refer to **PINPOINT TEST Z**.	REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** , Four Wheel Drive (4WD) Systems to diagnose any transfer case concerns.

QE18 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

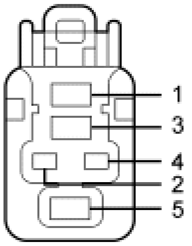
Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST TA: CLUTCH PEDAL POSITION (CPP) SWITCH

INTRODUCTION

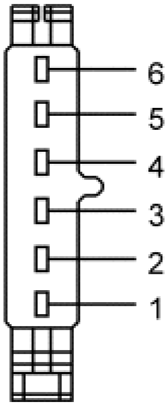
This pinpoint test is intended to diagnose the following:

- CPP (11A152/7C534)
- harness circuits: CPP / CPP BT and SIGRTN / GND
- powertrain control module (PCM) (12A650)



N0047960

Fig. 199: Clutch Pedal Position (CPP) Switch Connector - A
Courtesy of FORD MOTOR CO.



A0077530

Fig. 200: Clutch Pedal Position (CPP) Switch Connector - B
Courtesy of FORD MOTOR CO.

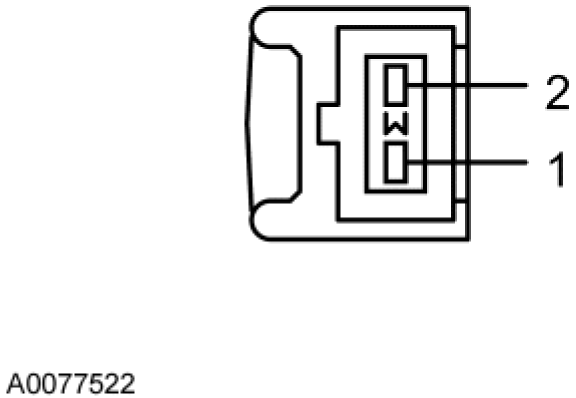


Fig. 201: Clutch Pedal Position (CPP) Switch Connector - C
Courtesy of FORD MOTOR CO.

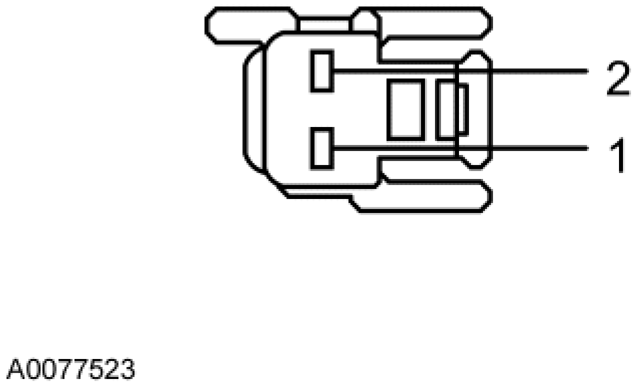


Fig. 202: Clutch Pedal Position (CPP) Switch Connector - D
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	A	2 4	SIGRTN CPP
F-150	B	2 1	GND CPP
Mustang	C	2 1	GND CPP
Ranger	B	5 6	GND CPP
All other vehicles	D	2	GND

		1	CPP

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
Escape/Mariner	150 (50-50-50) Pin	B41, E41, T41 T27	SIGRTN CPP
F-150	190 Pin	B39 B58, E58, T43	CPP-BT SIGRTN
F-Super Duty	170 Pin	B34 B41, E58, T41	CPP-BT SIGRTN
Focus	190 Pin	T26 B58, E64, T40	CPP-BT SIGRTN
Fusion, Milan	140 Pin	B18 B58, E58	CPP-BT SIGRTN
All other vehicles	170 Pin	B41, E58, T41 B33	SIGRTN CPP

TEST PROCEDURE

TA1 DTC P0704, P0830: CHECK THE CPP SWITCH

WARNING: **Block all wheels, set the parking brake and firmly apply the service brake to reduce the risk of vehicle movement during this procedure. Failure to follow these instructions may result in serious personal injury.**

NOTE: During self-test, the clutch pedal must be down and gearshift lever in NEUTRAL.

- Key ON, engine OFF.
- Access the PCM and monitor the CPP PID.
- **Does the reading cycle when the CPP switch is activated?**

Yes	No
This may be an intermittent circuit concern. INSPECT connectors for signs of damage, water intrusion, corrosion. REPAIR as necessary.	GO to TA2.

TA2 CHECK THE SWITCH CIRCUIT RESISTANCE

NOTE: The CPP switch is located near the clutch pedal.

NOTE: Measure the CPP switch resistance with the clutch pedal pressed down.

- Inspect the switches and brackets for damage. Repair as necessary.
- CPP Switch connector disconnected.
- For Focus or Escape,
- Measure the resistance between:

(+) CPP Switch Connector, Component Side	(-) CPP Switch Connector, Component Side
CPP	SIGRTN

- For all others,
- Measure the resistance between:

(+) CPP Switch Connector, Component Side	(-) CPP Switch Connector, Component Side
CPP	GND

- **Is the resistance less than 5 ohms?**

Yes	No
GO to TA3.	INSTALL a new CPP switch. CLEAR the DTCs. REPEAT the self-test.

TA3 CHECK THE CPP FOR INTERNAL SHORTS

NOTE: Measure the CPP switch resistance with the clutch pedal released.

- For Focus or Escape,
- Measure the resistance between:

(+) CPP Switch Connector, Component Side	(-) CPP Switch Connector, Component Side
CPP	SIGRTN

- For all others,
- Measure the resistance between:

(+) CPP Switch Connector, Component Side	(-) CPP Switch Connector, Component Side
CPP	GND

- **Is the resistance greater than 10K ohms?**

Yes	No
For Focus or Escape, GO to TA5.	INSTALL a new CPP switch. CLEAR the DTCs.

For all others, GO to TA4.	REPEAT the self-test.

TA4 CHECK THE CPP AND GROUND CIRCUITS FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) CPP Switch Connector, Harness Side	(-) PCM Connector, Harness Side
CPP	CPP

- Measure the resistance between:

(+) CPP Switch Connector, Harness Side	(-)
GND	Ground

- **Is the resistance less than 5 ohms?**

Yes	No
GO to TA6.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

TA5 CHECK THE CPP AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CPP Switch Connector, Harness Side
CPP	CPP
SIGRTN	SIGRTN

- **Are the resistances less than 5 ohms?**

Yes	No
GO to TA6.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

TA6 CHECK THE CPP CIRCUIT FOR A SHORT TO VOLTAGE

- Key ON, engine OFF.
- Measure the voltage between:

(+) CPP Switch Connector, Harness Side	(-)
CPP	Ground

- **Is the voltage less than 1 V?**

Yes	No
GO to TA7.	REPAIR the short circuit to PWR. CLEAR the DTCs. REPEAT the self-test.

TA7 CHECK THE CPP CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) CPP Switch Connector, Harness Side	(-)
CPP	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to TA8.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

TA8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST TB: TRANSMISSION CONTROL SWITCH (TCS)/ TRANSMISSION CONTROL INDICATOR LAMP (TCIL)

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- TCS
- TCIL

- harness circuits: TCS and TCIL
- powertrain control module (PCM) (12A650)

For PCM connector views or reference values, refer to the **REFERENCE VALUES** article.

Vehicle	Connector	Pin	Circuit
E-Series	170 Pin	B43 B27	TCIL TCS
Edge, MKX, Sable, Taurus, Taurus X	190 Pin	B16	TCS
Escape/Mariner	150 (50-50-50) Pin	B27	TCS
F-150, Mark LT	190 Pin	B45	TCS
F-Super Duty	170 Pin	B27	TCS
Focus	190 Pin	T30	TCS
Fusion	140 Pin	B16	TCS
All other vehicles	170 Pin	B29	TCS

TEST PROCEDURE

TB1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTC)

- **Is DTC P1780 present?**

Yes	No
GO to TB2.	For TCIL never on, GO to TB10. For TCIL always on, GO to TB8.

TB2 DTC P1780: CHECK THE TCS FUNCTION

NOTE: **Verify the TCS was cycled during self-test.**

- Key ON, engine OFF.
- Access the PCM and monitor the TCS PID.
- Apply and release the TCS and then hold it applied for 3 seconds. Release the switch.
- **Does the TCS PID change from ON to OFF and does the PID indicate ON when the switch is applied?**

Yes	No
REPEAT the KOER self-test and cycle the TCS during the test.	GO to TB3.

TB3 CHECK THE TCS VOLTAGE

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
TCS	Ground

- Monitor the voltage while applying and releasing the TCS several times.
- **Does the voltage change states?**

Yes	No
GO to TB12.	GO to TB4.

TB4 CHECK THE TCS CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Key in OFF position.
- TCS connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
TCS	Ground

- **Is the resistance greater than 10K ohms?**

Yes	No
GO to TB5.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

TB5 CHECK FOR VOLTAGE TO THE TCS

- Key ON, engine OFF.
- Measure the voltage between:

(+) TCS Connector, Harness Side	(-)
VPWR	Ground

- **Is the voltage greater than 10 V?**

Yes	No
GO to TB6.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

TB6 CHECK THE TCS CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TCS Connector, Harness Side
TCS	TCS

- **Is the resistance less than 5 ohms?**

Yes	No
GO to TB7.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

TB7 CHECK THE TCS CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) TCS Connector, Harness Side	(-)
TCS	Ground

- **Is the voltage less than 1 V?**

Yes	No
INSTALL a new TCS. REFER to the **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS -- E-SERIES** . CLEAR the DTCs. REPEAT the self-test.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

TB8 TCIL ALWAYS ON: CHECK THE TCIL FUNCTION

- Key ON, engine OFF.
- Apply and release the TCS.
- **Does the TCIL change state?**

Yes	No
Unable to duplicate or identify the concern at this time. refer to **PINPOINT TEST Z**.	GO to TB9.

TB9 CHECK THE TCIL CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

NOTE: The TCIL turns off when the PCM is disconnected.

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- **Does the TCIL change state?**

Yes	No
GO to TB12.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

TB10 TCIL NEVER ON: CHECK FOR KOER P1780

- Carry out the PCM KOER self-test.
- **Is DTC P1780 present?**

Yes	No
REPAIR the DTC. CLEAR the DTCs. REPEAT the self-test. GO to TB2.	GO to TB11.

TB11 CHECK FOR VOLTAGE TO THE TCIL

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Connect a 5 amp fused jumper wire between the following:

Point A PCM Connector, Harness Side	Point B Vehicle Battery
TCIL	Negative terminal

- **Does the TCIL illuminate?**

Yes	No
GO to TB12.	CHECK the indicator bulb and the fuse. If OK, the open is in the wiring between the ignition switch and the TCIL pin at the harness connector. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

TB12 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.

- Carry out the PCM self-test and verify the concern is still present.
- **Is the concern still present?**

Yes	No
INSTALL a new PCM. REFER to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST Z: INTERMITTENT

INTRODUCTION

WARNING: **Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to part 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.**

This pinpoint test is intended to diagnose and isolate intermittent concerns for the following:

- all electronic engine control (EEC) subsystems

This chart is used to determine which test to run for the suspect circuit. PIDs corresponding to each circuit are listed. Some circuits do not have an associated PID or the PID may not be available and has to be measured with a digital multimeter (DMM). More specific information on the PID can be found. If the vehicle has a coil pack system with a no start condition, carry out the ignition test.

PCM PIDS/SIGNALS

PCM/TCM PIDS/SIGNALS	Associated Circuit	Test Type
ACCS	A/CCS	input
ACET	ACET	input
ACP	ACPSW	input
AIR	AIR	output
AIRM	AIRM	input
APP1	APPS	input
APP2	APPS	input
APP3	APPS	input
BPP/BOO	BPP	input
BPA	BPS	input
Use DMM	CD A-J (primary)	output
CHT	CHT	input
CKP	CKP	input
CMP	CMP	input

CPP/PNP	CPP	input
DPFEGR	DPFE	input
ECT	ECT	input
EGRMC1	EGRMC1	output
EGRMC2	EGRMC2	output
EGRMC3	EGRMC3	output
EGRMC4	EGRMC4	output
EGRMDSD	EGRMC	output
EVR	EVR	output
EOT	EOT	input
EPC, EPCV	EPC	output
EVAPCV	CV	output
EVAPPDC	VMV	output
EVAPPF	VMV	output
FANDC	VDF	output
FANSS	FANSS	input
FLI	FLI	input
FP	FP	output
FPM	FPM	input
FP M	FPM	input
FRP	FRP	input
FRT	FRT	input
FTP	FTP	input
HFC	HFC	output
HOS11	HEGO	input
HOS12	HEGO	input
HOS13	HEGO	input
IAC	IAC	output
IAT	IAT	input
IAT2	IAT 2	input
IMRC	IMRC	output
IMRC1M	IMRCM	input
IMTV1	IMTV1	output
IMTV2	IMTV2	output
KS1	KS1	input
KS2	KS2	input
LFC	LFC	output
MAF, MAF V	MAF	input
MAP V	MAP	input
O2S11	O2S	input
O2S12	O2S	input
O2S13		

	O2S	input
OSS	OSS	input
PSP	PSP	input
PSPT	PSP	input
PTO	PTO	input
TACM (+)	TACM (+)	output
TACM (-)	TACM (-)	output
TP1	TP1	input
TP2	TP2	input
TCIL	TCIL	output
TP	TP	input
VCT1	VCT1	output
VCT2	VCT2	output
VPWR	VPWR	input
Use DMM	VREF	output
Use DMM	VSO	output
VSS	VSS+	input
WAC	WAC	output

TEST PROCEDURE

Z1 DIRECTION FOR INTERMITTENT DIAGNOSTIC PATH

NOTE: **Proceed with this step only if the powertrain control module (PCM) was not previously cleared. Record freeze frame data prior to clearing the PCM DTCs. Clearing the DTCs clears any freeze frame data and eliminates FMEM. This helps to recreate the original conditions that set the DTCs or caused the symptom.**

- Key ON, engine OFF.
- Clear the PCM DTCs.
- **Are the PCM DTCs cleared?**

Yes	No
GO to Z2.	RESET the keep alive memory (KAM). REFER to**RESETTING THE KEEP ALIVE MEMORY (KAM)** .

Z2 SELECT THE PIDS AND/OR SIGNALS RELATED TO THE SYSTEM

- A list of related PIDs and/or signals are needed for use with the scan tool to monitor the suspect areas. Obtain the customer symptom description. Use the Reference Value Symptom chart and proceed to the Reference Value PID/Signal Measurement chart located at the beginning of Reference Values.

- Highlight each available PID/signal recommended by the charts under the PID/signal selection menu on the scan tool.
- **Are all available PIDs/signals related to the symptom selected?**

Yes	No
GO to Z3.	REPEAT the test step. GO to Z2.

Z3 DECISION TO VERIFY THE SYMPTOM

NOTE: The path to symptom verification is optional, but is recommended for several reasons. For example: the vehicle is back for a repeat repair, or there is no DTC present.

- **Is a concern symptom detected?**

Yes	No
GO to Z10.	GO to Z4.

Z4 COLLECT ANY SYMPTOM RELATED DATA TO AID IN VERIFICATION

NOTE: Only MIL codes trigger freeze frame data. Refer to the scan tool instruction article to retrieve the freeze frame information.

- Prepare the freeze frame data for use with information from the Symptom Charts.
- Check for continuous memory DTCs that should have been recorded from an earlier pinpoint test.
- Access the information from the customer information worksheet and the customer if available. Access any other symptom related data available, such as TSBs and OASIS reports.
- **Is all available data recorded?**

Yes	No
GO to Z5.	GATHER as much data as possible to aid in isolating the intermittent concern area. REPEAT the test step. GO to Z4.

Z5 RECREATE THE SYMPTOM USING ALL AVAILABLE DATA

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- With the scan tool, select and monitor the same PIDs as displayed in freeze frame along with any previously selected PIDs/signals from step Z2. Using the freeze frame data recorded earlier, recreate the conditions described by each freeze frame PID. Pay special attention to ECT, LOAD, RPM and VSS. Also, use any available data from the customer, TSBs, and other sources to aid in producing the correct conditions for recreating the symptom.

- When the symptom occurs, press the trigger to begin recording. Refer to the scan tool instruction article for information on the recorder function.
- **Can the symptom be recreated?**

Yes	No
GO to Z10.	GO to Z6.

Z6 RECREATE THE SYMPTOM

NOTE: **PIDs for output in the Reference Value Charts represent command values only. Circuit measurements with a digital multimeter indicate the actual output status. Therefore, in the case of a concern, the PID and circuit reading on the vehicle may not correspond with each other. PIDs for PCM circuits with a mismatch in the digital multimeter measurement indicate a possible PCM concern.**

- The road test is the last attempt to locate the area of concern before physically disturbing vehicle circuits.
- The Intermittent Road Test Procedure is a set of instructions for monitoring PIDs/signals with a scan tool and circuit measurements with a digital multimeter. This is done under 4 different conditions - key on/engine off, hot idle, 48 km/h (30 mph) and 88 km/h (55 mph). Use the typical diagnostic reference values to compare with the actual vehicle.
- Locate the correct Reference Value Chart.
- Setup the vehicle to measure the circuits with a digital multimeter and a scan tool.
- Connect a scan tool to the DLC.
- Key ON, engine OFF.
- With the scan tool, select and monitor PIDs and measure the circuits shown in the Reference Value Chart.
- Compare the scan tool PIDs and digital multimeter values to the Reference Value Charts.
- **Are any values out of range?**

Yes	No
GO to Z10.	GO to Z7.

Z7 RECREATE THE SYMPTOM USING THE HOT IDLE ROAD TEST

NOTE: **The engine temperature should be at least 87°C (189°F).**

- Key ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.
- **Are any values out of range?**

Yes	No
GO to Z10.	GO to Z8.

Z8 RECREATE THE SYMPTOM DURING AN 48 KM/H (30 MPH) ROAD TEST

- Drive the vehicle on a preplanned route.
- Continue to monitor the PIDs and circuits as in the previous step.
- **Are any values out of range?**

Yes	No
GO to Z10.	GO to Z9.

Z9 RECREATE THE SYMPTOM DURING AN 88 KM/H (55 MPH) ROAD TEST

- Continue to drive the vehicle on the preplanned route.
- Continue to monitor the PIDs and circuits as in the previous step.
- **Are any values out of range?**

Yes	No
GO to Z10.	It is now necessary to physically disturb the selected vehicle circuits in an attempt to recreate the intermittent concern. GO to Z10.

Z10 SELECT THE CIRCUITS FROM THE PCM PIDS/SIGNALS CHART

NOTE: **From the same chart, be sure to select and proceed with the appropriate test type.**

NOTE: **The Input Test step should be used on sensing inputs such as temperature, position or oxygen.**

NOTE: **The Output Test step should be used on output devices such as relays, coils or solenoids.**

- Remain in the PID/Signal selection menu with the scan tool.
- Highlight only the PIDs/signals from step Z2.
- Proceed to the PCM PIDS/SIGNALS chart located at the beginning of this test.
- Match the selected PIDs/signals to the corresponding circuit in the chart. There may be more than one circuit to test. If a PID/signal recording was made with the scan tool, it may be helpful to replay it at this time. Refer to the scan tool instruction article for additional information.
- **Has a test been chosen?**

Yes	No

For the input test step, GO to Z11. For the output test step, GO to Z15.	To diagnose other driveability symptoms, REFER to**NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .

Z11 KOEO INPUT TEST PROCEDURE FOR THE PCM SENSORS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Using the circuits chosen from the PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a digital multimeter to check the value.
- Proceed to the area of the suspect wiring or component concern.
- Key ON, engine OFF.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM while tapping on the component.
- Monitor while wiggling the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Are there abrupt changes in the PID values that do not compare with the values?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to Z12.

Z12 KOER INPUT TEST PROCEDURE FOR THE PCM SENSORS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Key ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component concern.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM while tapping on the component.
- Monitor while wiggling the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.

- **Are any values fluctuating in and out of range?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to Z13.

Z13 KOEO WATER SOAK TEST PROCEDURE FOR THE PCM SENSORS, EXCLUDING HIGH VOLTAGE CIRCUITS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Key ON, engine OFF.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component concern.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Monitor while spraying the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Are any values fluctuating in and out of range?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to Z14.

Z14 KOER WATER SOAK TEST PROCEDURE FOR THE PCM SENSORS, EXCLUDING HIGH VOLTAGE CIRCUITS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Key ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component concern.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Monitor while spraying the sensor harness wire from the component to the PCM.

- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Are any values fluctuating in and out of range?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to Z15.

Z15 KOER WIGGLE TEST PROCEDURE FOR THE PCM SENSORS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

NOTE: **Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A digital multimeter measurement is needed to display the actual values. Be sure to compare them. Look for fluctuations to occur during any part of the following test. The output state test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.**

- Using the circuits chosen from the PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a DMM to check the value.
- Key ON, engine OFF.
- With the scan tool, turn on selected outputs using output state control. Refer to the scan tool instruction article.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM while tapping on the component.
- Monitor while wiggling the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the Reference Value Charts?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to Z16.

Z16 KOER OUTPUT TEST PROCEDURE FOR THE PCM ACTUATORS

WARNING: **When carrying out any test steps, always be aware of hands,**

clothing or tools near cooling fans, belts or hot surfaces.

Failure to follow these instructions may result in personal injury.

NOTE: **Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A digital multimeter measurement is needed to display the actual values. Be sure to compare them. Look for fluctuations to occur during any part of the following test. The output state test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.**

- Key ON, engine running.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PIDs with the scan tool and note the values. Compare the scan tool values with values from a digital multimeter with the engine at idle. Look for fluctuations in the values while tapping on the suspect component.
- If a coil for a coil on plug application is suspect, turn off the key. Gain access to the coil and measure continuity from the spark plug terminal to the signal terminal while tapping the coil. A large fluctuation in resistance indicates an intermittent open or short.
- Monitor while wiggling the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Is there a scan tool to DMM value mismatch or an idle fluctuation?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to Z17.

Z17 KOEO WATER SOAK TEST PROCEDURE FOR THE PCM ACTUATORS, EXCLUDING HIGH VOLTAGE CIRCUITS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

NOTE: **Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A digital multimeter measurement is needed to display the actual values. Be sure to compare them. Look for fluctuations to occur during any part of the following test. The output state test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.**

- Key ON, engine OFF.

- With the scan tool, turn on selected outputs using output state control. Refer to the scan tool instruction article.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the Reference Value Charts?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to Z18.

Z18 KOER WATER SOAK TEST PROCEDURE FOR THE PCM ACTUATORS

WARNING: **When carrying out any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.**

Failure to follow these instructions may result in personal injury.

- Key ON, engine running.
- Using the circuits chosen from the PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a DMM to check the value.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Monitor while spraying the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the Typical Diagnostic Reference Values.
- **Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the Reference Value Charts?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	GO to Z19.

Z19 INSPECT FOR INTERMITTENT MECHANICAL CONCERNS

NOTE: **It is possible for an intermittent mechanical concern to cause a good PCM system to react abnormally.**

- An inspection of DTC related mechanical systems should have been carried out in an earlier part. If not, visually inspect at this time.

- Look for possible vacuum lines, wires, cables, linkage or hoses that may become kinked, shorted or restricted during normal engine operation.
- This may include engine/transmission gear changes, acceleration and deceleration, rough roads and various engine RPM and torque related conditions.
- **Is a mechanical concern detected?**

Yes	No
REPAIR as necessary. VERIFY the repair. CLEAR the DTCs. REPEAT the self-test.	It is necessary to seek additional help. REFER to the Professional Technician Society (PTS) web site, the OASIS system or the Technical Hotline. A vehicle data recorder (VDR) or similar recorder may also be useful.

2008 ENGINE PERFORMANCE

Powertrain DTC Charts & Descriptions - Gasoline Engines

DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS

NOTE: Refer to the applicable Workshop Manual part to diagnose the body and chassis DTCs.

DTC LIST

DIAGNOSTIC TROUBLE CODES (DTC) LIST

DTC	Description
DTC P0010	INTAKE CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1)
DTC P0011	INTAKE CAMSHAFT POSITION TIMING - OVER-ADVANCED (BANK 1)
DTC P0012	INTAKE CAMSHAFT POSITION TIMING - OVER-RETARDED (BANK 1)
DTC P0016	CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION - BANK 1 SENSOR A
DTC P0018	CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION - BANK 2 SENSOR A
DTC P0020	INTAKE CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 2)
DTC P0021	INTAKE CAMSHAFT POSITION TIMING - OVER-ADVANCED (BANK 2)
DTC P0022	INTAKE CAMSHAFT POSITION TIMING - OVER-RETARDED (BANK 2)
DTC P0030	HO2S HEATER CONTROL CIRCUIT (BANK 1, SENSOR 1)
DTC P0040	OXYGEN SENSOR SIGNALS SWAPPED BANK 1 SENSOR 1/BANK 2 SENSOR 1
DTC P0041	OXYGEN SENSOR SIGNALS SWAPPED BANK 1 SENSOR 2/BANK 2 SENSOR 2
DTC P0050	HO2S HEATER CONTROL CIRCUIT (BANK 2, SENSOR 1)
DTC P0053	HO2S HEATER RESISTANCE (BANK 1, SENSOR 1)
DTC P0054	HO2S HEATER RESISTANCE (BANK 1, SENSOR 2)
DTC P0055	HO2S HEATER RESISTANCE (BANK 1, SENSOR 3)
DTC P0059	HO2S HEATER RESISTANCE (BANK 2, SENSOR 1)
DTC P0060	HO2S HEATER RESISTANCE (BANK 2, SENSOR 2)
DTC P0068	MANIFOLD ABSOLUTE PRESSURE (MAP)/MASS AIR FLOW (MAF) - THROTTLE POSITION CORRELATION
DTC P0097	INTAKE AIR TEMPERATURE SENSOR 2 CIRCUIT LOW
DTC P0098	INTAKE AIR TEMPERATURE SENSOR 2 CIRCUIT HIGH
DTC P0102	MASS OR VOLUME AIR FLOW A CIRCUIT LOW
DTC P0103	MASS OR VOLUME AIR FLOW A CIRCUIT HIGH
DTC P0104	MASS OR VOLUME AIR FLOW A CIRCUIT INTERMITTENT/ERRATIC
DTC P0106	MANIFOLD ABSOLUTE PRESSURE (MAP/BARO) SENSOR RANGE/PERFORMANCE
DTC P0107	MANIFOLD ABSOLUTE PRESSURE (MAP)/BAROMETRIC PRESSURE (BARO) SENSOR LOW

DTC P0108	MANIFOLD ABSOLUTE PRESSURE (MAP)/BAROMETRIC PRESSURE (BARO) SENSOR HIGH
DTC P0109	MANIFOLD ABSOLUTE PRESSURE (MAP)/BAROMETRIC PRESSURE (BARO) SENSOR INTERMITTENT
DTC P0111	INTAKE AIR TEMPERATURE (IAT) SENSOR 1 CIRCUIT RANGE/PERFORMANCE
DTC P0112	INTAKE AIR TEMPERATURE (IAT) SENSOR 1 CIRCUIT LOW
DTC P0113	INTAKE AIR TEMPERATURE (IAT) SENSOR 1 CIRCUIT HIGH
DTC P0114	INTAKE AIR TEMPERATURE (IAT) SENSOR 1 INTERMITTENT/ERRATIC
DTC P0116	ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT RANGE/PERFORMANCE
DTC P0117	ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT LOW
DTC P0118	ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT HIGH
DTC P0119	ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT INTERMITTENT/ERRATIC
DTC P0121	THROTTLE/PEDAL POSITION SENSOR A CIRCUIT RANGE/PERFORMANCE
DTC P0122	THROTTLE/PEDAL POSITION SENSOR A CIRCUIT LOW
DTC P0123	THROTTLE/PEDAL POSITION SENSOR A CIRCUIT HIGH
DTC P0125	INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL
DTC P0127	INTAKE AIR TEMPERATURE (IAT) TOO HIGH
DTC P0128	COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)
DTC P012B	TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE
DTC P012C	TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT LOW
DTC P012D	TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT HIGH
DTC P012E	TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT INTERMITTENT/ERRATIC
DTC P0130	O2 CIRCUIT (BANK 1, SENSOR 1)
DTC P0132	O2 CIRCUIT HIGH VOLTAGE (BANK 1, SENSOR 1)
DTC P0133	O2 CIRCUIT SLOW RESPONSE (BANK 1, SENSOR 1)
DTC P0134	O2 CIRCUIT NO ACTIVITY DETECTED (BANK 1, SENSOR 1)
DTC P0135	O2 HEATER CIRCUIT (BANK 1, SENSOR 1)
DTC P0138	O2 CIRCUIT HIGH VOLTAGE (BANK 1, SENSOR 2)
DTC P0139	O2 CIRCUIT SLOW RESPONSE (BANK 1, SENSOR 2)
DTC P0141	O2 HEATER CIRCUIT (BANK 1, SENSOR 2)
DTC P0144	O2 CIRCUIT HIGH VOLTAGE (BANK 1, SENSOR 3)
DTC P0147	O2 HEATER CIRCUIT (BANK 1, SENSOR 3)
DTC P0148	FUEL DELIVERY ERROR
DTC P0150	O2 CIRCUIT (BANK 2, SENSOR 1)
DTC P0152	O2 CIRCUIT HIGH VOLTAGE (BANK 2, SENSOR 1)

DTC P0153	O2 CIRCUIT SLOW RESPONSE (BANK 2, SENSOR 1)
DTC P0154	O2 CIRCUIT NO ACTIVITY DETECTED (BANK 2, SENSOR 1)
DTC P0155	O2 HEATER CIRCUIT (BANK 2, SENSOR 1)
DTC P0158	O2 CIRCUIT HIGH VOLTAGE (BANK 2, SENSOR 2)
DTC P0159	O2 CIRCUIT SLOW RESPONSE (BANK 2, SENSOR 2)
DTC P0161	O2 HEATER CIRCUIT (BANK 2, SENSOR 2)
DTC P0171	SYSTEM TOO LEAN (BANK 1)
DTC P0172	SYSTEM TOO RICH (BANK 1)
DTC P0174	SYSTEM TOO LEAN (BANK 2)
DTC P0175	SYSTEM TOO RICH (BANK 2)
DTC P0180	FUEL TEMPERATURE SENSOR A CIRCUIT
DTC P0181	FUEL TEMPERATURE SENSOR A CIRCUIT RANGE/PERFORMANCE
DTC P0182	FUEL TEMPERATURE SENSOR A CIRCUIT LOW
DTC P0183	FUEL TEMPERATURE SENSOR A CIRCUIT HIGH
DTC P0190	FUEL RAIL PRESSURE SENSOR A CIRCUIT
DTC P0191	FUEL RAIL PRESSURE SENSOR A CIRCUIT RANGE/PERFORMANCE
DTC P0192	FUEL RAIL PRESSURE SENSOR A CIRCUIT LOW
DTC P0193	FUEL RAIL PRESSURE SENSOR A CIRCUIT HIGH
DTC P0196	ENGINE OIL TEMPERATURE (EOT) SENSOR CIRCUIT RANGE/PERFORMANCE
DTC P0197	ENGINE OIL TEMPERATURE (EOT) SENSOR CIRCUIT LOW
DTC P0198	ENGINE OIL TEMPERATURE (EOT) SENSOR CIRCUIT HIGH
DTC P020X	INJECTOR CIRCUIT/OPEN - CYLINDER X
DTC P0210	INJECTOR CIRCUIT/OPEN - CYLINDER 10
DTC P0217	ENGINE COOLANT OVER-TEMPERATURE CONDITION
DTC P0218	TRANSMISSION FLUID TEMPERATURE OVER-TEMPERATURE CONDITION
DTC P0219	ENGINE OVER SPEED CONDITION
DTC P0221	THROTTLE/PEDAL POSITION SENSOR/SWITCH B CIRCUIT RANGE/PERFORMANCE
DTC P0222	THROTTLE/PEDAL POSITION SENSOR/SWITCH B CIRCUIT LOW
DTC P0223	THROTTLE/PEDAL POSITION SENSOR/SWITCH B CIRCUIT HIGH
DTC P0230	FUEL PUMP PRIMARY CIRCUIT
DTC P0231	FUEL PUMP SECONDARY CIRCUIT LOW
DTC P0232	FUEL PUMP SECONDARY CIRCUIT HIGH
DTC P0297	VEHICLE OVER SPEED CONDITION
DTC P0298	ENGINE OIL OVER TEMPERATURE CONDITION
DTC P0300	RANDOM MISFIRE DETECTED
DTC P0301 - P0309	CYLINDER X MISFIRE DETECTED
DTC P0310	CYLINDER 10 MISFIRE DETECTED
DTC P0315	CRANKSHAFT POSITION SYSTEM VARIATION NOT LEARNED.
DTC P0316	MISFIRE DETECTED ON STARTUP (FIRST 1000 REVOLUTIONS)

DTC P0320	IGNITION/DISTRIBUTOR ENGINE SPEED INPUT CIRCUIT
DTC P0325	KNOCK SENSOR 1 CIRCUIT (BANK 1)
DTC P0326	KNOCK SENSOR 1 CIRCUIT RANGE/PERFORMANCE (BANK 1)
DTC P0330	KNOCK SENSOR 2 CIRCUIT (BANK 2)
DTC P0331	KNOCK SENSOR 2 CIRCUIT RANGE/PERFORMANCE (BANK 2)
DTC P0340	CAMSHAFT POSITION SENSOR A CIRCUIT (BANK 1 OR SINGLE SENSOR)
DTC P0344	CAMSHAFT POSITION SENSOR A CIRCUIT INTERMITTENT (BANK 1 OR SINGLE SENSOR)
DTC P0345	CAMSHAFT POSITION SENSOR A CIRCUIT (BANK 2)
DTC P0349	CAMSHAFT POSITION SENSOR A CIRCUIT INTERMITTENT (BANK 2)
DTC P0350	IGNITION COIL PRIMARY/SECONDARY CIRCUIT
DTC P0351	IGNITION COIL A PRIMARY/SECONDARY CIRCUIT
DTC P0352	IGNITION COIL B PRIMARY/SECONDARY CIRCUIT
DTC P0353	IGNITION COIL C PRIMARY/SECONDARY CIRCUIT
DTC P0354	IGNITION COIL D PRIMARY/SECONDARY CIRCUIT
DTC P0355	IGNITION COIL E PRIMARY/SECONDARY CIRCUIT
DTC P0356	IGNITION COIL F PRIMARY/SECONDARY CIRCUIT
DTC P0357	IGNITION COIL G PRIMARY/SECONDARY CIRCUIT
DTC P0358	IGNITION COIL H PRIMARY/SECONDARY CIRCUIT
DTC P0359	IGNITION COIL I PRIMARY/SECONDARY CIRCUIT
DTC P0360	IGNITION COIL J PRIMARY/SECONDARY CIRCUIT
DTC P0400	EXHAUST GAS RECIRCULATION (EGR) FLOW
DTC P0401	EXHAUST GAS RECIRCULATION (EGR) FLOW INSUFFICIENT DETECTED
DTC P0402	EXHAUST GAS RECIRCULATION (EGR) FLOW EXCESSIVE DETECTED
DTC P0403	EXHAUST GAS RECIRCULATION (EGR) CONTROL CIRCUIT
DTC P0405	EXHAUST GAS RECIRCULATION (EGR) SENSOR A CIRCUIT LOW
DTC P0406	EXHAUST GAS RECIRCULATION (EGR) SENSOR A CIRCUIT HIGH
DTC P0410	SECONDARY AIR INJECTION (AIR) SYSTEM
DTC P0412	SECONDARY AIR INJECTION (AIR) SYSTEM - SWITCHING VALVE A CIRCUIT
DTC P0420	CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)
DTC P0430	CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 2)
DTC P0442	EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (SMALL LEAK)
DTC P0443	EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT
DTC P0446	EVAPORATIVE EMISSION SYSTEM VENT CONTROL CIRCUIT
DTC P0451	EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH RANGE/PERFORMANCE
DTC P0452	EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH LOW
DTC P0453	EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH HIGH
DTC P0454	EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH INTERMITTENT
DTC P0455	EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (GROSS LEAK/NO FLOW)

DTC P0456	EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (VERY SMALL LEAK)
DTC P0457	EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)
DTC P0460	FUEL LEVEL SENSOR A CIRCUIT
DTC P0461	FUEL LEVEL SENSOR A CIRCUIT RANGE/PERFORMANCE
DTC P0462	FUEL LEVEL SENSOR A CIRCUIT LOW
DTC P0463	FUEL LEVEL SENSOR A CIRCUIT HIGH
DTC P0480	FAN 1 CONTROL CIRCUIT
DTC P0481	FAN 2 CONTROL CIRCUIT
DTC P0482	FAN 3 CONTROL CIRCUIT
DTC P0483	FAN PERFORMANCE
DTC P0491	SECONDARY AIR INJECTION (AIR) SYSTEM INSUFFICIENT FLOW (BANK 1)
DTC P0500	VEHICLE SPEED SENSOR (VSS) A
DTC P0503	VEHICLE SPEED SENSOR (VSS) A INTERMITTENT/ERRATIC/HIGH
DTC P0504	BRAKE SWITCH CORRELATION
DTC P0505	IDLE AIR CONTROL (IAC) SYSTEM
DTC P0506	IDLE AIR CONTROL (IAC) SYSTEM RPM LOWER THAN EXPECTED
DTC P0507	IDLE AIR CONTROL (IAC) SYSTEM RPM HIGHER THAN EXPECTED
DTC P050A	COLD START IDLE AIR CONTROL PERFORMANCE
DTC P050B	COLD START IGNITION TIMING PERFORMANCE
DTC P050E	COLD START ENGINE EXHAUST TEMPERATURE OUT OF RANGE
DTC P0511	IDLE AIR CONTROL (IAC) CIRCUIT
DTC P0512	STARTER REQUEST CIRCUIT
DTC P0528	FAN SPEED SENSOR CIRCUIT NO SIGNAL
DTC P052A	COLD START CAMSHAFT POSITION TIMING OVER-ADVANCED (BANK 1)
DTC P052B	COLD START CAMSHAFT POSITION TIMING OVER-RETARDED (BANK 1)
DTC P052C	COLD START CAMSHAFT POSITION TIMING OVER-ADVANCED (BANK 2)
DTC P052D	COLD START CAMSHAFT POSITION TIMING OVER-RETARDED (BANK 2)
DTC P0532	A/C PRESSURE REFRIGERANT SENSOR A CIRCUIT LOW
DTC P0533	A/C REFRIGERANT PRESSURE SENSOR A CIRCUIT HIGH
DTC P0534	A/C REFRIGERANT CHARGE LOSS
DTC P0537	A/C EVAPORATOR TEMPERATURE SENSOR CIRCUIT LOW
DTC P0538	A/C EVAPORATOR TEMPERATURE SENSOR CIRCUIT HIGH
DTC P053A	POSITIVE CRANKCASE VENTILATION (PCV) HEATER CONTROL CIRCUIT / OPEN
DTC P0552	POWER STEERING PRESSURE (PSP) SENSOR/SWITCH CIRCUIT LOW
DTC P0553	POWER STEERING PRESSURE (PSP) SENSOR CIRCUIT HIGH INPUT
DTC P0563	SYSTEM VOLTAGE HIGH
DTC P0571	BRAKE SWITCH A CIRCUIT
DTC P0572	BRAKE SWITCH A CIRCUIT LOW
DTC P0573	BRAKE SWITCH A CIRCUIT HIGH

DTC P0579	CRUISE CONTROL MULTIFUNCTION INPUT A CIRCUIT RANGE / PERFORMANCE
DTC P0581	CRUISE CONTROL MULTIFUNCTION INPUT A CIRCUIT HIGH
DTC P0600	SERIAL COMMUNICATION LINK
DTC P0602	POWERTRAIN CONTROL MODULE (PCM) PROGRAMMING ERROR
DTC P0603	INTERNAL CONTROL MODULE KEEP ALIVE MEMORY (KAM) ERROR
DTC P0604	INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR
DTC P0605	INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR
DTC P0606	CONTROL MODULE PROCESSOR
DTC P0607	CONTROL MODULE PERFORMANCE
DTC P060A	INTERNAL CONTROL MODULE MONITORING PROCESSOR PERFORMANCE
DTC P060B	INTERNAL CONTROL MODULE A/D PROCESSING PERFORMANCE
DTC P060C	INTERNAL CONTROL MODULE MAIN PROCESSOR PERFORMANCE
DTC P060D	INTERNAL CONTROL MODULE ACCELERATOR PEDAL POSITION PERFORMANCE
DTC P0610	CONTROL MODULE VEHICLE OPTIONS ERROR
DTC P061B	INTERNAL CONTROL MODULE TORQUE CALCULATION PERFORMANCE
DTC P061C	INTERNAL CONTROL MODULE ENGINE RPM PERFORMANCE
DTC P061D	INTERNAL CONTROL MODULE ENGINE AIR MASS PERFORMANCE
DTC P061F	INTERNAL CONTROL MODULE THROTTLE ACTUATOR CONTROLLER PERFORMANCE
DTC P0620	GENERATOR CONTROL CIRCUIT
DTC P0622	GENERATOR FIELD TERMINAL CIRCUIT
DTC P0625	GENERATOR FIELD TERMINAL CIRCUIT LOW
DTC P0626	GENERATOR FIELD TERMINAL CIRCUIT HIGH
DTC P062C	INTERNAL CONTROL MODULE VEHICLE SPEED PERFORMANCE
DTC P0642	SENSOR REFERENCE VOLTAGE A CIRCUIT LOW
DTC P0643	SENSOR REFERENCE VOLTAGE A CIRCUIT HIGH
DTC P0645	AIR CONDITIONING CLUTCH RELAY (A/CCR) CONTROL CIRCUIT
DTC P064D	INTERNAL CONTROL MODULE O2 SENSOR PROCESSOR PERFORMANCE - BANK 1
DTC P064E	INTERNAL CONTROL MODULE O2 SENSOR PROCESSOR PERFORMANCE - BANK 2
DTC P0657	ACTUATOR SUPPLY VOLTAGE A CIRCUIT/OPEN
DTC P065B	GENERATOR CONTROL CIRCUIT RANGE/PERFORMANCE
DTC P0660	INTAKE MANIFOLD TUNING VALVE (IMTV) CONTROL CIRCUIT OPEN - BANK 1
DTC P0663	INTAKE MANIFOLD TUNING VALVE (IMTV) CONTROL CIRCUIT OPEN - BANK 2
DTC P0685	ELECTRONIC CONTROL MODULE (ECM)/POWERTRAIN CONTROL MODULE (PCM) POWER RELAY CONTROL CIRCUIT/OPEN
DTC P0689	ELECTRONIC CONTROL MODULE (ECM)/POWERTRAIN CONTROL MODULE

	(PCM) POWER RELAY SENSE CIRCUIT LOW
DTC P0690	ELECTRONIC CONTROL MODULE (ECM)/POWERTRAIN CONTROL MODULE (PCM) POWER RELAY SENSE CIRCUIT HIGH
DTC P0703	BRAKE SWITCH B INPUT CIRCUIT
DTC P0704	CLUTCH SWITCH INPUT CIRCUIT
DTC P0705	TRANSMISSION RANGE SENSOR A CIRCUIT (PRNDL) INPUT
DTC P0707	TRANSMISSION RANGE SENSOR A CIRCUIT LOW
DTC P0708	TRANSMISSION RANGE SENSOR A CIRCUIT HIGH
DTC P071X	TRANSMISSION CODE
DTC P0720	OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT
DTC P0721	OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT RANGE/PERFORMANCE
DTC P0722	OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT NO SIGNAL
DTC P0723	OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT INTERMITTENT
DTC P073X	TRANSMISSION CODE
DTC P074X	TRANSMISSION CODE
DTC P075X	TRANSMISSION CODE
DTC P076X	TRANSMISSION CODE
DTC P077X	TRANSMISSION CODE
DTC P078X	TRANSMISSION CODE
DTC P079X	TRANSMISSION CODE
DTC P0815	UPSHIFT SWITCH CIRCUIT
DTC P0830	CLUTCH PEDAL SWITCH A CIRCUIT
DTC P0833	CLUTCH PEDAL SWITCH B CIRCUIT
DTC P0840	TRANSMISSION FLUID PRESSURE SENSOR/SWITCH A CIRCUIT
DTC P09XX	TRANSMISSION CODE
DTC P1000	ON-BOARD DIAGNOSTIC (OBD) SYSTEMS READINESS TEST NOT COMPLETE
DTC P1001	KEY ON ENGINE RUNNING (KOER) NOT ABLE TO COMPLETE, KOER ABORTED
DTC P1100	MASS AIR FLOW (MAF) SENSOR CIRCUIT INTERMITTENT
DTC P1101	MASS AIR FLOW (MAF) SENSOR OUT OF SELF-TEST RANGE
DTC P1112	INTAKE AIR TEMPERATURE (IAT) CIRCUIT INTERMITTENT
DTC P1114	INTAKE AIR TEMPERATURE 2 (IAT2) CIRCUIT LOW (SUPERCHARGED/TURBOCHARGED ENGINES)
DTC P1115	INTAKE AIR TEMPERATURE 2 (IAT2) CIRCUIT HIGH (SUPERCHARGED/TURBOCHARGED ENGINES)
DTC P1116	ENGINE COOLANT TEMPERATURE (ECT) SENSOR OUT OF SELF-TEST RANGE
DTC P1117	ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT INTERMITTENT
DTC P1120	THROTTLE POSITION SENSOR A OUT OF RANGE LOW (RATCH TOO LOW)
DTC P1124	THROTTLE POSITION SENSOR A OUT OF SELF-TEST RANGE
DTC P1127	EXHAUST TEMPERATURE OUT OF RANGE, O2 SENSOR TESTS NOT COMPLETED

DTC P115E	THROTTLE ACTUATOR CONTROL (TAC) THROTTLE BODY AIR FLOW TRIM AT MAX LIMIT
DTC P117A	ENGINE OIL OVER TEMPERATURE - FORCED LIMITED POWER
DTC P1184	ENGINE OIL TEMPERATURE (EOT) SENSOR OUT OF SELF-TEST RANGE
DTC P1227	WASTEGATE FAILED CLOSED (OVER PRESSURE)
DTC P1228	WASTEGATE FAILED OPEN (UNDER PRESSURE)
DTC P1229	CHARGE AIR COOLER (CAC) PUMP DRIVER
DTC P1233	FUEL PUMP DRIVER MODULE DISABLED OR OFF LINE
DTC P1234	FUEL PUMP DRIVER MODULE DISABLED OR OFF LINE
DTC P1235	FUEL PUMP CONTROL OUT OF RANGE
DTC P1236	FUEL PUMP CONTROL OUT OF RANGE
DTC P1237	FUEL PUMP SECONDARY CIRCUIT
DTC P1238	FUEL PUMP SECONDARY CIRCUIT
DTC P1244	ALTERNATOR LOAD HIGH INPUT
DTC P1245	ALTERNATOR LOAD LOW INPUT
DTC P1246	ALTERNATOR LOAD INPUT
DTC P1260	THEFT DETECTED, VEHICLE IMMOBILIZED
DTC P1270	ENGINE RPM OR VEHICLE SPEED LIMITER REACHED
DTC P1285	CYLINDER HEAD OVER TEMPERATURE CONDITION
DTC P1288	CYLINDER HEAD TEMPERATURE (CHT) SENSOR OUT OF SELF-TEST RANGE
DTC P1289	CYLINDER HEAD TEMPERATURE (CHT) SENSOR CIRCUIT HIGH
DTC P128A	CYLINDER HEAD TEMPERATURE (CHT) SENSOR CIRCUIT INTERMITTENT/ERRATIC
DTC P1290	CYLINDER HEAD TEMPERATURE (CHT) SENSOR CIRCUIT LOW
DTC P1299	CYLINDER HEAD OVER TEMPERATURE PROTECTION ACTIVE
DTC P1336	CRANKSHAFT/CAMSHAFT SENSOR RANGE/PERFORMANCE
DTC P1397	SYSTEM VOLTAGE OUT OF SELF -TEST RANGE
DTC P1405	DIFFERENTIAL PRESSURE FEEDBACK SENSOR UPSTREAM HOSE OFF OR PLUGGED
DTC P1406	DIFFERENTIAL PRESSURE FEEDBACK SENSOR DOWNSTREAM HOSE OFF OR PLUGGED
DTC P1408	EXHAUST GAS RECIRCULATION (EGR) FLOW OUT OF SELF-TEST RANGE (NON-MIL)
DTC P1409	EXHAUST GAS RECIRCULATION (EGR) VACUUM REGULATOR SOLENOID CIRCUIT
DTC P1436	A/C EVAPORATOR AIR TEMPERATURE CIRCUIT LOW
DTC P1437	A/C EVAPORATOR AIR TEMPERATURE CIRCUIT HIGH
DTC P144A	EVAPORATIVE EMISSION SYSTEM PURGE VAPOR LINE RESTRICTED/BLOCKED
DTC P1450	UNABLE TO BLEED UP FUEL TANK VACUUM
DTC P1451	EVAPORATIVE EMISSION SYSTEM VENT CONTROL CIRCUIT
DTC P145E	PCV HEATER CONTROL B CIRCUIT

DTC P1460	WIDE OPEN THROTTLE A/C CUTOUT CIRCUIT
DTC P1461	A/C PRESSURE SENSOR CIRCUIT HIGH
DTC P1462	AIR CONDITIONING PRESSURE (A/CP) SENSOR LOW VOLTAGE DETECTED
DTC P1463	AIR CONDITIONING PRESSURE SENSOR (A/CP) INSUFFICIENT PRESSURE CHANGE
DTC P1464	A/C DEMAND OUT OF SELF-TEST RANGE
DTC P1469	RAPID A/C CYCLING
DTC P1474	FAN CONTROL PRIMARY CIRCUIT
DTC P1477	ADDITIONAL FAN RELAY CIRCUIT
DTC P1479	HIGH FAN CONTROL PRIMARY CIRCUIT
DTC P1489	PCV HEATER CONTROL CIRCUIT
DTC P1500	VEHICLE SPEED SENSOR (VSS)
DTC P1501	VEHICLE SPEED SENSOR (VSS) OUT OF SELF-TEST RANGE
DTC P1502	VEHICLE SPEED SENSOR (VSS) INTERMITTENT
DTC P1504	IDLE AIR CONTROL (IAC) CIRCUIT
DTC P1506	IDLE AIR CONTROL (IAC) OVERSPEED ERROR
DTC P1507	IDLE AIR CONTROL (IAC) UNDER SPEED ERROR
DTC P1512	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 1)
DTC P1513	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 2)
DTC P1516	INTAKE MANIFOLD RUNNER CONTROL (IMRC) INPUT ERROR (BANK 1)
DTC P1517	INTAKE MANIFOLD RUNNER CONTROL (IMRC) INPUT ERROR (BANK 2)
DTC P1518	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN BANK 1
DTC P1519	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED BANK 1
DTC P151A	INTAKE MANIFOLD RUNNER CONTROLLER PERFORMANCE
DTC P1520	INTAKE MANIFOLD RUNNER CONTROL (IMRC) CIRCUIT
DTC P1537	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 1)
DTC P1538	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 2)
DTC P1548	ENGINE AIR FILTER RESTRICTION
DTC P1549	INTAKE MANIFOLD COMMUNICATION CONTROL (IMCC) CIRCUIT (BANK 1)
DTC P1550	POWER STEERING PRESSURE (PSP) SENSOR OUT OF SELF-TEST RANGE
DTC P1572	BRAKE PEDAL SWITCH CIRCUIT
DTC P1575	PEDAL POSITION OUT OF SELF TEST RANGE
DTC P1633	KEEP ALIVE POWER (KAPWR) VOLTAGE TOO LOW
DTC P1635	TIRE/AXLE RATIO OUT OF ACCEPTABLE RANGE
DTC P1636	INDUCTIVE SIGNATURE CHIP COMMUNICATION ERROR
DTC P1639	VEHICLE ID (VID) BLOCK CORRUPTED, NOT PROGRAMMED
DTC P1640	POWERTRAIN DTCS AVAILABLE IN ANOTHER MODULE
DTC P1641	FUEL PUMP PRIMARY CIRCUIT
DTC P1646	LINEAR O2 SENSOR CONTROL CHIP (BANK 1)
DTC P1647	LINEAR O2 SENSOR CONTROL CHIP (BANK 2)
DTC P1650	POWER STEERING PRESSURE (PSP) SWITCH OUT OF SELF-TEST RANGE

DTC P1651	POWER STEERING PRESSURE (PSP) SWITCH INPUT
DTC P1674	CONTROL MODULE SOFTWARE CORRUPTED
DTC P1703	BRAKE SWITCH OUT OF SELF-TEST RANGE
DTC P1705	TRANSMISSION RANGE SENSOR OUT OF SELF-TEST RANGE
DTC P1709	PARK/NEUTRAL POSITION (PNP) SWITCH OUT OF SELF-TEST RANGE
DTC P1729	4X4L SWITCH
DTC P1780	TRANSMISSION CONTROL SWITCH (TCS) OUT OF SELF-TEST RANGE
DTC P1781	4X4L SWITCH OUT OF SELF-TEST RANGE
DTC P17XX	
DTC P18XX	
DTC P1900	OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT INTERMITTENT
DTC P1901	TURBINE SHAFT SPEED (TSS) SENSOR CIRCUIT INTERMITTENT
DTC P2004	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 1)
DTC P2005	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 2)
DTC P2006	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 1)
DTC P2007	INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 2)
DTC P2008	INTAKE MANIFOLD RUNNER CONTROL (IMRC) CIRCUIT OPEN (BANK 1)
DTC P2014	INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT (BANK 1)
DTC P2015	INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT RANGE/PERFORMANCE (BANK 1)
DTC P2019	INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT (BANK 2)
DTC P2020	INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT RANGE/PERFORMANCE (BANK 2)
DTC P2065	FUEL LEVEL SENSOR B CIRCUIT
DTC P2066	FUEL LEVEL SENSOR B CIRCUIT RANGE/PERFORMANCE
DTC P2067	FUEL LEVEL SENSOR B CIRCUIT LOW
DTC P2068	FUEL LEVEL SENSOR B CIRCUIT HIGH
DTC P2070	INTAKE MANIFOLD TUNING VALVE (IMTV) STUCK OPEN BANK 1
DTC P2071	INTAKE MANIFOLD TUNING VALVE (IMTV) STUCK CLOSED BANK 1
DTC P2072	THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - ICE BREAKAGE
DTC P2096	POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1
DTC P2097	POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1
DTC P2098	POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 2
DTC P2099	POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 2
DTC P2100	THROTTLE ACTUATOR CONTROL (TAC) MOTOR CIRCUIT/OPEN
DTC P2101	THROTTLE ACTUATOR CONTROL (TAC) MOTOR RANGE/PERFORMANCE
DTC P2104	THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - FORCED IDLE
DTC P2105	THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - FORCED ENGINE SHUTDOWN
DTC P2107	THROTTLE ACTUATOR CONTROL (TAC) MODULE PROCESSOR
DTC P2110	THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - FORCED LIMITED RPM
DTC P2111	THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - STUCK OPEN

DTC P2112	THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - STUCK CLOSED
DTC P2121	THROTTLE/PEDAL POSITION SENSOR/SWITCH D CIRCUIT RANGE/PERFORMANCE
DTC P2122	THROTTLE/PEDAL POSITION SENSOR/SWITCH D CIRCUIT LOW
DTC P2123	THROTTLE/PEDAL POSITION SENSOR/SWITCH D CIRCUIT HIGH
DTC P2126	THROTTLE/PEDAL POSITION SENSOR/SWITCH E CIRCUIT RANGE/PERFORMANCE
DTC P2127	THROTTLE/PEDAL POSITION SENSOR/SWITCH E CIRCUIT LOW
DTC P2128	THROTTLE/PEDAL POSITION SENSOR/SWITCH E CIRCUIT HIGH
DTC P2131	THROTTLE/PEDAL POSITION SENSOR/SWITCH F CIRCUIT RANGE/PERFORMANCE
DTC P2132	THROTTLE/PEDAL POSITION SENSOR/SWITCH F CIRCUIT LOW
DTC P2133	THROTTLE/PEDAL POSITION SENSOR/SWITCH F CIRCUIT HIGH
DTC P2135	THROTTLE/PEDAL POSITION SENSOR/SWITCH A/B VOLTAGE CORRELATION
DTC P2138	THROTTLE/PEDAL POSITION SENSOR/SWITCH D/E VOLTAGE CORRELATION
DTC P2195	O2 SENSOR SIGNAL BIASED/STUCK LEAN - BANK 1, SENSOR 1
DTC P2196	O2 SENSOR SIGNAL BIASED/STUCK RICH - BANK 1, SENSOR 1
DTC P2197	O2 SENSOR SIGNAL BIASED/STUCK LEAN - BANK 2, SENSOR 1
DTC P2198	O2 SENSOR SIGNAL BIASED/STUCK RICH - BANK 2, SENSOR 1
DTC P2257	SECONDARY AIR INJECTION (AIR) SYSTEM CONTROL A CIRCUIT LOW
DTC P2258	SECONDARY AIR INJECTION (AIR) SYSTEM CONTROL A CIRCUIT HIGH
DTC P2270	O2 SENSOR SIGNAL STUCK LEAN - BANK 1, SENSOR 2
DTC P2271	O2 SENSOR SIGNAL STUCK RICH - BANK 1, SENSOR 2
DTC P2272	O2 SENSOR SIGNAL STUCK LEAN - BANK 2, SENSOR 2
DTC P2273	O2 SENSOR SIGNAL STUCK RICH - BANK 2, SENSOR 2
DTC P2274	O2 SENSOR SIGNAL STUCK LEAN - BANK 1, SENSOR 3
DTC P2275	O2 SENSOR SIGNAL STUCK RICH - BANK 1, SENSOR 3
DTC P2448	SECONDARY AIR INJECTION SYSTEM HIGH AIRFLOW (BANK 1)
DTC P260F	EVAPORATIVE SYSTEM MONITORING PROCESSOR PERFORMANCE
DTC PXXXX	
DTC U0101	LOST COMMUNICATION WITH TRANSAXLE CONTROL MODULE (TCM)
DTC U0121	LOST COMMUNICATION WITH THE ANTILOCK BRAKING SYSTEM (ABS) CONTROL MODULE
DTC U0155	LOST COMMUNICATION WITH INSTRUMENT PANEL CLUSTER CONTROL MODULE
DTC U0300	INTERNAL CONTROL MODULE SOFTWARE INCOMPATIBILITY
DTC U1039	SCP (J1850) INVALID OR MISSING DATA FOR VEHICLE SPEED
DTC UXXXX	NETWORK COMMUNICATION DIAGNOSTIC TROUBLE CODE (DTC)

DTC DIAGNOSIS

P0010 - INTAKE CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1)

P0010 - INTAKE CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1)

Description:	The powertrain control module (PCM) monitors the variable camshaft timing (VCT) circuit to the PCM for high and low voltage. The test fails if the voltage exceeds or falls below a calibrated limit for a calibrated amount of time.		
Possible Causes:	• Open or short in the VCT circuit • Open VPWR circuit • Open or short in the VCT solenoid valve		
Diagnostic Aids:	This DTC is a circuit check. Testing should include the harness and solenoid coil.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HK** .		

P0011 - INTAKE CAMSHAFT POSITION TIMING - OVER-ADVANCED (BANK 1)

P0011 - INTAKE CAMSHAFT POSITION TIMING - OVER-ADVANCED (BANK 1)

Description:	The powertrain control module (PCM) monitors the variable camshaft timing (VCT) position for an over-advanced camshaft timing. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in an advanced position.		
Possible Causes:	• Camshaft timing incorrectly set • Continuous oil flow to the VCT piston chamber • VCT solenoid valve stuck open • Camshaft advance mechanism binding (VCT unit)		
Diagnostic Aids:	This DTC is a functional check of the VCT unit. Diagnose any base engine concerns related to the engine oil pressure or engine timing. Refer to the **ENGINE SYSTEM - GENERAL INFORMATION -- E-SERIES** , Oil Pressure Test, to check the engine oil pressure. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** , Timing Drive Components, to check the engine timing.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST HK** .	refer to **PINPOINT TEST HK** .

P0012 - INTAKE CAMSHAFT POSITION TIMING - OVER-RETARDED (BANK 1)

P0012 - INTAKE CAMSHAFT POSITION TIMING - OVER-RETARDED (BANK 1)

Description:	The powertrain control module (PCM) monitors the variable camshaft timing (VCT) position for over-retarded camshaft timing. The test fails when the camshaft timing exceeds a maximum calibrated value or remains

	in a retarded position.		
Possible Causes:	• Camshaft timing incorrectly set • Continuous oil flow to the VCT piston chamber • VCT solenoid valve stuck open • Camshaft advance mechanism binding (VCT unit)		
Diagnostic Aids:	This DTC is a functional check of the VCT unit. Diagnose any base engine concerns related to the engine oil pressure or engine timing. Refer to the **ENGINE SYSTEM - GENERAL INFORMATION -- E-SERIES** , Oil Pressure Test, to check the engine oil pressure. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** , Timing Drive Components, to check the engine timing.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST HK** .	refer to **PINPOINT TEST HK** .

P0016 - CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION - BANK 1 SENSOR A

P0016 - CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION - BANK 1 SENSOR A

Description:	The powertrain control module (PCM) monitors the variable camshaft timing (VCT) position for a misalignment between the camshaft and crankshaft. The test fails when the misalignment is 1 tooth or greater. This DTC can also be set due to VCT system concerns (oil contamination or VCT solenoid stuck).		
Possible Causes:	• Camshaft timing incorrectly set • VCT solenoid stuck in position • Camshaft advance mechanism binding (VCT unit)		
Diagnostic Aids:	This DTC is a functional check of the VCT unit. Diagnose any base engine concerns related to the engine oil pressure or engine timing. Refer to the **ENGINE SYSTEM - GENERAL INFORMATION -- E-SERIES** , Oil Pressure Test, to check the engine oil pressure. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** , Timing Drive Components, to check the engine timing.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HK** .

P0018 - CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION - BANK 2 SENSOR A

P0018 - CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION - BANK 2 SENSOR A

Description:	See the description for DTC P0016.
Possible Causes:	See the possible causes for DTC P0016.
Diagnostic Aids:	See the diagnostic aids for DTC P0016.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	-	-	refer to **PINPOINT TEST HK** .

P0020 - INTAKE CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 2)

P0020 - INTAKE CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 2)

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0010. See the possible causes for DTC P0010. See the diagnostic aids for DTC P0010.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HK** .		

P0021 - INTAKE CAMSHAFT POSITION TIMING - OVER-ADVANCED (BANK 2)

P0021 - INTAKE CAMSHAFT POSITION TIMING - OVER-ADVANCED (BANK 2)

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0011. See the possible causes for DTC P0011. See the diagnostic aids for DTC P0011.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST HK** .	refer to **PINPOINT TEST HK** .

P0022 - INTAKE CAMSHAFT POSITION TIMING - OVER-RETARDED (BANK 2)

P0022 - INTAKE CAMSHAFT POSITION TIMING - OVER-RETARDED (BANK 2)

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0012. See the possible causes for DTC P0012. See the diagnostic aids for DTC P0012.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST HK** .	refer to **PINPOINT TEST HK** .

P0030 - HO2S HEATER CONTROL CIRCUIT (BANK 1, SENSOR 1)

P0030 - HO2S HEATER CONTROL CIRCUIT (BANK 1, SENSOR 1)

Description:	The powertrain control module (PCM) monitors the heater in the heated oxygen sensor (HO2S) for correct operation. The PCM controls the heater on/off duty cycle to maintain a temperature of 780°C (1,436°F). The test fails when the sensor does not warm up to the required temperature in a

	calibrated amount of time. The test also fails when the PCM is not able to maintain the required temperature after the sensor is warm.		
Possible Causes:	• Open UO2S circuit • Open UO2SGREF circuit • Open UO2SHTR circuit • UO2SHTR circuit short to voltage • Loose connection, and damaged or corroded terminals • Exhaust temperature significantly higher than expected • Damaged universal HO2S		
Diagnostic Aids:	Inspect the connectors for signs of damage, water ingress, or corrosion.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST DZ** .	refer to **PINPOINT TEST DZ** .

P0040 - OXYGEN SENSOR SIGNALS SWAPPED BANK 1 SENSOR 1/BANK 2 SENSOR 1

P0040 - OXYGEN SENSOR SIGNALS SWAPPED BANK 1 SENSOR 1/BANK 2 SENSOR 1

Description:	The heated oxygen sensor (HO2S) monitor determines if the HO2S signal response for a fuel shift corresponds to the correct engine bank. The test fails when there is no response from the HO2S being tested.		
Possible Causes:	• Crossed HO2S harness connectors • Crossed HO2S wiring at the harness connectors • Crossed HO2S wiring at the PCM connectors		
Diagnostic Aids:	Connect the HO2S connector to the correct bank.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Sable PZEV, Taurus PZEV, Taurus X PZEV	-	refer to **PINPOINT TEST DZ** .	-
All others	-	refer to **PINPOINT TEST DW** .	-

P0041 - OXYGEN SENSOR SIGNALS SWAPPED BANK 1 SENSOR 2/BANK 2 SENSOR 2

P0041 - OXYGEN SENSOR SIGNALS SWAPPED BANK 1 SENSOR 2/BANK 2 SENSOR 2

Description:	The heated oxygen sensor (HO2S) monitor determines if the HO2S signal response for a fuel shift corresponds to the correct engine bank. The test fails when there is no response from the HO2S being tested.
Possible Causes:	• Crossed HO2S harness connectors • Crossed HO2S wiring at the harness connectors • Crossed HO2S wiring at the PCM connectors

Diagnostic Aids:	Connect the HO2S connector to the correct bank.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST DW** .	-

P0050 - HO2S HEATER CONTROL CIRCUIT (BANK 2, SENSOR 1)

P0050 - HO2S HEATER CONTROL CIRCUIT (BANK 2, SENSOR 1)

Description:	See the description for DTC P0030.		
Possible Causes:	See the possible causes for DTC P0030.		
Diagnostic Aids:	See the diagnostic aids for DTC P0030.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST DZ** .	refer to **PINPOINT TEST DZ** .

P0053 - HO2S HEATER RESISTANCE (BANK 1, SENSOR 1)

P0053 - HO2S HEATER RESISTANCE (BANK 1, SENSOR 1)

Description:	Heater current requirements too low or high in the heated oxygen sensor (HO2S) heater control circuit.		
Possible Causes:	• VPWR circuit open • HO2S heater circuit open • HO2S heater circuit short in the harness • Damaged HO2S heater		
Diagnostic Aids:	Inspect the connectors for signs of damage, water ingress, or corrosion.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Sable PZEV, Taurus PZEV, Taurus X PZEV	refer to **PINPOINT TEST DZ** .		
All others	refer to **PINPOINT TEST DW** .		

P0054 - HO2S HEATER RESISTANCE (BANK 1, SENSOR 2)

P0054 - HO2S HEATER RESISTANCE (BANK 1, SENSOR 2)

Description:	See the description for DTC P0053.		
Possible Causes:	See the possible causes for DTC P0053.		
Diagnostic Aids:	See the diagnostic aids for DTC P0053.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DW** .		

P0055 - HO2S HEATER RESISTANCE (BANK 1, SENSOR 3)

P0055 - HO2S HEATER RESISTANCE (BANK 1, SENSOR 3)

Description:	See the description for DTC P0053.		
Possible Causes:	See the possible causes for DTC P0053.		
Diagnostic Aids:	See the diagnostic aids for DTC P0053.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DW** .		

P0059 - HO2S HEATER RESISTANCE (BANK 2, SENSOR 1)

P0059 - HO2S HEATER RESISTANCE (BANK 2, SENSOR 1)

Description:	See the description for DTC P0053.		
Possible Causes:	See the possible causes for DTC P0053.		
Diagnostic Aids:	See the diagnostic aids for DTC P0053.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Sable PZEV, Taurus PZEV, Taurus X PZEV	refer to **PINPOINT TEST DZ** .		
All others	refer to **PINPOINT TEST DW** .		

P0060 - HO2S HEATER RESISTANCE (BANK 2, SENSOR 2)

P0060 - HO2S HEATER RESISTANCE (BANK 2, SENSOR 2)

Description:	See the description for DTC P0053.		
Possible Causes:	See the possible causes for DTC P0053.		
Diagnostic Aids:	See the diagnostic aids for DTC P0053.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DW** .		

P0068 - MANIFOLD ABSOLUTE PRESSURE (MAP)/MASS AIR FLOW (MAF) - THROTTLE POSITION CORRELATION

P0068 - MANIFOLD ABSOLUTE PRESSURE (MAP)/MASS AIR FLOW (MAF) - THROTTLE POSITION CORRELATION

Description:	The powertrain control module (PCM) monitors a vehicle operation rationality check by comparing sensed throttle position to mass air flow readings. If during a key on engine running (KOER) self-test, the comparison of the throttle position (TP) sensor and MAF sensor readings are not consistent with the calibrated load values, the test fails and a DTC is stored in continuous memory.

Possible Causes:	• Air leak between MAF sensor and throttle body • Damaged MAF sensor • TP sensor not seated correctly • Damaged TP sensor		
Diagnostic Aids:	Diagnose any MAF or TP circuit DTCs first. Drive the vehicle and exercise the throttle and the TP sensor in all gears. A TP PID less than 4.82% (0.24 volt) with a LOAD PID greater than 55%, or a TP PID greater than 49.05% (2.44 volts) with a LOAD PID less than 30% indicates a concern is present.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles With Electronic Throttle Control (ETC)	-	refer to **PINPOINT TEST DV** .	refer to **PINPOINT TEST DV** .
All others	-	refer to **PINPOINT TEST DH** .	refer to **PINPOINT TEST DH** .

P0097 - INTAKE AIR TEMPERATURE SENSOR 2 CIRCUIT LOW

P0097 - INTAKE AIR TEMPERATURE SENSOR 2 CIRCUIT LOW

Description:	Indicates the sensor signal is less than the self-test minimum. The intake air temperature 2 (IAT2) sensor minimum is 0.2 volt.		
Possible Causes:	• Grounded circuit in the harness • Incorrect harness connection • Damaged sensor		
Diagnostic Aids:	Monitor the IAT2 PID value. A typical IAT2 temperature should be greater than the IAT1 temperature.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DU** .		

P0098 - INTAKE AIR TEMPERATURE SENSOR 2 CIRCUIT HIGH

P0098 - INTAKE AIR TEMPERATURE SENSOR 2 CIRCUIT HIGH

Description:	Indicates the sensor signal is greater than the self-test maximum. The intake air temperature 2 (IAT2) sensor maximum is 4.6 volts.		
Possible Causes:	• Open circuit in the harness • Sensor signal short to voltage • Incorrect harness connection • Damaged sensor		
Diagnostic Aids:	Monitor the IAT2 PID value. A typical IAT2 temperature should be greater than the IAT1 temperature.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**

All		refer to **PINPOINT TEST DU** .

P0102 - MASS OR VOLUME AIR FLOW A CIRCUIT LOW

P0102 - MASS OR VOLUME AIR FLOW A CIRCUIT LOW

Description:	The mass air flow (MAF) sensor circuit is monitored by the powertrain control module (PCM) for low air flow (or voltage) input through the comprehensive component monitor (CCM). If during key on, engine running (KOER) the air flow (or voltage) changes below a minimum calibrated limit, the test fails.		
Possible Causes:	• MAF sensor disconnected • MAF circuit open to PCM • VPWR open to MAF sensor • PWR GND open to the MAF sensor • MAF RTN circuit open to PCM • MAF circuit shorted to GND • Intake air leak (near the MAF sensor) • A closed throttle indication (throttle position [TP] sensor system) • Damaged MAF sensor		
Diagnostic Aids:	A MAF PID reading less than 0.23 volt in continuous memory or KOER indicates a hard fault.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST DC** .	refer to **PINPOINT TEST DC** .

P0103 - MASS OR VOLUME AIR FLOW A CIRCUIT HIGH

P0103 - MASS OR VOLUME AIR FLOW A CIRCUIT HIGH

Description:	The mass air flow (MAF) sensor circuit is monitored by the powertrain control module (PCM) for high air flow (or voltage) input through the comprehensive component monitor (CCM). If during key on, engine off (KOEO), or key on, engine running (KOER), the air flow (or voltage) changes above a maximum calibrated limit, the test fails.		
Possible Causes:	• MAF sensor screen is blocked • MAF circuit shorted to voltage • Damaged MAF sensor		
Diagnostic Aids:	A MAF PID (MAF PID) reading greater than 4.6 volts during KOER indicates a hard fault.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DC** .		

P0104 - MASS OR VOLUME AIR FLOW A CIRCUIT INTERMITTENT/ERRATIC

P0104 - MASS OR VOLUME AIR FLOW A CIRCUIT INTERMITTENT/ERRATIC

Description:	A concern exists in the mass air flow (MAF) sensor A circuit, or the air tube containing the sensor, causing an incorrect air flow reading.		
Possible Causes:	• Intermittent circuit A open or short • Air leaks in the tube from the MAF to the throttle body		
Diagnostic Aids:	Verify the integrity of the MAF sensor circuit A for an intermittent concern. Check the MAF sensor tube for air leaks.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST DC** .	refer to **PINPOINT TEST DC** .

P0106 - MANIFOLD ABSOLUTE PRESSURE (MAP/BARO) SENSOR RANGE/PERFORMANCE

P0106 - MANIFOLD ABSOLUTE PRESSURE (MAP/BARO) SENSOR RANGE/PERFORMANCE

Description:	MAP sensor input to the powertrain control module (PCM) is monitored and is not within the calibrated value.		
Possible Causes:	• Slow responding MAP sensor • Electrical circuit failure • Damaged MAP sensor		
Diagnostic Aids:	The VREF voltage should be between 4.0 and 6.0 volts.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DM** .		

P0107 - MANIFOLD ABSOLUTE PRESSURE (MAP)/BAROMETRIC PRESSURE (BARO) SENSOR LOW

P0107 - MANIFOLD ABSOLUTE PRESSURE (MAP)/BAROMETRIC PRESSURE (BARO) SENSOR LOW

Description:	MAP sensor operating voltage is below the minimum calibrated parameter of 0.25 volts.		
Possible Causes:	• Open in the circuit, or short to ground • VREF circuit open, or short to ground • Damaged MAP sensor		
Diagnostic Aids:	The VREF voltage should be between 4.0 and 6.0 volts.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DM** .		

P0108 - MANIFOLD ABSOLUTE PRESSURE (MAP)/BAROMETRIC PRESSURE (BARO) SENSOR

HIGH

P0108 - MANIFOLD ABSOLUTE PRESSURE (MAP)/BAROMETRIC PRESSURE (BARO) SENSOR HIGH

Description:	Sensor operating voltage is greater than 5 volts (VREF). As a result it failed above the maximum allowable calibrated parameter.
Possible Causes:	• VREF shorted to VPWR • MAP signal shorted to VPWR • VREF should be less than 6.0 volts • Open circuit
Diagnostic Aids:	The VREF voltage should be between 4.0 and 6.0 volts.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DM** .		

P0109 - MANIFOLD ABSOLUTE PRESSURE (MAP)/BAROMETRIC PRESSURE (BARO) SENSOR INTERMITTENT

P0109 - MANIFOLD ABSOLUTE PRESSURE (MAP)/BAROMETRIC PRESSURE (BARO) SENSOR INTERMITTENT

Description:	The sensor signal to the powertrain control module (PCM) is failing intermittently.
Possible Causes:	• Loose electrical connection • Damaged MAP sensor
Diagnostic Aids:	Check the harness and connection.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DM** .	-	-

P0111 - INTAKE AIR TEMPERATURE (IAT) SENSOR 1 CIRCUIT RANGE/PERFORMANCE

P0111 - INTAKE AIR TEMPERATURE (IAT) SENSOR 1 CIRCUIT RANGE/PERFORMANCE

Description:	Indicates the IAT rationality test has failed. This DTC indicates that the IAT value is higher than a calibrated value and could prevent 1 or more on-board diagnostic (OBD) monitors from completing. The PCM runs this logic after an engine off and a calibrated soak period (typically 6 hours). This soak period allows IAT and engine coolant temperature (CHT or ECT) to stabilize and not differ by more than a calibrated value. DTC P0111 is set when: the IAT at engine start exceeds the ECT or CHT by more than a calibrated value, typically 17°C (30°F).
Possible Causes:	• IAT Sensor
	Make sure the IAT and the CHT or ECT are similar when the engine is

Diagnostic Aids:	cold.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DA** .		

P0112 - INTAKE AIR TEMPERATURE (IAT) SENSOR 1 CIRCUIT LOW

P0112 - INTAKE AIR TEMPERATURE (IAT) SENSOR 1 CIRCUIT LOW

Description:	Indicates the sensor signal is less than the self-test minimum. The IAT sensor minimum is 0.2 volt or 121°C (250°F).		
Possible Causes:	• Grounded circuit in the harness • Damaged sensor • Incorrect harness connection		
Diagnostic Aids:	An IAT V PID reading less than 0.2 volt with key ON engine OFF or during any engine operating mode indicates a concern is present.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DA** .		

P0113 - INTAKE AIR TEMPERATURE (IAT) SENSOR 1 CIRCUIT HIGH

P0113 - INTAKE AIR TEMPERATURE (IAT) SENSOR 1 CIRCUIT HIGH

Description:	Indicates the sensor signal is greater than the self-test maximum. The IAT sensor maximum is 4.6 volts or -50°C (-58°F).		
Possible Causes:	• Open circuit in the harness • Sensor signal short to voltage • Damaged sensor • Incorrect harness connection		
Diagnostic Aids:	An IAT PID reading greater than 4.6 volts with the key ON engine OFF or during any engine operating mode indicates a concern is present.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DA** .		

P0114 - INTAKE AIR TEMPERATURE (IAT) SENSOR 1 INTERMITTENT/ERRATIC

P0114 - INTAKE AIR TEMPERATURE (IAT) SENSOR 1 INTERMITTENT/ERRATIC

Description:	Indicates the sensor signal was intermittent during the comprehensive component monitor (CCM).
Possible Causes:	• Damaged harness • Damaged sensor • Damaged harness connector

Diagnostic Aids:	Monitor the IAT on a scan tool. Look for sudden changes in the reading when the harness is wiggled or the sensor is tapped.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DA** .		

P0116 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT RANGE/PERFORMANCE

P0116 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT RANGE/PERFORMANCE

Description:	Indicates the engine coolant temperature rationality test has failed. This DTC indicates that the ECT or cylinder head temperature (CHT) value is higher than the calibrated value and could prevent 1 or more on-board diagnostic (OBD) monitors from completing. The PCM runs this logic after an engine off and a calibrated soak period (typically 6 hours). This soak period allows the intake air temperature (IAT) and the CHT or ECT to stabilize and not differ by more than a calibrated value. DTC P0116 is set when all of the following conditions are met: The ECT at engine start exceeds the IAT at engine start by more than a calibrated value, typically 17°C (30°F). The ECT exceeds a calibrated value, typically 107°C (225°F). The fuel system, heated oxygen and misfire monitors have not completed. The calibrated time to set DTC P0116 has expired.		
Possible Causes:	• ECT or CHT sensor • Coolant system concern		
Diagnostic Aids:	Make sure the IAT and the ECT are similar when the engine is cold. Also make sure the ECT or CHT sensor and the actual engine operating temperatures are the same.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles with only a CHT sensor	-	-	refer to **PINPOINT TEST DL** .
All others	-	-	refer to **PINPOINT TEST DX** .

P0117 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT LOW

P0117 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT LOW

Description:	Indicates the sensor signal is less than the self-test minimum. The ECT sensor minimum is 0.2 volt or 121°C (250°F).
Possible Causes:	• Grounded circuit in the harness • Damaged sensor

	• Incorrect harness connection			
Diagnostic Aids:	A concern is present if an ECT PID reading less than 0.2 volt with the key ON engine OFF or during any engine operating mode.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		refer to **PINPOINT TEST DX** .		

P0118 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT HIGH

P0118 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT HIGH

Description:	Indicates the sensor signal is greater than the self-test maximum. The ECT sensor maximum is 4.6 volts or -50°C (-58°F).			
Possible Causes:	• Open circuit in the harness • Sensor signal short to voltage • Incorrect harness connection • Damaged sensor			
Diagnostic Aids:	An ECT PID reading greater than 4.6 volts with the key ON engine OFF or during any engine operating mode indicates a concern is present.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		refer to **PINPOINT TEST DX** .		

P0119 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT INTERMITTENT/ERRATIC

P0119 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1 CIRCUIT INTERMITTENT/ERRATIC

Description:	Indicates the ECT circuit became intermittently open or shorted while the engine was running. On vehicles that are not equipped with an ECT sensor, the cylinder head temperature (CHT) sensor can be used and can set this DTC.			
Possible Causes:	• Damaged harness • Damaged sensor • Damaged harness connector • Low engine coolant			
Diagnostic Aids:	Monitor the ECT or the CHT on a scan tool, look for sudden changes in the reading when the harness is wiggled or the sensor is tapped.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles with only a CHT sensor		-	-	refer to **PINPOINT TEST DL** .
All others		-	-	refer to **PINPOINT TEST DX** .

P0121 - THROTTLE/PEDAL POSITION SENSOR A CIRCUIT RANGE/PERFORMANCE

P0121 - THROTTLE/PEDAL POSITION SENSOR A CIRCUIT RANGE/PERFORMANCE

<table>
<tr><th colspan="4">For Vehicles With Electronic Throttle Control (ETC)</th></tr>
<tr><td>Description:</td><td colspan="3">The electronic throttle control (ETC) throttle position (TP) sensor 1 circuit was flagged as a concern by the powertrain control module (PCM) indicating an out of range in either the closed or wide open throttle (WOT) modes.</td></tr>
<tr><td>Possible Causes:</td><td colspan="3">Obstruction in the throttle plate movement
Damaged throttle body
TP circuit open to PCM
Damaged TP sensor
SIG RTN circuit open to the TP sensor
Self-test operator error (foot resting on the accelerator pedal during test)</td></tr>
<tr><td>Diagnostic Aids:</td><td colspan="3">This concern exhibits a symptom of limited power.</td></tr>
<tr><th colspan="4">For All Others</th></tr>
<tr><td>Description:</td><td colspan="3">The throttle position (TP) sensor circuit is monitored by the powertrain control module (PCM) for a non-closed throttle position at idle. The test fails if the key on engine running (KOER) self-test terminates upon placing the transmission gear selector in DRIVE or REVERSE or the TP closed throttle position is not achieved when closing the throttle (idle) after opening it (in PARK or NEUTRAL).</td></tr>
<tr><td>Possible Causes:</td><td colspan="3">Binding throttle linkage
Damaged throttle body
TP circuit open to PCM
Damaged TP sensor
SIG RTN circuit open to the TP sensor</td></tr>
<tr><td>Diagnostic Aids:</td><td colspan="3">Drive the vehicle, bring it to a stop, and turn the key to the OFF position. Start the vehicle, and run the KOER self-test at idle.</td></tr>
<tr><th>Application</th><th>Key On Engine Off</th><th>Key On Engine Running</th><th>Continuous Memory</th></tr>
<tr><td>Vehicles With Electronic Throttle Control (ETC)</td><td colspan="3">refer to <u>PINPOINT TEST DV</u> .</td></tr>
<tr><td>All others</td><td colspan="3">refer to <u>PINPOINT TEST DH</u> .</td></tr>
</table>

P0122 - THROTTLE/PEDAL POSITION SENSOR A CIRCUIT LOW

P0122 - THROTTLE/PEDAL POSITION SENSOR A CIRCUIT LOW

<table>
<tr><th colspan="2">For Vehicles With Electronic Throttle Control (ETC)</th></tr>
<tr><td>Description:</td><td>The ETC throttle position (TP) sensor 1 circuit was flagged as a concern by the powertrain control module (PCM) indicating a low voltage or open circuit.</td></tr>
</table>

Possible Causes:	• Open ETC TP sensor harness • Short to ground in the ETC TP sensor harness • Damaged TP sensor • SIG RTN circuit open to the TP sensor
Diagnostic Aids:	This concern exhibits a symptom of limited power. A TP1 PID reading less than 0.25 volt in key ON, engine OFF or key ON, engine running indicates a concern is present.
For All Others	
Description:	The TP sensor circuit is monitored by the PCM for a high TP rotation angle (or voltage) input through the comprehensive component monitor (CCM). The test fails if the TP rotation angle (or voltage) changes above the maximum calibrated limit.
Possible Causes:	• TP sensor not seated properly • TP circuit open to PCM • VREF open to TP sensor • TP circuit short to GND • Damaged TP sensor
Diagnostic Aids:	This concern exhibits a symptom of limited power. A TP PID reading less than 3.42% (0.17 volt) in key ON, engine OFF or key ON, engine running indicates a concern is present.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles With Electronic Throttle Control (ETC)	refer to **PINPOINT TEST DV** .		
All others	refer to **PINPOINT TEST DH** .		

P0123 - THROTTLE/PEDAL POSITION SENSOR A CIRCUIT HIGH

P0123 - THROTTLE/PEDAL POSITION SENSOR A CIRCUIT HIGH

For Vehicles With Electronic Throttle Control (ETC)	
Description:	The ETC throttle position (TP) sensor 1 circuit was flagged as a concern by the powertrain control module (PCM) indicating a high voltage.
Possible Causes:	• TP sensor harness short to VREF • TP sensor harness is short to voltage • Damaged TP sensor • VREF circuit short to TP sensor
Diagnostic Aids:	Drive the vehicle, bring it to a stop, and turn the key to the OFF position. Start the vehicle and carry out the key on engine running (KOER) self-test at idle. Access the KOER DTCs on the scan tool. The TP1 signal is normally at a high voltage at closed throttle, and a lower voltage at wide open throttle (WOT) (opposite of TP2). A TP1 PID reading greater than 4.75 volts in key ON, engine OFF or key ON, engine running indicates a

	concern is present.
For All Others	
Description:	The TP sensor circuit is monitored by the PCM for a high TP rotation angle (or voltage) input through the comprehensive component monitor (CCM). The test fails if the TP rotation angle (or voltage) changes above the maximum calibrated limit.
Possible Causes:	• TP sensor not seated properly • TP sensor harness is short to voltage • TP sensor harness short to VREF • SIG RTN circuit open to the TP sensor • Damaged TP sensor
Diagnostic Aids:	A TP PID reading greater than 93% (4.65 volts) in key ON, engine OFF or key ON, engine running indicates a concern is present.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
Vehicles With Electronic Throttle Control (ETC)	refer to **PINPOINT TEST DV** .		
All others	refer to **PINPOINT TEST DH** .		

P0125 - INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

P0125 - INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

Description:	Indicates the engine coolant temperature (ECT) or the cylinder heat temperature (CHT) sensor has not achieved the required temperature level to enter closed loop operating conditions within a specified amount of time after starting the engine.
Possible Causes:	• Insufficient warm up time • Low engine coolant level • Leaking or stuck open thermostat • Malfunctioning ECT sensor • Malfunctioning CHT sensor
Diagnostic Aids:	Compare the thermostat specification to the actual ECT using the engine temperature PID (ECT or CHT). The temperature reading should be similar when the engine is at a normal operating temperature.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
Vehicles with only a CHT sensor	-	-	refer to **PINPOINT TEST DL** .
All others	-	-	refer to **PINPOINT TEST DX** .

P0127 - INTAKE AIR TEMPERATURE (IAT) TOO HIGH

P0127 - INTAKE AIR TEMPERATURE (IAT) TOO HIGH

Description:	Indicates that the IAT2 sensor has detected a concern in the charge air cooler CAC system.		
Possible Causes:	• Blockage of heat exchangers • Low fluid level • Fluid leakage • CAC pump or relay failure • Crossed CAC coolant lines		
Diagnostic Aids:	Monitor the IAT2 PID. A typical IAT2 temperature should be greater than the IAT1 temperature.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DU** .		

P0128 - COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

P0128 - COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

Description:	Indicates that the thermostat monitor has not achieved the required engine operating temperature within a specified amount of time after starting the engine.		
Possible Causes:	• Insufficient warm up time • Low engine coolant level • Leaking or stuck open thermostat • Inoperative engine coolant temperature (ECT) sensor • Inoperative cylinder head temperature (CHT) sensor		
Diagnostic Aids:	Refer to**THERMOSTAT MONITOR** for system information.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles with only a CHT sensor	-	-	refer to **PINPOINT TEST DL** .
All others	-	-	refer to **PINPOINT TEST DX** .

P012B - TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE

P012B - TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE

Description:	Manifold absolute pressure (MAP) sensor input to the powertrain control module (PCM) is monitored and is not within the calibrated value.
	• Slow responding MAP sensor

Possible Causes:	• Electrical circuit failure • Damaged MAP sensor		
Diagnostic Aids:	The VREF voltage should be between 4.0 and 6.0 volts.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DM** .		

P012C - TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT LOW

P012C - TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT LOW

Description:	MAP sensor operating voltage is below the minimum calibrated parameter of 0.25 volts.		
Possible Causes:	• Open in the circuit, or short to ground • VREF circuit open, or short to ground • Damaged MAP sensor		
Diagnostic Aids:	VREF voltage should be between 4.0 and 6.0 volts.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DM** .		

P012D - TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT HIGH

P012D - TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT HIGH

Description:	Manifold absolute pressure (MAP) sensor operating voltage is above the maximum calibrated parameter of 5 volts.		
Possible Causes:	• VREF shorted to VPWR • MAP signal shorted to VPWR • VREF circuit short to voltage • Open circuit		
Diagnostic Aids:	VREF should be greater than 4.0 volts.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DM** .		

P012E - TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT INTERMITTENT/ERRATIC

P012E - TURBOCHARGER/SUPERCHARGER INLET PRESSURE SENSOR CIRCUIT INTERMITTENT/ERRATIC

Description:	The sensor signal to the powertrain control module (PCM) is intermittent.
Possible Causes:	• Loose electrical connection • Damaged manifold absolute pressure (MAP) sensor

Diagnostic Aids:	Check the harness and connection.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DM** .	-	-

P0130 - O2 CIRCUIT (BANK 1, SENSOR 1)

P0130 - O2 CIRCUIT (BANK 1, SENSOR 1)

Description:	The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) for a circuit concern. The test fails when the PCM detects a concern with one of the circuits used to determine the oxygen content in the exhaust gas.		
Possible Causes:	• Open UO2S circuit • Open UO2SGREF circuit • UO2S circuit short to voltage or ground • UO2SGREF circuit short to voltage or ground • UO2SPC circuit short to voltage or ground • UO2SPCT circuit short to voltage or ground • Damaged universal HO2S		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST DZ** .	refer to **PINPOINT TEST DZ** .

P0132 - O2 CIRCUIT HIGH VOLTAGE (BANK 1, SENSOR 1)

P0132 - O2 CIRCUIT HIGH VOLTAGE (BANK 1, SENSOR 1)

Description:	The heated oxygen sensor (HO2S) signals are monitored for an over voltage condition. The code is set when the HO2S signal voltage is 1.5 volts or greater.		
Possible Causes:	• Short to VPWR in the harness or HO2S		
Diagnostic Aids:	An HO2S PID switching across 0.45 volt from 0.2 to 0.9 volt indicates a normal switching HO2S. An HO2S PID voltage of 1.5 volts or greater indicates a short to voltage.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DW** .		

P0133 - O2 CIRCUIT SLOW RESPONSE (BANK 1, SENSOR 1)

P0133 - O2 CIRCUIT SLOW RESPONSE (BANK 1, SENSOR 1)

Description:	For the Taurus, Taurus X, Sable PZEVs, the powertrain control module (PCM) commands an air/fuel ratio that changes in the shape of a square wave. The PCM calculates the length of the resulting signal from the HO2S. The test fails when the length of the signal is less than a calibrated limit. For all others, the PCM checks the HO2S signal frequency and amplitude. The test fails when the frequency and amplitude less than a calibrated limit.			
Possible Causes:	• Contaminated HO2S • Exhaust leaks • Short/open wiring • Incorrect fueling • MAF sensor • Deteriorating HO2S • Inlet air leaks			
Diagnostic Aids:	Access the HO2S test results from the generic OBD menu to verify the DTC.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Sable PZEV, Taurus PZEV, Taurus X PZEV		-	-	refer to **PINPOINT TEST DZ** .
All others		-	-	refer to **PINPOINT TEST DW** .

P0134 - O2 CIRCUIT NO ACTIVITY DETECTED (BANK 1, SENSOR 1)

P0134 - O2 CIRCUIT NO ACTIVITY DETECTED (BANK 1, SENSOR 1)

Description:	The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) for a lack of movement concern. If the sensor signal value is not changing from the default value, the PCM commands an oscillating air/fuel ratio attempting to detect some movement in the signal value. The test fails when the PCM is unable to detect movement in the sensor signal while the air/fuel ratio is oscillating.			
Possible Causes:	• Open UO2SPC circuit • Damaged universal HO2S			
Diagnostic Aids:				
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		-	refer to **PINPOINT TEST DZ** .	refer to **PINPOINT TEST DZ** .

P0135 - O2 HEATER CIRCUIT (BANK 1, SENSOR 1)

P0135 - O2 HEATER CIRCUIT (BANK 1, SENSOR 1)

Description:	During testing the heated oxygen sensor (HO2S) heaters are checked for open and short circuits and excessive current draw. The test fails when the current draw exceeds a calibrated limit or an open or short circuit is detected.		
Possible Causes:	• Vacuum hose disconnected on exhaust gas recirculation (EGR) system module (ESM) applications • Short to VPWR in the harness or HO2S • Water in the harness connector • Open VPWR circuit • Open UO2SHTR circuit • Open GND circuit • Low battery voltage • Corrosion or incorrect harness connections • Damaged HO2S heater		
Diagnostic Aids:	Inspect the connectors for signs of damage, water ingress, or corrosion.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Sable PZEV, Taurus PZEV, Taurus X PZEV	refer to **PINPOINT TEST DZ** .		
All others	refer to **PINPOINT TEST DW** .		

P0138 - O2 CIRCUIT HIGH VOLTAGE (BANK 1, SENSOR 2)

P0138 - O2 CIRCUIT HIGH VOLTAGE (BANK 1, SENSOR 2)

Description:	See the description for DTC P0132.		
Possible Causes:	See the possible causes for DTC P0132.		
Diagnostic Aids:	See the diagnostic aids for DTC P0132.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DW** .		

P0139 - O2 CIRCUIT SLOW RESPONSE (BANK 1, SENSOR 2)

P0139 - O2 CIRCUIT SLOW RESPONSE (BANK 1, SENSOR 2)

Description:	The heated oxygen sensor (HO2S) monitor tracks the rate of voltage change during the rise and fall of the HO2S signal. When the rate of voltage change is less than a calibrated value, the powertrain control module (PCM) begins to modify the fuel trim attempting to increase the HO2S voltage switch rate. The DTC is set when the PCM is at the allowable limit or has exceeded an allowable length of time for fuel trim modification, without detecting an acceptable rate of voltage change.

Possible Causes:	• Contaminated or damaged HO2S • Deteriorating HO2S • Exhaust leaks • Aftermarket accessories • Performance modifications		
Diagnostic Aids:	Access the HO2S test results from the generic OBD menu to verify the DTC.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST DW** .

P0141 - O2 HEATER CIRCUIT (BANK 1, SENSOR 2)

P0141 - O2 HEATER CIRCUIT (BANK 1, SENSOR 2)

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0135. See the possible causes for DTC P0135. See the diagnostic aids for DTC P0135.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DW** .		

P0144 - O2 CIRCUIT HIGH VOLTAGE (BANK 1, SENSOR 3)

P0144 - O2 CIRCUIT HIGH VOLTAGE (BANK 1, SENSOR 3)

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0132. See the possible causes for DTC P0132. See the diagnostic aids for DTC P0132.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DW** .		

P0147 - O2 HEATER CIRCUIT (BANK 1, SENSOR 3)

P0147 - O2 HEATER CIRCUIT (BANK 1, SENSOR 3)

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0135. See the possible causes for DTC P0135. See the diagnostic aids for DTC P0135.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DW** .		

P0148 - FUEL DELIVERY ERROR

P0148 - FUEL DELIVERY ERROR

Description:	At least 1 bank is lean at wide open throttle (WOT).		
Possible Causes:	• Severely restricted fuel filter • Severely restricted fuel supply line • Damaged or worn fuel pump • Damaged or contaminated mass air flow (MAF) sensor		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HC** .

P0150 - O2 CIRCUIT (BANK 2, SENSOR 1)

P0150 - O2 CIRCUIT (BANK 2, SENSOR 1)

Description:	See the description for DTC P0130.		
Possible Causes:	See the possible causes for DTC P0130.		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST DZ** .	refer to **PINPOINT TEST DZ** .

P0152 - O2 CIRCUIT HIGH VOLTAGE (BANK 2, SENSOR 1)

P0152 - O2 CIRCUIT HIGH VOLTAGE (BANK 2, SENSOR 1)

Description:	See the description for DTC P0132.		
Possible Causes:	See the possible causes for DTC P0132.		
Diagnostic Aids:	See the diagnostic aids for DTC P0132.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST DW** .	refer to **PINPOINT TEST DW** .

P0153 - O2 CIRCUIT SLOW RESPONSE (BANK 2, SENSOR 1)

P0153 - O2 CIRCUIT SLOW RESPONSE (BANK 2, SENSOR 1)

Description:	See the description for DTC P0133.		
Possible Causes:	See the possible causes for DTC P0133.		
Diagnostic Aids:	See the diagnostic aids for DTC P0133.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Sable PZEV,			refer to **PINPOINT TEST**

Taurus PZEV, Taurus X PZEV		-	-	**DZ** .
All others		-	-	refer to **PINPOINT TEST DW** .

P0154 - O2 CIRCUIT NO ACTIVITY DETECTED (BANK 2, SENSOR 1)

P0154 - O2 CIRCUIT NO ACTIVITY DETECTED (BANK 2, SENSOR 1)

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0134. See the possible causes for DTC P0134.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST DZ** .	refer to **PINPOINT TEST DZ** .

P0155 - O2 HEATER CIRCUIT (BANK 2, SENSOR 1)

P0155 - O2 HEATER CIRCUIT (BANK 2, SENSOR 1)

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0135. See the possible causes for DTC P0135. See the diagnostic aids for DTC P0135.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Sable PZEV, Taurus PZEV, Taurus X PZEV	refer to **PINPOINT TEST DZ** .		
All others	refer to **PINPOINT TEST DW** .		

P0158 - O2 CIRCUIT HIGH VOLTAGE (BANK 2, SENSOR 2)

P0158 - O2 CIRCUIT HIGH VOLTAGE (BANK 2, SENSOR 2)

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0132. See the possible causes for DTC P0132. See the diagnostic aids for DTC P0132.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST DW** .	refer to **PINPOINT TEST DW** .

P0159 - O2 CIRCUIT SLOW RESPONSE (BANK 2, SENSOR 2)

P0159 - O2 CIRCUIT SLOW RESPONSE (BANK 2, SENSOR 2)

Description:	See the description for DTC P0139.

Possible Causes: **Diagnostic Aids:**	See the possible causes for DTC P0139. See the diagnostic aids for DTC P0139.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		-	-	refer to **PINPOINT TEST DW** .

P0161 - O2 HEATER CIRCUIT (BANK 2, SENSOR 2)

P0161 - O2 HEATER CIRCUIT (BANK 2, SENSOR 2)

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0135. See the possible causes for DTC P0135. See the diagnostic aids for DTC P0135.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		refer to **PINPOINT TEST DW** .		

P0171 - SYSTEM TOO LEAN (BANK 1)

P0171 - SYSTEM TOO LEAN (BANK 1)

Description:	The adaptive fuel strategy continuously monitors the fuel delivery hardware. The test fails when the adaptive fuel tables reach a rich calibrated limit. Refer to**POWERTRAIN CONTROL SOFTWARE** Fuel Trim for more information.
Possible Causes:	Fuel System: • Damaged or leaking fuel pulse damper • Fuel filter plugged or dirty • Damaged or worn fuel pump • Leaking fuel pump check valve • Leaking/contaminated fuel injectors • Low fuel pressure or running out of fuel • Evaporative emission (EVAP) canister purge valve is leaking when the canister is clean • Fuel supply line restricted • Fuel rail pressure sensor bias • Ethanol content in the fuel Exhaust System: • Exhaust leaks in the exhaust manifold gasket or mating gaskets before or near the heated oxygen sensor (HO2S)

	EGR System: • Vacuum hose disconnected on exhaust gas recirculation (EGR) system module (ESM) applications • EGR valve tube/gasket leak • EGR vacuum regulator solenoid leak Intake Air System: • Air leaks after the mass air flow (MAF) sensor • Vacuum leaks • Positive crankcase ventilation (PCV) system is leaking or the valve is stuck open • Incorrectly seated engine oil dipstick • Intake air turbulence due to incorrect air filter • Damaged or contaminated MAF sensor
Diagnostic Aids:	View the Freeze Frame Data to determine the operating conditions when the DTC was set. Observe the LONGFT1 and LONGFT2 PIDs. Refer to**ADAPTIVE FUEL DTC DIAGNOSTIC TECHNIQUES** for more information and the appropriate pinpoint test for specific concern identification.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST H** .

P0172 - SYSTEM TOO RICH (BANK 1)

P0172 - SYSTEM TOO RICH (BANK 1)

Description:	The adaptive fuel strategy continuously monitors the fuel delivery hardware. The test fails when the adaptive fuel tables reach a lean calibrated limit. Refer to**POWERTRAIN CONTROL SOFTWARE** Fuel Trim for more information.
Possible Causes:	Fuel System: • Damaged or leaking fuel pulse damper • Leaking fuel injectors • Fuel return line restricted • Fuel rail pressure sensor bias • EVAP canister purge valve is leaking when the canister is full

	Base engine: • Engine oil contamination Intake Air System: • Damaged or contaminated mass air flow (MAF) sensor		
Diagnostic Aids:	View the Freeze Frame Data to determine the operating conditions when the DTC was set. Observe the LONGFT1 and LONGFT2 PIDs. Refer to **ADAPTIVE FUEL DTC DIAGNOSTIC TECHNIQUES** for more information and the appropriate pinpoint test for specific concern identification.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST H** .

P0174 - SYSTEM TOO LEAN (BANK 2)

P0174 - SYSTEM TOO LEAN (BANK 2)

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0171. See the possible causes for DTC P0171. See the diagnostic aids for DTC P0171.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST H** .

P0175 - SYSTEM TOO RICH (BANK 2)

P0175 - SYSTEM TOO RICH (BANK 2)

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0172. See the possible causes for DTC P0172. See the diagnostic aids for DTC P0172.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST H** .

P0180 - FUEL TEMPERATURE SENSOR A CIRCUIT

P0180 - FUEL TEMPERATURE SENSOR A CIRCUIT

	The comprehensive component monitor (CCM) monitors the fuel

Description:	temperature sensor circuit to the powertrain control module (PCM) for low and high voltage. The test fails if the voltage falls below or exceeds a calibrated limit and amount of time during testing.		
Possible Causes:	• Open or short in the harness • Low ambient temperature operation • Incorrect harness connection • Damaged fuel temperature sensor		
Diagnostic Aids:	Verify the FRT PID value to determine an open or short.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DD** .		

P0181 - FUEL TEMPERATURE SENSOR A CIRCUIT RANGE/PERFORMANCE

P0181 - FUEL TEMPERATURE SENSOR A CIRCUIT RANGE/PERFORMANCE

Description:	The comprehensive component monitor (CCM) monitors the fuel temperature sensor for acceptable operating temperature. The test fails if the voltage falls below or exceeds a calibrated limit, for a calibrated amount of time during testing.		
Possible Causes:	• Open or short in the harness • Low ambient temperature operation • Incorrect harness connection • Damaged fuel temperature sensor • Damaged powertrain control module (PCM)		
Diagnostic Aids:	Verify the FRT PID value to determine an open or short.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DD** .	refer to **PINPOINT TEST DD** .	-

P0182 - FUEL TEMPERATURE SENSOR A CIRCUIT LOW

P0182 - FUEL TEMPERATURE SENSOR A CIRCUIT LOW

Description:	The comprehensive component monitor (CCM) monitors the fuel temperature sensor circuit to the powertrain control module (PCM) for low voltage. The test fails if the voltage falls below a calibrated limit for a calibrated amount of time during testing.
Possible Causes:	• Short in the harness • VREF open or short • Low ambient temperature operation • Incorrect harness connection • Damaged fuel temperature sensor

Diagnostic Aids:	Verify the FRT PID and VREF values to determine an open or short.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DD** .		

P0183 - FUEL TEMPERATURE SENSOR A CIRCUIT HIGH

P0183 - FUEL TEMPERATURE SENSOR A CIRCUIT HIGH

Description:	The comprehensive component monitor (CCM) monitors the fuel temperature sensor circuit to the powertrain control module (PCM) for high voltage. The test fails if the voltage exceeds a calibrated limit for a calibrated amount of time during testing.		
Possible Causes:	• Open circuit • Open or short to voltage in the harness • Incorrect harness connection • Damaged fuel temperature sensor		
Diagnostic Aids:	Verify the FRT PID value to determine an open or short.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DD** .		

P0190 - FUEL RAIL PRESSURE SENSOR A CIRCUIT

P0190 - FUEL RAIL PRESSURE SENSOR A CIRCUIT

Description:	The comprehensive component monitor (CCM) monitors the fuel rail pressure (FRP) sensor to the powertrain control module (PCM) for VREF voltage. The test fails when the VREF voltage from the PCM drops to a voltage less than a minimum calibrated value.		
Possible Causes:	• VREF open in harness • VREF open in sensor • Vacuum leaks		
Diagnostic Aids:	Verify a VREF voltage between 4 and 6 volts.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST DD** .

P0191 - FUEL RAIL PRESSURE SENSOR A CIRCUIT RANGE/PERFORMANCE

P0191 - FUEL RAIL PRESSURE SENSOR A CIRCUIT RANGE/PERFORMANCE

Description:	The comprehensive component monitor (CCM) checks the fuel rail pressure (FRP) sensor for an acceptable fuel pressure. The test fails when the fuel pressure falls below or exceeds a minimum/maximum calibrated

Possible Causes:	value for a calibrated period of time. • High fuel pressure • Low fuel pressure • Damaged FRP sensor • Excessive resistance in the circuit • Vacuum leaks • Low or no fuel		
Diagnostic Aids:	A FRP PID value during key ON, engine running of 138 kPa (20 psi) to 413 kPa (60 psi) is acceptable.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DD** .		

P0192 - FUEL RAIL PRESSURE SENSOR A CIRCUIT LOW

P0192 - FUEL RAIL PRESSURE SENSOR A CIRCUIT LOW

Description:	The comprehensive component monitor (CCM) monitors the fuel rail pressure (FRP) sensor circuit to the powertrain control module (PCM) for low voltage. The test fails if the voltage falls below a calibrated limit for a calibrated amount of time during testing.		
Possible Causes:	• FRP signal short to SIG RTN or PWR GND • Damaged FRP sensor		
Diagnostic Aids:	A FRP PID value during key ON, engine OFF or key ON, engine running less than 0.3 volt indicates a concern is present.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DD** .		

P0193 - FUEL RAIL PRESSURE SENSOR A CIRCUIT HIGH

P0193 - FUEL RAIL PRESSURE SENSOR A CIRCUIT HIGH

Description:	The comprehensive component monitor (CCM) monitors the fuel rail pressure (FRP) sensor circuit to the powertrain control module (PCM) for high voltage. The test fails if the voltage exceeds a calibrated limit for a calibrated amount of time during testing.
Possible Causes:	• FRP signal short to VREF or VPWR • FRP signal open • Damaged FRP sensor
Diagnostic Aids:	An FRP signal high condition can be caused by any number of conditions, including a short on FRP signal to VREF, a more positive voltage level, an open FRP signal or signal return. The FRP signal line is pulled up by the PCM and VREF at the sensor, and down by the sensor through SIGRTN.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	refer to **PINPOINT TEST DD** .		

P0196 - ENGINE OIL TEMPERATURE (EOT) SENSOR CIRCUIT RANGE/PERFORMANCE

P0196 - ENGINE OIL TEMPERATURE (EOT) SENSOR CIRCUIT RANGE/PERFORMANCE

Description:	Indicates the value from the EOT sensor is not within the powertrain control module (PCM) predicted engine oil temperature range, based on other PCM inputs.		
Possible Causes:	• Engine not at operating temperature • Cooling system problem or stuck thermostat • EOT circuit failure		
Diagnostic Aids:	The EOT rationality test looks for the EOT sensor value to be within a calibrated delta of the PCM predicted engine oil temperature. Make sure the EOT sensor reading is similar to the engine temperature. If the EOT reading greatly differs from engine temperature, check the EOT circuitry for correct operation.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DY** .		

P0197 - ENGINE OIL TEMPERATURE (EOT) SENSOR CIRCUIT LOW

P0197 - ENGINE OIL TEMPERATURE (EOT) SENSOR CIRCUIT LOW

Description:	Indicates EOT signal voltage is low (high temperature).		
Possible Causes:	• Damaged harness • Damaged harness connector • Damaged sensor		
Diagnostic Aids:	An EOT PID reading less than 0.2 volt with the key on engine off (KOEO) or during any engine operating mode indicates a concern is present.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DY** .		

P0198 - ENGINE OIL TEMPERATURE (EOT) SENSOR CIRCUIT HIGH

P0198 - ENGINE OIL TEMPERATURE (EOT) SENSOR CIRCUIT HIGH

Description:	Indicates EOT signal voltage is high (low temperature).
Possible Causes:	• Damaged harness • Damaged harness connector • Damaged sensor

Diagnostic Aids:	An EOT PID reading greater than 4.5 volts with the key ON engine OFF or during any engine operating mode indicates a concern is present.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DY** .		

P020X - INJECTOR CIRCUIT/OPEN - CYLINDER X

P020X - INJECTOR CIRCUIT/OPEN - CYLINDER X

Description:	Note: x represents injector numbers 1 through 9. The comprehensive component monitor (CCM) monitors the operation of the fuel injector drivers in the powertrain control module (PCM). The test fails when the fuel injector circuitry is inoperative.		
Possible Causes:	• Open circuit • Damaged fuel injector • Damaged PCM		
Diagnostic Aids:	PID Data Monitor INJx_F fault flags equals YES. This DTC is set when a concern is detected between the PCM and the fuel injector.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KG** .		

P0210 - INJECTOR CIRCUIT/OPEN - CYLINDER 10

P0210 - INJECTOR CIRCUIT/OPEN - CYLINDER 10

Description:	See the description for DTC P020x.		
Possible Causes:	See the possible causes for DTC P020x.		
Diagnostic Aids:	See the diagnostic aids for DTC P020x.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KG** .		

P0217 - ENGINE COOLANT OVER-TEMPERATURE CONDITION

P0217 - ENGINE COOLANT OVER-TEMPERATURE CONDITION

Description:	Indicates an engine overheat condition was detected by the engine temperature sensor (CHT or ECT depending how the vehicle is equipped).
Possible Causes:	• Engine cooling system concerns • Low engine coolant level • Base engine concerns
	Monitor the engine temperature PID (CHT or ECT) for an overheat

Diagnostic Aids:	condition. Typical engine temperature should be close to cooling system thermostat specification.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DX** .		

P0218 - TRANSMISSION FLUID TEMPERATURE OVER-TEMPERATURE CONDITION

P0218 - TRANSMISSION FLUID TEMPERATURE OVER-TEMPERATURE CONDITION

Description:	Indicates a transmission overheat condition was sensed by the transmission fluid temperature (TFT) sensor.		
Possible Causes:	• Low transmission fluid level • Transmission cooling system concerns		
Diagnostic Aids:	Monitor the transmission temperature PID TFT for an overheat condition.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P0219 - ENGINE OVER SPEED CONDITION

P0219 - ENGINE OVER SPEED CONDITION

Description:	Indicates the vehicle has been operated in a manner which caused the engine speed to exceed a calibrated limit. The engine RPM is continuously monitored and evaluated by the powertrain control module (PCM). The DTC is set when the RPM exceeds the calibrated limit set within the PCM. For additional information on the engine RPM limiter, refer to**POWERTRAIN CONTROL SOFTWARE** .		
Possible Causes:	• Wheel slippage (water, ice, mud, and snow) • Excessive engine RPM in NEUTRAL or operated in the wrong transmission gear		
Diagnostic Aids:	The DTC indicates the vehicle has been operated in a manner which caused the engine speed to exceed a calibrated limit.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST ND** .

P0221 - THROTTLE/PEDAL POSITION SENSOR/SWITCH B CIRCUIT RANGE/PERFORMANCE

P0221 - THROTTLE/PEDAL POSITION SENSOR/SWITCH B CIRCUIT RANGE/PERFORMANCE

Description:	The electronic throttle control (ETC) throttle position (TP) sensor 2 circuit was flagged as a concern by the powertrain control module (PCM) indicating an out of range in either the closed or wide open throttle

Possible Causes:	(WOT) modes. • Binding throttle linkage • Damaged throttle body • TP circuit open to PCM • Damaged TP sensor • SIG RTN circuit open to the TP sensor • Self-test operator error (foot resting on the accelerator pedal during test)		
Diagnostic Aids:	This concern exhibits a symptom of limited power.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DV** .		

P0222 - THROTTLE/PEDAL POSITION SENSOR/SWITCH B CIRCUIT LOW

P0222 - THROTTLE/PEDAL POSITION SENSOR/SWITCH B CIRCUIT LOW

Description:	The electronic throttle control (ETC) throttle position (TP) sensor 2 circuit was flagged as a concern by the powertrain control module (PCM) indicating a low voltage, or open circuit.		
Possible Causes:	• Open ETC TP sensor harness • Short to ground in the ETC TP sensor harness • Damaged TP sensor • SIG RTN circuit open to the TP sensor		
Diagnostic Aids:	This concern exhibits a symptom of limited power. A TP2 PID reading less than 0.25 volt in key ON, engine OFF or key ON, engine running indicates a concern is present.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DV** .		

P0223 - THROTTLE/PEDAL POSITION SENSOR/SWITCH B CIRCUIT HIGH

P0223 - THROTTLE/PEDAL POSITION SENSOR/SWITCH B CIRCUIT HIGH

Description:	The electronic throttle control (ETC) throttle position (TP) sensor 2 circuit was flagged as a concern by the powertrain control module (PCM) indicating a high voltage.
Possible Causes:	• ETC TP sensor harness shorted to VREF • Damaged TP sensor • ETC TP2 circuit open • VREF circuit short to TP sensor
Diagnostic Aids:	This concern exhibits a symptom of limited power. A TP2 PID reading greater than 4.75 volts in key ON, engine OFF or key ON, engine

	running indicates a concern is present.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DV** .		

P0230 - FUEL PUMP PRIMARY CIRCUIT

P0230 - FUEL PUMP PRIMARY CIRCUIT

Description:	The powertrain control module (PCM) monitors the fuel pump (FP) circuit output from the PCM. The test fails when the FP output is commanded ON (grounded) and excessive current draw is detected on the FP circuit. The test also fails when the FP output is commanded OFF and voltage is not detected on the FP circuit. The PCM expects to detect VPWR voltage coming through the fuel pump relay coil to the FP circuit.		
Possible Causes:	• Open or shorted (FP) circuit • Open VPWR circuit to the fuel pump relay • Damaged fuel pump relay • Damaged PCM		
Diagnostic Aids:	A concern is present when the FP_F PID reads YES. An open circuit or short to ground can only be detected with the fuel pump commanded OFF. A short to voltage can only be detected with the fuel pump commanded ON. During the key on engine off (KOEO) and key on engine running (KOER) self-test, the fuel pump output command is cycled on and off.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KA** .		

P0231 - FUEL PUMP SECONDARY CIRCUIT LOW

P0231 - FUEL PUMP SECONDARY CIRCUIT LOW

Description:	The powertrain control module (PCM) monitors the fuel pump monitor (FPM) circuit. The test fails if the PCM commands the fuel pump ON and B+ voltage is not detected on the FPM circuit.		
Possible Causes:	• Open B+ circuit to the fuel pump relay • Open FP PWR circuit between the fuel pump relay and its connection to the FPM circuit • Damaged fuel pump relay		
Diagnostic Aids:	During the key on engine off (KOEO) self-test, the PCM commands the fuel pump ON so this test can be carried out.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KA** .		

P0232 - FUEL PUMP SECONDARY CIRCUIT HIGH

P0232 - FUEL PUMP SECONDARY CIRCUIT HIGH

Description:	The powertrain control module (PCM) monitors the fuel pump monitor (FPM) circuit. This test fails when the PCM detects voltage on the FPM circuit while the fuel pump is commanded OFF. The FPM circuit is wired to a pull-up voltage inside the PCM. The FPM circuit goes high if, with the key ON, engine OFF and the fuel pump commanded OFF, the FPM/FP PWR circuit loses its path to ground through the fuel pump. The FPM circuit also goes high if the FPM/FP PWR circuit is short to voltage.		
Possible Causes:	• Inertia fuel shutoff (IFS) switch not reset or electrically open • Open circuit between the fuel pump and the FPM connection to the FP PWR circuit • Poor fuel pump ground • Fuel pump electrically open • Fuel pump secondary circuits short to voltage • Fuel pump relay contacts always closed • Open FPM circuit between the PCM and the connection to the FP PWR circuit		
Diagnostic Aids:	Continuous memory P0232 can be set if the IFS switch is tripped then reset, or if the fuel pump circuit is activated when the PCM expected the circuit to be off. This DTC may set during a fuel system test or prime procedure.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KA** .		

P0297 - VEHICLE OVER SPEED CONDITION

P0297 - VEHICLE OVER SPEED CONDITION

Description:	Indicates the vehicle has been operated in a manner which caused the vehicle speed to exceed a calibration limit. The vehicle speed is continuously monitored and evaluated by the powertrain control module (PCM). The DTC is set when the vehicle speed exceeds the calibrated limit set within the PCM. For additional information on the vehicle speed limiter, refer to**POWERTRAIN CONTROL SOFTWARE** .		
Possible Causes:	• Vehicle driven at a high rate of speed		
Diagnostic Aids:	The DTC indicates the vehicle has been operated in a manner which caused the engine speed to exceed a calibrated limit.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST ND** .

P0298 - ENGINE OIL OVER TEMPERATURE CONDITION

P0298 - ENGINE OIL OVER TEMPERATURE CONDITION

Description:	Indicates the engine oil temperature protection strategy in the powertrain control module (PCM) has been activated. This temporarily prohibits high engine speed operation by disabling injectors, to reduce the risk of engine damage from high engine oil temperature. On engines equipped with an oil temperature sensor, the PCM reads oil temperature to determine if it is excessive. When an oil temperature sensor is not present, the PCM uses an oil algorithm to determine actual temperature. Engine shutdown strategy function is the same on vehicles with and without oil temperature sensors.		
Possible Causes:	• Very high engine RPM for an extended period of time • Overheating condition • Damaged engine oil temperature (EOT) sensor or circuit (vehicles with an EOT sensor) • Base engine concerns		
Diagnostic Aids:	The engine is operating in high RPM range due to incorrect gear selection. This may cause a lack/loss of power or surge.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST DY** .

P0300 - RANDOM MISFIRE DETECTED

P0300 - RANDOM MISFIRE DETECTED

Description:	The random misfire DTC indicates multiple cylinders are misfiring or the powertrain control module (PCM) cannot identify which cylinder is misfiring.		
Possible Causes:	• Camshaft position sensor (CMP) • Low fuel (less than 1/8 tank) • Stuck open EGR valve • Blocked EGR passages		
Diagnostic Aids:	One or more EGR passages may be blocked or partially blocked. If this is the case the misfire detection monitor indicates the EGR port to check for possible blockage.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HD** .

P0301 - P0309 - CYLINDER X MISFIRE DETECTED

P030X - CYLINDER X MISFIRE DETECTED

Description:	NOTE: x represents cylinder numbers 1 through 9. The misfire detection monitor is designed to monitor engine misfire and identify the specific cylinder in which the misfire has occurred. Misfire is defined as lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or any other cause.
Possible Causes:	• Ignition system • Fuel injectors • Running out of fuel • EVAP canister purge valve • Fuel pressure • Evaporative emission system • EGR system • Base engine
Diagnostic Aids:	The malfunction indicator lamp (MIL) blinks once per second when a misfire severe enough to cause catalyst damage is detected. If the MIL is on steady state due to a misfire, this indicates the threshold for emissions was exceeded and caused the vehicle to fail an inspection and maintenance tailpipe test.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HD** .

P0310 - CYLINDER 10 MISFIRE DETECTED

P0310 - CYLINDER 10 MISFIRE DETECTED

Description:	See the description for DTC P030x.
Possible Causes:	See the possible causes for DTC P030x.
Diagnostic Aids:	See the diagnostic aids for DTC P030x.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HD** .

P0315 - CRANKSHAFT POSITION SYSTEM VARIATION NOT LEARNED.

P0315 - CRANKSHAFT POSITION SYSTEM VARIATION NOT LEARNED.

Description:	The powertrain control module (PCM) is unable to learn and correct for mechanical inaccuracies in crankshaft pulse wheel tooth spacing. This DTC disables the misfire monitor.
Possible Causes:	• Damaged crankshaft pulse wheel teeth • Damaged crankshaft position (CKP) sensor

Diagnostic Aids:	Requires visual inspection of the CKP sensor and the crankshaft pulse wheel teeth for damage.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HD** .

P0316 - MISFIRE DETECTED ON STARTUP (FIRST 1000 REVOLUTIONS)

P0316 - MISFIRE DETECTED ON STARTUP (FIRST 1000 REVOLUTIONS)

Description:	DTC P0316 is set in addition to any type B misfire DTC which occurs in the first 1,000 revolution test interval following engine start.		
Possible Causes:	• Damaged crankshaft position (CKP) sensor • Ignition system • Fuel injectors • Running out of fuel • Fuel quality • Base engine • Damaged powertrain control module (PCM)		
Diagnostic Aids:	Freeze frame data and the DTC P03xx are also stored, indicating which cylinder the misfire occurred.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HD** .

P0320 - IGNITION/DISTRIBUTOR ENGINE SPEED INPUT CIRCUIT

P0320 - IGNITION/DISTRIBUTOR ENGINE SPEED INPUT CIRCUIT

Description:	The ignition engine speed sensor input signal to powertrain control module (PCM) is continuously monitored. The test fails when the signal indicates that 2 successive erratic profile ignition pickup (PIP) pulses occurred.		
Possible Causes:	• Loose wires/connectors • Arcing secondary ignition components (coil, wires and plugs) • On-board transmitter (2-way radio)		
Diagnostic Aids:	The DTC indicates that 2 successive erratic PIP pulses occurred.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST NC** .

P0325 - KNOCK SENSOR 1 CIRCUIT (BANK 1)

P0325 - KNOCK SENSOR 1 CIRCUIT (BANK 1)

Description:	The KS detects vibrations upon increase and decrease in engine RPM. The knock sensor generates a voltage based on this vibration. A DTC is set if the voltage goes outside a calibrated level.		
Possible Causes:	• KS circuit short to GND • KS sensor circuit short to voltage • KS circuit open • Damaged KS		
Diagnostic Aids:	A knock sensor voltage greater than 0.5 volt with the key ON engine OFF indicates a concern is present.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST DG** .	refer to **PINPOINT TEST DG** .

P0326 - KNOCK SENSOR 1 CIRCUIT RANGE/PERFORMANCE (BANK 1)

P0326 - KNOCK SENSOR 1 CIRCUIT RANGE/PERFORMANCE (BANK 1)

Description:	See the description for DTC P0325.		
Possible Causes:	See the possible causes for DTC P0325.		
Diagnostic Aids:	See the diagnostic aids for DTC P0325.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST DG** .	refer to **PINPOINT TEST DG** .

P0330 - KNOCK SENSOR 2 CIRCUIT (BANK 2)

P0330 - KNOCK SENSOR 2 CIRCUIT (BANK 2)

Description:	See the description for DTC P0325.		
Possible Causes:	See the possible causes for DTC P0325.		
Diagnostic Aids:	See the diagnostic aids for DTC P0325.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST DG** .	refer to **PINPOINT TEST DG** .

P0331 - KNOCK SENSOR 2 CIRCUIT RANGE/PERFORMANCE (BANK 2)

P0331 - KNOCK SENSOR 2 CIRCUIT RANGE/PERFORMANCE (BANK 2)

Description:	See the description for DTC P0325.		
Possible Causes:	See the possible causes for DTC P0325.		
Diagnostic Aids:	See the diagnostic aids for DTC P0325.		

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	-	refer to **PINPOINT TEST DG** .	refer to **PINPOINT TEST DG** .

P0340 - CAMSHAFT POSITION SENSOR A CIRCUIT (BANK 1 OR SINGLE SENSOR)

P0340 - CAMSHAFT POSITION SENSOR A CIRCUIT (BANK 1 OR SINGLE SENSOR)

Description:	The test fails when the powertrain control module (PCM) can no longer detect the signal from the camshaft position (CMP) sensor on bank 1.
Possible Causes:	• CMP circuit open • CMP circuit short to GND • CMP circuit short to voltage • SIG RTN open (VR sensor) • CMP GND open (Hall-effect sensor) • CMP circuit short to CMP2 circuit (if equipped) • CMP incorrectly installed (Hall-effect sensor) • Damaged CMP sensor shielding • Damaged CMP sensor • Damaged PCM
Diagnostic Aids:	Harness routing, harness alterations, incorrect shielding, or electrical interference from other systems may have an intermittent impact on the CMP signal.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	refer to **PINPOINT TEST DR** .		

P0344 - CAMSHAFT POSITION SENSOR A CIRCUIT INTERMITTENT (BANK 1 OR SINGLE SENSOR)

P0344 - CAMSHAFT POSITION SENSOR A CIRCUIT INTERMITTENT (BANK 1 OR SINGLE SENSOR)

Description:	The test fails when the powertrain control module (PCM) detects an intermittent signal from the camshaft position (CMP) sensor.
Possible Causes:	• Intermittent open circuit • Intermittent short circuit • Damaged sensor shielding • Damaged sensor
Diagnostic Aids:	Harness routing, harness alterations, incorrect shielding, or electrical interference from other systems may have an intermittent impact on the CMP signal.

	Key On Engine	Key On Engine	

Application		Off	Running	Continuous Memory
All		-	-	refer to **PINPOINT TEST DR** .

P0345 - CAMSHAFT POSITION SENSOR A CIRCUIT (BANK 2)

P0345 - CAMSHAFT POSITION SENSOR A CIRCUIT (BANK 2)

Description:	The test fails when the powertrain control module (PCM) can no longer detect the signal from the camshaft position (CMP) sensor on bank 2.			
Possible Causes:	See the possible causes for DTC P0340.			
Diagnostic Aids:	See the diagnostic aids for DTC P0340.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		refer to **PINPOINT TEST DR** .		

P0349 - CAMSHAFT POSITION SENSOR A CIRCUIT INTERMITTENT (BANK 2)

P0349 - CAMSHAFT POSITION SENSOR A CIRCUIT INTERMITTENT (BANK 2)

Description:	See the description for DTC P0344.			
Possible Causes:	See the possible causes for DTC P0344.			
Diagnostic Aids:	See the diagnostic aids for DTC P0344.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		-	-	refer to **PINPOINT TEST DR** .

P0350 - IGNITION COIL PRIMARY/SECONDARY CIRCUIT

P0350 - IGNITION COIL PRIMARY/SECONDARY CIRCUIT

Description:	Each ignition primary circuit is continuously monitored. The test fails when the powertrain control module (PCM) does not receive a valid ignition diagnostic monitor (IDM) pulse signal from the ignition module (integrated in the PCM).
Possible Causes:	• Open or short in the ignition START/RUN circuit • Open coil driver circuit • Coil driver circuit short to ground • Damaged coil • Coil driver circuit short to VPWR
Diagnostic Aids:	The PCM may disable the fuel injector for a cylinder that is misfiring to protect the exhaust system catalyst. Use the 12-volt non-powered test lamp to verify START/RUN voltage at the ignition coil harness connector. Check the coil driver circuit for open, short to VPWR, or short to ground.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	refer to **PINPOINT TEST JE** .		

P0351 - IGNITION COIL A PRIMARY/SECONDARY CIRCUIT

P0351 - IGNITION COIL A PRIMARY/SECONDARY CIRCUIT

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0350. See the possible causes for DTC P0350. See the diagnostic aids for DTC P0350.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Coil-on-plug (COP) ignition testing	-	refer to **PINPOINT TEST JF** .	refer to **PINPOINT TEST JF** .
Coil pack ignition testing	-	refer to **PINPOINT TEST JE** .	refer to **PINPOINT TEST JE** .

P0352 - IGNITION COIL B PRIMARY/SECONDARY CIRCUIT

P0352 - IGNITION COIL B PRIMARY/SECONDARY CIRCUIT

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0350. See the possible causes for DTC P0350. See the diagnostic aids for DTC P0350.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Coil-on-plug (COP) ignition testing	-	refer to **PINPOINT TEST JF** .	refer to **PINPOINT TEST JF** .
Coil pack ignition testing	-	refer to **PINPOINT TEST JE** .	refer to **PINPOINT TEST JE** .

P0353 - IGNITION COIL C PRIMARY/SECONDARY CIRCUIT

P0353 - IGNITION COIL C PRIMARY/SECONDARY CIRCUIT

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0350. See the possible causes for DTC P0350. See the diagnostic aids for DTC P0350.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Coil-on-plug (COP) ignition testing	-	refer to **PINPOINT TEST JF** .	refer to **PINPOINT TEST JF** .
Coil pack ignition testing	-	refer to **PINPOINT TEST JE** .	refer to **PINPOINT TEST JE** .

P0354 - IGNITION COIL D PRIMARY/SECONDARY CIRCUIT

P0354 - IGNITION COIL D PRIMARY/SECONDARY CIRCUIT

Description:	See the description for DTC P0350.		
Possible Causes:	See the possible causes for DTC P0350.		
Diagnostic Aids:	See the diagnostic aids for DTC P0350.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Coil-on-plug (COP) ignition testing	-	refer to **PINPOINT TEST JF** .	refer to **PINPOINT TEST JF** .
Coil pack ignition testing	-	refer to **PINPOINT TEST JE** .	refer to **PINPOINT TEST JE** .

P0355 - IGNITION COIL E PRIMARY/SECONDARY CIRCUIT

P0355 - IGNITION COIL E PRIMARY/SECONDARY CIRCUIT

Description:	See the description for DTC P0350.		
Possible Causes:	See the possible causes for DTC P0350.		
Diagnostic Aids:	See the diagnostic aids for DTC P0350.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST JF** .	refer to **PINPOINT TEST JF** .

P0356 - IGNITION COIL F PRIMARY/SECONDARY CIRCUIT

P0356 - IGNITION COIL F PRIMARY/SECONDARY CIRCUIT

Description:	See the description for DTC P0350.		
Possible Causes:	See the possible causes for DTC P0350.		
Diagnostic Aids:	See the diagnostic aids for DTC P0350.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST JF** .	refer to **PINPOINT TEST JF** .

P0357 - IGNITION COIL G PRIMARY/SECONDARY CIRCUIT

P0357 - IGNITION COIL G PRIMARY/SECONDARY CIRCUIT

Description:	See the description for DTC P0350.		
Possible Causes:	See the possible causes for DTC P0350.		
Diagnostic Aids:	See the diagnostic aids for DTC P0350.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST JF** .	refer to **PINPOINT TEST JF** .

P0358 - IGNITION COIL H PRIMARY/SECONDARY CIRCUIT

P0358 - IGNITION COIL H PRIMARY/SECONDARY CIRCUIT

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0350. See the possible causes for DTC P0350. See the diagnostic aids for DTC P0350.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST JF** .	refer to **PINPOINT TEST JF** .

P0359 - IGNITION COIL I PRIMARY/SECONDARY CIRCUIT

P0359 - IGNITION COIL I PRIMARY/SECONDARY CIRCUIT

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0350. See the possible causes for DTC P0350. See the diagnostic aids for DTC P0350.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST JF** .	refer to **PINPOINT TEST JF** .

P0360 - IGNITION COIL J PRIMARY/SECONDARY CIRCUIT

P0360 - IGNITION COIL J PRIMARY/SECONDARY CIRCUIT

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P0350. See the possible causes for DTC P0350. See the diagnostic aids for DTC P0350.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST JF** .	refer to **PINPOINT TEST JF** .

P0400 - EXHAUST GAS RECIRCULATION (EGR) FLOW

P0400 - EXHAUST GAS RECIRCULATION (EGR) FLOW

Description:	The electric EGR (EEGR) system is monitored once per drive cycle at high and low load conditions. The test fails when a concern is detected by powertrain control module (PCM) calculations indicating the EGR flow is less or greater than expected.
	• EEGR valve stuck open or closed • Connector to EEGR not seated • EEGR motor winding circuits short or open • No voltage to the EEGR

Possible Causes:	• Harness open or short to voltage or ground • Vacuum signal to manifold absolute pressure (MAP) restricted or leaking • Mass air flow (MAF) sensor signal erroneous • Carbon build up in the EEGR valve seat area • One or more sensors is not responding or is out of range		
Diagnostic Aids:	All of the following sensors input data to the PCM for correct operation of the EEGR system: engine coolant temperature (ECT), crankshaft position (CKP), intake air temperature (IAT), MAF, throttle position (TP), MAP. Any DTC relating to these sensors must be resolved prior to addressing DTC P0400.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KD** .		

P0401 - EXHAUST GAS RECIRCULATION (EGR) FLOW INSUFFICIENT DETECTED

P0401 - EXHAUST GAS RECIRCULATION (EGR) FLOW INSUFFICIENT DETECTED

Description:	The EGR system is monitored during steady state driving conditions while the EGR is commanded on. The test fails when the signal from the differential pressure feedback EGR sensor indicates that EGR flow is less than the desired minimum.		
Possible Causes:	• Vacuum supply • EGR valve stuck closed • EGR valve leaks vacuum • EGR flow path restricted • EVR circuit short to voltage • VREF open to differential pressure feedback EGR sensor • Differential pressure feedback EGR sensor downstream hose is off or plugged • EVR circuit open • VPWR open to EGR vacuum regulator solenoid • Differential pressure feedback EGR sensor hoses are both off • Differential pressure feedback EGR sensor hoses are reversed • Damaged EGR orifice tube • Damaged EGR vacuum regulator solenoid		
Diagnostic Aids:	Carry out the key on engine running (KOER) self-test and look for DTC P1408 as an indication of a hard fault. If DTC P1408 is not present, look for contamination, restrictions, leaks, and intermittent concerns.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**

Vehicles with an EGR system module (ESM)		-	-	refer to **PINPOINT TEST HH** .
All others		-	-	refer to **PINPOINT TEST HE** .

P0402 - EXHAUST GAS RECIRCULATION (EGR) FLOW EXCESSIVE DETECTED

P0402 - EXHAUST GAS RECIRCULATION (EGR) FLOW EXCESSIVE DETECTED

Description:	The EGR system is monitored for undesired EGR flow during idle. The EGR monitor looks at the differential pressure feedback EGR (DPFE) signal at idle and compares it to the stored signal measured during key on engine off (KOEO). The test fails when the signal at idle is greater than at KOEO by a calibrated amount.		
Possible Causes:	• EGR valve stuck open • Plugged EGR vacuum regulator solenoid vent • Plugged EGR tube • Slow responding differential pressure feedback EGR sensor • Damaged differential pressure feedback EGR sensor • Incorrect vacuum hose connection • Plugged vacuum hoses • EVR circuit short to ground • Damaged EGR vacuum regulator solenoid		
Diagnostic Aids:	A DPFEGR PID reading that is greater at idle than during KOEO by 0.5 volt or a rough engine idle may indicate a hard fault.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles with an EGR system module (ESM)	-	refer to **PINPOINT TEST HH** .	refer to **PINPOINT TEST HH** .
All others	-	refer to **PINPOINT TEST HE** .	refer to **PINPOINT TEST HE** .

P0403 - EXHAUST GAS RECIRCULATION (EGR) CONTROL CIRCUIT

P0403 - EXHAUST GAS RECIRCULATION (EGR) CONTROL CIRCUIT

For Vehicles With an Electric EGR (EEGR)	
Description:	The EEGR system is continuously monitored to check the 4 EEGR motor coils, circuits, and the powertrain control module (PCM) for opens, shorts to voltage and ground. If a concern is detected, the EEGR system is disabled and additional monitoring is suspended for the remainder of the drive until the next drive cycle.
	• EEGR motor windings open • Connector to EEGR not seated • Open circuit in the harness from the PCM to the EEGR

Possible Causes:	• Short circuit in the EEGR motor • Short circuit in the harness from the PCM to the EEGR • PCM
Diagnostic Aids:	
For All Others	
Description:	This test checks the electrical function of the EGR vacuum regulator solenoid. The test fails when the EVR circuit voltage is either too high or too low when compared to the expected voltage range. The EGR system must be enabled for the test to be completed.
Possible Causes:	• EVR circuit open • EVR circuit short to voltage or ground • VPWR open to EGR vacuum regulator solenoid • EGR vacuum regulator solenoid • PCM
Diagnostic Aids:	The EGR vacuum regulator solenoid resistance is between 26 and 40 ohms.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles with an EGR system module (ESM)	refer to **PINPOINT TEST HH** .		
Vehicles With an Electric EGR (EEGR)	refer to **PINPOINT TEST KD** .		
All others	refer to **PINPOINT TEST HE** .		

P0405 - EXHAUST GAS RECIRCULATION (EGR) SENSOR A CIRCUIT LOW

P0405 - EXHAUST GAS RECIRCULATION (EGR) SENSOR A CIRCUIT LOW

Description:	The EGR monitor checks the differential pressure feedback EGR sensor signal to the powertrain control module (PCM) for low voltage. The test fails when the average voltage to the PCM drops to a voltage less than the minimum calibrated value.
Possible Causes:	• Differential pressure feedback EGR circuit short to ground • Damaged differential pressure feedback EGR sensor • VREF circuit short to ground
Diagnostic Aids:	A DPFEGR PID reading less than 0.05 volt with the key ON, engine OFF or running indicates a hard fault.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles with an EGR system module (ESM)	refer to **PINPOINT TEST HH** .		
All others	refer to **PINPOINT TEST HE** .		

P0406 - EXHAUST GAS RECIRCULATION (EGR) SENSOR A CIRCUIT HIGH

P0406 - EXHAUST GAS RECIRCULATION (EGR) SENSOR A CIRCUIT HIGH

Description:	The EGR monitor checks the EGR sensor signal to the powertrain control module (PCM) for high voltage. The test fails when the average voltage to the PCM exceeds the maximum calibrated value.
Possible Causes:	• Differential pressure feedback EGR circuit open • VREF circuit short to voltage • Damaged differential pressure feedback EGR sensor • Differential pressure feedback EGR circuit short to voltage • SIG RTN circuit open
Diagnostic Aids:	A DPFEGR PID reading greater than 4.5 volts with the key ON, engine OFF or running indicates a hard fault.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
Vehicles with an EGR system module (ESM)	refer to **PINPOINT TEST HH** .		
All others	refer to **PINPOINT TEST HE** .		

P0410 - SECONDARY AIR INJECTION (AIR) SYSTEM

P0410 - SECONDARY AIR INJECTION (AIR) SYSTEM

Description:	The AIR system detected a lack of air flow with the secondary AIR pump ON.
Possible Causes:	• AIR inlet hose leak. • AIR inlet hose disconnected.
Diagnostic Aids:	Measured air flow is less than expected. Visually inspect the secondary AIR inlet hose.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	refer to **PINPOINT TEST HM** .		

P0412 - SECONDARY AIR INJECTION (AIR) SYSTEM - SWITCHING VALVE A CIRCUIT

P0412 - SECONDARY AIR INJECTION (AIR) SYSTEM - SWITCHING VALVE A CIRCUIT

Description:	On the primary side of the AIR relay, open and short faults on the AIR command circuit are detected during normal operation by the powertrain control module (PCM) output driver.
Possible Causes:	• Short to voltage or ground in the AIR command circuit • Open in the AIR command circuit • AIR bypass solenoid fault • AIR relay fault

Diagnostic Aids:	For intermittent faults use the AIR PCM output driver fault PID (AIRF) during a harness wiggle test with the AIR PCM output driver in OFF and ON states. The AIR PCM output driver fault PID AIRF instantly detects open circuits and shorts to ground with the PCM output driver off. The AIR PCM output driver fault PID AIRF instantly detects open circuits and shorts to ground with the PCM output driver off. The AIR PCM output driver fault PID AIRF instantly detects a short to voltage or low resistance load with the PCM output driver on. Use the OTM to toggle the PCM output driver from OFF to ON. Refer to**OUTPUT TEST MODE (OTM)** .		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HM** .		

P0420 - CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

P0420 - CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

Description:	Indicates the bank 1 catalyst system efficiency is below the acceptable threshold.
Possible Causes:	• Use of leaded fuel • Damaged heated oxygen sensor (HO2S) • Out of range engine coolant temperature (ECT) sensor • High fuel pressure • Damaged exhaust manifold • Damaged catalytic converter • Oil contamination • Cylinder misfiring • Downstream HO2S wires incorrectly connected • Damaged exhaust system pipe • Damaged muffler/tailpipe assembly • Retarded spark timing • Leaking fuel injector
Diagnostic Aids:	The signal line lengths of the downstream HO2Ss are compared against the signal line lengths of the upstream HO2Ss. Under normal closed loop fuel conditions, high efficiency catalysts have oxygen storage which reduces the frequency and amplitude of the downstream HO2S as compared with an upstream HO2S signal. As catalyst efficiency deteriorates, its ability to store oxygen declines and the downstream HO2S signal has an increased amplitude and frequency, approaching the amplitude and frequency of the upstream HO2S. Once beyond an acceptable limit the DTC is set. Vehicles with universal HO2Ss compare the signal line length of the downstream HO2Ss to an expected signal line length of the downstream

	HO2Ss with a deteriorated catalytic converter.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HF** .

P0430 - CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 2)

P0430 - CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 2)

Description:	Indicates the bank 2 catalyst system efficiency is below the acceptable threshold.		
Possible Causes:	See the possible causes for DTC P0420.		
Diagnostic Aids:	See the diagnostic aids for DTC P0420.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HF** .

P0442 - EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (SMALL LEAK)

P0442 - EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (SMALL LEAK)

Description:	The powertrain control module (PCM) monitors the complete evaporative emission (EVAP) control system for the presence of a small fuel vapor leak. System failure occurs when a fuel vapor leak from an opening as small as 1.016 mm (0.040 in) is detected by the EVAP running loss monitor test.
Possible Causes:	• Aftermarket EVAP hardware that does not conform to the required specifications • Small holes or cuts in the fuel vapor hoses/tubes • Canister vent solenoid stays partially open on closed command • Damaged, missing or loosely installed fuel filler cap • Capless fuel tank filler pipe damaged or not sealed properly (if equipped) • Loose fuel vapor hose/tube connections to the EVAP system components • EVAP system component seals leaking at or near the EVAP canister purge valve, fuel tank pressure sensor, canister vent (CV) solenoid, fuel vapor control valve tube assembly or fuel vapor vent valve assembly
Diagnostic Aids:	Check for a missing fuel filler cap or the integrity of the cap. Verify the capless fuel tank filler pipe is sealed properly (if equipped). Check for loose or damaged vapor hoses. Visually inspect the EVAP canister inlet port, CV solenoid filter, and canister vent hose assembly for contamination or debris.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	-	-	refer to **PINPOINT TEST HX** .

P0443 - EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT

P0443 - EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT

Description:	The powertrain control module (PCM) monitors the state of the evaporative emission (EVAP) canister purge valve circuit output driver. The test fails when the signal moves outside the minimum or maximum limit for the commanded state.		
Possible Causes:	• VPWR circuit open • EVAP canister purge valve circuit short to GND • Damaged EVAP canister purge valve • EVAP canister purge valve circuit open • EVAP canister purge valve circuit short to VPWR • Damaged PCM		
Diagnostic Aids:	To verify normal function, monitor the EVAP canister purge valve signal PID EVAPPDC (or EVMV for electronic valve) and the signal voltage (PCM control side). With the valve closed, the EVAPPDC indicates a 0% duty cycle (0 mA for EVMV) and voltage approximately equal to battery voltage. When the valve is commanded fully open, EVAPPDC indicates 100% duty cycle (1000 mA for EVMV) and a voltage drop of 3 volts minimum is normal. Output test mode may be used to switch output on/off to verify function.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HX** .		

P0446 - EVAPORATIVE EMISSION SYSTEM VENT CONTROL CIRCUIT

P0446 - EVAPORATIVE EMISSION SYSTEM VENT CONTROL CIRCUIT

Description:	Monitors the canister vent (CV) solenoid circuit for an electrical failure. The test fails when the signal moves outside the minimum or maximum allowable calibrated parameters for a specified canister vent duty cycle by powertrain control module (PCM) command.
Possible Causes:	• VPWR circuit open • KAPWR circuit open (vehicles equipped with engine off natural vacuum (EONV) EVAP leak check monitor) • CV solenoid circuit short to PWR GND or CHASSIS GND • Damaged CV solenoid • CV solenoid circuit open

	• CV solenoid circuit short to VPWR • CV solenoid circuit short to KAPWR (vehicles equipped with engine off natural vacuum (EONV) EVAP leak check monitor) • Damaged PCM		
Diagnostic Aids:	To verify normal functioning, monitor the EVAP canister vent solenoid signal PID EVAPCV and the signal voltage (PCM control side). With the valve open, EVAPCV indicates 0% duty cycle and a voltage approximately equal to battery voltage. When the valve is commanded fully closed, EVAPCV indicates 100% duty cycle, and a minimum voltage drop of 4 volts is normal. Output test mode may be used to switch output on/off to verify function.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HX** .		

P0451 - EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH RANGE/PERFORMANCE

P0451 - EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH RANGE/PERFORMANCE

Description:	Note: For some vehicle applications, DTC P0451 is set for a fuel tank pressure (FTP) sensor range (offset) concern. The DTC P0454 replaces the original P0451 for intermittent (noisy) sensor concerns. Until the phase in process is complete, noisy or offset FTP sensor concerns may set DTC P0451. The fuel tank pressure changes greater than 14 inches of water in 0.10 seconds. FTP sensor output is offset by + /- 1.7 inches of water.		
Possible Causes:	• Intermittent open or short in the FTP sensor or the FTP sensor signal • Contaminated or damaged sensor • Damaged powertrain control module (PCM)		
Diagnostic Aids:	Monitor the FTP PID and note if it changes from above 15 inches of water to below minus (-) 15 inches of water often in 1 minute. With the FTP sensor at atmospheric pressure, the FTP PID normally indicates 0 inches of water. Look for a minimum reading of +/- 1.7 inches of water as an indication of an offset condition.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HX** .		

P0452 - EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH LOW

P0452 - EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH LOW

Description:	The powertrain control module (PCM) monitors the evaporative emission (EVAP) control system fuel tank pressure (FTP) sensor input signal to the PCM. The test fails when the signal average drops below a minimum allowable calibrated parameter.		
Possible Causes:	• Contamination internal to the FTP sensor connector • FTP circuit short to GND or SIG RTN • Damaged FTP sensor		
Diagnostic Aids:	An FTP voltage PID reading less than 0.22 volt in key ON, engine OFF or key ON, engine running indicates a concern is present.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HX** .		

P0453 - EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH HIGH

P0453 - EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH HIGH

Description:	The powertrain control module (PCM) monitors the evaporative emission (EVAP) control system fuel tank pressure (FTP) sensor input signal to the PCM. The test fails when the signal average jumps above a minimum allowable calibrated parameter.		
Possible Causes:	• FTP circuit open • VREF short to VPWR • FTP circuit short to VREF or VPWR • SIG RTN circuit open • Damaged FTP sensor		
Diagnostic Aids:	An FTP voltage PID reading greater than 4.50 volts in key ON, engine OFF or key ON, engine running indicates a concern is present.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HX** .		

P0454 - EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH INTERMITTENT

P0454 - EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH INTERMITTENT

Description:	The fuel tank pressure changes greater than 14 inches of water in 0.10 seconds.		
Possible Causes:	• Intermittent open or short in the fuel tank pressure (FTP) sensor or the FTP sensor signal • Contaminated or damaged sensor		
Diagnostic Aids:	Monitor the FTP PID and note if it changes from above 15 inches of water to below minus (-) 15 inches of water often in 1 minute.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**

All	-	-	refer to **PINPOINT TEST Z** .

P0455 - EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (GROSS LEAK/NO FLOW)

P0455 - EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (GROSS LEAK/NO FLOW)

Description:	The powertrain control module (PCM) monitors the complete evaporative emission (EVAP) control system for no purge flow, the presence of a large fuel vapor leak, or multiple small fuel vapor leaks. System failure occurs when no purge flow, which is attributed to fuel vapor blockages or restrictions, a large fuel vapor leak, or multiple fuel vapor leaks are detected by the EVAP running loss monitor test with the engine running, but not at idle.		
Possible Causes:	• Aftermarket EVAP hardware that does not conform to the required specifications • Disconnected or cracked fuel EVAP canister tube, EVAP canister purge outlet tube, or EVAP return tube • EVAP canister purge valve stuck closed • Damaged EVAP canister • Damaged, missing or loosely installed fuel filler cap • Capless fuel tank filler pipe damaged or not sealed properly (if equipped) • Loose fuel vapor hose/tube connections to the EVAP system components • Blockages or restrictions in the fuel vapor hoses/tubes • Fuel vapor control valve tube assembly or fuel vapor vent valve assembly blocked • Canister vent (CV) solenoid stuck open • Mechanically inoperative fuel tank pressure (FTP) sensor		
Diagnostic Aids:	Check for audible vacuum noise or significant fuel odor in the engine compartment or near the EVAP canister and fuel tank.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HX** .

P0456 - EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (VERY SMALL LEAK)

P0456 - EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (VERY SMALL LEAK)

Description:	The powertrain control module (PCM) monitors the complete evaporative emission (EVAP) control system for the presence of a very small fuel vapor leak. The system failure occurs when a fuel vapor leak from an opening as small as 0.508 mm (0.020 inch) is detected by the

Possible Causes:	EVAP running loss monitor test. • Very small holes or cuts in the fuel vapor hoses/tubes • Loose fuel vapor hose/tube connections to the EVAP system components • EVAP system component seals leaking. See the Possible Causes for DTC P0442		
Diagnostic Aids:	Check for a missing fuel filler cap or the integrity of the cap. Verify the capless fuel tank filler pipe is sealed properly (if equipped). Check for loose or damaged vapor hoses. Visually inspect the EVAP canister inlet port, CV solenoid filter, and canister vent hose assembly for contamination or debris.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HX** .

P0457 - EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)

P0457 - EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)

Description:	The powertrain control module (PCM) continuously monitors the fuel level and retains the last updated value prior to the ignition switch being placed in the OFF position. After the ignition switch is placed in the ON position a new fuel level is taken and compared to the level recorded at key off. If the fuel level has increased, a flag is set in the PCM indicating the vehicle was refueled. If the evaporative emission (EVAP) monitor detects a gross leak while the refueling flag is set, a loose fuel filler cap or an improperly sealed fuel tank filler pipe (if equipped) is suspected and the DTC is set. On most vehicles when the DTC sets, either the check fuel cap indicator illuminates or a message on the instrument cluster displays to instruct the driver to check the fuel cap or capless fuel tank filler pipe (if equipped).		
Possible Causes:	• Damaged, missing, or loosely installed fuel filler cap • Capless fuel tank filler pipe damaged or not sealed properly (if equipped)		
Diagnostic Aids:	Check for a missing fuel filler cap or the integrity of the cap. Verify the capless fuel tank filler pipe is sealed properly (if equipped). If OK, clear the continuous memory DTCs and test the system for correct operation.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HX** .

P0460 - FUEL LEVEL SENSOR A CIRCUIT

P0460 - FUEL LEVEL SENSOR A CIRCUIT

Description:	The powertrain control module (PCM) monitors the fuel level input (FLI) communications network message for a concern. The test fails when the PCM determines that the value of the FLI signal is stuck. The PCM calculates the amount of fuel used during operation. If the FLI signal does not change or does not correspond with the calculated fuel usage, the DTC is set.		
Possible Causes:	• Stuck float arm • Fuel level is always greater than 95% due to refueling patterns • Fuel level is always less than 5% due to refueling patterns • Fuel level is always at the same level between 3% and 97% full due to refueling patterns • Fuel pump (FP) module concern • Damaged instrument cluster (IC)		
Diagnostic Aids:	Check with the customer for driving and fueling habits that would keep the fuel level at approximately the same value. Monitor the FLI PIDs while attempting to move the fuel level float by adding or removing fuel as necessary.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HX** .		

P0461 - FUEL LEVEL SENSOR A CIRCUIT RANGE/PERFORMANCE

P0461 - FUEL LEVEL SENSOR A CIRCUIT RANGE/PERFORMANCE

Description:	The powertrain control module (PCM) monitors the fuel level input (FLI) communications network message for a concern. The test fails when the FLI signal repeatedly moves in and out of range, exceeding the minimum or maximum allowable calibrated parameters for a specified fuel fill percentage in the fuel tank.		
Possible Causes:	• Excessive electrical noise • Intermittent open circuit		
Diagnostic Aids:	Verify aftermarket equipment does not generate the radio frequency interference / electromagnetic interference (RFI/EMI) which may cause noisy FLI input signal.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HX** .		

P0462 - FUEL LEVEL SENSOR A CIRCUIT LOW

P0462 - FUEL LEVEL SENSOR A CIRCUIT LOW

Description:	The powertrain control module (PCM) monitors the fuel level input (FLI) communications network message for a concern. The test fails when the FLI signal is less than the minimum allowable calibrated parameter for a

	specified fuel fill percentage in the fuel tank.		
Possible Causes:	• Empty fuel tank • Fuel pump (FP) module concern • Incorrectly installed fuel gauge • Damaged instrument cluster (IC) • Damaged fuel gauge • FLI circuit short to ground		
Diagnostic Aids:	Monitor the FLI PIDs in key ON, engine running. A concern is present if the FLI percentage PID is at 25% fill and the FLI voltage PID is less than 0.90 volt with a non-matching fuel gauge or the FLI percentage PID is at 75% fill and the FLI voltage PID is greater than 2.45 volts with a non-matching fuel gauge.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HX** .		

P0463 - FUEL LEVEL SENSOR A CIRCUIT HIGH

P0463 - FUEL LEVEL SENSOR A CIRCUIT HIGH

Description:	The powertrain control module (PCM) monitors the fuel level input (FLI) communications network message for a concern. The test fails when the FLI signal is greater than the maximum allowable calibrated parameter for a specified fuel fill percentage in the fuel tank.		
Possible Causes:	• Fuel pump (FP) module concern • Incorrectly installed fuel gauge • Damaged instrument cluster (IC) • FLI circuit open • FLI short to VPWR • Overfilled fuel tank • Damaged fuel gauge		
Diagnostic Aids:	See the diagnostic aids for DTC P0462.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HX** .		

P0480 - FAN 1 CONTROL CIRCUIT

P0480 - FAN 1 CONTROL CIRCUIT

For Relay Controlled Electric Cooling Fan	
Description:	Monitors the low fan control (LFC) primary circuit output from the powertrain control (PCM). The test fails when the PCM grounds the LFC circuit and excessive current draw is detected on the LFC circuit; or with

	the LFC circuit not grounded by the PCM the voltage is not detected on the LFC circuit (the PCM expects to detect VPWR voltage coming through the low speed fan control relay coil to the LFC circuit).
Possible Causes:	• Open or short LFC circuit • Open VPWR circuit to the low speed FC relay • Damaged low speed FC relay
Diagnostic Aids:	When the LFC PID reads YES, a concern is currently present. During the key on engine off (KOEO) self-test, the cooling fan is cycled on and off. A short to voltage can only be detected when the PCM is grounding the LFC circuit. During the KOEO and key on engine running (KOER) self-test, the LFC circuit is cycled on and off.
For Variable Speed Electric Cooling Fan	
Description:	This test checks the fan control-variable (FCV) output circuit. The DTC sets if the powertrain control module (PCM) detects the voltage on the FCV circuit is not within the expected range.
Possible Causes:	• FCV circuit open or short • B+ or ground circuit concern to cooling fan • VPWR open to cooling fan (if applicable) • Damaged cooling fan module
Diagnostic Aids:	During the key on engine off (KOEO) self-test, the cooling fan is cycled on and off.
For Cooling Fan Clutch	
Description:	This test checks the fan control-variable (FCV) output circuit for the cooling fan clutch. The DTC sets if the powertrain control module (PCM) detects the voltage on the FCV circuit is not within the expected range.
Possible Causes:	• FCV circuit open in the harness • FCV circuit short to voltage or ground in the harness • Damaged cooling fan clutch solenoid.
Diagnostic Aids:	During the key on engine off (KOEO) self-test, the cooling fan is cycled on and off.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Relay Controlled Electric Cooling Fan	refer to **PINPOINT TEST KF** .		
Variable Speed Electric Cooling Fan	refer to **PINPOINT TEST KN** .		
Cooling Fan Clutch	refer to **PINPOINT TEST HV** .		

P0481 - FAN 2 CONTROL CIRCUIT

P0481 - FAN 2 CONTROL CIRCUIT

	Monitors the HFC primary circuit output from the powertrain control module (PCM). The test fails, when the HFC output is commanded on

Description:	(grounded) and excessive current draw is detected on the HFC circuit; or when the HFC circuit is commanded off and voltage is not detected on the HFC circuit (the PCM expects to detect VPWR voltage through the high speed FC relay coil to the HFC circuit).		
Possible Causes:	• Open or short HFC circuit • Open VPWR circuit to the high speed FC relay • Damaged high speed FC relay		
Diagnostic Aids:	When the HFCF PID reads YES, a concern is currently present. An open circuit or short to ground can only be detected when the PCM is not grounding the HFC circuit. A short to voltage can only be detected when the PCM is grounding the HFC circuit. During the key on engine off (KOEO) and key on engine running (KOER) self-test, the HFC circuit is cycled on and off.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KF** .		

P0482 - FAN 3 CONTROL CIRCUIT

P0482 - FAN 3 CONTROL CIRCUIT

Description:	Monitors the MFC primary circuit output from the powertrain control module (PCM). The test fails, when the MFC output is commanded on (grounded) and excessive current draw is detected on the MFC circuit; or when the MFC circuit is commanded off and voltage is not detected on the MFC circuit (the PCM expects to detect IGN START/RUN voltage through the medium speed FC relay coil to the MFC circuit).		
Possible Causes:	• Open or short MFC circuit • Open IGN START/RUN circuit to the medium speed FC relay • Damaged medium speed FC relay		
Diagnostic Aids:	When the MFCF PID reads YES, a concern is currently present. An open circuit or short to ground can only be detected when the PCM is not grounding the MFC circuit. A short to voltage can only be detected when the PCM is grounding the MFC circuit. During the key on engine off (KOEO) and key on engine running (KOER) self-test, the MFC circuit is cycled on and off. Use output test mode to command the low speed/high speed fan on. The PCM also activates the medium speed fan output.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KF** .		

P0483 - FAN PERFORMANCE

P0483 - FAN PERFORMANCE

For Vehicles Equipped With Electronic Fan Clutch	

Description:	If the cooling fan clutch fan is binding, or the PCM detects the fan speed is at or near 0 RPM, the DTC is set.
Possible Causes:	• Cooling fan motor mechanical concerns • Obstruction or binding conditions
Diagnostic Aids:	Check for a mechanical concern with the cooling fan motor or for obstructions limiting the cooling fan motor operation.
For All others	
Description:	The PCM controls the fan speed and operation using a duty cycle output on the fan control variable (FCV) circuit.
Possible Causes:	• Cooling fan motor mechanical concerns • Obstruction or binding conditions • Overheated controller
Diagnostic Aids:	Check for a mechanical concern with the cooling fan motor or for obstructions limiting the cooling fan motor operation.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All others	-	-	refer to **PINPOINT TEST KN** .
Vehicles Equipped With Electronic Fan Clutch	-	-	refer to **PINPOINT TEST HV** .

P0491 - SECONDARY AIR INJECTION (AIR) SYSTEM INSUFFICIENT FLOW (BANK 1)

P0491 - SECONDARY AIR INJECTION (AIR) SYSTEM INSUFFICIENT FLOW (BANK 1)

Description:	The AIR system detected that there was insufficient mass air flow change during pump switching (ON/OFF).
Possible Causes:	• Secondary AIR pump with no or low air flow. • Secondary AIR bypass solenoid leaking/blocked or stuck open/closed. • Secondary AIR diverter valve leaking/blocked or stuck open/closed. • Secondary AIR air hose restricted. • Secondary AIR vacuum hoes restricted or leaking.
Diagnostic Aids:	Measured air flow is less than expected. Visually inspect the secondary AIR inlet hose.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST HM** .	refer to **PINPOINT TEST HM** .

P0500 - VEHICLE SPEED SENSOR (VSS) A

P0500 - VEHICLE SPEED SENSOR (VSS) A

Description:	Indicates the powertrain control module (PCM) detected an error in the vehicle speed information. Vehicle speed data is received from either the VSS, the transfer case speed sensor (TCSS) or the anti-lock brake system (ABS) control module. If the engine RPM is above the torque converter stall speed (automatic transmission) and the engine load is high, it can be inferred that the vehicle must be moving. If there is insufficient vehicle speed data input, a concern is indicated and a DTC is set. On most vehicle applications the malfunction indicator lamp (MIL) is illuminated when this DTC is set.
Possible Causes:	• Open in the VSS+/VSS- harness circuit • Open in the TCSS signal or the TCSS signal return harness circuit • Short to GND in the VSS harness circuit • Short to GND in the TCSS harness circuit • Short to PWR in the VSS harness circuit • Short to PWR in the TCSS harness circuit • Damaged drive mechanism for VSS or TCSS • Damaged VSS or TCSS • Damaged wheel speed sensors • Damaged wheel speed sensor harness circuits • Damage in the module(s) connected to the VSC/VSS circuit • Open or short in the vehicle speed circuit VSS signal between the ABS VSS signal output and the VSS signal inputs to the PCM and other modules (F-Super Duty)
Diagnostic Aids:	Monitor the VSS PID while driving the vehicle. This DTC is set when the PCM detects a sudden loss of vehicle speed signal over a period of time. If vehicle speed data is lost, check the source of the vehicle speed input: VSS, TCSS or ABS. Note: On some manual shift-on-the-fly (MSOF) applications, VSS and TCSS PID can be monitored. However if no TCSS PID is available and VSS PID is zero, TCSS circuitry frequency must be checked for loss of sensor signal. If another vehicle electronic module has generated the P0500 and the vehicle does not receive its vehicle speed input from the VSS, TCSS or ABS, check the PCM for output shaft speed (OSS) sensor DTCs. On OSS applications the PCM uses the OSS to calculate the vehicle speed. If no OSS DTCs are found check for correct PCM configuration, tire size and axle ratio.

Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
F-Super Duty		refer to **PINPOINT TEST DF** .		
Expedition, Navigator, Sable, Taurus, Taurus X		The powertrain control module (PCM) uses information from the anti-lock brake system (ABS) module and the transmission control module (TCM) to calculate vehicle speed. Check these modules for DTCs.		
All others		refer to **PINPOINT TEST DP** .		

P0503 - VEHICLE SPEED SENSOR (VSS) A INTERMITTENT/ERRATIC/HIGH

P0503 - VEHICLE SPEED SENSOR (VSS) A INTERMITTENT/ERRATIC/HIGH

Description:	Indicates poor or noisy VSS performance. Vehicle speed data is received from either the VSS, the transfer case speed sensor (TCSS), or the anti-lock brake system (ABS) control module.		
Possible Causes:	• Noisy VSS/TCSS input signal from the radio frequency interference / electromagnetic interference (RFI/EMI) external sources, such as ignition components or the charging circuit • Damaged VSS or driven gears • Damaged TCSS • Damaged wiring harness or connectors • Malfunction in the module(s) or circuit connected to the VSS/TCSS circuit • Aftermarket add-on		
Diagnostic Aids:	Monitor the VSS PID while driving the vehicle, and check for intermittent vehicle speed indication. Verify the ignition and charging systems are functioning correctly.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
F-Super Duty	refer to **PINPOINT TEST DF** .		
Expedition, Navigator, Sable, Taurus, Taurus X	The powertrain control module (PCM) uses information from the anti-lock brake system (ABS) module and the transmission control module (TCM) to calculate vehicle speed. Check these modules for DTCs.		
All others	refer to **PINPOINT TEST DP** .		

P0504 - BRAKE SWITCH CORRELATION

P0504 - BRAKE SWITCH CORRELATION

Description:	The PCM does a comparison test between the brake pedal switch and the brake pedal position switch.		
Possible Causes:	• Damaged brake switch • Open or short in the BPS circuit • Open or short in the BPP circuit		
Diagnostic Aids:	Check the state of PID BPS and PID BPP. BPS is normally closed and BPP is normally open.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST FD** .		

P0505 - IDLE AIR CONTROL (IAC) SYSTEM

P0505 - IDLE AIR CONTROL (IAC) SYSTEM

For Vehicles With Electronic Throttle Control (ETC)			
Description:	The powertrain control module (PCM) attempts to control engine speed during the key on, engine running (KOER) self-test. The test fails when the desired RPM could not be reached or controlled during the self-test.		
Possible Causes:	• Failure mode effects management (FMEM) condition is present • Intake air restriction • Exhaust restriction • Sludged throttle body • Vacuum leaks • Damaged electronic throttle body (ETB) • Damaged PCM		
Diagnostic Aids:	This DTC may be accompanied by other DTCs. Diagnose other DTCs first. If other DTCs are not present inspect the intake air system for air restrictions, vacuum leaks, and damage. If no concerns are present, clear the DTC and carry out the KOER self-test.		
For All Others			
Description:	The powertrain control module (PCM) attempts to control engine speed during the key on, engine running (KOER) self-test. The test fails when the desired RPM could not be reached or controlled during the self-test.		
Possible Causes:	• IAC circuit open • VPWR to IAC solenoid open • B+ or VPWR to IAC solenoid open • Air inlet is plugged • IAC circuit shorted to PWR • Damaged IAC valve		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles With Electronic Throttle Control (ETC)	refer to **PINPOINT TEST HU** .		
All others	refer to **PINPOINT TEST KE** .		

P0506 - IDLE AIR CONTROL (IAC) SYSTEM RPM LOWER THAN EXPECTED

P0506 - IDLE AIR CONTROL (IAC) SYSTEM RPM LOWER THAN EXPECTED

For Vehicles With Electronic Throttle Control (ETC)	
Description:	This DTC is set when the powertrain control module (PCM) detects an engine idle speed that is less than the desired RPM.
	• Intake air restriction • Vacuum leaks

Possible Causes:	• Exhaust restriction • Engine mechanical concern • Sludged throttle body • Damaged electronic throttle body (ETB) • Damaged PCM
Diagnostic Aids:	This DTC may be accompanied by other DTCs. Diagnose other DTCs first. If other DTCs are not present inspect the intake air system for air restrictions and damage. If no concerns are present, clear the DTC and carry out the KOER self-test.
For All Others	
Description:	This DTC is set when the powertrain control module (PCM) detects an engine idle speed that is less than the desired RPM.
Possible Causes:	• IAC circuit open • Air inlet is plugged • B+ or VPWR to IAC solenoid open • Damaged or incorrect IAC valve • IAC valve stuck closed • VPWR to IAC solenoid open • IAC circuit shorted to PWR
Diagnostic Aids:	Disconnect the IAC valve and look for little or no change in engine RPM as an indication of a stuck or damaged valve.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles With Electronic Throttle Control (ETC)	refer to **PINPOINT TEST HU** .		
All others	refer to **PINPOINT TEST KE** .		

P0507 - IDLE AIR CONTROL (IAC) SYSTEM RPM HIGHER THAN EXPECTED

P0507 - IDLE AIR CONTROL (IAC) SYSTEM RPM HIGHER THAN EXPECTED

For Vehicles With Electronic Throttle Control (ETC)	
Description:	This DTC is set when the powertrain control module (PCM) detects an engine idle speed that is greater than the desired RPM.
Possible Causes:	• Intake air leak after throttle body • Vacuum leaks • Damaged EVAP system • EGR valve leaks vacuum • Damaged electronic throttle body (ETB) • Damaged PCM
	This DTC is informational only and it may be accompanied by other DTCs. Diagnose other DTCs first. If other DTCs are not present inspect

Diagnostic Aids:	the intake air system for air or vacuum leaks and damage. If no concerns are present, clear the DTC and repeat the self-test.
For All Others	
Description:	This DTC is set when the powertrain control module (PCM) detects an engine idle speed that is greater than the desired RPM.
Possible Causes:	• IAC circuit shorted to ground • Damaged or incorrect IAC valve • IAC valve stuck open • Intake air leak after throttle body • Vacuum leaks • Damaged EVAP system • EGR valve leaks vacuum
Diagnostic Aids:	Disconnect the IAC valve and look for little or no change in engine RPM as an indication of a stuck or damaged valve.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles With Electronic Throttle Control (ETC)	Refer to the Description, Possible Causes and Diagnostic Aids for the DTC.		
All others	refer to **PINPOINT TEST KE** .		

P050A - COLD START IDLE AIR CONTROL PERFORMANCE

P050A - COLD START IDLE AIR CONTROL PERFORMANCE

Description:	The cold start emission reduction monitor has detected an airflow performance deficiency. The cold start emission reduction monitor validates the operation of the components of the system required to achieve the cold start emission reduction strategy, retarded spark timing (P050B) and elevated idle airflow (P050A). When the idle airflow test portion of the cold start emission reduction strategy is enabled, the idle air control system requests a higher idle RPM to increase the engine airflow. The cold start emission reduction monitor compares the actual airflow measured by the MAF sensor to the requested PCM airflow. The DTC is set when the airflow is less than the calibrated limit.
Possible Causes:	• Damaged intake air system tubes • Restricted air filter • Restricted or blocked idle air control or intake passages • Air or vacuum leaks • Base engine problem
Diagnostic Aids:	This DTC is an informational DTC and may be accompanied by other DTCs. Diagnose other DTCs first. If other DTCs are not present inspect the intake air system for air restrictions and damage. If no concerns are present, clear the DTCs and repeat the self-test. The cold start emission reduction monitor runs during a cold start. Before

	repeating the self-test, a 2 to 3 hour soak period is required for the cold start emission reduction monitor to run at start up.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the Description, Possible Causes and Diagnostic Aids for the DTC.		

P050B - COLD START IGNITION TIMING PERFORMANCE

P050B - COLD START IGNITION TIMING PERFORMANCE

Description:	The cold start ignition timing performance has a functional response test of actual spark timing angle actual versus commanded spark timing in the powertrain control module (PCM).		
Possible Causes:	• Spark timing • Spark capture circuit • Spark timing monitor • Spark capture circuit monitor		
Diagnostic Aids:	Diagnose all other powertrain related DTCs first.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles with coil pack ignition system	refer to **PINPOINT TEST JC** .		
All others	refer to **PINPOINT TEST JB** .		

P050E - COLD START ENGINE EXHAUST TEMPERATURE OUT OF RANGE

P050E - COLD START ENGINE EXHAUST TEMPERATURE OUT OF RANGE

For Vehicles With Electronic Throttle Control (ETC)	
Description:	The powertrain control module (PCM) calculates the actual catalyst warm up temperature during a cold start. The PCM then compares the actual temperature to the expected catalyst temperature model. The difference between the actual and expected temperatures is a ratio. When this ratio exceeds the calibrated value this DTC is set and the malfunction indicator lamp (MIL) illuminates.
Possible Causes:	• Intake air restriction • Exhaust restriction • Engine mechanical concern • Damaged or sludged electronic throttle body (ETB) • Vacuum leaks • Damaged PCM
Diagnostic Aids:	This DTC is informational only and it may be accompanied by other DTCs. Diagnose other DTCs first. If other DTCs are not present inspect the intake air system for air restrictions, vacuum leaks, and damage. If no

	concerns are present, clear the DTC and carry out the key ON, engine running (KOER) self-test.		
For All Others			
Description:	The powertrain control module (PCM) attempts to control engine speed during the key on, engine running (KOER) self-test. The test fails when the desired RPM could not be reached or controlled during the self-test.		
Possible Causes:	• IAC circuit open • VPWR to IAC solenoid open • B+ or VPWR to IAC solenoid open • Air inlet is plugged • IAC circuit shorted to PWR • Damaged IAC valve		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles With Electronic Throttle Control (ETC)	Refer to the Description, Possible Causes and Diagnostic Aids for the DTC.		
All others	Refer to the Description, Possible Causes and Diagnostic Aids for the DTC.		

P0511 - IDLE AIR CONTROL (IAC) CIRCUIT

P0511 - IDLE AIR CONTROL (IAC) CIRCUIT

Description:	This DTC is set when the powertrain control module (PCM) detects an electrical load failure on the IAC output circuit.		
Possible Causes:	• IAC circuit open • VPWR to IAC solenoid open • B+ or VPWR to IAC solenoid open • IAC circuit shorted to PWR • Damaged IAC valve • IAC circuit short to GND		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KE** .		

P0512 - STARTER REQUEST CIRCUIT

P0512 - STARTER REQUEST CIRCUIT

Description:	Indicates the one touch integrated starting system voltage circuit to the starter relay has a short to voltage.
Possible Causes:	• Short to voltage

Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **STARTING SYSTEM - GASOLINE ENGINES -- E-SERIES** .		

P0528 - FAN SPEED SENSOR CIRCUIT NO SIGNAL

P0528 - FAN SPEED SENSOR CIRCUIT NO SIGNAL

Description:	The powertrain control module (PCM) uses the fan speed sensor (FSS) input to monitor the cooling fan clutch speed. If the indicated fan speed is lower than the calibrated value during the key on engine running (KOER) self-test, the DTC is set.		
Possible Causes:	• FSS VPWR circuit open in the harness • FSS PWRGND circuit open in the harness • FSS circuit open in the harness • FSS circuit short to voltage or ground in the harness • Damaged FSS sensor • Damaged PCM		
Diagnostic Aids:	Visually inspect the cooling fan clutch for damage or obstruction.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HV** .		

P052A - COLD START CAMSHAFT POSITION TIMING OVER-ADVANCED (BANK 1)

P052A - COLD START CAMSHAFT POSITION TIMING OVER-ADVANCED (BANK 1)

Description:	The powertrain control module (PCM) monitors the variable camshaft timing (VCT) position for an over-advanced camshaft timing during cold start up. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in an advanced position.		
Possible Causes:	• Camshaft timing incorrectly set • Continuous oil flow to the VCT piston chamber • VCT solenoid valve stuck open • Camshaft advance mechanism binding (VCT unit)		
Diagnostic Aids:	This DTC is a functional check of the VCT unit. Diagnose any base engine concerns related to the engine oil pressure or engine timing. Refer to the **ENGINE SYSTEM - GENERAL INFORMATION -- E-SERIES** , Oil Pressure Test, to check the engine oil pressure. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** , Timing Drive Components, to check the engine timing.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**

All	-	refer to **PINPOINT TEST HK** .	refer to **PINPOINT TEST HK** .

P052B - COLD START CAMSHAFT POSITION TIMING OVER-RETARDED (BANK 1)

P052B - COLD START CAMSHAFT POSITION TIMING OVER-RETARDED (BANK 1)

Description:	The powertrain control module (PCM) monitors the variable camshaft timing (VCT) position for over-retarded camshaft timing during cold start up. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in a retarded position.		
Possible Causes:	• Camshaft timing incorrectly set • Continuous oil flow to the VCT piston chamber • VCT solenoid valve stuck open • Camshaft advance mechanism binding (VCT unit)		
Diagnostic Aids:	This DTC is a functional check of the VCT unit. Diagnose any base engine concerns related to the engine oil pressure or engine timing. Refer to the **ENGINE SYSTEM - GENERAL INFORMATION -- E-SERIES** , Oil Pressure Test, to check the engine oil pressure. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** , Timing Drive Components, to check the engine timing.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST HK** .	refer to **PINPOINT TEST HK** .

P052C - COLD START CAMSHAFT POSITION TIMING OVER-ADVANCED (BANK 2)

P052C - COLD START CAMSHAFT POSITION TIMING OVER-ADVANCED (BANK 2)

Description:	The powertrain control module (PCM) monitors the variable camshaft timing (VCT) position for an over-advanced camshaft timing during cold start up. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in an advanced position.		
Possible Causes:	• Camshaft timing improperly set • Continuous oil flow to the VCT piston chamber • VCT solenoid valve stuck open • Camshaft advance mechanism binding (VCT unit)		
Diagnostic Aids:	This DTC is a functional check of the VCT unit. Diagnose any base engine concerns related to the engine oil pressure or engine timing. Refer to the **ENGINE SYSTEM - GENERAL INFORMATION -- E-SERIES** , Oil Pressure Test, to check the engine oil pressure. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** , Timing Drive Components, to check the engine timing.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**

All	-	refer to **PINPOINT TEST HK** .	refer to **PINPOINT TEST HK** .

P052D - COLD START CAMSHAFT POSITION TIMING OVER-RETARDED (BANK 2)

P052D - COLD START CAMSHAFT POSITION TIMING OVER-RETARDED (BANK 2)

Description:	The powertrain control module (PCM) monitors the variable camshaft timing (VCT) position for over-retarded camshaft timing during cold start up. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in a retarded position.		
Possible Causes:	• Camshaft timing improperly set • Continuous oil flow to the VCT piston chamber • VCT solenoid valve stuck open • Camshaft advance mechanism binding (VCT unit)		
Diagnostic Aids:	This DTC is a functional check of the VCT unit. Diagnose any base engine concerns related to the engine oil pressure or engine timing. Refer to the **ENGINE SYSTEM - GENERAL INFORMATION -- E-SERIES** , Oil Pressure Test, to check the engine oil pressure. Refer to the **ENGINE - 4.6L AND 5.4L -- E-SERIES** , Timing Drive Components, to check the engine timing.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST HK** .	refer to **PINPOINT TEST HK** .

P0532 - A/C PRESSURE REFRIGERANT SENSOR A CIRCUIT LOW

P0532 - A/C PRESSURE REFRIGERANT SENSOR A CIRCUIT LOW

Description:	The ACP transducer sensor inputs a voltage to the powertrain control module (PCM). If the voltage is below the calibrated level the DTC sets.		
Possible Causes:	• ACP transducer sensor circuit short to GND or SIGRTN • VREF circuit open • Open ACP transducer sensor circuit • Damaged ACP transducer sensor		
Diagnostic Aids:	Verify the VREF voltage is between 4 and 6 volts.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DS** .		

P0533 - A/C REFRIGERANT PRESSURE SENSOR A CIRCUIT HIGH

P0533 - A/C REFRIGERANT PRESSURE SENSOR A CIRCUIT HIGH

Description:	The ACP transducer sensor inputs a voltage to the powertrain control

	module (PCM). If the voltage is above a calibrated level the DTC sets.		
Possible Causes:	• ACP transducer sensor circuit short to PWR • Open ACP transducer sensor circuit • ACP transducer sensor circuit short to VREF • Damaged ACP transducer sensor		
Diagnostic Aids:	Verify the VREF voltage is between 4 and 6 volts.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DS** .		

P0534 - A/C REFRIGERANT CHARGE LOSS

P0534 - A/C REFRIGERANT CHARGE LOSS

Description:	Indicates frequent A/C compressor clutch cycling.		
Possible Causes:	• Mechanical A/C system concern (such as low refrigerant charge, damaged A/C cycling switch) • Intermittent open between the cycling pressure switch and the powertrain control module (PCM) • Intermittent open in the IGN RUN circuit to cycling pressure switch (if applicable)		
Diagnostic Aids:	This test is designed to protect the transmission. In some strategies, the PCM unlocks the torque converter during A/C clutch engagement. If a concern is present that results in frequent A/C clutch cycling, damage could occur if the torque converter is cycled at these intervals. This test detects this condition, sets the DTC and prevents the torque converter from excessive cycling.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST KM** .

P0537 - A/C EVAPORATOR TEMPERATURE SENSOR CIRCUIT LOW

P0537 - A/C EVAPORATOR TEMPERATURE SENSOR CIRCUIT LOW

Description:	Indicates the ACET signal input was less than the self-test minimum. The self-test minimum is 0.13 volts.
Possible Causes:	• ACET circuit short to ground or SIG RTN • Damaged ACET sensor
Diagnostic Aids:	The powertrain control module (PCM) sources a low current 5 volts on the ACET circuit (this voltage can be measured with the sensor disconnected). As the A/C evaporator air temperature changes, the ACET circuit resistance to SIG RTN (ground) changes (which changes the voltage the PCM detects). When the ACET signal is detected below the

	self-test minimum, check for shorts to the SIG RTN or ground, which would pull the voltage low.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DJ** .		

P0538 - A/C EVAPORATOR TEMPERATURE SENSOR CIRCUIT HIGH

P0538 - A/C EVAPORATOR TEMPERATURE SENSOR CIRCUIT HIGH

Description:	Indicates the ACET signal input was greater than the self-test maximum. The self-test maximum is 4.5 volts.
Possible Causes:	• ACET circuit open • SIG RTN circuit open to the ACET sensor • ACET circuit short to voltage (VREF) • Damaged ACET sensor
Diagnostic Aids:	The powertrain control module (PCM) sources a low current 5 volts on the ACET circuit (this voltage can be measured with the sensor disconnected). As the A/C evaporator air temperature changes, the ACET circuit resistance to SIG RTN (ground) changes (which changes the voltage the PCM detects). When the ACET signal is detected above the self-test maximum, check for open circuits (ACET or SIG RTN), which would cause the voltage to remain high. Although not as probable, also check for a short to voltage (VREF).

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DJ** .		

P053A - POSITIVE CRANKCASE VENTILATION (PCV) HEATER CONTROL CIRCUIT / OPEN

P053A - POSITIVE CRANKCASE VENTILATION (PCV) HEATER CONTROL CIRCUIT / OPEN

Description:	This DTC sets when the powertrain control module (PCM) detects a positive crankcase ventilation (PCV) heater circuit failure.
Possible Causes:	• Open or shorted PCV circuit • Damaged PCV heater assembly
Diagnostic Aids:	Make sure the PCV valve is correct for the engine application and the PCV heater connector is properly connected.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HG** .

P0552 - POWER STEERING PRESSURE (PSP) SENSOR/SWITCH CIRCUIT LOW

P0552 - POWER STEERING PRESSURE (PSP) SENSOR/SWITCH CIRCUIT LOW

Description:	Indicates the PSP sensor input signal was less than the self-test minimum.		
Possible Causes:	• PSP sensor damaged • SIG RTN circuit open • VREF circuit open or shorted • PSP sensor signal circuit open or shorted		
Diagnostic Aids:	View the PSP PID to monitor the PSP input.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DT** .		

P0553 - POWER STEERING PRESSURE (PSP) SENSOR CIRCUIT HIGH INPUT

P0553 - POWER STEERING PRESSURE (PSP) SENSOR CIRCUIT HIGH INPUT

Description:	Indicates the PSP sensor input signal was greater than the self-test maximum.		
Possible Causes:	• PSP sensor damaged • VREF circuit shorted to voltage • PSP sensor signal circuit open • PSP sensor signal circuit shorted to voltage		
Diagnostic Aids:	View the PSP PID to monitor the PSP input.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DT** .		

P0563 - SYSTEM VOLTAGE HIGH

P0563 - SYSTEM VOLTAGE HIGH

Description:	This DTC is set when the powertrain control module (PCM) detects high system voltage.		
Possible Causes:	• Charging system concern		
Diagnostic Aids:	System voltage is monitored by the PCM. When the voltage is above or below a calibrated value, an internal counter increments until a DTC is set.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST B** .		

P0571 - BRAKE SWITCH A CIRCUIT

P0571 - BRAKE SWITCH A CIRCUIT

Description:	The purpose of this DTC is to check whether the brake switch has toggled or not during the KOER test.

Possible Causes:	• Open or short in the BPP circuit • Open or short in the stoplamp circuits • Concern in module(s) connected to the BPP circuit • Damaged brake switch • Misadjusted brake switch		
Diagnostic Aids:	Using the scan tool, check the BOO PID. The BOO PID should toggle on and off with brake pedal activation.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST FD** .		

P0572 - BRAKE SWITCH A CIRCUIT LOW

P0572 - BRAKE SWITCH A CIRCUIT LOW

Description:	This DTC indicates the brake switch is stuck in the ON position.		
Possible Causes:	• Open or short in the BPP circuit • Open or short in the stoplamp circuits • Damaged brake switch • Misadjusted brake switch		
Diagnostic Aids:	Using the scan tool, check the BOO PID. The BOO PID should toggle on and off with brake pedal activation.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST FD** .		

P0573 - BRAKE SWITCH A CIRCUIT HIGH

P0573 - BRAKE SWITCH A CIRCUIT HIGH

Description:	This DTC indicates the brake switch is stuck in the OFF position.		
Possible Causes:	• Open or short in the BPP circuit • Open or short in the stoplamp circuits • Damaged brake switch • Misadjusted brake switch		
Diagnostic Aids:	Using the scan tool, check the BOO PID. The BOO PID should toggle on and off with brake pedal activation.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST FD** .		

P0579 - CRUISE CONTROL MULTIFUNCTION INPUT A CIRCUIT RANGE / PERFORMANCE

P0579 - CRUISE CONTROL MULTIFUNCTION INPUT A CIRCUIT RANGE / PERFORMANCE

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **SPEED CONTROL -- E-SERIES** .		

P0581 - CRUISE CONTROL MULTIFUNCTION INPUT A CIRCUIT HIGH

P0581 - CRUISE CONTROL MULTIFUNCTION INPUT A CIRCUIT HIGH

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **SPEED CONTROL -- E-SERIES** .		

P0600 - SERIAL COMMUNICATION LINK

P0600 - SERIAL COMMUNICATION LINK

Description:	Indicates an error occurred in the powertrain control module (PCM). This DTC may be set alone or in combination with P2105.		
Possible Causes:	• Software incompatibility issue • Damaged PCM		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST QE** .

P0602 - POWERTRAIN CONTROL MODULE (PCM) PROGRAMMING ERROR

P0602 - POWERTRAIN CONTROL MODULE (PCM) PROGRAMMING ERROR

Description:	This DTC indicates a programming error within the vehicle ID (VID) block.		
Possible Causes:	• VID data corrupted by the scan tool during VID reprogramming		
Diagnostic Aids:	Using the scan tool, reprogram the VID block. If the PCM does not allow reprogramming of the VID block, reflashing of the PCM is required.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	The VID block must be programmed. Refer to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Making Changes to the VID Block.		

P0603 - INTERNAL CONTROL MODULE KEEP ALIVE MEMORY (KAM) ERROR

P0603 - INTERNAL CONTROL MODULE KEEP ALIVE MEMORY (KAM) ERROR

Description:	Indicates the powertrain control module (PCM) has experienced an internal memory concern. However, there are external items that can cause this DTC.		
Possible Causes:	• Reprogramming • Battery terminal corrosion • KAPWR to PCM interrupt/open • Loose battery connection		
Diagnostic Aids:	If KAPWR is interrupted to the PCM because of a battery or PCM disconnect, this DTC can be generated on the first power-up.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST QB** .	-	refer to **PINPOINT TEST QB** .

P0604 - INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

P0604 - INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

Description:	Indicates the powertrain control module (PCM) RAM has been corrupted.		
Possible Causes:	• Module reprogramming • Aftermarket performance products. • Damaged PCM		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Reprogram or update the calibration. Check for other DTCs or drive symptoms for further action. Make sure to check for aftermarket performance products before installing a new PCM. If it is necessary to install a new PCM, refer to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.		

P0605 - INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR

P0605 - INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR

Description:	The powertrain control module (PCM) ROM has been corrupted.
Possible Causes:	• An attempt was made to change the calibration • Module programming error • Aftermarket performance products • Damaged PCM

Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Reprogram the vehicle identification VID block (use as built data). Check for other DTCs or drive symptoms for further action. Make sure to check for aftermarket performance products before installing a new powertrain control module (PCM). If it is necessary to install a new PCM, refer to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.		

P0606 - CONTROL MODULE PROCESSOR

P0606 - CONTROL MODULE PROCESSOR

Description:	This DTC indicates an internal powertrain control module (PCM) communication error.		
Possible Causes:	• Damaged PCM		
Diagnostic Aids:	Reprogram or update the calibration. Check for other DTCs and diagnose those first. Make sure to check for aftermarket performance products before installing a new PCM. Clear the DTCs, repeat the self-test. If the DTC is retrieved again, install a new PCM. Refer to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Reprogram or update the calibration. Check for other DTCs and diagnose those first. Make sure to check for aftermarket performance products before installing a new PCM. Clear the DTCs, repeat the self-test. If the DTC is retrieved again, install a new PCM. Refer to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.		

P0607 - CONTROL MODULE PERFORMANCE

P0607 - CONTROL MODULE PERFORMANCE

Description:	Indicates that the powertrain control module (PCM) internal central processing unit (CPU) has encountered an error. The PCM monitors itself and carries out internal checks of its own CPU. If any of these checks returns an incorrect value, the DTC is set.
Possible Causes:	• Module programming error • Aftermarket performance products • Damaged PCM
	Reprogram or update the calibration. Check for other DTCs and diagnose

Diagnostic Aids:	those first. Make sure to check for aftermarket performance products before installing a new PCM. Clear the DTCs, repeat the self-test. If the DTC is retrieved again, install a new PCM. Refer to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Reprogram or update the calibration. Check for other DTCs and diagnose those first. Make sure to check for aftermarket performance products before installing a new PCM. Clear the DTCs, repeat the self-test. If the DTC is retrieved again, install a new PCM. Refer to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.		

P060A - INTERNAL CONTROL MODULE MONITORING PROCESSOR PERFORMANCE

P060A - INTERNAL CONTROL MODULE MONITORING PROCESSOR PERFORMANCE

Description:	Indicates an error occurred in the powertrain control module (PCM). This DTC may set in combination with P2105.		
Possible Causes:	• Software incompatibility issue • Damaged PCM		
Diagnostic Aids:	Verify the PCM is at the latest calibration level.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST QE** .

P060B - INTERNAL CONTROL MODULE A/D PROCESSING PERFORMANCE

P060B - INTERNAL CONTROL MODULE A/D PROCESSING PERFORMANCE

Description:	Indicates an error occurred in the powertrain control module (PCM). This DTC may set in combination with P2104 or P2110.		
Possible Causes:	• Damaged PCM		
Diagnostic Aids:	Inspect the harness for damage. Verify correct operation of the sensors using VREF and related circuits.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST QE** .

P060C - INTERNAL CONTROL MODULE MAIN PROCESSOR PERFORMANCE

P060C - INTERNAL CONTROL MODULE MAIN PROCESSOR PERFORMANCE

Description:	Indicates an error occurred in the powertrain control module (PCM).		
Possible Causes:	• Software incompatibility issue • Damaged PCM		
Diagnostic Aids:	Verify the PCM is at the latest calibration level.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST QE** .

P060D - INTERNAL CONTROL MODULE ACCELERATOR PEDAL POSITION PERFORMANCE

P060D - INTERNAL CONTROL MODULE ACCELERATOR PEDAL POSITION PERFORMANCE

Description:	Indicates an error occurred in the powertrain control module (PCM). If the PCM detects a concern identifying an issue with an accelerator pedal position (APP) sensor signal or with processing the brake pedal sensor input, the DTC is set.		
Possible Causes:	• Damaged PCM		
Diagnostic Aids:	Verify the PCM is at the latest calibration level.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST QE** .

P0610 - CONTROL MODULE VEHICLE OPTIONS ERROR

P0610 - CONTROL MODULE VEHICLE OPTIONS ERROR

Description:	Indicates a powertrain control module (PCM) vehicle options error.		
Possible Causes:	• Module reprogramming • Aftermarket performance products. • PCM		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	See Note 1

P061B - INTERNAL CONTROL MODULE TORQUE CALCULATION PERFORMANCE

P061B - INTERNAL CONTROL MODULE TORQUE CALCULATION PERFORMANCE

Description:	Indicates a calculation error occurred in the powertrain control module (PCM).		
Possible Causes:			
Diagnostic Aids:	Check for sensor and circuit related DTCs. Do not install a new electronic throttle body (ETB) for this DTC.		

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	-	-	refer to **PINPOINT TEST QE** .

P061C - INTERNAL CONTROL MODULE ENGINE RPM PERFORMANCE

P061C - INTERNAL CONTROL MODULE ENGINE RPM PERFORMANCE

Description:	Indicates a calculation error occurred in the powertrain control module (PCM).		
Possible Causes:	• Crankshaft position (CKP) sensor circuit is open or short • CKP sensor circuit intermittent • Damaged CKP sensor • Camshaft position (CMP) sensor circuit is open or short • CMP sensor circuit intermittent • Damaged CMP sensor • Damaged PCM		
Diagnostic Aids:	Verify correct operation of the CKP and CMP sensors and related circuits.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST QE** .

P061D - INTERNAL CONTROL MODULE ENGINE AIR MASS PERFORMANCE

P061D - INTERNAL CONTROL MODULE ENGINE AIR MASS PERFORMANCE

Description:	Indicates an error occurred in the powertrain control module (PCM).		
Possible Causes:	• Software incompatibility issue • Damaged PCM		
Diagnostic Aids:	Verify the PCM is at the latest calibration level.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST QE** .

P061F - INTERNAL CONTROL MODULE THROTTLE ACTUATOR CONTROLLER PERFORMANCE

P061F - INTERNAL CONTROL MODULE THROTTLE ACTUATOR CONTROLLER PERFORMANCE

Description:	Indicates an error occurred in the powertrain control module (PCM).
Possible Causes:	

Diagnostic Aids:	Verify correct operation of the electronic throttle control (ETC) components and related circuits.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST QE** .

P0620 - GENERATOR CONTROL CIRCUIT

P0620 - GENERATOR CONTROL CIRCUIT

Description:	The powertrain control module (PCM) reads the GENLI and sends a DTC through the network when the signal frequency of GENLI indicates a concern.		
Possible Causes:	• I-line control (ILC) circuit short to ground • ILC circuit short to voltage • ILC circuit open • GENLI circuit short to voltage or ground • GENLI circuit open • B+ circuit open • Generator drive mechanism • Damaged generator/regulator assembly • Damaged PCM		
Diagnostic Aids:	Verify the battery voltage is 14.5 volts. Verify the generator/regulator has the correct part number.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HY** .		

P0622 - GENERATOR FIELD TERMINAL CIRCUIT

P0622 - GENERATOR FIELD TERMINAL CIRCUIT

Description:	The powertrain control module (PCM) monitors the generator load from the generator/regulator in the form of frequency. The frequency range is determined by the temperature of the voltage regulator, where 97% indicates a full load, and less than 6% indicates no load.
Possible Causes:	• GENLI circuit short to voltage or ground • GENLI circuit open • GENRC circuit short to voltage or ground • GENRC circuit open • ILC circuit short to voltage or ground • ILC circuit open • Battery-sense circuit open

	• Generator drive mechanism • Damaged generator/regulator assembly • Damaged PCM		
Diagnostic Aids:	Verify the battery voltage is 14.5 volts. Verify the generator/regulator has the correct part number.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HY** .		

P0625 - GENERATOR FIELD TERMINAL CIRCUIT LOW

P0625 - GENERATOR FIELD TERMINAL CIRCUIT LOW

Description:	The powertrain control module (PCM) monitors generator load from the generator/regulator in the form of frequency. The concern indicates the input is lower than the load should be in normal operation. The load input could be low when no generator output exists.		
Possible Causes:	• GENRC circuit short to ground • GENLI circuit short to ground • Open B+ wire during operation • Low system voltage • Broken generator belt • Damaged generator/regulator assembly		
Diagnostic Aids:	Verify the battery voltage is 14.5 volts. Verify the generator/regulator has the correct part number.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HY** .		

P0626 - GENERATOR FIELD TERMINAL CIRCUIT HIGH

P0626 - GENERATOR FIELD TERMINAL CIRCUIT HIGH

Description:	The powertrain control module (PCM) monitors generator load from the generator/regulator in the form of frequency. The concern indicates the input is higher than the load should be in normal operation. The load input could be high when a battery short to ground exists.		
Possible Causes:	• GENLI circuit short to voltage • GENRC circuit short to voltage • B+ open prior to start-up • Open GENRC prior to start-up • Open ILC prior to start-up		
Diagnostic Aids:	Verify the battery voltage is 14.5 volts. Verify the generator/regulator has the correct part number.		

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	refer to **PINPOINT TEST HY** .		

P062C - INTERNAL CONTROL MODULE VEHICLE SPEED PERFORMANCE

P062C - INTERNAL CONTROL MODULE VEHICLE SPEED PERFORMANCE

Description:	Indicates an error occurred in the powertrain control module (PCM).		
Possible Causes:	• Module communications network concerns • Output shaft speed (OSS) sensor concern • Turbine shaft speed (TSS) sensor concern • Antilock braking system (ABS) concern		
Diagnostic Aids:	Repair any ABS DTCs, ABS-related DTCs in other modules, or vehicle communication concerns.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST QE** .

P0642 - SENSOR REFERENCE VOLTAGE A CIRCUIT LOW

P0642 - SENSOR REFERENCE VOLTAGE A CIRCUIT LOW

Description:	Indicates the reference voltage (VREF) circuit is less than VREF minimum.		
Possible Causes:	• VREF circuit short to ground • Damaged sensor • Incorrect harness connection		
Diagnostic Aids:	This DTC is set due to an under voltage condition on the VREF circuit.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST C** .		

P0643 - SENSOR REFERENCE VOLTAGE A CIRCUIT HIGH

P0643 - SENSOR REFERENCE VOLTAGE A CIRCUIT HIGH

Description:	Indicates the reference voltage (VREF) circuit is greater than VREF maximum.		
Possible Causes:	• VREF circuit short to voltage • Damaged sensor • Incorrect harness connection		
Diagnostic Aids:	This DTC is set due to an over voltage condition on the VREF circuit.		
Application	**Key On Engine**	**Key On Engine**	**Continuous Memory**

	Off	Running	
All	refer to **PINPOINT TEST C** .		

P0645 - AIR CONDITIONING CLUTCH RELAY (A/CCR) CONTROL CIRCUIT

P0645 - AIR CONDITIONING CLUTCH RELAY (A/CCR) CONTROL CIRCUIT

Description:	Monitors the A/CCR circuit output from the powertrain control module (PCM). The test fails when the PCM grounds the A/CCR circuit, excessive current draw is detected on the A/CCR circuit; or, with the A/CCR circuit not grounded by the PCM, voltage is not detected on the A/CCR circuit (the PCM expects to detect VPWR voltage coming through the A/CCR relay coil to the A/CCR circuit).		
Possible Causes:	• Open or short A/CCR circuit • Damaged A/CCR relay • Open VPWR circuit to the A/CCR relay		
Diagnostic Aids:	The A/CCR control circuit can be monitored using the WACF and WAC PID. When the WACF PID reads YES, a concern is present. An open circuit or short to ground can only be detected when the PCM is not grounding the circuit. A short to voltage can only be detected when the PCM is grounding the circuit. During the key on engine off (KOEO) and key on engine running (KOER) self-test, the WAC circuit is cycled on and off. Verify the A/C and the defrost were OFF during the KOEO and KOER self-tests. Check ACCS the PID to verify. If the vehicle is not equipped with A/C, ignore DTC P0645.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KM** .		

P064D - INTERNAL CONTROL MODULE O2 SENSOR PROCESSOR PERFORMANCE - BANK 1

P064D - INTERNAL CONTROL MODULE O2 SENSOR PROCESSOR PERFORMANCE - BANK 1

Description:	The powertrain control module (PCM) monitors the application-specific integrated circuit that controls and monitors the heated oxygen sensor (HO2S). The test fails when the PCM detects an internal circuit or communication concern.		
Possible Causes:	• Damaged PCM		
Diagnostic Aids:	Internal PCM concern.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
	Reprogram or update the calibration. Check for other DTCs and diagnose those first. Make sure to check for aftermarket performance products before installing a new PCM. Clear the DTCs, repeat the self-		

All		test. If the DTC is retrieved again, install a new PCM. Refer to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .

P064E - INTERNAL CONTROL MODULE O2 SENSOR PROCESSOR PERFORMANCE - BANK 2

P064E - INTERNAL CONTROL MODULE O2 SENSOR PROCESSOR PERFORMANCE - BANK 2

Description: **Possible Causes:** **Diagnostic Aids:**	See the description for DTC P064D. See the possible causes for DTC P064D. See the diagnostic aids for DTC P064D.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Reprogram or update the calibration. Check for other DTCs and diagnose those first. Make sure to check for aftermarket performance products before installing a new PCM. Clear the DTCs, repeat the self-test. If the DTC is retrieved again, install a new PCM. Refer to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .		

P0657 - ACTUATOR SUPPLY VOLTAGE A CIRCUIT/OPEN

P0657 - ACTUATOR SUPPLY VOLTAGE A CIRCUIT/OPEN

Description:	Voltage to all transmission solenoids has been interrupted.		
Possible Causes:			
Diagnostic Aids:	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P065B - GENERATOR CONTROL CIRCUIT RANGE/PERFORMANCE

P065B - GENERATOR CONTROL CIRCUIT RANGE/PERFORMANCE

Description:	The powertrain control module (PCM) reads the GENLI and sends a DTC through the network when the signal frequency of GENLI indicates a concern.		
Possible Causes:	• GENLI circuit short to voltage or ground • GENLI circuit open • Damaged generator/regulator assembly • Damaged PCM		
Diagnostic Aids:	Verify the battery voltage is 14.5 volts. Verify the generator/regulator has the correct part number.		
	Key On Engine	**Key On Engine**	

Application	Off	Running	Continuous Memory
All	refer to **PINPOINT TEST HY** .		

P0660 - INTAKE MANIFOLD TUNING VALVE (IMTV) CONTROL CIRCUIT OPEN - BANK 1

P0660 - INTAKE MANIFOLD TUNING VALVE (IMTV) CONTROL CIRCUIT OPEN - BANK 1

Description:	The IMTV system is monitored for failure during continuous, key on engine off (KOEO), or key on engine running (KOER) self-tests. The test fails when the signal is more or less than an expected calibrated range.		
Possible Causes:	• IMTV signal circuit open, shorted to PWR GND or SIG RTN • Damaged IMTV actuator		
Diagnostic Aids:	An IMTVM PID reading may indicate a fault.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P0663 - INTAKE MANIFOLD TUNING VALVE (IMTV) CONTROL CIRCUIT OPEN - BANK 2

P0663 - INTAKE MANIFOLD TUNING VALVE (IMTV) CONTROL CIRCUIT OPEN - BANK 2

Description:	The IMTV system is monitored for failure during continuous, key on engine off (KOEO), or key on engine running (KOER) self-tests. The test fails when the signal is more or less than an expected calibrated range.		
Possible Causes:	• IMTV signal circuit open, shorted to PWR GND or SIG RTN • Damaged IMTV actuator		
Diagnostic Aids:	An IMTVM PID reading may indicate a fault.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P0685 - ELECTRONIC CONTROL MODULE (ECM)/POWERTRAIN CONTROL MODULE (PCM) POWER RELAY CONTROL CIRCUIT/OPEN

P0685 - ELECTRONIC CONTROL MODULE (ECM)/POWERTRAIN CONTROL MODULE (PCM) POWER RELAY CONTROL CIRCUIT/OPEN

Description:	This DTC sets when the ignition switch position run (ISP-R) circuit indicates the key is in the OFF, ACC, or LOCK position, and the amount of time the PCM remains powered through the PCM power relay exceeds a predetermined amount of time.		
Possible Causes:	• PCM relay control (PCMRC) circuit short to ground in the harness • Damaged PCM power relay		
Diagnostic Aids:	Ability to communicate with the PCM when the key is in the OFF, ACC, or LOCK position indicates a hard fault.		
Application	**Key On Engine**	**Key On Engine**	**Continuous Memory**

	Off	Running	
All	refer to **PINPOINT TEST B** .		

P0689 - ELECTRONIC CONTROL MODULE (ECM)/POWERTRAIN CONTROL MODULE (PCM) POWER RELAY SENSE CIRCUIT LOW

P0689 - ELECTRONIC CONTROL MODULE (ECM)/POWERTRAIN CONTROL MODULE (PCM) POWER RELAY SENSE CIRCUIT LOW

Description:	This DTC sets when the passive anti theft system (PATS) system indicates the key is in ON or START position and the ignition switch position run (ISP-R) circuit indicates OFF, ACC, or LOCK position.		
Possible Causes:	• Ignition circuit fuse • ISP-R circuit open in the harness • ISP-R circuit short to ground in the harness • Damaged ignition switch • Damaged PATS system		
Diagnostic Aids:	Diagnose and repair all PATS DTCs first.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST B** .		

P0690 - ELECTRONIC CONTROL MODULE (ECM)/POWERTRAIN CONTROL MODULE (PCM) POWER RELAY SENSE CIRCUIT HIGH

P0690 - ELECTRONIC CONTROL MODULE (ECM)/POWERTRAIN CONTROL MODULE (PCM) POWER RELAY SENSE CIRCUIT HIGH

Description:	This DTC sets when the passive anti theft system (PATS) system indicates the key is in the OFF, ACC, or LOCK position and the ignition switch position run (ISP-R) circuit indicates ON or START position.		
Possible Causes:	• ISP-R circuit short to voltage in the harness • Damaged PATS system • Damaged ignition switch		
Diagnostic Aids:	Diagnose and repair all PATS DTCs first.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST B** .		

P0703 - BRAKE SWITCH B INPUT CIRCUIT

P0703 - BRAKE SWITCH B INPUT CIRCUIT

Description:	Indicates the powertrain control module (PCM) did not receive a brake pedal position (BPP) input.
	• Open or short in the BPP circuit

Possible Causes:	• Open or short in the stoplamp circuits • Damage in module(s) connected to the BPP circuit. • Damaged brake switch • Misadjusted brake switch		
Diagnostic Aids:	Check for proper function of the stoplamp. Using a scan tool, check the BPP PID. The stoplamp and PID should toggle on and off with brake pedal activation.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Town Car	Verify the brake pedal was applied and released during the key on engine running (KOER) self-test. For additional concerns, refer to the **EXTERIOR LIGHTING -- E-SERIES** .		
Expedition, Navigator	Verify the brake pedal was applied and released during the key on engine running (KOER) self-test. For additional concerns, refer to the **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS) -- E-SERIES** .		
All others	refer to **PINPOINT TEST FD** .		

P0704 - CLUTCH SWITCH INPUT CIRCUIT

P0704 - CLUTCH SWITCH INPUT CIRCUIT

Description:	When the clutch pedal is applied the voltage goes to low. If the powertrain control module (PCM) does not see this change from high to low the DTC is set.		
Possible Causes:	• Clutch pedal position (CPP) circuit short to voltage • Damaged CPP switch • CPP circuit open in the SIGRTN		
Diagnostic Aids:	When the clutch pedal is applied and then released, the CPP switch voltage should cycle.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST TA** .	-	refer to **PINPOINT TEST TA** .

P0705 - TRANSMISSION RANGE SENSOR A CIRCUIT (PRNDL) INPUT

P0705 - TRANSMISSION RANGE SENSOR A CIRCUIT (PRNDL) INPUT

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION -**		

	4R70E/4R75E -- E-SERIES .

P0707 - TRANSMISSION RANGE SENSOR A CIRCUIT LOW

P0707 - TRANSMISSION RANGE SENSOR A CIRCUIT LOW

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P0708 - TRANSMISSION RANGE SENSOR A CIRCUIT HIGH

P0708 - TRANSMISSION RANGE SENSOR A CIRCUIT HIGH

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P071X - TRANSMISSION CODE

P071X - TRANSMISSION CODE

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P0720 - OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT

P0720 - OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT

Description:	The OSS sensor inputs a signal to the powertrain control module (PCM) based on the speed of the output shaft of the transmission.
Possible Causes:	• OSS sensor circuit short to GND • OSS sensor circuit short to PWR • OSS sensor circuit open

	• Damaged OSS sensor		
Diagnostic Aids:	Verify the sensor signal output varies with the vehicle speed.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Manual Transmission	-	-	refer to **PINPOINT TEST DP** .
Automatic Transmission	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P0721 - OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT RANGE/PERFORMANCE

P0721 - OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT RANGE/PERFORMANCE

Description:	The OSS sensor signal is very sensitive to noise. This noise distorts the input to the powertrain control module (PCM).		
Possible Causes:	• Wiring misrouted • Aftermarket add-on • Wiring damaged • Wiring insulation wear		
Diagnostic Aids:	Check the routing of the harness. Check the wiring and the connector for damage.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Manual Transmission	-	-	refer to **PINPOINT TEST DP** .
Automatic Transmission	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P0722 - OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT NO SIGNAL

P0722 - OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT NO SIGNAL

Description:	The OSS sensor failed to provide a signal to the PCM upon initial movement of vehicle.		
Possible Causes:	• Damaged OSS connector • Damaged OSS sensor, or not installed properly • Harness intermittently shorted or open		
Diagnostic Aids:	Check the wiring, connector, and sensor for damage.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Manual Transmission	-	-	refer to **PINPOINT TEST DP** .
Automatic Transmission	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P0723 - OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT INTERMITTENT

P0723 - OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT INTERMITTENT

Description:	The OSS sensor signal to the PCM is irregular or interrupted.		
Possible Causes:	• Harness connector not properly seated • Harness intermittently shorted or open • Harness connector damaged • OSS sensor damaged, or not installed properly		
Diagnostic Aids:	Verify harness and connector integrity. Verify proper installation of the OSS sensor.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Manual Transmission	-	-	refer to **PINPOINT TEST DP** .
Automatic Transmission	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P073X - TRANSMISSION CODE

P073X - TRANSMISSION CODE

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P074X - TRANSMISSION CODE

P074X - TRANSMISSION CODE

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P075X - TRANSMISSION CODE

P075X - TRANSMISSION CODE

Description:	

Possible Causes: **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P076X - TRANSMISSION CODE

P076X - TRANSMISSION CODE

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P077X - TRANSMISSION CODE

P077X - TRANSMISSION CODE

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P078X - TRANSMISSION CODE

P078X - TRANSMISSION CODE

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P079X - TRANSMISSION CODE

P079X - TRANSMISSION CODE

Description:	

Possible Causes: **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P0815 - UPSHIFT SWITCH CIRCUIT

P0815 - UPSHIFT SWITCH CIRCUIT

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P0830 - CLUTCH PEDAL SWITCH A CIRCUIT

P0830 - CLUTCH PEDAL SWITCH A CIRCUIT

Description:	The powertrain control module (PCM) monitors the clutch pedal position bottom of travel (CPP-BT) switch only during the calibrated engine speed range (cranking speed range). This DTC is set when the CPP-BT switch does not indicate that the clutch is disengaged (clutch pedal pressed) when the engine is cranked.		
Possible Causes:	• Damaged CPP-BT switch • Damaged CPP-BT harness • Open PWRGND circuit to the CPP-BT switch • Vehicle push-started with the clutch engaged (clutch pedal released) • Aftermarket remote starting device		
Diagnostic Aids:	Verify that the vehicle was not push-started with the clutch engaged. Check for aftermarket equipment such as remote starting devices which may bypass the clutch pedal position switch when cranking the engine.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
F-150 4.2L	-	-	refer to **PINPOINT TEST TA** .
All others	Refer to the **STARTING SYSTEM - GASOLINE ENGINES -- E-SERIES** to diagnose the symptom no start, no crank.		

P0833 - CLUTCH PEDAL SWITCH B CIRCUIT

P0833 - CLUTCH PEDAL SWITCH B CIRCUIT

Description:	The powertrain control module (PCM) monitors the clutch pedal position top of travel (CPP-TT) switch only during the calibrated engine speed range (cranking speed range). This DTC is set when the CPP-TT does not indicate that the clutch is disengaged (clutch pedal pressed) when the engine is cranked.		
Possible Causes:	• Damaged CPP-TT switch • Damaged CPP-TT harness • Open PWRGND circuit to the CPP-TT switch • Vehicle push-started with the clutch engaged (clutch pedal released) • Aftermarket remote starting device		
Diagnostic Aids:	Verify that the vehicle was not push-started with the clutch engaged. Check for aftermarket equipment such as remote starting devices which may bypass the clutch pedal position switch when cranking the engine.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **SPEED CONTROL -- E-SERIES** .		

P0840 - TRANSMISSION FLUID PRESSURE SENSOR/SWITCH A CIRCUIT

P0840 - TRANSMISSION FLUID PRESSURE SENSOR/SWITCH A CIRCUIT

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P09XX - TRANSMISSION CODE

P09XX - TRANSMISSION CODE

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P1000 - ON-BOARD DIAGNOSTIC (OBD) SYSTEMS READINESS TEST NOT COMPLETE

P1000 - ON-BOARD DIAGNOSTIC (OBD) SYSTEMS READINESS TEST NOT COMPLETE

Description:	The OBD monitors are carried out during the OBD drive cycle. This DTC is stored in continuous memory if any of the OBD monitors do not carry out their full diagnostic check.		
Possible Causes:	• The vehicle is new from the factory • Battery or powertrain control module (PCM) had recently been disconnected • An OBD monitor concern occurred before completion of an OBD drive cycle • PCM DTCs have recently been cleared with a scan tool • Power take off (PTO) circuit concern or PTO is on during testing.		
Diagnostic Aids:	This DTC, inspection/maintenance (I/M) readiness function is part of the PCM strategy. A battery disconnection or clearing codes using a scan tool results in the various I/M readiness bits being set to a not-ready condition. As each non-continuous OBD monitor completes a full diagnostic check, the I/M readiness bit associated with that monitor is set to a ready condition. This may take 1 or 2 drive cycles based on whether concerns are detected or not. The readiness bits for comprehensive component monitoring (CCM), misfire and fuel system monitoring are considered complete once all the non-continuous monitors have been evaluated. Because the EVAP system monitor requires certain ambient conditions to run, special logic can bypass the monitor for the purpose of clearing the EVAP and I/M readiness bit, due to continued presence of these extreme conditions. DTC P1000 does not need to be cleared from the PCM except to pass an I/M test. The malfunction indicator lamp (MIL) flashes after a period of time with the key in the RUN position (engine not running) if DTC P1000 is set.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	See Note 2	See Note 2	refer to **PINPOINT TEST QC** .

P1001 - KEY ON ENGINE RUNNING (KOER) NOT ABLE TO COMPLETE, KOER ABORTED

P1001 - KEY ON ENGINE RUNNING (KOER) NOT ABLE TO COMPLETE, KOER ABORTED

Description:	This non-malfunction indicator lamp (MIL) DTC is set when the KOER self-test does not complete in the time allowed.		
Possible Causes:	• Incorrect self-test procedure • Unexpected response from the self-test monitors • RPM out of specification		
Diagnostic Aids:	Carry out the KOEO self-test. Refer to the **SYMPTOM CHARTS** article, Powertrain Control Module (PCM) Quick Test.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the Description, Possible Causes and Diagnostic Aids for the		

	DTC.

P1100 - MASS AIR FLOW (MAF) SENSOR CIRCUIT INTERMITTENT

P1100 - MASS AIR FLOW (MAF) SENSOR CIRCUIT INTERMITTENT

Description:	The MAF sensor circuit is monitored by the powertrain control module (PCM) for sudden voltage (or air flow) input change through the comprehensive component monitor (CCM). If during the last 40 warm-up cycles in key on, engine running (KOER) the PCM detects a voltage (or air flow) change beyond the minimum or maximum calibrated limit, a continuous memory DTC is stored.		
Possible Causes:	• Poor continuity through the MAF sensor connectors • Poor continuity through the MAF sensor harness • Intermittent open or short inside the MAF sensor		
Diagnostic Aids:	While accessing the MAF PID on the scan tool, lightly tap on the MAF sensor or wiggle the MAF sensor connector and harness. If the MAF PID suddenly changes below 0.23 volt or above 4.60 volts, an intermittent fault is indicated.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DC** .		

P1101 - MASS AIR FLOW (MAF) SENSOR OUT OF SELF-TEST RANGE

P1101 - MASS AIR FLOW (MAF) SENSOR OUT OF SELF-TEST RANGE

Description:	The MAF sensor circuit is monitored by the powertrain control module (PCM) for an out of range air flow (or voltage) input. If, during key on engine off (KOEO), the air flow voltage signal is greater than 0.27 volt the test fails. Likewise, if, during key on engine running (KOER), the air flow voltage signal is not within 0.46 volt to 2.44 volts, the test fails.		
Possible Causes:	• Low battery charge • MAF sensor partially connected • MAF sensor contamination • PWR GND open to the MAF sensor • MAF RTN circuit open to PCM • Damaged MAF sensor		
Diagnostic Aids:	A MAF PID reading greater than 0.27 volt (KOEO) or a MAF PID reading outside the 0.46 volt to 2.44 volts range (KOER) indicates a hard fault.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DC** .	refer to **PINPOINT TEST DC** .	-

P1112 - INTAKE AIR TEMPERATURE (IAT) CIRCUIT INTERMITTENT

P1112 - INTAKE AIR TEMPERATURE (IAT) CIRCUIT INTERMITTENT

Description:	Indicates the IAT sensor signal was intermittent.		
Possible Causes:	• Damaged harness • Damaged sensor • Damaged harness connector		
Diagnostic Aids:	Monitor the IAT on a scan tool. Look for sudden changes in the reading when the harness is wiggled or the sensor is tapped.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST DA** .

P1114 - INTAKE AIR TEMPERATURE 2 (IAT2) CIRCUIT LOW (SUPERCHARGED/TURBOCHARGED ENGINES)

P1114 - INTAKE AIR TEMPERATURE 2 (IAT2) CIRCUIT LOW (SUPERCHARGED/TURBOCHARGED ENGINES)

Description:	Indicates the sensor signal is less than the self-test minimum. The IAT2 sensor minimum is 0.2 volt.		
Possible Causes:	• Grounded circuit in the harness • Incorrect harness connection • Damaged sensor		
Diagnostic Aids:	Monitor the IAT2 PID value. A typical IAT2 temperature should be greater than the IAT1 temperature.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DU** .		

P1115 - INTAKE AIR TEMPERATURE 2 (IAT2) CIRCUIT HIGH (SUPERCHARGED/TURBOCHARGED ENGINES)

P1115 - INTAKE AIR TEMPERATURE 2 (IAT2) CIRCUIT HIGH (SUPERCHARGED/TURBOCHARGED ENGINES)

Description:	Indicates the sensor signal is greater than the self-test maximum. The IAT2 sensor maximum is 4.6 volts.
Possible Causes:	• Open circuit in the harness • Sensor signal short to voltage • Incorrect harness connection • Damaged sensor
Diagnostic Aids:	Monitor the IAT2 PID value. A typical IAT2 temperature should be greater than the IAT1 temperature.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	refer to **PINPOINT TEST DU** .		

P1116 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR OUT OF SELF-TEST RANGE

P1116 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR OUT OF SELF-TEST RANGE

Description:	Indicates the ECT sensor is out of self-test range. The correct range is 0.3 to 3.7 volts.		
Possible Causes:	• Overheating condition • Malfunctioning thermostat • Damaged ECT sensor • Low engine coolant • Damaged harness connector		
Diagnostic Aids:	The ECT must be greater than 10°C (50°F) to pass the key on engine off (KOEO) self-test and greater than 82°C (180°F) to pass the key on engine running (KOER) self-test.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles with only a (CHT) sensor	refer to **PINPOINT TEST DL** .	refer to **PINPOINT TEST DL** .	-
All others	refer to **PINPOINT TEST DX** .	refer to **PINPOINT TEST DX** .	-

P1117 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT INTERMITTENT

P1117 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT INTERMITTENT

Description:	Indicates the ECT circuit became intermittently open or shorted while the engine was running.		
Possible Causes:	• Damaged harness • Damaged sensor • Damaged harness connector • Low engine coolant		
Diagnostic Aids:	Monitor the ECT on a scan tool. Look for sudden changes in the reading when the harness is wiggled or the sensor is tapped.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST DX** .

P1120 - THROTTLE POSITION SENSOR A OUT OF RANGE LOW (RATCH TOO LOW)

P1120 - THROTTLE POSITION SENSOR A OUT OF RANGE LOW (RATCH TOO LOW)

Description:	The throttle position (TP) sensor circuit is monitored by the powertrain control module (PCM) for a low TP rotation angle or voltage input below the closed throttle position through the comprehensive component monitor (CCM). The test fails if the TP rotation angle or voltage remains within the calibrated self-test range, but falls between 3.42-9.85% (0.17-0.49 volt).		
Possible Causes:	• TP circuit with frayed wires • Corrosion or loose connection on the TP circuit connectors and pins • VREF open to TP sensor • VREF short to SIG RTN		
Diagnostic Aids:	A TP PID between 3.42-9.85% (0.17-0.49 volt) in key ON, engine OFF or key ON, engine running indicates a concern is present.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DH** .		

P1124 - THROTTLE POSITION SENSOR A OUT OF SELF-TEST RANGE

P1124 - THROTTLE POSITION SENSOR A OUT OF SELF-TEST RANGE

For Vehicles With Electronic Throttle Control (ETC)			
Description:	During key on engine off (KOEO) and key on engine running (KOER) self-tests, the powertrain control module (PCM) monitors the electronic throttle control (ETC) throttle position (TP) sensor inputs to determine if the TP1 and TP2 signals are less than an expected value. If either TP1 or TP2 is greater than the expected value, the DTC is set.		
Possible Causes:	• Accelerator pedal applied during KOEO or KOER self-test		
Diagnostic Aids:	Repeat the self-test without applying the accelerator pedal. Make sure the floor mat is not interfering with the accelerator pedal. Diagnose any TP circuit DTCs first.		
For All Others			
Description:	The throttle position (TP) sensor circuit is monitored by the powertrain control module (PCM) for an out of range TP rotation angle or voltage input. The test fails if the TP rotation angle or voltage reading is less than 13.27% (0.66 volt) or greater than 23.52% (1.17 volts).		
Possible Causes:	• Binding or bent throttle linkage • TP sensor not seated properly • Throttle plate below closed throttle position • Throttle plate/screw misadjusted • Damaged TP sensor		
Diagnostic Aids:	The TP PID reading not between 13.27-23.52% (0.66-1.17 volts) in key ON, engine OFF or key ON, engine running indicates a concern is present.		
Application	**Key On Engine Off**	**Key On Engine**	**Continuous Memory**

			Running	
Vehicles With Electronic Throttle Control (ETC)		refer to **PINPOINT TEST DV** .	refer to **PINPOINT TEST DV** .	-
All others		refer to **PINPOINT TEST DH** .	refer to **PINPOINT TEST DH** .	-

P1127 - EXHAUST TEMPERATURE OUT OF RANGE, O2 SENSOR TESTS NOT COMPLETED

P1127 - EXHAUST TEMPERATURE OUT OF RANGE, O2 SENSOR TESTS NOT COMPLETED

Description:	The heated oxygen sensor (HO2S) monitor uses an exhaust temperature model to determine when the HO2S heaters are cycled ON. The test fails when the inferred exhaust temperature is below a minimum calibrated value.		
Possible Causes:	• Engine not operating long enough prior to carrying out the key on engine running (KOER) self-test • Exhaust system too cool		
Diagnostic Aids:	Monitor the HO2S heater PIDs to determine their ON/OFF state. DTC P1127 is present if the exhaust is not hot.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Sable PZEV, Taurus PZEV, Taurus X PZEV	-	refer to **PINPOINT TEST DZ** .	-
All others	-	refer to **PINPOINT TEST DW** .	-

P115E - THROTTLE ACTUATOR CONTROL (TAC) THROTTLE BODY AIR FLOW TRIM AT MAX LIMIT

P115E - THROTTLE ACTUATOR CONTROL (TAC) THROTTLE BODY AIR FLOW TRIM AT MAX LIMIT

Description:	During idle, the powertrain control module (PCM) monitors the throttle angle and air flow. If the air flow is determined to be less than expected, the PCM adjusts the throttle angle to compensate. The air flow reduction is typically the result of engine deposit buildup around the throttle plate. This DTC indicates the PCM has reached the maximum allowed compensation and is no longer able to compensate for the buildup.		
Possible Causes:	• Engine deposits around the throttle plate		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Install a new throttle body. Refer to the **FUEL SYSTEM - GENERAL INFORMATION - GASOLINE AND DIESEL -- E-SERIES** .		

P117A - ENGINE OIL OVER TEMPERATURE - FORCED LIMITED POWER

P117A - ENGINE OIL OVER TEMPERATURE - FORCED LIMITED POWER

Description:	Indicates the engine oil protection strategy is enabled when the engine oil temperature (EOT) reaches a predetermined level in the powertrain control module (PCM). The PCM then limits the engine RPMs until the EOT returns to normal.		
Possible Causes:	• Engine overheating • Low engine coolant • Loaded weight is greater than the maximum vehicle weight rating. Refer to Owner's Literature for vehicle weight ratings.		
Diagnostic Aids:	This DTC is an informational DTC and may be set by an engine overheating concern. If the engine overheats, check the cooling system. Refer to the **ENGINE COOLING -- E-SERIES** for cooling system diagnosis.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the Description, Possible Causes and Diagnostic Aids for the DTC.		

P1184 - ENGINE OIL TEMPERATURE (EOT) SENSOR OUT OF SELF-TEST RANGE

P1184 - ENGINE OIL TEMPERATURE (EOT) SENSOR OUT OF SELF-TEST RANGE

Description:	Indicates the EOT signal was out of self-test range.		
Possible Causes:	• Damaged harness • Damaged sensor • Damaged harness connector		
Diagnostic Aids:	The engine should be at operating temperature before carrying out the self-test.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DY** .		

P1227 - WASTEGATE FAILED CLOSED (OVER PRESSURE)

P1227 - WASTEGATE FAILED CLOSED (OVER PRESSURE)

Description:	Indicates that boost pressure is continuously higher than desired.
Possible Causes:	• EGR valve • MAF sensor • SIP sensor • Supercharger bypass actuator stuck closed • Supercharger
	This DTC is informational only and it may be accompanied by other

Diagnostic Aids:	DTCs. Diagnose other DTCs first.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST KJ** .

P1228 - WASTEGATE FAILED OPEN (UNDER PRESSURE)

P1228 - WASTEGATE FAILED OPEN (UNDER PRESSURE)

Description:	Indicates that boost pressure is continuously lower than desired.		
Possible Causes:	• EGR valve • MAF sensor • SIP sensor • Supercharger bypass actuator stuck open • Supercharger		
Diagnostic Aids:	This DTC is informational only and it may be accompanied by other DTCs. Diagnose other DTCs first.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST KJ** .

P1229 - CHARGE AIR COOLER (CAC) PUMP DRIVER

P1229 - CHARGE AIR COOLER (CAC) PUMP DRIVER

Description:	This DTC sets when the powertrain control module (PCM) commands the supercharger CAC pump to operate but no current is detected.		
Possible Causes:	• CAC pump motor open circuit • CAC pump relay coil open • Open circuit between the relay and pump • CAC pump motor shorted • Open circuit between the PCM and the relay • Poor CAC pump ground connection		
Diagnostic Aids:	Check for voltage at the relay. Check the fuse in the voltage circuit. Check the ground connection of the CAC pump motor.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KP** .		

P1233 - FUEL PUMP DRIVER MODULE DISABLED OR OFF LINE

P1233 - FUEL PUMP DRIVER MODULE DISABLED OR OFF LINE

Description:	The powertrain control module (PCM) monitors the fuel pump monitor (FPM) circuit from the fuel pump driver module (FPDM). With the key ON, engine OFF or key ON, engine running the FPDM continuously sends a duty cycle signal to the PCM through the FPM circuit. The test fails if the PCM stops receiving the duty cycle signal.		
Possible Causes:	• Inertia fuel shutoff (IFS) switch needs to be reset • Open FPDM ground circuit • Open circuit to FPDM PWR RLY • Open FPDM PWR circuit • Open or short FPM circuit (engine should start) • Damaged IFS switch • Damaged FPDM PWR RLY • Damaged FPDM		
Diagnostic Aids:	The PCM expects to see one of the following duty cycle signals from the FPDM on the FPM circuit: 1) 50% (500 ms on, 500 ms off), all OK. 2) 25% (250 ms on, 750 ms off), FPDM did not receive a fuel pump (FP) duty cycle command from the PCM, or the duty cycle that was received was invalid. 3) 75% (750 ms on, 250 off), the FPDM detected a concern in the circuits between the FPDM and the fuel pump.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KB** .		

P1234 - FUEL PUMP DRIVER MODULE DISABLED OR OFF LINE

P1234 - FUEL PUMP DRIVER MODULE DISABLED OR OFF LINE

Description:	The powertrain control module (PCM) monitors the fuel pump monitor 2 (FPM2) circuit from the fuel pump driver module 2 (FPDM2). With the key ON, engine OFF or key ON, engine running the FPDM2 continuously sends a duty cycle signal to the PCM through the FPM2 circuit. The test fails if the PCM stops receiving the duty cycle signal.
Possible Causes:	• Inertia fuel shutoff (IFS) switch needs to be reset • Open FPDM2 ground circuit • Open circuit to FPDM2 PWR RLY • Open FPDM2 PWR circuit • Open or short FPM2 circuit (engine should start) • Damaged IFS switch • Damaged FPDM2 PWR RLY • Damaged FPDM2
Diagnostic Aids:	The PCM expects to see one of the following duty cycle signals from the FPDM2 on the FPM2 circuit: 1) 50% (500 ms on, 500 ms off), all OK. 2) 25% (250 ms on, 750 ms off), the FPDM2 did not receive a fuel pump

	(FP) duty cycle command from the PCM, or the duty cycle that was received was invalid. 3) 75% (750 ms on, 250 off), the FPDM2 detected a concern in the circuits between the FPDM2 and the fuel pump.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KB** .		

P1235 - FUEL PUMP CONTROL OUT OF RANGE

P1235 - FUEL PUMP CONTROL OUT OF RANGE

Description:	This DTC indicates the fuel pump driver module (FPDM) detected an invalid or missing fuel pump (FP) duty cycle signal on the fuel pump control (FPC) circuit from the powertrain control module (PCM). The FPDM sends a message to the PCM through the fuel pump monitor (FPM) circuit, indicating this concern was detected. The PCM sets the DTC when the message is received.		
Possible Causes:	• FPC circuit open or short • Electronic throttle control (ETC) system concern. Check for ETC DTCs • Damaged FPDM • Damaged PCM		
Diagnostic Aids:	The FPDM sends a 25% duty cycle (250 ms on, 750 ms off) through the FPM circuit to the PCM while the concern is being detected by the FPDM. If the concern is no longer detected, the FPDM returns to sending an all OK (50% duty cycle) message to the PCM. For ETC applications, check if ETC DTC P2105 is present. An ETC system concern could cause DTC P1235, and should be diagnosed first.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KB** .		

P1236 - FUEL PUMP CONTROL OUT OF RANGE

P1236 - FUEL PUMP CONTROL OUT OF RANGE

Description:	This DTC indicates the fuel pump driver module 2 (FPDM2) detected an invalid or missing fuel pump (FP) duty cycle signal on the fuel pump control (FPC) circuit from the powertrain control module (PCM). The FPDM2 sends a message to the PCM through the fuel pump monitor 2 (FPM2) circuit, indicating this concern was detected. The PCM sets the DTC when the message is received.
Possible Causes:	• FPC circuit open or short • Damaged FPDM2 • Damaged PCM
	The FPDM2 sends a 25% duty cycle (250 ms on, 750 ms off) through the

Diagnostic Aids:	FPM2 circuit to the PCM while the concern is being detected by the FPDM2. If the concern is no longer detected, the FPDM2 returns to sending an all OK (50% duty cycle) message to the PCM.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KB** .		

P1237 - FUEL PUMP SECONDARY CIRCUIT

P1237 - FUEL PUMP SECONDARY CIRCUIT

Description:	This DTC indicates that the fuel pump driver module (FPDM) detected a fuel pump secondary circuit concern. The FPDM sends a message to the powertrain control module (PCM) through the fuel pump monitor (FPM) circuit indicating this concern was detected. The PCM sets the DTC when the message is received.		
Possible Causes:	• Open or short FP PWR circuit • Open FP RTN circuit to FPDM • Open or short circuit in the fuel pump • Locked fuel pump rotor • Damaged FPDM		
Diagnostic Aids:	The FPDM sends a 75% duty cycle (750 ms on, 250 ms off) through the FPM circuit to the PCM while the concern is being detected by the FPDM. If the concern is no longer detected, the PCM returns to sending an all OK (50% duty cycle) message to the PCM. The FPDM controls pump speed by supplying a variable ground on the FP RTN circuit.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KB** .		

P1238 - FUEL PUMP SECONDARY CIRCUIT

P1238 - FUEL PUMP SECONDARY CIRCUIT

Description:	This DTC indicates the fuel pump driver module (FPDM2) detected a fuel pump secondary circuit concern. The FPDM2 sends a message to the powertrain control module (PCM) through the fuel pump monitor (FPM2) circuit, indicating this concern was detected. The PCM sets the DTC when the message is received.
Possible Causes:	• Open or short FP2PWR circuit • Open FP2RTN circuit to FPDM2 • Open or short circuit in the fuel pump • Locked fuel pump rotor • Damaged FPDM2
	The FPDM2 sends a 75% duty cycle (750 ms on, 250 ms off) through the

Diagnostic Aids:	FPM2 circuit to the PCM while the concern is being detected by the FPDM2. If the concern is no longer detected, the PCM returns to sending an all OK (50% duty cycle) message to the PCM. The FPDM2 controls pump speed by supplying a variable ground on the FP2RTN circuit.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KB** .		

P1244 - ALTERNATOR LOAD HIGH INPUT

P1244 - ALTERNATOR LOAD HIGH INPUT

Description:	The powertrain control module (PCM) monitors generator load from the generator/regulator in the form of frequency. The concern indicates the input is higher than the load should be in normal operation. The load input could be high when a battery short to ground exists.		
Possible Causes:	• GENLI circuit short to voltage • GENRC circuit short to voltage • B+ open prior to start-up • Open GENRC prior to start-up • Open ILC prior to start-up • Damaged PCM		
Diagnostic Aids:	Verify the battery voltage is 14.5 volts. Verify the generator/regulator has the correct part number.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HY** .		

P1245 - ALTERNATOR LOAD LOW INPUT

P1245 - ALTERNATOR LOAD LOW INPUT

Description:	The powertrain control module (PCM) monitors generator load from the generator/regulator in the form of frequency. The concern indicates the input is lower than the load should be in normal operation. The load input could be low when no generator output exists.
Possible Causes:	• GENRC circuit short to ground • GENLI circuit short to ground • Open B+ wire during operation • Low system voltage • Broken generator belt • Damaged generator/regulator assembly • Damaged PCM
Diagnostic Aids:	Verify the battery voltage is 14.5 volts.

	Verify the generator/regulator has the correct part number.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HY** .		

P1246 - ALTERNATOR LOAD INPUT

P1246 - ALTERNATOR LOAD INPUT

Description:	The powertrain control module (PCM) monitors the generator load from the generator/regulator in the form of frequency. The frequency range is determined by the temperature of the voltage regulator, where 97% indicates a full load, and less than 6% indicates no load.		
Possible Causes:	• GENLI circuit shorted to voltage or ground • GENLI circuit open • GENRC circuit shorted to power or ground • GENRC circuit open • ILC circuit shorted to voltage or ground • ILC circuit open • Battery-sense circuit open • Generator drive mechanism • Damaged generator/regulator assembly • Damaged PCM		
Diagnostic Aids:	Verify the battery voltage is 14.5 volts. Verify the generator/regulator has the correct part number.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HY** .		

P1260 - THEFT DETECTED, VEHICLE IMMOBILIZED

P1260 - THEFT DETECTED, VEHICLE IMMOBILIZED

Description:	Indicates the passive anti-theft system (PATS) determined a theft condition existed and the engine is disabled. This DTC is a good indicator to check the PATS for DTCs.		
Possible Causes:	• Previous theft condition • Anti-theft system failure		
Diagnostic Aids:	Theft indicator flashing rapidly or on solid when ignition switch is in the ON position. Check anti-theft system for DTCs.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST QD** .

P1270 - ENGINE RPM OR VEHICLE SPEED LIMITER REACHED

P1270 - ENGINE RPM OR VEHICLE SPEED LIMITER REACHED

Description:	Indicates the vehicle has been operated in a manner which caused the engine or vehicle to exceed a calibration limit. The engine RPM and vehicle speed are continuously monitored and evaluated by the powertrain control module (PCM). The DTC is set when the RPM or vehicle speed falls out of a calibrated range. For additional information on the engine RPM/vehicle speed limiter, refer to**POWERTRAIN CONTROL SOFTWARE** .
Possible Causes:	• Wheel slippage (water, ice, mud, and snow) • Excessive engine RPM in NEUTRAL or operated in the wrong transmission gear • Vehicle driven at a high rate of speed
Diagnostic Aids:	The DTC indicates the vehicle was operated in a manner which caused the engine RPM or vehicle speed to exceed a calibrated limit.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST ND** .

P1285 - CYLINDER HEAD OVER TEMPERATURE CONDITION

P1285 - CYLINDER HEAD OVER TEMPERATURE CONDITION

Description:	Indicates an engine overheat condition was sensed by the cylinder head temperature (CHT) sensor.
Possible Causes:	• Low engine coolant level • Base engine concerns • Engine cooling system concerns • CHT sensor concern
Diagnostic Aids:	On some applications when this fault occurs the engine temperature warning indicator illuminates or forces the temperature gauge to the full H (hot) zone. The warning indicator can be triggered by either grounding the engine temperature warning circuit when wired to the powertrain control module (PCM), or by sending a PCM network message to the instrument cluster (IC).

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DL** .		

P1288 - CYLINDER HEAD TEMPERATURE (CHT) SENSOR OUT OF SELF-TEST RANGE

P1288 - CYLINDER HEAD TEMPERATURE (CHT) SENSOR OUT OF SELF-TEST RANGE

	Indicates the CHT sensor is out of self-test range. The engine is not at a

Description:	normal operating temperature.		
Possible Causes:	• Cold engine • Engine overheating • Damaged harness connector • Low engine coolant level • Damaged CHT sensor		
Diagnostic Aids:	Bring the engine to operating temperature. If cold, repeat the self-test. If the engine overheats, check the cooling system. Refer to the **ENGINE COOLING -- E-SERIES** for cooling system diagnosis.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DL** .		

P1289 - CYLINDER HEAD TEMPERATURE (CHT) SENSOR CIRCUIT HIGH

P1289 - CYLINDER HEAD TEMPERATURE (CHT) SENSOR CIRCUIT HIGH

Description:	Indicates a CHT sensor circuit open.		
Possible Causes:	• Open CHT sensor circuit • CHT sensor circuit short to voltage • Damaged CHT sensor • Incorrect harness connection		
Diagnostic Aids:	A CHT V PID reading of greater than 4.6 volts with key ON engine OFF, or during any engine operating mode, indicates a concern is present. Note: DTC P0118 may also be reported when this DTC is set. Either of these DTCs activate the MIL.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DL** .		

P128A - CYLINDER HEAD TEMPERATURE (CHT) SENSOR CIRCUIT INTERMITTENT/ERRATIC

P128A - CYLINDER HEAD TEMPERATURE (CHT) SENSOR CIRCUIT INTERMITTENT/ERRATIC

Description:	Indicates the CHT circuit became intermittently open or shorted while the engine was running.		
Possible Causes:	• Damaged harness or connector • Damaged sensor		
Diagnostic Aids:	Monitor the CHT on a scan tool. Look for sudden changes in the reading when the harness is wiggled or the sensor is tapped.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**

All	-	-	refer to **PINPOINT TEST DL** .

P1290 - CYLINDER HEAD TEMPERATURE (CHT) SENSOR CIRCUIT LOW

P1290 - CYLINDER HEAD TEMPERATURE (CHT) SENSOR CIRCUIT LOW

Description:	Indicates a CHT sensor circuit short to ground.		
Possible Causes:	• Grounded circuit in CHT harness • Damaged CHT sensor • Incorrect harness connection		
Diagnostic Aids:	A CHT V PID value reading of less than 0.2 volt with key ON engine OFF, or during any engine operating mode, indicates a concern is present. DTC P0117 may also be reported when this DTC is set. Either of these DTCs activates the malfunction indicator lamp (MIL).		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DL** .		

P1299 - CYLINDER HEAD OVER TEMPERATURE PROTECTION ACTIVE

P1299 - CYLINDER HEAD OVER TEMPERATURE PROTECTION ACTIVE

Description:	Indicates an engine overheat condition was detected by the cylinder head temperature (CHT) sensor. A failure mode effects management (FMEM) strategy called fail-safe cooling was activated to cool the engine.		
Possible Causes:	• Engine cooling system concerns • Low engine coolant level • Base engine concerns		
Diagnostic Aids:	Refer to**POWERTRAIN CONTROL SOFTWARE** , for more information on the fail-safe cooling strategy and cylinder head temperature sensor.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DL** .		

P1336 - CRANKSHAFT/CAMSHAFT SENSOR RANGE/PERFORMANCE

P1336 - CRANKSHAFT/CAMSHAFT SENSOR RANGE/PERFORMANCE

Description:	The input signal to the powertrain control module (PCM) from the crankshaft position (CKP) sensor or the camshaft position (CMP) sensor is erratic.
Possible Causes:	• Damaged CKP sensor • Damaged CMP sensor • Base engine concerns

Diagnostic Aids:	• Harness concerns Check the harness for routing, alterations, incorrect shielding, or electrical interference from other systems.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST JD** .

P1397 - SYSTEM VOLTAGE OUT OF SELF -TEST RANGE

P1397 - SYSTEM VOLTAGE OUT OF SELF -TEST RANGE

Description:	This DTC indicates that the 12-volt system voltage is too high or too low during the key on engine off (KOEO) or key on engine running (KOER) self-test. It sets if the system voltage falls below or exceeds the calibrated threshold at any time during the KOEO or KOER self-test.		
Possible Causes:	• Battery or charging system concern.		
Diagnostic Aids:	Make sure the battery voltage is between 11 and 18 volts before running a KOEO or KOER self-test.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **GENERATOR AND REGULATOR -- E-SERIES** to diagnose the battery is discharged or battery voltage is low symptom or the charging system overcharges (battery voltage is greater than 15.5 volts) symptom.		

P1405 - DIFFERENTIAL PRESSURE FEEDBACK SENSOR UPSTREAM HOSE OFF OR PLUGGED

P1405 - DIFFERENTIAL PRESSURE FEEDBACK SENSOR UPSTREAM HOSE OFF OR PLUGGED

Description:	While driving, the exhaust gas recirculation (EGR) monitor commands the EGR valve closed and checks the differential pressure across the EGR orifice. The test fails when the signal from the differential pressure feedback EGR sensor indicates EGR flow is in the negative direction.		
Possible Causes:	• The upstream hose is disconnected • The upstream hose is plugged (ice) • Plugged or damaged EGR tube		
Diagnostic Aids:	Look for signs of water or icing in the hose. Verify the hose connection and routing (no excessive dips). Check the differential pressure feedback EGR sensor for correct mounting and function. View the DPFEGR PID while applying and releasing vacuum directly to the sensor with a hand pump.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST HE** .	refer to **PINPOINT TEST HE** .

P1406 - DIFFERENTIAL PRESSURE FEEDBACK SENSOR DOWNSTREAM HOSE OFF OR PLUGGED

P1406 - DIFFERENTIAL PRESSURE FEEDBACK SENSOR DOWNSTREAM HOSE OFF OR PLUGGED

Description:	While driving, the exhaust gas recirculation (EGR) monitor commands the EGR valve closed and checks the differential pressure across the EGR orifice. The test fails when the signal from the differential pressure feedback EGR sensor continues to indicate EGR flow even after the EGR valve is commanded closed.		
Possible Causes:	• Downstream hose is disconnected • Downstream hose is plugged (ice) • Plugged or damaged EGR tube		
Diagnostic Aids:	Look for signs of water or icing in the hose. Verify the hose connection and routing (no excessive dips). Check the differential pressure feedback EGR sensor for correct mounting and function. View the DPFEGR PID while applying and releasing vacuum directly to the sensor with a hand pump.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HE** .		

P1408 - EXHAUST GAS RECIRCULATION (EGR) FLOW OUT OF SELF-TEST RANGE (NON-MIL)

P1408 - EXHAUST GAS RECIRCULATION (EGR) FLOW OUT OF SELF-TEST RANGE (NON-MIL)

Description:	This test is carried out during the key on engine running (KOER) on-demand self-test only. The EGR system is commanded on at a fixed engine speed. The test does not pass and the DTC is set when the measured EGR flow falls above or below the required calibration.		
Possible Causes:	• For electric EGR (EEGR) system, see possible causes for DTC P0400. • For vacuum activated systems, see the possible causes for DTC P0401.		
Diagnostic Aids:	For EEGR, use the output state control function of the scan tool and monitor the manifold absolute pressure (MAP) PID and the EEGR PID (EGRMDSD) while commanding the EEGR on. If EGR is introduced into the engine at idle, the RPM drops or stalls out. For vacuum systems see diagnostic aids for DTC P0401.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles With an Electric EGR (EEGR)	-	refer to **PINPOINT TEST KD** .	-
Vehicles with an EGR system module (ESM)	-	refer to **PINPOINT TEST HH** .	-
		refer to **PINPOINT TEST**	

All others		-	**HE** .	-

P1409 - EXHAUST GAS RECIRCULATION (EGR) VACUUM REGULATOR SOLENOID CIRCUIT

P1409 - EXHAUST GAS RECIRCULATION (EGR) VACUUM REGULATOR SOLENOID CIRCUIT

Description:	This test checks the electrical function of the EGR vacuum regulator solenoid. The test fails when the EVR circuit voltage is either too high or too low when compared to the expected voltage range. The EGR system must be enabled for the test to be completed.			
Possible Causes:	• EVR circuit open • EVR circuit short to voltage or ground • VPWR open to EGR vacuum regulator solenoid • Damaged EGR vacuum regulator solenoid			
Diagnostic Aids:	The EGR vacuum regulator solenoid resistance is between 26 and 40 ohms.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles with an EGR system module (ESM)		refer to **PINPOINT TEST HH** .		
All others		refer to **PINPOINT TEST HE** .		

P1436 - A/C EVAPORATOR AIR TEMPERATURE CIRCUIT LOW

P1436 - A/C EVAPORATOR AIR TEMPERATURE CIRCUIT LOW

Description:	Indicates the A/CET signal input was less than the self-test minimum. The self-test minimum is 0.13 volts.			
Possible Causes:	• A/CET circuit short to ground or SIG RTN • Damaged A/CET sensor			
Diagnostic Aids:	The powertrain control module (PCM) sources a low current 5 volt reference on the A/CET circuit (this voltage can be measured with the sensor disconnected). As the A/C evaporator air temperature changes, the A/CET circuit resistance to SIG RTN (ground) changes (which changes the voltage the PCM detects). When the A/CET signal is detected below the self-test minimum, check for shorts to SIG RTN or ground which would pull the voltage low.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		refer to **PINPOINT TEST DJ** .		

P1437 - A/C EVAPORATOR AIR TEMPERATURE CIRCUIT HIGH

P1437 - A/C EVAPORATOR AIR TEMPERATURE CIRCUIT HIGH

Description:	Indicates the A/CET signal input was greater than the self-test minimum. The self-test maximum is 4.5 volts.

Possible Causes:	• A/CET circuit open • SIG RTN circuit open to A/CET sensor • A/CET circuit short to voltage (VREF) • Damaged A/CET sensor		
Diagnostic Aids:	The powertrain control module (PCM) sources a low current 5 volt reference on the A/CET circuit (this voltage can be measured with the sensor disconnected). As the A/C evaporator air temperature changes, the A/CET circuit resistance to SIG RTN (ground) changes (which changes the voltage the PCM detects). When the A/CET signal is detected above the self-test maximum, check for open circuits (A/CET or SIG RTN), which would cause the voltage to remain high. Although not as probable, also check for a short to voltage (VREF).		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DJ** .		

P144A - EVAPORATIVE EMISSION SYSTEM PURGE VAPOR LINE RESTRICTED/BLOCKED

P144A - EVAPORATIVE EMISSION SYSTEM PURGE VAPOR LINE RESTRICTED/BLOCKED

Description:	The powertrain control module (PCM) monitors the evaporative emission (EVAP) system for a blocked fuel vapor tube between the fuel tank pressure (FTP) sensor and the fuel tank. During the initial phase of the EVAP monitor, the PCM closes the canister vent and a vacuum develops in the fuel vapor tubes and lines and in the fuel tank. The PCM monitors the FTP sensor to determine the amount of vacuum and how quickly the vacuum increases. The rate at which the vacuum increases is compared to an expected value. If the vacuum increases quicker than expected, a blocked fuel vapor tube is suspected and an intrusive test is carried out in the final phase of the EVAP monitor. If the intrusive test confirms a blockage a counter is increments and once the counter reaches a calibrated number of completions, the DTC is set.		
Possible Causes:	• Blocked fuel vapor tube between the FTP sensor and the fuel tank		
Diagnostic Aids:	Check the fuel vapor tube for blockage between the fuel tank pressure FTP sensor and the fuel tank.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HX** .

P1450 - UNABLE TO BLEED UP FUEL TANK VACUUM

P1450 - UNABLE TO BLEED UP FUEL TANK VACUUM

Description:	Monitors the fuel vapor vacuum and pressure in the fuel tank. System failure occurs when the evaporative emission (EVAP) running loss monitor detects excessive fuel tank vacuum with the engine running, but

Possible Causes:	not at idle. • Blockages or kinks in the EVAP canister tube or EVAP canister purge outlet tube between the fuel tank, the EVAP canister purge valve and the EVAP canister • Fuel filler cap stuck closed, preventing vacuum relief • Capless fuel tank filler pipe damaged, preventing vacuum relief (if equipped) • Contaminated fuel vapor elbow on the EVAP canister • Restricted EVAP canister • CV solenoid stuck partially or fully open • Plugged CV solenoid filter • EVAP canister purge valve stuck open • VREF circuit open in the harness near the fuel tank pressure (FTP) sensor, the FTP sensor or the powertrain control module (PCM) • Damaged FTP sensor		
Diagnostic Aids:	Visually inspect the EVAP canister inlet port, CV solenoid filter, and canister vent hose assembly for contamination or debris. Check EVAP canister purge valve for vacuum leak.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HX** .

P1451 - EVAPORATIVE EMISSION SYSTEM VENT CONTROL CIRCUIT

P1451 - EVAPORATIVE EMISSION SYSTEM VENT CONTROL CIRCUIT

Description:	Monitors the canister vent (CV) solenoid circuit for an electrical failure. The test fails when the signal moves outside the minimum or maximum allowable calibrated parameters for a specified canister vent duty cycle by powertrain control module (PCM) command.		
Possible Causes:	• VPWR circuit open • CV solenoid circuit short to PWR GND or CHASSIS GND • Damaged CV solenoid • CV solenoid circuit open • CV solenoid circuit short to VPWR		
Diagnostic Aids:	To verify normal functioning, monitor the evaporative emission (EVAP) CV solenoid signal PID EVAPCV and the signal voltage on the PCM control side. With the valve open, the EVAPCV PID indicates 0% duty cycle and a voltage approximately equal to battery voltage. When the valve is commanded fully closed, the EVAPCV PID indicates 100% duty cycle, and a minimum voltage drop of 4 volts is normal. Output test mode may be used to switch the output on and off to verify function.		

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	refer to **PINPOINT TEST HX** .		

P145E - PCV HEATER CONTROL B CIRCUIT

P145E - PCV HEATER CONTROL B CIRCUIT

Description:	This DTC sets when the powertrain control module (PCM) detects a positive crankcase ventilation (PCV) heater circuit failure.		
Possible Causes:	• Open or shorted PCV circuit • Damaged PCV heater assembly		
Diagnostic Aids:	Make sure the PCV valve is correct for the engine application and the PCV heater connector is properly connected.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HG** .	-	-

P1460 - WIDE OPEN THROTTLE A/C CUTOUT CIRCUIT

P1460 - WIDE OPEN THROTTLE A/C CUTOUT CIRCUIT

Description:	Monitors the A/CCR circuit output from the powertrain control module (PCM). The test fails when the PCM grounds the A/CCR circuit, excessive current draw is detected on the A/CCR circuit; or, with the A/CCR circuit not grounded by the PCM, voltage is not detected on the A/CCR circuit (the PCM expects to detect VPWR voltage coming through the A/CCR relay coil to the A/CCR circuit).		
Possible Causes:	• Open or short A/CCR circuit • Damaged A/CCR relay • Open VPWR circuit to the A/CCR relay		
Diagnostic Aids:	The A/CCR control circuit can be monitored using the WACF and WAC PID. When the WACF PID reads YES, a concern is present. An open circuit or short to ground can only be detected when the PCM is not grounding the circuit. A short to voltage can only be detected when the PCM is grounding the circuit. During the key ON engine OFF (KOEO) and the key OFF engine running (KOER) self-test, the WAC circuit is cycled on and off. Verify the A/C and the defrost were off during KOEO and KOER self-test (Check the A/CCS PID to verify). If the vehicle is not equipped with A/C, ignore DTC P1460.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**

All		refer to **PINPOINT TEST KM** .

P1461 - A/C PRESSURE SENSOR CIRCUIT HIGH

P1461 - A/C PRESSURE SENSOR CIRCUIT HIGH

Description:	The A/CP sensor inputs a voltage to the PCM. If the voltage is above a calibrated level the DTC sets.		
Possible Causes:	• A/CP sensor circuit short to PWR • A/CP circuit open • A/CP circuit short to VREF • Damaged A/CP sensor		
Diagnostic Aids:	Verify a VREF voltage between 4 and 6 volts.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DS** .		

P1462 - AIR CONDITIONING PRESSURE (A/CP) SENSOR LOW VOLTAGE DETECTED

P1462 - AIR CONDITIONING PRESSURE (A/CP) SENSOR LOW VOLTAGE DETECTED

Description:	The A/CP sensor inputs a voltage to the powertrain control module (PCM). If the voltage is below the calibrated level the DTC sets. The A/CP sensor inputs a voltage to the PCM. If the voltage is below the calibrated level the DTC sets.		
Possible Causes:	• A/CP circuit short to GND or SIGRTN • VREF circuit open • Open A/CP circuit • Damaged A/CP sensor		
Diagnostic Aids:	Verify a VREF voltage between 4 and 6 volts.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DS** .		

P1463 - AIR CONDITIONING PRESSURE SENSOR (A/CP) INSUFFICIENT PRESSURE CHANGE

P1463 - AIR CONDITIONING PRESSURE SENSOR (A/CP) INSUFFICIENT PRESSURE CHANGE

Description:	Each time the A/C clutch engages, the powertrain control module (PCM) is looking for a pressure change in the refrigerant. If the change in pressure is outside of the calibration the DTC sets.
Possible Causes:	• A/C system mechanical failure • Open ACP or VREF circuit • A/C sensor damaged • A/C system electrical failure

	• A/C clutch always engaged			
Diagnostic Aids:	Verify the A/C system function, including refrigerant charge. Refer to the **CLIMATE CONTROL -- E-SERIES** .			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		-	-	refer to **PINPOINT TEST DS** .

P1464 - A/C DEMAND OUT OF SELF-TEST RANGE

P1464 - A/C DEMAND OUT OF SELF-TEST RANGE

Description:	The diagnostic trouble code (DTC) sets when the powertrain control module (PCM) receives a request for A/C during the self-test.			
Possible Causes:	• A/C or defrost on during self-test • A/CCS circuit short to voltage • Damaged A/C demand switch • Damaged WAC relay			
Diagnostic Aids:	If the A/C or defrost was on during self-test, turn the A/C or defrost off and repeat the self-test. An A/C request to the PCM may come through the communication link or on a dedicated hardwire circuit from the A/C switch.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		refer to **PINPOINT TEST KM** .	refer to **PINPOINT TEST KM** .	-

P1469 - RAPID A/C CYCLING

P1469 - RAPID A/C CYCLING

Description:	Indicates frequent A/C compressor clutch cycling.			
Possible Causes:	• Mechanical A/C system concern (such as low refrigerant charge, damaged A/C cycling switch) • Intermittent open between the cycling pressure switch and the powertrain control module (PCM) • Intermittent open in the IGN RUN circuit to cycling pressure switch (if applicable)			
Diagnostic Aids:	This test is designed to protect the transmission. In some strategies, the PCM unlocks the torque converter during A/C clutch engagement. If a concern is present that results in frequent A/C clutch cycling, damage could occur if the torque converter is cycled at these intervals. This test detects this condition, sets the DTC and prevents the torque converter from excessive cycling.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**

All		-	-	refer to **PINPOINT TEST KM** .

P1474 - FAN CONTROL PRIMARY CIRCUIT

P1474 - FAN CONTROL PRIMARY CIRCUIT

Description:	Monitors the LFC primary circuit output from the powertrain control module (PCM). The test fails if the PCM grounds the LFC circuit, excessive current draw is detected on the LFC circuit, or with the LFC circuit not grounded by the PCM, voltage is not detected on the LFC circuit (the PCM expects to detect VPWR voltage coming through the low speed FC relay coil to the LFC circuit).			
Possible Causes:	• Open or short LFC circuit • Open VPWR circuit to the low speed FC relay • Damaged low speed FC relay			
Diagnostic Aids:	When the LFCF PID reads YES, a concern is currently present. An open circuit or short to ground can only be detected when the PCM is not grounding the LFC circuit. A short to voltage can only be detected when the PCM is grounding the LFC circuit. During the key on engine off (KOEO) and key on engine running (KOER) self-test, the LFC circuit is cycled on and off.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		refer to **PINPOINT TEST KF** .		

P1477 - ADDITIONAL FAN RELAY CIRCUIT

P1477 - ADDITIONAL FAN RELAY CIRCUIT

Description:	Monitors the MFC primary circuit output from the powertrain control module (PCM). The test fails if the MFC output commanded on (grounded), excessive current draw is detected on the MFC circuit or, with the MFC circuit commanded off, voltage is not detected on the MFC circuit (the PCM expects to detect IGN START/RUN voltage through the medium speed FC relay coil to the MFC circuit).
Possible Causes:	• Open or short MFC circuit • Open IGN START/RUN circuit to the medium speed FC relay • Damaged medium speed FC relay
Diagnostic Aids:	When the MFCF PID reads YES, a concern is currently present. An open circuit or short to ground can only be detected when the PCM is not grounding the MFC circuit. A short to voltage can only be detected when the PCM is grounding the MFC circuit. During the key on engine off (KOEO) and key on engine running (KOER) self-test, the MFC circuit is cycled on and off.

	When using output test mode on a scan tool, and commanding the low speed fan on, the PCM also activates the medium speed fan output.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KF** .		

P1479 - HIGH FAN CONTROL PRIMARY CIRCUIT

P1479 - HIGH FAN CONTROL PRIMARY CIRCUIT

Description:	Monitors the HFC primary circuit output from the powertrain control module (PCM). The test fails if the HFC output commanded on (grounded), excessive current draw is detected on the HFC circuit or, with the HFC circuit commanded off, voltage is not detected on the HFC circuit (the PCM expects to detect VPWR voltage through the high speed FC relay coil to the HFC circuit).		
Possible Causes:	• Open or short HFC circuit • Open VPWR circuit to the high speed FC relay • Damaged high speed FC relay		
Diagnostic Aids:	When the HFCF PID reads YES, a concern is currently present. An open circuit or short to ground can only be detected when the PCM is not grounding the HFC circuit. A short to voltage can only be detected when the PCM is grounding the HFC circuit. During the key on engine off (KOEO) and key on engine running (KOER) self-test, the HFC circuit is cycled on and off.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KF** .		

P1489 - PCV HEATER CONTROL CIRCUIT

P1489 - PCV HEATER CONTROL CIRCUIT

Description:	This DTC sets when the powertrain control module (PCM) detects a positive crankcase ventilation (PCV) heater circuit failure.		
Possible Causes:	• Open or shorted PCV circuit • Damaged PCV heater assembly		
Diagnostic Aids:	Make sure the PCV valve is correct for the engine application and the PCV heater connector is properly connected.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HG** .		

P1500 - VEHICLE SPEED SENSOR (VSS)

P1500 - VEHICLE SPEED SENSOR (VSS)

Description:	Indicates the VSS input signal was intermittent. This DTC is set when a VSS concern interferes with other on-board diagnostics (OBD) tests, such as the catalyst efficiency monitor, the EVAP monitor or the HO2S monitor.		
Possible Causes:	• Intermittent VSS connections • Intermittent open in the VSS harness circuit(s) • Intermittent short in VSS harness circuit(s) • Damaged VSS		
Diagnostic Aids:	Check the wiring, connector, and sensor for damage.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
F-Super Duty	refer to **PINPOINT TEST DF** .		
Expedition, Navigator, Sable, Taurus, Taurus X	The powertrain control module (PCM) uses information from the anti-lock brake system (ABS) module and the transmission control module (TCM) to calculate vehicle speed. Check these modules for DTCs.		
All others	refer to **PINPOINT TEST DP** .		

P1501 - VEHICLE SPEED SENSOR (VSS) OUT OF SELF-TEST RANGE

P1501 - VEHICLE SPEED SENSOR (VSS) OUT OF SELF-TEST RANGE

Description:	Indicates the VSS input signal is out of self-test range. If the powertrain control module (PCM) detects a VSS input signal any time during the self-test, DTC P1501 is set and the test aborts.		
Possible Causes:	• Noise on the VSS input signal from the radio frequency interference/electro magnetic interference (RFI/EMI) • External sources, such as ignition wires, the charging circuit or aftermarket equipment		
Diagnostic Aids:	Verify the VSS input is 0 km/h (0 mph) when the vehicle transmission is in PARK.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
F-Super Duty	refer to **PINPOINT TEST DF** .	refer to **PINPOINT TEST DF** .	-
Expedition, Navigator, Sable, Taurus, Taurus X	The powertrain control module (PCM) uses information from the anti-lock brake system (ABS) module and the transmission control module (TCM) to calculate vehicle speed. Check these modules for DTCs.		
All others	refer to **PINPOINT TEST DP** .	refer to **PINPOINT TEST DP** .	-

P1502 - VEHICLE SPEED SENSOR (VSS) INTERMITTENT

P1502 - VEHICLE SPEED SENSOR (VSS) INTERMITTENT

Description:	Indicates the powertrain control module (PCM) detected an error in the vehicle speed information. Vehicle speed data is received from either the VSS, transfer case speed sensor (TCSS) or anti-lock brake system (ABS) control module. This DTC is set the same way as P0500. However, it is intended to flash the transmission control indicator lamp (TCIL) for first time VSS circuit error/malfunctions.		
Possible Causes:	See the possible causes for DTC P0500.		
Diagnostic Aids:	See the diagnostic aids for DTC P0500.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
F-Super Duty	refer to **PINPOINT TEST DF** .		
Expedition, Navigator, Sable, Taurus, Taurus X	The powertrain control module (PCM) uses information from the anti-lock brake system (ABS) module and the transmission control module (TCM) to calculate vehicle speed. Check these modules for DTCs.		
All others	refer to **PINPOINT TEST DP** .		

P1504 - IDLE AIR CONTROL (IAC) CIRCUIT

P1504 - IDLE AIR CONTROL (IAC) CIRCUIT

Description:	This DTC is set when the powertrain control module (PCM) detects an electrical load failure on the IAC output circuit.		
Possible Causes:	• IAC circuit open • VPWR to IAC solenoid open • IAC circuit short to voltage • IAC circuit short to GND • Damaged IAC valve		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KE** .		

P1506 - IDLE AIR CONTROL (IAC) OVERSPEED ERROR

P1506 - IDLE AIR CONTROL (IAC) OVERSPEED ERROR

Description:	This DTC is set when the powertrain control module (PCM) detects an engine idle speed that is greater than the desired RPM.
	• IAC circuit short to GND • Damaged IAC valve

Possible Causes:	• IAC valve stuck open • Intake air leak after throttle body • Vacuum leaks • Damaged EVAP system
Diagnostic Aids:	Disconnect the IAC valve and look for little or no change in engine RPM as an indication of a stuck or damaged valve.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KE** .		

P1507 - IDLE AIR CONTROL (IAC) UNDER SPEED ERROR

P1507 - IDLE AIR CONTROL (IAC) UNDER SPEED ERROR

Description:	This DTC is set when the powertrain control module (PCM) detects an engine idle speed that is less than the desired RPM.
Possible Causes:	• IAC circuit open • Air inlet is plugged • Damaged or incorrect IAC valve • IAC valve stuck closed • VPWR to IAC solenoid open • IAC circuit short to voltage
Diagnostic Aids:	Disconnect the IAC valve and look for little or no change in engine RPM as an indication of a stuck or damaged valve.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST KE** .		

P1512 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 1)

P1512 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 1)

Description:	This DTC is set when the vacuum actuated IMRC is commanded open, but the IMRC monitor indicates closed.
Possible Causes:	• IMRC monitor circuit open • Suspect IMRC solenoid • Mechanical concern - bind, seize, damage, or obstruction of IMRC hardware
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HU** .

P1513 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 2)

P1513 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 2)

Description:	This DTC is set when the vacuum actuated IMRC is commanded open, but the IMRC monitor indicates closed.		
Possible Causes:	• IMRC monitor circuit open • Suspect IMRC solenoid • Mechanical concern - bind, seize, damage, or obstruction of IMRC hardware		
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST HU** .

P1516 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) INPUT ERROR (BANK 1)

P1516 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) INPUT ERROR (BANK 1)

Description:	The IMRC system is monitored for failure during continuous or key on engine off (KOEO) self-test. Each DTC distinguishes the corresponding bank for IMRC actuator assemblies with dual monitor switches. The test fails when the signal is outside an expected calibrated range.		
Possible Causes:	• Mechanical concern - bind, seize, damage, or obstruction of IMRC hardware		
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .	-	refer to **PINPOINT TEST HU** .

P1517 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) INPUT ERROR (BANK 2)

P1517 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) INPUT ERROR (BANK 2)

Description:	The IMRC system is monitored for failure during continuous or key on engine off (KOEO) self-test. Each DTC distinguishes the corresponding bank for IMRC actuator assemblies with dual monitor switches. The test fails when the signal is outside an expected calibrated range.		
Possible Causes:	• Mechanical concern - bind, seize, damage, or obstruction of IMRC hardware		
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.		
Application	**Key On Engine Off**	**Key On Engine**	**Continuous Memory**

			Running	
All		refer to **PINPOINT TEST HU** .	-	refer to **PINPOINT TEST HU** .

P1518 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN BANK 1

P1518 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN BANK 1

Description:	This DTC is set when the electrically actuated IMRC is commanded closed, but the IMRC monitor indicates open.		
Possible Causes:	• IMRC monitor signal circuit shorted to PWR GND or SIG RTN • Damaged IMRC actuator		
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P1519 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED BANK 1

P1519 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED BANK 1

Description:	This DTC is set when the electrically actuated IMRC is commanded open, but the IMRC monitor indicates closed.		
Possible Causes:	• IMRC monitor circuit open • IMRC control circuit open • IMRC monitor circuit short to VREF • IMRC monitor return circuit open • Damaged IMRC actuator • IMRC VPWR circuit open		
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P151A - INTAKE MANIFOLD RUNNER CONTROLLER PERFORMANCE

P151A - INTAKE MANIFOLD RUNNER CONTROLLER PERFORMANCE

Description:	The intake manifold runner control (IMRC) system is monitored for failures. The test fails when the system detects a loss of bi-directional communication or signal(s) between the PCM and the IMRC solenoid.
	• IMRC control circuit open • Mechanical concern - bind, seize, damage, or obstruction of IMRC

Possible Causes:	hardware • IMRC control circuit short to voltage • IMRC VPWR circuit open • IMRC GND circuit open • Damaged IMRC actuator		
Diagnostic Aids:	View the IMRCF PID to monitor for a fault.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P1520 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) CIRCUIT

P1520 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) CIRCUIT

Description:	This DTC indicates a failure in the IMRC primary control circuit.		
Possible Causes:	• IMRC control circuit open		
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P1537 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 1)

P1537 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 1)

Description:	This DTC is set when the vacuum actuated IMRC is commanded closed, but the IMRC monitor indicates open.		
Possible Causes:	• IMRC monitor signal circuit shorted to PWR GND or SIG RTN • Damaged IMRC solenoid • Blocked vacuum hoses		
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P1538 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 2)

P1538 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 2)

Description:	This DTC is set when the vacuum actuated IMRC is commanded closed, but the IMRC monitor indicates open.
Possible Causes:	• IMRC monitor signal circuit shorted to PWR GND or SIG RTN • Damaged IMRC solenoid

	• Blocked vacuum hoses		
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P1548 - ENGINE AIR FILTER RESTRICTION

P1548 - ENGINE AIR FILTER RESTRICTION

Description:	The powertrain control module (PCM) monitors the manifold absolute pressure (MAP) at various engine speeds during wide open throttle (WOT) operation, and compares the information to a calibrated value. If the air flow is out of range, the DTC is set.		
Possible Causes:	• Intake air restriction • Clogged air filter		
Diagnostic Aids:	If this DTC is set, inspect the intake air system and replace the air filter if no obstructions are found.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	REFER to the Workshop article part 303-12.		

P1549 - INTAKE MANIFOLD COMMUNICATION CONTROL (IMCC) CIRCUIT (BANK 1)

P1549 - INTAKE MANIFOLD COMMUNICATION CONTROL (IMCC) CIRCUIT (BANK 1)

Description:	The IMCC or intake manifold tuning (IMTV) system is monitored for failure during continuous or key on engine off (KOEO) self-test. The test fails when the powertrain control module (PCM) detects a concern with the IMTV output circuit.		
Possible Causes:	• Open IMTV circuit • Open VPWR circuit • Shorted IMTV circuit • Damaged IMTV		
Diagnostic Aids:	An IMTV fault PID (IMTVF) displaying YES may indicate a fault.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .	-	refer to **PINPOINT TEST HU** .

P1550 - POWER STEERING PRESSURE (PSP) SENSOR OUT OF SELF-TEST RANGE

P1550 - POWER STEERING PRESSURE (PSP) SENSOR OUT OF SELF-TEST RANGE

	The PSP sensor input signal to the powertrain control module (PCM) is

Description:	continuously monitored. The test fails when the signal falls out of a maximum or minimum calibrated range.			
Possible Causes:	• Steering wheel not turned during self-test. • PSP sensor or circuit damaged • Power steering concern			
Diagnostic Aids:	The DTC indicates the PSP sensor is out of self-test range.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		refer to **PINPOINT TEST DT** .	refer to **PINPOINT TEST DT** .	-

P1572 - BRAKE PEDAL SWITCH CIRCUIT

P1572 - BRAKE PEDAL SWITCH CIRCUIT

Description:	Indicates the brake input rationality test for brake pedal position (BPP) and brake pressure switch (BPS) has detected a concern. One or both inputs to the powertrain control module (PCM) did not change state when expected. On some vehicles with stability assist, the BPP switch is connected to the anti-lock brake system (ABS) module and the ABS generates a driver brake application (DBA) signal, which is then sent to the PCM.			
Possible Causes:	• Misadjusted brake switches, BPP or BPS • Blown fuse • Damaged BPP switch • Damaged BPS switch • Open or short in the BPP circuit • Open or short in the DBA circuit • Open or short in the BPS circuit			
Diagnostic Aids:	DTC P1572 is set when the PCM does not sense the proper sequence of the brake pedal input signal from both the BPP and BPS switches when the brake pedal is pressed and released.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		-	-	refer to **PINPOINT TEST FD** .

P1575 - PEDAL POSITION OUT OF SELF TEST RANGE

P1575 - PEDAL POSITION OUT OF SELF TEST RANGE

Description:	During key on engine off (KOEO) self-test, the powertrain control module (PCM) monitors the accelerator pedal position (APP) sensor inputs to determine if the APP1 and APP2 signals are less than an expected value. If either APP1 or APP2 is greater than the expected value, the DTC is set.

Possible Causes:	• Accelerator pedal applied during KOEO self-test		
Diagnostic Aids:	Repeat the self-test without applying the accelerator pedal. Make sure the floor mat is not interfering with the accelerator pedal. Diagnose any APP circuit DTCs first.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DK** .	-	-

P1633 - KEEP ALIVE POWER (KAPWR) VOLTAGE TOO LOW

P1633 - KEEP ALIVE POWER (KAPWR) VOLTAGE TOO LOW

Description:	Indicates the KAPWR circuit has experienced a voltage interrupt.		
Possible Causes:	• Open KAPWR circuit • Intermittent KAPWR		
Diagnostic Aids:	Loss of KAPWR to the powertrain control module (PCM) results in immediate malfunction indicator lamp (MIL) illumination and DTC P1633.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST QB** .		

P1635 - TIRE/AXLE RATIO OUT OF ACCEPTABLE RANGE

P1635 - TIRE/AXLE RATIO OUT OF ACCEPTABLE RANGE

Description:	This DTC indicates the tire and axle information contained in the vehicle ID block (VID) does not match the vehicle hardware.		
Possible Causes:	• Incorrect tire size • Incorrect axle ratio • Incorrect VID configuration parameters		
Diagnostic Aids:	Using the scan tool, view the tire and axle parameters within the VID. They must match the vehicle hardware.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the Description, Possible Causes and Diagnostic Aids for the DTC.		

P1636 - INDUCTIVE SIGNATURE CHIP COMMUNICATION ERROR

P1636 - INDUCTIVE SIGNATURE CHIP COMMUNICATION ERROR

Description:	Indicates the powertrain control module (PCM) has lost communication with the inductive signature chip.
Possible Causes:	• Damaged PCM

Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	DTC P1636 indicates the PCM has lost communication with the inductive signature chip. Install a new PCM. Refer to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.		

P1639 - VEHICLE ID (VID) BLOCK CORRUPTED, NOT PROGRAMMED

P1639 - VEHICLE ID (VID) BLOCK CORRUPTED, NOT PROGRAMMED

Description:	This DTC indicates the VID block is not programmed or the information within is corrupt.		
Possible Causes:	• New powertrain control module (PCM) • Incorrect PCM • Incorrect VID configuration		
Diagnostic Aids:	Program the PCM to the most recent calibration available.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	The VID block must be programmed. Refer to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Making Changes to the VID Block.		

P1640 - POWERTRAIN DTCS AVAILABLE IN ANOTHER MODULE

P1640 - POWERTRAIN DTCS AVAILABLE IN ANOTHER MODULE

Description:	Vehicles using a secondary engine control module can request that the powertrain control module (PCM) illuminates the malfunction indicator lamp (MIL) when a failure occurs which affects emissions.		
Possible Causes:	• DTCs stored in a secondary module, which requested the MIL to be turned on		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the Description, Possible Causes and Diagnostic Aids for the DTC.		

P1641 - FUEL PUMP PRIMARY CIRCUIT

P1641 - FUEL PUMP PRIMARY CIRCUIT

For Vehicles Equipped With a FPDM	
Description:	See the description for DTC P1235/P1236.
Possible Causes:	See the possible causes for DTC P1235/P1236.

Diagnostic Aids:	See the diagnostic aids for DTC P1235/P1236.		
For All Others			
Description:	See the description for DTC P0230.		
Possible Causes:	See the possible causes for DTC P0230.		
Diagnostic Aids:	See the diagnostic aids for DTC P0230.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Vehicles Equipped With a FPDM	refer to **PINPOINT TEST KB** .		
All others	refer to **PINPOINT TEST KA** .		

P1646 - LINEAR O2 SENSOR CONTROL CHIP (BANK 1)

P1646 - LINEAR O2 SENSOR CONTROL CHIP (BANK 1)

Description:	The powertrain control module (PCM) monitors the application-specific integrated circuit that controls and monitors the heated oxygen sensor (HO2S). The test fails when the PCM detects an internal circuit or communication concern.		
Possible Causes:	• Damaged PCM		
Diagnostic Aids:	Internal PCM concern.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Reprogram or update the calibration. Check for other DTCs and diagnose those first. Make sure to check for aftermarket performance products before installing a new PCM. Clear the DTCs, repeat the self-test. If the DTC is retrieved again, install a new PCM. Refer to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .		

P1647 - LINEAR O2 SENSOR CONTROL CHIP (BANK 2)

P1647 - LINEAR O2 SENSOR CONTROL CHIP (BANK 2)

Description:	See the description for DTC P1646.		
Possible Causes:	See the possible causes for DTC P1646.		
Diagnostic Aids:	See the diagnostic aids for DTC P1646.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Reprogram or update the calibration. Check for other DTCs and diagnose those first. Make sure to check for aftermarket performance products before installing a new PCM. Clear the DTCs, repeat the self-test. If the DTC is retrieved again, install a new PCM. Refer to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .		

P1650 - POWER STEERING PRESSURE (PSP) SWITCH OUT OF SELF-TEST RANGE

P1650 - POWER STEERING PRESSURE (PSP) SWITCH OUT OF SELF-TEST RANGE

Description:	In the key on engine off (KOEO) self-test, this DTC indicates the PSP input to the powertrain control module (PCM) is high. In the key on engine running (KOER) self-test, this DTC indicates the PSP input did not change state.		
Possible Causes:	• The steering wheel must be turned during KOER self-test • PSP switch/shorting bar damaged • SIG RTN circuit open • PSP circuit open or shorted to SIGRTN		
Diagnostic Aids:	Check if the vehicle was towed or a power steering repair was carried out. Observe the PSP PID while checking the wires for intermittent concerns.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST FF** .	refer to **PINPOINT TEST FF** .	-

P1651 - POWER STEERING PRESSURE (PSP) SWITCH INPUT

P1651 - POWER STEERING PRESSURE (PSP) SWITCH INPUT

Description:	The powertrain control module (PCM) counts the number of vehicle speed transitions from 0 to a calibrated speed. After a calibrated number of speed transitions, the PCM expects the PSP input to change. This DTC is set if the transition is not detected.		
Possible Causes:	• Vehicle towed with the engine running • The power steering hydraulic concern was repaired but the DTC was not erased • PSP switch/shorting bar damaged • SIG RTN circuit open • PSP circuit open or shorted to SIGRTN		
Diagnostic Aids:	Check if the vehicle was towed or a power steering repair was carried out. Observe the PSP PID while checking the wires for intermittent concerns.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST FF** .

P1674 - CONTROL MODULE SOFTWARE CORRUPTED

P1674 - CONTROL MODULE SOFTWARE CORRUPTED

Description:	Indicates an error occurred in the powertrain control module (PCM). This DTC is set in combination with P2105.
Possible Causes:	• Software incompatibility issue • Damaged PCM

Diagnostic Aids:	Verify the PCM is at the latest calibration level.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST QE** .

P1703 - BRAKE SWITCH OUT OF SELF-TEST RANGE

P1703 - BRAKE SWITCH OUT OF SELF-TEST RANGE

Description:	Indicates that during the key on engine off (KOEO) self-test, the brake pedal position (BPP) signal was high, or during the key on engine running (KOER) self-test, the BPP signal did not cycle high and low.		
Possible Causes:	• Open or short in the BPP circuit • Open or short in the stoplamp circuits • Concern in module(s) connected to the BPP circuit • Damaged brake switch • Misadjusted brake switch		
Diagnostic Aids:	Check for correct function of the stoplamp. Using the scan tool, check the BPP PID. The stoplamp and PID should toggle on and off with brake pedal activation.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST FD** .		

P1705 - TRANSMISSION RANGE SENSOR OUT OF SELF-TEST RANGE

P1705 - TRANSMISSION RANGE SENSOR OUT OF SELF-TEST RANGE

Description:	The transmission range circuit is not indicating PARK/NEUTRAL during self-test.		
Possible Causes:	• Gear selector not in PARK/NEUTRAL		
Diagnostic Aids:	Verify the gear selector is in PARK/NEUTRAL.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P1709 - PARK/NEUTRAL POSITION (PNP) SWITCH OUT OF SELF-TEST RANGE

P1709 - PARK/NEUTRAL POSITION (PNP) SWITCH OUT OF SELF-TEST RANGE

Description:	This DTC indicates that the voltage is high when it should be low.
Possible Causes:	• PNP/CPP circuit short to PWR • Damaged PNP or CPP switch • PNP/CPP circuit open in the SIGRTN

Diagnostic Aids:	When activating either the PNP or CPP switch, the voltage should cycle from 5 volts to low.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P1729 - 4X4L SWITCH

P1729 - 4X4L SWITCH

Description:	The 4x4L switch is an on/off switch. If the powertrain control module (PCM) does not sense appropriate voltage when the switch is cycled on and off, a DTC sets for mechanical shift on the fly systems.		
Possible Causes:	• The 4x4L harness between the PCM and the 4x4L switch is open or shorted • Damaged 4x4L switch		
Diagnostic Aids:	Verify the 4x4L switch cycles on/off.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the Workshop article part 308-07A, Four-Wheel Drive Systems.		

P1780 - TRANSMISSION CONTROL SWITCH (TCS) OUT OF SELF-TEST RANGE

P1780 - TRANSMISSION CONTROL SWITCH (TCS) OUT OF SELF-TEST RANGE

Description:	During key on engine running (KOER) self-test the TCS must be cycled, or a DTC is set.		
Possible Causes:	• TCS not cycled during the self-test. • TCS circuit short or open • Damaged TCS switch		
Diagnostic Aids:	Verify the TCS switch cycles on/off.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST TB** .		

P1781 - 4X4L SWITCH OUT OF SELF-TEST RANGE

P1781 - 4X4L SWITCH OUT OF SELF-TEST RANGE

Description:	The 4x4L switch is an on/off switch. If the powertrain control module (PCM) does not sense low voltage when the switch is on, the DTC sets.
Possible Causes:	• 4x4L harness open or shorted • Damaged electronic shift module
Diagnostic Aids:	Verify the 4x4L switch cycles on/off.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	Refer to the Workshop article part 308-07A, Four-Wheel Drive Systems.		

P17XX -

P17XX -

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P18XX -

P18XX -

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the Workshop article part 308-07A, Four-Wheel Drive Systems.		

P1900 - OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT INTERMITTENT

P1900 - OUTPUT SHAFT SPEED (OSS) SENSOR CIRCUIT INTERMITTENT

Description:	The OSS sensor signal to the powertrain control module (PCM) is irregular or interrupted.		
Possible Causes:	• Harness connector not properly seated • Harness intermittently shorted or open • Harness connector damaged • OSS sensor damaged, or not installed correctly		
Diagnostic Aids:	Verify harness and connector integrity. Verify proper installation of the OSS sensor.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
Manual Transmission	refer to **PINPOINT TEST DP** .		
Automatic Transmission	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P1901 - TURBINE SHAFT SPEED (TSS) SENSOR CIRCUIT INTERMITTENT

P1901 - TURBINE SHAFT SPEED (TSS) SENSOR CIRCUIT INTERMITTENT

Description:	The TSS sensor signal to the powertrain control module (PCM) is irregular or interrupted.		
Possible Causes:	• Harness connector not properly seated • Harness intermittently shorted or open • Harness connector damaged • TSS sensor damaged or not installed correctly		
Diagnostic Aids:	Verify harness and connector integrity. Verify proper installation of the TSS sensor.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - 4R70E/4R75E -- E-SERIES** .		

P2004 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 1)

P2004 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 1)

Description:	This DTC is set when the IMRC is commanded closed, but the IMRC monitor indicates open. This DTC replaces P1518 and P1537.		
Possible Causes:	• IMRC monitor signal circuit shorted to PWR GND or SIG RTN • Damaged IMRC actuator or solenoid • Blocked vacuum hoses		
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P2005 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 2)

P2005 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK OPEN (BANK 2)

Description:	This DTC is set when the IMRC is commanded closed, but the IMRC monitor indicates open. This DTC replaces P1538.		
Possible Causes:	• IMRC monitor signal circuit shorted to PWR GND or SIG RTN • Damaged IMRC actuator or solenoid • Damaged PCM • Blocked vacuum hoses		
Diagnostic Aids:	An IMRCM PID reading near approximately 1 volt at closed throttle may indicate a fault.		
Application	**Key On Engine**	**Key On Engine**	**Continuous Memory**

	Off	Running		
All	refer to **PINPOINT TEST HU** .			

P2006 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 1)

P2006 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 1)

Description:	This DTC is set when the IMRC is commanded open, but the IMRC monitor indicates closed. This DTC replaces P1512 and P1519.		
Possible Causes:	• IMRC monitor circuit open • IMRC control circuit open • IMRC monitor circuit short to VREF • Damaged IMRC actuator or solenoid		
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P2007 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 2)

P2007 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) STUCK CLOSED (BANK 2)

Description:	This DTC is set when the IMRC is commanded open, but the IMRC monitor indicates closed. This DTC replaces P1513.		
Possible Causes:	• IMRC monitor circuit open • IMRC control circuit open • IMRC monitor circuit short to VREF • Damaged IMRC actuator or solenoid		
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P2008 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) CIRCUIT OPEN (BANK 1)

P2008 - INTAKE MANIFOLD RUNNER CONTROL (IMRC) CIRCUIT OPEN (BANK 1)

Description:	This DTC indicates a failure in the IMRC primary control circuit. This DTC replaces P1520.		
Possible Causes:	• IMRC control circuit open		
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.		
Application	**Key On Engine**	**Key On Engine**	**Continuous Memory**

		Off	**Running**	
All		refer to **PINPOINT TEST HU** .		

P2014 - INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT (BANK 1)

P2014 - INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT (BANK 1)

Description:	The intake manifold runner control (IMRC) system is monitored for failure during continuous or key on engine off (KOEO) self-test. Each DTC distinguishes the corresponding bank for IMRC actuator assemblies with dual monitor switches. The test fails when the signal on the monitor pin is outside an expected calibrated range. This DTC replaces P1516.		
Possible Causes:	• IMRC monitor circuit open • Mechanical concern - bind, seize, damage or obstruction of IMRC hardware		
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P2015 - INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT RANGE/PERFORMANCE (BANK 1)

P2015 - INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT RANGE/PERFORMANCE (BANK 1)

Description:	The intake manifold runner control (IMRC) system is monitored for failures. Each DTC distinguishes the corresponding bank. The test fails when the system detects the presence of a broken or persistently out of range linkage.		
Possible Causes:	• Mechanical concern - bind, seize, damage, or obstruction of IMRC hardware		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P2019 - INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT (BANK 2)

P2019 - INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT (BANK 2)

Description:	The intake manifold runner control (IMRC) system is monitored for failure during continuous or key on engine off (KOEO) self-test. Each DTC distinguishes the corresponding bank for IMRC actuator assemblies with dual monitor switches. The test fails when the signal on the monitor pin is outside an expected calibrated range. This DTC replaces P1517.

Possible Causes:	• IMRC monitor circuit open • Mechanical concern - bind, seize, damage or obstruction of IMRC hardware		
Diagnostic Aids:	Monitor the IMRC and IMRCM PIDs. The IMRCM state should change when the IMRC is commanded open or closed.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P2020 - INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT RANGE/PERFORMANCE (BANK 2)

P2020 - INTAKE MANIFOLD RUNNER POSITION SENSOR/SWITCH CIRCUIT RANGE/PERFORMANCE (BANK 2)

Description:	See the description for DTC P2015.		
Possible Causes:	See the possible causes for DTC P2015.		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HU** .		

P2065 - FUEL LEVEL SENSOR B CIRCUIT

P2065 - FUEL LEVEL SENSOR B CIRCUIT

Description:	Fuel level information is sent to the powertrain control module (PCM) on the communication link.		
Possible Causes:	• Communication link concern • Damaged instrument cluster (IC) • Damaged generic electronic module (GEM) • Damaged PCM		
Diagnostic Aids:	Refer to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** for fuel level indicator diagnosis.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** to diagnose the incorrect fuel gauge indication symptom		

P2066 - FUEL LEVEL SENSOR B CIRCUIT RANGE/PERFORMANCE

P2066 - FUEL LEVEL SENSOR B CIRCUIT RANGE/PERFORMANCE

Description:	See the description for DTC P2065.
Possible Causes:	See the possible causes for DTC P2065.

Diagnostic Aids:	See the diagnostic aids for DTC P2065.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** to diagnose the incorrect fuel gauge indication symptom		

P2067 - FUEL LEVEL SENSOR B CIRCUIT LOW

P2067 - FUEL LEVEL SENSOR B CIRCUIT LOW

Description:	See the description for DTC P2065.		
Possible Causes:	See the possible causes for DTC P2065.		
Diagnostic Aids:	See the diagnostic aids for DTC P2065.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** to diagnose the incorrect fuel gauge indication symptom		

P2068 - FUEL LEVEL SENSOR B CIRCUIT HIGH

P2068 - FUEL LEVEL SENSOR B CIRCUIT HIGH

Description:	See the description for DTC P2065.		
Possible Causes:	See the possible causes for DTC P2065.		
Diagnostic Aids:	See the diagnostic aids for DTC P2065.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** to diagnose the incorrect fuel gauge indication symptom		

P2070 - INTAKE MANIFOLD TUNING VALVE (IMTV) STUCK OPEN BANK 1

P2070 - INTAKE MANIFOLD TUNING VALVE (IMTV) STUCK OPEN BANK 1

Description:	The IMTV system is monitored for failure during continuous, key on engine off (KOEO), or key on engine running (KOER) self-tests. The test fails when the signal is more or less than an expected calibrated range.		
Possible Causes:	• IMTV signal circuit shorted to PWR GND or SIG RTN • Damaged IMRC actuator		
Diagnostic Aids:	An IMTVM PID reading may indicate a fault.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST HU** .	refer to **PINPOINT TEST HU** .

P2071 - INTAKE MANIFOLD TUNING VALVE (IMTV) STUCK CLOSED BANK 1

P2071 - INTAKE MANIFOLD TUNING VALVE (IMTV) STUCK CLOSED BANK 1

Description:	The IMTV system is monitored for failure during continuous, key on engine off (KOEO), or key on engine running (KOER) self-tests. The test fails when the signal is more or less than an expected calibrated range.		
Possible Causes:	• IMTV signal circuit shorted to PWR GND or SIG RTN • Damaged IMRC actuator • IMTV circuit open		
Diagnostic Aids:	An IMTVM PID reading may indicate a fault.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST HU** .	refer to **PINPOINT TEST HU** .

P2072 - THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - ICE BREAKAGE

P2072 - THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - ICE BREAKAGE

Description:	This DTC only identifies that the strategy has carried out several open and close cycles to remove potential ice build up. This DTC does not imply any system concerns, only that the mode has occurred, and that mode may be causing a long start time.		
Possible Causes:	• Ice or oil in the intake air system could be the result of a positive crankcase ventilation (PCV) system concern		
Diagnostic Aids:	Do not install a new electronic throttle body (ETB) for this DTC. Check the PCV system for evidence of water or ice. Disconnect the intake air fresh air plenum from the throttle body. Check for water or oily residue at the PCV fresh air port. Disconnect the tube at the valve cover and check the tube for ice obstruction/ice. Start the engine and, to check the PCV system, place a piece of cardboard on the crankcase vent in the rocker cover. If the cardboard is held on the crankcase vent and fumes are not exiting, reconnect the tube to the valve cover and the intake air port. If the test passes, the PCV system is OK. If the cardboard is not held in place, turn off the engine and check the PCV valve side of the system for ice or obstruction and repair as necessary. If no obstruction is found there, isolate and repair any obstruction in the intake manifold connection. If no obstruction is found there, make sure the PCV coolant heater is functional and repair as necessary. If no concern is present, make sure the PCV valve is allowing the proper vacuum flow and repair as necessary.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the Description, Possible Causes and Diagnostic Aids for the DTC.		

P2096 - POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1

P2096 - POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1

Description:	The powertrain control module (PCM) monitors the correction value from downstream heated oxygen sensor (HO2S) as part of the fore-aft oxygen sensor control routine. The test fails when the correction value is greater than a calibrated limit.		
Possible Causes:	• Loose connection, and damaged or corroded terminals • Exhaust leaks • Contaminated HO2S		
Diagnostic Aids:	Inspect the connectors for signs of damage, water ingress, or corrosion.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST DZ** .

P2097 - POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1

P2097 - POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1

Description:	See the description for DTC P2096.		
Possible Causes:	See the possible causes for DTC P2096.		
Diagnostic Aids:	See the diagnostic aids for DTC P2096.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST DZ** .

P2098 - POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 2

P2098 - POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 2

Description:	See the description for DTC P2096.		
Possible Causes:	See the possible causes for DTC P2096.		
Diagnostic Aids:	See the diagnostic aids for DTC P2096.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST DZ** .

P2099 - POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 2

P2099 - POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 2

Description:	See the description for DTC P2096.
Possible Causes:	See the possible causes for DTC P2096.
Diagnostic Aids:	See the diagnostic aids for DTC P2096.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	-	-	refer to **PINPOINT TEST DZ** .

P2100 - THROTTLE ACTUATOR CONTROL (TAC) MOTOR CIRCUIT/OPEN

P2100 - THROTTLE ACTUATOR CONTROL (TAC) MOTOR CIRCUIT/OPEN

Description:	A powertrain control module (PCM) fault flag is set indicating the motor circuit is open. May require cycling the key.		
Possible Causes:	• TAC motor has an open winding • TAC motor is damaged • TAC motor harness is open • TAC motor harness is short to PWR • TAC motor harness circuits are short together • TAC motor harness connector is unplugged		
Diagnostic Aids:	A TAC motor circuit PID reading may indicate a concern, if available.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DV** .		

P2101 - THROTTLE ACTUATOR CONTROL (TAC) MOTOR RANGE/PERFORMANCE

P2101 - THROTTLE ACTUATOR CONTROL (TAC) MOTOR RANGE/PERFORMANCE

Description:	A powertrain control module (PCM) fault flag is set indicating the motor circuit is open, and may require cycling the key.		
Possible Causes:	• TAC motor circuits are cross-wired		
Diagnostic Aids:	A TAC motor circuit PID reading may indicate a concern, if available.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DV** .		

P2104 - THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - FORCED IDLE

P2104 - THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - FORCED IDLE

Description:	The TAC system is in the failure mode effects management (FMEM) mode of forced idle.		
Possible Causes:			
Diagnostic Aids:	This DTC is an informational DTC and may be set in combination with a number of other DTCs which are causing the FMEM. Diagnose other DTCs first.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**

All		refer to **PINPOINT TEST QE** .

P2105 - THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - FORCED ENGINE SHUTDOWN

P2105 - THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - FORCED ENGINE SHUTDOWN

Description:	The TAC system is in the failure mode effects management (FMEM) mode of forced engine shutdown.		
Possible Causes:			
Diagnostic Aids:	This DTC is an informational DTC and may be set in combination with a number of other DTCs which are causing the FMEM. Diagnose other DTCs first.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST QE** .		

P2107 - THROTTLE ACTUATOR CONTROL (TAC) MODULE PROCESSOR

P2107 - THROTTLE ACTUATOR CONTROL (TAC) MODULE PROCESSOR

Description:	The electronic throttle control (ETC) area of the powertrain control module (PCM) failed the self-test. The concern could be the result of an incorrect throttle position (TP) command, or TAC motor wires shorted together.		
Possible Causes:	• TAC motor harness circuit short to ground • TAC motor harness circuit short to voltage • Damaged electronic throttle body (ETB) • Damaged PCM		
Diagnostic Aids:	This DTC may be accompanied by other DTCs. If DTC P2110 is present along with other DTCs, disregard DTCs P2107 and P2110 at this time. Diagnose other DTCs first. A TAC motor circuit PID reading may indicate a concern, if available.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DV** .		

P2110 - THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - FORCED LIMITED RPM

P2110 - THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - FORCED LIMITED RPM

Description:	The TAC system is in the failure mode effects management (FMEM) mode of forced limited RPM.		
Possible Causes:			
Diagnostic Aids:	This DTC is an informational DTC and may be set in combination with a number of other DTCs which are causing the FMEM. Diagnose other DTCs first.		
	Key On Engine	**Key On Engine**	

Application		Off	Running	Continuous Memory
All		refer to **PINPOINT TEST QE** .		

P2111 - THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - STUCK OPEN

P2111 - THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - STUCK OPEN

Description:	This powertrain control module (PCM) fault status indicates the throttle plate is at a greater angle than commanded.			
Possible Causes:	• Binding throttle body, stuck open • TAC motor circuit open • TAC motor circuits are cross-wired • TAC motor harness circuits are shorted together • Damaged PCM			
Diagnostic Aids:				
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		refer to **PINPOINT TEST DV** .		

P2112 - THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - STUCK CLOSED

P2112 - THROTTLE ACTUATOR CONTROL (TAC) SYSTEM - STUCK CLOSED

Description:	This powertrain control module (PCM) fault status indicates the throttle plate is at a lower angle than commanded.			
Possible Causes:	• Binding throttle body, stuck closed • TAC motor circuit open • TAC motor circuits are cross-wired • TAC motor harness circuits are shorted together • Damaged PCM			
Diagnostic Aids:				
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		refer to **PINPOINT TEST DV** .		

P2121 - THROTTLE/PEDAL POSITION SENSOR/SWITCH D CIRCUIT RANGE/PERFORMANCE

P2121 - THROTTLE/PEDAL POSITION SENSOR/SWITCH D CIRCUIT RANGE/PERFORMANCE

Description:	The accelerator pedal position (APP) sensor fault flag is set for sensor 1 by the powertrain control module (PCM), indicating the signal is out of the normal self-test operating range.
Possible Causes:	• APP sensor 1 is open, or short to ground or voltage • APP sensor signal circuits are short together • Damaged APP sensor

	• Damaged PCM		
Diagnostic Aids:	An APP1 sensor PID reading may indicate a concern.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DK** .		

P2122 - THROTTLE/PEDAL POSITION SENSOR/SWITCH D CIRCUIT LOW

P2122 - THROTTLE/PEDAL POSITION SENSOR/SWITCH D CIRCUIT LOW

Description:	The accelerator pedal position (APP) sensor 1 is out of self-test range low.		
Possible Causes:	• APP sensor harness open (ETC system with a 2-track APP sensor) • APP sensor harness short to ground • Damaged APP sensor		
Diagnostic Aids:	An APP1 sensor PID reading may indicate a concern.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DK** .		

P2123 - THROTTLE/PEDAL POSITION SENSOR/SWITCH D CIRCUIT HIGH

P2123 - THROTTLE/PEDAL POSITION SENSOR/SWITCH D CIRCUIT HIGH

Description:	The accelerator pedal position (APP) sensor 1 is out of self-test range high.		
Possible Causes:	• APP sensor harness open (ETC system with a 3-track APP sensor) • APP sensor harness is short to VREF • Damaged APP sensor		
Diagnostic Aids:	An APP1 sensor PID reading may indicate a concern.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DK** .		

P2126 - THROTTLE/PEDAL POSITION SENSOR/SWITCH E CIRCUIT RANGE/PERFORMANCE

P2126 - THROTTLE/PEDAL POSITION SENSOR/SWITCH E CIRCUIT RANGE/PERFORMANCE

Description:	The accelerator pedal position (APP) sensor fault flag is set for sensor 2 by the powertrain control module (PCM), indicating the signal is out of the normal self-test operating range.
Possible Causes:	• APP sensor assembly is binding • Damaged APP sensor • Damaged PCM
Diagnostic Aids:	An APP2 sensor PID reading may indicate a concern.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	refer to **PINPOINT TEST DK** .		

P2127 - THROTTLE/PEDAL POSITION SENSOR/SWITCH E CIRCUIT LOW

P2127 - THROTTLE/PEDAL POSITION SENSOR/SWITCH E CIRCUIT LOW

Description:	The accelerator pedal position (APP) sensor 2 is out of self-test range low.
Possible Causes:	• APP sensor circuit is short to ground • APP sensor circuit is open • Damaged APP sensor
Diagnostic Aids:	An APP2 sensor PID reading may indicate a concern.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	refer to **PINPOINT TEST DK** .		

P2128 - THROTTLE/PEDAL POSITION SENSOR/SWITCH E CIRCUIT HIGH

P2128 - THROTTLE/PEDAL POSITION SENSOR/SWITCH E CIRCUIT HIGH

Description:	The accelerator pedal position (APP) sensor 2 is out of self-test range high.
Possible Causes:	• APP sensor assembly is binding • APP sensor harness is short to voltage • Damaged APP sensor
Diagnostic Aids:	An APP2 sensor PID reading may indicate a concern.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory
All	refer to **PINPOINT TEST DK** .		

P2131 - THROTTLE/PEDAL POSITION SENSOR/SWITCH F CIRCUIT RANGE/PERFORMANCE

P2131 - THROTTLE/PEDAL POSITION SENSOR/SWITCH F CIRCUIT RANGE/PERFORMANCE

Description:	The accelerator pedal position (APP) sensor fault flag is set for sensor 3 by the powertrain control module (PCM), indicating the signal is out of the normal self-test operating range.
Possible Causes:	• APP sensor assembly is binding • Damaged APP sensor • Damaged PCM
Diagnostic Aids:	An APP3 sensor PID reading may indicate a concern.

Application	Key On Engine Off	Key On Engine Running	Continuous Memory

All	refer to **PINPOINT TEST DK** .		

P2132 - THROTTLE/PEDAL POSITION SENSOR/SWITCH F CIRCUIT LOW

P2132 - THROTTLE/PEDAL POSITION SENSOR/SWITCH F CIRCUIT LOW

Description:	The accelerator pedal position (APP) sensor 3 is out of self-test range low.		
Possible Causes:	• APP sensor assembly is binding • APP sensor circuit is open • APP sensor harness short to ground • Damaged APP sensor		
Diagnostic Aids:	An APP3 sensor PID reading may indicate a concern.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DK** .		

P2133 - THROTTLE/PEDAL POSITION SENSOR/SWITCH F CIRCUIT HIGH

P2133 - THROTTLE/PEDAL POSITION SENSOR/SWITCH F CIRCUIT HIGH

Description:	The accelerator pedal position (APP) sensor 3 is out of self-test range high.		
Possible Causes:	• APP sensor assembly is binding • APP sensor harness is short to voltage • Damaged APP sensor		
Diagnostic Aids:	An APP3 sensor PID reading may indicate a concern.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DK** .		

P2135 - THROTTLE/PEDAL POSITION SENSOR/SWITCH A/B VOLTAGE CORRELATION

P2135 - THROTTLE/PEDAL POSITION SENSOR/SWITCH A/B VOLTAGE CORRELATION

Description:	The powertrain control module (PCM) flagged a concern indicating that throttle position (TP) 1 and TP2 disagree by more than a calibrated limit.
Possible Causes:	• TP sensor shorted internally to VREF • TP sensor harness is short to voltage • TP sensor signal wires are short together • Damaged TP sensor
Diagnostic Aids:	Compare the TP1 and TP2 PID values for a full sweep and correlation. Refer to the chart in pinpoint test DV. refer to **PINPOINT TEST DV** . Check the wiring harness for an open or a short circuit. Check the TP sensor for an internal open or short circuit. If no circuit concerns are

	present, install a new TP sensor.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DV** .		

P2138 - THROTTLE/PEDAL POSITION SENSOR/SWITCH D/E VOLTAGE CORRELATION

P2138 - THROTTLE/PEDAL POSITION SENSOR/SWITCH D/E VOLTAGE CORRELATION

Description:	The powertrain control module (PCM) monitors the accelerator pedal position (APP) sensor for a concern. The PCM compares the accelerator pedal position information from the APP sensor inputs, APP1 and APP2. If the APP sensor inputs APP1 and APP2 disagree on the position of the accelerator pedal by more than an expected value, the DTC is set.		
Possible Causes:	• APP sensor circuit concerns • Damaged APP sensor		
Diagnostic Aids:	Monitor the APP_MAXDIFF PID while applying and releasing the accelerator pedal.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST DK** .		

P2195 - O2 SENSOR SIGNAL BIASED/STUCK LEAN - BANK 1, SENSOR 1

P2195 - O2 SENSOR SIGNAL BIASED/STUCK LEAN - BANK 1, SENSOR 1

Description:	A heated oxygen sensor (HO2S) indicating lean at the end of a test is trying to correct for an over-rich condition. The test fails when the fuel control system no longer detects switching for a calibrated amount of time. Electrical: • Short to VPWR in the harness or HO2S • Water in the harness connector • Open/shorted HO2S circuit • Open UO2SPC circuit • Corrosion or incorrect harness connections • Damaged HO2S • Damaged powertrain control module (PCM) Fuel System: • Excessive fuel pressure • Leaking/contaminated fuel injectors • Leaking fuel pressure regulator

Possible Causes:	• Low fuel pressure or running out of fuel • Vapor recovery system Intake Air System: • Air leaks after the mass air flow (MAF) sensor • Vacuum leaks • Positive crankcase ventilation (PCV) system is leaking or the valve is stuck open • Incorrectly seated engine oil dipstick EGR System: • Leaking gasket • Stuck EGR valve • Leaking diaphragm or EGR vacuum regulator Base Engine: • Oil overfill • Camshaft timing • Cylinder compression • Exhaust leaks before or near the HO2S(s)
Diagnostic Aids:	

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST H** .	refer to **PINPOINT TEST H** .

P2196 - O2 SENSOR SIGNAL BIASED/STUCK RICH - BANK 1, SENSOR 1

P2196 - O2 SENSOR SIGNAL BIASED/STUCK RICH - BANK 1, SENSOR 1

Description:	A heated oxygen sensor (HO2S) indicating rich at the end of a test is trying to correct for an over-lean condition. The test fails when the fuel control system no longer detects switching for a calibrated amount of time.
Possible Causes:	See the possible causes for DTC P2195.
Diagnostic Aids:	

Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**

All		refer to **PINPOINT TEST H** .

P2197 - O2 SENSOR SIGNAL BIASED/STUCK LEAN - BANK 2, SENSOR 1

P2197 - O2 SENSOR SIGNAL BIASED/STUCK LEAN - BANK 2, SENSOR 1

Description:	See the description for DTC P2195.		
Possible Causes:	See the possible causes for DTC P2195.		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST H** .	refer to **PINPOINT TEST H** .

P2198 - O2 SENSOR SIGNAL BIASED/STUCK RICH - BANK 2, SENSOR 1

P2198 - O2 SENSOR SIGNAL BIASED/STUCK RICH - BANK 2, SENSOR 1

Description:	See the description for DTC P2196.		
Possible Causes:	See the possible causes for DTC P2195.		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST H** .		

P2257 - SECONDARY AIR INJECTION (AIR) SYSTEM CONTROL A CIRCUIT LOW

P2257 - SECONDARY AIR INJECTION (AIR) SYSTEM CONTROL A CIRCUIT LOW

Description:	The AIR system monitor circuit is low, indicating the secondary AIR pump is off although the secondary AIR pump was commanded on by the powertrain control module (PCM).		
Possible Causes:	• Open B+ circuit • Open VPWR circuit • Open voltage circuit between the AIR relay and the secondary AIR pump • Damaged AIR relay		
Diagnostic Aids:	The AIR monitor circuit PCM input contains a pull up voltage through a resistance internal to the PCM. This voltage is normally held low by the resistance path through the secondary AIR pump when the secondary AIR pump is off. A single electrical open circuit component such as an AIR relay coil in this multi-component circuit is not detected by the PCM output driver, yet it sets DTC P2257.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HM** .		

P2258 - SECONDARY AIR INJECTION (AIR) SYSTEM CONTROL A CIRCUIT HIGH

P2258 - SECONDARY AIR INJECTION (AIR) SYSTEM CONTROL A CIRCUIT HIGH

Description:	The AIR system monitor circuit is high, indicating the secondary AIR pump is on although the secondary AIR pump was commanded off by the powertrain control module (PCM).		
Possible Causes:	• AIR relay fault - stuck closed • Secondary AIR pump fault - circuit open in motor • Open ground to secondary AIR pump • Open AIR monitor circuit between the secondary AIR pump and the PCM • Short to voltage in the AIR relay to secondary AIR pump voltage circuit		
Diagnostic Aids:	The AIR monitor circuit PCM input contains a pull up voltage through a resistance internal to the PCM. This voltage is normally held low by the resistance path through the secondary AIR pump when the secondary AIR pump is off.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HM** .		

P2270 - O2 SENSOR SIGNAL STUCK LEAN - BANK 1, SENSOR 2

P2270 - O2 SENSOR SIGNAL STUCK LEAN - BANK 1, SENSOR 2

Description:	The downstream heated oxygen sensor (HO2S) is forced rich and lean and monitored by the powertrain control module (PCM). The test fails if the PCM does not detect the output of the HO2S in a calibrated amount of time.		
Possible Causes:	• Pinched, shorted, and corroded wiring and pins • Crossed HO2S wires • Exhaust leaks • Contaminated or damaged HO2S		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST H** .	refer to **PINPOINT TEST H** .

P2271 - O2 SENSOR SIGNAL STUCK RICH - BANK 1, SENSOR 2

P2271 - O2 SENSOR SIGNAL STUCK RICH - BANK 1, SENSOR 2

Description:	See the description for DTC P2270.
Possible Causes:	See the possible causes for DTC P2270.

Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST H** .	refer to **PINPOINT TEST H** .

P2272 - O2 SENSOR SIGNAL STUCK LEAN - BANK 2, SENSOR 2

P2272 - O2 SENSOR SIGNAL STUCK LEAN - BANK 2, SENSOR 2

Description:	See the description for DTC P2270.		
Possible Causes:	See the possible causes for DTC P2270.		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST H** .	refer to **PINPOINT TEST H** .

P2273 - O2 SENSOR SIGNAL STUCK RICH - BANK 2, SENSOR 2

P2273 - O2 SENSOR SIGNAL STUCK RICH - BANK 2, SENSOR 2

Description:	See the description for DTC P2270.		
Possible Causes:	See the possible causes for DTC P2270.		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST H** .	refer to **PINPOINT TEST H** .

P2274 - O2 SENSOR SIGNAL STUCK LEAN - BANK 1, SENSOR 3

P2274 - O2 SENSOR SIGNAL STUCK LEAN - BANK 1, SENSOR 3

Description:	See the description for DTC P2270.		
Possible Causes:	See the possible causes for DTC P2270.		
Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST H** .	refer to **PINPOINT TEST H** .

P2275 - O2 SENSOR SIGNAL STUCK RICH - BANK 1, SENSOR 3

P2275 - O2 SENSOR SIGNAL STUCK RICH - BANK 1, SENSOR 3

Description:	See the description for DTC P2270.
Possible Causes:	See the possible causes for DTC P2270.

Diagnostic Aids:			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	refer to **PINPOINT TEST H** .	refer to **PINPOINT TEST H** .

P2448 - SECONDARY AIR INJECTION SYSTEM HIGH AIRFLOW (BANK 1)

P2448 - SECONDARY AIR INJECTION SYSTEM HIGH AIRFLOW (BANK 1)

Description:	The AIR system detects excessive mass air flow change with the pump ON and a rich exhaust system air fuel ratio.		
Possible Causes:	• AIR outlet hose leak. • AIR outlet hose is disconnected.		
Diagnostic Aids:	Measured air flow is less than expected. Visually inspect the secondary AIR inlet hose.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HM** .		

P260F - EVAPORATIVE SYSTEM MONITORING PROCESSOR PERFORMANCE

P260F - EVAPORATIVE SYSTEM MONITORING PROCESSOR PERFORMANCE

Description:	This DTC sets when a concern is detected internal to the powertrain control module (PCM). The microprocessor that controls the engine off natural vacuum (EONV) leak check monitor is separate from the main processor within the PCM.		
Possible Causes:	• Module communications network concerns • PCM calibration level • Damaged PCM		
Diagnostic Aids:	Verify the PCM is at the latest calibration level. Reprogram if necessary.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	refer to **PINPOINT TEST HX** .		

PXXXX -

PXXXX -

Description: **Possible Causes:** **Diagnostic Aids:**			
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
	For Pxxxx DTCs not listed in this chart, refer to the customer's		

All		symptom to determine the applicable Workshop article part for diagnosis.

U0101 - LOST COMMUNICATION WITH TRANSAXLE CONTROL MODULE (TCM)

U0101 - LOST COMMUNICATION WITH TRANSAXLE CONTROL MODULE (TCM)

Description:	The powertrain control module (PCM) continuously monitors the controller area network (CAN) for messages from the TCM. This DTC sets when the PCM does not receive the TCM message within the defined amount of time.		
Possible Causes:	• Damaged CAN communication bus circuit		
Diagnostic Aids:	Network DTC concerns occur during module-to-module communication. Refer to the **MODULE COMMUNICATIONS NETWORK -- E-SERIES** to diagnose the transmission control module (TCM) does not respond to the scan tool symptom.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-		

U0121 - LOST COMMUNICATION WITH THE ANTILOCK BRAKING SYSTEM (ABS) CONTROL MODULE

U0121 - LOST COMMUNICATION WITH THE ANTILOCK BRAKING SYSTEM (ABS) CONTROL MODULE

Description:	The powertrain control module (PCM) continuously monitors the controller area network (CAN) for messages from the ABS. This DTC sets when the PCM fails to receive the ABS message within the defined amount of time.		
Possible Causes:	• Damaged CAN communication bus circuit		
Diagnostic Aids:	Network DTC concerns occur during module-to-module communication. Refer to the **MODULE COMMUNICATIONS NETWORK -- E-SERIES** , to diagnose the anti-lock brake system (ABS) module does not respond to the scan tool symptom.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-		

U0155 - LOST COMMUNICATION WITH INSTRUMENT PANEL CLUSTER CONTROL MODULE

U0155 - LOST COMMUNICATION WITH INSTRUMENT PANEL CLUSTER CONTROL MODULE

Description:	Missing message concerns are logged by a module upon failure to receive a message from another module within a defined retry period.
Possible Causes:	• Open VPWR circuit to the sending module • Open GND circuit to the sending module

	• Open network circuits to the sending module		
Diagnostic Aids:	Carry out the diagnostics for the associated network module.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **INSTRUMENT CLUSTER (IC) AND WARNING CHIMES -- E-SERIES** to diagnose the instrument cluster does not respond to the scan tool symptom.		

U0300 - INTERNAL CONTROL MODULE SOFTWARE INCOMPATIBILITY

U0300 - INTERNAL CONTROL MODULE SOFTWARE INCOMPATIBILITY

Description:	This DTC indicates that there are incompatible software levels within the powertrain control module (PCM) that control the electronic throttle control (ETC) system. The ETC system uses multiple microprocessors within the PCM, each having its own software level and function. The microprocessors must have the correct level of software in order to communicate and function together.		
Possible Causes:			
Diagnostic Aids:	Verify the PCM is at the latest calibration level.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	-	-	refer to **PINPOINT TEST QE** .

U1039 - SCP (J1850) INVALID OR MISSING DATA FOR VEHICLE SPEED

U1039 - SCP (J1850) INVALID OR MISSING DATA FOR VEHICLE SPEED

Description:			
Possible Causes:	Network DTC(s) occur during module-to-module communication concerns. Two types of network concerns can be categorized: • Invalid data network concerns - data is transferred within the normal inter-module message, but contains known invalid data. The transmitting module logs a DTC related to the invalid data concern. • Missing message network concerns - missing message concerns are logged by the module upon failure to receive a message from another module within a defined retry period.		
Diagnostic Aids:	Carry out the on-board diagnostics for the associated network module.		
Application	**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All	Refer to the **MODULE COMMUNICATIONS NETWORK -- E-SERIES** to diagnose the no international standards organization (ISO) 9141 network communication symptom or the antilock braking system (ABS) module does not respond to the scan tool symptom.		

UXXXX - NETWORK COMMUNICATION DIAGNOSTIC TROUBLE CODE (DTC)

UXXXX - NETWORK COMMUNICATION DIAGNOSTIC TROUBLE CODE (DTC)

Description: **Possible Causes:** **Diagnostic Aids:**	Powertrain related DTC from another module.			
Application		**Key On Engine Off**	**Key On Engine Running**	**Continuous Memory**
All		For U DTC(s) received during self-test of a module other than the powertrain control module (PCM), refer to the **SYMPTOM CHARTS** article, Powertrain Control Module (PCM) Quick Test.		
Note: 'x' equals any number 0 through 9 or letter A through F. Note 1: Reprogram or update the calibration. Check for other DTCs or drive symptoms for further action. Make sure to check for aftermarket performance products before installing a new PCM. If it is necessary to install a new PCM, refer to**FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM. Note 2: DTC P1000 is ignored in the key on engine off (KOEO) and key on engine running (KOER) self-tests. Disregard DTC P1000 and continue as directed.				

2008 ENGINE PERFORMANCE

Reference Values - Gasoline Engines

REFERENCE VALUE SYMPTOM CHART

The Reference Value Symptom Chart provides guidance in selecting the appropriate parameter identification (PID) or measured signal related to the fault area. Select a symptom from the symptom chart along with the category number and go to the PID/Measured Signal Chart. For multiple symptoms, select the symptom that is the most evident.

SYMPTOM CHART

Symptom Occurs During	Symptom	Category Number
Startup:	No start/Normal crank	1
	Hard start/Long crank	2
	Stall after start	3
	Diesels/Runs on	4
Idle:	MIL	5
	Stalls/Quits	6
	Slow	7
	Slow return	8
	Rolling	9
	Fast	10
	Rough	11
	Misses	12
	Backfires	13
Acceleration:	Stalls/Quits	6
	Misses	12
	Bucks/Jerks	14
	Backfires	13
	Hesitation	15
	Lack/Loss of power	16
	Surge	17
	Spark knock	18
	Cooling system temperature	19
	Poor fuel economy	20
	Emissions compliance	21
Cruise:	Stalls/Quits	6
	Misses	12
	Bucks/Jerks	14

	Backfires Lack/Loss of power Surge Spark knock Cooling system temperature Poor fuel economy Emissions compliance	13 16 17 18 19 20 21
Deceleration:	Stalls/Quits Backfires	6 13
Transmission Operation: (Automatic)	Shift/engagement concerns No overdrive	22 23

REFERENCE VALUE PARAMETER IDENTIFICATION (PID)/MEASURED SIGNAL CHART

The following listing reflects PIDS and/or measured values which may reveal a possible concern within each system shown. Match the category number with the related PID/measured signal and go to the Typical Diagnostic Reference Value Charts.

PID/MEASURED SIGNAL CHART

Category Number	Related PIDS/Measured Signals
5-9-10-17	WAC/ACCR
5-9-10-17	ACCS
5-10-17	ACP
5-10-17	ACP V
5-21	AIR
5-21	AIRF
5-21	AIRM
1-23	APP1
1-23	APP2
1-23	APP3
23	BPP (BOO)
18-19	CHT
18-19	CHT V
1-2-3-5-6-7-11-12-13-14-15-16-17-20-21	CMP
1-2-3-5-6-7-11-12-13-14-15-16-17-20-21	CKP
1-2-3-5-6-7-11-12-13-14-15-16-17-20-21	CMP1/2

10	CPP/PNP
3-5-6-7-9-11-15-16-20-21	DPFEGR
4-18-19-21-22	ECT[a]
4-18-19-21-22	ECT V
3-5-6-7-9-11-15-16-20-21	EGRMC1-4
3-5-6-7-9-11-15-16-20-21	EGRMDSD
3-5-6-7-9-11-15-16-20-21	EGRVR
5-18-19-20-21	EOT
5-18-19-20-21	EOT V
22	EPC/EPC1/EPC2/EPC3
22	EPC V
3-5-6-11-21	EVAPCV
3-5-6-11-21	EVAPPDC
3-5-6-11-21	EVMV
19	FCV 3
20	FLI (H)
20	FLI V
1 thru 21	FP
1 thru 21	FPM or FP M
1 thru 21	FRP
1 thru 21	FRP V
1 thru 21	FRT
5	FTP
1 thru 21	FUELPW1/2
1 thru 21	FUELSYS (OL/CLSD-LP)[a]
22-23	GEAR
5	GENMON
19	HFC (FC3)
1 thru 21	HTR11/12/13/21/22
1 thru 21	IAC
2-3-5-7-8-10-22	IAT[a]
2-3-5-7-8-10-22	IAT2[a]
5-14-15-16-17-20	IMRC
5-14-15-16-17-20	IMRCM
5-14-15-16-17-20	IMTV
6-11-12-14 thru 18-20-21	INJ x F
4-5-16-18-19-20-21	KNOCK 1[a]
4-5-16-18-19-20-21	KNOCK 2[a]
19	LFC (FCI)
1 thru 21	LONGFT1/2[a]

1 thru 23	MAF[a]
1 thru 23	MAP
1 thru 22	MISF
1 thru 21	HO2S11/12/13/21/22
22	OSS
10	PSP
10	PSPT
5	PTO
1 thru 23	RPM[a]
5-14-16-17	SCBC
5-14-16-17	SCIPC
1 thru 21	SHRTFT1/2/11/12/21/22
15-16-18-19-20-21	SPRKADV[a]
22-23	SS1(SSA)/SS2(SSB)/SS3(SSC)/SS4(SSD)
1-23	TACM (-)
1-23	TACM (+)
6-14-16-20	TCC
22	TCIL
22-23	TCS
22-23	TFT
1-23	TP
1-23	TP1 NS
1-23	TP2 PS
1-23	TP V
22-23	TR
22-23	TR 1-4
22-23	TR V
22-23	TR D
22-23	TSS
2-4-5-9-10-11-16-17-18-19-20-21	VCT
2-4-5-9-10-11-16-17-18-19-20-21	VCTDC1/2
1-2-3-5-6-11-12-13-14	VPWR
22-23	VSS

[a] Generic PID

Some signals can only be measured and require the use of a digital multimeter (DMM).

TYPICAL DIAGNOSTIC REFERENCE VALUES

NOTES:

Footnotes are referenced throughout the Typical Diagnostic Reference Value Charts. A letter in parentheses next to a value indicates supplemental information is applicable.

An attempt is made to provide as much information as possible; some vehicles may not display all input and output signals.

The Typical Diagnostic Reference Value Charts do not display fault parameter identifications (PIDs). These are PIDs which indicate a hard fault with the circuit. They display a value of YES or NO and are PIDs ending with the letter F.

Reference values may vary 20% depending on operating conditions, altitude, and other factors. RPM values are axle and tire dependent.

Values are taken at an altitude of approximately Meters 55.7 (600 ft) above sea level.

Refer to the Introduction part, Acronyms and Definitions for technical terms applicable to Ford Motor Company products.

Refer to**PARAMETER IDENTIFICATION (PID)** , for PID descriptions.

For detailed transmission diagnostics, refer to the Workshop article. Transmission signals may be referred to in either alpha or numeric form. For example, 1=A, 2=B, 3=C.

A. A/C on.
B. Cooling fan on (single, low or high speed).
C. Heated oxygen sensors (HO2S) should switch from rich to lean at least once every 3 seconds. HO2S voltage should toggle above and below 0.450 DCV and never be a negative value. Valid HO2S switching occurs only during closed loop fuel control operation.
D. Downstream HO2S(s) stay close to a constant voltage when the catalyst monitor is off (positive value only). When the catalyst monitor is on, the HO2S switches rich to lean above and below 0.450 DCV and never be a negative value. For downstream HO2S(s) (12, 13, 22) greater activity results when the catalyst monitor is active.
E. Brake pedal applied.
F. The electric vapor management valve (VMV) commanded current varies from 0 mA - 1000 mA depending on the PCM command to purge the EVAP system.
G. While pressing the transmission control switch (TCS) or switching to manual drive mode.
H. Value is dependent on fuel tank level. Typical operating range is 15% (empty) to 90% (full).
I. Steering wheel turned.
J. Clutch pedal applied.
K. Value is dependent upon ambient air temperature and may fall outside of range.
L. Value is not useful under this condition.
M. If equipped.

N. Transmission in selected range.
O. May change state under this condition.
P. While pressing switch.
Q. Value may cycle 5-6 times every 5 seconds.
R. Canister vent duty cycles to 100% (close) when EVAP monitor test is running.
S. Refer to Workshop article part 419-01.
T. EGR voltage and duty cycle will vary from 0-VBAT or 0-100% depending on EGR demand.
U. RPM dependent. If signal is 0 Hz at idle, check signal at 900 RPM.
V. Crank position.
W. Value may vary 20% depending on altitude, operating conditions, weather, and other factors.

2.0L 4V FOCUS

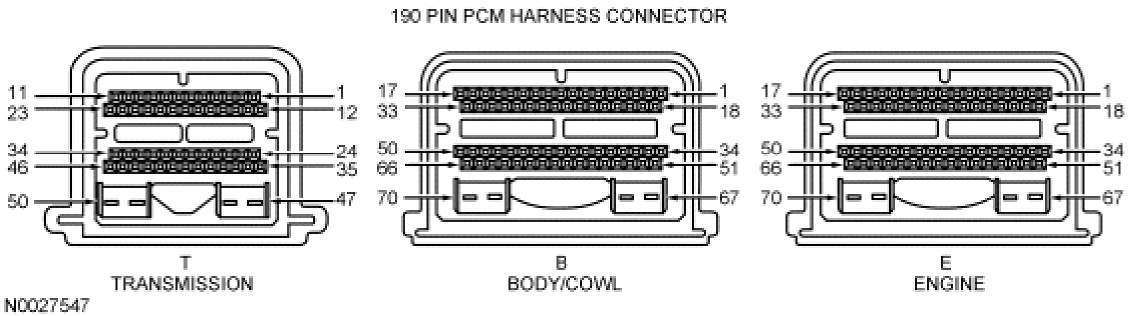


Fig. 1: 190 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
BOO1	B13	OFF	ON (E)	OFF	OFF	ON/OFF
APP1	B28	0.77/15.29	0.77/15.29	1.38/25.49	1.45/28.24	DCV/%
APP2	B29	0.38/7.45	0.38/7.45	0.69/13.73	0.73/14.51	DCV/%
ACP_PRESS	B31	1.56/66.55	1.69/74.53	1.45/59.30	1.39/55.69	DCV/PSI
FPM	B32	0	100	100	100	%
MAF	B40	0	0.6	1.83	1.87	DCV
BOO2	B46	OFF	ON (E)	OFF	OFF	ON/OFF
IAT	B47	1.78/120.2 (K)	1.99/111.2 (K)	2.53/93.2 (K)	2.66/87.8 (K)	DCV/DEG F
FTP	B65	2.6/0	2.6/0	2.6/0	2.6/0	DCV/PSI
O2S11	E11	(L)	switching (C)	switching (C)	switching (C)	DCV

CHT	E15	3.2/224.6	3.56/204.8	0.67/186.8	0.67/186.8	DCV/DEG F
IMRC1M (PZEV)	E25	0.1	0.1	4.98	4.98	DCV
MAP	E40	4.02/14.35 (W)	1.15/4.06 (W)	2.42/8.70 (W)	3.15/11.31 (W)	DCV/PSI
TP1	E44	4.10	4.33	3.90	4.06	DCV
TP2	E45	1.19	0.72	1.60	1.27	DCV
HTRCM11	E52	1.58	1.58	1.65	1.65	AMPS
O2S13 (PZEV)	T7	0.1	(D)	(D)	(D)	DCV
O2S12	T16	(L)	(D)	(D)	(D)	DCV
HTRCM12	T18	676	676	634	634	mA
TFT (A/T)	T19	118 (K)	117 (K)	147 (K)	144 (K)	DEG F
TFTV (A/T)	T19	1.9 (K)	1.9 (K)	1.3 (K)	1.4 (K)	DCV
PSP	T29	OFF	OFF	OFF	OFF	ON/OFF
TCC (A/T)	T30	0	0	0	99.61	%
TSS_SRC (A/T)	T37	0	731	1513	1844	RPM
APP	PID	0	0	19	21	%
APP_ MAXDIFF	PID	0	0	0	-0.06	DEG
BARO	PID	14.5/29.53	14.5/29.53	14.5/29.53	14.5/29.53	PSI/IN HG
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	MODE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.73	1.48	7.79	8.25	DEG
ETC_DSD	PID	7.60	1.45	7.71	8.12	DEG
ETC_TRIM	PID	0	0	0.01	0.02	DEG
GENMON	PID	0	54.9	18.96	22.1	%
LOAD	PID	0 (L)	27	55.29	74.9	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	702	2527	1887	RPM
TP_MAXDIFF	PID	-4	-8	-8	-8	DEG
TR (A/T)	PID	PARK	PARK	OVERDRIVE	OVERDRIVE	MODE
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B19	0/OFF	100/ON	100/ON	100/ON	%/ON-OFF
EVAPCV	B20	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVMV	B55	0/OFF	0/OFF	500-900 (F)/VARYING	500-900 (F)/VARYING	mA/OFF-VARYING

IMRC (PZEV)	E22	ON	ON	OFF	OFF	ON/OFF
HTR11	E52	OFF (O)	ON	ON	ON	ON/OFF
SSA (SS1) (A/T)	T11	OFF	ON	OFF	OFF	ON/OFF
HTR12	T18	OFF (O)	ON	ON	ON	ON/OFF
SSB (SS2) (A/T)	T23	0/OFF	0/OFF	0/OFF	100/ON	%/ON-OFF
HTR13 (PZEV)	T25	OFF (O)	ON	ON	ON	ON/OFF
EGRPCT	PID	0	0.78	43.14	49.02	%
EGR_STEP	PID	0	1	23	26	0-52
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAPSOAK	PID	YES	YES	YES	YES	YES/NO
FUELSYS1	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
GENCMD	PID	0	0 (Q)	0 (Q)	0 (Q)	%
HFC	PID	OFF	ON (B)	OFF	OFF	ON/OFF
LFC	PID	OFF	ON (B)	OFF	OFF	ON/OFF
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LOOP_ CONTRL	PID	OPEN	OPEN	CLOSED	CLOSED	OPEN/ CLOSED
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	9.75	39.75	23.75	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VREF	B52, E63, T70	5	5	5	5	DCV
VPWR	B67/68	VBAT	VBAT	VBAT	VBAT	DCV

2.3L 4V FUSION/MILAN

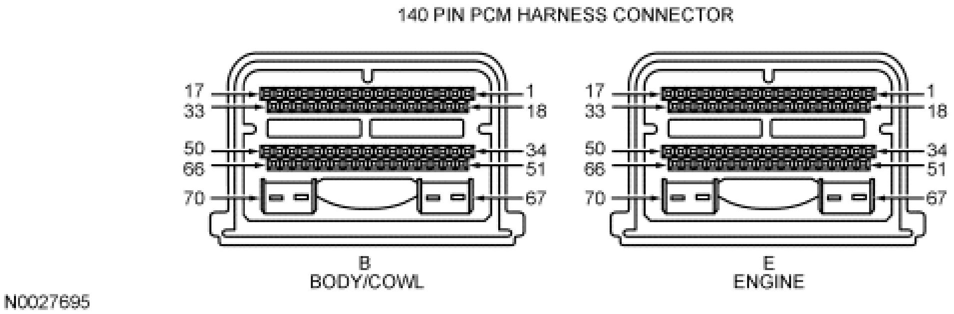


Fig. 2: Identifying 140 Pin PCM Harness Connectors/Terminals
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
APP1	B25	4.1	4.1	3.8	3.8	DCV
APP2	B26	1.5	1.5	1.6	1.7	DCV
APP3	B27	1.0	1	1	1.1	DCV
FPM	B30	OFF	ON	ON	ON	ON/OFF
MAF	B41	0	0.71	1.2	1.28	DCV
IAT	B43	1.6/126 (K)	1.71/122 (K)	3.5/54 (K)	3.43/55 (K)	DCV/DEG F
FTP	B44	2.6/-0.01	2.5/-0.02	2.3/-0.09	2.2/-0.11	DCV/PSI
BOO	B46	OFF	ON (E)	OFF	OFF	ON/OFF
BPA	B47	OFF	ON (E)	OFF	OFF	ON/OFF
AIRM (PZEV)	B50	OFF	OFF	OFF	OFF	ON/OFF
A/CT	B53	95	98.6 (A)	113	113	DEG F
A/CT_V	B53	2.46	2.38	1.98	1.98	DCV
ACP_PRESS	B63	2.4/240	2.43/243	1.65/158	1.68/162	DCV/PSI
O2S12	E3	(L)	(D)	(D)	(D)	DCV
O2S13 (PZEV)	E5	0.1	(D)	(D)	(D)	DCV
HTRCM12	E23	582	582	582	582	mA
GENMON	E26	0	40	25	21.8	%
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
CHT	E41	4.5-1/240-160	3.4/212	3.22/224	3.18/226	DCV/DEG F
KNOCK 1	E49	219	175	264	373	N/A
TP2	E60	1.15/23.14	0.66/13.33	0.93/18.43	2.12/42.35	DCV/%
TP1	E61	4.12/17.26	4.36/12.55	4.22/15.29	3.64/27.06	DCV/%
MAP	E62	4/14.35 (W)	1.15/4.06 (W)	2.66/9.42 (W)	2.87/10.29 (W)	DCV/PSI
IMTV	E64	OFF	ON	ON	ON	ON/OFF
PSP	E65	LOW	HIGH (I)	LOW	LOW	HIGH/LOW
HTRCM11	E69	1.49	1.49	1.49	1.49	AMPS
APP	PID	0	0	10.5	19	%
BARO	PID	14.3/156.2	14.3/156.2	14.3/156.2	14.3/156.2	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.25	1.25	8.43	11.69	DEG
ETC_DSD	PID	6.5	1.28	8.45	11.68	DEG

FLI	PID	36 (H)	36 (H)	40 (H)	36 (H)	%
LOAD	PID	54 (L)	17.6	19.7	22.4	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	797	1717	2434	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
AIR (PZEV)	B1	OFF	OFF	OFF	OFF	ON/OFF
EVMV	B4	0/OFF	450/ VARYING	801/ VARYING	930/ VARYING	mA/OFF-VARYING
FANVAR	B8	0	55	0	0	%
EVAPCV	B61	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
FP	B62	OFF	ON	ON	ON	ON/OFF
WAC/ACCR	B64	OFF	ON	OFF	OFF	ON/OFF
SPARKDUR_2	E11	0	2.06	1.37	781	uS
SPARKDUR_3	E12	0	2.12	1.46	719	uS
GENCMD	E13	3.79	0 (Q)	0 (Q)	0 (Q)	%
SPARKDUR_4	E16	0	2.31	1.21	719	uS
SPARKDUR_1	E17	0	2.25	1.37	656	uS
HTR12	E23	OFF	ON	ON	ON	ON/OFF
HTR13 (PZEV)	E25	ON (O)	ON	ON	ON	ON/OFF
VCTDC	E67	0	0	0	0	%
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
VCTADV	PID	0	0	-0.37	-1.06	DEG
VCTADVERR	PID	0	0	0.37	1.06	DEG
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	4.5	25.75	29.75	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B51/52	VBAT	VBAT	VBAT	VBAT	DCV

3.0L 4V FUSION/MILAN

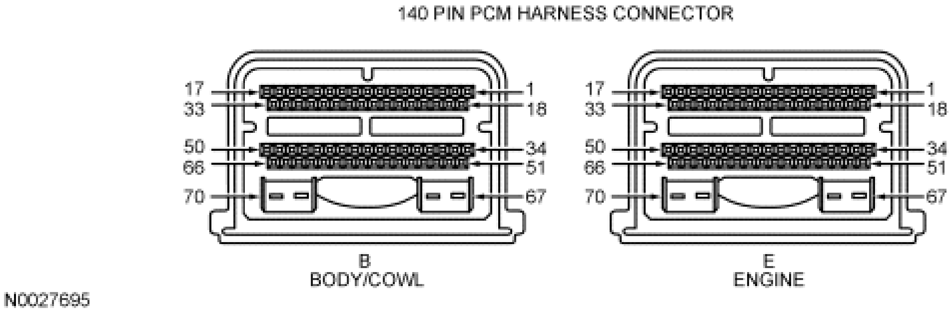


Fig. 3: Identifying 140 Pin PCM Harness Connectors/Terminals
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
APP1	B25	4	4	3.9	3.7	DCV
APP2	B26	1.5	1.5	1.6	1.8	DCV
APP3	B27	1	1	1.1	1.2	DCV
FPM	B30	OFF	ON	ON	ON	ON/OFF
MAF	B41	0	0.68	1.27	1.83	DCV
IAT	B43	1.75/120 (K)	2.02/109 (K)	3.16/64 (K)	3.22/63 (K)	DCV/DEG F
FTP	B44	2.6/-0	2.6/-0	2.57/-0.01	2.5/-0.03	DCV/PSI
BPA	B47	OFF	ON (E)	OFF	OFF	ON/OFF
A/CT	B53	3.1/73.4	3.05/75.2 (A)	4/39	3.92/42	DCV/DEG F
ACP_PRESS	B63	2.36/235	2.39/239	2.24/223	2.12/210	DCV/PSI
PSP	B65	LOW	HIGH (I)	LOW	LOW	HIGH/LOW
O2S12	E3	(L)	(D)	(D)	(D)	DCV
O2S22	E4	0.1	(D)	(D)	(D)	DCV
ECT	E18	0.45/210	0.44/210	0.53/199	0.57/196	DCV/DEG F
HTRCM12	E23	617	617	617	617	mA
HTRCM22	E24	605	605	605	605	mA
GENMON	E26	0	35.16	28.13	25	%
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN

O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
BOO	E46	OFF	ON (E)	OFF	OFF	ON/OFF
KNOCK 1	E49	654	650	1366	1621	N/A
TP2	E60	1.22/24.31	0.74/14.9	0.99/19.61	1.3/25.88	DCV/%
TP1	E61	4.05/18.82	4.29/13.73	4.17/16.47	4/19.61	DCV/%
MAP	E62	4.02/14.35 (W)	1.28/4.49 (W)	2.37/8.55 (W)	1.86/6.67 (W)	DCV/PSI
HTRCM11	E69	1.62	1.62	1.62	1.62	AMPS
HTRCM21	E70	1.58	1.58	1.58	1.58	AMPS
APP	PID	0	0	4	11	%
BARO	PID	14.48/157.4	14.48/157.4	14.48/157.4	14.48/157.4	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	8	2.62	6.45	8.93	DEG
ETC_DSD	PID	7.79	2.62	6.45	9.08	DEG
FLI	PID	73.5 (H)	73 (H)	90 (H)	83 (H)	%
LOAD	PID	65 (L)	17	19	25	%
MISFIRE	PID	NO	NO	NO	NO	ON/OFF
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	766	1600	1700	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
EVMV	B4	0/OFF	0/OFF	480/ VARYING	962/ VARYING	mA/OFF-VARYING
FANVAR	B8	0	38	32	71	%
FP	B62	OFF	ON	ON	ON	ON/OFF
WAC/ACCR	B64	OFF	ON	OFF	OFF	ON/OFF
PCVHC	E2	0	0	0	0	%
SPKDUR_6	E10	0	2.18	2.12	1.15	ms
SPKDUR_5	E11	0	2.06	1.87	1.09	ms
SPKDUR_4	E12	0	2.37	2.15	1.43	ms
GENCMD	E13	3.79	0 (Q)	0 (Q)	0 (Q)	%
SPKDUR_3	E15	0	1.71	2.12	0.875	ms
SPKDUR_2	E16	0	2.28	1.71	1	ms
SPKDUR_1	E17	0	2.4	2	1.46	ms

HTR12	E23	OFF	ON	ON	ON	ON/OFF
HTR22	E24	OFF	ON	ON	ON	ON/OFF
VCTDC	E67	0	0	41.7	39.5	%
VCTDC2	E68	0	0	43.3	33.7	%
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	READY	READY	READY	READY	READY/NOT READY
EVAPCV	PID	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	14	36	40	DEG
VCTADV	PID	0	-0.37	10.8	32	DEG
VCTADV2	PID	0	-1	8	33.7	DEG
VCTADVERR	PID	0	-0.68	0.81	1.12	DEG
VCTADVERR2	PID	0	1	1.56	-0.43	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B51/52	VBAT	VBAT	VBAT	VBAT	DCV

3.5L 4V EDGE/MKX

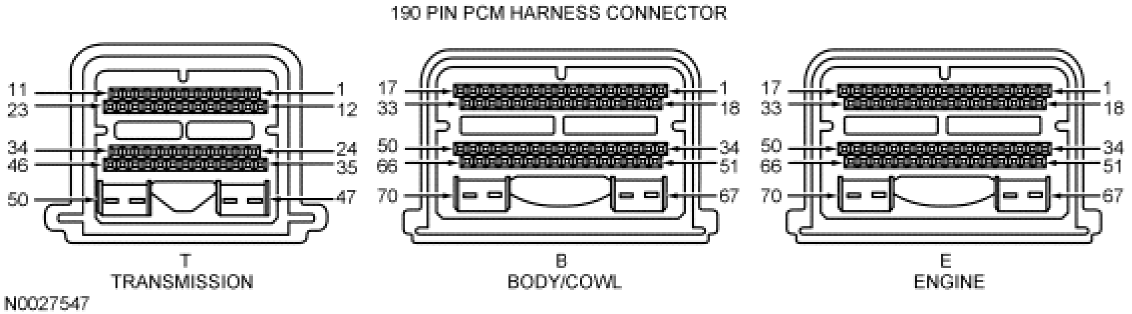


Fig. 4: 190 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
PSP	B17	0.1/LOW	VBAT/HIGH (I)	0.1/LOW	0.1/LOW	DCV/ HIGH-LOW
GENMON	B23	0	41.41	30.47	27.34	%
APP1	B25	3.9	3.9	3.5	3.3	DCV
APP2	B26	1.6	1.7	1.8	2.1	DCV
APP3	B27	1.0	1.0	1.3	1.5	DCV
FPM	B30	OFF	ON	ON	ON	ON/OFF
ACP	B37	0.8/70	0.86/73	0.9/75	1.0/87	DCV/PSI
MAF	B41	0	0.7	1.4	1.5	DCV
MAF SIGRTN	B42	0	0.6-1.9	1-1.6	1.3-2.3	DCV
IAT	B43	80 (K)	50 (K)	37 (K)	34 (K)	DEG F
FTP	B44	2.6/-0.01	2.6/-0.01	2.6/-0.01	2.6/-0.01	DCV/PSI
BOO	B46	VBAT/OFF	0.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
BPA	B47	0.1/OFF	VBAT/ON (E)	0.1/OFF	0.1/OFF	DCV/ON-OFF
FEPS	B55	0.5-0.6	0.5-0.6	0.5-0.6	0.5-0.6	DCV
HO2S12	E23	(L)	(D)	(D)	(D)	DCV
HO2S22	E24	0.1	(D)	(D)	(D)	DCV
HO2S21	E28	0	switching (C)	switching (C)	switching (C)	DCV
HO2S11	E29	(L)	switching (C)	switching (C)	switching (C)	DCV
CHT	E41	3.6/199	3.6/199	3.58/201	3.45/208	DCV/DEG F
CMP2	E44	0	5-7	13-16	20-23	Hz
CMP1	E45	0	5-7	13-16	20-23	Hz
CKP	E47	0	400-500	850-1050	1050-1150	Hz
KNOCK 1	E49	23.99k	25.01k	25.73k	44.51k	N/A
TP2	E60	1.1/25	0.8/15	1.0/19	1.4/27	DCV/%
TP1	E61	4.1/17	4.4/13	4.2/16	4.0/19	DCV/%

ACCS	PID	VBAT/OFF	VBAT/ON (A)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
APP	PID	3.9	0	0	22	%
APP_FLT	PID	NO FAULT	NO FAULT	NO FAULT	NO FAULT	FAULT/NO FAULT
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
ETC_ACT	PID	7.56	1.27	6.22	12.74	DEG
ETC_DSD	PID	7.62	1.31	6.19	12.73	DEG
ETC_TRIM	PID	0.23	0.21	0.24	0.24	DEG
FANVAR_F	PID	NO FAULT	NO FAULT	NO FAULT	NO FAULT	FAULT/NO FAULT
FLI	PID	71 (H)	72 (H)	82 (H)	81 (H)	%
LOAD	PID	51.4 (L)	16.1	35.4	34.7	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
RPM	PID	0	600	1200	1500	RPM
VSS	PID	0	0	30	55	MPH
WAC_F	PID	NO FAULT	NO FAULT	NO FAULT	NO FAULT	FAULT/NO FAULT

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
GENCMD	B22	3.79	0 (Q)	0 (Q)	0 (Q)	%
SMC	B34	0	0	0	0	DCV
CTO	B49	0	0	0	0	Hz
EVMV	B50	0	337	0	847	mA
EVAPCV	B61	0	0	0	0	%
FP	B62	8.3/75	3.6/27	3.6/27	3.8/29	DCV/%
WAC/ACCR	B64	OFF	OFF	OFF	OFF	ON/OFF
HTR12	E1	VBAT/OFF	0.2/ON	0.2/ON	0.2/ON	DCV/ON-OFF
HTR22	E2	VBAT/OFF	0.2/ON	0.2/ON	0.2/ON	DCV/ON-OFF
CD6F (CYL 6)	E10	VBAT	VBAT	VBAT	VBAT	DCV
CD5D (CYL 5)	E11	VBAT	VBAT	VBAT	VBAT	DCV
CD4B (CYL 4)	E12	VBAT	VBAT	VBAT	VBAT	DCV
CD3E (CYL 3)	E15	VBAT	VBAT	VBAT	VBAT	DCV
CD2C (CYL 2)	E16	VBAT	VBAT	VBAT	VBAT	DCV
CD1A (CYL 1)	E17	VBAT	VBAT	VBAT	VBAT	DCV
PCVHC	E33	0	0	0	0	%
TACM (+)	E34	3.7	VBAT	VBAT	VBAT	DCV
TACM (-)	E51	3.7	VBAT	VBAT	VBAT	DCV
VCTADV	E67	0	-.031	-27.56	-30.94	DEG

VCTADV2	E68	0	0	-27.69	-31.06	DEG
HTR11	E69	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
HTR21	E70	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
FANVAR	PID	0	0	0	0	%
FANDC	PID	7.5	7.5	7.5	7.5	%
FP	PID	ON/OFF	ON	ON	ON	ON/OFF
LONGFT1	PID	(L)	(-)20-(+) 20	(-)20-(+) 20	(-)20-(+) 20	%
LONGFT2	PID	(L)	(-)20-(+) 20	(-)20-(+) 20	(-)20-(+) 20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+) 10	(-)10-(+) 10	(-)10-(+) 10	%
SHRTFT2	PID	(L)	(-)10-(+) 10	(-)10-(+) 10	(-)10-(+) 10	%
SPARKADV	PID	10	13.25	44	45.25	DEG
VCTDC	PID	0	0	47.32	80	%
VCTDC2	PID	0	0	46.8	80	%
VCTADVERR	PID	0	0.18	-0.37	-0.18	DEG
VCTADVERR2	PID	0	0.06	-0.43	0	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
ETCVREF	B21/28	5	5	5	5	DCV
VREF	B33/E57	5	5	5	5	DCV
VPWR	B51/52	VBAT	VBAT	VBAT	VBAT	DCV
KAPWR	B54	VBAT	VBAT	VBAT	VBAT	DCV

3.5L 4V MKZ

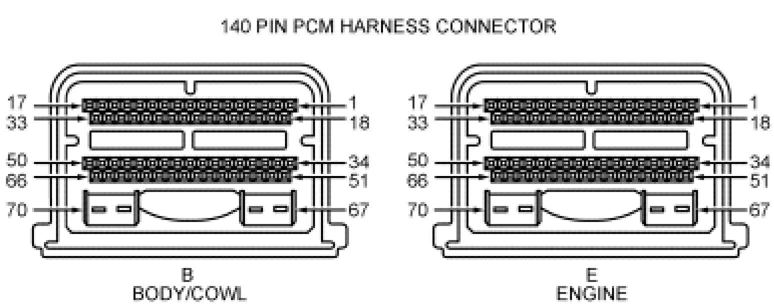


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Fig. 5: Identifying 140 Pin PCM Harness Connectors/Terminals
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
APP1	B25	4.1	4.2	3.9	3.7	DCV
APP2	B26	1.6	1.7	1.9	2.1	DCV
APP3	B27	1.0	1.1	1.3	1.5	DCV
FPM	B30	OFF	ON	ON	ON	ON/OFF
MAF	B41	0	0.62	1.06	1.44	DCV
IAT	B43	1.89/114.8 (K)	2.13/104 (K)	3.32/59 (K)	3.37/57.2 (K)	DCV/DEG F
FTP	B44	2.55/-0.01	2.53/-0.02	2.49/-0.03	2.28/-0.08	DCV/PSI
BOO	B46	OFF	ON (E)	OFF	OFF	ON/OFF
BPA	B47	OFF	ON (E)	OFF	OFF	ON/OFF
ACP_PRESS	B63	1.46/47.99	1.48/51.98	1.42/41.99	1.42/41.99	DCV/PSI
PSP	E65	LOW	HIGH (I)	LOW	LOW	HIGH/LOW
O2S12	E3	(L)	(D)	(D)	(D)	DCV
O2S22	E4	(L)	(D)	(D)	(D)	DCV
HTRCM12	E23	582	582	582	582	mA
HTRCM22	E24	613	613	613	613	mA
GENMON	E26	0	50.78	31.25	31.25	%
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
CHT	E41	0.61/192.2	0.64/190.4	0.71/181.4	0.69/183.2	DCV/DEG F
KNOCK 1	E49	26590	27310	32090	40910	N/A
TP2	E60	1.25/25.1	0.85/16.8	0.82/16	1.26/25.1	DCV/%
TP1	E61	4.1/16.9	4.4/12.2	4.3/12.9	4.2/14.9	DCV/%
HTRCM11	E69	1.43	1.43	1.43	1.43	AMPS
HTRCM11	E70	1.49	1.49	1.49	1.49	AMPS
ACCS	PID	OFF	ON (A)	OFF	OFF	ON/OFF
BARO	PID	14.24/155.8	14.24/155.8	14.24/155.8	14.24/155.8	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
APP	PID	0	0	19.5	24.5	%
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.25	1.87	5.68	7.81	DEG
ETC_DSD	PID	7.62	1.94	5.66	7.81	DEG
FLI	PID	13.58 (H)	13.59 (H)	23.15 (H)	28 (H)	%
LOAD	PID	49 (L)	17	21	29	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO

O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	640	1146	1675	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
EVMV	B4	0/OFF	155/ VARYING	553/ VARYING	905/ VARYING	mA/OFF-VARYING
EVAPCV	B61	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
FP	B62	OFF	ON	ON	ON	ON/OFF
WAC/ACCR	B64	OFF	OFF	OFF	OFF	ON/OFF
PCVHC	E2	0	0	0	0	%
SPKDUR_6	E10	0	2.31	1.53	1.56	ms
SPKDUR_5	E11	0	2.12	1.62	1.34	ms
SPKDUR_4	E12	0	2.31	1.87	1.59	ms
GENCMD	E13	3.79	0 (Q)	0 (Q)	0 (Q)	%
SPKDUR_3	E15	0	2.12	1.75	1.5	ms
SPKDUR_2	E16	0	2.5	1.75	1.5	ms
SPKDUR_1	E17	0	2.31	1.78	1.9	ms
HTR12	E23	OFF	ON	ON	ON	ON/OFF
HTR22	E24	OFF	ON	ON	ON	ON/OFF
VCTADV	E67	0	0.5	0.5	-40.44	DEG
VCTADV2	E68	0	0.06	0.12	-40	DEG
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	YES	YES	YES	YES/NO
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
FANDC	PID	7.5	7.5	7.5	7.5	%
FANVAR	PID	0	29	29	0	%
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF

SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	31.25	25.5	47.5	42.5	DEG
STRT_RLY	PID	ENABLED	DISABLED	DISABLED	DISABLED	ENABLED/ DISABLED
VCTADVERR	PID	0	-0.31	-1.56	0.43	DEG
VCTADVERR2	PID	0	-0.31	-2.06	0.12	DEG
VCTDC	PID	0	0	0	80	%
VCTDC2	PID	0	0	0	80	%

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B51/52	VBAT	VBAT	VBAT	VBAT	DCV

3.5L 4V TAURUS/TAURUS X/SABLE

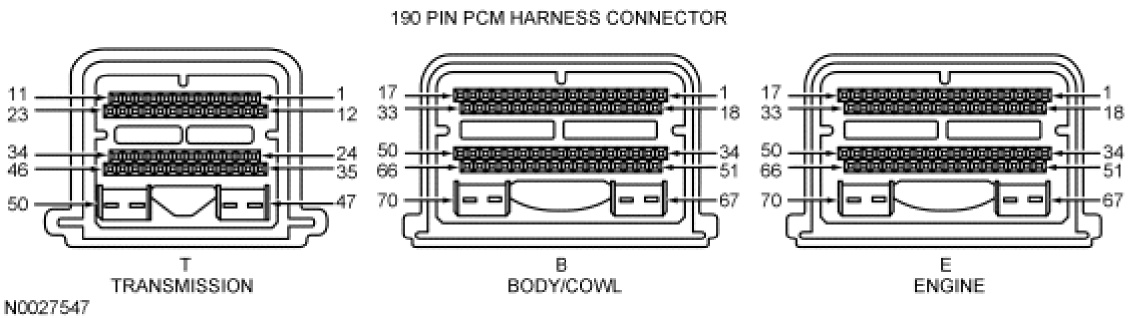


Fig. 6: 190 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
PSP	B17	LOW	HIGH (I)	LOW	LOW	HIGH/LOW
GENMON	B23	0	46.09	22.66	25.78	%
APP1	B25	3.9	3.9	3.5	3.3	DCV
APP2	B26	1.6	1.7	1.8	2.1	DCV
APP3	B27	1.0	1.0	1.3	1.5	DCV
FPM	B30	OFF	ON	ON	ON	ON/OFF
ACP_PRESS	B37	1.34/103.98	1.34/103.98	0.89/47.99	0.93/51.98	DCV/PSI
MAF	B41	0	0.7	1.4	1.5	DCV
IAT	B43	2.1/105.8 (K)	2.1/105.8 (K)	3.9/32 (K)	3.9/32 (K)	DCV/DEG F

FTP	B44	2.6/-0.01	2.6/-0.01	2.6/-0.01	2.6/-0.01	DCV/PSI
BPA	B47	OFF	ON	OFF	OFF	ON/OFF
O2S11_CUR (PZEV)	E18	0	66	16	137	uA
O2S21_CUR (PZEV)	E20	0	4	39	213	uA
O2S12	E23	0.87	0.33	0.78	0.6	DCV
O2S22	E24	0.16	0.21	0.8	0.6	DCV
CHT	E41	0.74/179.6	0.71/181.4	3.86/183.2	3.81/188.6	DCV/DEG F
TP2	E60	1.1/25	0.8/15	1.0/19	1.4/27	DCV/%
TP1	E61	4.1/17	4.4/13	4.2/16	4.0/19	DCV/%
TSS	T15	0	601.3	1130	1519	RPM
ACCS	PID	OFF	ON	OFF	OFF	ON/OFF
APP	PID	0	0	16.5	17	%
B+	PID	12.06	14.06	14.5	14.25	DCV
BARO	PID	149.6/13.26	149.6/13.26	149.6/13.26	149.6/13.26	Hz/PSI
BOO	PID	OFF	ON (E)	OFF	OFF	ON/OFF
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	NO	NO	NO	NO	YES/NO
EONV_RDY	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EQ_RAT11	PID	0	(-)2-(+)2	(-)2-(+)2	(-)2-(+)2	RATIO
EQ_RAT21	PID	0	(-)2-(+)2	(-)2-(+)2	(-)2-(+)2	RATIO
ETC_ACT	PID	7.37	2.95	4.68	23	DEG
ETC_DSD	PID	7.62	2.98	4.74	23.19	DEG
ETC_TRIM	PID	-0.63	-0.61	-0.54	-0.54	DEG
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	5	6	GEAR
INJPWR_M	PID	0.34	13.97	14.19	14.14	DCV
LOAD	PID	51.4 (L)	16.1	35.4	34.7	%
MIL_DIS	PID	0	0	0	0	Miles
MISFIRE	PID	NO	NO	NO	NO	YES/NO
NM	PID	0	0	0	0	COUNT
O2S11_ IMPED (PZEV)	PID	4.94	1.0	0.93	0.97	DCV
O2S21_ IMPED (PZEV)	PID	4.94	1.03	0.98	0.95	DCV
OSS	PID	0	0	1131	1990	RPM
OSS_SRC	PID	0	0	1121	2027	RPM
RPM	PID	0	600	1200	1500	RPM

STRT_RLY	PID	ENABLED	DISABLED	DISABLED	DISABLED	ENABLED/ DISABLED
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
TFT	PID	176	176	192.2	192.2	DEG F
TFTV	PID	0.8	0.81	0.63	0.62	DCV
TORQUE	PID	207	4	18.7	45.42	Nm
TR	PID	P	P	OD	OD	MODE
TR2	PID	OPEN	OPEN	CLOSED	CLOSED	OPEN/ CLOSED
TSS/ISS	PID	0	600.8	1130	1516	RPM
TSS_SRC	PID	0	600.3	1131	1516	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
GENCMD	B22	3.79	0 (Q)	0 (Q)	0 (Q)	%
EVMV	B50	0/OFF	0/OFF	543/ VARYING	289/ VARYING	mA/OFF-VARYING
FP	B62	OFF	ON	ON	ON	ON/OFF
HTR12	E1	OFF	ON	ON	ON	ON/OFF
HTRCM12	E1	609	609	566	566	mA
HTR22	E2	OFF	ON	ON	ON	ON/OFF
HTRCM22	E2	715	715	586	586	mA
PCVHC	E33	0	0	0	0	%
VCTADV	E67	0	-.031	-27.56	-30.94	DEG
VCTADV2	E68	0	0	-27.69	-31.06	DEG
O2S11_HTR (PZEV)	E69	0	36.4	32.12	33.35	%
HTR11 (Non-PZEV)	E69	ON (O)	OFF	ON	ON	ON/OFF
HTRCM11	E69	1.37	1.37	1.39	1.39	Amps
O2S21_HTR (PZEV)	E70	0	39.5	28.29	25.48	%
HTR21 (Non PZEV)	E70	ON (O)	ON	ON	ON	ON/OFF
HTRCM21	E70	1.35	1.35	1.35	1.35	Amps
CAT_EVAL	PID	YES	YES	YES	YES	YES/NO
CLRDIST	PID	40.37	40.37	11.8	10.56	MILES
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT	NOT	NOT	NOT	READY/NOT

		READY	READY	READY	READY	READY
EVAPCV	PID	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVAPSOAK	PID	YES	YES	YES	YES	YES/NO
EVAPSTA	PID	6-MONITOR COMPLETE	6-MONITOR COMPLETE	6-MONITOR COMPLETE	1-VAC STABLE	STATUS
EVAP_EVAL	PID	YES	YES	YES	NO	YES/NO
FANDC	PID	7.5	7.5	7.5	7.5	%
FANVAR	PID	0	0	0	0	%
FTP_H20	PID	-0.03	-0.03	-2.13	-3.38	in H2O
FUELSYST	PID	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
IGN_R/S	PID	ON	ON	ON	ON	ON/OFF
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
O2S_EVAL	PID	YES	YES	YES	YES	YES/NO
O2SHTR_ EVAL	PID	YES	YES	YES	YES	YES/NO
RPMDSD	PID	1120	731.8	1179	608	RPM
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	13.25	44	45.25	DEG
TRIP_CNT	PID	1	1	0	0	COUNT
VCTADVERR	PID	0	0.18	-0.37	-0.18	DEG
VCTADVERR2	PID	0	0.06	-0.43	0	DEG
VCTDC	PID	0	0	47.32	80	%
VCTDC2	PID	0	0	46.8	80	%
VCTSYS	PID	OL	CL	CL	CL	OPEN/ CLOSED LOOP

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B51/52/53	VBAT	VBAT	VBAT	VBAT	DCV
VREF	C64	5	5	5	5	DCV

4.0L MUSTANG

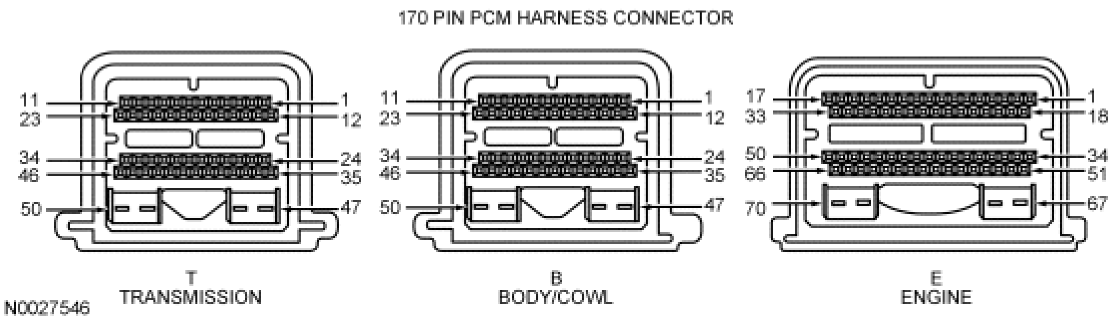


Fig. 7: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0	2.6/0	2.6/0	2.6/0	DCV/PSI
FTP_H2O	B3	0	-0.2	-0.61	-0.34	IN-H2O
APP1	B5	4.1	4.1	3.8	3.8	DCV
ACCS	B15	OFF	OFF	OFF	OFF	ON/OFF
APP2	B17	1.4	1.4	1.65	1.65	DCV
FPM	B21	0	0	0	0	%
ACP_PRESS	B26	0.8/63.98	0.8/63.98	0.8/63.98	0.8/63.98	DCV/PSI
APP3	B28	0.9	0.9	1.1	1.1	DCV
TCS (A/T)	B29	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
CPP-BT	B33	CLOSED	CLOSED	CLOSED	CLOSED	OPEN/ CLOSED
PSP	B34	LOW	LOW	LOW	LOW	HIGH/LOW
BOO	B46	OFF	OFF	OFF	OFF	ON/OFF
BPA	B47	OFF	OFF	OFF	OFF	ON/OFF
GENMON	E5	0	24.22	21.09	21.09	%
ECT	E18	0.56/199.4	0.56/199.4	0.56/199.4	0.56/199.4	DCV/DEG F
FRT	E19	2.7/86 (K)	2.7/86 (K)	3.49/57.2 (K)	3.49/57.2 (K)	DCV/DEG F
DPFEGR	E21	0.25-1.3	0.25-1.3	0.25-4.65	0.25-4.65	DCV
IAT	E22	3/73 (K)	3.1/68 (K)	3.9/32 (K)	4/25 (K)	DCV/DEG F
MAF	E25	0	0.86	1.8	1.9	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.35/53	3.06/45	2.8/39	2.8/39	DCV/PSI

KNOCK 1	E49	16380	177	339	313	N/A
TP2	E60	1.31/26.28	0.92/18.43	1.11/22.35	1.11/22.35	DCV/%
TP1	E61	4.1/17.65	4.29/13.73	4.2/15.69	4.2/15.69	DCV/%
MAP	E62	4.3/-0.29/14.64 (W)	1.05/21.55/3.91 (W)	1.61/17.71/5.8 (W)	2.18/14.16/7.54 (W)	DCV/in Hg/PSI
OSS_SRC	T3	0	0	1256	2275	RPM
ISS (A/T)	T4	0	365-380/ 630-720	595/1080	1070/1640 - 2060	Hz/RPM
TSS (A/T)	T15	0	634	913	1642	RPM
TR 1 (A/T)	T16	0	0	11.5	11.5	DCV
TR 2 (A/T)	T17	0	0	11.5	11.5	DCV
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TR 3 (A/T)	T27	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
TR 4 (A/T)	T28	0	0	11.5	11.5	DCV
TFT (A/T)	T29	2.2/107 (K)	2.1/109 (K)	0.9/172 (K)	0.9/169 (K)	DCV/DEG F
APP	PID	0	0	8.5	10	%
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
BARO	PID	158.1/14.61	158.1/14.61	158.1/14.61	158.1/14.61	Hz/PSI
CPP/PNP	PID	NEUTRAL	DRIVE	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.56	1	4.91	8.53	DEG
ETC_DSD	PID	7.62	0.96	4.88	8.52	DEG
ETC_TRIM	PID	0.18	0.18	0.19	0.18	DEG
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	5	5	GEAR
LOAD	PID	70 (L)	17	16.35	32.32	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	631	1232	1675	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	75/OFF	24/ON	21/ON	24/ON	%/ON-OFF
WAC/ACCR	B14	OFF	OFF	OFF	OFF	ON-OFF
GENCMD	B32	3.79	0 (Q)	0 (Q)	0 (Q)	%

HFC	E4	OFF	OFF	OFF	OFF	ON/OFF
EVMV	E6	0/OFF	0/OFF	331/ VARYING	353/ VARYING	mA/OFF-VARYING
LFC	E7	OFF	OFF	OFF	OFF	ON/OFF
EGRVR	E63	0	0	(T)	(T)	%
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTRCM11	E69	1.15	1.15	1.15	1.15	AMPS
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
HTRCM21	E70	1.11	1.11	1.11	1.11	AMPS
PC1 (A/T)	T11	7/8	9/8	9-9.8/12-22	9-10.7/18-22	DCV/PSI
PC2 (A/T)	T23	8.6	10.7	10.4	10.5	DCV
PC3 (A/T)	T34	5.8	8.1	VBAT	VBAT	DCV
SSA (SS1) (A/T)	T42	0.1/ON	0.1/ON	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
SSB (SS2) (A/T)	T43	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
SSC (SS3) (A/T)	T44	VBAT/OFF	VBAT/OFF	0.35/ON	0.1/ON	DCV/ON-OFF
SSD (SS4) (A/T)	T45	0.1/ON	0.1/ON	0.35/ON	0.1/ON	DCV/ON-OFF
TCC (A/T)	T46	0.2/100	VBAT/0	11.1-VBAT/ 0-45	0.2/95-100	DCV/%
HTR12	T47	ON (O)	ON	ON	ON	ON/OFF
HTRCM12	T47	641	641	641	641	mA
HTR22	T48	ON (O)	ON	ON	ON	ON/OFF
HTRCM22	T48	652	652	652	652	mA
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	READY	READY	READY	READY	READY/NOT READY
EVAPCV	PID	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAPSTA	PID	NOT RUNNING	NOT RUNNING	NOT RUNNING	NOT RUNNING	STATUS
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%

SPARKADV	PID	0-10	17-23	30-40	31-40	DEG
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57	5	5	5	5	DCV

4.6L 3V MUSTANG

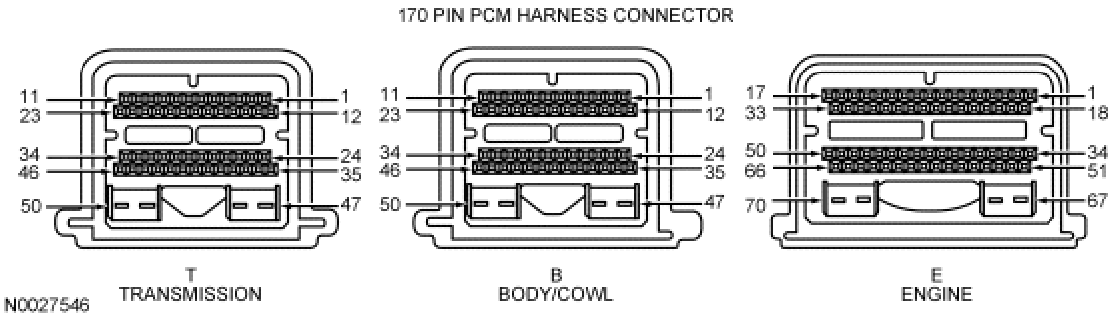


Fig. 8: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.1/-0.13 (M)	2.6/-0.24 (M)	DCV/PSI
FTP_H2O	B3	0.06	0.06	-0.41	-0.37	IN H2O
APP1	B5	4.0	4.0	3.7	3.7	DCV
ACCS	B15	OFF	ON (A)	OFF	OFF	ON/OFF
APP2	B17	1.5	1.5	1.7	1.7	DCV
FPM	B21	100	100	100	100	%
ACP	B26	OPEN	OPEN	OPEN	OPEN	OPEN/ CLOSED
APP3	B28	1.0	1.1	1.3	1.5	DCV
TCS (A/T)	B29	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
GENMON	E5	0	38	36.7	35.9	%
FRT	E19	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	DCV/DEG F
		1.7-3.5/120-50	1.7-3.5/120-50	1.7-4.1/120-32	1.7-4.1/120-32	

IAT	E22	(K)	(K)	(K)	(K)	DCV/DEG F
MAF (A/T)	E25	0	0.88-0.94	0.8-1.5	1.3-1.9	DCV
MAF (M/T)	E25	0	1	1.5	1.3	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
KNOCK 2	E31	0	288	218	292	N/A
FRP	E32	3.35/56	3/39	2.8/40	2.8/39	DCV/PSI
CHT	E41	3.6/199	3.6/199	3.58/201	3.45/208	DCV/DEG F
KNOCK 1	E49	0	235	266	357	N/A
TP2	E60	1.18/23.53	0.66/12.94	0.96/19.22	1.05/20.78	DCV/%
TP1	E61	4.09/18.04	4.35/12.55	4.2/15.69	4.16/16.47	DCV/%
HTRCM11	E69	1.01	1.01	1.03	1.03	AMPS
HTRCM21	E70	1.01	1.01	1.01	1.01	AMPS
OSS (A/T)	T3	0	0	1385	2400	RPM
OSS (M/T)	T3	0	0	1420	2500	RPM
TSS (A/T)	T15	0	680	595	2060	RPM
TR 2 (A/T)	T17	CLOSED	CLOSED	OPEN	OPEN	OPEN/ CLOSED
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TFT (A/T)	T29	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	DCV/DEG F
CPP-BOT (M/T)	T33	NO	YES (J)	NO	NO	YES/NO
HTRCM12	T47	664	664	664	664	mA
HTRCM22	T48	660	660	660	660	mA
APP	PID	0	0	11	18.5	%
BARO	PID	155.8/14.24	155.8/14.24	155.8/14.24	155.8/14.24	Hz/PSI
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
CPP/PNP	PID	NEUTRAL	DRIVE	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ECT_ACT	PID	7.43	1.06	7.45	9.66	DEG
ECT_DSD	PID	7.62	1.04	7.52	9.66	DEG
ECT_TRIM	PID	0.18	0.18	0.25	0.25	DEG
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR (A/T)	PID	1	1	5	5	GEAR
LOAD	PID	59 (L)	16	22	18	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN

O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	660	1200	1450	RPM
TR (A/T)	PID	P	P	OD	OD	MODE
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FP	B12	75/OFF	28/ON	28/ON	28/ON	%/ON-OFF
EVAPCV	B13	0/OFF	0/OFF	0 (R)/OFF	0 (R)/OFF	%/ON-OFF
WAC/ACCR	B14	ON	OFF (A)	ON	ON	ON/OFF
GENCMD	B32	3.79	0 (Q)	0 (Q)	0 (Q)	%
HFC	E4	OFF	ON (B)	OFF	OFF	ON/OFF
EVMV	E6	0/OFF	0/OFF	350/ VARYING	235/ VARYING	mA/OFF-VARYING
LFC	E7	OFF	ON (B)	OFF	OFF	ON/OFF
IMRC	E50	OFF	OFF	OFF	OFF	ON/OFF
VCTDC	E67	0	0	41.7	39.5	%
VCTDC2	E68	0	0	43.3	33.7	%
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
TCC (A/T)	T46	0/OFF	0/OFF	0/OFF	100/ ENGAGED	%/OFF-ENGAGED
HTR12	T47	ON (O)	ON	ON	ON	ON/OFF
HTR22	T48	ON (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	YES	YES	YES/NO
EVAPSTA	PID	NOT RUNNING	NOT RUNNING	NOT RUNNING	NOT RUNNING	STATUS
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
LONGFT1	PID	(L)	(L)	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	-10-0	15-20	29-38	34-41	DEG
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF

VCTADV	PID	0	-0.37	10.8	32	DEG
VCTADV2	PID	0	-1	8	33.7	DEG
VCTADVERR	PID	0	-0.68	0.81	1.12	DEG
VCTADVERR2	PID	0	1	1.56	-0.43	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57	5	5	5	5	DCV

5.4L 4V MUSTANG

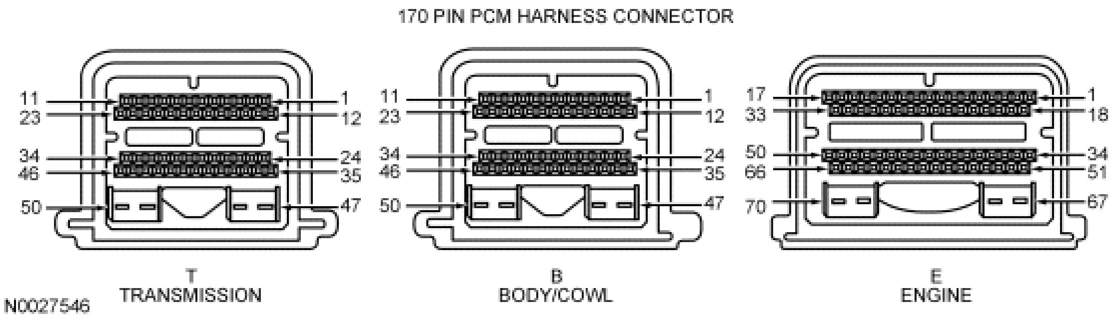


Fig. 9: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.1/-0.13 (M)	2.6/-0.24 (M)	DCV/PSI
APP1	B5	4.0	4.0	3.8	3.6	DCV
APP2	B17	1.5	1.5	1.7	1.7	DCV
APP3	B28	1.0	1.1	1.3	1.5	DCV
CPP-BOT	B33	NO	NO	NO	NO	YES/NO
GENMON	E5	0	34	24	27	%
ACCS	E15	OFF	ON (A)	OFF	OFF	ON/OFF
FRT	E19	1.7/122 (K)	1.8/120 (K)	2.9/79 (K)	2.7/84 (K)	DCV/DEG F
IAT	E22	1.7/158 (K)	1.9/135 (K)	3.8/34 (K)	3.9/30 (K)	DCV/DEG F
MAF	E25	0	0.6	1.1	1.3	DCV
IAT2	E27	1.2/158 (K)	1.3/135 (K)	2.5/93 (K)	2.7/84 (K)	DCV/DEG F
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN

O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	2.6/36	3/44	3/44	3/44	DCV/PSI
CHT	E41	3.6/199	3.6/199	3.58/201	3.45/208	DCV/DEG F
TP2	E60	1.23/24.31	0.74/14.51	0.87/17.26	0.96/19.22	DCV/%
TP1	E61	4.1/17.65	4.35/12.94	4.28/14.12	4.23/14.9	DCV/%
HTRCM11	E69	1.02	1.02	1.02	1.02	AMPS
HTRCM21	E70	1.02	1.02	1.02	1.02	AMPS
OSS_SRC	T3	0	0	1251	2268	RPM
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
HTRCM12	T47	676	676	676	676	mA
HTRCM22	T48	660	660	660	660	mA
APP	PID	0	0	9.5	9.5	%
BARO	PID	14.73/158.9	14.73/158.9	14.73/158.9	14.73/158.9	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.62	1.7	6.5	5.43	DEG
ETC_DSD	PID	7.62	1.57	6.44	5.4	DEG
ETC_TRIM	PID	0.12	0.12	0.12	0.12	DEG
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
LOAD	PID	73 (L)	16	23.7	27.3	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	660-780	1200-1300	1450-1740	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	75/OFF	21.59/ON	21.26/ON	20.94/ON	%/ON-OFF
EVAPCV	B13	OFF	OFF	OFF	OFF	ON/OFF
WAC/ACCR	B14	ON	OFF (A)	ON	ON	ON/OFF
FPM	B21	100.2	100.2	99.71	103.4	%
GENCMD	B32	3.79	0 (Q)	0 (Q)	0 (Q)	%
HFC	E4	OFF	ON (B)	OFF	OFF	ON/OFF
EVMV	E6	0/OFF	327/ VARYING	427/ VARYING	200/ VARYING	mA/OFF- VARYING
LFC	E7	OFF	ON (B)	OFF	OFF	ON/OFF
SPKDUR_8	E9	0	1.78	1.46	1.59	ms

SPKDUR_5	E10	0	1.56	1.37	1.81	ms
SPKDUR_2	E11	0	1.75	1.43	1.46	ms
SPKDUR_3	E12	0	1.84	1.62	1.53	ms
SPKDUR_4	E14	0	1.78	1.59	1.62	ms
SPKDUR_6	E15	0	1.56	1.65	1.56	ms
SPKDUR_7	E16	0	1.96	1.62	1.43	ms
SPKDUR_1	E17	0	1.9	1.75	1.43	ms
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
HTR12	T47	ON (O)	ON	ON	ON	ON/OFF
HTR22	T48	ON (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(L)	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	14.7	34.7	31	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57	5	5	5	5	DCV

4.6L 2V CROWN VICTORIA/GRAND MARQUIS

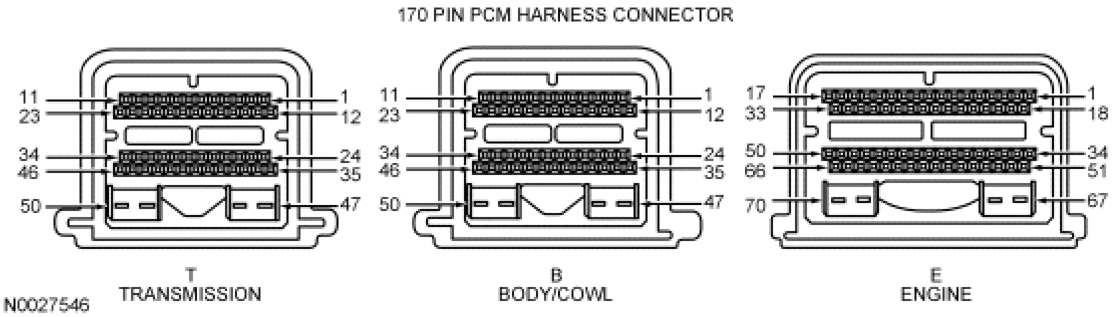


Fig. 10: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.6/0 (M)	1.4/-0.3 (M)	DCV/PSI
APP1	B5	4.0	4.0	3.8	3.6	DCV
BPP/BOO	B8	OFF	OFF	OFF	OFF	ON/OFF
ACCS	B15	OFF	OFF	OFF	OFF	ON/OFF
APP2	B17	1.5	1.5	1.7	1.7	DCV
ACP	B26	1.64/157	1.64/157	1.27/117	1.27/117	DCV/PSI
APP3	B28	1.0	1.1	1.3	1.5	DCV
TCS	B29	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
GENMON	E5	0	46	34	27	%
FRT	E19	3.4/62 (K)	3.4/64 (K)	3.2/68 (K)	3.3/66 (K)	DCV/DEG F
DPFEGR	E21	0.25-1.3	0.25-1.3	0.25-4.65	0.25-4.65	DCV
IAT	E22	1.9/115 (K)	2.6/86 (K)	3.2/63 (K)	3.2/61 (K)	DCV/DEG F
MAF	E25	0	0.9	1.97	1.94	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.35/50	3/43	2.8/39	2.8/39	DCV/PSI
CHT	E41	3.64/190.4	3.7/188.6	3.76/186.8	3.76/186.8	DCV/DEG F
KNOCK 1	E48	0	235	266	357	N/A
TP2	E60	1.2	0.7	0.90	1.2	DCV
TP1	E61	4.1	4.4	4.1	4.1	DCV
MAP	E62	4.39/0/14.79	1.25/69/4.49	2.27/46/7.83	2.06/51/7.1	DCV/kPa/PSI
OSS_SRC	T3	0	0	1385-1420	2400-2500	RPM
TSS	T15	0	624	737	1339	RPM

TR2	T17	CLOSED	CLOSED	OPEN	OPEN	OPEN/ CLOSED
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TFT	T29	1.4/142 (K)	1.4/140 (K)	0.8/176 (K)	0.8/179 (K)	DCV/DEG F
APP	PID	0	0	6	10.5	%
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
BARO	PID	159.3/14.79	159.3/14.79	159.3/14.79	159.3/14.79	Hz/PSI
BPA	PID	OFF	OFF	OFF	OFF	ON/OFF
CPP/PNP	PID	NEUTRAL	DRIVE	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.87	1.62	6.22	12.74	DEG
ETC_DSD	PID	7.85	1.65	6.19	12.73	DEG
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	58 (L)	15	19	14	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	638	1065	1330	RPM
TR	T16	P	P	OD	OD	MODE
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
PATSENABL	B2	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
FP	B12	75/OFF	17/ON	28/ON	28/ON	%/ON-OFF
WAC/ACCR	B14	ON	OFF (A)	ON	ON	ON/OFF
EGRVR	E63	0	0	(T)	(T)	%
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTRCM11	E69	1.1	1.1	1.1	1.1	Amps
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
HTRCM21	E70	1.04	1.04	1.04	1.04	Amps
TCC	T46	0/OFF	0/OFF	0/OFF	100/ ENGAGED	%/OFF- ENGAGED
HTR12	T47	ON (O)	ON	ON	ON	ON/OFF
HTRCM12	T47	629	629	629	629	mA
HTR22	T48	ON (O)	ON	ON	ON	ON/OFF
HTRCM22	T48	629	629	629	629	mA

EGR_EVAL	PID	YES	YES	NO	NO	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020F	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPCV	PID	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAPSTA	PID	NOT RUNNING	NOT RUNNING	NOT RUNNING	NOT RUNNING	STATUS
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
EVMV	PID	0/OFF	VARYING	VARYING	VARYING	mA/OFF-VARYING
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
GENCMD	PID	3.79	0 (Q)	0 (Q)	0 (Q)	%
LONGFT1	PID	(L)	(L)	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	17.7	20	37	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57	5	5	5	5	DCV

4.6L 2V TOWN CAR

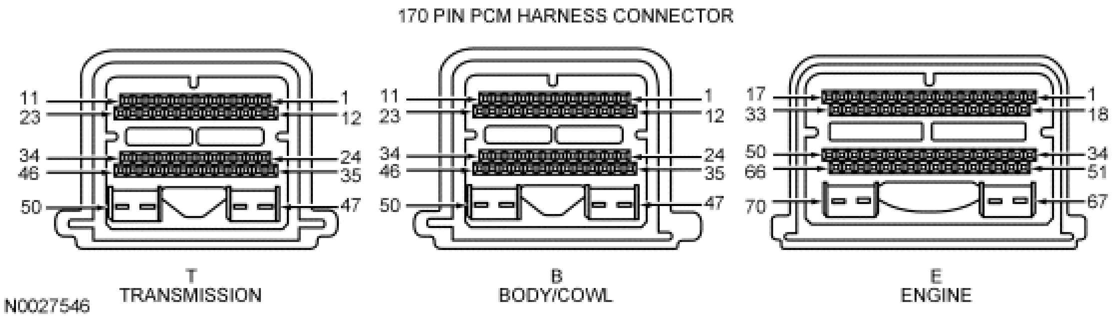


Fig. 11: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.6/0 (M)	1.4/-0.3 (M)	DCV/PSI
APP1	B5	4.0	4.0	3.8	3.6	DCV
SMR	B7	VBAT (V)	0	0	0	DCV
BPP	B8	VBAT/OFF	0.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
BPS	B9	0.1/OFF	VBAT/ON (E)	0.1/OFF	0.1/OFF	DCV/ON-OFF
ACCS	B15	0.1/OFF	VBAT/ON (A)	0.1/OFF	0.1/OFF	DCV/ON-OFF
APP2	B17	1.5	1.5	1.7	1.7	DCV
FPM	B21	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACP	B26	1.3/80	1.4/75	1.3/80	1.3/80	DCV/PSI
APP3	B28	1.0	1.1	1.3	1.5	DCV
TCS	B29	0.1/OFF	VBAT/ON (G)	0.1/OFF	0.1/OFF	DCV/ON-OFF
PSP	B34	0.1/LOW	VBAT/HIGH (I)	0.1/LOW	0.1/LOW	DCV/ HIGH-LOW
PATS IN	B42	VBAT	VBAT	VBAT	VBAT	DCV
FEPS	B44	0.1	0.1	0.1	0.1	DCV
GENMON	E5	0	39.8	30	24	%
FRT	E19	2.6/90 (K)	3.2/ 70 (K)	3.1/72 (K)	3.2/70 (K)	DCV/DEG F
DPFEGR	E21	0.25-1.3	0.25-1.3	0.25-4.65	0.25-4.65	DCV
IAT	E22	2.74/81 (K)	2.9/73 (K)	4/27 (K)	3.9/30 (K)	DCV/DEG F
MAF	E25	0	0.9	1	1.5	DCV
HO2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV
HO2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV
FRP	E32	3.35/50	3/43	2.8/39	2.8/39	DCV/PSI
CHT	E41	3.54/194	3.54/194	3.72/188.6	3.65/190.4	DCV/DEG F
CMP1	E45	0	5-7	10-12	12-16	Hz
CKP	E47	0	390-450	650-760	980-1020	Hz
KNOCK 1	E48	0	235	266	357	N/A
TP2	E60	1.2	0.7	0.90	1.2	DCV
TP1	E61	4.1	4.4	4.1	4.1	DCV
MAP	E62	4.3/14.5 (W)	1.2/4.5 (W)	1.2/4.4 (W)	1.7/5.8 (W)	DCV/PSI
OSS_SRC	T3	0	0	1201	2236	RPM
TSS	T15	0	623	825	1569	Hz/RPM
TR 1	T16	0	0	11.5	11.5	DCV
TR 2	T17	0	0	11.5	11.5	DCV
HO2S12	T24	(L)	(D)	(D)	(D)	DCV
HO2S22	T25	0.1	(D)	(D)	(D)	DCV
TR3A	T27	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE

TR 4	T28	0	0	11.5	11.5	DCV
TFT	T29	1.5/135 (K)	1.5/136 (K)	1.2/154 (K)	1.2/156 (K)	DCV/DEG F
CPP/PNP	PID	NEUTRAL	DRIVE	DRIVE	DRIVE	NEUTRAL/ DRIVE
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
FRT	PID	2.5/93 (K)	2.6/90 (K)	3.1/72 (K)	3.1/72 (K)	DCV/DEG F
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	14 (L)	14	17	19	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
RPM	PID	0	660-780	1200-1300	1450-1740	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
PATSTRT	B2	0	0	0	0	DCV
FP	B12	3.7/75	1.3/28	1.3/28	1.3/28	DCV/%
CANV	B13	VBAT/0	VBAT/0	VBAT/0 (R)	VBAT/0 (R)	DCV/%
PATS OUT	B31	10.5	VBAT (A)	VBAT	VBAT	DCV
WAC/ACCR	B14	0.1/ON	VBAT/OFF (A)	0.1/ON	0.1/ON	DCV/ON-OFF
GENCMD	B32	3.79	0 (Q)	0 (Q)	0 (Q)	%
PCVHC	E3	0.1/ON	0.1/ON	VBAT/OFF	0.1/ON	DCV/ON-OFF
EVAPPDC	E6	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VFC	E7	0-100	0-100	0-100	0-100	%
CDH (CYL 8)	E9	VBAT	VBAT	VBAT	1.3/28	DCV
CDF (CYL 5)	E10	VBAT	VBAT	VBAT	VBAT	DCV
CDD (CYL 2)	E11	VBAT	VBAT	VBAT	VBAT	DCV
CDB (CYL 3)	E12	VBAT	VBAT	VBAT	VBAT	DCV
CDG (CYL 4)	E14	VBAT	VBAT	VBAT	VBAT	DCV
CDE (CYL 6)	E15	VBAT	VBAT	VBAT	VBAT	DCV
CDC (CYL 7)	E16	VBAT	VBAT	VBAT	VBAT	DCV
CDA (CYL 1)	E17	VBAT	VBAT	VBAT	VBAT	DCV
TACM (+)	E34	3.7	VBAT	VBAT	VBAT	DCV
TACM (-)	E51	3.7	VBAT	VBAT	VBAT	DCV
EGRVR	E63	VBAT/0	VBAT/0	(T)	(T)	DCV/%
HTR11	E69	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
HTR21	E70	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
EPC	T11	7.9/20	9.5/20	9.3/22	9.5/22	DCV/PSI
SSA (SS1)	T42	0.1/ON	0.1/ON	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
SSB (SS2)	T43	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/ON-OFF

TCC	T46	0.1/100	VBAT/0	VBAT/0	0.2/95-100	DCV/%
HTR12	T47	0.2/ON (O)	0.2/ON	0.2/ON	0.2/ON	DCV/ON-OFF
HTR22	T48	0.2/ON (O)	0.2/ON	0.2/ON	0.2/ON	DCV/ON-OFF
LONGFT1	PID	(L)	(L)	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	17.5	32.7	37.7	DEG
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57	5	5	5	5	DCV
KAPWR	B45	VBAT	VBAT	VBAT	VBAT	DCV
ETCVREF	E66	5	5	5	5	DCV

2.3L 4V ESCAPE/MARINER

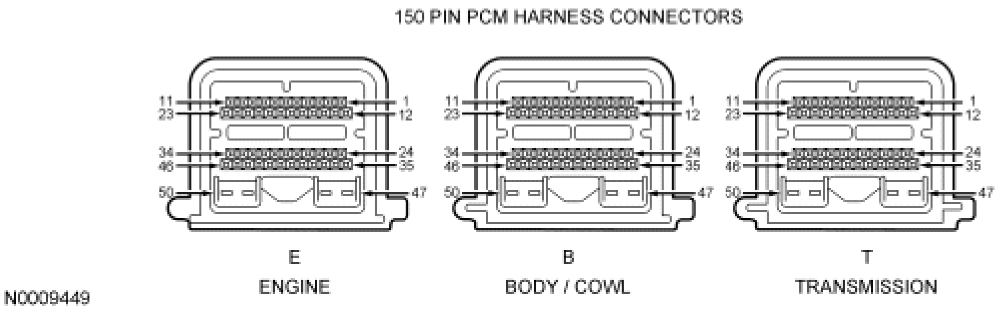


Fig. 12: Identifying 150 Pin PCM Harness Connectors/Terminals
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
BOO	B8	OFF	ON (E)	OFF	OFF	ON/OFF
FTP	B9	2.6/0	2.6/0	2.5/-0.03	2.15/-0.12	DCV/PSI
FTP_H2O	B9	-0.13	-0.13	-0.86	-3.27	in-Hg
ACCS	B15	OFF	ON (A)	OFF	OFF	ON/OFF
IAT	B20	111/1.96 (K)	104/2.16 (K)	3.15/66 (K)	3.18/64 (K)	DCV/DEG F

TCS (A/T)	B27	0.1/OFF	VBAT/ON (G)	0.1/OFF	0.1/OFF	DCV/ON-OFF
MAF (A/T)	B32	0	0.9	1.4	2.5	DCV
MAF (M/T)	B32	0	1-1.08	1-1.7	1.2-2.5	DCV
GENMON	E16	0	37.5	15.63	15.63	%
TP	E19	0.53-1.27	0.53-1.27	1-1.3	1.1-2	DCV
MAP	E23	4/14.3 (W)	1.2/4.2 (W)	1.1/4.1 (W)	3.3/11.9 (W)	DCV/PSI
FRT	E28	2.5/93 (K)	2.6/90 (K)	3.1/72 (K)	3.1/72 (K)	DCV/DEG F
O2S11	E30	(L)	switching (C)	switching (C)	switching (C)	DCV
CHT	E33	3.4/210	3.4/212	3.4/212	3.2/225	DCV/DEG F
FRP	E37	1.3/14	3.7/39	3.7/39	3.7/39	DCV/PSI
VSS (M/T)	T3	0	0	30	55	MPH
OSS (A/T)	T4	0	0	67-400	120/7300	RPM
TSS (A/T)	T15	0	686	1547	1995	RPM
O2S12	T24	(L)	(D)	(D)	(D)	DCV
TRS (A/T)	T27	4.4/PARK	4.4/PARK	2.1/OD	2.1/OD	DCV/MODE
CPP (M/T)	T27	0/ON	0/ON	12/OFF	12/OFF	DCV/ON-OFF
TFT (A/T)	T29	1.2/154 (K)	1.1/156 (K)	1.4/140 (K)	1.4/142 (K)	DCV/DEG F
ACP	PID	OPEN (OK)	OPEN (OK)	OPEN (OK)	OPEN (OK)	OPEN/ CLOSED
B+	PID	13	14.3	14.19	14.19	DCV
BARO	PID	157.7	157.7	157.7	155.8	Hz
CHT_COLD	PID	80.6	75.2	82.4	80.6	DEG F
CHT_HOT	PID	237.2	231.8	240.8	239	DEG F
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
EVMV	PID	0	0	36	741	mA
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR (A/T)	PID	1	1	3	4	GEAR
HTRCM11	PID	1.46	1.46	1.53	1.53	Amps
HTRCM12	PID	750	750	852	852	mA
LOAD (A/T)	PID	54 (L)	17.4	19.2	24.7	%
LOAD (M/T)	PID	(L)	10-20	19-30	30-48	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
RPM	PID	0	680	1877	2252	RPM
PSP	PID	LOW	HIGH (I)	LOW	LOW	HIGH/LOW
TPCT	PID	0.85	0.84	0.85	0.85	DCV
VSS	PID	0	0	30	55	MPH

	PCM	**Measured/PID Values**				

Actuators/Outputs	Pin/PID only	KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	Units Measured/PID
FP	B12	75	18	19.5	19.8	%
WAC/ACCR	B25	VBAT/OFF	1.5/ON	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
EVMV	B34	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
HFC	B38	VBAT/OFF	0.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
LFC	B39	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
GENCMD	E7	3.79	0 (Q)	0 (Q)	0 (Q)	%
IAC	E39	VBAT/6.89	10.1/37.37	8.2/60 (L)	7.6/64 (L)	DCV/%
HTR11	E49	OFF	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
EPC (A/T)	T11	7.5/0	8.4/0	9-10/25-37	10.3-11.2/42-51	DCV/PSI
SSC (SS3) (A/T)	T23	VBAT/OFF	VBAT/OFF	8.8/OFF	8.8/OFF	DCV/ON-OFF
SSA (SS1) (A/T)	T42	VBAT/OFF	VBAT/OFF	VBAT/OFF	0.1/ON	DCV/ON-OFF
SSB (SS2) (A/T)	T43	0.1/ON (O)	0.1/ON	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
TCC (A/T)	T46	VBAT/0	VBAT/0	VBAT/0	0.2/100	DCV/%
HTR12	T47	0.2/ON (O)	0.2/ON	0.2/ON	0.2/ON	DCV/ON-OFF
CAT_EVAL	PID	NO	NO	NO	NO	YES/NO
EVAPCV	PID	OFF/0	OFF/0	OFF/0 (R)	OFF/0 (R)	ON-OFF/%
EVAPSOAK	PID	YES	YES	YES	YES	YES/NO
FAN	PID	OFF	OFF	OFF	OFF	ON/OFF
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FRP_DSD	PID	39.15	39.15	39.15	39.15	PSI
FUELSYST	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
IMTV	PID	OFF	ON	ON	ON	ON/OFF
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MFC	PID	OFF	OFF	OFF	OFF	ON/OFF
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
RPMDSD	PID	848	672	672	672	RPM
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV (A/T)	PID	10	14-20	36-44	30-40	DEG
SPARKADV (M/T)	PID	0	15	46	45	DEG
STRT_RLY	PID	ENABLED	DISABLED	DISABLED	DISABLED	ENABLED/ DISABLED
TCIL (A/T)	PID	OFF	OFF	OFF	OFF	ON/OFF
TPCT	PID	0.85	0.84	0.85	0.85	DCV
TQ_CNTRL	PID	NONE	NONE	NONE	NONE	_

		Measured/PID Values				

Other	PCM Pin/PID only	KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	Units Measured/PID
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV

3.0L 4V ESCAPE/MARINER

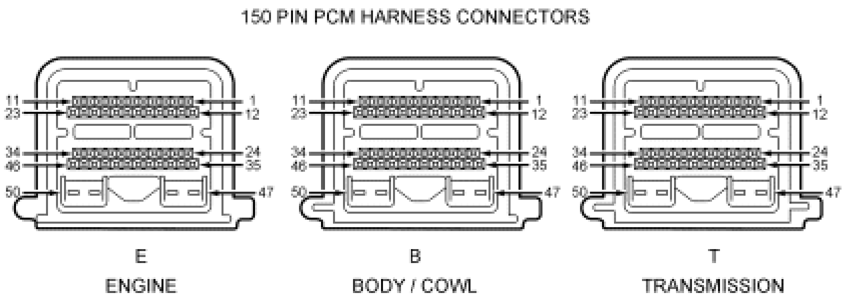


Fig. 13: Identifying 150 Pin PCM Harness Connectors/Terminals
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
PSP	B3	0.1/LOW	VBAT/HIGH (I)	0.1/LOW	0.1/LOW	DCV/ HIGH-LOW
BOO	B8	0.1/OFF	VBAT/ON (E)	0.1/OFF	0.1/OFF	DCV/ON-OFF
FTP	B9	2.6/57	2.6/48	2.6/65	2.6/36	DCV/kPa
ACCS	B15	0.1/OFF	VBAT/ON (A)	0.1/OFF	0.1/OFF	DCV/ON-OFF
IAT	B20	1.58/125.6 (K)	1.74/120.2 (K)	3.6/48.2 (K)	3.64/46.4 (K)	DCV/DEG F
ACP	B26	1.3/80	1.4/75	1.3/80	1.3/80	DCV/%
MAF	B32	0	0.80-1.03	0.7-1.5	1.3-2	DCV
GENMON	E16	0	31.25	18.75	25	%
ECT	E21	0.5-2.7/210-110	0.5-2.7/210-110	0.5-2.7/210-110	0.5-2.7/210-110	DCV/DEG F
MAP	E23	4 (W)	1-1.4 (W)	1.5-2.1 (W)	1.9-2.3 (W)	DCV
O2S21	E26	0	switching (C)	switching (C)	switching (C)	DCV
EGRVR	E27	VBAT/0	VBAT/0	(T)	(T)	DCV/%
FRT	E28	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	DCV/DEG F
O2S11	E30	(L)	switching (C)	switching (C)	switching (C)	DCV
FRP	E37	3.7/39	3.7/39	3.7/39	3.8/40	DCV/PSI
DPFEGR	E44	0.25-1.3	0.25-1.3	0.25-4.65	0.25-4.65	DCV
OSS	T4	0	0	67/1360	120/2466	Hz/RPM

TSS	T15	0	45-50/ 700-770	90-100/ 1350-1450	110-120/ 1700-1800	Hz/RPM
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TR	T27	PARK	PARK	OD	OD	MODE
TFT	T29	0.4-2/220-125 (K)	0.4-2/220-125 (K)	0.4-2.4/220-125 (K)	0.4-2/220-125 (K)	DCV/DEG F
B+	PID	12.63	14.63	14.5	14.44	DCV
BARO	PID	157.7/14.48	157.7/14.48	157.7/14.24	155.8/14.24	Hz/PSI
CAT_EVAL	PID	YES	YES	YES	YES	YES/NO
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	3	4	GEAR
HTRCM11	PID	1.09	1.09	1.09	1.09	Amps
HTRCM12	PID	680	680	680	680	mA
HTRCM21	PID	1.11	1.11	1.11	1.11	Amps
HTRCM22	PID	660	660	660	660	mA
LOAD	PID	(L)	10-20	19-30	30-48	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
RPM	PID	0	705-820	1200-1500	1600-1800	RPM
TPCT	PID	0.85	0.85	0.85	0.85	DCV
TSS_ISS	PID	0	761.5	1356	1765	RPM
TSS_SRC	PID	0	761.8	1354	1768	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	8.3/75	3.6/27	3.6/27	3.8/29	DCV/%
WAC/ACCR	B25	VBAT/OFF	1.5/ON	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
EVMV	B34	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
HFC	B38	OFF	ON	OFF	OFF	ON/OFF
LFC	B39	OFF	ON (B)	OFF	OFF	ON/OFF
GENCMD	E7	3.79	0 (Q)	0 (Q)	0 (Q)	%
IAC	E39	0	32-40	30-55	50-79	%
HTR21	E48	ON (O)	ON	ON	ON	ON/OFF
HTR11	E49	ON	ON	ON	ON	ON/OFF
TCC	T46	0/ON	0/ON	0/ON	100/ON	%/ON-OFF
HTR12	T47	ON	ON	ON	ON	ON/OFF
HTR22	T48	ON	ON	ON	ON	ON/OFF
CAT_EVAL	PID	YES	YES	YES	YES	YES/NO

EVAPCV	0/OFF	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVAPSOAK	PID	YES	YES	YES	YES	YES/NO
FAN	PID	OFF	OFF	OFF	OFF	ON/OFF
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FRP_DSD	PID	39.15	39.15	39.15	39.15	PSI
FTP_H2O	PID	-0.13	-0.13	-0.86	-3.27	in H2O
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
RPMDSD	PID	1120	763	672	672	RPM
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0-10	5-20	36-44	30-40	DEG
STRT_RLY	PID	ENABLED	DISABLED	DISABLED	DISABLED	ENABLED/ DISABLED
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
TQ_CNTRL	PID	NONE	NONE	NONE	NONE	_

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV

2.3L RANGER

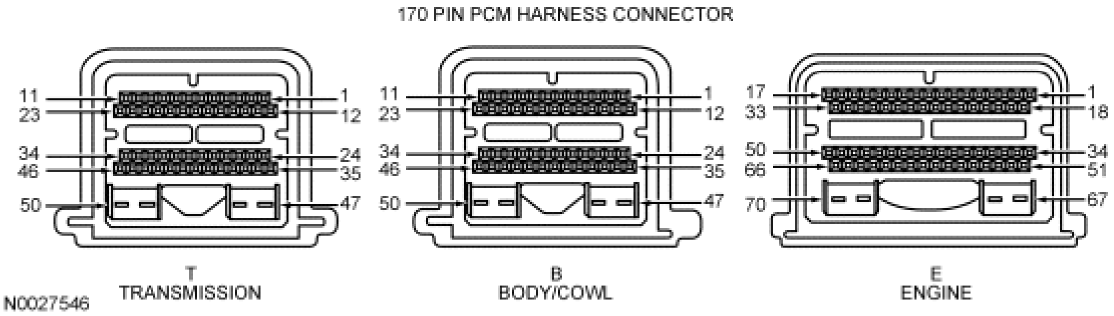


Fig. 14: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6	2.6	2.6	2.6	DCV
FTP_H2O	B3	0	0	0	0	IN H20
ACCS	B15	OFF	ON (A)	OFF	OFF	ON/OFF
FPM	B21	OFF	ON	ON	ON	ON/OFF
TCS	B29	0.1/OFF	VBAT/ON (G)	0.1/OFF	0.1/OFF	DCV/ON-OFF
CPP/PNP	B33	NEUTRAL	NEUTRAL	DRIVE	DRIVE	MODE
PSP	B34	LOW	HIGH(I)	LOW	LOW	HIGH/LOW
FEPS	B44	0.1	0.1	0.1	0.1	DCV
IAT	E22	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG F
MAF	E25	0	0.7-0.9	1.2-1.6	1.6-2.1	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV
CHT	E41	0.67 or 3.7/194 - 230	0.67 or 3.7/194 - 230	0.67 or 3.7/194 - 230	0.67 or 3.7/194 - 230	DCV/DEG F
KNOCK 1	E49	0	0	0	0	N/A
TP	E61	0.53-1.27	0.53-1.27	0.8-1.1	1.2-1.7	DCV
MAP	E62	3.99/14.21/28.9	0.95/3.33/6.79	1.58/5.91/11.22	2.01/6.81/13.87	DCV/PSI/IN HG
HTRCM11	E69	531	531	531	531	mA
OSS	T3	0	0	1250-1290	2100-2400	RPM
TSS	T15	0	320-360/ 630-670	500-713/ 1100-1300	845-985/ 1700-1800	Hz/RPM
TR 1	T16	0	0	VBAT	VBAT	DCV
TR 2	T17	0	0	VBAT	VBAT	DCV
O2S12	T24	(L)	(D)	(D)	(D)	DCV
TR3 V/TR3	T27	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
TR 4	T28	0	0	VBAT	VBAT	DCV
TFT	T29	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	DCV/DEG F
HTRCM12	T47	977	977	977	977	mA
BARO	PID	156.2/14.3	156.2/14.3	156.2/14.3	156.2/14.3	Hz/PSI
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	NO	NO	NO	NO	YES/NO
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	17-28	19-26	30-40	%
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	750	1300	1780	RPM

VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	OFF	ON	ON	ON	ON/OFF
EVAPCV	B13	0 (R)/OFF	0 (R)/OFF	0 (R)/OFF	0 (R)/OFF	%/ON-OFF
WAC/ACCR	B14	OFF	ON (A)	OFF	OFF	ON/OFF
EVMV	E6	0/OFF	0/OFF	500-900 (F)/VARYING	500-900 (F)/VARYING	mA/OFF-VARYING
IAC	E33	0	35	35-41 (L)	57-68 (L)	%
HTR11	E69	OFF (O)	ON	ON	ON	ON/OFF
EPC	T11	6.0	8.0	10.0	10.0	DCV
SSA (SS1)	T42	0.1/ON	0.1/ON	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
SSB (SS2)	T43	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
SSC (SS3)	T44	VBAT/OFF	VBAT/OFF	VBAT/OFF	0.1/ON	DCV/ON-OFF
SSD (SS4)	T45	0.1/ON	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
TCC	T46	VBAT/0	VBAT/0	VBAT/0	0.2/100	DCV/%
HTR12	T47	OFF (O)	ON	ON	ON	ON/OFF
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
EGR_EVAL	PID	YES	YES	NO	NO	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	20-25	30-35	30-35	DEG
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VPWR	B35/B36	VBAT	VBAT	VBAT	VBAT	DCV

VREF	E57	5	5	5	5	DCV

3.0L RANGER

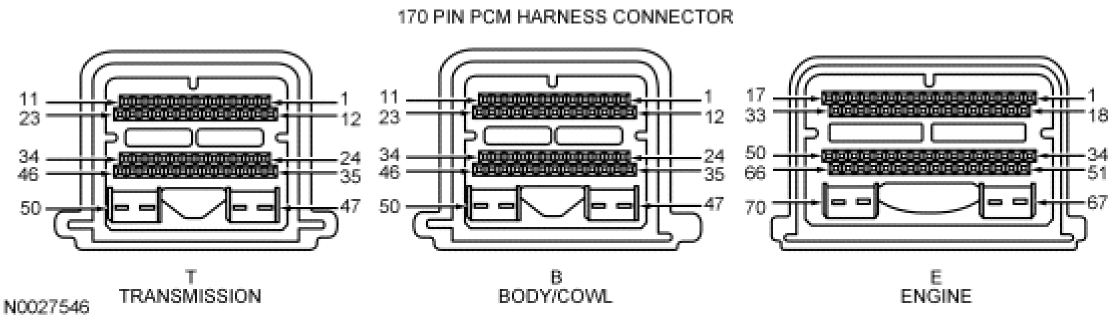


Fig. 15: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0	2.6/0	2.6/0	2.6/0	DCV/PSI
ACCS	B15	OFF	ON (A)	OFF	OFF	ON/OFF
FPM	B21	OFF	ON	ON	ON	ON/OFF
TCS	B29	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
CPP/PNP	B33	NEUTRAL	NEUTRAL	DRIVE	DRIVE	MODE
ECT	E18	0.4-1/200-160	0.4-1/200-160	0.4-1/200-160	0.4-1/200-160	DCV/DEG F
DPFEGR	E21	0.25-1.30	0.25-1.30	0.25-4.65	0.25-4.65	DCV
IAT	E22	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG F
MAF	E25	0	0.7-0.9	1.2-1.6	1.6-2.1	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
KNOCK 1	E49	0	0	0	0	N/A
TP	E61	0.53-1.27/CT	0.53-1.27/CT	0.8-1.1/PT	1.2-1.7/PT	DCV/MODE
HTRCM11	E69	539	539	539	539	mA
HTRCM21	E70	504	504	504	504	mA
OSS	T3	0	0	1250-1290	2100-2400	RPM
TSS	T15	0	630-670	1100-1300	1700-1800	RPM
						OPEN/

TR 2	T17	CLOSED	CLOSED	OPEN	OPEN	CLOSED
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TFT	T29	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	DCV/DEG F
HTRCM12	T47	969	969	969	969	mA
HTRCM22	T48	965	965	965	965	mA
BARO	PID	13.87/153.5	13.87/153.5	13.87/153.5	13.87/153.5	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	YES	NO	NO	NO	YES/NO
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	17-28	19-26	30-40	%
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	750	1300-1350	1780	RPM
TR	PID	P	P	OD	OD	MODE
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FP	B12	OFF	ON	ON	ON	ON/OFF
EVAPCV	B13	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
WAC/ACCR	B14	OFF	ON (A)	OFF	OFF	ON/OFF
PCVHC	E3	0	0	0	0	%
EVMV	E6	0	0	500-900 (F)/VARYING	500-900 (F)/VARYING	mA/OFF-VARYING
IAC	E33	0	35	35-41 (L)	57-68 (L)	%
EGRVR	E63	0	0	(T)	(T)	%
HTR11	E69	OFF (O)	ON	ON	ON	ON/OFF
HTR21	E70	OFF (O)	ON	ON	ON	ON/OFF
TCC	T46	0/OFF	0/OFF	0/OFF	100/ ENGAGED	%/OFF-ENGAGED
HTR12	T47	OFF (O)	ON	ON	ON	ON/OFF
HTR22	T48	OFF (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
		NOT	NOT			READY/NOT

EVAP020R	PID	READY	READY	NOT READY	NOT READY	READY
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+) 20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+) 20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	0	(-)10-(+) 10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	0	(-)10-(+) 10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	20-25	30-35	30-35	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VPWR	B35/B36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/T40	5	5	5	5	DCV

4.0L RANGER

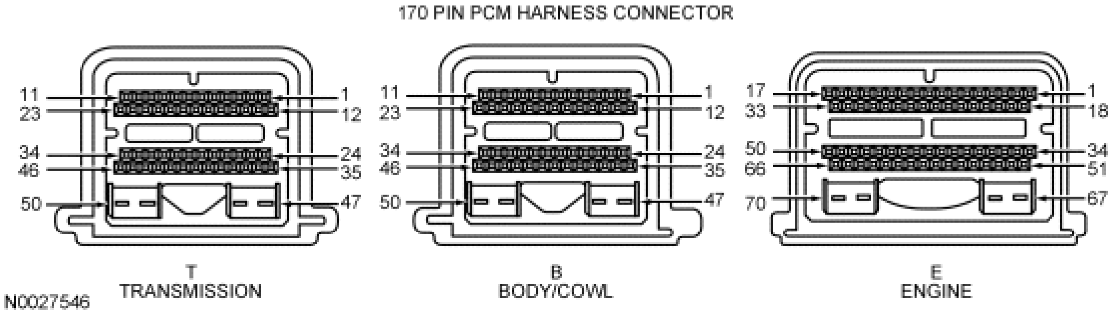


Fig. 16: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FTP	B3	2.6/0	2.6/0	2.6/0	2.6/0	DCV/PSI
FTP_H2O	B3	0	0	0	0	H2O
BOO	B8	OFF	OFF	OFF	OFF	ON/OFF
FPM	B21	OFF	ON	ON	ON	ON/OFF

TCS	B29	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
CPP/PNP	B33	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
ECT	E18	0.4-1/200-160	0.4-1/200-160	0.4-1/200-160	0.4-1/200-160	DCV/DEG F
DPFEGR	E21	0.25-1.30	0.25-1.30	0.25-4.65	0.25-4.65	DCV
IAT	E22	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG F
MAF	E25	0	0.7-0.9	1.2-1.6	1.6-2.1	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
KNOCK 1	E49	16380	196	173	212	N/A
TP	E61	1.05/CT	1.05/CT	1.21/PT	1.29/PT	DCV/CT/ PT/WOT
OSS	T3	0	0	1261	2294	RPM
TSS	T15	0	775	926	1716	RPM
TR2	T17	CLOSED	CLOSED	OPEN	OPEN	OPEN/ CLOSED
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TFT	T29	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	DCV/DEG F
ACCS	PID	OFF	ON (A)	OFF	OFF	ON/OFF
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
BARO	PID	155.1/14.18	155.1/14.18	155.1/14.18	155.1/14.18	Hz/PSI
DECHOKE	PID	YES	NO	NO	NO	YES/NO
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	17-28	19-26	30-40	%
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	750	1300-1350	1780	RPM
TORQUE	PID	238.7	10.85	8.13	179	Nm
TPCT	PID	1.05	1.05	1.05	1.05	DCV
TR	PID	P	P	OD	OD	MODE
TSS/ISS	PID	0	750	990	1720	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FP	B12	OFF	ON	ON	ON	ON/OFF
PCVHC	E3	0	0	0	0	%
EVMV	E6	0	0	500-900 (F)	500-900 (F)	mA
IAC	E33	0	35	35-41 (L)	57-68 (L)	%
EGRVR	E63	0	0	(T)	(T)	%
HTR11	E69	OFF (O)	ON	ON	ON	ON/OFF
HTRCM11	E69	539	539	535	535	mA
HTR21	E70	OFF (O)	ON	ON	ON	ON/OFF
HTRCM21	E70	504	504	500	500	mA
TCC	T46	0/OFF	0/OFF	0/OFF	100/ ENGAGED	%/OFF-ENGAGED
HTR12	T47	OFF (O)	ON	ON	ON	ON/OFF
HTRCM12	T47	938	938	906	906	mA
HTR22	T48	OFF (O)	ON	ON	ON	ON/OFF
HTRCM22	T48	922	922	945	945	mA
EGR_EVAL	PID	NO	NO	NO	NO	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPCV	PID	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVAPSOAK	PID	YES	YES	NO	NO	YES/NO
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	20-25	30-35	30-35	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/B36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/T40	5	5	5	5	DCV

4.0L EXPLORER/EXPLORER SPORT TRAC/MOUNTAINEER

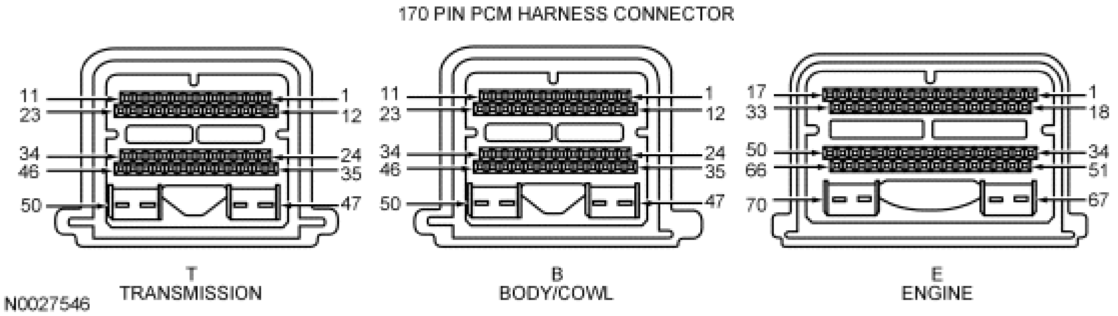


Fig. 17: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.61/0	2.61/0	2.19/-0.11	2.62/0	DCV/PSI
APP1	B5	4.0	4.0	3.4-4.0	2.9-4.0	DCV
BOO	B8	OFF	ON (E)	OFF	OFF	ON/OFF
ACCS	B15	OFF	ON (A)	OFF	OFF	ON/OFF
ACDS1	B16	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE/ DISABLED
APP2	B17	1.4	1.5	1.5-1.9	1.5-2.4	DCV
ACP_PRESS	B18	117.97	101.97	81.98	83.98	PSI
APP3	B28	0.9	0.9	0.9-1.3	0.9-1.8	DCV
TCS	B29	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
ECT	E18	0.4-1/200-160	0.4-1/200-160	0.4-1/200-160	0.4-1/200-160	DCV/DEG F
FRT	E19	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	DCV/DEG F
DPFEGR	E21	0.25-1.30	0.25-1.30	0.25-4.65	0.25-4.65	DCV
IAT	E22	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG F
FANSS	E24	0	300-500	300-550	300-500	RPM
MAF	E25	0	0.7-0.9	1.2-1.8	1.6-2.1	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.4/55	2.8/40	2.8/40	2.8/38	DCV/PSI

KNOCK 1	E49	8.19k	132	127	121	N/A
TP2	E60	1.23/24.31	0.75/14.9	0.85/16.86	1.43/28.63	DCV/%
TP1	E61	4.05/18.82	4.29.13.73	4.24/14.9	3.96/20.39	DCV/%
MAP	E62	4.3/14.5 (W)	1.21/4.49 (W)	2.14/7.54 (W)	2.83/9.71 (W)	DCV/PSI
HTRCM11	E69	523	523	523	523	mA
HTRCM21	E70	477	477	477	477	mA
OSS_SRC	T3	0	0	1250-1330	2100-2400	RPM
TSS	T15	0	630-670	1100-1310	1700-1800	RPM
TR 2	T17	CLOSED	CLOSED	OPEN	OPEN	DCV
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TFT	T29	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	DCV/DEG F
HTRCM12	T47	852	852	852	852	mA
HTRCM22	T48	887	887	887	887	mA
ACDS2	PID	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE/ DISABLED
APP	PID	0	0	15.5	23.5	%
BARO	PID	14.54/157.7	14.54/157.7	14.54/157.7	14.54/157.7	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.39	1.5	5.14	12.15	DEG
ETC_DSD	PID	7.62	1.42	5.12	12.22	DEG
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	15-28	19-26	30-40	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	750-820	1300-1520	1600-1780	RPM
TR	PID	P	P	OD	OD	MODE
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	75/OFF	20.44/ON	20.65/ON	23.04/ON	%/ON-OFF
EVAPCV	B13	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
WAC/ACCR	B14	OFF	ON (A)	OFF	OFF	ON/OFF
GENCMD (ILINE)	B22	0	8.62	8.75	8.81	DCV
PCVHC	E3	0	0	0	0	%

EVMV	E6	0/OFF	0/OFF	500-900 (F)/VARYING	500-900 (F)/VARYING	mA/OFF-VARYING
FANVAR	E7	0	0/100	13	10	%
EGRVR	E63	0	0	(T)	(T)	%
HTR11	E69	OFF (O)	ON	ON	ON	ON/OFF
HTR21	E70	OFF (O)	ON	ON	ON	ON/OFF
TCC	T46	0/OFF	0/OFF	0/OFF	100/ON	%/ON-OFF
HTR12	T47	OFF (O)	ON	ON	ON	ON/OFF
HTR22	T48	OFF (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	13-25	26-35	21-35	DEG
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VPWR	B35/B36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57	5	5	5	5	DCV

4.6L 3V EXPLORER/EXPLORER SPORT TRAC/MOUNTAINEER

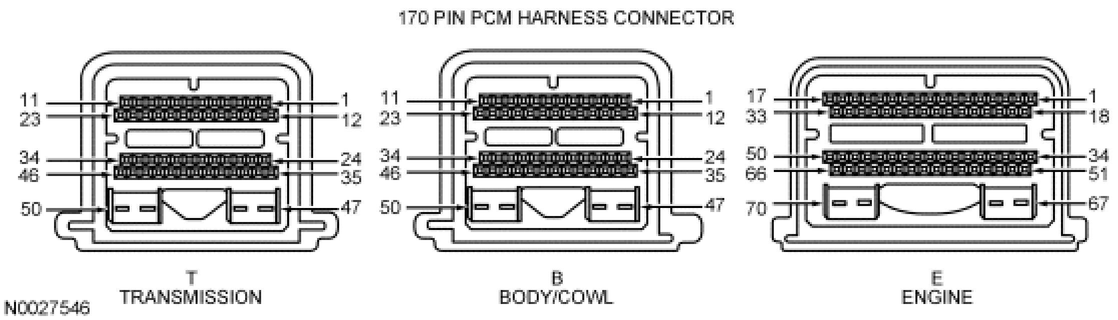


Fig. 18: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0	2.6/0	1.98/-0.16	2.05/-0.14	DCV/PSI
APP1	B5	4.0	4.0	3.4-4.0	2.9-4.0	DCV
ACCS	B15	OFF	ON (A)	OFF	OFF	ON/OFF
ACDS1	B16	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE/ DISABLE
APP2	B17	1.4	1.4	1.4-1.9	1.4-2.4	DCV
ACP_PRESS	B18	101.97	105.98	87.98	87.98	PSI
APP3	B28	0.9	0.9	0.9-1.3	0.9-1.8	DCV
TCS	B29	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
FRT	E19	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	DCV/DEG F
IAT	E22	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG F
FANSS	E24	0	300-1040	300-500	300-500	RPM
MAF	E25	0	0.7-0.9	1.2-1.7	1.5-2.4	DCV
EOT	E27	0.5-3/210-110	0.5-3/210-110	0.5-3/210-110	0.5-3/210-110	DCV/DEG F
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.0/50	2.8/40	2.8/39	2.8/39	DCV/PSI
CHT	E41	0.6-3.7/194 (K)	0.6-3.7/194 (K)	0.6-3.7/194 (K)	0.6-3.7/194 (K)	DCV/DEG F
TP2	E60	1.27/25.1	0.72/14.51	0.76/14.9	3.96/78.82	DCV/%
TP1	E61	4.03/19.22	4.3/13.73	4.28/14.12	2.71/45.88	DCV/%

HTRCM11	E69	512	512	512	512	mA
HTRCM21	E70	512	512	512	512	mA
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
HTRCM12	T47	863	863	863	863	mA
HTRCM22	T48	863	863	863	863	mA
ACDS2	PID	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE/ DISABLE
APP	PID	0	0	7	13	%
BARO	PID	14.48/157.4	14.48/157.4	14.48/157.4	14.48/157.4	PSI/BARO
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.98	1.43	4.37	5	DEG
ETC_DSD	PID	7.6	1.37	4.24	4.77	DEG
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	16-23	15-20	25-37	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	630-850	1400-1465	1500-1726	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	75/OFF	22.03/ON	19.89/ON	19.5/ON	%/ON-OFF
EVAPCV	B13	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
WAC/ACCR	B14	OFF	ON (A)	OFF	OFF	ON/OFF
GENCMD (ILINE)	B22	0	8.68	8.81	8.81	DCV
EVMV	E6	0/OFF	0/OFF	500-900 (F)/VARYING	500-900 (F)/VARYING	mA/OFF-VARYING
SPKDUR_8	E9	0	1.71	1.65	1.53	mS
SPKDUR_5	E10	0	1.62	1.65	1.59	mS
SPKDUR_2	E11	0	1.71	1.68	1.21	mS
SPKDUR_3	E12	0	1.84	1.78	1.43	mS
SPKDUR_4	E14	0	1.71	1.71	1.4	mS
SPKDUR_6	E15	0	1.65	1.68	1.5	mS
SPKDUR_7	E16	0	1.65	1.59	1.53	mS
SPKDUR_1	E17	0	1.68	1.62	1.21	mS
IMRC	E50	OFF	OFF	OFF	OFF	ON/OFF

VCTDC	E67	0	0	47.49	48.31	DEG
VCTDC2	E68	0	0	41.94	47	DEG
HTR11	E69	OFF (O)	ON	ON	ON	ON/OFF
HTR21	E70	OFF (O)	ON	ON	ON	ON/OFF
HTR12	T47	OFF (O)	ON	ON	ON	ON/OFF
HTR22	T48	OFF (O)	ON	ON	ON	ON/OFF
CHTIL	PID	OFF	OFF	OFF	OFF	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0-10	9-16	30-35	28-35	DEG
VCTADV	PID	0	-0.37	40.06	47.5	DEG
VCTADV2	PID	0	-1	41.94	49.63	DEG
VCTADVERR	PID	0	0.37	1.06	0.75	DEG
VCTADVERR2	PID	0	1	-0.75	-1.25	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VPWR	B35/B36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57/T40	5	5	5	5	DCV

4.2L F-150

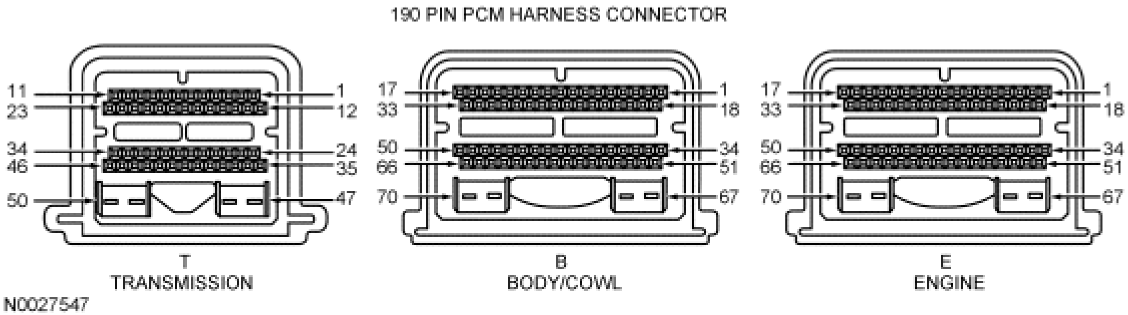


Fig. 19: 190 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
ACCS	B19	0.1/OFF	VBAT/ON (A)	0.1/OFF	0.1/OFF	DCV/ON-OFF
GENMON	B23	0	28.13	16.41	21.88	%
APP1	B25	3.9	4	3.9	3.7	DCV
APP2	B26	1.5	1.5	1.9	1.7	DCV
APP3	B27	1	1	1.3	1.2	DCV
PATS IN	B37	VBAT	VBAT	VBAT	VBAT	DCV
CPP-BT	B39	NO	NO	NO	NO	YES/NO
FTP	B44	2.6/0	2.6/0	2.6/0	2.6/0	DCV/PSI
TCS (A/T)	B45	0.1/OFF	VBAT/ON (G)	0.1/OFF	0.1/OFF	DCV/ON-OFF
BPP	B46	VBAT/OFF	VBAT/ON (E)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
BPS	B47	0.1/OFF	VBAT/ON (E)	0.1/OFF	0.1/OFF	DCV/ON-OFF
FEPS	B55	0.5-0.6	0.5-0.6	0.5-0.6	0.5-0.6	DCV
FRT	E19	80.6 (K)	84.2 (K)	53.6 (K)	57.2(K)	DEG F
DPFEGR	E21	0.25-1.3	0.25-1.3	0.25-4.65	0.25-4.65	DCV
IAT	E22	1.58/125.6 (K)	1.74/120.2 (K)	3.6/48.2 (K)	3.64/46.4 (K)	DCV/DEG F
MAF	E25	0	0.86	0.93	1.6	DCV
HO2S21	E28	0	switching (C)	switching (C)	switching (C)	DCV
HO2S11	E29	(L)	switching (C)	switching (C)	switching (C)	DCV
FRP	E32	3.7/39	3.8/40	3.7/39	3.8/40	DCV/PSI
CHT	E41	0.63/190	0.66/188	3.71/194	3.7/194	DCV/DEG F

IMRCM	E43	NO FAULT	NO FAULT	NO FAULT	NO FAULT	FAULT/NO FAULT
CMP	E45	0	6	11	15	Hz
CKP	E47	0	475	800	1100	Hz
KNOCK 1	E49	16	25	18	29	N/A
TP2	E60	1.31	1	1.27	1.66	DCV
TP1	E61	4	4.1	4	3.8	DCV
MAP	E62	4.2/14.21 (W)	1.24/4.49 (W)	1.27/4.49 (W)	2/7.25 (W)	DCV/PSI
OSS (A/T)	T14	0	0	500-524/ 1250-1310	960-1020/ 2400-2550	Hz/RPM
OSS (M/T)	T14	0	0	1133	2151	RPM
TSS (A/T)	T15	0	320-360/ 630-670	500-713/ 1100-1300	845-985/ 1700-1800	Hz/RPM
TR1 (A/T)	T17	0	0	11.5	11.5	DCV
TR2 (A/T)	T18	0	0	11.5	11.5	DCV
TR3 V/TR (A/T)	T19	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
TFT (A/T)	T20	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	DCV/DEG
HO2S22	T21	0.1	(D)	(D)	(D)	DCV
HO2S12	T22	(L)	(D)	(D)	(D)	DCV
TR4 (A/T)	T32	0	0	11.5	11.5	DCV
APP	PID	0	0	1.5	8	%
CPP/PNP	PID	ON	ON	OFF	OFF	ON/OFF
FLI	PID	98.2 (H)	98.2 (H)	100 (H)	100 (H)	%
GEAR (A/T)	PID	1	1	3	4	GEAR
VSS	PID	0	0	30	55	MPH
LOAD	PID	61.89 (L)	15.38	23.54	28.42	%
MISFIRE	PID	NO	NO	OFF	OFF	ON/OFF
RPM	PID	0	1018	1138	1721	RPM

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
WAC/ACCR	B18	VBAT/OFF	0.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
GENCMD	B22	3.79	0 (Q)	0 (Q)	0 (Q)	%
PATSTRT/SMC	B34	0	0	0	0	DCV
PAT IL	B35	0	0	0	0	DCV
PATS OUT	B36	10.5	VBAT (A)	VBAT	VBAT	DCV
EVAPCV	B61	VBAT/OFF	VBAT/OFF	VBAT/OFF (R)	VBAT/OFF (R)	DCV/ON-OFF
FP	B62	VBAT/OFF	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF

VSO	B63	0	0	55	125	Hz
PCVHC	E3	0	0	100	100	%
CDB (CYL 3 and 4)	E12	VBAT	VBAT	VBAT	VBAT	DCV
CDC (CYL 2 and 6)	E16	VBAT	VBAT	VBAT	VBAT	DCV
CDA (CYL 1 and 5)	E17	VBAT	VBAT	VBAT	VBAT	DCV
TACM (+)	E34	3.7	VBAT	VBAT	VBAT	DCV
IMRC	E50	VBAT/OFF	VBAT/OFF	VBAT/OFF	0/ON	DCV/ON-OFF
TACM (-)	E51	3.7	VBAT	VBAT	VBAT	DCV
EGRVR	E63	0	0	(T)	48.43 (T)	%
EVAPPDC	E65	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
HTR11	E69	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
HTR21	E70	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
HTR12	T1	0.2/ON (O)	0.2/ON	0.2/ON	0.2/ON	DCV/ON-OFF
HTR22	T12	0.2/ON (O)	0.2/ON	0.2/ON	0.2/ON	DCV/ON-OFF
TCC (A/T)	T36	0.2/100	VBAT/0	0.2-VBAT/ 0-100	0.2/90-100	DCV/%
SSB (SS2) (A/T)	T37	VBAT/OFF	VBAT/OFF	0.1/ON	0.1/ON	DCV/ON-OFF
SSA (SS1) (A/T)	T38	0.1/ON	0.1/ON	VBAT/OFF	0.1/ON	DCV/ON-OFF
EPC (A/T)	T39	7.7/15-20	8.8-10.2/15-20	10.3-10.6/ 35-40	10.6/45	DCV/PSI
CHTFM	PID	NO FAULT	NO FAULT	NO FAULT	NO FAULT	FAULT/NO FAULT
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
OTS_STAT (A/T)	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0.5	19.25	14.5	37.75	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
ETCVREF	B21/B28/E66	5	5	5	5	DCV
BVREF	B29/E57	5	5	5	5	DCV
VPWR	B51/52/53	VBAT	VBAT	VBAT	VBAT	DCV
KAPWR	B54	VBAT	VBAT	VBAT	VBAT	DCV

4.6L 2V F-150

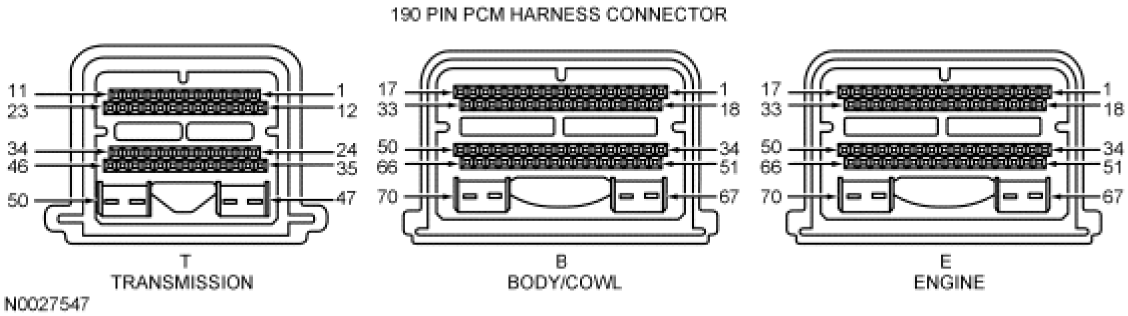


Fig. 20: 190 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
ACCS	B19	OFF	ON (A)	OFF	OFF	ON/OFF
GENMON	B23	0	28.13	21.88	20.31	%
APP1	B25	4.0	4.0	3.9	3.7	DCV
APP2	B26	1.5	1.5	1.6	1.75	DCV
APP3	B27	1	1	1	1.2	DCV
4WDMCS	B32	8.8 (2HIGH)	9.6 (4LOW)	6.6 (4HIGH)	9.5 (2HIGH)	DCV
FTP	B44	2.59/0	2.53/-0.02	2.58/0	2.56/-0.01	DCV/PSI
TCS	B45	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED-NOT DEPRESSED
BPP/BOO	B46	OFF	ON (E)	OFF	OFF	ON/OFF
DPFEGR	E21	0.25-1.3	0.25-1.3	0.25-4.65	0.25-4.65	DCV
IAT	E22	1.69/122 (K)	1.77/118(K)	3.07/68 (K)	3.08/68 (K)	DCV/DEG F
PSP	E24	4.99/1499.3	4.99/1499.3	4.99/1499.3	4.99/1499.3	DCV/PSI
MAF	E25	0	0.64	1.47	1.5	DCV
O2S21	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S11	E29	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.59/55	2.8/40	2.8/40	2.8/40	DCV/PSI
CHT	E41	0.6/194	0.6/194	0.61/192	0.61/192	DCV/DEG F
KNOCK 1	E49	24290	20470	27570	55580	N/A
TP2	E60	1.29/25.49	0.89/17.65	1.39/27.45	1.53/30.59	DCV
TP1	E61	4.1/17.65	4.31/13.33	4.06/18.43	3.98/20	DCV
MAP	E62	4.34/14.64 (W)	1.24/4.49 (W)	2.13/7.54 (W)	2.19/7.68 (W)	DCV/PSI
OSS	T14	0	0	1220	2361	RPM

TSS	T15	0	649	863	1637	RPM
TR2	T18	CLOSED	CLOSED	OPEN	OPEN	OPEN/ CLOSED
TFT	T20	0.98/165.2 (K)	0.88/172.4 (K)	1.21/153 (K)	1.13/158 (K)	DCV/DEG F
O2S22	T21	(L)	switching (D)	switching (D)	switching (D)	DCV
O2S12	T22	(L)	switching (D)	switching (D)	switching (D)	DCV
APP	PID	0	0	2	10.5	%
BARO	PID	14.48/157.4	14.48/157.4	14.48/157.4	14.48/157.4	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.37	2.25	5.06	11.02	DEG
ETC_DSD	PID	7.62	2.19	5.08	11.06	DEG
ETC_TRIM	PID	0.23	0.23	0.22	0.22	DEG
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	65.78 (L)	15.83	15.55	27.35	%
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	655	975	1650	RPM
TR	PID	P	P	OD	OD	MODE

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
WAC/ACCR	B18	OFF	ON (A)	OFF	OFF	ON/OFF
GENCMD	B22	3.79	0 (Q)	0 (Q)	0 (Q)	%
EVMV	B50	0/OFF	405/ VARYING	356/ VARYING	405/ VARYING	mA/OFF-VARYING
EVAPCV	B61	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
FP	B62	75/OFF	19.66/ON	22.02/ON	20.34/ON	%/ON-OFF
SPKDUR_8	E9	0	1.65	1.68	1.03	ms
SPKDUR_5	E10	0	1.5	1.37	1.15	ms
SPKDUR_2	E11	0	1.71	1.43	1.31	ms
SPKDUR_3	E12	0	1.37	1.56	1.31	ms
SPKDUR_4	E14	0	1.75	1.37	1.09	ms
SPKDUR_6	E15	0	1.75	1.43	1.25	ms
SPKDUR_7	E16	0	1.75	1.59	0.906	ms
SPKDUR_1	E17	0	1.68	1.12	1.25	ms
EGRVR	E63	0	0	36.25 (T)	77.8 (T)	%
HTR11	E69	OFF (O)	ON	ON	ON	ON/OFF
HTR21	E70	OFF (O)	ON	ON	ON	ON/OFF
HTR12	T1	OFF (O)	ON	ON	ON	ON/OFF

HTR22	T12	OFF (O)	ON	ON	ON	ON/OFF
TCC	T36	0/OFF	0/OFF	0/OFF	100/ ENGAGED	%/OFF- ENGAGED
4WDC	T49	0.5	0.2	0.2	0.2	DCV
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	YES	YES	NO	NO	YES/NO
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
OTS_STAT (A/T)	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	0.5	28	35.75	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
BVREF	B29/E57	5	5	5	5	DCV
VPWR	B51/52/53	VBAT	VBAT	VBAT	VBAT	DCV

5.4L 3V F-150/MARK LT

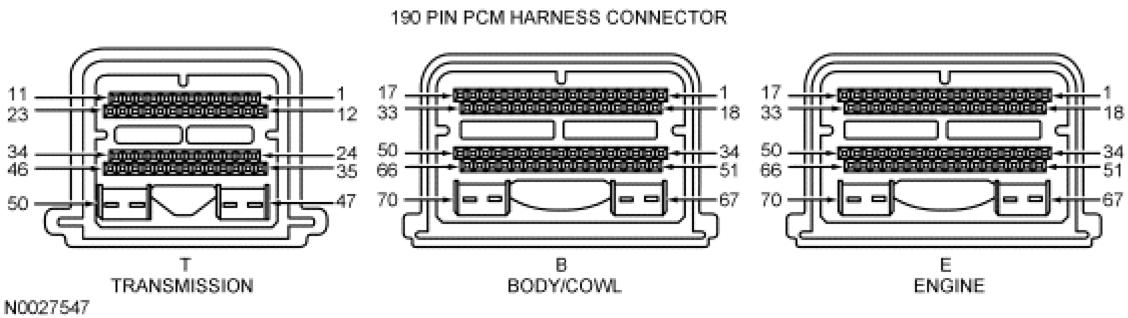


Fig. 21: 190 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
ACCS	B19	OFF	ON (A)	OFF	OFF	ON/OFF
GENMON	B23	0	34.36	21.88	20.31	%
APP1	B25	4.0	4.0	3.7	3.6	DCV
APP2	B26	1.5	1.5	1.7	1.8	DCV
APP3	B27	0.9	0.9	1.16	1.22	DCV
4WDMCS	B32	9.5 (2HIGH)	4.5 (4LOW)	6.6 (4HIGH)	9.5 (2HIGH)	DCV
FTP	B44	2.6/-0.01	2.6/-0.01	2.3/-0.09	2.7/-0.09	DCV/PSI
TCS	B45	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
BPP/BOO	B46	OFF	ON (E)	OFF	OFF	ON/OFF
BPA	B47	OFF	ON (E)	OFF	OFF	ON/OFF
FRT	E19	2.7/86 (K)	2.7/86 (K)	3.5/57 (K)	3.5/61 (K)	DCV/DEG F
IAT	E22	1.6/126 (K)	1.7/120 (K)	3.6/48 (K)	3.6/46 (K)	DCV/DEG F
PSP	E24	4.99/1499.3	4.99/1499.3	4.99/1499.3	4.99/1499.3	DCV/PSI
MAF	E25	0	0.72	1.25	1.75	DCV
O2S21	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S11	E29	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
KNOCK 2	E31	65.54k	170	183	234	N/A
FRP	E32	2.9/41.4	2.7/38.6	2.7/39	2.7/39.3	DCV/PSI
CHT	E41	3.6/201	3.5/204	3.5/201	3.5/207	DCV/DEG F
KNOCK 1	E49	175	178	205	254	N/A
TP2	E60	1.31/26.28	0.83/16.47	1.21/23.92	1.61/32.16	DCV/%
TP1	E61	4.08/18.04	4.32/13.33	4.14/17.65	3.93/21.18	DCV/%
HTRCM11	E69	516	516	516	516	mA
HTRCM21	E70	539	539	539	539	mA
HTRCM12	T1	500	500	500	500	mA
4WDP1 (ESOF)	T6	VBAT	VBAT	VBAT	VBAT	DCV
4WDP2 (ESOF)	T7	VBAT	VBAT	VBAT	VBAT	DCV
4WDMP1 (MSOF)	T7	0	0	0	0	DCV
4WDP3 (ESOF)	T8	VBAT	VBAT	VBAT	VBAT	DCV
4WDMP2 (MSOF)	T8	0	0	0	0	DCV
4WDP4 (ESOF)	T9	VBAT	VBAT	VBAT	VBAT	DCV
HTRCM22	T1	520	520	520	520	mA
OSS	T14	0	0	1162	2150	RPM

TSS	T15	0	724	823	1514	RPM
TCSS/VSS	T16	0	0	0	0	MPH
TR2	T18	CLOSED	CLOSED	OPEN	OPEN	OPEN/ CLOSED
TFT	T20	1.86/118 (K)	1.87/118 (K)	1.41/142 (K)	1.38/144 (K)	DCV/DEG F
O2S22	T21	(L)	switching (D)	switching (D)	switching (D)	DCV
O2S12	T22	(L)	switching (D)	switching (D)	switching (D)	DCV
APP	PID	0	0	9	16.5	%
BARO	PID	14.67/158.5	14.67/158.5	14.67/158.5	14.67/158.5	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.62	1.02	3.5	8.06	DEG
ETC_DSD	PID	7.62	0.96	3.62	8.09	DEG
ETC_TRIM	PID	-0.43	-0.43	-0.43	-0.43	DEG
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	62 (L)	14.5	21.4	32	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	655	1230	1500	RPM
TR	PID	P	P	OD	OD	MODE
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
WAC/ACCR	B18	OFF	ON (A)	OFF	OFF	ON/OFF
GENCMD	B22	6.08	0 (Q)	0 (Q)	0 (Q)	%
EVAPCV	B61	0/OFF	0/OFF	0 (R)/OFF	0 (R)/OFF	%/ON-OFF
FP	B62	75/OFF	18.81/ON	19.45/ON	21.39/ON	DCV/%
4WDMCS	B32	9.5 (2HIGH)	4.5 (4LOW)	6.6 (4HIGH)	9.5 (2HIGH)	DCV
EVMV	C50	0/OFF	0/OFF	472 (F)/VARIES	760 (F)/VARIES	mA/OFF-VARIES
SPKDUR_8	E9	0	1.75	1.62	0.688	ms
SPKDUR_5	E10	0	1.84	1.59	0.688	ms
SPKDUR_2	E11	0	1.68	1.12	0.750	ms
SPKDUR_3	E12	0	1.68	1.37	0.750	ms
SPKDUR_4	E14	0	1.81	1.25	0.688	ms
SPKDUR_6	E15	0	1.84	1.71	0.938	ms
SPKDUR_7	E16	0	1.75	1.18	0.688	ms
SPKDUR_1	E17	0	1.75	1	0.906	ms

IMRC	E50	OFF	OFF	OFF	OFF	ON/OFF
VCTDC	E67	0	0	46.88	43.95	%
VCTDC2	E68	0	0	45.88	44.25	%
HTR11	E69	OFF (O)	ON	ON	ON	ON/OFF
HTR21	E70	OFF (O)	ON	ON	ON	ON/OFF
HTR12	T1	OFF (O)	ON	ON	ON	ON/OFF
HTR22	T12	OFF (O)	ON	ON	ON	ON/OFF
TCC	T36	0/OFF	0/OFF	0/OFF	100/ ENGAGED	%/OFF-ENGAGED
4WDC (ESOF)	T49	0.5	0.2	0.2	0.2	DCV
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/ NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
OTS_STAT (A/T)	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	15.75	34	35.75	DEG
VCTADV	PID	0	0.62	50.69	49.56	DEG
VCTADV2	PID	0	0.5	50.75	50.38	DEG
VCTADVERR	PID	0	-0.62	0.68	-1.25	DEG
VCTADVERR2	PID	0	-0.5	-1.68	-0.5	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VREF	B29/E57	5	5	5	5	DCV
VPWR	B51/52/53	VBAT	VBAT	VBAT	VBAT	DCV

4.6L 2V E-SERIES

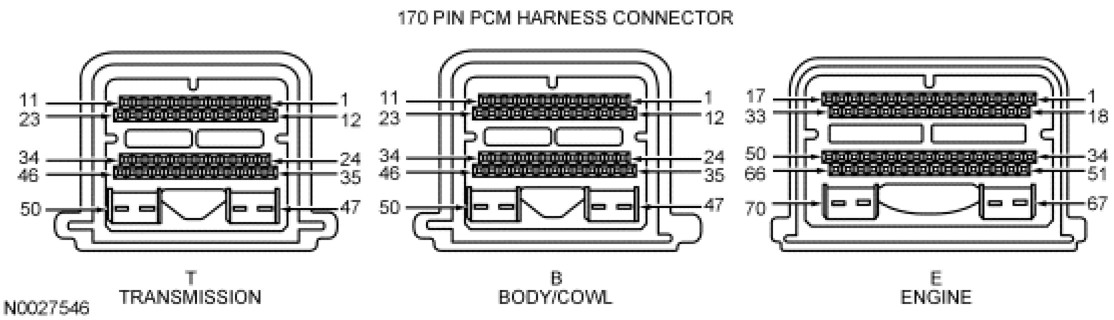


Fig. 22: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0	2.6/0	2.6/0	2.6/0	DCV/PSI
APP1	B5	4.1	4.1	3.8	3.6	DCV
BPP/BOO	B8	OFF	ON (E)	OFF	OFF	ON/OFF
APP2	B17	1.64	1.7	1.7	1.9	DCV
TCS	B27	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
APP3	B28	1	1	1.2	1.3	DCV
ACCS	E4	OFF	ON (A)	OFF	OFF	ON/OFF
FRT	E19	2.02/109.4	2/111.2	2.45/96.8	2.5/93.2	DCV/DEG F
DPFEGR	E21	0.25-1.3	0.25-1.3	0.25-4.65	0.25-4.65	DCV
IAT	E22	2.9/75 (K)	3.1/66 (K)	3.6/50 (K)	3.6/50 (K)	DCV/DEG F
MAF	E25	0	0.78	.8	1.5	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.2/47	2.8/40	2.8/40	2.8/40	DCV/PSI
CHT	E41	0.6/190	0.64/190	0.61/192	0.61/192	DCV/DEG F
KNOCK 1	E49	4095	56	87	116	N/A
TP2	E60	1.25/24.71	0.9/18.04	1.1/21.96	1.54/29.8	DCV/%
TP1	E61	4.08/18.04	4.26/14.51	4.16/16.47	3.94/20.78	DCV/%
MAP	E62	4.3/14.5 (W)	1.2/4.35 (W)	1.3/4.78 (W)	2.7/9.13 (W)	DCV/PSI
BPA	E65	OFF	ON (E)	OFF	OFF	ON/OFF
HTRCM11	E69	1.49	1.49	1.49	1.49	AMPS
HTRCM21	E70	1.57	1.57	1.57	1.57	AMPS
OSS_SRC	T3	0	0	1207	2298	RPM

TSS	T15	0	744	866	1610	RPM
TR	T16	P	P	OD	OD	MODE
TR2	T17	CLOSED	CLOSED	OPEN	OPEN	OPEN/ CLOSED
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TFT	T29	2.3/102 (K)	2.6/93 (K)	1.7/124 (K)	1.65/129 (K)	DCV/DEG F
HTRCM12	T47	961	961	961	961	mA
HTRCM22	T48	945	945	945	945	mA
APP	PID	0	0	5.5	13.5	%
BARO	PID	14.36/156.6	14.36/156.6	14.36/156.6	14.36/156.6	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.75	2.87	5.18	10.92	DEG
ETC_DSD	PID	7.62	2.51	5.15	10.92	DEG
ETC_TRIM	PID	0.23	0.23	0.23	0.23	DEG
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	59 (L)	18	16	28	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	728	1315	1597	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VSO	B1	0	0	65	125	Hz
FP	B12	75/OFF	20/ON	21/ON	22/ON	%/ON-OFF
EVAPCV	B13	0/OFF	0/OFF	0/OFF (R)	0/OFF (R)	%/ON-OFF
EVMV	E1	0/OFF	0/OFF	0/OFF	20/VARYING	mA/OFF-VARYING
PCVHC	E2	0	0	0	0	%
WAC/ACCR	E3	OFF	ON (A)	OFF	OFF	ON/OFF
EGRVR	E63	0	0	33 (T)	53 (T)	%
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
TCC	T46	0/OFF	0/OFF	0/OFF	100/ ENGAGED	%/OFF-ENGAGED

HTR12	T47	ON (O)	ON	ON	ON	ON/OFF
HTR22	T48	ON (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	YES	YES	YES	YES	YES/NO
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	11.75	27.5	41	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57	5	5	5	5	DCV

5.4L 2V E-SERIES

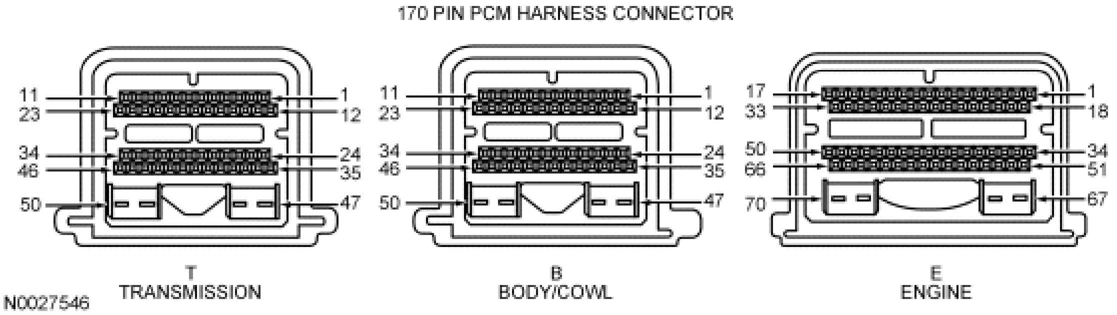


Fig. 23: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.1/-0.13 (M)	2.6/-0.24 (M)	DCV/PSI
APP1	B5	4.1	4	3.9	3.7	DCV
PTOIR V (5R110W)	B7	VBAT	VBAT	VBAT	VBAT	DCV
BPP/BOO	B8	OFF	ON (E)	OFF	OFF	ON/OFF
APP2	B17	1.4	1.4	1.6	1.8	DCV
PTO (5R110W)	B26	OFF	OFF	OFF	OFF	ON/OFF
TCS	B27	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
APP3	B28	1	0.9	1	3.7	DCV
ACCS	E4	OFF	ON (A)	OFF	OFF	ON/OFF
FRT	E19	3.4/62 (K)	3.4/64 (K)	3.2/68 (K)	3.3/66 (K)	DCV/DEG F
IAT	E22	3.5/52 (K)	3.6/48 (K)	4/27 (K)	4/23 (K)	DCV/DEG F
MAF	E25	0	0.71	1	1.7	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.5/52	2.8/40	2.8/40	2.7/39	DCV/PSI
CHT	E41	0.61/192	0.67/187	3.7/195	3.6/197	DCV/DEG F
KNOCK 1	E49	4.09k	54	62	110	N/A
TP2	E60	1.23/24.31	0.79/15.69	1.12/22.35	1.33/26.28	DCV/%
TP1	E61	4.06/18.43	4.28/14.12	4.12/17.26	4.01/19.61	DCV/%
BPA	E65	OFF	ON (E)	OFF	OFF	ON/OFF
HTRCM11	E69	1.53	1.53	1.53	1.53	AMPS
HTRCM21	E70	1.57	1.57	1.57	1.57	AMPS
OSS_SRC	T3	0	0	1157	2264	RPM
TSS	T15	0	931	831	1600	RPM
TR2 (4R75E)	T17	CLOSED	CLOSED	OPEN	OPEN	OPEN/ CLOSED
TR-P (5R110W)	T19	P	P	OD	OD	MODE
O2S12	T24	(L) (M)	(D) (M)	(D) (M)	(D) (M)	DCV
O2S22	T25	0 (M)	(D) (M)	(D) (M)	(D) (M)	DCV
TFT	T29	2.9/82 (K)	3/77 (K)	2.3/100 (K)	2.2/104 (K)	DCV/DEG F
HTRCM12	T47	898	898	898	898	mA
HTRCM22	T48	906	906	906	906	mA
APP	PID	0	0	14.5	16	%
BARO	PID	14.48/157.4	14.48/157.4	14.48/157.4	14.48/157.4	PSI/HZ

B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.47	2.1	12.19	12.48	DEG
ETC_DSD	PID	7.62	2.06	12.29	12.61	DEG
ETC_TRIM	PID	-0.33	-0.35	-0.3	-0.3	DEG
FLI	PID	40 (H)	41(H)	43 (H)	48 (H)	%
GEAR (4R75E)	PID	1	1	4	4	GEAR
GEAR (5R110W)	PID	1	1	5	6	GEAR
LOAD	PID	71 (L)	15	18	32	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	720	1100	1600	RPM
TR (4R75E)	PID	P	P	OD	OD	MODE
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	75/OFF	20/ON	20/ON	23/ON	%/ON-OFF
EVAPCV	B13	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVMV	E1	0/OFF	0/OFF	626/ VARYING	839/ VARYING	mA/OFF-VARYING
WAC/ACCR	E3	OFF	ON (A)	OFF	OFF	ON/OFF
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
TCC (4R75E)	T46	0/OFF	0/OFF	0/OFF	39.29/ ENGAGED	%/OFF-ENGAGED
HTR12	T47	ON (M) (O)	ON (M)	ON (M)	ON (M)	ON/OFF
HTR22	T48	ON (M) (O)	ON (M)	ON (M)	ON (M)	ON/OFF
TSPC (5R110W)	T49	VBAT	VBAT	VBAT	VBAT	DCV
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO

LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	8.75	27	29.75	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	E57	5	5	5	5	DCV

6.8L 2V E-SERIES

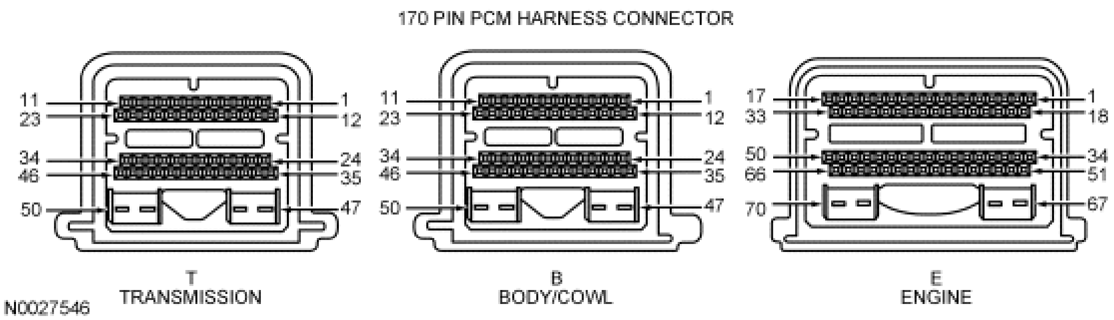


Fig. 24: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.6/0 (M)	1.4/-0.3 (M)	DCV/PSI
APP1	B5	4	4	3.8	3.7	DCV
PTOIR V	B7	0.0	0.0	0.0	0.0	DCV
BOO	B8	OFF	ON (E)	OFF	OFF	ON/OFF
PTOLOAD	B9	NO	NO	NO	NO	YES/NO
O2S13	B14	0 (M)	switching (C) (M)	switching (C) (M)	switching (C) (M)	DCV
APP2	B17	1.4	1.4	1.7	1.7	DCV
PTO	B26	OFF	OFF	OFF	OFF	ON/OFF

TCS	B27	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
APP3	B28	0.9	0.9	1.2	1.2	DCV
ACCS	E4	OFF	ON (A)	OFF	OFF	ON/OFF
FRT	E19	2.6/90 (K)	3.2/ 70 (K)	3.1/72 (K)	3.2/70 (K)	DCV/DEG F
IAT	E22	2.74/81 (K)	2.9/73 (K)	4/27 (K)	3.9/30 (K)	DCV/DEG F
MAF	E25	0	1	1.3	1.8	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.3/49	4.2/65	4.2/65	4.2/65	DCV/PSI
CHT	E41	0.7/188	0.6/187	0.7/188	0.6/188	DCV/DEG F
TP2	E60	1.16/23.14	0.69/13.73	1.16/23.14	1.1/21.96	DCV/%
TP1	E61	4.09/18.04	4.32/13.33	4.09/18.04	4.12/17.26	DCV/%
BPA	E65	OFF	ON (E)	OFF	OFF	ON/OFF
HTRCM11	E69	1.59	1.59	1.59	1.59	AMPS
HTRCM21	E70	1.54	1.54	1.54	1.54	AMPS
OSS	T3	0	0	1317	2503	RPM
TSS	T15	0	769	894	1761	RPM
O2S12	T24	(L) (M)	(D) (M)	(D) (M)	(D) (M)	DCV
O2S22	T25	0 (M)	(D) (M)	(D) (M)	(D) (M)	DCV
TFT	T29	1.5/135 (K)	1.5/136 (K)	1.2/154 (K)	1.2/156 (K)	DCV/DEG F
HTRCM12	T47	969	969	969	969	mA
HTRCM22	T48	957	957	957	957	mA
APP	PID	0	0	5.5	12.5	%
BARO	PID	14.92/160	14.92/160	14.92/160	14.92/160	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.54	1.62	4.85	8.47	DEG
ETC_DSD	PID	8	1.6	4.84	8.51	DEG
ETC_TRIM	PID	0.22	0.22	0.22	0.22	DEG
GEAR	PID	1	1	6	6	GEAR
LOAD	PID	40 (L)	40	20	27	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	670	1026	1828	RPM
VSS	PID	0	0	30	55	MPH

	PCM	**Measured/PID Values**				

Actuators/Outputs	Pin/PID only	KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	Units Measured/PID
FP	B12	75/OFF	26/ON	26/ON	27/ON	%/ON-OFF
EVAPCV	B13	0/OFF (M)	0/OFF (M)	0/OFF (M) (R)	0/OFF (M) (R)	%/ON-OFF
HTR13	B38	ON (M) (O)	ON (M)	ON (M)	ON (M)	ON/OFF
PTOIL	B42	OFF	OFF	OFF	OFF	ON/OFF
TCIL	B43	OFF	OFF	OFF	OFF	ON/OFF
EVMV	E1	0/OFF	0/OFF	697/ VARYING	758/ VARYING	mA/OFF-VARYING
PCVHC	E2	0	0	0	0	%
WAC/ACCR	E3	OFF	ON	OFF	OFF	ON/OFF
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
HTR12	T47	ON (M) (O)	ON (M)	ON (M)	ON (M)	ON/OFF
HTR22	T48	ON (M) (O)	ON (M)	ON (M)	ON (M)	ON/OFF
CHTIL	PID	OFF	OFF	OFF	OFF	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
LONGFT1	PID	(L)	(-)20-(+) 20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+) 20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+) 10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+) 10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	13.5	33.5	26-34	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV

VREF	E57	5	5	5	5	DCV

5.4L 3V EXPEDITION/NAVIGATOR

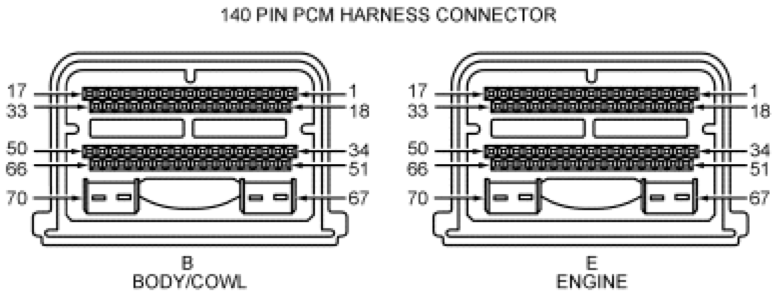


Fig. 25: Identifying 140 Pin PCM Harness Connectors/Terminals
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
GENMON	B23	0	25.78	22.66	4.68	%
APP1	B25	4.0	4.0	3.7	3.4	DCV
APP2	B26	1.5	1.5	1.7	2.0	DCV
APP3	B27	0.9	0.9	1.1	1.4	DCV
O2S12	B39	(L)	(D)	(D)	(D)	DCV
O2S22	B40	(L)	(D)	(D)	(D)	DCV
MAF	B41	0	0.77	1.56	1.75	DCV
IAT	B43	2.43/93.2 (K)	2.72/82.4 (K)	3.85/33.8 (K)	3.85/33.8 (K)	DCV/DEG F
FTP	B44	2.6/0	2.6/0	2.6/0	2.6/0	DCV/PSI
FTP_H2O	B44	0	0	-0.24	-1.86	in-Hg
BOO	B46	OFF	OFF	OFF	OFF	ON/OFF
BPA	B47	OFF	OFF	OFF	OFF	ON/OFF
O2S21	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S11	E29	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
KNOCK 2	E31	0	283	322	396	N/A
CHT	E41	0.57/196	0.56/198	3.63/194	3.5/204	DCV/DEG F
KNOCK 1	E49	0	174	323	413	N/A
TP2	E60	25.1/1.26	14.9/0.74	18.82/0.92	26.7/1.34	%/DCV
TP1	E61	18/4	12.9/4.3	14.9/4.2	22/3.9	%/DCV
ACCS	PID	OFF	OFF	OFF	OFF	ON/OFF

APP	PID	0	0	11	15	%
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
BARO	PID	160.4/14.97	160.4/14.97	160.4/14.97	160.4/14.97	Hz/PSI
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.56	1.39	6.65	7.75	DEG
ETC_DSD	PID	7.62	1.34	5.65	7.66	DEG
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	5	6	GEAR
LOAD	PID	61.9 (L)	14.3	20.5	38.2	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
TCS	PID	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
RPM	PID	0	695	1516	1497	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
HTR12	B10	OFF	ON	ON	ON	ON/OFF
HTRCM12	B10	895	895	895	895	mA
HTR22	B11	OFF	ON	ON	ON	ON/OFF
HTRCM22	B11	887	887	887	887	mA
WAC/ACCR	B18	OFF	OFF	OFF	OFF	ON/OFF
GENCMD	B22	6.08	57.54 (Q)	57.67 (Q)	57.65 (Q)	%
PTO	B26	OFF	OFF	OFF	OFF	ON/OFF
EVMV	B50	0/OFF	0/OFF	192/ VARYING	633/ VARYING	mA/OFF-VARYING
EVAPCV	B61	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
FP	B62	0/OFF	100/ON	100/ON	100/ON	%/ON-OFF
IMRC	E50	OFF	OFF	OFF	OFF	ON/OFF
HTR11	E69	OFF	ON	ON	ON	ON/OFF
HTRCM11	E69	512	512	512	512	mA
HTR21	E70	OFF	ON	ON	ON	ON/OFF
HTRCM21	E70	527	527	527	527	mA
CHT_F	PID	NO FAULT	NO FAULT	NO FAULT	NO FAULT	FAULT/NO FAULT

EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAPSOAK	PID	NO	NO	YES	YES	YES/NO
EVAPSTA	PID	NOT RUNNING	NOT RUNNING	NOT RUNNING	NOT RUNNING	STATUS
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	14.8	34	36	DEG
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
VCTADV	PID	0	-0.31	35	56.56	DEG
VCTADV2	PID	0	0.62	32.63	55.94	DEG
VCTADVERR	PID	0	0.31	-1.31	-1.56	DEG
VCTADVERR2	PID	0	-0.62	0.06	-0.95	DEG
VCTDC	PID	0	0	39.69	38.85	%
VCTDC2	PID	0	0	41.39	40.34	%

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VREF	E57	5	5	5	5	DCV
VPWR	B51/52/53	VBAT	VBAT	VBAT	VBAT	DCV

5.4L 3V F-SUPER DUTY

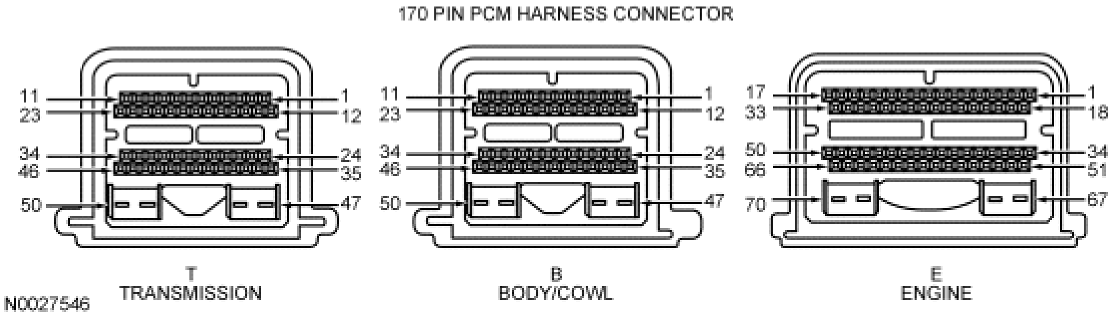


Fig. 26: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
SMC_MON	B2	OFF	OFF	OFF	OFF	ON/OFF
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.3/-0.07 (M)	2.1/-0.13 (M)	DCV/PSI
FTP_H2O	B3	2.6/0 (M)	2.6/0 (M)	2.3/-0.07 (M)	2.1/-0.13 (M)	DCV/PSI
APP1	B5	4.1	4.1	3.9	3.4	DCV
PTOIR_V	B7	VBAT	VBAT	VBAT	VBAT	DCV
BOO	B8	VBAT/OFF	0.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
APP2	B17	1.5	1.5	1.8	2.0	DCV
FPM	B21	0.1-VBAT	0.1-VBAT	0.1-VBAT	0.1-VBAT	DCV
PTO	B26	OFF	OFF	OFF	OFF	ON/OFF
TCS (A/T)	B27	0.1/NOT DEPRESSED	VBAT/ DEPRESSED (G)	0.1/NOT DEPRESSED	0.1/NOT DEPRESSED	DCV/ DEPRESSED-NOT DEPRESSED
APP3	B28	0.9	0.9	1.20	1.4	DCV
TCSS/VSS	B29	0	0	30	55	MPH
CPP/PNP (M/T)	B34	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
BPA	B65	OFF	OFF	OFF	OFF	ON/OFF
WAC/ACCR	E3	OFF	OFF	OFF	OFF	ON/OFF
ACCS	E4	OFF	OFF	OFF	OFF	ON/OFF
SPKDUR_8	E9	0	1.7	1.3	1.1	ms
SPKDUR_5	E10	0	1.1	1.1	1.2	ms
SPKDUR_2	E11	0	1.6	1.5	1.3	ms
SPKDUR_3	E12	0	1.8	1.2	1.2	ms
SPKDUR_4	E14	0	1.6	1.4	1.6	ms
SPKDUR_6	E15	0	1.7	1.1	1.2	ms
SPKDUR_7	E16	0	1.7	1.2	1.0	ms
SPKDUR_1	E17	0	1.6	1.3	1.4	ms
FRT	E19	2.5/93 (K)	2.6/90 (K)	3.1/72 (K)	3.1/72 (K)	DCV/DEG F
IAT	E22	2.6/86 (K)	2.9/73 (K)	3.7/43 (K)	3.7/41 (K)	DCV/DEG F
MAF (A/T)	E25	0	0.8	1.45	1.77	DCV
MAF (M/T)	E25	0	0.83-0.91	1-1.6	1.7-2.4	DCV
KNOCK 2	E31	0	65	74	141	N/A
FRP	E32	3.5/53	2.8/40	2.8/40	2.7/39	DCV/PSI

CHT	E41	3.6/188	3.6/201	3.6/201	3.4/210	DCV/DEG F
HTRCM12	E47	844	844	844	844	mA
HTRCM22	E48	871	871	871	871	mA
KNOCK 1	E49	0	72	78	141	N/A
IMRC1M	E50	5.0	5.0	5.0	0	DCV
TP2	E60	1.2/27	0.7/17	1.1/25/21	1.7	DCV/%
TP1	E61	4.1/13	4.3/18	4.1/17	3.8/15	DCV/%
HTRCM21	E70	1.33	1.33	1.33	1.33	mA
OSS (A/T)	T3	0	0	1185	2224	RPM
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0	(D)	(D)	(D)	DCV
TFT (A/T)	T29	1.5/136 (K)	1.5/136 (K)	1.2/154 (K)	1.4/156 (K)	DCV/DEG F
ACP	PID	OPEN (OK)	OPEN (OK)	OPEN (OK)	OPEN (OK)	OPEN/ CLOSED
APP	PID	NO PEDAL	NO PEDAL	NO PEDAL	NO PEDAL	YES/NO PEDAL
BARO	PID	156	156	159	157	Hz
CAT_EVAL	PID	YES	YES	YES	YES	YES/NO
CHTIL	PID	OFF	OFF	OFF	OFF	ON/OFF
CPP/PNP (A/T)	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EONV_RDY	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAPSOAK	PID	NO	YES	YES	YES	YES/NO
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FLI	PID	89 (H)	88 (H)	85 (H)	95 (H)	%
FUELSYS	PID	OPEN LOOP	OPEN LOOP	OPEN LOOP	OPEN LOOP	OPEN/ CLOSED LOOP
LOAD	PID	61	15	23	29	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
MP_LRN	PID	YES	YES	YES	YES	YES/NO
O2S_EVAL	PID	YES	YES	YES	YES	YES/NO
PTOLOAD	PID	NO	NO	NO	NO	YES/NO
RPM	PID	0	722	1288	1565	RPM
VCTADVERR	PID	0	-0.56°	-5.12°	-0.93°	DEG
VCTADVERR2	PID	O	-1.06°	-2.56°	-0.50°	DEG

VCTSYS	PID	OL	CL	CL	CL	OPEN/ CLOSED
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	75/ON	20.4/ON	22.58/ON	24.67/ON	%/ON-OFF
EVAPCV	B13	0%/OFF	0%/OFF	0%/OFF (R)	0%/OFF (R)	%/ON-OFF
PTOIL	B42	OFF	OFF	OFF	OFF	ON/OFF
PCVHC	E2	0	0	0	0	%
WAC/ACCR	E3	0.1/OFF	VBAT/ON (A)	0.1/OFF	0.1/OFF	DCV/ON-OFF
IMRC	E50	OFF	OFF	OFF	OFF	ON/OFF
VCTDC	E67	0	0	42	43.1	DCV
VCTDC2	E68	0	0	39.8	39.3	DCV
HTRCM11	PID	1.33	1.33	1.33	1.33	mA
HTRCM12	PID	844	844	844	844	mA
HTRCM21	PID	1.33	1.33	1.33	1.33	mA
HTRCM22	PID	871	871	871	871	mA
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
VCTADV	PID	0	0.56	44.69	-0.37	DEG
VCTADV2	PID	0	1.06	45.19	0.68	DEG
O2SHTR_ EVAL	PID	YES	YES	YES	YES	YES/NO
ETC_DSD	PID	7.62	1.36	2.61	8.26	DEG
FRP_DSD	PID	49.99	40	40	40	PSI
RPM_DSD	PID	640	640	624	624	RPM
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	12.25	37	37.2	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
APPVREF	B4/16	5	5	5	5	DCV
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
BVREF	E57	5	5	5	5	DCV

TPVREF	E66	5	5	5	5	DCV

6.8L 3V F-SUPER DUTY

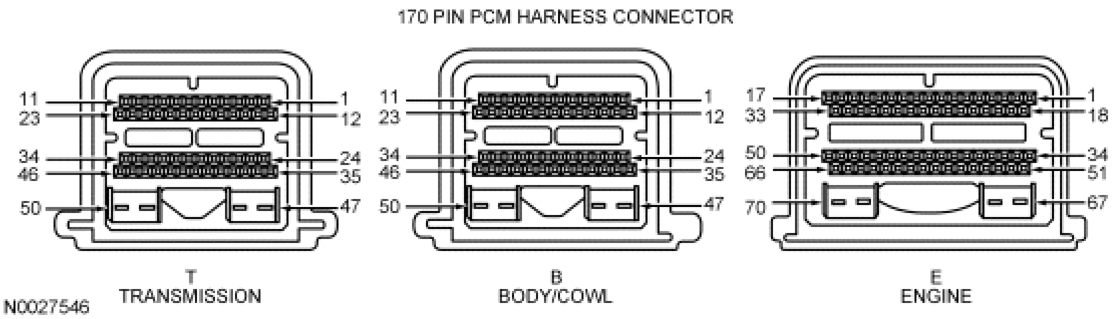


Fig. 27: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.6/0 (M)	1.6/-0.26 (M)	DCV/PSI
APP1	B5	4	4	3.9	3.7	DCV
PTOIR V	B7	0.02	0.02	0.02	0	DCV
BOO	B8	VBAT/OFF	0.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
PTO LOAD	B9	NO	NO	NO	NO	YES/NO
HO2S13	B14	0 (M)	(D) (M)	(D) (M)	(D) (M)	DCV
APP2	B17	1.5	1.5	1.6	1.8	DCV
FPM	B21	0.1-VBAT	0.1-VBAT	0.1-VBAT	0.1-VBAT	DCV
PTO	B26	OFF	OFF	OFF	OFF	ON/OFF
TCS (A/T)	B27	0.1/OFF	VBAT/ON (G)	0.1/OFF	0.1/OFF	DCV/ON-OFF
APP3	B28	1	1.1	1.3	1.5	DCV
VSS	B29	0	0	30	55	MPH
CPP BT (M/T)	B34	OPEN	OPEN	OPEN	OPEN	OPEN/ CLOSED
ACCS	E4	0.1/OFF	VBAT/ON (A)	0.1/OFF	0.1/OFF	DCV/ON-OFF
FRT	E19	2.5/97 (K)	2.5/93 (K)	2.9/79 (K)	3/79 (K)	DCV/DEG F
IAT	E22	2.9/73 (K)	3.3/59 (K)	3.7/45 (K)	3.7/43 (K)	DCV/DEG F
MAF (A/T)	E25	0	1.1	1.2	2.1	DCV
MAF (M/T)	E25	0	1.1	1.2	2.1	DCV
HO2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV

HO2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV
KNOCK 2	E31	32770	206	245	303	N/A
FRP	E32	3.5/53	3.7/39	3.7/39	2.7/39	DCV/PSI
CHT	E41	0.61/192.2	0.6/194	3.58/201.2	3.56/204.8	DCV/DEG F
CMP	E45	0	6.5-10	10-13	13-16	Hz
CKP	E47	0	420-520	800-1050	1100-1300	Hz
KNOCK 1	E49	32770	205	212	319	N/A
TP2	E60	1.3	0.9	1	1.4	DCV
TP1	E61	4.1	4.3	4.2	4	DCV
BPA	E65	0.1/OFF	VBAT/ON (E)	0.1/OFF	0.1/OFF	DCV/ON-OFF
OSS	T3	0	0	1194	2278	RPM
ISS	T4	0	782	860	1623	RPM
TSS	T15	0	782	860	1623	RPM
HO2S12	T24	(L) (M)	(D) (M)	(D) (M)	(D) (M)	DCV
HO2S22	T25	0 (M)	(D) (M)	(D) (M)	(D) (M)	DCV
TFT (A/T)	T29	1.6/132 (K)	1.5/136 (K)	1.1/154 (K)	1.1/158 (K)	DCV/DEG F
CPP/PNP (A/T)	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
GEAR (A/T)	PID	1	1	6	6	GEAR
LOAD	PID	63 (L)	18	17	35	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
RPM	PID	0	654	1127	1618	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VSO	B1	0	0	65	125	Hz
SMC	B2	0	0	0	0	DCV
FP	B12	75	20	20.8	21.3	%
EVAPCV	B13	VBAT/0 (M)	VBAT/0 (M)	VBAT/0 (M) (R)	VBAT/0 (M) (R)	DCV/%
CTO	B25	0	55-65	110-130	140-175	Hz
PTOIL	B42	OFF	OFF	OFF	OFF	ON/OFF
TCIL (A/T)	B43	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
EVAPPDC	E1	0	0/0	0/0	0/0	Hz/%
PCVHC	E2	0 (M)	0 (M)	0 (M)	0 (M)	%
WAC/ACCR	E3	VBAT/OFF	0.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
CDD (CYL 10)	E8	VBAT	VBAT	VBAT	VBAT	DCV
CDH (CYL 8)	E9	VBAT	VBAT	VBAT	VBAT	DCV
CDC (CYL 5)	E10	VBAT	VBAT	VBAT	VBAT	DCV

CDE (CYL 2)	E11	VBAT	VBAT	VBAT	VBAT	DCV
CDG (CYL 3)	E12	VBAT	VBAT	VBAT	VBAT	DCV
CDJ (CYL 9)	E13	VBAT	VBAT	VBAT	VBAT	DCV
CDI (CYL 4)	E14	VBAT	VBAT	VBAT	VBAT	DCV
CDB (CYL 6)	E15	VBAT	VBAT	VBAT	VBAT	DCV
CDF (CYL 7)	E16	VBAT	VBAT	VBAT	VBAT	DCV
CDA (CYL 1)	E17	VBAT	VBAT	VBAT	VBAT	DCV
TACM (+)	E34	3.7	VBAT	VBAT	VBAT	DCV
TACM (-)	E51	3.7	VBAT	VBAT	VBAT	DCV
IMTV	E64	0	0	0	VBAT	DCV
HTR11	E69	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
HTR21	E70	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
HTR12	T47	0.2/ON (M) (O)	0.2/ON (M)	0.2/ON (M)	0.2/ON (M)	DCV/ON-OFF
HTR22	T48	0.2/ON (M) (O)	0.2/ON (M)	0.2/ON (M)	0.2/ON (M)	DCV/ON-OFF
CHTIL	PID	OFF	OFF	OFF	OFF	ON/OFF
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	13.75	29.5	27.25	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
APVREF	B4/16	5	5	5	5	DCV
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
KAPWR	B45	VBAT	VBAT	VBAT	VBAT	DCV
BVREF	E57	5	5	5	5	DCV
TPVREF	E66	5	5	5	5	DCV
VBPWR	T39	VBAT	VBAT	VBAT	VBAT	DCV

2008 ENGINE PERFORMANCE

Symptom Charts - Gasoline Engines

DIAGNOSTIC TESTS

PINPOINT TEST QT: POWERTRAIN CONTROL MODULE (PCM) QUICK TEST

QT1 CARRY OUT THE PCM QUICK TEST

NOTE:	**If the vehicle was brought in with an emission compliance concern, refer to PINPOINT TEST EM - EMISSION COMPLIANCE .**

NOTE:	**For applications that use a stand-alone transmission control module (TCM), the PCM does not output TCM related diagnostic trouble codes (DTCs). Refer to the Workshop Manual Section 307-01, Automatic Transaxle/Transmission, diagnostic strategy to continue diagnosis.**

NOTE:	**If unable to access the PCM DTCs, or a scan tool communication concern exists, refer to PINPOINT TEST QA - UNABLE TO ACTIVATE SELF-TEST/NETWORK COMMUNICATION ERROR . For additional information on retrieving malfunction indicator lamp (MIL) and non-MIL DTCs, refer toQUICK TEST DESCRIPTION for the Continuous Memory Self-Test.**

- Complete the preliminary checks looking for obvious concerns that may relate to the symptom. Check for the following items:
  - fuses
  - electrical circuits and connectors
  - vacuum lines (leaks, routing)
  - air intake system (leaks, restrictions)
  - fuel quality (octane, contamination, winter/summer blend)
  - cooling system (engine operating at correct temperature)
- Access any related On-line Automotive Service Information System (OASIS) or Technical Service Bulletin (TSB) information (if available).
- Carry out the PCM self-test to access any DTCs. Record any key on engine off (KOEO), key on engine running (KOER) (if the engine runs) and continuous memory (MIL and non-MIL) DTCs.
- **Are any DTCs present?**

Yes	No
GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** for direction to repair DTCs after noting the following: DIAGNOSE the DTCs in the following order (begin	

diagnosis with the first DTC output in that mode and diagnose any circuit related DTCs first). For multiple circuit DTCs that are set as a result of a concern with more than one component, REFER to the Wiring Diagrams Manual Electronic Engine Controls Cell and identify the common cause such as SIGRTN, VREF, or VPWR. Continue DTC diagnosis by referring to the appropriately identified pinpoint test. Any KOEO self-test DTCs Any KOER self-test DTCs Any continuous memory self-test DTCs. Retrieve any available freeze frame data and disregard any identical/related continuous DTCs already repaired.	GO to **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** for direction to the correct symptom chart in **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHARTS**. If the symptom is not listed, REFER to the applicable Workshop Manual Section to continue diagnosis.

NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX

Driveability

System/Symptom		Chart Number
Starting Concerns	Hard Start/Long Crank/Erratic Start/Erratic Crank	**CHART NUMBER: 2**
	No crank	**CHART NUMBER: 23**
	No start (engine cranks)	**CHART NUMBER: 3**
Unique Idle Concerns	Slow return to idle	**CHART NUMBER: 4**
	Rolling idle	**CHART NUMBER: 1**
	Fast idle	**CHART NUMBER: 5**
	Low/Slow idle	**CHART NUMBER: 6**

Driveability - Performance While Driving Concerns

System/Symptom		Chart Number
Stalls/Quits	Idle/Acceleration/Cruise	**CHART NUMBER: 1**
	Deceleration	**CHART NUMBER: 6**
	Stall after start	**CHART NUMBER: 1**
Runs Rough		**CHART NUMBER: 1**
Misses		**CHART NUMBER: 1**
Buck/Jerk		**CHART NUMBER: 1**
Hesitation/Stumble		**CHART NUMBER: 1**
Surge		**CHART NUMBER: 1**
Backfires		**CHART NUMBER: 7**
Lack/Loss of Power		**CHART NUMBER: 8**

Spark Knock	**CHART NUMBER: 9**

Note: OASIS identifiers (the x means any number (1-9) can be used) xxx4xx equals during idle, xxx5xx equals during acceleration, xxx6xx equals during cruise, xxx7xx equals during deceleration.

Additional Driveability Concerns

System/Symptom	Chart Number
Diesels/Runs On	**CHART NUMBER: 5**
Poor Fuel Economy	**CHART NUMBER: 10**
Emissions Compliance	**CHART NUMBER: 11**

Electrical

System/Symptom		Chart Number
Warning Indicators	Malfunction indicator lamp (MIL)	**CHART NUMBER: 12**
	Transmission control indicator lamp (TCIL)	**CHART NUMBER: 12**
	Power take off (PTO)	**CHART NUMBER: 12**
	Temperature warning indicator or gauge (for vehicles equipped with a cylinder head temperature (CHT) sensor only)	**CHART NUMBER: 12**
	Check fuel cap indicator	**CHART NUMBER: 12**
	Powertrain malfunction indicator (wrench)	**CHART NUMBER: 12**
Climate Control	Lack of A/C cooling, A/C not functioning	**CHART NUMBER: 21**
	A/C always on or A/C compressor runs continuously	**CHART NUMBER: 21**
Instrumentation	Tachometer inoperative	**CHART NUMBER: 14**
	Speedometer/odometer inoperative	**CHART NUMBER: 14**
	Boost gauge indicates higher than normal boost	**CHART NUMBER: 14**
	Fuel gauge inoperative	**CHART NUMBER: 14**

Engine

System/Symptom		Chart Number
Oil System Concerns	High oil consumption	**CHART NUMBER: 15**
	Leaks	**CHART NUMBER: 15**
Cooling System Concerns	Electric cooling fan(s) does not operate (low, medium, high or variable speed)	**CHART NUMBER: 16**
	Cooling fan clutch does not operate	**CHART NUMBER: 16**
	Electric cooling fan(s) always runs	**CHART NUMBER: 17**
Exhaust System Concerns	Visible smoke	**CHART NUMBER: 18**
	Odor (sulfur or rotten egg smell)	**CHART NUMBER: 22**
Fuel System Concerns	Odor, engine compartment	**CHART NUMBER: 19**
Engine Noise (under hood)		**CHART NUMBER: 20**

Driveline

System/Symptom		Chart Number
Automatic Transmission (A/T) Shift Concerns	Upshift	**CHART NUMBER: 13**
	Downshift	**CHART NUMBER: 13**
	Engagement	**CHART NUMBER: 13**

Power Take Off (PTO)

System/Symptom		Chart Number
PTO Concerns	Not working correctly	**CHART NUMBER: 12**

NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHARTS

CHART 1

- Stalls/Quits: Idle, Acceleration, Cruise, Stall After Start
- Runs Rough
- Misses
- Buck/Jerk
- Hesitation/Stumble
- Surge
- Unique Idle Concerns: Rolling Idle

NOTE: For some vehicle applications, the engine may stall if left running while refueling. Advise the customer to turn the engine off while refueling to avoid contamination or damage to the evaporative emission (EVAP) system.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Check the following parameter identifiers (PIDs): • DPFEGR (if equipped) (hot idle value within 0.15 volt of the key ON, engine OFF	**DPFEGR PID value not within 0.15 volt of key ON, engine OFF value:** • For vehicles equipped with an exhaust gas recirculation system module (ESM), refer to **PINPOINT TEST HH - Exhaust Gas Recirculation System Module (ESM)** . • For all others, refer to **PINPOINT TEST HE - Exhaust Gas Recirculation (EGR) Systems** . **LONGFT1/LONGFT2 value low (-):** Continue diagnosis. Concentrate checks in areas that would cause the engine to run

value) • LONGFT1/LONGFT2 (value between -20 and +20%) • VPWR (value between 10.5 and 17.0 volts, and within 0.5 volt of battery voltage)	rich. **LONGFT1/LONGFT2 value high (+):** Continue diagnosis. Concentrate checks in areas that would cause the engine to run lean. **VPWR not between 10.5 and 17.0 volts:** REFER to the Workshop Manual Section 414-00, Charging System and carry out the Inspection and Verification to continue diagnosis. **VPWR between 10.5 and 17.0 volts, but not within 0.5 volt of battery voltage:** CHECK the B+ voltage to the powertrain control module (PCM) power relay. CHECK the VPWR circuit between the PCM and the PCM power relay. CHECK the PWR GND circuits.
For vehicles that run rough at idle: Check the INJx_F PIDs (the "x" indicates the injector number) with the key ON, engine OFF. There is 1 INJx_F PID for each engine cylinder. All INJx_F PIDs must indicate no fault (or NO).	The INJx_F PID(s) indicate a fault (an injector circuit concern is indicated), refer to **PINPOINT TEST KG - Fuel Injector** .
Mass Air Flow (MAF) Sensor	refer to **PINPOINT TEST DC - Mass Air Flow (MAF) Sensor** .
Secondary Ignition System	For vehicles equipped with a coil pack ignition system, refer to **PINPOINT TEST JC - Secondary Ignition (Coil Pack)** . For all others, refer to **PINPOINT TEST JB - Secondary Ignition (COP)** .
Fuel Delivery System	refer to **PINPOINT TEST HC - Fuel Delivery System** .
Exhaust System	refer to **PINPOINT TEST HF - Catalyst Efficiency Monitor and Exhaust Systems** .
Positive Crankcase Ventilation (PCV) System	refer to **PINPOINT TEST HG - Positive Crankcase Ventilation (PCV) System** .
EVAP System	refer to **PINPOINT TEST HX - Evaporative Emission (EVAP) Monitor and System** .
Charging System	refer to **PINPOINT TEST HY - Generator/Regulator System** .

Heated Oxygen Sensor (HO2S) (for Taurus, Taurus X, Sable PZEVs)	refer to **PINPOINT TEST DZ - Universal Heated Oxygen Sensor (HO2S)** .
Automatic Transmission	REFER to the Workshop Manual Section 307-01, Automatic Transmission/Transaxle diagnostic strategy to continue diagnosis.
Base Engine	REFER to the Workshop Manual Section 303-00, Engine System and carry out the Inspection and Verification to continue diagnosis.
Intake Air System	refer to **PINPOINT TEST HU - Intake Air Systems** .
A/C Pressure (ACP) Transducer Sensor	refer to **PINPOINT TEST DS - Air Conditioning Pressure (ACP) Sensor** .
Additional Testing	refer to **PINPOINT TEST Z - Intermittent** .
Additional Checks: • Some vehicles have a TQ_CNTRL PID available. Check this PID to determine if the PCM is reducing torque, and if so, why the torque is being reduced. As a PID display example; 0 equals no torque reduction requested, 1 equals torque truncation, which cuts fuel to protect when line pressure falls to minimum limit and 2 equals traction control event, which cuts fuel/spark for traction control. • Correct PCM vehicle identification (VID) block information. Refer to Section 2, **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** to carry out the Making Changes to the VID Block procedure. • Be aware of engine RPM/speed limiting functions of the PCM (look for incorrect high vehicle speed signal from ABS, VSS, or OSS). • Verify the fuel filler cap is correctly tightened or the capless fuel tank filler pipe is correctly sealed and not physically damaged. • Driveline	REFER to the applicable Workshop Manual section.

- Manual transmission/clutch - Charging system - Traction control system (if equipped) - A/C system (for surge with A/C on) - Speed control system (for surge with speed control on) - A/C compressor diode, if equipped (for rolling idle)	

CHART 2

- Starting Concerns: Hard Start/Long Crank/Erratic Start/Erratic Crank

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Battery Condition and Current Draw	Visual. REFER to the Workshop Manual Section 414-00, Charging System and carry out the Inspection and Verification to continue diagnosis.
Secondary Ignition System	For vehicles equipped with a coil pack ignition system, refer to **PINPOINT TEST JC - Secondary Ignition (Coil Pack)** . For all others, refer to **PINPOINT TEST JB - Secondary Ignition (COP)** .
Fuel Delivery System	refer to **PINPOINT TEST HC - Fuel Delivery System** .
Exhaust System	refer to **PINPOINT TEST HF - Catalyst Efficiency Monitor and Exhaust Systems** .
PCV System	refer to **PINPOINT TEST HG - Positive Crankcase Ventilation (PCV) System** .
EVAP System	refer to **PINPOINT TEST HX - Evaporative Emission (EVAP) Monitor and System** .
Intake Air System	refer to **PINPOINT TEST HU - Intake Air Systems** .
Starting System	REFER to the Workshop Manual Section 303-06, Starting System and diagnose the engine cranks slowly

	symptom.
MAF Sensor	refer to **PINPOINT TEST DC - Mass Air Flow (MAF) Sensor** .
Additional Testing	refer to **PINPOINT TEST Z - Intermittent** .
Additional Checks: • For vehicles equipped with 2 camshaft position (CMP) sensors, verify the CMP1 and CMP2 circuits are not shorted together.	Visual

CHART 3

- Starting Concerns: No Start (Engine Cranks)

NOTE: An extended crank because of a no start may load the exhaust system with raw fuel, damaging the catalytic converter after the engine starts. For vehicles equipped with a secondary air injection (AIR) system, carry out the following after the no start concern is repaired: Disconnect the electric AIR pump relay, run the engine until the surplus fuel is used up, and connect the relay. Disconnecting the relay may set a continuous memory PCM DTC that needs to be cleared.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Add-on Anti-Theft Devices	Visual. CHECK with the customer.
Fuel/Ignition	refer to **PINPOINT TEST A - No Start** .
Intake Air System (for vehicles equipped with an IAC valve). If the engine will not start at closed throttle, but will start and run normally at part throttle, check the IAC valve.	refer to **PINPOINT TEST KE - Idle Air Control (IAC) Valve** .
Exhaust System Restrictions	refer to **PINPOINT TEST HF - Catalyst Efficiency Monitor and Exhaust Systems** .
Base Engine	REFER to the Workshop Manual Section 303-00, Engine System and carry out the Inspection and Verification to continue diagnosis.
Additional Testing	refer to **PINPOINT TEST Z - Intermittent** .

CHART 4

- Unique Idle Concerns: Slow Return To Idle

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Vacuum Leaks, Throttle Body	Visual
PCV System	refer to **PINPOINT TEST HG - Positive Crankcase Ventilation (PCV) System** .
Intake Air System Leaks (for vehicles equipped with an IAC valve)	refer to **PINPOINT TEST HU - Intake Air Systems** .

CHART 5

- Unique Idle Concerns: Fast Idle
- Diesels/Runs On

NOTE: **If the vehicle runs normally with the key in the OFF position, check for a damaged ignition switch, an IGN START/RUN or ISP-R circuit short to voltage, or a VPWR circuit short to voltage.**

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Base Engine Check for air leaks, including correct sealing of intake manifold and components/vacuum lines attached to intake air (such as the PCV, EGR or IAC valve/vacuum lines).	Visual. REFER to the Workshop Manual Section 303-00, Engine System and carry out the Inspection and Verification to continue diagnosis.
Verify the engine operates at normal temperature.	Visual. REFER to the Workshop Manual Section 303-03, Engine Cooling or **No Diagnostic Trouble Codes (DTCs) Present Symptom Chart Index**, to diagnose any cooling system concerns that are present.
Fast idle concerns (for vehicles equipped with an IAC valve)	TP MODE PID is not C/T with the throttle closed: At vehicle start, the TPREL begins at about 1.25 volts and counts down to the lowest TP voltage value seen since engine start. If the TP voltage value goes below the normal range, then increases again, TPREL sets to the lower voltage.

With the key ON, engine OFF monitor the TP MODE PID while wiggling the TP sensor circuits. The TP MODE PID can also be monitored during vehicle drive. With the throttle closed, the TP MODE PID must be C/T (closed throttle).	If the TP voltage is about 0.04 volt greater than the TPREL value at closed throttle, the PCM goes into part throttle mode. MONITOR the TP voltage and TPREL PIDs for sudden changes while checking for intermittent TP circuit/connector concerns. CHECK for loose or worn throttle plates. If no concern is found, refer to **PINPOINT TEST Z - Intermittent** .
Intake Air System Leaks (for vehicles equipped with an IAC valve)	refer to **PINPOINT TEST HU - Intake Air Systems** .
Additional Testing	refer to **PINPOINT TEST Z - Intermittent** .

CHART 6

- Unique Idle Concerns: Low/Slow Idle
- Stalls/Quits: Deceleration

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Verify the fuel filler cap is correctly tightened or the capless fuel tank filler pipe is correctly sealed.	Visual
Automatic Transmission (stalls/quits on deceleration)	REFER to the Workshop Manual Section 307-01, Automatic Transmission/Transaxle to diagnose the torque convertor operation concerns.
Fuel Delivery System	refer to **PINPOINT TEST HC - Fuel Delivery System** .
Intake Air System	refer to **PINPOINT TEST HU - Intake Air Systems** .
Charging System	refer to **PINPOINT TEST HY - Generator/Regulator System** .
Heated Oxygen Sensor (HO2S) (for Taurus, Taurus X, Sable PZEVs)	refer to **PINPOINT TEST DZ - Universal Heated Oxygen Sensor (HO2S)** .
Base Engine	REFER to the Workshop Manual Section 303-00, Engine System and carry out the Inspection and Verification to continue diagnosis.
Additional Testing	refer to **PINPOINT TEST Z - Intermittent** .

CHART 7

- Backfires

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Secondary Ignition	For vehicles equipped with a coil pack ignition system, refer to **PINPOINT TEST JC - Secondary Ignition (Coil Pack)** . For all others, refer to **PINPOINT TEST JB - Secondary Ignition (COP)** .
Fuel Delivery System	refer to **PINPOINT TEST HC - Fuel Delivery System** .
Base Engine	REFER to the Workshop Manual Section 303-00, Engine System and carry out the Inspection and Verification to continue diagnosis.
Exhaust System	refer to **PINPOINT TEST HF - Catalyst Efficiency Monitor and Exhaust Systems** .
Additional Testing	refer to **PINPOINT TEST Z - Intermittent** .

CHART 8

- Lack/Loss of Power

NOTE: **Verify the symptom is reported under normal driving conditions without excessive engine or vehicle load. Also, be aware of the engine RPM/speed limiting functions of the PCM.**

NOTE: **For vehicles equipped with a knock sensor, a lack of power may result when the vehicle is operated with a breakout box installed at the PCM. The knock sensor circuits are not shielded in the breakout box, and knock sensor signal noise may be noticed by the PCM. If this happens, spark timing is retarded and a lack of power may result.**

NOTE: **For applications with a knock sensor, a lack of power may result if the engine has developed an abnormal noise. The knock sensors may interpret some abnormal noise as detonation and retard spark timing.**

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)

Automatic Transmission Fluid	Visual
Throttle Linkage	Visual
Air Cleaner Element	Visual
Check the following PIDS: • LONGFT1/LONGFT2 (value between -20 and +20%) • IMTVF (if equipped): For both key ON, engine OFF and key ON, engine running with the transmission in PARK/NEUTRAL and the engine RPM greater than 3,000 RPM, the PID should indicate no fault (or NO) in both situations.	**LONGFT1/LONGFT2 value low (-):** Continue diagnosis. Concentrate checks in areas that would cause the engine to run rich. **LONGFT1/LONGFT2 value high (+):** Continue diagnosis. Concentrate checks in areas that would cause the engine to run lean. **IMTVF PID indicates a fault:** refer to **PINPOINT TEST HU - Intake Air Systems** .
Fuel Delivery System	refer to **PINPOINT TEST HC - Fuel Delivery System** .
Secondary Ignition	For vehicles equipped with a coil pack ignition system, refer to **PINPOINT TEST JC - Secondary Ignition (Coil Pack)** . For all others, refer to **PINPOINT TEST JB - Secondary Ignition (COP)** .
MAF Sensor	refer to **PINPOINT TEST DC - Mass Air Flow (MAF) Sensor** .
Exhaust System	refer to **PINPOINT TEST HF - Catalyst Efficiency Monitor and Exhaust Systems** .
Variable Camshaft Timing (VCT) System	refer to **PINPOINT TEST HK - Variable Camshaft Timing (VCT)** .
Accelerator Pedal Position Sensor	refer to **PINPOINT TEST DK - Accelerator Pedal Position Sensor** .
Base Engine	REFER to the Workshop Manual Section 303-00, Engine System and carry out the Inspection and Verification to continue diagnosis.
Automatic Transmission	REFER to the Workshop Manual Section 307-01, Automatic Transmission/Transaxle diagnostic strategy to continue diagnosis.
Brake System Drag or Binding	REFER to the Workshop Manual Section 206-00, Brake System.

Supercharger Bypass System	refer to **PINPOINT TEST KJ - Supercharger Bypass Control** .
Additional Testing	refer to **PINPOINT TEST Z - Intermittent** .
Additional Checks: • Some vehicles have a TQ_CNTRL PID available. Check this PID to determine if the PCM is reducing torque, and if so, why the torque is being reduced. As a PID display example; 0 equals no torque reduction requested, 1 equals torque truncation, which cuts fuel to protect when line pressure falls to minimum limit, and 2 equals traction control event, which cuts fuel/spark for traction control. • Customer driving habits • Correct PCM vehicle identification (VID) block information. Refer to Section 2, **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** to carry out the Making Changes to the VID Block procedure. • Intake manifold runner control (IMRC) linkage (if equipped) • Clutch (M/T) • Charging system • Engine RPM/speed limiting functions of the PCM (look for incorrect high vehicle speed signal from ABS, VSS, or OSS)	Visual. REFER to the applicable Workshop Manual section.

CHART 9

- Spark Knock

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Verify the engine operates at normal temperature	Visual. REFER to the Workshop Manual Section 303-03, Engine Cooling or **No Diagnostic Trouble Codes (DTCs) Present Symptom Chart Index** to diagnose any cooling system concerns that are present.

Verify correct coolant level and coolant concentration	REFER to the Workshop Manual Section 303-03, Engine Cooling for correct coolant concentrations and fill procedures.
MAF Sensor	refer to **PINPOINT TEST DC - Mass Air Flow (MAF) Sensor** .
Base Engine	REFER to the Workshop Manual Section 303-00, Engine System and carry out the Inspection and Verification to continue diagnosis.
Fuel Delivery System	refer to **PINPOINT TEST HC - Fuel Delivery System** .
Secondary Ignition System	For vehicles equipped with a coil pack ignition system, refer to **PINPOINT TEST JC - Secondary Ignition (Coil Pack)** . For all others, refer to **PINPOINT TEST JB - Secondary Ignition (COP)** .
PCV System	refer to **PINPOINT TEST HG - Positive Crankcase Ventilation (PCV) System** .
Engine Oil Quality	Visual
Additional Testing	refer to **PINPOINT TEST Z - Intermittent** .

CHART 10

- Poor Fuel Economy

NOTE: **Driving styles may have a significant influence on fuel economy. Verify the concern before starting an in-depth diagnosis. If available, use the IDS fuel economy test to verify a concern is present. The following external factors may contribute to poor fuel economy:**

- stop and go driving
- incorrect tire pressure and size
- vehicle loads (such as trailer towing)
- extended winter warm-up conditions
- high speed driving
- incorrect axle ratio

- road/weather conditions
- aftermarket add-ons
- short run operations
- customer expectations

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Check the following PIDs: • LONGFT1/LONGFT2 (value between -20 and +20%) • VPWR (value between 10.5 and 17.0 volts, and within 0.5 volt of battery voltage)	**LONGFT1/LONGFT2 value low (-):** Continue diagnosis. Concentrate checks in areas that would cause the engine to run rich. **LONGFT1/LONGFT2 value high (+):** Continue diagnosis. Concentrate checks in areas that would cause the engine to run lean. **VPWR not between 10.5 and 17.0 volts:** REFER to the Workshop Manual Section 414-00, Charging System and carry out the Inspection and Verification to continue diagnosis. **VPWR between 10.5 and 17.0 volts, but not within 0.5 volt of battery voltage:** CHECK the B+ voltage to the PCM power relay. CHECK the VPWR circuit between the PCM and the PCM power relay. CHECK the PWR GND circuits.
Verify the engine operates at normal temperature.	Visual. REFER to the Workshop Manual Section 303-03, Engine Cooling to diagnose any cooling system concerns that are present.
Secondary Ignition System	For vehicles equipped with a coil pack ignition system, refer to **PINPOINT TEST JC - Secondary Ignition (Coil Pack)** . For all others, refer to **PINPOINT TEST JB - Secondary Ignition (COP)** .
Fuel System	refer to **PINPOINT TEST HC - Fuel Delivery System** .
Exhaust System	refer to **PINPOINT TEST HF - Catalyst Efficiency Monitor and Exhaust Systems** .
	refer to **PINPOINT TEST HK -**

Variable Camshaft Timing (VCT) System	**Variable Camshaft Timing (VCT)** .
Transmission Fluid Level	Visual
Automatic Transmission	REFER to the Workshop Manual Section 307-01, Automatic Transmission/Transaxle diagnostic strategy to continue diagnosis.
PCV System	refer to **PINPOINT TEST HG - Positive Crankcase Ventilation (PCV) System** .
Additional Checks: • Correct PCM VID block information. Refer to Section 2, **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** to carry out the Making Changes to the VID Block procedure. • Brake drag • Base engine concerns • Incorrect PCV valve • Contaminated MAF sensor • Intake air system	REFER to the applicable Workshop Manual section.
Additional Testing	refer to **PINPOINT TEST Z - Intermittent** .

CHART 11

- Emissions Compliance

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Emissions Related Systems	refer to **PINPOINT TEST EM - Emission Compliance** .

CHART 12

- Warning Indicators: Check Fuel Cap Indicator, Malfunction Indicator Lamp (MIL), Power Take Off (PTO), Temperature Warning Indicator or Gauge (applications with CHT sensor only), Transmission Control Indicator Lamp (TCIL), Powertrain Malfunction Indicator (Wrench)
- PTO Concerns: Not Working Correctly

NOTE:

- **If the symptom is both a MIL on and exhaust emission test failure, GO directly to Chart 11.**

- **If the engine is a no start, GO directly to Chart 3.**
- **If the engine runs rough at idle, GO directly to Chart 1.**

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Verify the fuel filler cap is correctly tightened or the capless fuel tank filler pipe is correctly sealed.	Visual
Check Fuel Cap Indicator • Never/always on	REFER to the Workshop Manual Section 413-01, Instrument Cluster to diagnose the check fuel cap indicator is never/always on or Section 413-08 Information and Message Center to diagnose the CHECK FUEL CAP warning is inoperative.
MIL • Always on when the engine is running (no DTCs present) • Never on (including during indicator prove out)	REFER to the Workshop Manual Section 413-01, Instrument Cluster and carry out the Inspection and Verification to continue diagnosis.
PTO • PTO indicator never/always on • PTO not working correctly	refer to **PINPOINT TEST FB - Power Take Off (PTO)** .
Temperature Warning Indicator or Gauge (applications with CHT sensor only) • Engine cooling system • Indicator circuits	For an engine that is overheating, REFER to the Workshop Manual Section 303-03, Engine Cooling to diagnose the engine overheating symptom. Be aware that since a PCM DTC is not present, the PCM is not attempting to activate the indicator. For an engine operating at normal temperature, refer to **PINPOINT TEST DL - Cylinder Head Temperature (CHT) Sensor** .
TCIL • Always on when the engine is running (no DTCs present) • Never on	For E-Series, refer to **PINPOINT TEST TB - Transmission Control Switch (TCS)/ Transmission Control Indicator Lamp (TCIL)** . For all others, REFER to the Workshop Manual Section 413-01, Instrument Cluster.
Powertrain Malfunction Indicator (Wrench)	REFER to the Workshop Manual Section 413-01, Instrument Cluster to diagnose the wrench indicator is never/always on or

• Never/always on	Section 413-08 Information and Message Center to diagnose the POWERTRAIN MALFUNCTION warning is inoperative .
Additional Testing	refer to **PINPOINT TEST Z - Intermittent** .

CHART 13

- Automatic Transmission (A/T) Shift Concerns: Upshift, Downshift, Engagement

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Transmission	REFER to the Workshop Manual Section 307-01, Automatic Transmission/Transaxle diagnostic strategy to continue diagnosis.
Additional Tests	refer to **PINPOINT TEST Z - Intermittent** .

CHART 14

- Instrumentation: Tachometer Inoperative, Speedometer/Odometer Inoperative, Boost Gauge Indicates Higher Than Normal Boost, Fuel Gauge Inoperative

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Tachometer Inoperative	REFER to the Workshop Manual Section 413-01, Instrument Cluster to diagnose the incorrect tachometer indication.
Speedometer/Odometer Inoperative	REFER to the Workshop Manual Section 413-01, Instrument Cluster to diagnose the inoperative speedometer/odometer.
Boost Gauge (for vehicles equipped with a supercharger) • Indicates higher than normal boost	For supercharger bypass control concerns, refer to **PINPOINT TEST KJ - Supercharger Bypass Control** . For charge air cooler (CAC) system concerns, refer to **PINPOINT TEST KP - Charge Air Cooler (CAC) Pump** .
Fuel Gauge Inoperative • Fuel gauge always indicates full or empty	REFER to the Workshop Manual Section 413-01, Instrument Cluster to diagnose the incorrect fuel gauge indication.
Instrumentation	REFER to the Workshop Manual Section 413-01, Instrument Cluster.

CHART 15

- Oil System Concerns: High Oil Consumption, Leaks

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
PCV System	refer to **PINPOINT TEST HG - Positive Crankcase Ventilation (PCV) System** .
Base Engine	REFER to the Workshop Manual Section 303-00, Engine System and carry out the Inspection and Verification to continue diagnosis.
Additional Checks • External leaks • Correct dipstick • Correct oil viscosity	Visual

CHART 16

- Cooling System Concerns: Electric Cooling Fan(s) Does Not Operate (Low, Medium, High or Variable Speed), Cooling Fan Clutch Does Not Operate

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Electric Cooling Fan	For Crown Victoria/Grand Marquis, Fusion/Milan/MKZ, Edge/MKX, Taurus/Taurus X/Sable, and Town Car, refer to **PINPOINT TEST KN - Variable Speed Electric Cooling Fan** . For all others, refer to **PINPOINT TEST KF - Fan Control (FC) Relays** .
Cooling Fan Clutch	refer to **PINPOINT TEST HV - Visctronic Drive Fan (VDF)** .
Cooling System	REFER to the Workshop Manual Section 303-03, Engine Cooling to diagnose the cooling fan clutch.

CHART 17

- Cooling System Concerns: Electric Cooling Fan(s) Always Runs

NOTE: **This chart is only intended to diagnose an electric cooling fan that always runs with a cool engine and the A/C and defroster off.**

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Cooling Fan A/C pressure switch (ACPSW) or ACP transducer sensor circuits	For Crown Victoria/Grand Marquis, Fusion/Milan/MKZ, Edge/MKX, Taurus/Taurus X/Sable, and Town Car, VERIFY the results of the PCM self-test. Visually INSPECT the cooling fan for concerns. For all others, refer to **PINPOINT TEST KF - Fan Control (FC) Relays** .
Cooling System	REFER to the Workshop Manual Section 303-03, Engine Cooling to diagnose the electric cooling fans.

CHART 18

- Exhaust System Concerns: Visible Smoke

NOTE: **Black smoke indicates a rich fuel mixture, blue smoke indicates burning oil, and white smoke indicates water in the combustion chamber.**

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Base Engine	REFER to the Workshop Manual Section 303-00, Engine System and carry out the Inspection and Verification to continue diagnosis.
Fuel Delivery System • Black smoke	refer to **PINPOINT TEST HC - Fuel Delivery System** .
Ignition System • Black smoke	For vehicles equipped with a coil pack ignition system, refer to **PINPOINT TEST JC - Secondary Ignition (Coil Pack)** . For all others, refer to **PINPOINT TEST JB - Secondary Ignition (COP)** .
PCV System • Blue smoke	REFER to the Workshop Manual Section 303-00, Engine System for a description of the Oil Consumption Test.

CHART 19

- Fuel System Concerns: Odor, Engine Compartment

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
EVAP System	Visual
Fuel System	Visual. refer to **PINPOINT TEST HC - Fuel Delivery System** .

CHART 20

- Engine Noise (under hood)

NOTE: **Attempt to identify the source of the noise. If the noise is from a source other than those listed below, refer to NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX (for noise such as spark knock) or the applicable Workshop Manual section to continue diagnosis.**

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Secondary Ignition System Snap noise that may be due to secondary ignition arcing.	For vehicles equipped with a coil pack ignition system, refer to **PINPOINT TEST JC - Secondary Ignition (Coil Pack)** . For all others, CHECK the condition of the spark plug boots.

CHART 21

- Climate Control: Lack of A/C Cooling, A/C Not Functioning, A/C Always On, or A/C Compressor Runs Continuously

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
A/C System	If sent here from the Workshop Manual with WAC_F PID indicating a fault (or YES), GO to**DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** and follow the directions for KOEO DTC P0645. For all others, REFER to the Workshop Manual Section 412-00, Climate Control System.

CHART 22

- Exhaust System Concerns: Odor (Sulfur or Rotten Egg Smell)

NOTE: **A slight sulfur smell may be normal. Catalysts with less than 8,000-16,000 kilometers (5,000-10,000 miles), either from a new vehicle or new catalyst, are likely to have a sulfur smell due to the highly active state of new catalysts. Installing a new catalyst may actually make the symptom worse.**

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Check for any driveability or exhaust smoke symptoms.	REFER to **No Diagnostic Trouble Codes (DTCs) Present Symptom Chart Index** for direction to repair other symptoms.
Fuel Delivery System	refer to **PINPOINT TEST HC - Fuel Delivery System** .
Fuel Source	Talk with the customer. Sulfur content can vary in different fuels. Suggest trying a different fuel source.

CHART 23

- Starting Concerns: No Crank

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Add-on Anti-Theft Devices	Visual. CHECK with the customer.
Anti-Theft	REFER to the Workshop Manual Section 419-01, Anti-Theft and diagnose the vehicle does not start symptom.
Base Engine • Starting system	REFER to the Workshop Manual Section 303-06, Starting System and diagnose the engine does not crank symptom.

2008 ENGINE

Engine Cooling - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Motorcraft Premium Gold Engine Coolant with Bittering Agent (bittered in US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1	2.3L engine 8.1L (8.6 qt); 3.0L engine 9.2L (9.7 qt); 3.5L engine 9.5L (10.0 qt)
Premium Cooling System Flush VC-1	ESR-M14P7-A	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Cooling System Pressure Test Specifications	
Cooling System	124 kPa (18 psi)
Radiator Cap Pressure Test Specification	
Pressure release cap	89-124 kPa (13-18 psi)
Thermostat Opening Temperatures	
Thermostat starts to open (2.3L)	80-84°C (176-183°F)
Thermostat starts to open (3.0L)	84-88°C (183-190°F)
Thermostat starts to open (3.5L)	86°C (187°F)
Thermostat fully open (2.3L)	97°C (207°F)
Thermostat fully open (3.0L)	99°C (210°F)
Thermostat fully open (3.5L)	96°C (205°F)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Air cleaner bracket bolts (3.5L)	10	-	89
Block heater (2.3L)	20	-	177
Block heater (3.0L, 3.5L)	40	30	-
Bypass tube bolt and stud bolt (3.0L)	10	-	89
Coolant pump bolts (2.3L)	10	-	89

Coolant pump bolts (3.0L, 3.5L)[a]	-	-	-
Coolant pump pulley bolts (2.3L)	20	-	177
Degas bottle-to-fender bolt and nut	9	-	80
Engine oil filter[a]	-	-	-
Oil pan drain plug	27	20	-
Power steering pump bolts	24	18	-
Primary timing chain guide bolts (3.5L)	10	-	89
Primary timing chain tensioner bolts (3.5L)	10	-	89
Thermostat housing bolts	10	-	89
Transmission cooler tubes	30	22	-
Variable Camshaft Timing (VCT) oil control solenoid housing bolts (3.5L)[a]	-	-	-

[a] Refer to the procedure.

DESCRIPTION AND OPERATION

ENGINE COOLING

NOTE: **The engine cooling system is filled with Motorcraft Premium Gold Engine Coolant. Mixing coolant types degrades the corrosion protection of Motorcraft Premium Gold Engine Coolant.**

NOTE: **Stop-leak style pellets/products must not be used as an additive in this engine cooling system. The addition of stop-leak style pellets/products can clog or damage the cooling system, resulting in degraded cooling system performance and/or failure.**

The cooling system components are the:

- block heater (if equipped).
- radiator.
- bypass tube.
- pressure relief cap.
- degas bottle.
- radiator draincock.
- coolant pump.
- thermostat (cold side).
- Engine Coolant Temperature (ECT) sensor.
- variable speed fan motor assembly.
- fan control module.

- engine block coolant weep hole (3.5L only).

The 3.5L engine is equipped with an engine block coolant weep hole. If the inner coolant pump shaft seal fails, coolant will be diverted out the weep hole in the LH side of the engine block. This prevents any coolant from entering the crankcase.

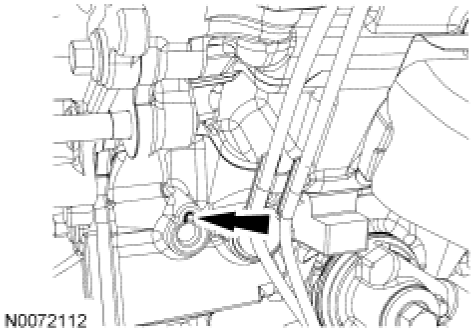


Fig. 1: Locating Engine Block Coolant Weep Hole
Courtesy of FORD MOTOR CO.

Engine coolant provides freeze protection, boil protection, cooling efficiency and corrosion protection to the engine and cooling components. In order to obtain these protections, the engine coolant must be maintained at the correct concentration and fluid level in the degas bottle.

When adding engine coolant, use a 50/50 mixture of engine coolant and distilled water.

To maintain the integrity of the coolant and the cooling system:

- Add Motorcraft Premium Gold Engine Coolant or equivalent meeting Ford Specification WSS-M97B51-A1 (yellow color). Do not mix coolant types.
- Do not add/mix orange-colored Motorcraft Specialty Orange Engine Coolant or equivalent meeting Ford specification WSS-M97B44-D or green-colored Motorcraft Premium Engine Coolant meeting Ford specification ESE-M97B44-A or equivalent. Mixing coolants may degrade the coolant's corrosion protection.
- Do not add alcohol, methanol or brine, or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.
- Ford Motor Company does NOT recommend the use of recycled engine coolant in vehicles originally equipped with Motorcraft Premium Gold Engine Coolant since a Ford-approved recycling process is not yet available.
- Used engine coolant should be disposed of in an appropriate manner. Follow the community's regulations and standards for recycling and disposing of automotive fluids.

Fail Safe Cooling (2.3L and 3.5L only)

NOTE:	**If the driver is using a high percentage of throttle travel (for example, an overtaking maneuver) when the PCM starts, engine deactivation will be delayed for 10 seconds.**

NOTE: After the cylinder deactivation operation has begun, the engine will not revert to operating on all cylinders, even if the temperature should fall, until the ignition is switched OFF and then ON again.

NOTE: The Malfunction Indicator Lamp (MIL) can only be extinguished by using a scan tool after the fault has been rectified and the DTC cleared.

The vehicle has a strategy built into the PCM that will control the engine if it starts to overheat.

Stage 1 of the strategy will commence if the engine starts to overheat. The Cylinder Head Temperature (CHT) sensor transmits a signal to the PCM, which then moves the temperature gauge pointer into the red zone.

If the engine is not switched OFF and the temperature continues to rise, the powertrain check lamp is illuminated. This indicates to the driver that the engine is approaching critical limits and should be stopped. At this point, DTC P1285 is set in the PCM and can be retrieved using a scan tool.

Stage 2 of the strategy will commence if the lamp and temperature gauge are ignored by the driver. The PCM will start to control the engine by cutting out cylinders and restricting the RPM to below 3,000 RPM. Simultaneously, the MIL will be illuminated. This indicates that long-term engine damage can occur and vehicle emissions will be affected. At this point, DTC 1299 is set in the PCM and can be retrieved using a scan tool.

Air is then drawn into the deactivated cylinders. This helps to control the temperature of the engine internal components. The deactivated cylinders are alternated to allow even cooling of all the cylinders.

Stage 3 of the strategy will commence if the engine temperature still continues to rise. This will result in the engine being totally disabled before major engine damage or seizure occurs. The powertrain check lamp will begin to flash, indicating to the driver that the engine will be switched OFF after 30 seconds. This allows the driver time to choose a suitable parking place.

Coolant Flow Diagram

NOTE: Black arrows indicate hot, white arrows indicate cold.

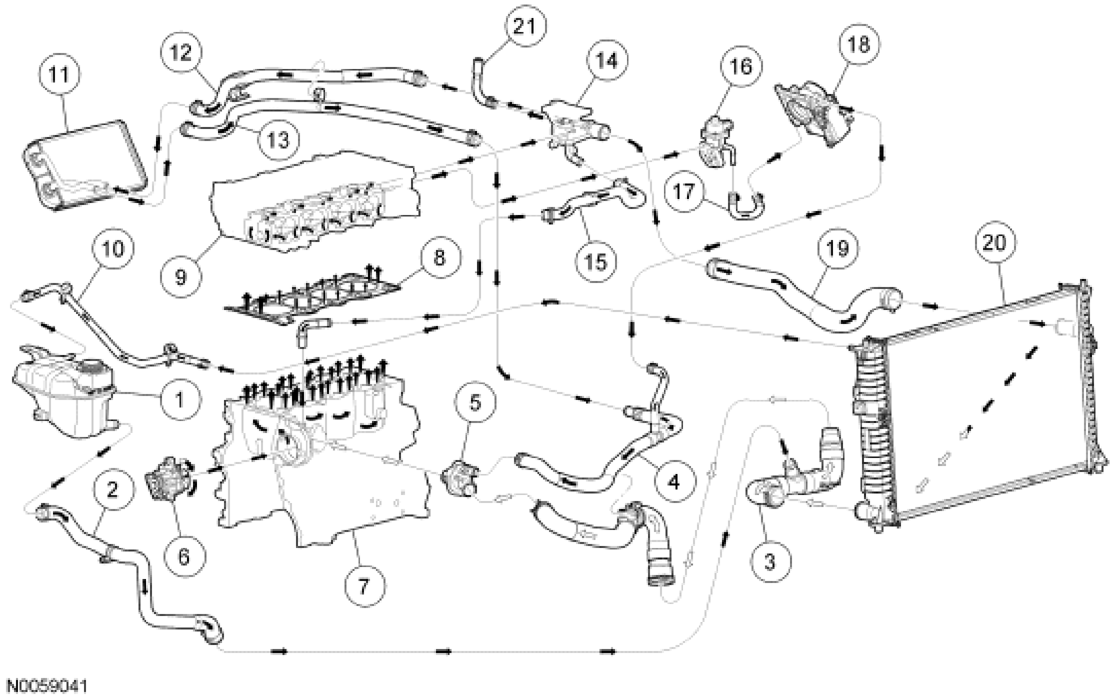


Fig. 2: Coolant Flow Diagram - 2.3L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8A080	Degas bottle
2	8C351	Lower degas bottle hose
3	8B273	Lower radiator hose
4	18C266	Heater core outlet-to-thermostat housing hose
5	8575	Thermostat housing
6	8501	Coolant pump
7	6010	Engine block
8	6051	Head gasket
9	6049	Cylinder head
10	8276	Radiator vent hose
11	19B555	Heater core
12	18C266	Heater core inlet hose
13	18C266	Heater core outlet hose
14	8K556	Coolant outlet adapter
15	8A582	Coolant outlet adapter-to-engine block hose
16	9D475	EGR valve assembly
17	9Y439	EGR valve assembly-to-Throttle Body (TB) hose

18	9F991	TB
19	8B274	Upper radiator hose
20	8005	Radiator
21	8C633	Bleed valve hose

NOTE: **Black arrows indicate hot, white arrows indicate cold.**

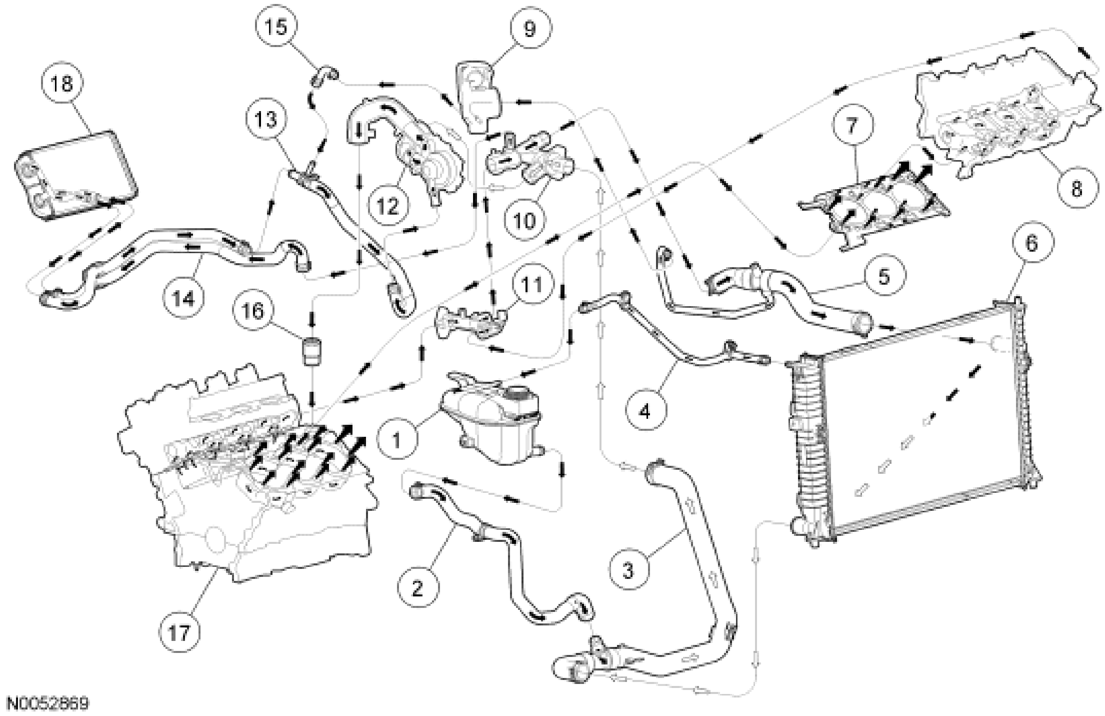


Fig. 3: Coolant Flow Diagram - 3.0L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8A080	Degas bottle
2	8C351	Lower degas bottle hose
3	8B273	Lower radiator hose
4	8276	Degas bottle-to-radiator hose
5	8B274	Upper radiator hose
6	8005	Radiator
7	6083	Cylinder head gasket
8	6050	Cylinder head
9	9F991	Throttle Body (TB)
10	8A586	Thermostat housing
11	8548	Bypass tube
12	8501	Coolant pump

13	18K359	Heater core outlet hose
14	18C266	Heater core inlet hose
15	18465	Heater core outlet-to-TB hose
16	8A505	Coolant inlet tube
17	6010	Engine block
18	19B555	Heater core

NOTE: Black arrows indicate hot, white arrows indicate cold.

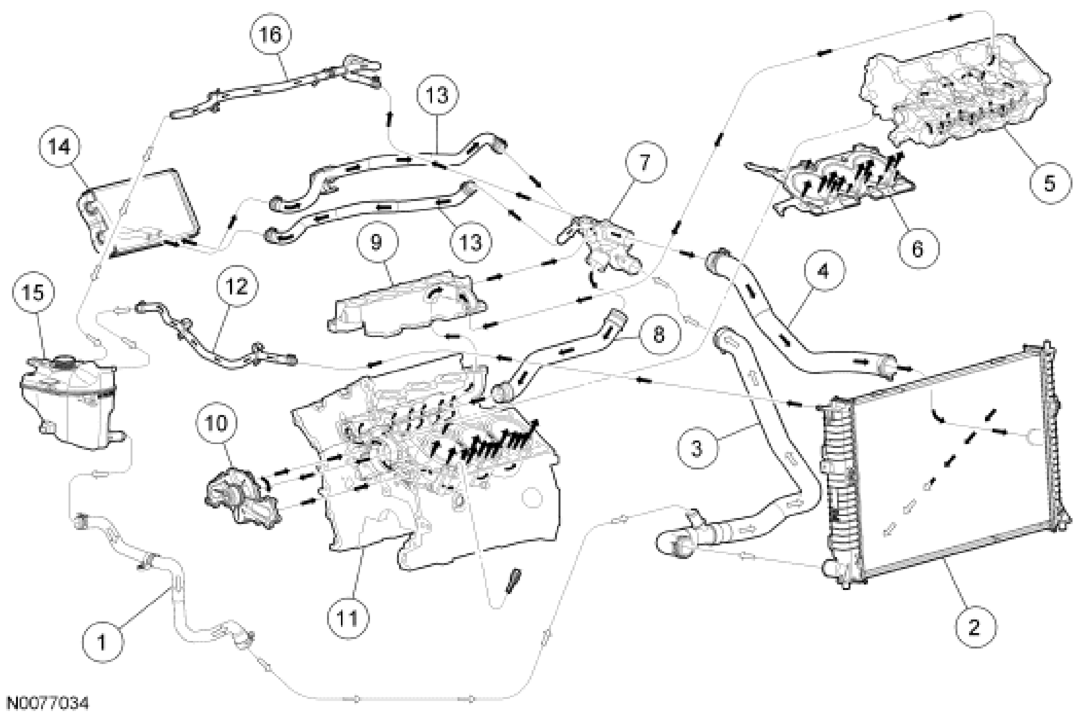


Fig. 4: Coolant Flow Diagram - 3.5L
Courtesy of FORD MOTOR CO.

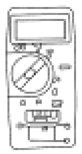
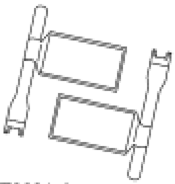
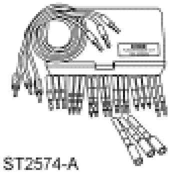
Item	Part Number	Description
1	8C351	Lower degas bottle hose
2	8005	Radiator
3	8B273	Lower radiator hose
4	8B274	Upper radiator hose
5	6050	Cylinder head
6	6083	Cylinder head gasket
7	8A586	Thermostat housing
8	9N271	Water inlet tube
9	9K461	Lower intake manifold
10	8501	Coolant pump

11	6010	Engine block
12	8C362	Degas bottle-to-radiator hose
13	18C266	Heater hose assembly
14	19B555	Heater core
15	8A080	Degas bottle
16	8B541	Degas bottle-to-thermostat housing hose

DIAGNOSTIC TESTS

ENGINE COOLING

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST1720-A	Battery/Antifreeze Tester	014-R1060 or equivalent
 ST2621-A	Pressure Test Kit	014-R1072 or equivalent
 ST2574-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware or equivalent scan tool	

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (bittered in US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

Principles of Operation

Engine coolant flows primarily from the engine to the radiator circuit and back to the coolant pump. From the coolant pump, coolant is sent through the engine block and cylinder heads. A separate circuit from the engine also feeds the heater core with coolant. On most engines, the coolant pump is operated by engine rotation through a pulley which is driven by the accessory drive belt to circulate the coolant. Some engines use a belt driven by a pulley attached to the camshaft and some engines use a sprocket driven by the timing chain to operate the coolant pump. The coolant thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant is allowed to flow through the radiator circuit in order to transfer engine generated heat to the outside air.

NOTE: The vehicle is equipped with either a degas bottle or an expansion tank.

The degas bottle, if equipped, holds surplus coolant and removes air from the cooling system, which reduces hot spots. It also allows for coolant expansion and system pressurization, replenishes coolant to the cooling system and serves as the location for service fill.

The coolant expansion tank, if equipped, holds surplus coolant, allows for coolant expansion and replenishes coolant to the cooling system. It is equipped with a non-pressurized cap which allows coolant to be added to the tank to keep it filled to prescribed levels.

The cooling fan draws air through the radiator to help cool the system coolant as it passes through the radiator.

The thermostat monitor is a function of the PCM and is designed to verify correct thermostat operation. The monitor will be executed once per drive cycle and has a monitor run duration of 300-800 seconds. If a malfunction occurs, DTC P0125 or P0128 is set, and the malfunction indicator lamp (MIL) will be illuminated.

For vehicle/engine specific information, refer to **Engine Cooling**.

Inspection and Verification

WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

NOTE: The engine cooling system is filled with Motorcraft Premium Gold Engine Coolant. Mixing coolant types degrades the corrosion protection of Motorcraft Premium Gold Engine Coolant. Do not mix coolant types. Failure to follow these instructions may result in engine or cooling system damage.

NOTE: Vehicles equipped with a degas bottle system have the pressure relief cap on the degas bottle and no radiator cap. Vehicles equipped with a coolant expansion tank system have the pressure relief cap on the radiator.

1. Verify the customer concern.
2. Visually check the engine coolant level at the degas bottle or coolant expansion tank when the system is cold.
3. Make sure the pressure relief cap is installed correctly.
4. Record any cooling system DTCs retrieved. Refer to the PCM DTC chart in **Inspection and Verification**.

NOTE: Take note of any coolant odor or steam coming from cooling system components.

5. If the system coolant is filled correctly and no DTCs associated with fail-safe cooling are retrieved, verify the customer's concern by operating the engine to duplicate the condition.

NOTE: Refer to the coolant flow diagram in the Description and Operation Engine Cooling.

6. Inspect to determine if any of the following mechanical or electrical concerns apply.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Leaks or weeps at: ○ Hoses ○ Tubes ○ Clamp joints ○ Quick connect couplings (if equipped) ○ Gaskets ○ O-rings ○ Thermostat housing ○ Radiator ○ Pressure relief cap ○ Coolant pump ○ Heater core (wet floor or coolant odor in vehicle) ○ Heater control valve ○ Heated throttle body (TB) or heated TB adapter	• Inoperative or damaged: ○ Electric cooling fan (if equipped) ○ Electronically actuated fan clutch ○ Electronically actuated fan clutch controller ○ Wiring, connectors, relays or modules

(if equipped) ◦ Coolant crossover manifold assembly (if equipped) ◦ Oil cooler (if equipped) ◦ Degas bottle (if equipped) ◦ Coolant expansion tank (if equipped) ◦ Heated PCV (if equipped) ◦ Fuel pressure regulator coolant bowl (if equipped, natural gas engine) ◦ Cylinder block core plugs (if equipped) ◦ Cylinder head core plugs (if equipped) ◦ Block heater (if equipped)	◦ Engine coolant temperature (ECT) sensor (if equipped) ◦ Cylinder head temperature (CHT) sensor (if equipped) ◦ Intake air temperature (IAT) sensor (if equipped) ◦ Mass air flow (MAF) sensor ◦ Vehicle speed sensor (VSS)

VISUAL INSPECTION CHART

Mechanical	Electrical
• Cracked or damaged: ◦ Hoses ◦ Tubes ◦ Hose clamps ◦ Heater control valve (if equipped) ◦ Thermostat housing ◦ Radiator ◦ Pressure relief cap ◦ Cooling fan ◦ Fan clutch (if	

equipped) ◦ Coolant pump ◦ Degas bottle (if equipped) ◦ Coolant expansion tank (if equipped) ◦ Oil cooler (if equipped) ◦ Coolant crossover manifold assembly (if equipped) ◦ Cylinder block core plugs (if equipped) ◦ Cylinder head core plugs (if equipped) ◦ Block heater (if equipped) • Restricted airflow through the A/C condenser/radiator • Drive belt loose, worn or installed incorrectly • Broken or weak drive belt tensioner • Excessive white or light gray exhaust smoke (may have burnt coolant odor) • Coolant in engine oil • Engine oil in coolant • Coolant in automatic transmission fluid (if equipped) • Automatic transmission fluid (if equipped) in coolant	

7. If the inspection reveals an obvious concern that can be readily identified, repair it as necessary. Test the system for normal operation.
8. Inspect the coolant condition in the following sequence:

1. Inspect the coolant color.
    - If Motorcraft Premium Gold Engine Coolant has a clear or pale yellow color, this indicates higher water content than required. Test the engine coolant freezing point range with the Battery/Antifreeze Tester. The freezing point should be in the range -45°C to -23°C (-50°F to -10°F). If the vehicle is driven in cold climates less than -36°C (-34°F), it may be necessary to increase the coolant concentration to get adequate freeze protection. Recommended coolant concentration is 50/50 ethylene glycol to distilled water.
    - A pale green color indicates incorrect coolant (green in color) may have been added to the system. Use of incorrect (green in color) coolant degrades the corrosion protection of Motorcraft Premium Gold Engine Coolant. Flush the system and refill with the correct mixture of distilled water and Motorcraft Premium Gold Engine Coolant.

    NOTE: **If Cooling System Stop Leak Pellets are used, darkening of the Motorcraft Premium Gold Engine Coolant from yellow to golden tan will occur.**

    - Dark brown could indicate a commercially available stop leak may have been used. Flush the system and refill with the correct mixture of distilled water and Motorcraft Premium Gold Engine Coolant.
    - A light or reddish brown color indicates that rust may be present in the cooling system. Flush the system and refill with the correct mixture of distilled water and Motorcraft Premium Gold Engine Coolant.
    - An iridescent sheen on top of the coolant could indicate a trace of oil is entering the system. For information on engine diagnosis, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
    - A milky brown color may indicate that engine oil is entering the cooling system. Pressure test the cooling system. Refer to **Component Tests**. If engine oil is suspected, the cause of the leak may be internal to the engine. Refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
    - A red, orange or light green colored sheen on top of the coolant may indicate that transmission fluid is entering the cooling system. The cause may be a leaky radiator. Pressure test the cooling system. Refer to the **Component Tests**.
2. If the engine coolant appearance is acceptable, test the engine coolant freezing point range with the Battery/Antifreeze Tester. The freezing point should be in the range -45°C to -23°C (-50°F to -10°F). If the vehicle is driven in cold climates less than -36°C (-34°F), it may be necessary to increase the coolant concentration to get adequate freeze protection. Recommended coolant concentration is 50/50 ethylene glycol to distilled water.
    - Maximum coolant concentration is 60/40 for cold weather areas.
    - Minimum coolant concentration is 40/60 for warm weather areas.
3. Adjust coolant range and level if necessary:
    - If coolant is low, add specified coolant mixture only.
    - If the engine coolant tests too weak, remove some of the engine coolant and add undiluted engine coolant until the readings are within acceptable levels.
    - If the engine coolant tests strong, remove some of the engine coolant and add distilled water

until the readings are within acceptable levels.

9. If an obvious cause for an observed or reported concern is found, correct the cause and test the system for normal operation before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

10. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

11. If the scan tool does not communicate with the VCM:
    - check the VCM connection to the vehicle.
    - check the scan tool connection to the VCM.
    - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
12. If the scan tool does not communicate with the vehicle:
    - verify the ignition key is in the ON position.
    - verify the scan tool operation with a known good vehicle.
    - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
13. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record continuous memory DTCs.
14. Clear the continuous DTCs and carry out the self-test diagnostics PCM.
15. If the DTCs recovered are related to the concern, go to the PCM DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
16. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

PCM DTC CHART

DTC	Description	Action
P0217	Engine Coolant Overtemperature Condition	Go to **Pinpoint Test B**.
P1285	Cylinder Head Overtemperature Condition	Go to **Pinpoint Test B**.
P1299	Cylinder Head Overtemperature Protection Active	Go to **Pinpoint Test B**.
P0125	Insufficient Coolant Temp For Closed Loop Fuel Control	Go to **Pinpoint Test C**.
P0128	Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)	Go to **Pinpoint Test C**.
P0480 P0481 P0482	Fan 1, 2 or 3 Control Circuit, Respectively	REFER to the **Introduction - Gasoline Engines** article.
All Other	-	REFER to the **Introduction**

DTCs		**- Gasoline Engines** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Loss of coolant	• Coolant hoses or tubes • Hose clamps • Coolant pump O-ring seal or gasket • Thermostat O-ring seal or gasket • Thermostat housing • Radiator • Transmission fluid cooler (in radiator) (if equipped) (may leak internally or externally) • Degas bottle (if equipped) • Coolant expansion tank (if equipped) • Pressure relief cap • Coolant pump leaking from weep hole • Auxiliary coolant pump (if equipped) • Heater core • Heater control valve (if equipped) • Coolant crossover manifold assembly (if equipped) • Engine gaskets (may leak internally or externally) • Oil cooler (if equipped) (may leak internally or externally) • Heated throttle body (TB) or heated TB adapter (if equipped) • Heated PCV (if equipped) • Fuel pressure regulator coolant bowl (if equipped, natural gas engine) • Cylinder block core plugs (if equipped) • Cylinder head core plugs (if equipped) • Block heater (if equipped)	• Go to **Pinpoint Test A**.
	• Low coolant level • External engine coolant leak • Air lock in system	

• The engine overheats	• Pressure relief cap installation • Restricted airflow through the A/C condenser/radiator • Internal engine coolant leak • Coolant condition/concentration • Accessory drive components • Non-OEM engine enhancement components • Electric cooling fan (if equipped) • Mechanical cooling fan (if equipped) • Mechanical cooling fan clutch (if equipped) • Radiator • Thermostat • Engine coolant temperature (ECT) indicator system (gauge) • ECT sensor (if equipped) • Cylinder head temperature (CHT) sensor (if equipped) • Heater core • Coolant pump • Coolant flow restriction	• Go to **Pinpoint Test B**.
• The engine does not reach normal operating temperature	• Low coolant level • Thermostat • Mechanical fan clutch always engaged • Electric cooling fan always on • Engine coolant temperature indicator system (gauge) • ECT sensor (if equipped) • CHT sensor (if equipped)	• Go to **Pinpoint Test C**.
• The block heater does not operate correctly	• Block heater power cable • Block heater	• CHECK continuity in all 3 power cable circuits. If any circuit measures greater than 5 ohms, INSTALL a new power cable. • CHECK the resistance of the block heater. If the resistance does not measure between 12.5

		and 17 ohms, INSTALL a new block heater.
• The electric cooling fan(s) or electronically controlled fan clutch is inoperative in one or more speeds or does not operate correctly (if equipped)	• Wiring • Relays • Fuses • Fan control module • Cooling fan motor(s) • Cooling fan resistor(s) • Electric fan clutch	• REFER to the **Introduction - Gasoline Engines** article.
• The electric cooling fan(s) stay(s) on all the time (if equipped)	• Wiring • Relays	• REFER to the **Introduction - Gasoline Engines** article.
• Noisy electric cooling fan operation (if equipped)	• Foreign material contamination • Fan motor	• REMOVE the foreign material from the cooling fan and shroud. TEST the system for normal operation. If still noisy, INSTALL a new cooling fan assembly.
	• Fan blade detached from fan motor	• INSTALL a new cooling fan assembly.
• Noisy mechanical fan operation (if equipped)	• Fan clutch	• CARRY OUT the Fan Clutch Test - Minimum Speed Requirement component test.

Pinpoint Tests

Pinpoint Test A: Loss of Coolant

Normal Operation

The engine cooling system is a closed system that provides for coolant expansion and contraction and also changes in pressure as coolant warms and cools with engine operation. Various gaskets, seals, hoses and clamps are used to contain coolant within the cooling system and keep other fluids and contaminants from entering the cooling system.

Coolant loss can be attributed to either external or internal leaks anywhere within the cooling system.

For vehicle/engine specific information, refer to **Engine Cooling**.

This pinpoint test is intended to diagnose the following:

- Coolant hoses or tubes
- Hose clamps
- Thermostat O-ring seal or gasket
- Coolant pump O-ring seal or gasket
- Thermostat housing
- Heater control valve (if equipped)
- Radiator
- Transmission fluid cooler (in radiator) (if equipped)
- Pressure relief cap
- Coolant pump leaking from weep hole
- Auxiliary coolant pump (if equipped)
- Heater core
- Heated throttle body (TB) or heated TB adapter (if equipped)
- Coolant crossover manifold assembly (if equipped)
- Engine gaskets
- Oil cooler (if equipped)
- Degas bottle (if equipped)
- Coolant expansion tank (if equipped)
- Heated PCV (if equipped)
- Fuel pressure regulator coolant bowl (if equipped, natural gas engine)
- Cylinder block core plugs (if equipped)
- Cylinder head core plugs (if equipped)
- Block heater (if equipped)
- Engine coolant temperature (ECT) sensor (if equipped)

PINPOINT TEST A: LOSS OF COOLANT

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

A1 CARRY OUT INSPECTION AND VERIFICATION

- Carry out the **Inspection and Verification**.
- **Were any concerns found?**

YES : REPAIR as needed. TEST the system for normal operation.

NO : Go to A2 .

A2 CHECK THE ENGINE COOLANT LEVEL

NOTE: Allow the engine to cool before checking the engine coolant level.

- Key in OFF position.
- Visually inspect the engine coolant level at the degas bottle or the coolant expansion tank.
- **Is the engine coolant level within specifications?**

  YES : Go to A3.

  NO : ADJUST the engine coolant level as necessary. Go to A3.

A3 PRESSURE TEST THE ENGINE COOLING SYSTEM

- Pressure test the engine cooling system. Refer to **Pressure Test - Coolant Expansion Tank Systems**.
- **Does the engine cooling system leak?**

  YES : REPAIR or INSTALL new components. TEST the system for normal operation.

  NO : If the vehicle is equipped with a coolant expansion tank, go to A4. If the vehicle is equipped with a degas bottle, go to A5.

A4 CHECK THE PRESSURE RELIEF CAP

- Carry out the pressure relief cap pressure test. Refer to **Cap**.
- **Is the pressure relief cap OK?**

  YES : Go to A5.

  NO : INSTALL a new pressure relief cap. TEST the system for normal operation.

A5 CHECK THE ENGINE COOLANT FOR AN INTERNAL LEAK

- Inspect the engine coolant in the degas bottle or coolant expansion tank for signs of engine oil or transmission fluid.
- **Is engine oil or transmission fluid evident in the coolant?**

  YES : If engine oil is evident, go to **ENGINE SYSTEM - GENERAL INFORMATION** article for engine diagnosis. If transmission fluid is evident, INSTALL a new radiator. REPAIR the transmission as necessary. Refer to the appropriate Automatic Transmission article for the procedure. TEST the system for normal operation.

  NO : Go to A6.

A6 CHECK THE ENGINE OIL AND TRANSMISSION FLUID FOR COOLANT

- Remove the oil level indicators from the engine and the transmission.
- **Is coolant evident in the oil or transmission fluid?**

  YES : If coolant is in the engine oil, go to **ENGINE SYSTEM - GENERAL INFORMATION** article. If coolant is in the transmission fluid, INSTALL a new radiator. REPAIR the transmission as necessary. Refer to the appropriate Automatic Transmission article for the procedure.

  NO : Go to A7.

A7 CHECK THE COOLING SYSTEM FOR COMBUSTION GASES

NOTE: Use U-View® Combustion Leak Tester part number 560000 or equivalent.

- Using a cooling system combustion gas leak tester, following the instructions supplied with the tester, check the coolant for combustion gases.
- **Are combustion gases present?**

  YES : Go to **ENGINE SYSTEM - GENERAL INFORMATION** article for engine diagnosis.

  NO : The cooling system is operational.

Pinpoint Test B: The Engine Overheats

Normal Operation

The engine cooling system functions to maintain engine temperatures during operation. Correct coolant flow through the engine, radiator and remainder of cooling system passages and components is essential to maintaining a correct engine temperature.

Engine coolant flows primarily from the engine to the radiator circuit and back to the coolant pump. From the coolant pump, coolant is sent through the engine block and cylinder heads. A separate circuit from the engine also feeds the heater core with coolant. On most engines, the coolant pump is operated by engine rotation through a pulley which is driven by the accessory drive belt to circulate the coolant. Some engines use a belt driven by a pulley attached to the camshaft, and some engines use a sprocket driven by the timing chain to operate the coolant pump. The coolant thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant is allowed to flow through the radiator circuit in order to transfer engine generated heat to the outside air.

Engine overheating generally occurs when there is a disruption in the ability to control either coolant flow at the correct rate, the inability to transfer heat from the engine through the coolant (including low coolant) or an inability to transfer engine generated heat to the outside air through the radiator.

For vehicle/engine specific information, refer to **Engine Cooling**.

- DTC P0217 Engine Coolant Overtemperature Condition
- DTC P1285 Cylinder Head Overtemperature Condition
- DTC P1299 Cylinder Head Overtemperature Protection Active

This pinpoint test is intended to diagnose the following:

- Low coolant level
- External engine coolant leak
- Air lock in system
- Pressure relief cap installation
- Restricted airflow through the A/C condenser/radiator
- Internal engine coolant leak

- Coolant condition/concentration
- Accessory drive components
- Non-OEM engine enhancement components
- Electric cooling fan (if equipped)
- Mechanical cooling fan blade (if equipped)
- Mechanical cooling fan clutch (if equipped)
- Engine coolant temperature (ECT) indicator system (gauge)
- ECT sensor (if equipped)
- Cylinder head temperature (CHT) sensor (if equipped)
- Heater core
- Coolant pump
- Coolant flow restriction

PINPOINT TEST B: THE ENGINE OVERHEATS

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

B1 CARRY OUT INSPECTION AND VERIFICATION

- Carry out the **Inspection and Verification**.
- **Were any concerns found?**

  YES : REPAIR as needed. TEST the system for normal operation.

  NO : Go to B2 .

B2 CHECK FOR DTCs

NOTE: Refer to the Introduction - Gasoline Engines article for correct scan tool hook-up procedure.

- Check for DTC P0217, P1285 or P1299.
- **Is DTC P0217, P1285 or P1299 present?**

  YES : Go to B3.

  NO : Actual engine overheating has not been verified. CHECK the ECT gauge operation. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. If any other DTCs are retrieved, REFER to the **Introduction - Gasoline Engines** article.

B3 CHECK FOR AN AIRFLOW OBSTRUCTION

- Check the radiator or A/C condenser for an external obstruction such as leaves or cardboard.
- **Is an obstruction present?**

YES : REMOVE the obstruction. TEST the system for normal operation.

NO : Go to B4.

B4 CHECK THE ENGINE COOLANT LEVEL

NOTE: Allow the engine to cool before checking the coolant level.

- Key in OFF position.
- Visually check the engine coolant level in the degas bottle or coolant expansion tank.
- **Is the engine coolant level within specification?**

  YES : Go to B5.

  NO : ADJUST the engine coolant level as necessary. Go to B5.

B5 PRESSURE TEST THE ENGINE COOLING SYSTEM

- Pressure test the engine cooling system. Refer to **Pressure Test - Coolant Expansion Tank Systems**.
- **Does the engine cooling system leak?**

  YES : REPAIR or INSTALL new components. TEST the system for normal operation.

  NO : Vehicles equipped with an expansion tank, go to B6. Vehicles equipped with a degas bottle, go to B7.

B6 CHECK THE PRESSURE RELIEF CAP

- Carry out the pressure relief cap pressure test. Refer to **Cap**.
- **Is the pressure relief cap OK?**

  YES : Go to B7.

  NO : INSTALL a new pressure relief cap. TEST the system for normal operation.

B7 CHECK THE ENGINE COOLANT FOR AN INTERNAL LEAK

- Inspect the engine coolant in the degas bottle or coolant expansion tank for signs of engine oil or transmission fluid.
- **Is engine oil or transmission fluid evident in the coolant?**

  YES : If engine oil is evident, go to **ENGINE SYSTEM - GENERAL INFORMATION** article for engine diagnosis. If transmission fluid is evident, INSTALL a new radiator. REPAIR the transmission as necessary. Refer to the appropriate Automatic Transmission article for the procedure. TEST the system for normal operation.

  NO : Go to B8.

B8 CHECK THE ENGINE OIL AND TRANSMISSION FLUID FOR COOLANT

- Remove the oil level indicators from the engine and the transmission.
- **Is coolant evident in the oil or transmission fluid?**

  YES : If coolant is in the engine oil, go to **ENGINE SYSTEM - GENERAL INFORMATION** article. If coolant is in the transmission fluid, INSTALL a new radiator. REPAIR the transmission as necessary. Refer to the appropriate Automatic Transmission article for the procedure.

  NO : Go to B9.

B9 CHECK THE COOLING SYSTEM FOR COMBUSTION GASES

NOTE: Use U-View® Combustion Leak Tester part number 560000 or equivalent.

- Using a cooling system combustion gas leak tester, following the instructions supplied with the tester, check the coolant for combustion gases.
- **Are combustion gases present?**

  YES : Go to **ENGINE SYSTEM - GENERAL INFORMATION** article for engine diagnosis.

  NO : Go to B10.

B10 CHECK COOLANT CONDITION

- Check the coolant for dirt, rust or contamination and check the coolant concentration.
- **Is the coolant condition OK?**

  YES : Vehicles equipped with an electric cooling fan, go to B11 . Vehicles equipped with only a mechanical cooling fan, go to B12 .

  NO : FLUSH the engine cooling system. REFER to **Cooling System Flushing**. TEST the system for normal operation.

B11 CHECK THE ELECTRIC COOLING FAN OPERATION

- Start the engine.
- Place the climate control function selector in the MAX A/C position and the blower motor switch in the HI position.
- **Did the electric cooling fan operate?**

  YES : If the vehicle is also equipped with a mechanical cooling fan, go to B12 . Otherwise, go to B13 .

  NO : DIAGNOSE the electric cooling fan operation. REFER to **Introduction - Gasoline Engines** article.

B12 CHECK THE MECHANICAL COOLING FAN OPERATION

- Key in OFF position.
- If the vehicle is equipped with a viscous fan clutch, carry out the **Fan Clutch Test**. If the vehicle is equipped with an electronically actuated fan clutch, refer to the **Introduction - Gasoline Engines** article.
- **Is the cooling fan operation OK?**

  YES : Go to B13.

  NO : INSTALL a new fan clutch. TEST the system for normal operation.

B13 CHECK THE COOLANT PUMP OPERATION

- Start the engine.
- Allow the engine to run for 10 minutes (hot side thermostat equipped vehicles) or 30 minutes (cold side thermostat equipped vehicles). Place the climate control function selector in the MAX HEAT position. Feel the heater outlet hose.
- **Is the heater outlet hose hot?**

  YES : Go to B14.

  NO : INSTALL a new coolant pump. TEST the system for normal operation.

B14 CHECK THE THERMOSTAT OPERATION

- Start the engine.
- Allow the engine to run for 10 minutes (hot side thermostat equipped vehicles) or 30 minutes (cold side thermostat equipped vehicles). Feel the upper radiator hose (hot side thermostat equipped vehicles) or the lower radiator hose (cold side thermostat equipped vehicles).
- **Is the upper (hot side thermostat equipped vehicles) or lower (cold side equipped vehicles) radiator hose hot?**

  YES : CHECK the engine coolant temperature gauge operation. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

  NO : Go to B15.

B15 VISUALLY INSPECT THE THERMOSTAT

- Carry out the **Thermostat Visual Inspection**.
- **Is the thermostat damaged?**

  YES : INSTALL a new thermostat. TEST the system for normal operation.

  NO : INSTALL a new thermostat. TEST the system for normal operation. If the engine still overheats, INSTALL a new radiator. TEST the system for normal operation.

Pinpoint Test C: The Engine Does Not Reach Normal Operating Temperature

Normal Operation

The engine cooling system functions to maintain engine temperatures during operation. Correct coolant flow through the engine, radiator and remainder of cooling system passages and components is essential to maintaining a correct engine temperature.

Engine coolant flows primarily from the engine to the radiator circuit and back to the coolant pump. From the coolant pump, coolant is sent through the engine block and cylinder heads. A separate circuit from the engine also feeds the heater core with coolant. On most engines, the coolant pump is operated by engine rotation through a pulley which is driven by the accessory drive belt to circulate the coolant. Some engines use a belt driven by a pulley attached to the camshaft, and some engines use a sprocket driven by the timing chain to operate the coolant pump. The coolant thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant is allowed to flow through the radiator circuit in order to transfer engine generated heat to the outside air.

Concerns of engine inability to reach normal operating temperature typically occur when the rate of coolant flow through some coolant circuits (radiator, heater core) is more than expected given the conditions, or when the cooling fans operate all the time (electric fans) or the fan clutch is always engaged (engine driven fans). Heat is not allowed to build in the engine because a heat exchanger is removing too much heat, including the radiator, heater core and oil cooler. In addition, perceived concerns that the engine does not reach normal operating temperature can be related to a low coolant level or trapped air which does not allow for hot coolant to be available at the heater core, an inoperative climate control system, or for concerns perceived or related to an incorrect engine temperature gauge indication.

For vehicle/engine specific information, refer to **Engine Cooling**.

- DTC P0125 Insufficient Coolant Temp for Closed Loop Fuel Control
- DTC P0128 Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)

This pinpoint test is intended to diagnose the following:

- Low coolant level
- Thermostat
- Engine coolant temperature (ECT) indicator system (gauge)
- Engine cooling fan

PINPOINT TEST C: THE ENGINE DOES NOT REACH NORMAL OPERATING TEMPERATURE

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

C1 CARRY OUT INSPECTION AND VERIFICATION

- Carry out the **Inspection and Verification**.
- **Were any concerns found?**

  YES : REPAIR as needed. TEST the system for normal operation.

  NO : Go to C2.

C2 CHECK FOR DTCs P0125 or P0128

NOTE: **Refer to the Introduction - Gasoline Engines article for correct scan tool hook-up procedure.**

- Check for DTC P0125 or P0128.
- **Is DTC P0125 or P0128 present?**

  YES : If the vehicle is equipped with an electric cooling fan, go to C3. If the vehicle is equipped with only a mechanical cooling fan, go to C4.

  NO : The cooling system is operational. If an inoperative engine coolant temperature gauge is suspected, CHECK the engine coolant temperature gauge operation. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. If an inoperative climate control system is suspected, CHECK the climate control system operation. REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article. If any other DTCs are retrieved, REFER to the **Introduction - Gasoline Engines** article.

C3 CHECK THE ELECTRIC COOLING FAN OPERATION

- Allow the engine to cool.
- Make sure the A/C switch is OFF (if equipped).
- Start the engine.

- Check the electric cooling fan.
- **Is the electric cooling fan on all the time?**

  YES : DIAGNOSE the electric cooling fan operation. REFER to the **Introduction - Gasoline Engines** article.

  NO : If the vehicle is also equipped with a mechanical cooling fan, go to C4. Otherwise, go to C5.

C4 CHECK THE MECHANICAL COOLING FAN OPERATION

- Carry out the Cooling Fan Clutch Component Test. For a mechanical cooling fan clutch, refer to **Component Tests**. For an electronic cooling fan clutch, refer to the **Introduction - Gasoline Engines** article.
- **Is the cooling fan clutch OK?**

  YES : Go to C5.

  NO : INSTALL a new cooling fan clutch. TEST the system for normal operation.

C5 CHECK THE COOLANT LEVEL

NOTE: Allow the engine to cool before checking the coolant level.

- Visually check the engine coolant level in the degas bottle or coolant expansion tank.
- **Is the engine coolant level within specification?**

  YES : INSTALL a new thermostat. TEST the system for normal operation.

  NO : Go to **Pinpoint Test A** to diagnose a coolant leak.

Component Tests

Pressure Test - Degas Bottle Systems

WARNING: Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

NOTE: Vehicles equipped with a degas bottle system have the pressure relief cap on the degas bottle and no radiator cap. Vehicles equipped with a coolant expansion tank system have the pressure relief cap on the radiator.

1. Turn the engine OFF.
2. Check the engine coolant level. Adjust the coolant level as necessary.
3. Attach the Radiator/Heater Core Pressure Tester to the degas bottle nipple and overflow hose. Install a pressure test pump to the quick connect fitting of the test adapter.

NOTE: Do not pressurize the cooling system beyond the maximum pressure

listed in the SPECIFICATIONS or cooling system components may be damaged.

NOTE: If the plunger of the pressure tester is depressed too fast, an erroneous pressure reading will result.

4. Slowly depress the plunger of the pressure test pump until the pressure gauge reading stops increasing and note the highest pressure reading obtained. If the pressure reading exceeds the maximum cap pressure listed in the specifications table, install a new pressure relief cap.
5. If the system does not hold pressure, remove the pressure relief cap and wash in clean water to dislodge all the foreign material from the gasket. Check the sealing surface in the filler neck of the degas bottle for nicks or cuts. Install the pressure relief cap.
6. Pressurize the engine cooling system as described in Step 4 above. Observe the gauge reading for approximately 2 minutes. Pressure should not drop during this time. If the pressure drops within this time, inspect for leaks and repair as necessary.
7. If no leaks are found and the pressure drops. the pressure relief cap may be leaking. Install a new pressure relief cap and retest the system.
8. If no leaks are found after a new pressure relief cap is installed, and the pressure drops, the leak may be internal to the radiator transmission cooler (if equipped). Inspect the coolant for transmission fluid and the transmission fluid for coolant. Repair as necessary.
9. If there is no contamination of the coolant or transmission fluid, the leak may be internal to the engine. Inspect the coolant for engine oil and the engine oil for coolant. Refer to **ENGINE SYSTEM - GENERAL INFORMATION** article to diagnose the engine.
10. Release the system pressure by loosening the pressure relief cap. Check the coolant level and adjust as necessary.

Pressure Test - Coolant Expansion Tank Systems

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

NOTE: Vehicles equipped with a degas bottle system have the pressure relief cap on the degas bottle and no radiator cap. Vehicles equipped with a coolant expansion tank system have the pressure relief cap on the radiator.

1. Turn the engine OFF.
2. Remove the pressure relief cap. Top off the radiator as needed. Fit the pressure tester to the radiator fill neck.

NOTE: Do not pressurize the cooling system beyond 138 kPa (20 psi) or cooling

system components may be damaged.

NOTE: If the plunger of the pressure tester is depressed too fast, an incorrect pressure reading will result.

3. Pump the cooling system to a maximum of 138 kPa (20 psi) and hold for 2 minutes. If the pressure drops within this time, inspect for leaks and repair as necessary.
4. If no leaks are found and the pressure drops, the leak may be internal to the radiator transmission cooler (if equipped). Inspect the coolant for transmission fluid and the transmission fluid for coolant. Repair as necessary.
5. If there is no contamination of the coolant or transmission fluid, the leak may be internal to the engine. Inspect the coolant for engine oil and the engine oil for coolant. Refer to **ENGINE SYSTEM - GENERAL INFORMATION** article to diagnose the engine.

Cap

1. Inspect the pressure relief cap and seals for damage or deterioration. Install a new pressure relief cap if necessary.
2. Fit the pressure relief cap to the Radiator/Heater Core Pressure Tester Kit using the correct adapter.

NOTE: If the plunger of the pressure tester is depressed too fast, an incorrect pressure reading will result.

3. Slowly pump the pressure tester until the pressure gauge stops increasing and note the highest pressure reading. Release the pressure and repeat the test. Install a new pressure relief cap if the pressure is not within specification. Refer to **SPECIFICATIONS**.

Thermostat

A new thermostat should be installed only after the following tests and checks have been carried out:

- Pinpoint Test A, B or C
- Thermostat Visual Inspection

Thermostat Visual Inspection

1. Remove the thermostat.
2. Examine the thermostat for signs of damage including:
    - Valve not fully seated (light visible through the valve)
    - Foreign material lodged in the main valve
    - Bent or broken frame or flange
    - Bent or broken spring
    - Bent or broken valve or valve stem
    - Wax leaking from wax reservoir or a bulge in the reservoir

- Any other damage or distortion

NOTE: If no damage is found during the inspection, do not attempt to open the thermostat using hot water or other heat sources. This method is not an accurate means to test the function of the thermostat and may damage the thermostat.

3. If damage is found during the inspection, remove any foreign material or broken pieces and install a new thermostat.
4. If no damage is found during the inspection, continue troubleshooting the system concern. Go to the Symptom Chart for further instructions.

Radiator Leak Test, Removed From Vehicle

NOTE: Never leak test an aluminum radiator in the same water that copper/brass radiators are tested in. Flux and caustic cleaners may be present in the cleaning tank and they will damage aluminum radiators.

NOTE: Always install plugs in the oil cooler fittings before leak testing or cleaning any radiator.

NOTE: Clean the radiator before leak testing to avoid contamination of tank.

1. Leak test the radiator in clean water with 138 kPa (20 psi) air pressure.

Fan Clutch Test

1. Turn the engine OFF and wait until the fan comes to a complete stop.
2. Spin the fan blade by hand. A light resistance should be felt. If there is no resistance or very high resistance, the minimum and maximum fan speeds must be checked. For an electronically actuated fan clutch, refer to the **Introduction - Gasoline Engines** article. For a viscous fan clutch, carry out the following:

Fan Clutch Test - Minimum Speed Requirement

1. Use a suitable marker to mark the coolant pump or fan pulley and one of the fan blades.
2. Make sure the A/C is OFF, if equipped.

WARNING: Do not operate the engine with the hood open until the fan blade has been examined for possible cracks and separation. A damaged fan can separate during operation. Failure to follow this instruction may result in serious personal injury.

3. Start the engine and run it at approximately 2,000 RPM for 5 minutes or until there is a noticeable reduction in fan noise to allow the fan clutch to go into disengaged mode.

4. Aim a laser photo tachometer at the coolant pump or fan pulley. Run the engine to achieve 3,000 RPM at the coolant pump or fan pulley.
5. With the coolant pump or fan pulley at 3,000 RPM, aim the laser photo tachometer at the fan blade. Monitor and record fan speed.
6. The fan blade speed must be less than the specified RPM at 3,000 RPM coolant pump or fan pulley RPM. Refer to **SPECIFICATIONS** for correct fan speed.
7. Turn the engine off.
8. If the fan blade speed was greater than specified, install a new fan clutch.

Fan Clutch Test - Maximum Speed Requirement

1. Use a suitable marker to mark the coolant pump or fan pulley and one of the fan blades.
2. Block off areas on each side of the radiator in the engine compartment, the front of the radiator grille and the bumper. Close the hood. This will raise the temperature of the air striking the fan clutch and should cause the fan blade to operate at maximum speed.
3. Place the climate control function selector switch in the MAX A/C position and the blower motor switch in the HI position, if equipped.

WARNING: **Do not operate the engine with the hood open until the fan blade has been examined for possible cracks and separation. A damaged fan can separate during operation. Failure to follow this instruction may result in serious personal injury.**

NOTE: **Do not open the hood to check the coolant pump or fan pulley temperature. This will lower the temperature of the air reaching the fan clutch and void the test. Aim the infrared thermometer through the wheel well or from under the vehicle.**

4. Start the engine and run it at approximately 2,000 RPM until normal operating temperature has been achieved. Using an infrared thermometer, monitor the coolant pump or fan pulley. Run the engine until the coolant pump or fan pulley is at least 96°C (205°F).

NOTE: **Do not open the hood to check the coolant pump or fan pulley or fan blade speed. This will lower the temperature of the air reaching the fan clutch and void the test. Aim the laser photo tachometer through the wheel well or from under the vehicle.**

5. Aim a laser photo tachometer at the coolant pump or fan pulley. Run the engine to achieve 3,000 RPM at the coolant pump or fan pulley.
6. With the coolant pump or fan pulley at 3,000 RPM, aim the laser photo tachometer at the fan blade. Monitor and record fan blade speed.
7. The fan blade speed must be greater than the specified RPM at 3,000 RPM coolant pump or fan pulley RPM. Refer to **SPECIFICATIONS** for correct fan speed.
8. Open the hood and allow the engine to idle momentarily to lower engine temperature. Turn the engine off

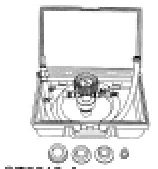
and remove the blocks from the radiator, grille and bumper.

9. If the fan blade speed is less than specified, install a new fan clutch.

GENERAL PROCEDURES

COOLING SYSTEM DRAINING, FILLING AND BLEEDING

Special Tools

Illustration	Tool Name	Tool Number
 ST2818-A	RADKITPLUS	078-00497

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (bittered in US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

Draining

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

NOTE: The coolant must be recovered in a suitable, clean container for reuse. If the coolant is contaminated, it must be recycled or disposed of correctly. Using contaminated coolant may result in damage to the engine or cooling system components.

NOTE: The engine cooling system is filled with Motorcraft Premium Gold Engine Coolant. Mixing coolant types degrades the corrosion protection of Motorcraft Premium Gold Engine Coolant.

NOTE: Stop-leak style pellets/products must not be used as an additive in this engine cooling system. The addition of stop-leak style pellets/products can clog or damage the cooling system, resulting in degraded cooling system performance and/or failure.

NOTE: Less than 80% of coolant capacity can be recovered with the engine in the vehicle. Dirty, rusty or contaminated coolant requires replacement.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Release the pressure in the cooling system by slowly turning the pressure relief cap one half turn counterclockwise. When the pressure is released, remove the pressure relief cap.
3. Place a suitable container below the radiator draincock.
    - Open the draincock and allow to drain.
    - Close the draincock after draining.
4. When the coolant is drained, make sure drain plugs are installed and tight.

Filling and Bleeding with RADKITPLUS

1. Install the RADKITPLUS and follow the manufacturer's instructions to fill and bleed the cooling system.

Filling and Bleeding without RADKITPLUS

NOTE: Engine coolant provides freeze protection, boil protection, cooling efficiency and corrosion protection to the engine and cooling components. In order to obtain these protections, the engine coolant must be maintained at the correct concentration and fluid level in the degas bottle.
When adding engine coolant, use a 50/50 mixture of engine coolant and distilled water.
To maintain the integrity of the coolant and the cooling system:

- **Vehicle cooling systems are filled with Motorcraft Premium Gold Engine Coolant. Always fill the cooling system with the same coolant that is present in the system. Do not mix coolant types.**
- **Do not add/mix orange-colored Motorcraft Specialty Orange Engine Coolant or equivalent meeting Ford specification WSS-M97B44-D or green-colored Premium Engine Coolant. Mixing coolants may degrade the coolant's corrosion protection.**
- **Do not add alcohol, methanol or brine, or any engine coolants mixed with alcohol or methanol antifreeze. These can cause engine damage from overheating or freezing.**
- **Ford Motor Company does NOT recommend the use of recycled engine coolant in vehicles originally equipped with Motorcraft Premium Gold Engine Coolant since a Ford-approved recycling process is not yet available.**
- **Used engine coolant should be disposed of in an appropriate manner. Follow the community's regulations and standards for recycling and disposing of automotive fluids.**

NOTE: **Stop-leak style pellets/products must not be used as an additive in this engine cooling system. The addition of stop-leak style pellets/products can clog or damage the cooling system, resulting in degraded cooling system performance and/or failure.**

2.3L engine

1. Open the degas bottle cap and the bleed valve on the back of the engine water outlet.

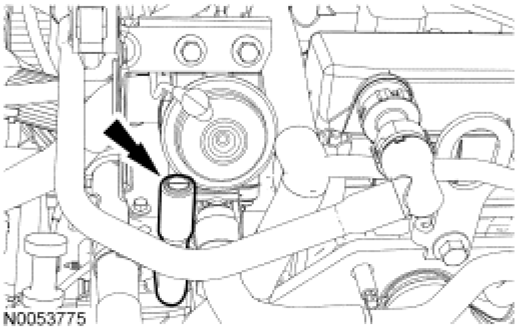


Fig. 5: Identifying Bleed Valve (2.3L)
Courtesy of FORD MOTOR CO.

3.0L engine

2. Open the degas bottle cap and the bleed valve on the upper radiator hose.

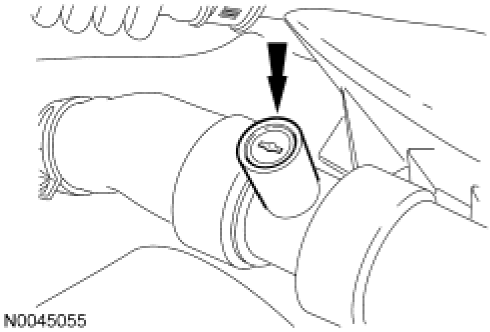


Fig. 6: Identifying Bleed Valve (3.0L)
Courtesy of FORD MOTOR CO.

2.3L and 3.0L engines

NOTE: **Make sure the coolant flows from the radiator through the upper radiator hose and fills the engine. When full, coolant should flow from the bleed hole.**

3. Fill the degas bottle to the MAX fill line.
4. Close the degas bottle cap and the bleed valve.

NOTE: If the engine overheats or the fluid level drops below the minimum fill line, shut off the engine and add fluid to the degas bottle maximum fill line once the engine cools. Failure to follow these instructions may result in damage to the engine.

5. Start the engine and let it idle for 10 minutes (3.0L), 30 minutes (2.3L) or until the engine reaches normal operating temperature.
6. Allow the engine to cool and repeat Step 3 if necessary.
7. Start the engine and turn the heater to the MAX position.

NOTE: If the engine overheats or the fluid level drops below the minimum fill line, shut off the engine and add fluid to the degas bottle maximum fill line once the engine cools. Failure to follow these instructions may result in damage to the engine.

8. Run the engine at 2,500 RPM for 10 minutes.
9. Repeat Step 8 if necessary.

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

10. Check the engine coolant level in degas bottle and fill as necessary.

3.5L engine

11. Open the degas bottle cap and fill the degas bottle to the MAX fill line.
12. Close the degas bottle cap.

NOTE: If the engine overheats or the fluid level drops below the minimum fill line, shut off the engine and add fluid to the degas bottle maximum fill line once the engine cools. Failure to follow these instructions may result in damage to the engine.

13. Start the engine and let idle for 10 minutes or until the engine reaches normal operating temperature.
14. Repeat Step 13 if necessary.
15. Start the engine and turn the heater to the MAX position.

NOTE: If the engine overheats or the fluid level drops below the minimum fill line, shut off the engine and add fluid to the degas bottle maximum fill line once the engine cools. Failure to follow these instructions may result in damage

to the engine.

16. Idle engine until the fan turns on, indicating the thermostat is fully open.
    1. Increase engine speed to 2,500 RPM for 30 seconds.
    2. Idle engine for 2 minutes.
    3. Repeat Steps 1 and 2 five times.
17. Repeat Step 16 if necessary.

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

18. Check the engine coolant level in the degas bottle and fill as necessary.

COOLING SYSTEM FLUSHING

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (bittered in US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
Premium Cooling System Flush VC-1	ESR-M14P7-A

1. To remove rust, sludge and other foreign material from the cooling system, use cooling system flush that is safe for use with aluminum radiators. For additional information, refer to **SPECIFICATIONS**. This cleaning restores cooling system efficiency and helps prevent overheating. A pulsating or reversed direction of flushing water will loosen sediment more quickly than a steady flow in the normal coolant flow direction. In severe cases where cleaning solvents will not clean the cooling system efficiently, it will be necessary to use the pressure flushing method using cooling system flusher. Dispose of old coolant and flushing water contaminated with antifreeze and cleaning chemicals in accordance with local, state or federal laws.
2. Remove the radiator. For additional information, refer to **Radiator**.

NOTE: **Radiator internal pressure must not exceed 138 kPa (20 psi). Damage to the radiator can result.**

3. Backflush the radiator with the radiator in an upside-down position with a high-pressure hose in the lower hose location and backflush.

NOTE: On 2.3L engines, the thermostat and housing are serviced as an assembly.

4. Remove the thermostat. For additional information, refer to **Thermostat Housing - 2.3L**, **Thermostat - 3.0L** or **Thermostat - 3.5L**.
5. Backflush the engine. Position the high-pressure water hose into the engine through the engine return and backflush the engine.

REMOVAL AND INSTALLATION

BLOCK HEATER

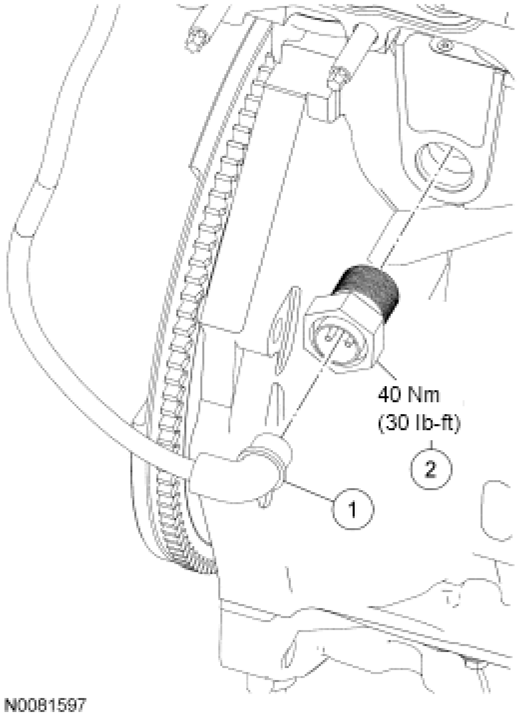


Fig. 7: Exploded View Of Block Heater With Torque Specification - 2.3L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6B018	Block heater electrical connector
2	6A051	Block heater

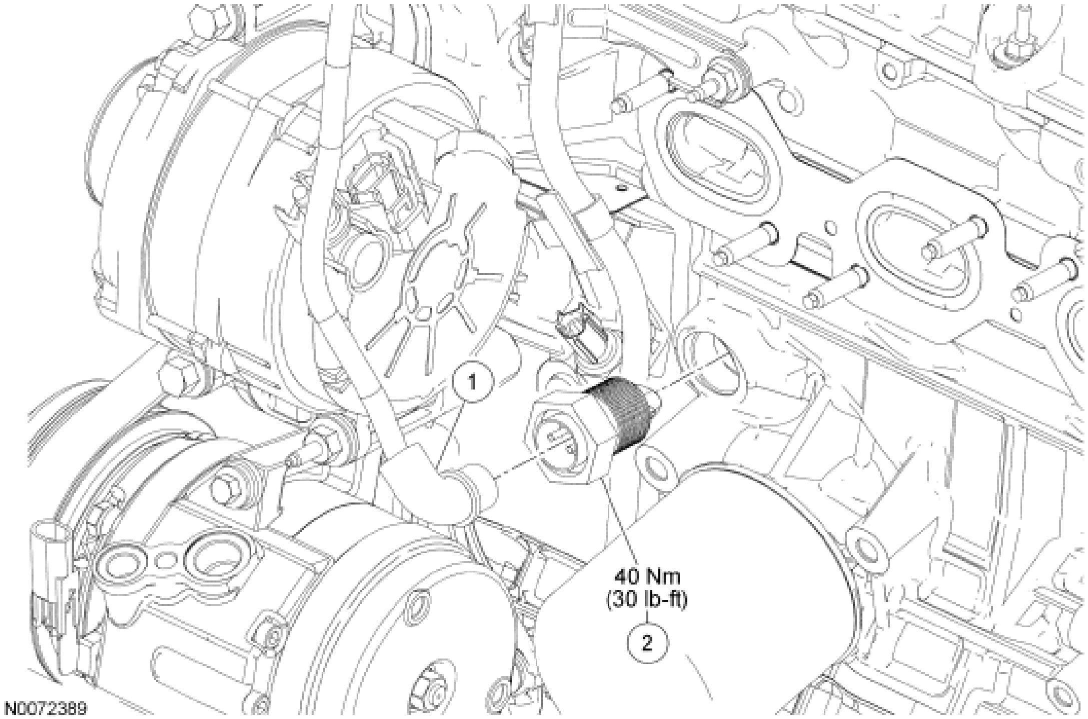


Fig. 8: Exploded View Of Block Heater With Torque Specification - 3.0L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6B018	Block heater electrical connector
2	6A051	Block heater

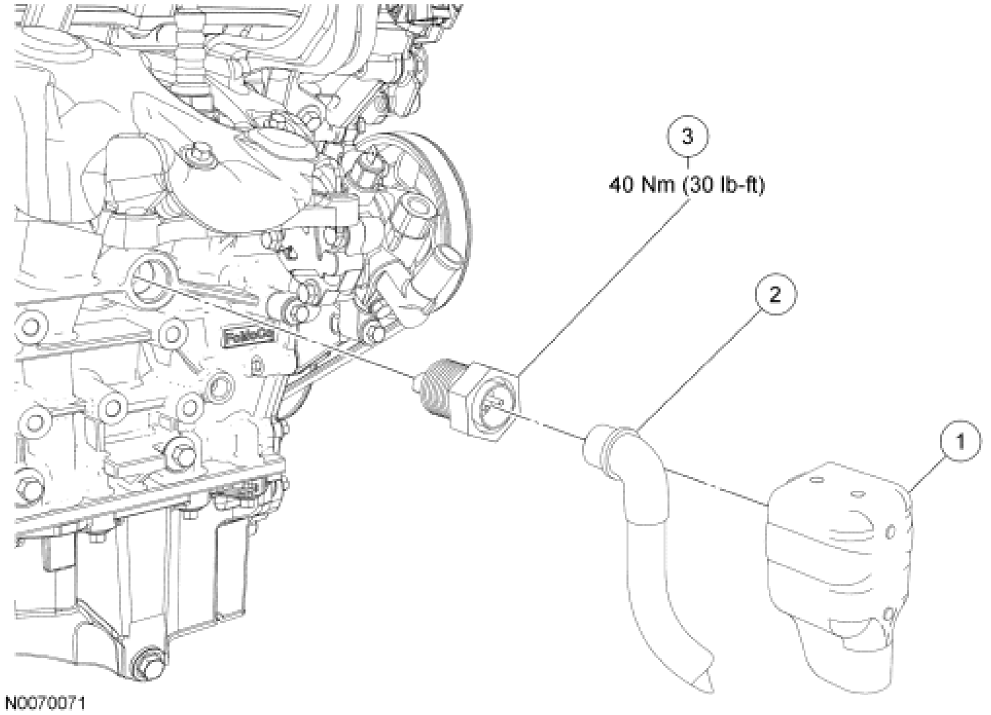


Fig. 9: Exploded View Of Block Heater With Torque Specification - 3.5L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	030104	Block heater cover
2	6B018	Block heater electrical connector
3	6A051	Block heater

REMOVAL AND INSTALLATION

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Drain the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.
3. If equipped, remove the 7 screws and the underbody cover.

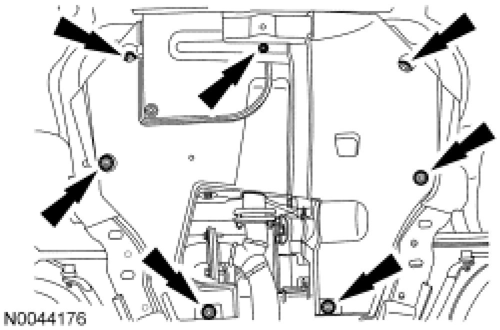


Fig. 10: Locating Underbody Cover Screws
Courtesy of FORD MOTOR CO.

3.5L only

4. Remove the RH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.
5. Remove the block heater cover.

All vehicles

NOTE: Make sure that the block heater wiring is routed and secured away from rotating or hot components, or damage to the wiring can occur.

6. Disconnect the block heater electrical connector.
7. Remove the block heater.
   - To install, tighten to 20 Nm (177 lb-in) (2.3L only).
   - To install, tighten to 40 Nm (30 lb-ft) (3.0L and 3.5L).
8. To install, reverse the removal procedure.
9. Fill and bleed the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.

THERMOSTAT HOUSING - 2.3L

NOTE: The thermostat and thermostat housing are serviced as an assembly.

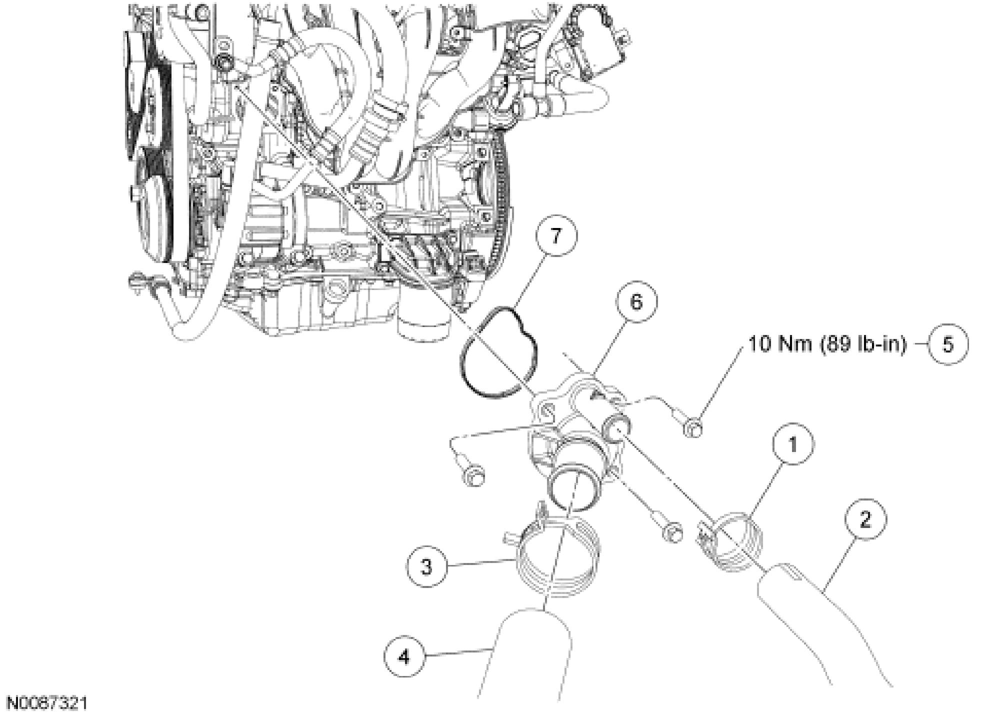


Fig. 11: Exploded View Of Thermostat Housing With Torque Specifications - 2.3L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	15161	Heater hose clamp
2	18C266	Heater hose
3	15161	Radiator hose clamp
4	8B273	Radiator hose
5	W500015	Thermostat housing bolt (3 required)
6	8575	Thermostat housing
7	8K530	Gasket

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Drain the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.

NOTE: **The view of the thermostat housing bolts is obstructed by power steering, A/C and engine components. However, the bolts can be removed using 1/4-in drive hand tools.**

NOTE: **The LH upper thermostat housing bolt can be accessed from under the hood. The RH upper and lower thermostat housing bolts can be accessed**

from under the vehicle as viewed in the illustration below.

3. Remove the 3 bolts and reposition the thermostat housing to gain access to the hose clamps.
    - Remove and discard the gasket.
    - To install, tighten the bolts to 10 Nm (89 lb-in).

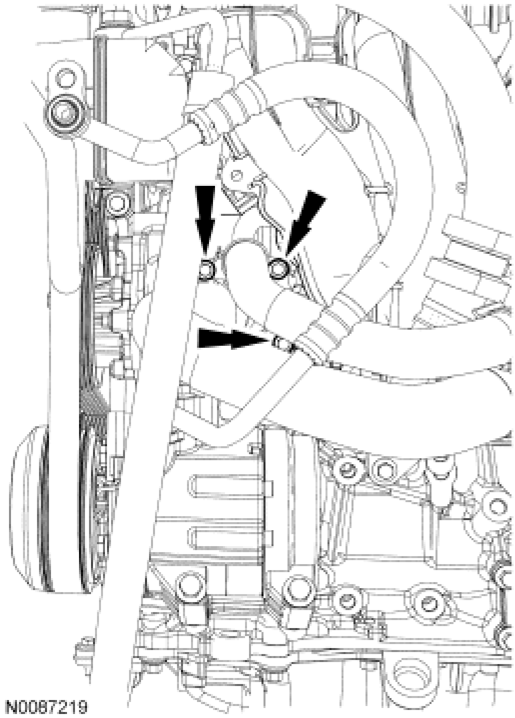


Fig. 12: Locating Bolts On Hose Clamps
Courtesy of FORD MOTOR CO.

4. Disconnect the heater hose from the thermostat housing.
5. Disconnect the lower radiator hose from the thermostat housing and remove the thermostat housing.
6. To install, reverse the removal procedure.
    - Install a new thermostat housing gasket.
7. Fill and bleed the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.

THERMOSTAT - 3.0L

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (bittered in US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

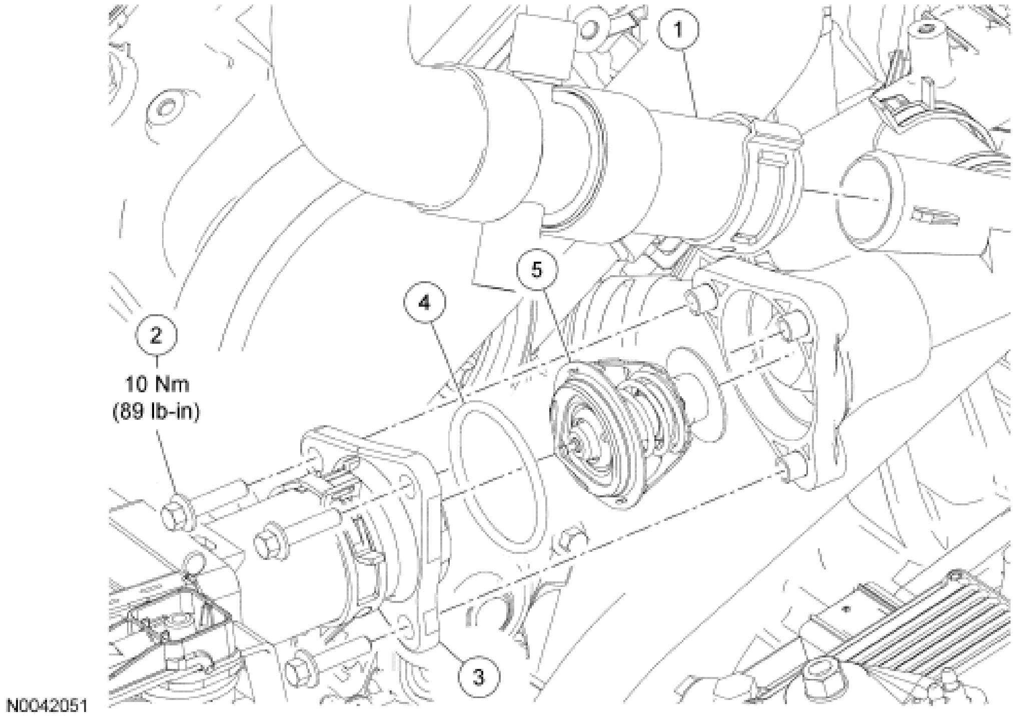


Fig. 13: Exploded View Of Thermostat With Torque Specification - 3.0L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8B274	Upper radiator-to-thermostat housing hose
2	W500015	Thermostat housing cover bolt (3 required)
3	8K528	Thermostat housing cover
4	N806807	O-ring seal
5	8575	Thermostat

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Drain the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.
3. Disconnect the upper radiator-to-thermostat housing hose and position aside.
4. Remove the 3 bolts, thermostat housing cover, O-ring seal and thermostat.
   - Clean and inspect the O-ring seal. Install a new seal if necessary.
   - To install, tighten to 10 Nm (89 lb-in).

NOTE: Lubricate the thermostat O-ring seal with clean engine coolant.

5. To install, reverse the removal procedure.
6. Fill and bleed the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.

THERMOSTAT HOUSING - 3.0L

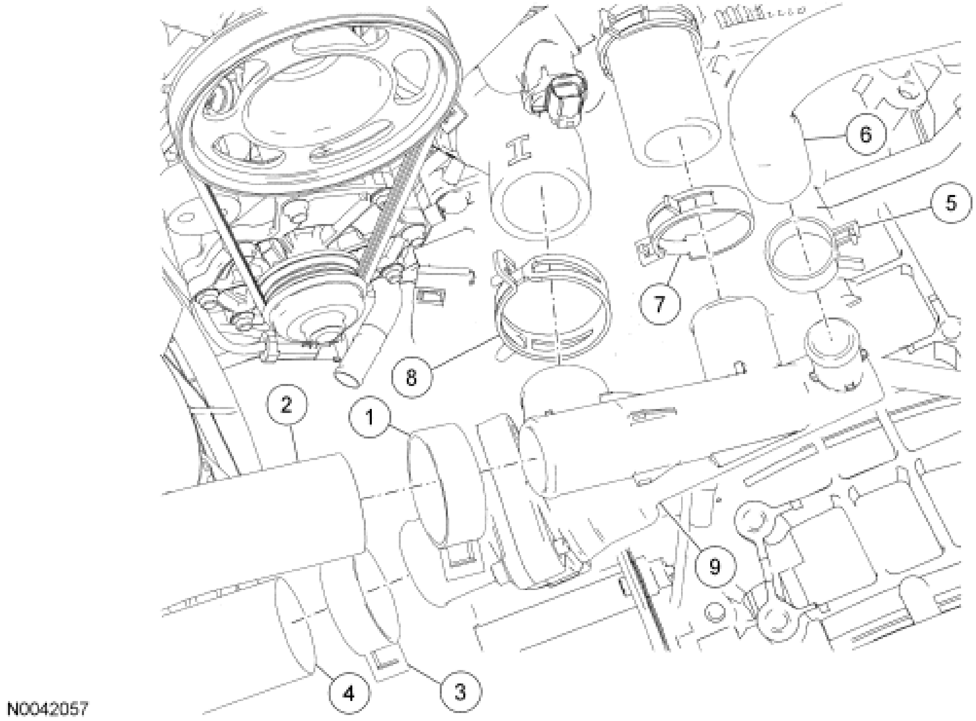


Fig. 14: Exploded View Of Thermostat Housing - 3.0L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W527371	Radiator hose clamp
2	8B274	Upper radiator hose
3	W527375	Radiator hose clamp
4	8B273	Lower radiator hose
5	W527212	Heater hose clamp
6	18C266	Heater hose
7	8287	Clamp
8	8287	Clamp
9	8A586	Thermostat housing

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

2. Drain the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.
3. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article.
4. Disconnect the upper radiator hose from the thermostat housing and position aside.
5. Disconnect the lower radiator hose from the thermostat housing and position aside.
6. Disconnect the heater hose from the thermostat housing and position aside.
7. Reposition the 2 thermostat housing-to-engine hose clamps.
    - Remove the thermostat housing.
8. To install, reverse the removal procedure.
9. Fill and bleed the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.

THERMOSTAT - 3.5L

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (bittered in US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

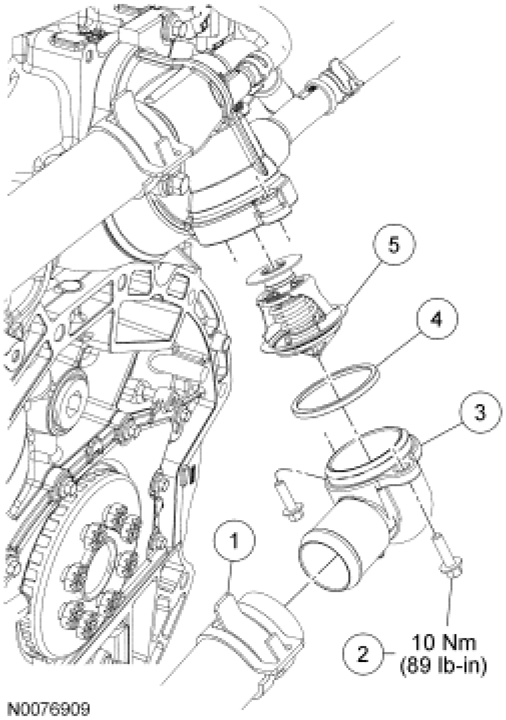


Fig. 15: Exploded View Of Thermostat With Torque Specification - 3.5L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8B273	Lower radiator-to-thermostat housing cover hose
2	W500014	Thermostat housing cover bolt (2 required)
3	8594	Thermostat housing cover
4	-	O-ring seal
5	8575	Thermostat

REMOVAL AND INSTALLATION

1. Drain the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.
2. Remove the air cleaner and outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.
3. Disconnect the lower radiator hose from the thermostat housing cover and position it aside.
4. Remove the 2 bolts, thermostat housing cover, O-ring seal and thermostat.
    - Clean and inspect the O-ring seal. Install a new seal if necessary.
    - To install, tighten to 10 Nm (89 lb-in).

NOTE: Lubricate the thermostat O-ring seal with clean engine coolant.

5. To install, reverse the removal procedure.
6. Fill and bleed the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.

THERMOSTAT HOUSING - 3.5L

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (bittered in US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

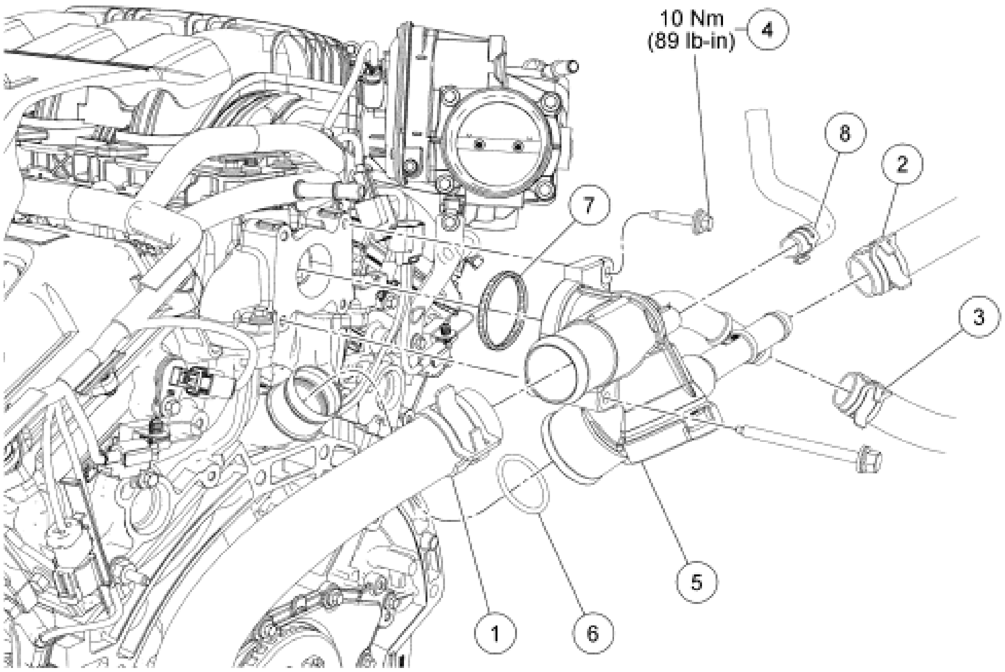


Fig. 16: Exploded View Of Thermostat Housing With Torque Specification - 3.5L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8B274	Upper radiator-to-thermostat housing hose
2	18C266	Heater outlet hose
3	18C266	Heater inlet hose
4	W503279	Thermostat housing bolt (2 required)
5	8A586	Thermostat housing
6	8565	O-ring seal
7	8A571	O-ring seal
8	8B541	Thermostat housing-to-degas bottle hose

REMOVAL AND INSTALLATION

1. Remove the thermostat. For additional information, refer to **Thermostat - 3.5L**.
2. Disconnect the 4 coolant hoses from the thermostat housing and position them aside.
3. Remove the 2 thermostat housing bolts.
   - To install, tighten to 10 Nm (89 lb-in).

NOTE: **Do not pull the other end of the coolant tube out of the engine block when separating the thermostat housing.**

4. Separate the thermostat housing from the coolant tube and remove the thermostat housing.
   - Remove and discard the O-ring seals.
5. To install, reverse the removal procedure.
   - Lubricate the new O-ring seals with clean engine coolant.

BYPASS TUBE - 2.3L

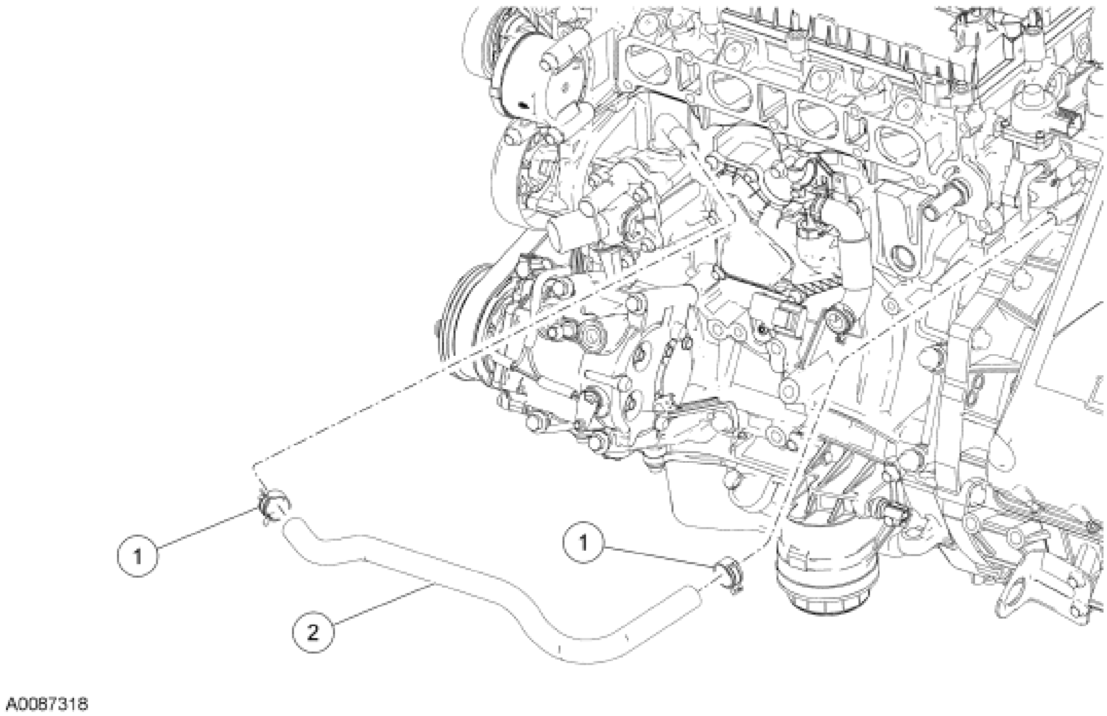


Fig. 17: Exploded View Of Bypass Tube
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W525958	Hose clamps (2 required)
2	8548	Bypass tube

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Drain the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.
3. Remove the intake manifold. For additional information, refer to **ENGINE - 2.3L** article.
4. Disconnect and remove the coolant bypass tube from the engine.
5. To install, reverse the removal procedure.
6. Fill and bleed the cooling system. For additional information, refer to **Cooling System Draining, Filling**

and Bleeding.

BYPASS TUBE - 3.0L

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (bittered in US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

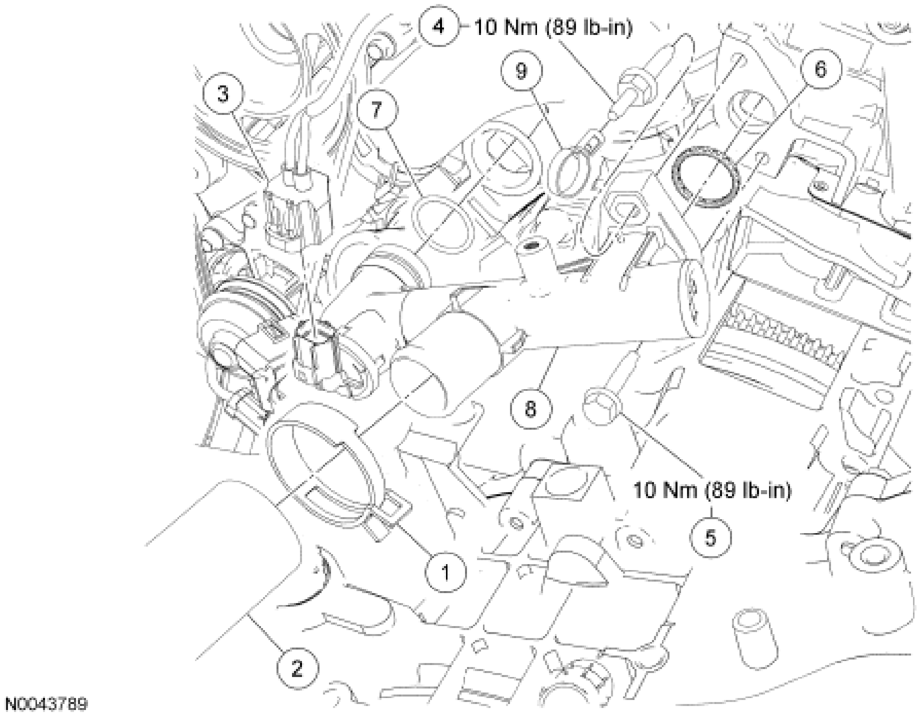


Fig. 18: Exploded View Of Bypass Tube With Torque Specifications - 3.0L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8287	Hose clamp
2	8A520	Bypass tube-to-thermostat housing hose
3	14A464	Engine Coolant Temperature (ECT) sensor electrical connector
4	W701632	Stud bolt
5	W7016699	Bolt
6	8548	O-ring seal
7	391552	O-ring seal
8	8548	Bypass tube
9	-	Wiring harness retainer

REMOVAL AND INSTALLATION

1. Remove the thermostat housing. For additional information, refer to **Thermostat Housing - 3.0L**.
2. Remove the bypass tube-to-thermostat housing hose.
3. Disconnect the Engine Coolant Temperature (ECT) sensor electrical connector.
4. Detach the wiring harness retainer from the bypass tube stud bolt.

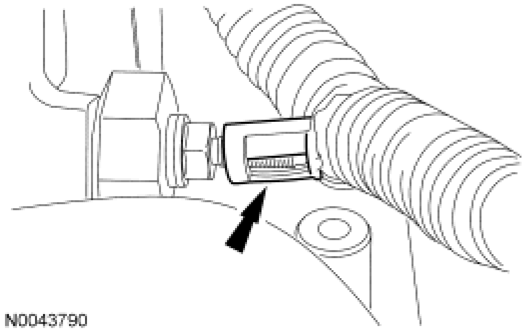


Fig. 19: Locating Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

5. Remove the bolt, stud bolt and bypass tube.
    - To install, tighten the bolt and stud bolt to 10 Nm (89 lb-in).
6. Remove and inspect the O-ring seals, install new seals if necessary.
7. To install, reverse the removal procedure.
    - Lubricate the O-ring seals with clean engine coolant.
8. Fill and bleed the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.

COOLANT PUMP - 2.3L

Material

Item	Specification
Motorcraft Premium Gold Engine Coolant with Bittering Agent (bittered in US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1

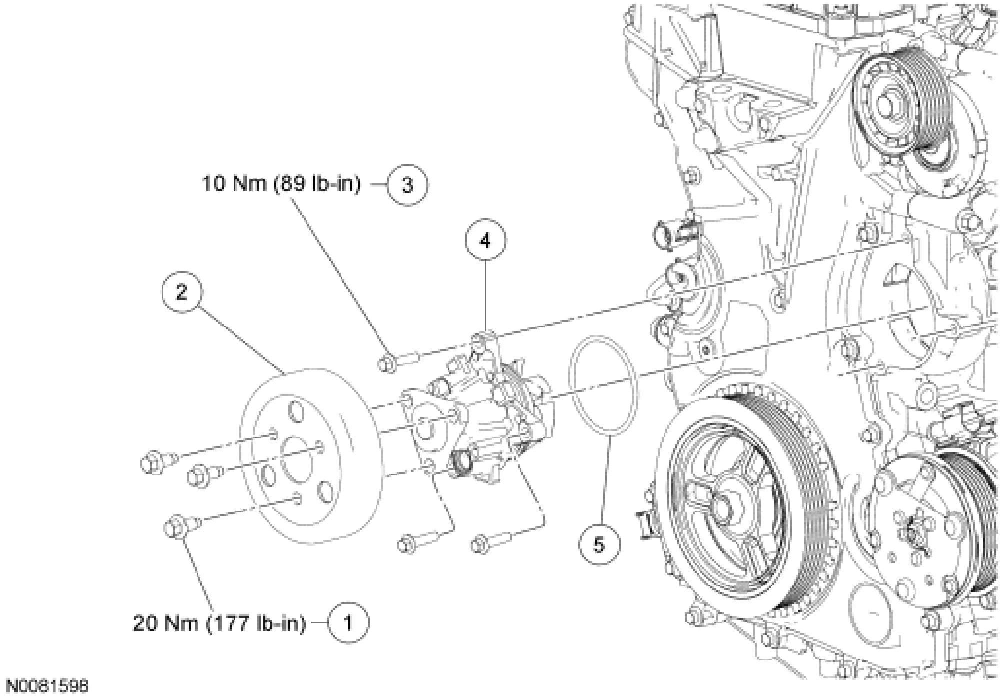


Fig. 20: Exploded View Of Coolant Pump With Torque Specifications - 2.3L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500221	Coolant pump pulley bolt (3 required)
2	8509	Coolant pump pulley
3	W500015	Coolant pump bolt (3 required)
4	8501	Coolant pump
5	8507	Coolant pump O-ring seal

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Drain the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.
3. Loosen the 3 coolant pump pulley bolts.
4. Remove the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 2.3L** article.
5. Remove the 3 bolts and the coolant pump pulley.
    - To install, tighten to 20 Nm (177 lb-in).

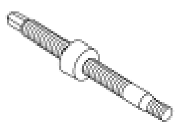
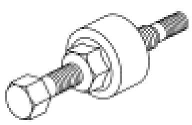
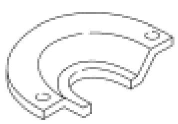
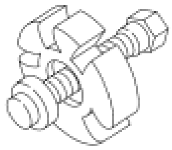
NOTE: **Make sure the coolant pump is correctly seated to the engine block before installing and tightening the fasteners, or damage to the coolant pump**

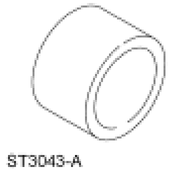
may occur.

6. Remove the 3 bolts and the coolant pump.
   - Remove and discard the O-ring seal.
   - To install, tighten to 10 Nm (89 lb-in).
7. To install, reverse the removal procedure.
   - Lubricate the O-ring seal with clean engine coolant.
8. Fill and bleed the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.

COOLANT PUMP - 3.0L

Special Tools

Illustration	Tool Name	Tool Number
 ST3042-A	Installer, Camshaft Pulley	303-458 (T94P-6312-AH3), part of 303-S455
 ST1586-A	Installer, Power Steering Pump Pulley (Nut only)	211-185 (T91P-3A733-A)
 ST3044-A	Plate, Water Pump Pulley	303-456 (T94P-6312-AH1), part of 303-S455
 ST3045-A	Protector, Water Pump Shaft	303-457 (T94P-6312-AH2), part of 303-A455
 ST1286-A	Remover, Crankshaft Vibration Damper	303-009 (T58P-6316-D)
		303-459 (T94P-6312-AH4), part

	Spacer, Water Pump Pulley	of 303-S455

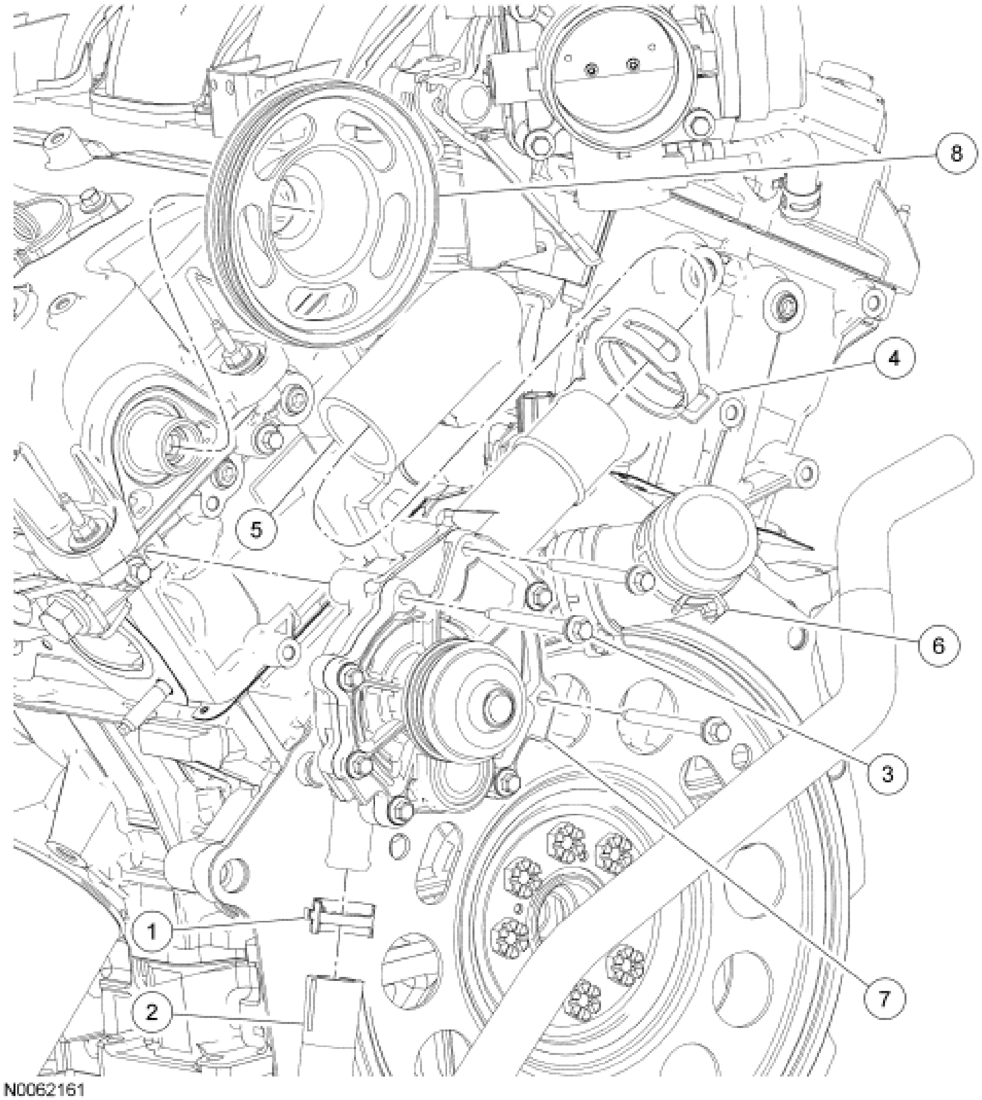


Fig. 21: Exploded View Of Coolant Pump - 3.0L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W525958	Heater hose clamp
2	18K359	Heater hose
3	W701544	Coolant pump assembly bolt (3 required)
4	8287	Coolant pump-to-engine hose clamp

5	8A577	Coolant pump-to-engine hose
6	8287	Coolant pump-to-thermostat housing hose clamp
7	8501	Coolant pump assembly
8	6A359	Coolant pump drive pulley

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Drain the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.
3. Remove the coolant pump belt. For additional information, refer to **ACCESSORY DRIVE - 3.0L (4V)** article.

NOTE: Failure to use the correct Water Pump Pulley Plate, Water Pump Shaft Protector and Crankshaft Vibration Damper Remover, assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or the Water Pump Pulley Plate, Water Pump Shaft Protector and Crankshaft Vibration Damper Remover.

4. Using the Water Pump Pulley Plate, Water Pump Shaft Protector and the Crankshaft Vibration Damper Remover, remove the coolant pump pulley.

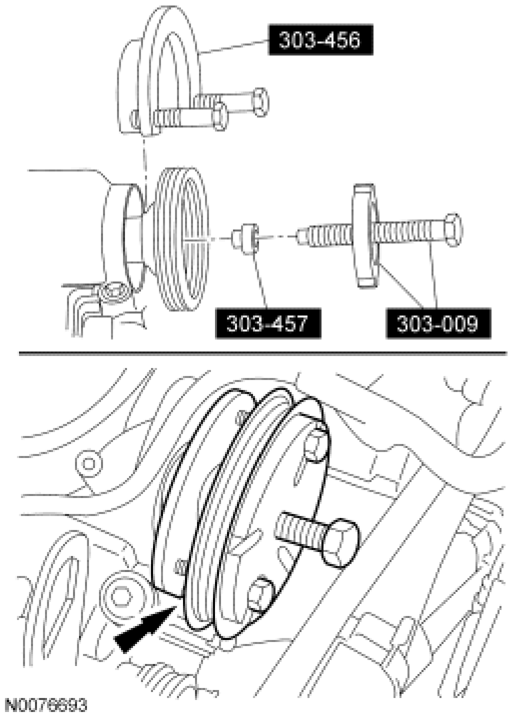


Fig. 22: Removing Coolant Pump Pulley Using Special Tools (303-009, 303-456, 303-457)

Courtesy of FORD MOTOR CO.

5. Disconnect the heater hose from the coolant pump.
6. Disconnect the coolant pump-to-engine hose and position aside.
7. Remove the 3 bolts from the coolant pump assembly.

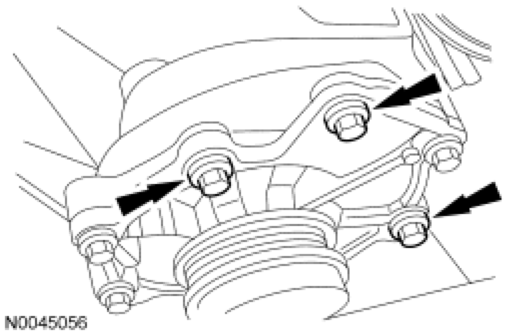


Fig. 23: Coolant Pump Assembly Bolts
Courtesy of FORD MOTOR CO.

8. Reposition the coolant pump-to-thermostat housing hose clamp and remove the coolant pump and hose as an assembly.

INSTALLATION

1. Connect the coolant pump-to-thermostat housing hose and reposition the clamp.
2. Position the coolant pump assembly and install the 3 bolts.
   - Tighten to 10 Nm (89 lb-in).
   - Tighten the 3 bolts an additional 90 degrees.
3. Connect the coolant pump-to-engine hose and the heater hose.

NOTE: **Failure to use the correct Camshaft Pulley Installer, assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or the Camshaft Pulley Installer.**

4. Install the Camshaft Pulley Installer on the camshaft as shown in the illustration.
   - Adjust the collar on the Camshaft Pulley Installer to get the best thread engagement in the rear of the camshaft.

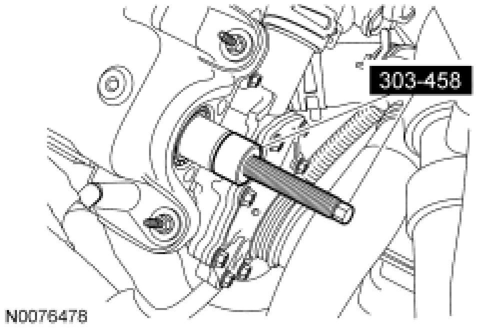


Fig. 24: Installing Special Tool On Camshaft
Courtesy of FORD MOTOR CO.

NOTE: Failure to use the correct Power Steering Pump Pulley Installer, Camshaft Pulley Installer and Water Pump Pulley Spacer assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or the Power Steering Pump Pulley Installer, Camshaft Pulley Installer and Water Pump Pulley Spacer.

NOTE: Only the roller collared nut from the Power Steering Pump Pulley Installer is used on the Camshaft Pulley Installer.

5. Position the coolant pump pulley over the previously installed Camshaft Pulley Installer on the end of the camshaft. Install the Camshaft Pulley Installer, Water Pump Pulley Spacer and the Power Steering Pump Pulley Installer as shown in the illustration.
   - Using the Camshaft Pulley Installer, Water Pump Pulley Spacer and the Power Steering Pump Pulley Installer, install the coolant pump pulley flush with the end of the camshaft.

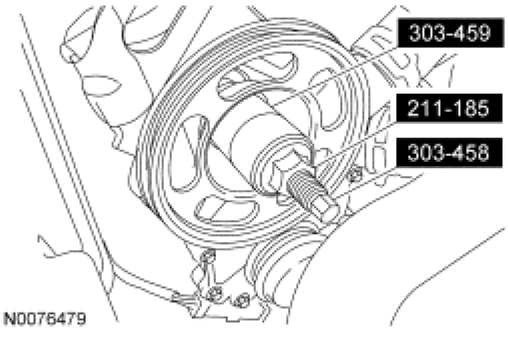
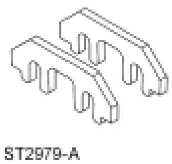


Fig. 25: Installing Coolant Pump Pulley Using Special Tools (211-185, 303-458, 303-459)
Courtesy of FORD MOTOR CO.

6. Install the coolant pump belt. For additional information, refer to **ACCESSORY DRIVE - 3.0L (4V)** article.
7. Fill and bleed the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.

COOLANT PUMP - 3.5L

Special Tools

Illustration	Tool Name	Tool Number
	Camshaft Holding Tool	303-1248

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

REMOVAL

NOTE: **During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan can cause engine failure.**

1. Remove the engine front cover. For additional information, refer to **ENGINE - 3.5L** article.
2. Remove and discard the engine oil filter.
3. Rotate the crankshaft clockwise and align the timing marks on the variable camshaft timing Variable Camshaft Timing (VCT) assemblies as shown.

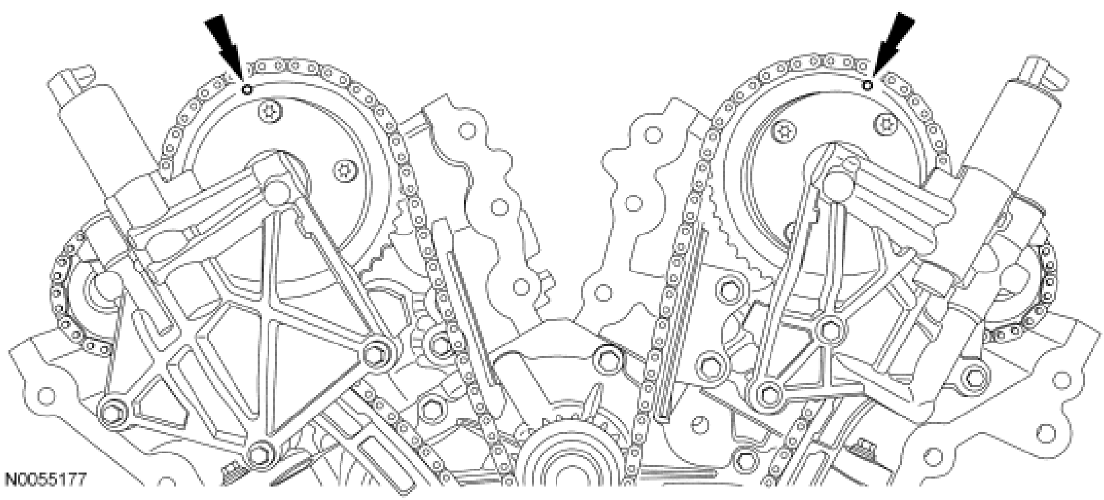


Fig. 26: Aligning Timing Marks On Variable Camshaft Timing (VCT) Assemblies
Courtesy of FORD MOTOR CO.

NOTE: The Camshaft Holding Tool will hold the camshafts in the Top Dead Center (TDC) position.

4. Install the Camshaft Holding Tool onto the flats of the LH camshafts.

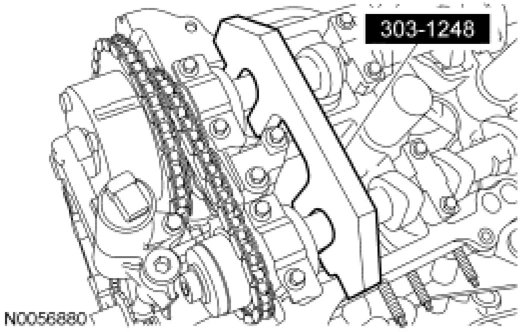


Fig. 27: Installing Special Tool (303-1248) Onto Flats Of LH Camshafts
Courtesy of FORD MOTOR CO.

NOTE: The Camshaft Holding Tool will hold the camshafts in the TDC.

5. Install the Camshaft Holding Tool onto the flats of the RH camshafts.

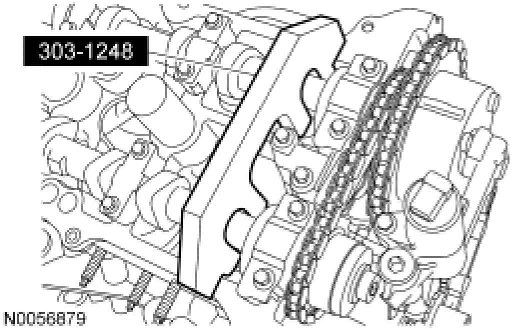


Fig. 28: Installing Special Tool (303-1248) Onto Flats Of RH Camshafts
Courtesy of FORD MOTOR CO.

6. Remove the 3 bolts and the RH VCT housing.

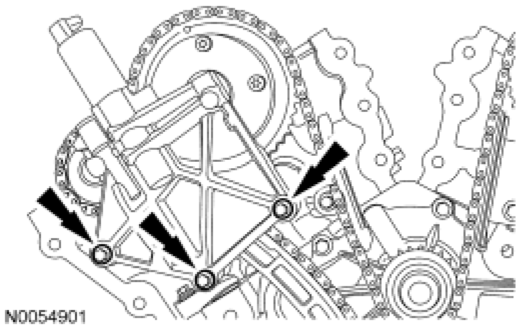


Fig. 29: Locating RH VCT Housing
Courtesy of FORD MOTOR CO.

7. Remove the 3 bolts and the LH VCT housing.

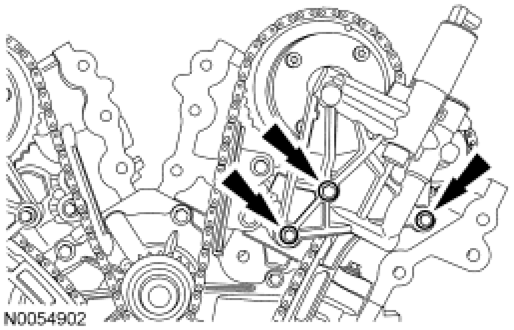


Fig. 30: Locating LH VCT Housing
Courtesy of FORD MOTOR CO.

8. Remove and discard the VCT housing seals.

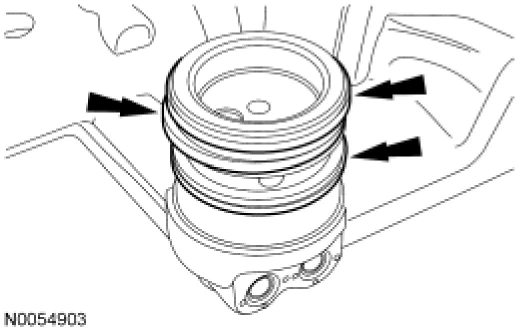


Fig. 31: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

9. Remove the 2 bolts and the primary timing chain tensioner.

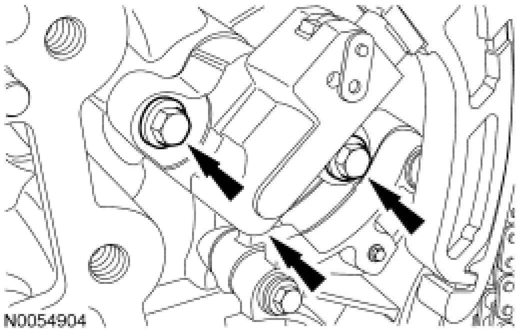


Fig. 32: Locating Primary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

10. Remove the primary timing chain tensioner arm.

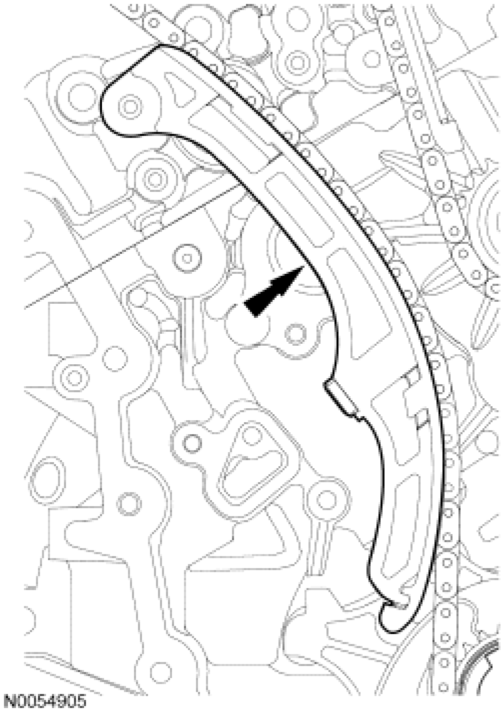
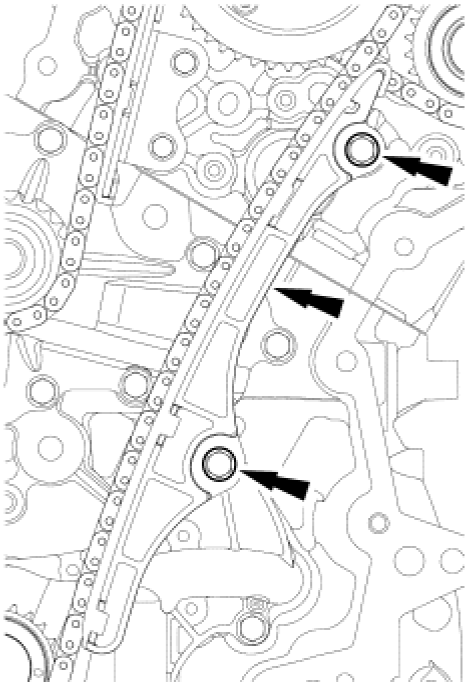


Fig. 33: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

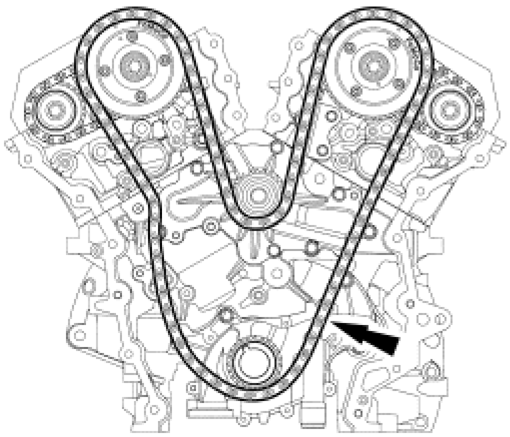
11. Remove the 2 bolts and the lower LH primary timing chain guide.



N0054906

Fig. 34: Locating Lower LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

12. Remove the primary timing chain.



N0054908

Fig. 35: Locating Primary Timing Chain

Courtesy of FORD MOTOR CO.

13. Remove the 2 bolts and the upper LH primary timing chain guide.

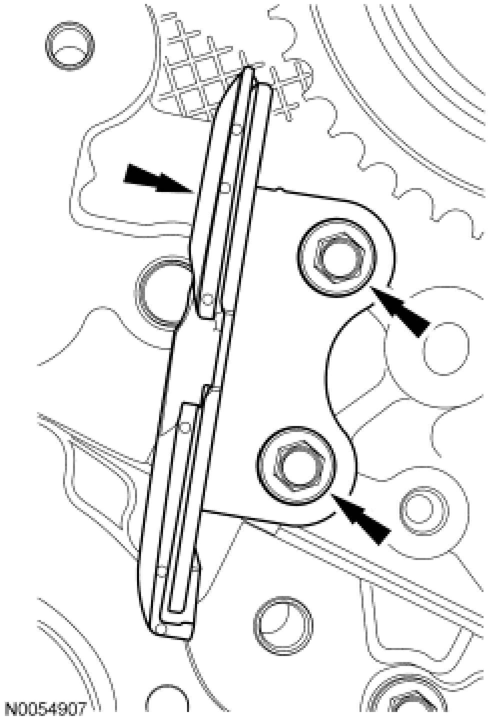


Fig. 36: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

14. Remove the RH primary timing chain guide lower bolt.

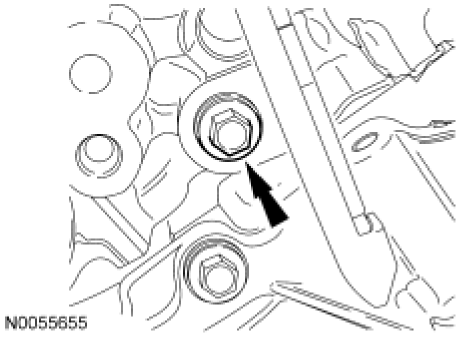


Fig. 37: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

NOTE:	**The RH primary timing chain guide must be repositioned to allow the coolant pump to be removed.**

15. Loosen the RH primary timing chain guide upper bolt.

- Rotate the guide and tighten the bolt.

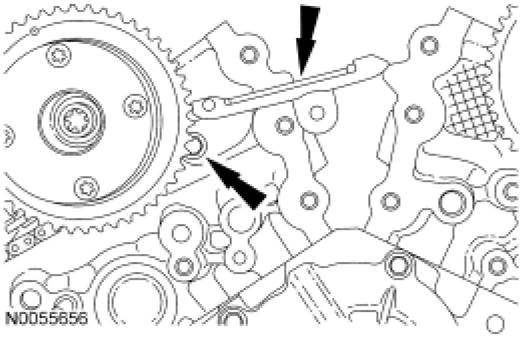


Fig. 38: Locating RH Primary Timing Chain Guide Upper Bolt
Courtesy of FORD MOTOR CO.

16. Place clean, lint-free shop towels in the oil pan opening to prevent coolant from entering the oil pan during coolant pump removal.
17. Remove the 8 bolts and the coolant pump.

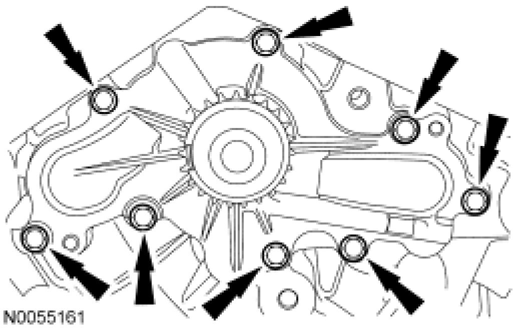


Fig. 39: Locating Coolant Pump Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: Clean and inspect all sealing surfaces.

1. Install the coolant pump and the 8 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

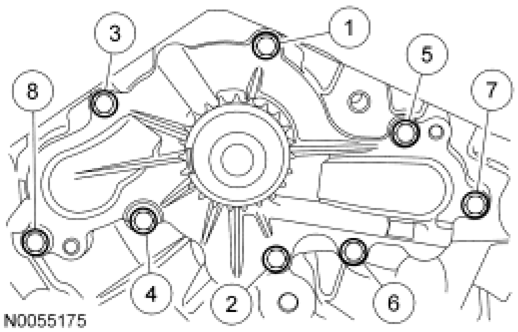


Fig. 40: Identifying Coolant Pump Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

2. Remove all of the shop towels from the oil pan opening.

NOTE: Any coolant that has accumulated in the oil pan must be drained from the pan and any residual coolant cleaned from the front of the engine and oil pan. Failure to remove all traces of the coolant can result in oil contamination and severe engine damage.

3. Remove the oil pan drain plug and allow any accumulated coolant to drain.
   - Remove any residual coolant from the front of the engine and the oil pan using regulated, compressed air and clean, lint-free shop towels.
   - Install the oil pan drain plug and tighten to 27 Nm (20 lb-ft).
4. Loosen the RH primary timing chain guide upper bolt.
   - Position the RH primary timing chain guide and install the lower bolt.
   - Tighten the 2 bolts to 10 Nm (89 lb-in).

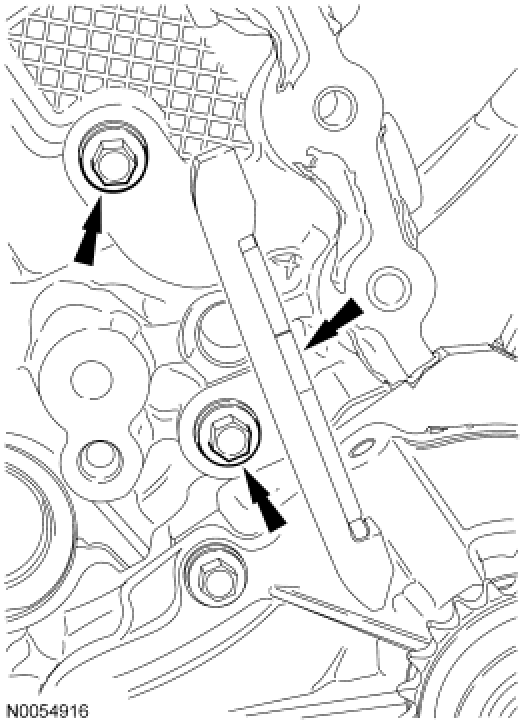


Fig. 41: Locating RH Primary Timing Chain Guide Lower Bolt
Courtesy of FORD MOTOR CO.

5. Install the primary timing chain with the colored links aligned with the timing marks on the VCT assemblies and the crankshaft sprocket.

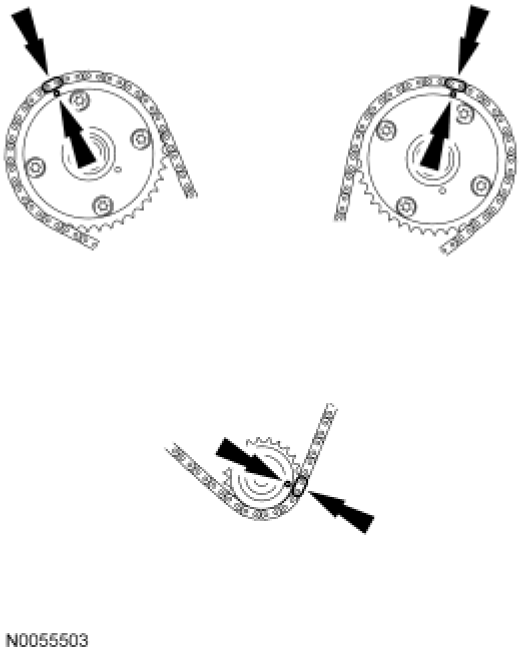


Fig. 42: Aligning Timing Marks On VCT Assemblies & Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

6. Install the upper LH primary timing chain guide and the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

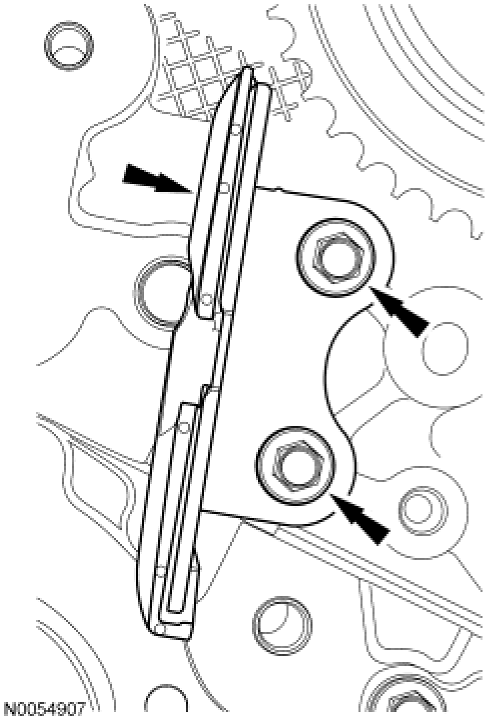


Fig. 43: Locating Upper LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

7. Install the lower LH primary timing chain guide and the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

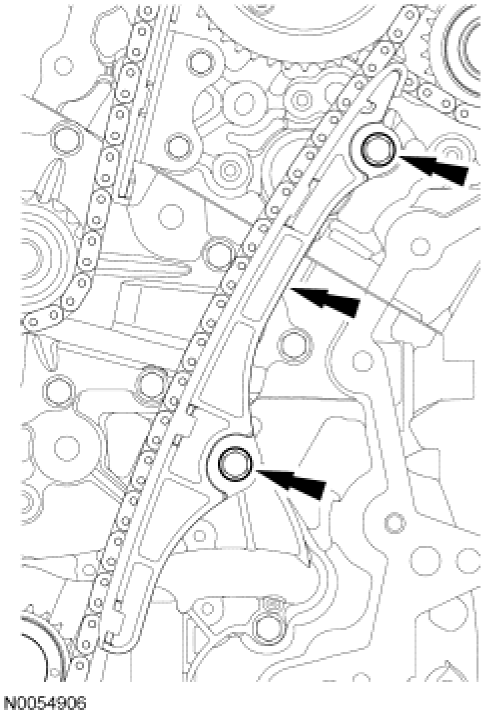


Fig. 44: Locating Lower LH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

8. Install the primary timing chain tensioner arm.

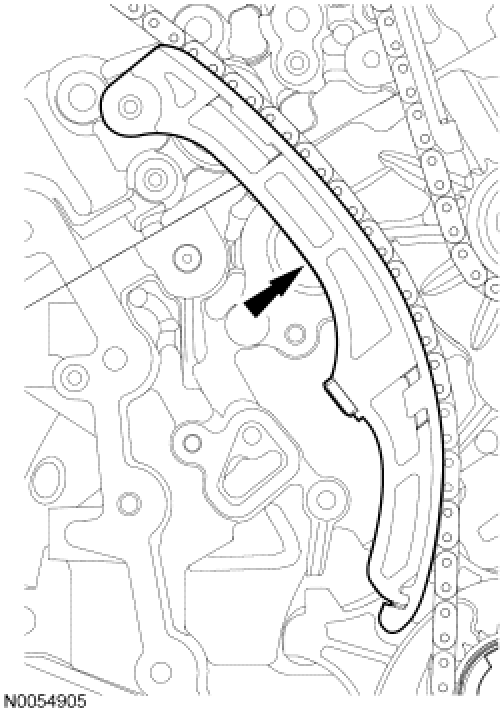


Fig. 45: Locating Primary Timing Chain Tensioner Arm

Courtesy of FORD MOTOR CO.

9. Reset the primary timing chain tensioner.
   - Rotate the lever counterclockwise.
   - Using a soft-jawed vise, compress the plunger.
   - Align the hole in the lever with the hole in the tensioner housing.
   - Install a suitable lock pin.

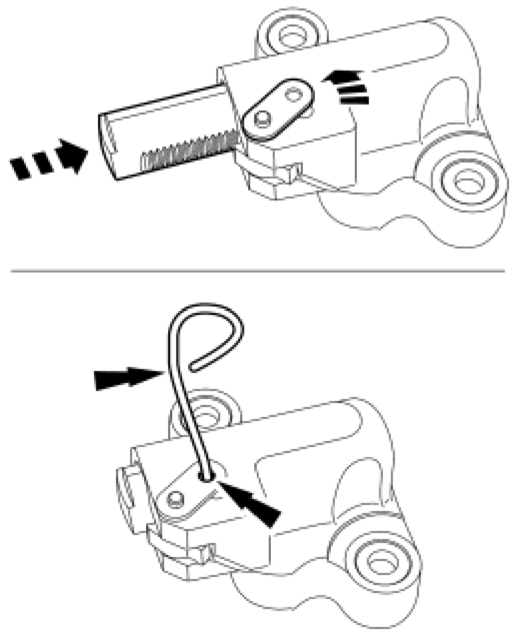


Fig. 46: Compressing Plunger Using A Soft-Jawed Vise
Courtesy of FORD MOTOR CO.

NOTE: It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.

10. Install the primary tensioner and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).
    - Remove the lock pin.

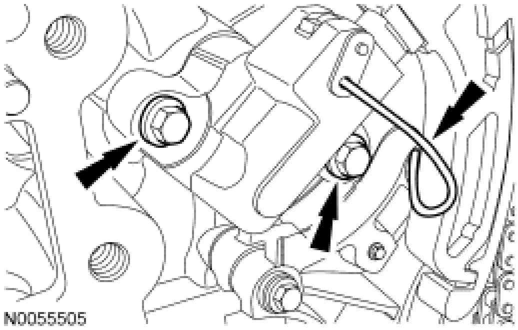


Fig. 47: Locating Primary Tensioner Bolts
Courtesy of FORD MOTOR CO.

11. As a post check, verify correct alignment of all timing marks.

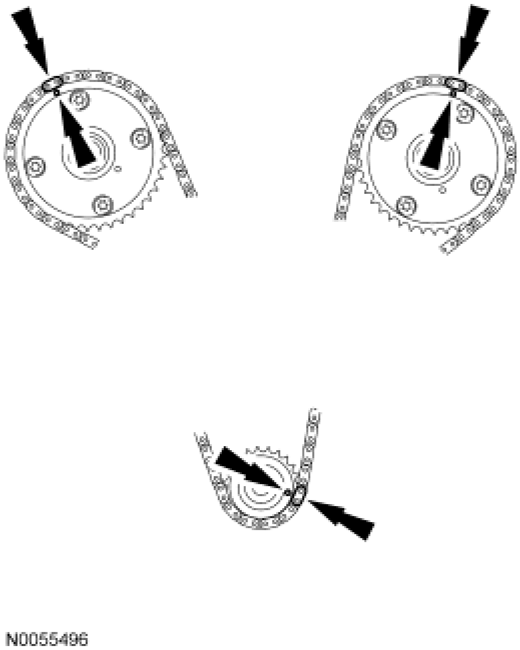


Fig. 48: Verifying Correct Alignment Of All Timing Marks
Courtesy of FORD MOTOR CO.

12. Install new VCT housing seals.

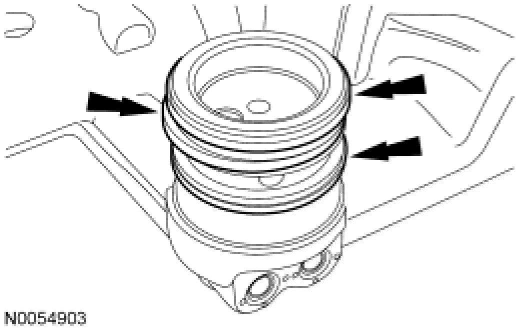


Fig. 49: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

NOTE:	**Make sure the dowels on the VCT housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.**

13. Install the LH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

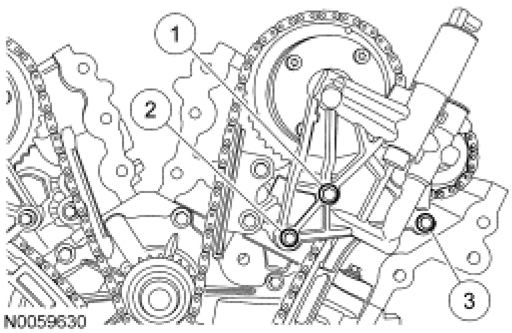


Fig. 50: Identifying LH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE:	**Make sure the dowels on the VCT housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.**

14. Install the RH VCT housing and the 3 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

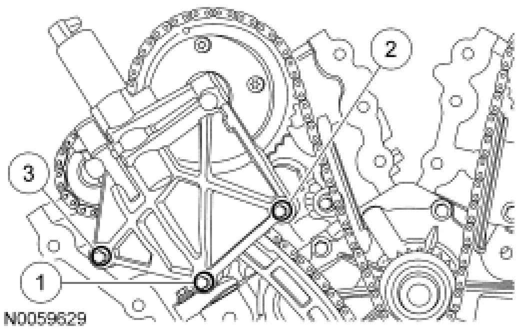


Fig. 51: Identifying RH VCT Housing Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the engine oil filter gasket with clean engine oil prior to installing the oil filter.

15. Install a new engine oil filter.
    - Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.
16. Install the engine front cover. For additional information, refer to **ENGINE - 3.5L** article.

COOLING FAN MOTOR AND SHROUD

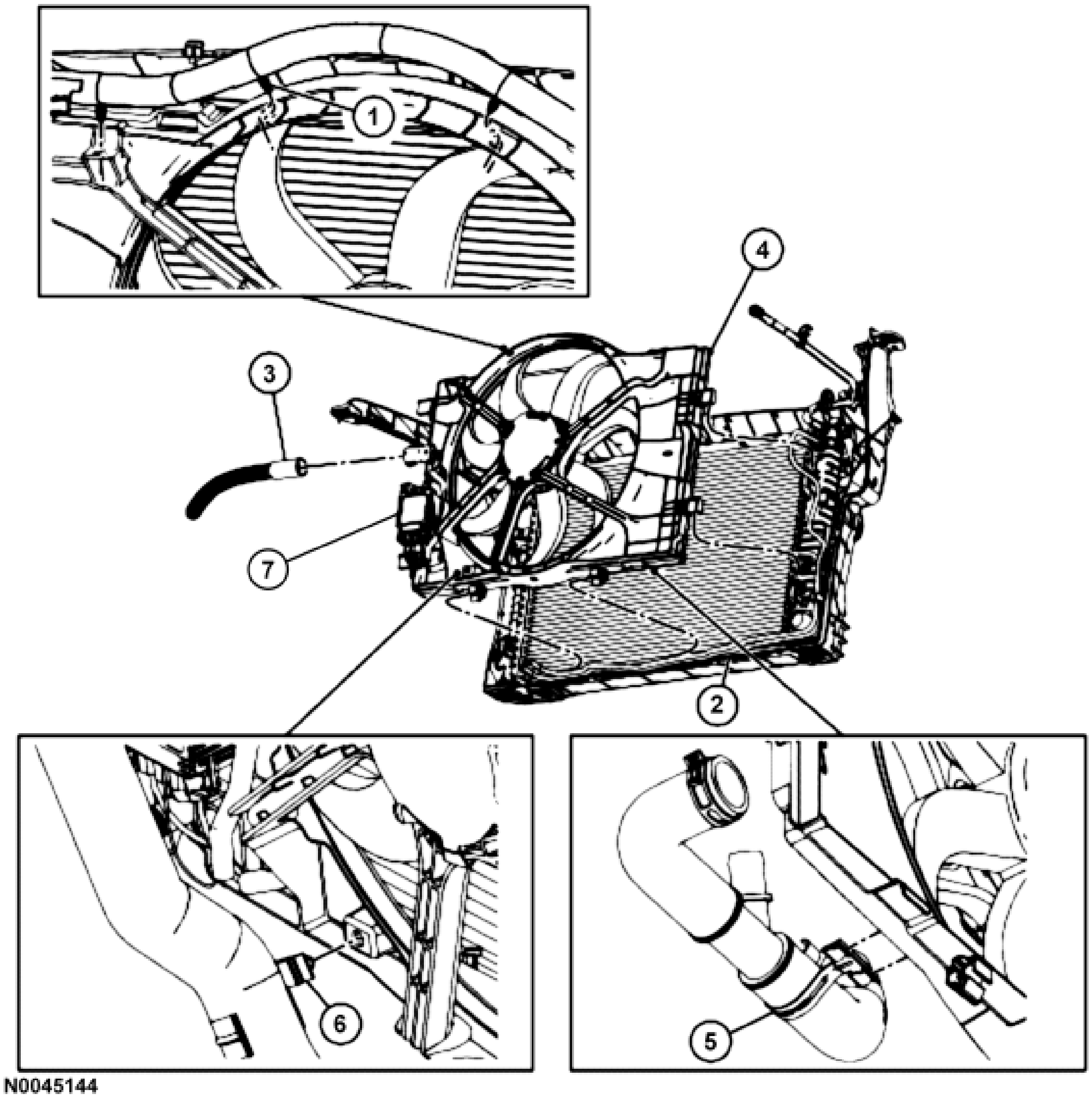


Fig. 52: Exploded View Of Cooling Fan Motor & Shroud - 2.3L and 3.0L Engines
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13A506	Wiring harness retainer
2	7H420	Transmission cooler tube (automatic transmission only)
3	14A464	Cooling fan motor electrical connector
4	8C607	Cooling fan motor and shroud
5	-	Lower radiator hose bracket
6	-	Lower radiator hose retainer (3.0L only)
7	6E5Z-8B658-A	Fan Control Module/Relay

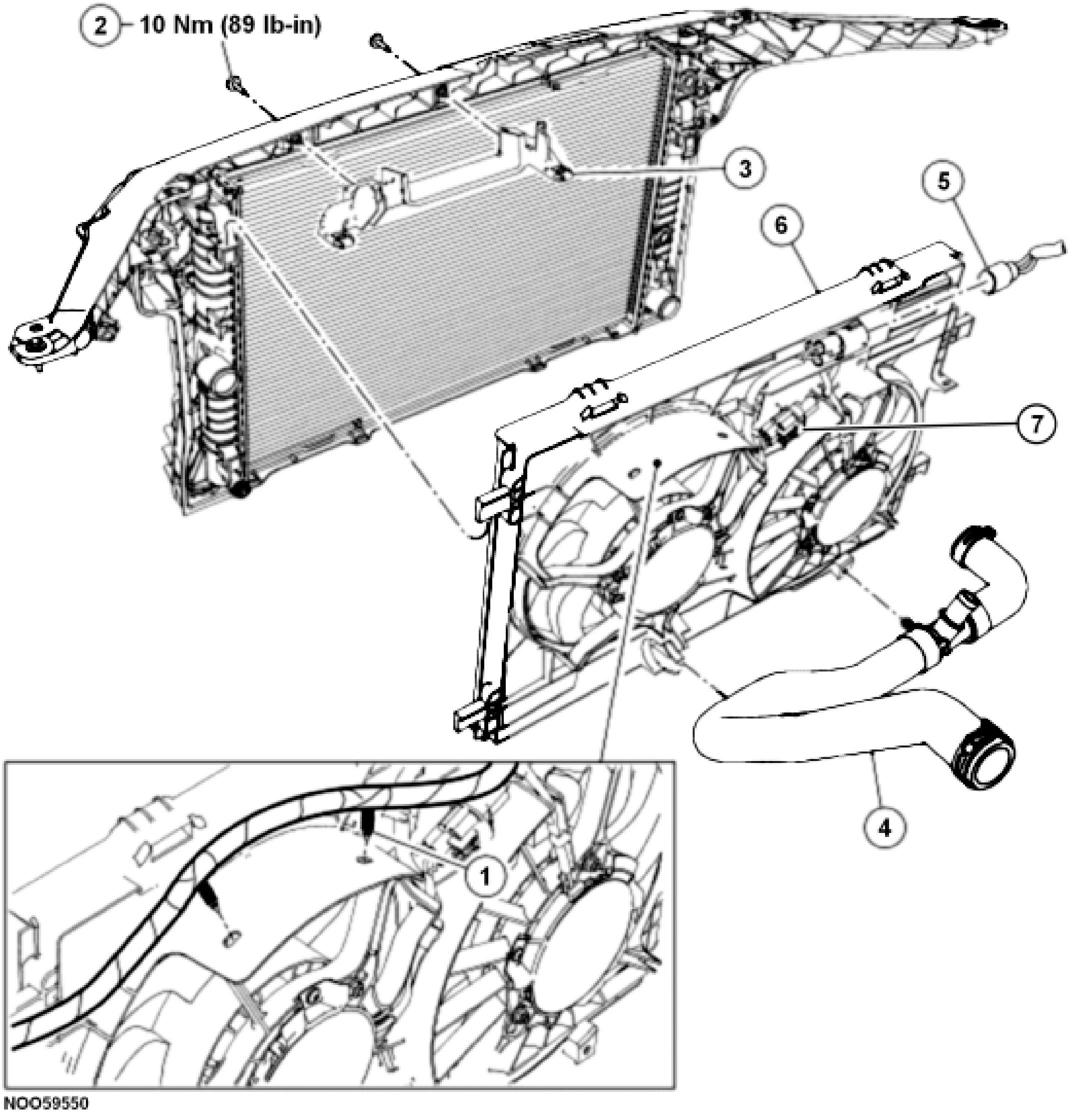


Fig. 53: Exploded View Of Cooling Fan Motor & Shroud With Torque Specification - 3.5L Engines
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13A506	Wiring harness retainer
2	W505425	Air cleaner bracket bolt (2 required)
3	9W541	Air cleaner bracket
4	8B273	Lower radiator hose
5	14A464	Cooling fan motor electrical connector
6	8C607	Cooling fan motor and shroud
7	6E5Z-8B658-A	Fan Control Module/Relay

All vehicles

1. With vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND**

LIFTING article.

2.3L engines

2. Remove the generator air inlet duct.

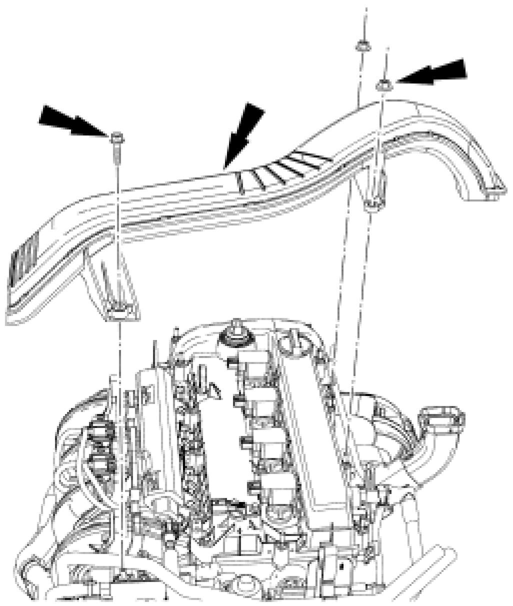


Fig. 54: Locating Generator Air Inlet Duct, Bolt And Nuts
Courtesy of FORD MOTOR CO.

3.5L engines

3. Remove the air cleaner. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.
4. Remove the 2 bolts and the air cleaner bracket.
   - To install, tighten to 10 Nm (89 lb-in).

All vehicles

5. If equipped, detach the 3 block heater wiring retainers from the cooling fan motor and shroud and position aside.

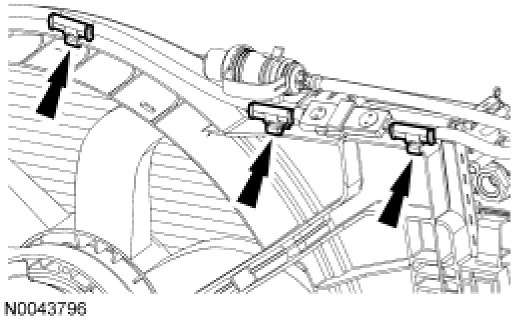


Fig. 55: Locating Block Heater Wiring Retainers
Courtesy of FORD MOTOR CO.

6. Remove the splash shield.

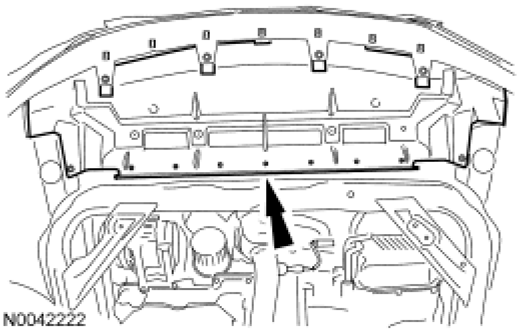


Fig. 56: Locating Splash Shield
Courtesy of FORD MOTOR CO.

7. Detach the lower radiator hose from the cooling fan motor and shroud.

3.0L and 3.5L engines

8. Detach the retainer on the lower radiator hose from the cooling fan motor and shroud.

All vehicles

9. If equipped, detach the transmission cooler tubes from the cooling fan motor and shroud.
10. Detach the wiring harness retainers and position the harness aside.
11. Disconnect the cooling fan electrical connector.
12. Release the 2 tabs and remove the cooling fan motor and shroud.

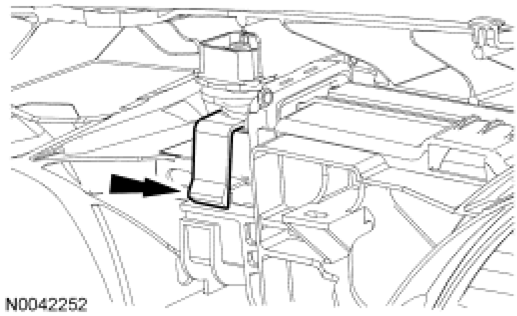


Fig. 57: Locating Cooling Fan Motor And Shroud Tab
Courtesy of FORD MOTOR CO.

13. To install, reverse the removal procedure.

RADIATOR

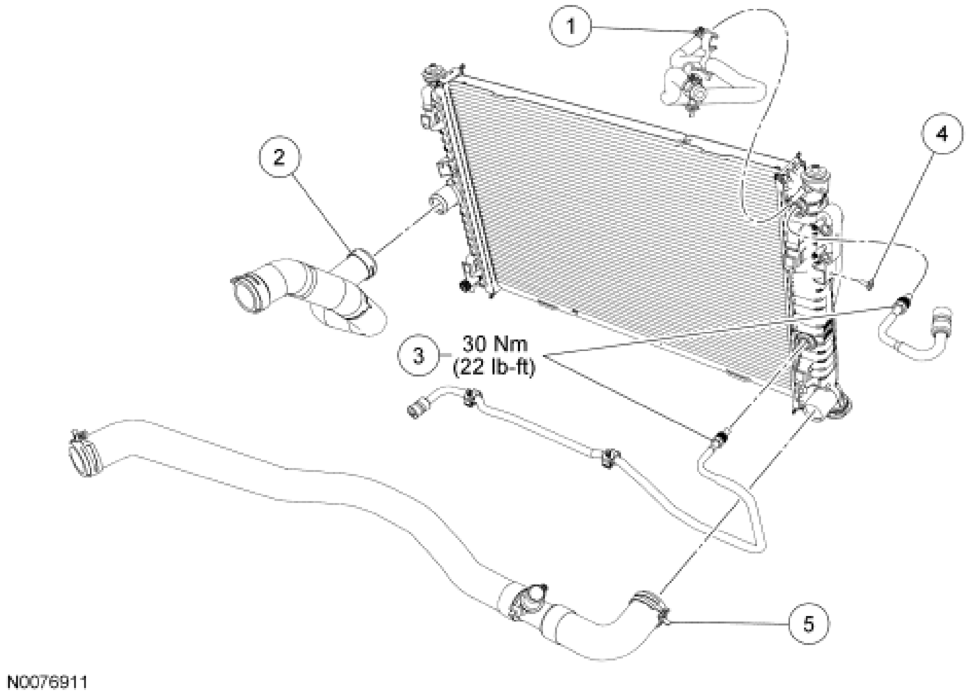


Fig. 58: Exploded View Of Radiator With Torque Specification (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8276	Radiator-to-degas bottle hose (3.0L and 3.5L)
2	8B274	Upper radiator hose
3	7H420	Transmission cooler tubes (automatic transmission only) (2 required)

4	19710	A/C condenser-to-radiator pin-type retainer
5	8B273	Lower radiator hose

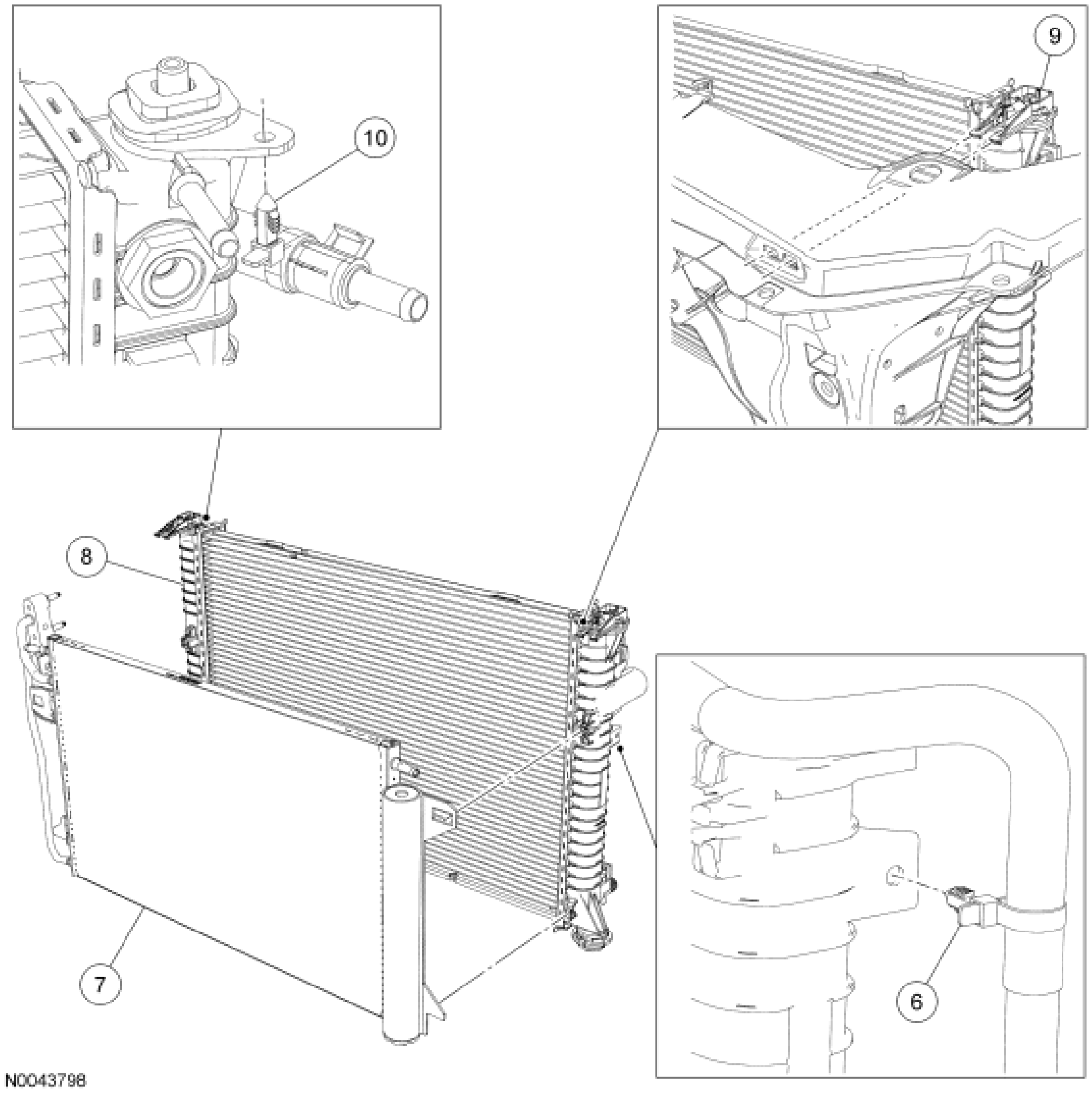


Fig. 59: Exploded View Of Radiator (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
6	3493	Retainer
7	19710	A/C condenser
8	8005	Radiator
9	8A194	Upper radiator support
10	-	Power steering hose retainer

All vehicles

1. Drain the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.
2. Remove the cooling fan motor and shroud. For additional information, refer to **Cooling Fan Motor and Shroud**.
3. Detach the power steering hose retainer from the radiator.

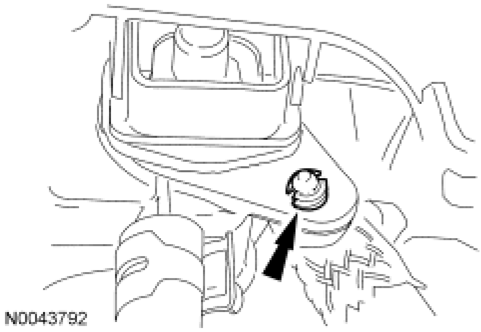


Fig. 60: Locating Power Steering Hose Retainer
Courtesy of FORD MOTOR CO.

4. Disconnect the upper radiator hose from the radiator.
5. Detach the retainer from the radiator.

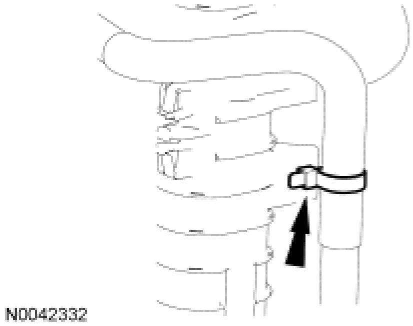


Fig. 61: Locating Radiator Retainer
Courtesy of FORD MOTOR CO.

6. Disconnect the radiator-to-degas bottle hose from the radiator.

Automatic transmission vehicles

7. Disconnect the 2 transmission cooling tubes from the radiator.
   - To install, tighten to 30 Nm (22 lb-ft).

All vehicles

8. Disconnect the lower radiator hose from the radiator.

9. Lift and remove the tabs from the upper radiator support and position the radiator towards the engine.

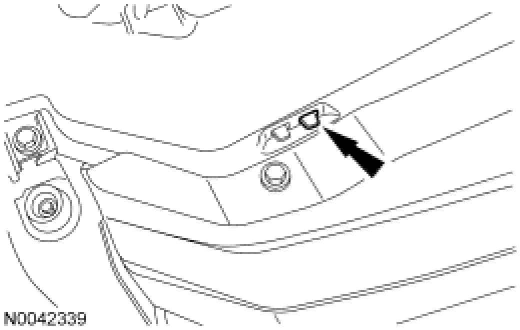


Fig. 62: Locating Upper Radiator Support Tab
Courtesy of FORD MOTOR CO.

10. Remove the A/C condensor-to-radiator pin-type retainer.

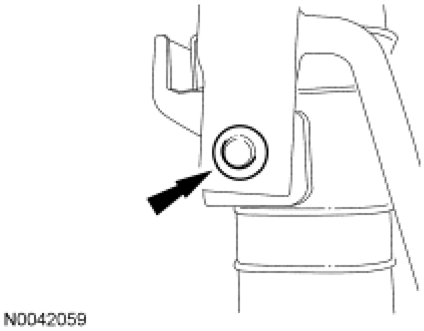


Fig. 63: Locating A/C Condensor-To-Radiator Pushpin-Type Retainer
Courtesy of FORD MOTOR CO.

11. Squeeze the tabs and separate the A/C condenser from the radiator.
    - Remove the radiator.

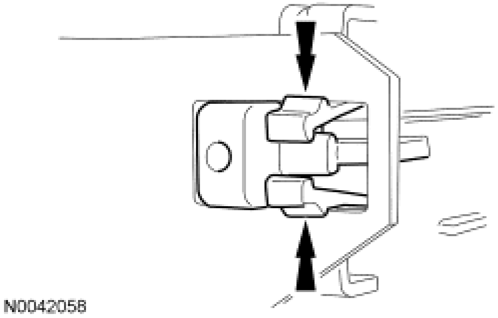


Fig. 64: Locating A/C Condenser Tabs
Courtesy of FORD MOTOR CO.

12. To install, reverse the removal procedure.

13. Fill and bleed the cooling system. For additional information, refer to **Cooling System Draining, Filling and Bleeding**.

DEGAS BOTTLE

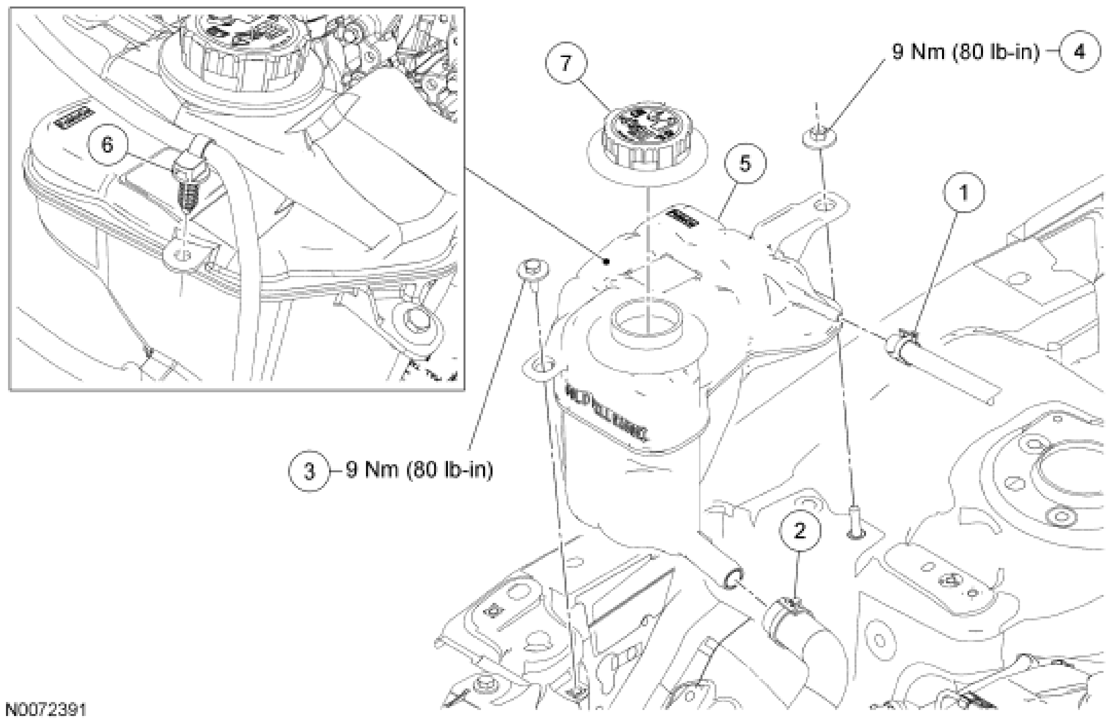


Fig. 65: Exploded View Of Degas Bottle With Torque Specifications - 2.3L and 3.0L Engines
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8276	Degas bottle-to-radiator hose
2	8C351	Lower degas bottle hose
3	W707398	Degas bottle-to-fender bolt
4	W709603	Degas bottle-to-fender nut
5	8A080	Degas bottle
6	14197	Wiring retainer (if equipped)
7	8100	Pressure relief cap

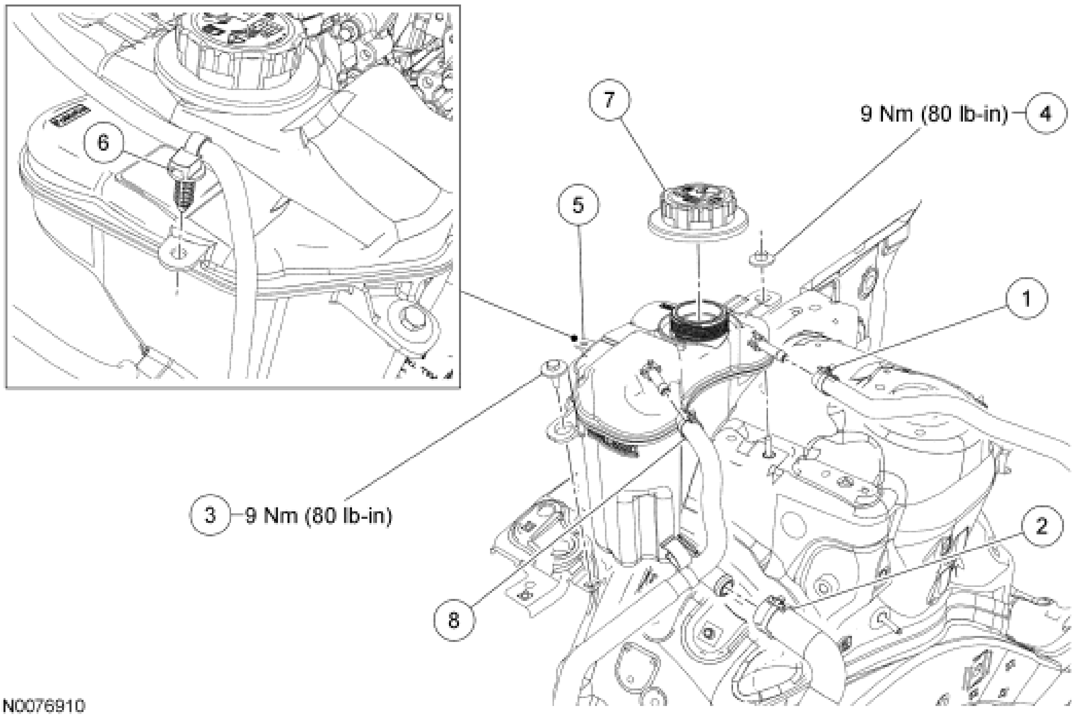


Fig. 66: Exploded View Of Degas Bottle With Torque Specifications - 3.5L Engines
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8B541	Degas bottle-to-thermostat housing hose
2	8C351	Lower degas bottle hose
3	W707398	Degas bottle-to-fender bolt
4	W709603	Degas bottle-to-fender nut
5	8A080	Degas bottle
6	14197	Wiring retainer (if equipped)
7	8100	Pressure relief cap
8	8276	Degas bottle-to-radiator hose

REMOVAL AND INSTALLATION

All vehicles

WARNING: **Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.**

1. Release the pressure in the cooling system by slowly turning the pressure relief cap one half turn

counterclockwise. When the pressure is released, remove the pressure relief cap.

2. Using hose clamp pliers, clamp the lower degas bottle hose.
3. Using a suitable suction device, siphon the coolant from the degas bottle.
4. If equipped, detach the wiring retainer from the degas bottle.
5. Disconnect the degas bottle-to-radiator hose and position aside.

3.5L engines

6. Disconnect the degas bottle-to-thermostat housing hose and position aside.

All vehicles

7. Disconnect the lower degas bottle hose and position aside.
8. Remove the nut, bolt and the degas bottle.
   - To install, tighten to 9 Nm (80 lb-in).
9. To install, reverse the removal procedure.
10. Fill the degas bottle. Refer to **Cooling System Draining, Filling and Bleeding** for the recommended coolant mixture and fill level.

2008 ENGINE PERFORMANCE

Engine Emission Control - 3.5L - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcract SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
PCV heater element retaining screws	6	53

DESCRIPTION AND OPERATION

ENGINE EMISSION CONTROL

NOTE: **Do not permanently remove or render inoperative any part of the vehicle emission control system including related hardware. Failure to comply may violate applicable state and federal law.**

The engine emission control system consists of the PCV system:

PCV System - The PCV system:

- uses intake manifold vacuum to ventilate blow-by vapors from the crankcase.
- returns the vapors to the intake manifold for combustion.

The PCV system consists of the:

- PCV heater element (early build engines only).
- crankcase ventilation tube.
- PCV valve.

The PCV valve:

- varies the amount of blow-by gases returned to the intake manifold based on available engine vacuum.
- prevents combustion gases backfiring into the crankcase.
- utilizes an internal heater (early build engines only).

The PCV heater element:

- heats the ventilating air and blow-by gases going to the intake manifold.
- is retained by 2 self-tapping screws and mounted in the intake manifold.
- has an optional set of mounting holes located in the intake manifold.

Vehicle Emission Vacuum Routing

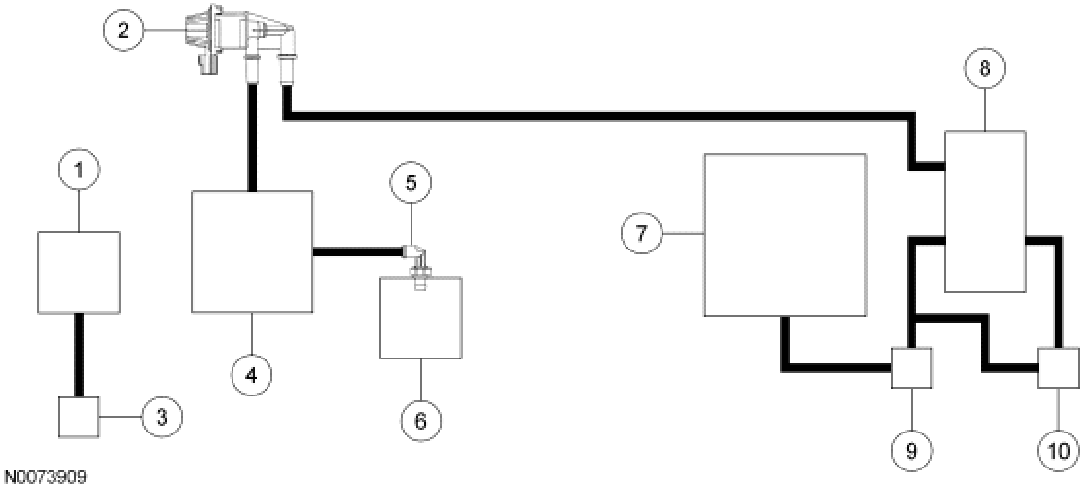


Fig. 1: View Of Vehicle Emission Vacuum Routing - All Wheel Drive (AWD) Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6A505	LH valve cover
2	9G641	Evaporative emission (EVAP) canister purge valve
3	9B659	Air cleaner outlet pipe
4	9S455	Intake manifold
5	6A666	PCV valve
6	6582	RH valve cover
7	9A007	Fuel tank
8	9E857	EVAP canister
9	-	Fuel tank pressure (FTP) sensor
10	9034	Fuel tank filler pipe

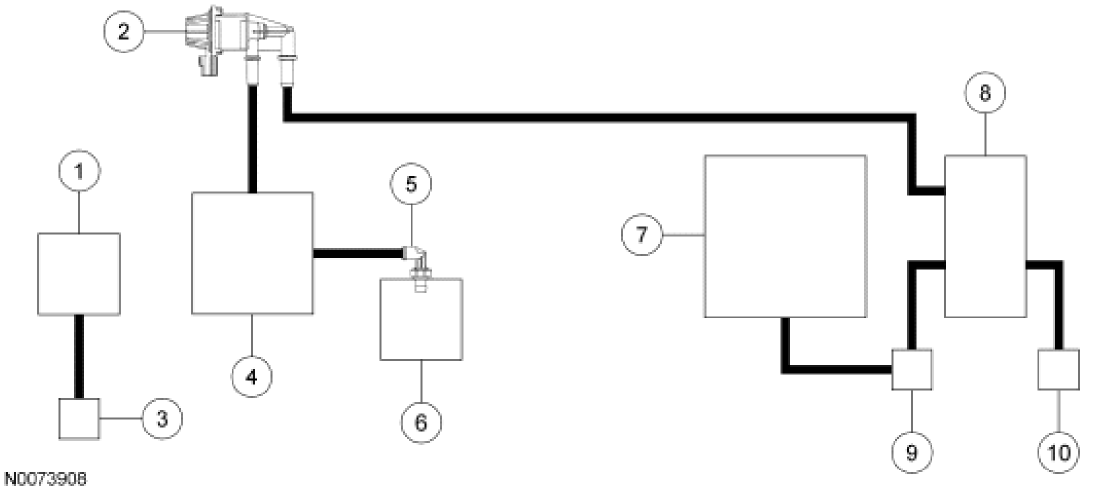


Fig. 2: View Of Vehicle Emission Vacuum Routing - Front Wheel Drive (FWD) Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6A505	LH valve cover
2	9G641	Evaporative emission (EVAP) canister purge valve
3	9B659	Air cleaner outlet pipe
4	9S455	Intake manifold
5	6A666	PCV valve
6	6582	RH valve cover
7	9A007	Fuel tank
8	9E857	EVAP canister
9	-	Fuel tank pressure (FTP) sensor
10	9034	Fuel tank filler pipe

DIAGNOSTIC TESTS

ENGINE EMISSION CONTROL

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM COMPONENTS - EXPLODED VIEW

NOTE: **Early build engine with PCV heater element and electric heated PCV valve shown, late build engine without PCV heater element and standard PCV valve similar.**

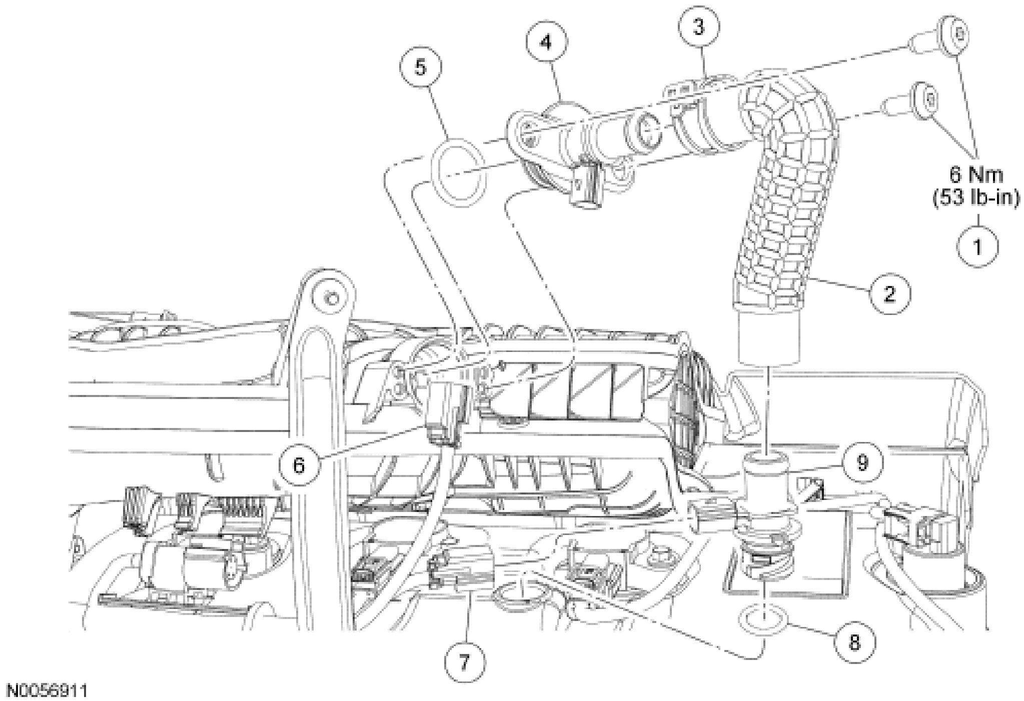


Fig. 3: Exploded View Of Positive Crankcase Ventilation (PCV) System Components With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	PCV heater element retainer screws (2 required) (early build only)
2	6A664	Crankcase ventilation tube
3	-	Crankcase ventilation tube spring clamp (part of 6K817)
4	9F695	PCV heater element (early build only)
5	9J469	PCV heater element O-ring (early build only)
6	14A464	PCV heater element electrical connector (early build only)
7	14A464	PCV valve electrical connector (early build only)
8	-	PCV valve O-ring (part of 6A666)
9	6A666	PCV valve

1. For additional information, refer to the procedures.

POSITIVE CRANKCASE VENTILATION (PCV) VALVE

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20	WSS-M2C930-A

Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	

REMOVAL AND INSTALLATION

Early build engines

1. Disconnect the PCV valve electrical connector.

   All engines

2. Disconnect the crankcase ventilation tube from the PCV valve.

CAUTION: A new positive crankcase ventilation (PCV) valve must be installed if removed from the valve cover. Damage will occur to the locking mechanism on the PCV valve.

NOTE: To install, apply clean engine oil to the O-ring seal.

NOTE: Upon installation, make sure the PCV valve electrical connector is pointing in the correct position to allow the wiring harness to be connected. Incorrect installation would require removal and replacement of the valve.

3. Rotate the PCV valve counterclockwise and remove from the valve cover.
   - Discard the PCV valve.
4. To install, reverse the removal procedure.

POSITIVE CRANKCASE VENTILATION (PCV) HEATER ELEMENT

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

REMOVAL AND INSTALLATION

1. Disconnect the PCV heater element electrical connector.
2. Release the spring tension clamp and remove the crankcase ventilation tube from the PCV heater element.

NOTE: The intake manifold is manufactured with an optional set of mounting holes for the PCV heater element self-tapping retaining screws that may be used if necessary.

3. Remove the 2 PCV heater element retainer screws.
   - To install, tighten to 6 Nm (53 lb-in).
4. Remove the PCV heater element from the intake manifold.

NOTE: To install, apply clean engine oil to the O-ring seal.

NOTE: Upon installation, make sure the PCV heater element electrical connector is in the correct position to allow the wiring harness to be connected.

5. To install, reverse the removal procedure.

2008 ENGINE

Engine Ignition - 3.5L - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Engine Ignition	
Spark plug	AYFS-22FM
Spark plug gap	1.29-1.45 mm (0.051-0.057 in)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Ignition coil-on-plug bolts	7	62
Spark plugs	15	133

DESCRIPTION AND OPERATION

ENGINE IGNITION

The Electronic Ignition (EI) system is a coil-on-plug ignition system. The coil-on-plug ignition system consists of:

- Camshaft Position (CMP) sensors.
- a Crankshaft Position (CKP) sensor.
- ignition coil-on-plugs.
- spark plugs.

The CMP sensors:

- are variable reluctance sensors.

- are mounted in the rear of the cylinder head.
- are triggered by a 3-plus-1 timing wheel on each intake camshaft.
- provides camshaft rotational location information to the PCM.

The CKP sensor:

- is a variable reluctance sensor.
- is triggered by a 36-minus-1 tooth trigger wheel mounted on the crankshaft, at the rear of the engine.
- provides base timing and crankshaft speed (RPM) to the PCM.

The ignition coil-on-plugs:

- change low voltage signals from the PCM to high voltage pulses.
- produce the high voltage pulses to the spark plugs.
- are connected directly to each spark plug.
- have replaceable coil seals.

The spark plugs:

- change high voltage pulses into a spark which ignites the fuel and air mixture.
- originally equipped on the vehicle have a platinum-enhanced fine wire electrode for long life.

DIAGNOSTIC TESTS

ENGINE IGNITION

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

ENGINE IGNITION COMPONENTS - EXPLODED VIEW

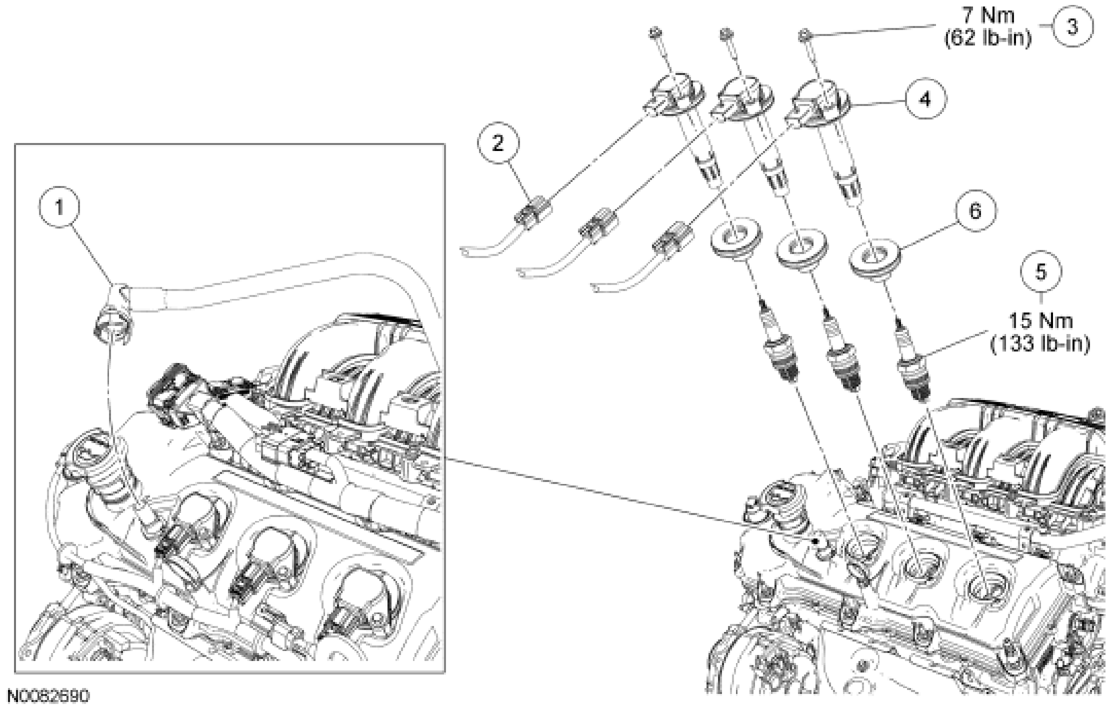


Fig. 1: Exploded View Of Engine Ignition Components With Torque Specifications - LH Side
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6758	Crankcase vent tube-to-valve cover fitting quick connect coupling
2	-	Ignition coil-on-plug electrical connector (3 required) (part of 12A581)
3	W708833	Ignition coil-on-plug bolt (3 required)
4	12A375	Ignition coil-on-plug (3 required)
5	12405	Spark plug (3 required)
6	12A384	Coil seal (3 required)

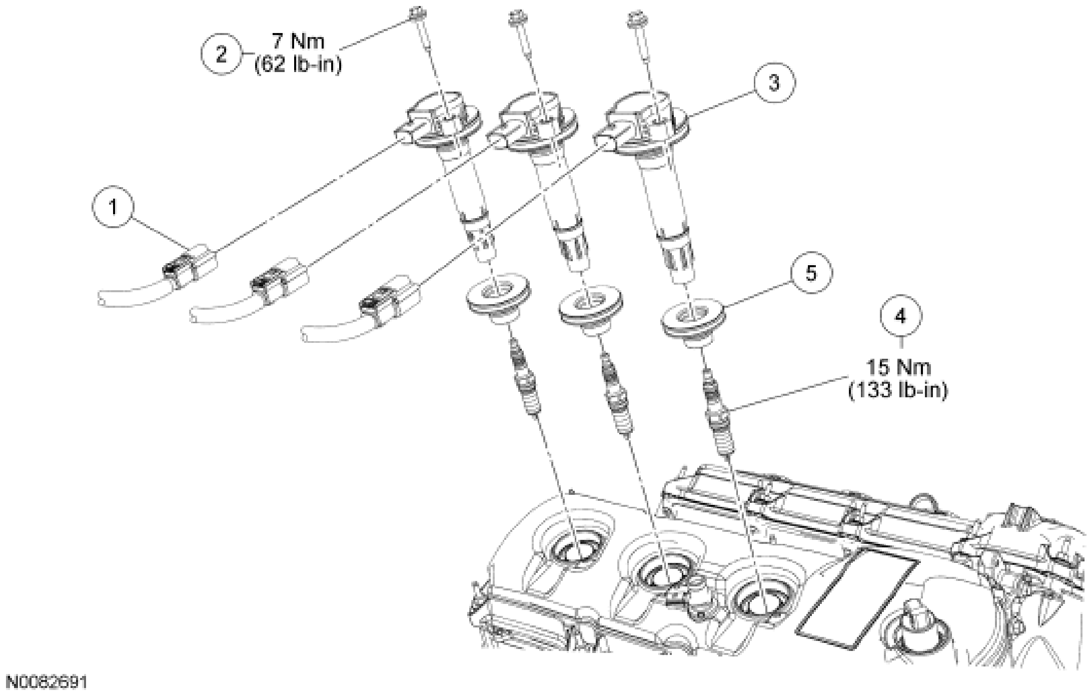


Fig. 2: Exploded View Of Engine Ignition Components With Torque Specifications - RH Side
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Ignition coil-on-plug electrical connector (3 required) (part of 12A581)
2	W708833	Ignition coil-on-plug bolt (3 required)
3	12A375	Ignition coil-on-plug (3 required)
4	12405	Spark plug (3 required)
5	12A384	Coil seal (3 required)

1. For additional information, refer to the procedures.

IGNITION COIL-ON-PLUG

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

REMOVAL AND INSTALLATION

LH side

1. Disconnect the crankcase ventilation tube-to-valve cover quick connect coupling and position aside. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

   RH side

   NOTE: The upper intake manifold must be removed to access the RH ignition coil-on-plugs.

2. Remove the upper intake manifold. For additional information, refer to **ENGINE - 3.5L** article.

   Both sides

3. Disconnect the 6 ignition coil-on-plug electrical connectors.

   NOTE: When removing the ignition coil-on-plugs, a slight twisting motion will break the seal and ease removal.

4. Remove the 6 bolts and the 6 ignition coil-on-plugs.
   - To install, tighten to 7 Nm (62 lb-in).
5. Inspect the coil seals for rips, nicks or tears. Remove and discard any damaged coil seals.
   - To install, slide the new coil seal onto the coil until it is fully seated at the top of the coil.

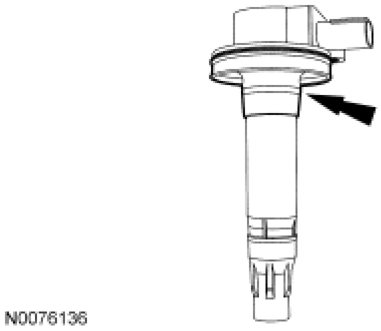


Fig. 3: Identifying Coil Seal On Coil
Courtesy of FORD MOTOR CO.

6. To install, reverse the removal procedure.
   - Apply a small amount of dielectric grease to the inside of the ignition coil-on-plug boots before attaching to the spark plugs.

SPARK PLUGS

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound	ESE-M1C171-A

XG-3-A	

REMOVAL

LH side

1. Disconnect the crankcase ventilation tube-to-valve cover quick connect coupling and position aside. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

   RH side

   NOTE: **The upper intake manifold must be removed to access the RH spark plugs.**

2. Remove the upper intake manifold. For additional information, refer to **ENGINE - 3.5L** article.

   Both sides

3. Disconnect the 6 ignition coil-on-plug electrical connectors.

   NOTE: **When removing the ignition coil-on-plugs, a slight twisting motion will break the seal and ease removal.**

4. Remove the 6 bolts and the 6 ignition coil-on-plugs.

   NOTE: **Only use hand tools when removing or installing the spark plugs, or damage may occur to the cylinder head or spark plug.**

   NOTE: **Use compressed air to remove any foreign material in the spark plug well before removing the spark plugs.**

5. Remove the 6 spark plugs.

INSTALLATION

Both sides

1. Inspect the 6 spark plugs. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
2. Adjust the spark plug gap as necessary.

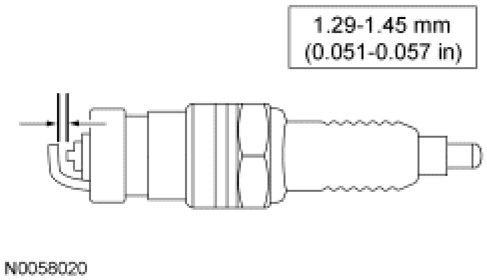


Fig. 4: Adjusting Spark Plug Gap With Specification
Courtesy of FORD MOTOR CO.

NOTE: **Only use hand tools when removing or installing the spark plugs, or damage may occur to the cylinder head or spark plug.**

3. Install the 6 spark plugs.
    - Tighten to 15 Nm (133 lb-in).

NOTE: **Apply a small amount of dielectric grease to the inside of the ignition coil-on-plug boots before attaching to the spark plugs.**

4. Install the 6 ignition coil-on-plugs and the 6 bolts.
    - Tighten to 7 Nm (62 lb-in).
5. Connect the 6 ignition coil-on-plug electrical connectors.

RH side

6. Install the upper intake manifold. For additional information, refer to **ENGINE - 3.5L** article.

LH side

7. Position and connect the crankcase ventilation tube-to-valve cover quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

2008 GENERAL INFORMATION

Engine System - General Information - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Dye-Lite® Gasoline Engine Oil Leak Detection Dye 164-R3700 (Rotunda)	-	29.6 ml (1 oz)
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-
Threadlock 262 TA-26	WSK-M2G351-A6	-

DESCRIPTION AND OPERATION

ENGINE

NOTE: **When repairing engines, all parts must be contamination free. If contamination/foreign material is present when repairing an engine, premature engine failure may occur.**

NOTE: **Specifications show the expected minimum or maximum condition. Refer to the appropriate Engine article for the procedure.**

NOTE: **If a component fails to meet the specifications, it is necessary to refinish it or install a new component. Wear limits are provided as an aid to determine if the component can be refinished. A new component must be installed when any component fails to meet specifications and cannot be refinished.**

NOTE: **This part contains information, steps and procedures that may not be specific to this engine.**

This part covers general procedures and diagnosis and testing of the engine system, except for exhaust emission control devices, which are covered in the **Introduction - Gasoline Engines** article.

The engine incorporates the following features: Refer to the appropriate Engine article for the procedure.

- Crankcase ventilation or breather system

- Exhaust emission control system
- Evaporative Emission (EVAP) control system

Some engines incorporate a fail-safe cooling system. Refer to the appropriate Engine article for the procedure.

The engine, fuel system, ignition system, emissions system and exhaust system all affect exhaust emission levels and must be maintained according to the maintenance schedule. Refer to the scheduled Maintenance Guide.

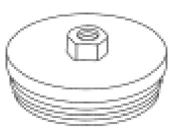
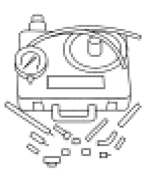
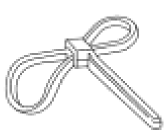
Correct engine identification is required to order parts. Refer to the appropriate Engine article for the procedure.

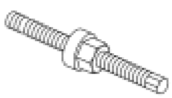
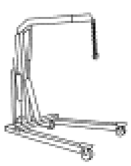
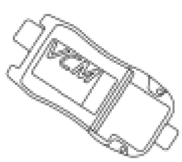
For complete vehicle and engine identification codes, refer to **IDENTIFICATION CODES** article.

DIAGNOSTIC TESTS

ENGINE

Special Tools

Illustration	Tool Name	Tool Number
 ST1382-A	12 Volt Master UV Diagnostic Inspection Kit	164-R0756 or equivalent (Leak Detector)
 ST1385-A	Dial Indicator Gauge with Holding Fixture	100-002 (TOOL-4201-C) or equivalent
 ST1298-A	Engine Cylinder Leak Detection/Air Pressurization Kit	014-00708 or equivalent
 ST1438-A	EngineEAR	107-R2100 or equivalent
	EngineEAR/ChassisEAR	107-R2102 or equivalent

 ST1185-A		
 ST1296-A	Oil Pressure Gauge	303-088 (T73L-6600-A)
 ST1287-A	Quick Disconnect Compression Tester	134-R0212 or equivalent
 ST1341-A	Vacuum/Pressure Tester	164-R0253 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
Dye-Lite® Gasoline Engine Oil Leak Detection Dye 164-R3700 (Rotunda)	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

There are 2 diagnostic paths that can be followed depending on the type of engine concern. Carry out Inspection and Verification - Engine Performance or Inspection and Verification - NVH.

Inspection and Verification - Engine Performance

1. Verify the customer concern by operating the engine to duplicate the condition.
2. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

VISUAL INSPECTION CHART

Mechanical
• Engine coolant leaks • Engine oil leaks • Fuel leaks • Damaged or severely worn parts • Loose mounting bolts, studs and nuts

3. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

NOTE: The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.
9. If the DTCs retrieved are related to the concern, go to the DTC Chart, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart - Engine Performance**.

Inspection and Verification - NVH

1. NVH symptoms should be identified using the diagnostic tools and techniques that are available. For a list of these techniques, tools, an explanation of their uses and a glossary of common terms, refer to **NOISE, VIBRATION AND HARSHNESS** article.

2. Verify the customer concern by operating the engine to duplicate the condition.
3. Check the engine oil level and check the oil for contamination. Low engine oil level or contaminated oil are a common cause of engine noise. If the oil is contaminated, the source of the contamination must be identified and repaired as necessary.
4. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

VISUAL INSPECTION CHART

Mechanical
• Loose mounting bolts, studs and nuts • Damaged or leaking powertrain mounts • Damaged or disconnected vacuum hoses • Obstruction of cooling fan • Obstruction of Front End Accessory Drive (FEAD) • Obstruction of Rear End Accessory Drive (READ), if equipped • Damaged or disconnected air intake components

5. If the inspection reveals obvious concerns that can be readily identified, repair as necessary.

NOTE: Make sure to use the latest scan tool software release.

6. If the cause is not visually evident, connect the scan tool to the DLC.

NOTE: The VCM LED prove out confirms power and ground from the DLC are provided to the VCM.

7. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
8. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
9. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
10. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.

11. If the DTCs retrieved are related to the concern, go to the DTC Chart, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
12. If no DTCs related to the concern are retrieved, continue the inspection and verification if a noise concern is related to the engine. For vibration concerns and noise concerns, such as powertrain mounts, air intake system and starter, Go to **Symptom Chart - NVH**.

    In some cases, a noise may be a normal characteristic of that engine type. In other cases the noise may require further investigation. Comparing the noise to a similar year/model vehicle equipped with the same engine will aid in determining if the noise is normal or abnormal.

    Once a customer concern has been identified as an abnormal engine noise, it is critical to determine the location of the specific noise. Use the EngineEAR/ChassisEAR or stethoscope to isolate the location of the noise to one of the following areas.

    - Fuel injector(s)
    - Upper end of engine
    - Lower end of engine
    - Front of engine
    - Rear of engine

    Fuel injector noise - A common source of an engine ticking noise can be related to the fuel injector(s). This is normal engine noise that can be verified by listening to another vehicle. If the injector noise is excessive or irregular, use the EngineEAR/ChassisEAR or stethoscope to isolate the noise to a specific fuel injector.

    Upper end engine noise - A common source of upper end engine noise (ticking, knocking or rattle) includes the camshaft(s) and valve train. Upper end engine noise can be determined using the EngineEAR/ChassisEAR or stethoscope on the valve cover bolts. If the noise is loudest from the valve cover bolts, then the noise is upper end. The EngineEAR/ChassisEAR or stethoscope can be used to further isolate the noise to the specific cylinder bank and cylinder. Removal of the valve covers will be required to pinpoint the source of the noise.

    Lower end engine noise - A common source of lower end engine noise (ticking or knocking) includes the crankshaft, connecting rod(s) and bearings. Lower end noises can be determined by using the oil pan or cylinder block lug bosses. If the noise is loudest from these areas, then the noise is lower end. If an engine noise is isolated to the lower end, some disassembly of the engine may be required to inspect for damage or wear.

    Front of engine noise - A common source of noise from the front of the engine (squeal, chirp, whine or hoot) is the Front End Accessory Drive (FEAD) components. To isolate FEAD noise, carry out the Engine Accessory Test, refer to **NOISE, VIBRATION AND HARSHNESS** article.

    Some other noises from the front of the engine (ticking, tapping or rattle) may be internal to the engine. Use the EngineEAR/ChassisEAR or stethoscope on the engine front cover to determine if the noise is internal to the engine. Removal of the engine front cover may be necessary to inspect internal engine components.

Rear of engine noise - A common source of noise from the rear of the engine (knocking) is the flywheel/flexplate. Inspection of the flywheel/flexplate will be necessary.

Some engines have timing drive components at the rear of the engine and may be the source of noise (ticking, knocking or rattle). Use the EngineEAR/ChassisEAR or stethoscope on the rear of the engine if you suspect the noise is internal to the engine. Some disassembly of the engine may be required to inspect for damage or wear.

If equipped, the Rear End Accessory Drive (READ) can also be a source of noise from the rear of the engine (squeal or chirp). The READ consists of the coolant pump and belt.

13. After you have localized the noise, note the characteristics of the noise, including type of noise, frequency and conditions when the noise occurs and Go to **Symptom Chart - NVH**.

Symptom Chart - Engine Performance

Symptom Chart - Engine Performance

Condition	Possible Sources	Action
• Difficult starting	• Inoperative or damaged ignition system • Air or vacuum leak • Inoperative or damaged fuel system • Inoperative or damaged starting system	• Refer to the appropriate Engine article for the procedure. REFER to the **Introduction - Gasoline Engines** article.
	• Damaged charging system/battery	• REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
	• Burnt valve	• INSTALL a new cylinder head. TEST the system for normal operation after the repair.
	• Worn piston • Worn piston rings • Worn cylinder	• INSTALL a new short block. TEST the system for normal operation after the repair.
	• Damaged head gasket	• INSTALL a new cylinder head gasket. TEST the system for normal operation after the repair.
	• Inoperative or damaged cooling system	• Refer to the appropriate Engine article for the procedure.
	• Fail-safe cooling invoked (if equipped)	• REFER to the **Introduction - Gasoline Engines** article.
• Poor idling	• Vacuum leaks • Inoperative or damaged	• Refer to the appropriate Engine article for the procedure. REFER

	EGR system	to the **Introduction - Gasoline Engines** article.
	• Inoperative or damaged ignition system	• Refer to the appropriate Engine article for the procedure.
	• Inoperative or damaged cooling system • Inoperative or damaged fuel system	• Refer to the appropriate Engine article for the procedure.
	• Fail-safe cooling invoked (if equipped)	• REFER to the **Introduction - Gasoline Engines** article.
	• Incorrect valve clearance	• ADJUST valve clearance. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
	• Incorrect valve-to-valve seat contact	• INSTALL a new cylinder head. TEST the system for normal operation after the repair.
	• Damaged head gasket	• INSTALL a new cylinder head gasket. TEST the system for normal operation after the repair.
• Engine runs rough	• Inoperative or damaged fuel system • Air or vacuum leaks • EGR system fault • Inoperative or damaged cooling system • Inoperative or damaged ignition system	• Refer to the appropriate Engine article for the procedure.
	• Fail-safe cooling invoked (if equipped)	• REFER to the **Introduction - Gasoline Engines** article.
	• Burnt or sticking valve	• INSTALL a new cylinder valve. TEST the system for normal operation after the repair.
	• Weak or broken valve spring	• INSTALL a new valve spring. TEST the system for normal operation after the repair.
	• Carbon accumulation in combustion chamber	• ELIMINATE carbon buildup. TEST the system for normal operation after the repair.
• Excessive oil	• Leaking oil	• REPAIR oil leakage. TEST the system for normal operation after

consumption	• Inoperative PCV system	the repair. • REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.
	• Incorrect oil	• CHANGE oil to correct specification.
	• Worn valve stem seal	• INSTALL a new valve stem seal. TEST the system for normal operation after the repair.
	• Worn valve stem or valve guide	• INSTALL a new cylinder head. TEST the system for normal operation after the repair.
	• Sticking piston rings • Worn piston ring groove • Worn piston or cylinder	• INSTALL a new short block. TEST the system for normal operation after the repair.
• Insufficient power	• Inoperative or damaged ignition system • Air intake system blockage • Lubrication system blockage • Inoperative or damaged fuel system	• Refer to the appropriate Engine article for the procedure. REFER to the **Introduction - Gasoline Engines** article.
	• Oil level too high	• DRAIN oil to correct level. TEST the system for normal operation after the repair.
	• Incorrect engine oil	• INSTALL correct specification engine oil. TEST the system for normal operation after the repair.
	• Excessive accessory drive belt loading • Inoperative or damaged cooling system	• Refer to the appropriate Engine article for the procedure.
	• Fail-safe cooling invoked (if equipped)	• REFER to the **Introduction - Gasoline Engines** article.
	• Damaged or plugged exhaust system	• INSPECT exhaust system. TEST the system for normal operation after the repair.
	• Incorrect tire size	• REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

	• Dragging brakes	• REFER to **BRAKE SYSTEM - GENERAL INFORMATION** article.
	• Slipping transmission	• Refer to the appropriate Automatic Transmission article for the procedure.
	• Incorrect valve clearance	• ADJUST valve clearance. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
	• Worn or damaged valve tappet	• INSTALL a new valve tappet. TEST the system for normal operation after the repair.
	• Damaged valve guide • Compression leakage at valve seat • Seized valve stem	• INSTALL a new cylinder head assembly. TEST the system for normal operation after the repair.
	• Weak or broken valve spring	• INSTALL a new valve spring. TEST the system for normal operation after the repair.
	• Worn or damaged cam	• INSTALL a new camshaft. TEST the system for normal operation after the repair.
	• Damaged head gasket	• INSTALL a new head gasket. TEST the system for normal operation after the repair.
	• Cracked or distorted cylinder head	• INSTALL a new cylinder head assembly. TEST the system for normal operation after the repair.
	• Damaged, worn or sticking piston ring(s) • Worn or damaged piston	• INSTALL a new short block. TEST the system for normal operation after the repair.

Symptom Chart - NVH

NOTE: **NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible that any one of multiple systems may be the cause of the symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the**

next likely system and continue diagnosis.

Symptom Chart - NVH

Condition	Possible Sources	Action
• Drone type noise	• Powertrain mount(s)	• CARRY OUT the **Powertrain/Drivetrain Mount Neutralizing** procedure. TEST the system for normal operation after the repair.
• Drumming noise - occurs inside the vehicle during idle or high idle, hot or cold. Very low-frequency drumming is very rpm dependent	• Engine vibration excites the body resonances inducing interior noise	• CARRY OUT the **Powertrain/Drivetrain Mount Neutralizing** procedure. TEST the system for normal operation after the repair.
• Engine drumming noise - accompanied by vibration	• Powertrain mount(s)	• CARRY OUT the **Powertrain/Drivetrain Mount Neutralizing** procedure. TEST the system for normal operation after the repair.
• Rattle - occurs at idle or at light acceleration from a stop	• Powertrain mount(s)	• CHECK the powertrain mounts for damage. INSTALL new mounts as necessary. For engine, Refer to the appropriate Engine article for the procedure. For automatic transmission, Refer to the appropriate Automatic Transmission article for the procedure. For manual transmission, REFER to **MANUAL TRANSAXLE/TRANSMISSION** article. TEST the system for normal operation after the repair.
• Whine/moan type noise - pitch increases or changes with vehicle speed	• Powertrain mount(s)	• CHECK the powertrain mounts for damage. INSTALL new mounts as necessary. For engine, Refer to the appropriate Engine article for the procedure. For automatic transmission, Refer to the appropriate Automatic Transmission article for the procedure. For manual transmission, REFER to **MANUAL TRANSAXLE/TRANSMISSION** article. TEST the system for normal operation after the repair.
		• CHECK the powertrain/drivetrain mounts for damage. INSTALL new mounts as necessary. For engine, Refer to the

• Clunk - occurs when shifting from PARK or between REVERSE and DRIVE	• Powertrain mounts	appropriate Engine article for the procedure. For automatic transmission, Refer to the appropriate Automatic Transmission article for the procedure. For manual transmission, REFER to **MANUAL TRANSAXLE/TRANSMISSION** article. TEST the system for normal operation after the repair.
	• Idle speed is too high	• CHECK for the correct idle speed. TEST the system for normal operation after the repair.
• Accessory drive bearing hoot - occurs at idle or high idle in cold temperatures of approximately 4° C (40°F) or colder at the first start of the day	• Accessory drive idler or tensioner pulley bearing is experiencing stick/slip between ball bearings and the bearing race	• CARRY OUT the engine cold soak procedure. REFER to **NOISE, VIBRATION AND HARSHNESS** article. • PLACE the EngineEAR probe directly on the idler/tensioner center post or bolt to verify which bearing is making the noise. INSTALL new parts as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
• Accessory drive belt noise, squeal or chirping	• Defective/worn or incorrect accessory drive belt • Misaligned pulley(s) • Pulley runout • Damaged or worn accessory drive component or idler • Fluid contamination of the accessory drive belt or pulleys • Damaged or worn accessory drive belt tensioner • Damaged pulley grooves	• CARRY OUT the Engine Accessory Test. REFER to **NOISE, VIBRATION AND HARSHNESS** article. INSPECT components and INSTALL new parts as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
• Clunking noise	• Coolant pump has excessive end play or imbalance	• CHECK the coolant pump for excessive end play. INSPECT the coolant pump for imbalance with the drive belt off. INSTALL a new coolant pump as necessary. REFER to **ENGINE COOLING** article. TEST the system for normal operation after the repair.

• Whine or moaning noise	• Air intake system	• CHECK the air cleaner and ducts for correct fit. INSPECT the air intake system for leaks or damage. REPAIR as necessary. TEST the system for normal operation after the repair.
• Whistling noise - normally accompanied with poor idle condition	• Air intake system	• CHECK the air intake ducts, air cleaner, Throttle Body (TB) and vacuum hoses for leaks and correct fit. REPAIR or ADJUST as necessary. TEST the system for normal operation after the repair.
• Hissing noise - occurs during idle or high idle that is apparent with the hood open	• Vacuum leak	• USE the EngineEAR/ChassisEAR to locate the source. SCAN the air intake system from the inlet to each cylinder intake port. DISCARD the leaking parts, and INSTALL a new component. TEST the system for normal operation after the repair.
	• Vehicles with a plastic intake manifold	• Acceptable condition. Some plastic intake manifolds exhibit this noise, which is the effect of the plastic manifold.
• Grinding noise - occurs during engine cranking	• Incorrect starter motor mounting	• INSPECT the starter motor for correct mounting. REPAIR as necessary. REFER to **STARTING SYSTEM** article. TEST the system for normal operation after the repair.
	• Starter motor	• CHECK the starter motor. INSTALL a new starter motor as necessary. REFER to **STARTING SYSTEM** article. TEST the system for normal operation after the repair.
	• Incorrect starter motor drive engagement	• INSPECT the starter motor drive for wear or damage. INSTALL a new starter motor as necessary. REFER to **STARTING SYSTEM** article. TEST the system for normal operation after the repair. • INSPECT the flywheel/flexplate for wear or damage. INSTALL a new flywheel/flexplate as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
• Engine noise, front of engine - knocking noise from lower front	• Damaged or separated crankshaft pulley/damper	• CHECK for obvious signs of damage or wobble during operation. INSTALL new as necessary. Refer to the appropriate Engine article for the procedure. TEST the system

of engine		for normal operation after the repair.
• Engine noise, front of engine - ticking, tapping or rattling noise from the front of the engine	• Timing drive components	• REMOVE the accessory drive belt. Refer to the appropriate Engine article for the procedure. • USE the EngineEAR to isolate the noise to the engine front cover. • REMOVE the engine front cover and INSPECT the timing drive components. INSTALL new parts as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
• Engine noise, upper end - ticking noise near the fuel rail and intake manifold	• Fuel rail clip	• CHECK for loose or damaged fuel rail clip (s). REPAIR as necessary.
	• Fuel injector	• USE the EngineEAR to isolate the noisy injector(s). INSTALL a new injector(s) as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
• Engine noise, upper end - ticking, knocking or rattle noise that occurs during idle or high idle during the first cold start of the day and may disappear as the engine warms	• Valve train noise (bled down lash adjuster)	• CARRY OUT the **Valve Train Analysis**. INSTALL new parts as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
• Engine noise, upper end - occurs mostly with a warm engine at light/medium acceleration	• Worn or damaged spark plugs	• REMOVE the spark plugs. INSPECT and INSTALL new as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
	• Carbon accumulation in combustion chamber	• Bore scope the cylinder. ELIMINATE carbon buildup. TEST the system for normal operation after the repair.
• Engine noise, upper end - rattling noise from	• Low oil level	• CHECK the oil level. FILL as necessary.

the valve train. Worse when the engine is cold	• Thin or diluted oil • Low oil pressure • Worn valve train components • Worn valve guides	• INSPECT the oil for contamination. If the oil is contaminated, CHECK for the source. REPAIR as necessary. CHANGE the oil and filter. • CARRY OUT an oil pressure test. If not within specifications, REMOVE the engine oil pan. Refer to the appropriate Engine article for the procedure. INSPECT for a blocked oil pick up tube. • CARRY OUT the **Valve Train Analysis**. INSTALL new parts as necessary. TEST the system for normal operation after the repair. • CARRY OUT the **Valve Guide Inner Diameter**.
	• Excessive runout of the valve seats on the valve face	• CARRY OUT the **Valve Seat Inspection**.
• Engine noise, upper end - pinging noise	• Gasoline octane too low • Knock Sensor (KS) operation • Incorrect spark timing • High operating temperature • Spark plug	• VERIFY with customer the type of gasoline used. CORRECT as necessary. TEST the system for normal operation after the repair. • CHECK the KS. INSTALL a new KS as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair. • CHECK the spark timing. REPAIR as necessary. TEST the system for normal operation after the repair. • INSPECT the cooling system for leaks. CHECK the coolant level. REFILL as necessary. CHECK the coolant for the correct mix ratio. DRAIN and REFILL as needed. VERIFY the engine operating temperature is within specifications. REPAIR as necessary. TEST the system for normal operation after the repair. • CHECK the spark plugs. REPAIR or INSTALL new spark plugs as necessary. TEST the system for normal operation after the repair.

	• Catalytic converter	• COMPARE with a similar vehicle for what is acceptable noise.
• Engine noise, lower end - ticking or knocking noise near the oil filter adapter	• Oil pump	• USE the EngineEAR to verify the oil pump as the source of the noise at low rpm. REPAIR as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
• Engine noise, lower end - light knocking noise, also described as piston slap. Noise is most noticeable when the engine is cold with light to medium acceleration. The noise disappears as the engine warms	• Excessive clearance between the piston and the cylinder wall	• INSTALL a new short block. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
• Engine noise, lower end - light double knock or sharp rap sound. Occurs mostly with a warm engine at idle or low speeds in drive. Increases in relation to engine load. Associated with a poor lubrication history	• Excessive clearance between the piston and the piston pin	• INSTALL a new short block. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
• Engine noise, lower end - light knocking noise. The noise is most noticeable when the engine is warm. The noise tends to decrease when the vehicle is coasting or in NEUTRAL	• Excessive clearance between the connecting rod bearings and the crankshaft	• INSTALL a new short block. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.

• Engine noise, lower end - Deep knocking noise. The noise is most noticeable when the engine is warm, at lower rpm and under a light load and then at float	• Worn or damaged crankshaft main bearings	• INSTALL a new short block. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
• Engine noise, rear of engine - knocking noise at rear of engine	• Damaged flywheel/flexplate	• CARRY OUT the **Flywheel Inspection** or the **Flexplate Inspection**.
• Engine vibration - vibration felt at all times	• Excessive engine pulley runout	• CARRY OUT the Engine Accessory Test. REFER to **NOISE, VIBRATION AND HARSHNESS** article. INSTALL a new engine pulley as necessary. TEST the system for normal operation after the repair.
	• Damaged or worn accessory component	• CARRY OUT the Engine Accessory Test. REFER to **NOISE, VIBRATION AND HARSHNESS** article. REPAIR or INSTALL a new component as necessary. TEST the system for normal operation after the repair.
• Engine vibration - at idle, a low-frequency vibration (5-20 Hz) or mild shake that is felt through the seat/floorpan	• Cylinder misfire	• Using the scan tool, CARRY OUT the cylinder power balance and the relative compression test. REPAIR as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
	• Engine or torque converter out of balance	• VERIFY the torque converter to crankshaft pilot clearance is correct. REPAIR as necessary. RE-INDEX the torque converter on the flexplate by 120 degrees for a 3-bolt converter or 180 degrees for a 4-bolt converter. Refer to the appropriate Automatic Transmission article for the procedure. TEST the system for normal operation after the repair.
		• CHECK the powertrain mounts for damage. INSTALL new mounts as necessary. For engine, Refer to the

• Engine vibration - is felt with increases and decreases in engine rpm	• Powertrain mount(s)	appropriate Engine article for the procedure. For automatic transmission, Refer to the appropriate Automatic Transmission article for the procedure. For manual transmission, REFER to **MANUAL TRANSAXLE/TRANSMISSION** article. TEST the system for normal operation after the repair.
	• Engine or transmission grounded to chassis	• INSPECT the powertrain/drivetrain for correct clearances. REPAIR as necessary. TEST the system for normal operation after the repair.
• Engine vibration - increases intensity as the engine rpm is increased	• Engine out-of-balance	• CARRY OUT the Neutral Engine Run-Up (NERU) Test. REFER to **NOISE, VIBRATION AND HARSHNESS** article. ROTATE the torque converter, 120 degrees for 3-bolt or 180 degrees for 4-bolt. INSPECT the torque converter pilot outer diameter-to-crankshaft pilot inner diameter. REPAIR as necessary. Refer to the appropriate Automatic Transmission article for the procedure. TEST the system for normal operation after the repair.
• Engine vibration - mostly at coast/neutral coast. Condition improves with vehicle acceleration	• Combustion instability	• CHECK the ignition system. INSTALL new components as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
• Engine vibration or shudder - occurs with light to medium acceleration above 56 km/h (35 mph)	• Worn or damaged spark plugs	• INSPECT the spark plugs for cracks, high resistance or broken insulators. INSTALL a new spark plug(s) as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
	• Plugged fuel injector	• REPAIR or INSTALL a new injector as necessary. Refer to the appropriate Engine article for the procedure. TEST the system for normal operation after the repair.
	• Contaminated fuel	• INSPECT the fuel for contamination. DRAIN the fuel system and refill. TEST the system for normal operation after the repair.

Component Tests

The following component tests are used to diagnose engine concerns.

Engine Oil Leaks

NOTE: If an overnight drive is done, the fan air or road air blast can cause erroneous readings.

NOTE: When diagnosing engine oil leaks, the source and location of the leak must be positively identified prior to repair.

Prior to carrying out this procedure, clean the cylinder block, cylinder heads, valve covers, oil pan and flywheel with a suitable solvent to remove all traces of oil.

Engine Oil Leaks - Fluorescent Oil Additive Method

Use the 12 Volt Master UV Diagnostic Inspection Kit to carry out the following procedure for oil leak diagnosis.

1. Add 29.6 ml (1 oz) of gasoline engine oil leak detection dye to a minimum of 0.47L (1/2 qt) and a maximum of 0.95L (1 qt) engine oil and fill through the engine oil fill. Thoroughly premix the gasoline engine oil dye or it will not have enough time to reach the crankcase, oil galleries and seal surfaces during this particular 15 minute test. The additive must be mixed well with oil and added through the oil fill. Check the level on the oil level indicator to determine what amount of oil to premix. If it is in the middle of the crosshatch area or below the full mark, use 0.95L (1 qt). If it is at the full mark, use 0.47L (1/2 qt).
2. Run the engine for 15 minutes. Stop the engine and inspect all seal and gasket areas for leaks using the UV Leak Detector Kit. A clear bright yellow or orange area will identify the leak. For extremely small leaks, several hours may be required for the leak to appear.
3. At the end of test, make sure the oil level is within the upper and lower oil indicator marks. Remove oil as necessary if it registers above the full mark.

Leakage Points - Underhood

Examine the following areas for oil leakage:

- Valve cover gaskets
- Cylinder head gaskets
- Oil cooler, if equipped
- Oil filter adapter
- Engine front cover
- Oil filter adapter and filter body
- Oil level indicator tube connection
- Oil pressure sensor

Leakage Points - Under Engine, With Vehicle on Hoist

Examine the following areas for oil leakage:

- Oil pan gaskets
- Oil pan sealer
- Engine front cover gasket
- Crankshaft front seal
- Crankshaft rear oil seal
- Oil filter adapter and filter body
- Oil cooler, if equipped

Leakage Points - With Transmission and Flywheel Removed

Examine the following areas for oil leakage:

- Crankshaft rear oil seal
- Rear main bearing cap parting line
- Flexplate mounting bolt holes (with flexplate installed)
- Pipe plugs at the end of oil passages

Oil leaks at crimped seams in sheet metal parts and cracks in cast or stamped parts can be detected when using the dye method.

Compression Test

1. Make sure the oil in the crankcase is of the correct viscosity and at the correct level and that the battery is correctly charged. Operate the vehicle until the engine is at normal operating temperature. Turn the ignition switch to the OFF position, then remove all the spark plugs.
2. Set the throttle plates in the wide-open position.
3. Install a compression gauge such as the Quick Disconnect Compression Tester in the No. 1 cylinder.
4. Install an auxiliary starter switch in the starting circuit. With the ignition switch in the OFF position, and using the auxiliary starter switch, crank the engine a minimum of 5 compression strokes and record the highest reading. Note the approximate number of compression strokes necessary to obtain the highest reading.
5. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.

Compression Test - Test Results

The indicated compression pressures are considered within specification if the lowest reading cylinder is at least 75% of the highest reading. Refer to the Compression Pressure Limit Chart.

COMPRESSION PRESSURE LIMIT CHART

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
924 kPa (134 psi)	696 kPa (101 psi)	1,131 kPa (164 psi)	848 kPa (123 psi)	1,338 kPa (194 psi)	1,000 kPa (146 psi)	1,544 kPa (224 psi)	1,158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1,145 kPa (166 psi)	855 kPa (124 psi)	1,351 kPa (196 psi)	1,014 kPa (147 psi)	1,558 kPa (226 psi)	1,165 kPa (169 psi)
952 kPa (138 psi)	717 kPa (104 psi)	1,158 kPa (168 psi)	869 kPa (126 psi)	1,365 kPa (198 psi)	1,020 kPa (148 psi)	1,572 kPa (228 psi)	1,179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (106 psi)	1,172 kPa (170 psi)	876 kPa (127 psi)	1,379 kPa (200 psi)	1,034 kPa (150 psi)	1,586 kPa (230 psi)	1,186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1,186 kPa (172 psi)	889 kPa (129 psi)	1,303 kPa (202 psi)	1,041 kPa (151 psi)	1,600 kPa (232 psi)	1,200 kPa (174 psi)
933 kPa (144 psi)	745 kPa (109 psi)	1,200 kPa (174 psi)	903 kPa (131 psi)	1,407 kPa (204 psi)	1,055 kPa (153 psi)	1,055 kPa (153 psi)	1,207 kPa (175 psi)
1,007 kPa (146 psi)	758 kPa (110 psi)	1,214 kPa (176 psi)	910 kPa (132 psi)	1,420 kPa (206 psi)	1,062 kPa (154 psi)	1,627 kPa (154 psi)	1,220 kPa (177 psi)
1,020 kPa (148 psi)	765 kPa (111 psi)	1,227 kPa (178 psi)	917 kPa (133 psi)	1,434 kPa (208 psi)	1,075 kPa (156 psi)	1,641 kPa (238 psi)	1,227 kPa (178 psi)
1,034 kPa (150 psi)	779 kPa (113 psi)	1,241 kPa (180 psi)	931 kPa (135 psi)	1,448 kPa (210 psi)	1,083 kPa (157 psi)	1,655 kPa (240 psi)	1,241 kPa (180 psi)
1,048 kPa (152 psi)	786 kPa (114 psi)	1,255 kPa (182 psi)	936 kPa (136 psi)	1,462 kPa (212 psi)	1,089 kPa (158 psi)	1,669 kPa (242 psi)	1,248 kPa (181 psi)
1,062 kPa (154 psi)	793 kPa (115 psi)	1,269 kPa (184 psi)	952 kPa (138 psi)	1,476 kPa (214 psi)	1,103 kPa (160 psi)	1,682 kPa (244 psi)	1,262 kPa (183 psi)
1,076 kPa (156 psi)	807 kPa (117 psi)	1,282 kPa (186 psi)	965 kPa (140 psi)	1,489 kPa (216 psi)	1,117 kPa (162 psi)	1,696 kPa (246 psi)	1,269 kPa (184 psi)
1,089 kPa (158 psi)	814 kPa (118 psi)	1,296 kPa (188 psi)	972 kPa (141 psi)	1,503 kPa (218 psi)	1,124 kPa (163 psi)	1,710 kPa (248 psi)	1,202 kPa (186 psi)
1,103 kPa (160 psi)	827 kPa (120 psi)	1,310 kPa (190 psi)	979 kPa (142 psi)	1,517 kPa (220 psi)	1,138 kPa (165 psi)	1,724 kPa (250 psi)	1,289 kPa (187 psi)
1,110 kPa (161 psi)	834 kPa (121 psi)	1,324 kPa (192 psi)	993 kPa (144 psi)	1,631 kPa (222 psi)	1,145 kPa (166 psi)	-	-

If one or more cylinders reads low, squirt approximately one tablespoon of engine oil meeting Ford specification on top of the pistons in the low-reading cylinders. Repeat the compression pressure check on these cylinders.

Compression Test - Interpreting Compression Readings

1. If compression improves considerably, piston rings are worn or damaged.
2. If compression does not improve, valves are sticking or not seating correctly.
3. If 2 adjacent cylinders indicate low compression pressures and squirting oil on each piston does not increase compression, the head gasket may be leaking between cylinders. Engine oil or coolant in cylinders could result from this condition.

Use the Compression Pressure Limit Chart when checking cylinder compression so that the lowest reading is within 75% of the highest reading.

Cylinder Leakage Detection

When a cylinder produces a low reading, use of the Engine Cylinder Leak Detection/Air Pressurization Kit will be helpful in pinpointing the exact cause.

The leakage detector is inserted in the spark plug hole, the piston is brought up to Top Dead Center (TDC) on the compression stroke, and compressed air is admitted.

Once the combustion chamber is pressurized, a special gauge included in the kit will read the percentage of leakage. Leakage exceeding 20% is excessive.

While the air pressure is retained in the cylinder, listen for the hiss of escaping air. A leak at the intake valve will be heard in the Throttle Body (TB). A leak at the exhaust valve can be heard at the tailpipe. Leakage past the piston rings will be audible at the PCV connection. If air is passing through a blown head gasket to an adjacent cylinder, the noise will be evident at the spark plug hole of the cylinder into which the air is leaking. Cracks in the cylinder block or gasket leakage into the cooling system may be detected by a stream of bubbles in the radiator.

Excessive Engine Oil Consumption

Nearly all engines consume oil, which is essential for normal lubrication of the cylinder bore walls and pistons and rings. Determining the level of oil consumption may require testing by recording how much oil is being added over a given set of miles.

Customer driving habits greatly influence oil consumption. Mileage accumulated during towing or heavy loading generates extra heat. Frequent short trips, stop-and-go type traffic or extensive idling, prevent the engine from reaching normal operating temperature. This prevents component clearances from reaching specified operating ranges.

The following diagnostic procedure may be utilized to determine internal oil consumption. Make sure that the concern is related to internal oil consumption, and not external leakage, which also consumes oil. Verify there are no leaks before carrying out the test. Once verified, the rate of internal oil consumption can be tested.

A new engine may require extra oil in the early stages of operation. Internal piston-to-bore clearances and sealing characteristics improve as the engine breaks in. Engines are designed for close tolerances and do not require break-in oils or additives. Use the oil specified in the Owner's Literature. Ambient temperatures may determine the oil viscosity specification. Verify that the correct oil is being used for the vehicle in the geographic region in which it is driven.

Basic Pre-checks

1. For persistent complaints of oil consumption, interview the customer to determine the oil consumption characteristics. If possible, determine the brand and grade of oil currently in the oil pan. Look at the oil filter or oil-change station tags to determine if Ford-recommended maintenance schedules have been followed. Make sure that the oil has been changed at the specified mileage intervals. If vehicle mileage is

past the first recommended drain interval, the OEM production filter should have been changed.

2. Ask how the most current mileage was accumulated. That is, determine whether the vehicle was driven under the following conditions:
   - Extended idling or curbside engine operation
   - Stop-and-go traffic or taxi operation
   - Towing a trailer or vehicle loaded heavily
   - Frequent short trips (engine not up to normal operating temperature)
   - Excessive throttling or high engine-rpm driving
3. Verify that there are no external leaks. If necessary, review the diagnostic procedure under **Engine Oil Leaks**.
4. Inspect the crankcase ventilation system for:
   - disconnected hoses at the valve cover or TB.
   - loose or missing valve cover fill cap.
   - missing or incorrectly seated engine oil level indicator.
   - incorrect or dirty PCV valve.
   - a PCV valve grommet unseated in the valve cover (if so equipped).
5. Inspect for signs of sludge. Sludge affects PCV performance and can plug or restrict cylinder head drainback wells. It can also increase oil pressure by restricting passages and reducing the drainback capability of piston oil control rings. Sludge can result from either excessive water ingestion in the crankcase or operation at extremely high crankcase temperatures.
6. Inspect the air filter for dirt, sludge or damage. A hole in the filter element will allow unfiltered air to bypass into the air induction system. This can cause premature internal wear (engine dusting), allowing oil to escape past rings, pistons, valves and guides.
7. If the engine is hot or was recently shut down, wait at least 5 minutes to allow the oil to drain back. Ask the customer if this requirement has been followed. Adding oil without this wait period can cause an overfill condition, leading to excessive oil consumption and foaming which may cause engine damage.
8. Make sure the oil level indicator (dipstick) is correctly and fully seated in the indicator tube. Remove the oil level indicator and record the oil level.

Detailed Pre-checks

1. Check the thermostat opening temperature to make sure that the cooling system is operating at the specified temperature. If it is low, internal engine parts are not running at specified internal operating clearances.
2. Verify the spark plugs are not oil saturated. Oil leaking into one or more cylinders will appear as an oil soaked condition on the plug. If a plug is saturated, a compression check may be necessary at the conclusion of the oil consumption test.

Oil Consumption Test

Once all of the previous conditions are met, carry out an oil consumption test.

1. Drain the engine oil and remove the oil filter. Install a new manufacturer-specified oil filter. Make sure

the vehicle is positioned on a level surface. Refill the oil pan to a level **one liter (quart) less** than the specified fill level, using manufacturer-specified oil.

2. Run the engine for 3 minutes (if hot) or 10 minutes (if cold). Allow for a minimum 5-minute drainback period and then record the oil level shown on the oil level indicator. Place a mark on the backside of the oil level indicator noting the oil level location.
3. Add the final one liter (quart) to complete the normal oil fill. Restart the engine and allow it to idle for 2 minutes. Shut the engine down.
4. After a 5-minute drainback period, record the location of the oil level again. Mark the oil level indicator with the new oil level location. (Note: Both marks should be very close to the MIN-MAX upper and lower limits or the upper and lower holes on the oil level indicator. These marks will exactly measure the engine's use of oil, with a one liter (quart) differential between the new marks.) Demonstrate to the customer that the factory-calibrated marks on the oil level indicator are where the oil should fall after an oil change with the specified fill amount. Explain however, that this may vary slightly between MIN-MAX or the upper and lower holes on the oil level indicator.
5. Record the vehicle mileage.
6. Advise the customer that oil level indicator readings must be taken every 320 km (200 mi) or weekly, using the revised marks as drawn. Remind the customer that the engine needs a minimum 5-minute drainback for an accurate reading and that the oil level indicator must be firmly seated in the tube prior to taking the reading.
7. When the subsequent indicator readings demonstrate a full liter (quart) has been used, record the vehicle mileage. The mileage driven between the 2 readings should not be less than 1,500 miles. The drive cycle the vehicle has been operated under must be considered when making this calculation. It may be necessary to have the customer bring the vehicle in for a periodic oil level indicator reading to closely monitor oil usage.

Post Checks, Evaluation and Corrective Action

1. If test results indicate excessive oil consumption, carry out a cylinder compression test. The cylinder compression test should be carried out with a fully charged battery and all spark plugs removed. See the **Compression Test** for pressure range limits.
2. Compression should be consistent across all cylinders. Refer to the **Compression Test**. If compression tested within the **SPECIFICATIONS**, the excessive oil consumption may be due to wear on the valve guides, valves or valve seals.
3. A cylinder leak detection test can be carried out using an Engine Cylinder Leak Detection/Air Pressurization Kit. This can help identify valves, piston rings, or worn valve guides/valve stems, inoperative valve stem seals or other related areas as the source of oil consumption.

NOTE: **An oil-soaked appearance on the porcelain tips of the spark plugs also indicates excessive oil use. A typical engine with normal oil consumption will exhibit a light tan to brown appearance. See Spark Plug Inspection for details. A single or adjoining, multiple cylinder leak can be traced by viewing the tips.**

4. If an internal engine part is isolated as the root cause, determine if the repair will exceed cost limits and proceed with a repair strategy as required.

5. Once corrective action to engine is complete and verifying that all pre-check items were eliminated in the original diagnosis, repeat the Oil Consumption Test as described above and verify consumption results.

Intake Manifold Vacuum Test

Bring the engine to normal operating temperature. Connect the Vacuum/Pressure Tester to the intake manifold. Run the engine at the specified idle speed.

The vacuum gauge should read between 51-74 kPa (15-22 in-Hg) depending upon the engine condition and the altitude at which the test is conducted. Subtract 4.0193 kPa (1 in-Hg) from the specified reading for every 304.8 m (1,000 ft) of elevation above sea level.

The reading should be steady. If necessary, adjust the gauge damper control (where used) if the needle is fluttering rapidly. Adjust the damper until the needle moves easily without excessive flutter.

Intake Manifold Vacuum Test - Interpreting Vacuum Gauge Readings

A careful study of the vacuum gauge reading while the engine is idling will help pinpoint trouble areas. Always conduct other appropriate tests before arriving at a final diagnostic decision. Vacuum gauge readings, although helpful, must be interpreted carefully.

Most vacuum gauges have a normal band indicated on the gauge face.

The following are potential gauge readings. Some are normal; others should be investigated further.

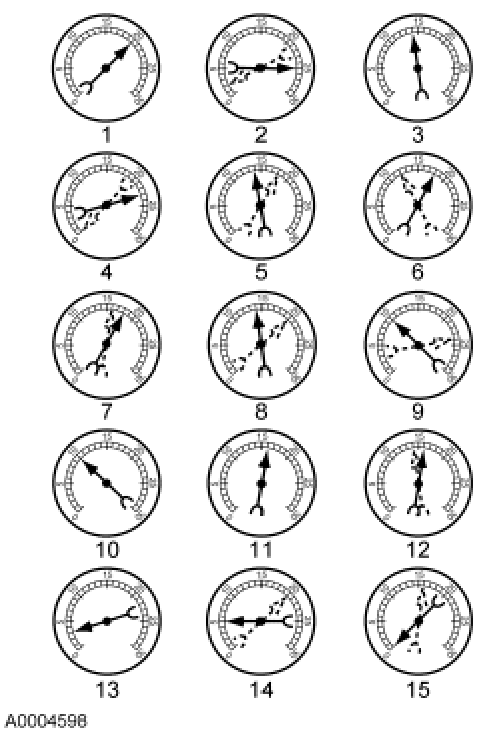


Fig. 1: Potential Vacuum Gauge Readings Chart
Courtesy of FORD MOTOR CO.

1. NORMAL READING: Needle between 51-74 kPa (15-22 in-Hg) and holding steady.
2. NORMAL READING DURING RAPID ACCELERATION AND DECELERATION: When the engine is rapidly accelerated (dotted needle), the needle will drop to a low reading (not to zero). When the throttle is suddenly released, the needle will snap back up to a higher than normal figure.
3. NORMAL FOR HIGH-LIFT CAMSHAFT WITH LARGE OVERLAP: The needle will register as low as 51 kPa (15 in-Hg) but will be relatively steady. Some oscillation is normal.
4. WORN RINGS OR DILUTED OIL: When the engine is accelerated (dotted needle), the needle drops to 0 kPa (0 in-Hg). Upon deceleration, the needle runs slightly above 74 kPa (22 in-Hg).
5. STICKING VALVES: When the needle (dotted) remains steady at a normal vacuum but occasionally flicks (sharp, fast movement) down and back about 13 kPa (4 in-Hg), one or more valves may be sticking.
6. BURNED OR WARPED VALVES: A regular, evenly-spaced, downscale flicking of the needle indicates one or more burned or warped valves. Insufficient valve clearance will also cause this reaction.
7. POOR VALVE SEATING: A small but regular downscale flicking can mean one or more valves are not seating.
8. WORN VALVE GUIDES: When the needle oscillates over about a 13 kPa (4 in-Hg) range at idle speed, the valve guides could be worn. As engine speed increases, the needle will become steady if guides are responsible.
9. WEAK VALVE SPRINGS: When the needle oscillation becomes more violent as engine rpm is increased, weak valve springs are indicated. The reading at idle could be relatively steady.
10. LATE VALVE TIMING: A steady but low reading could be caused by late valve timing.
11. IGNITION TIMING RETARDING: Retarded ignition timing will produce a steady but somewhat low reading.
12. INSUFFICIENT SPARK PLUG GAP: When spark plugs are gapped too close, a regular, small pulsation of the needle can occur.
13. INTAKE LEAK: A low, steady reading can be caused by an intake manifold or throttle body gasket leak.
14. BLOWN HEAD GASKET: A regular drop of fair magnitude can be caused by a blown head gasket or warped cylinder head-to-cylinder block surface.
15. RESTRICTED EXHAUST SYSTEM: When the engine is first started and is idled, the reading may be normal, but as the engine rpm is increased, the back pressure caused by a clogged muffler, kinked tailpipe or other concerns will cause the needle to slowly drop to 0 kPa (0 in-Hg). The needle then may slowly rise. Excessive exhaust clogging will cause the needle to drop to a low point even if the engine is only idling.
16. When vacuum leaks are indicated, search out and correct the cause. Excess air leaking into the system will upset the fuel mixture and cause concerns such as rough idle, missing on acceleration or burned valves. If the leak exists in an accessory unit such as the power brake booster, the unit will not function correctly. Always fix vacuum leaks.

Oil Pressure Test

1. Disconnect and remove the oil pressure sensor from the engine.
2. Connect the Oil Pressure Gauge to the oil pressure sender oil galley port.
3. Run the engine until normal operating temperature is reached.
4. Run the engine at the specified rpm and record the gauge reading.

5. The oil pressure should be within specifications; for additional information, refer to the **SPECIFICATIONS**.
6. If the pressure is not within specification, check the following possible sources:
    - Insufficient oil
    - Oil leakage
    - Worn or damaged oil pump
    - Oil pump screen cover and tube
    - Excessive main bearing clearance
    - Excessive connecting rod bearing clearance
    - Chain tensioner leak

Valve Train Analysis

The following component tests are used to diagnose valve train concerns.

Valve Train Analysis - Engine Off, Valve Cover Removed

Check for damaged or severely worn parts and correct assembly. Make sure correct parts are used with the static engine analysis as follows.

Valve Train Analysis - Camshafts

- Check for broken or damaged parts.
- Check for loose mounting bolts on camshaft caps.

Valve Train Analysis - Camshaft Roller Followers and Hydraulic Lash Adjusters - 3.0L Engine

- Check for broken or damaged parts.
- Check for incorrectly installed roller followers.
- Check for collapsed hydraulic lash adjusters.

Valve Train Analysis - Valve Tappet - 2.3L and 3.5L Engines

- Check for valve tappet face wear.
- Check for excessive valve tappet clearance. Refer to Valve Clearance Check. For the 2.3L engine, refer to **ENGINE - 2.3L** article. For the 3.5L engine, refer to **ENGINE - 3.5L** article.

Valve Train Analysis - Valve Springs, Valve Spring Retainers and Valve Spring Retainer Keys

NOTE: Valve tappers must be removed on 2.3L and 3.5L engines.

- Check for broken or damaged parts.
- Check for correct seating of the valve spring retainer key on the valve stem and in valve spring retainer.
- Check for correct seating on the valve stem.

Valve Train Analysis - Valves and Cylinder Head

NOTE: Valve tappets must be removed on 2.3L and 3.5L engines.

- Check for plugged oil drain back holes.
- Check for worn or damaged valve tips.
- Check for missing or damaged guide-mounted valve stem seal.
- Check for damaged hydraulic lash adjuster.
- Check installed valve spring height.
- Check for missing or worn valve spring seats.
- Check for plugged oil metering orifice in cylinder head oil reservoir (if equipped).

Valve Train Analysis - Camshaft Lobe Lift

Check the lift of each camshaft lobe in consecutive order and make a note of the readings.

1. Remove the spark plugs.
2. Install the Dial Indicator Gauge with Holding Fixture so the rounded tip of the dial indicator is on top of the camshaft lobe and on the same plane as the valve tappet (2.3L and 3.5L) or hydraulic lash adjuster (3.0L).
3. Rotate the crankshaft using a breaker bar and socket attached to the crankshaft pulley retainer bolt. Rotate the crankshaft until the base circle of the camshaft lobe is reached.

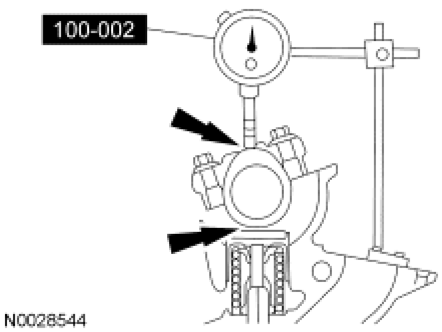


Fig. 2: Checking Camshaft Lobe Lift
Courtesy of FORD MOTOR CO.

4. Zero the dial indicator. Continue to rotate the crankshaft until the high-lift point of the camshaft lobe is in the fully-raised position (highest indicator reading).
5. To check the accuracy of the original indicator reading, continue to rotate crankshaft until the base circle is reached. The indicator reading should be zero. If zero reading is not obtained, repeat Steps 1 through 6.
6. If the lift on any lobe is below specified service limits, install a new camshaft and camshaft roller followers.
7. Install the spark plugs.

GENERAL PROCEDURES

SPROCKETS

1. Inspect the sprockets for cracks and worn or chipped teeth.

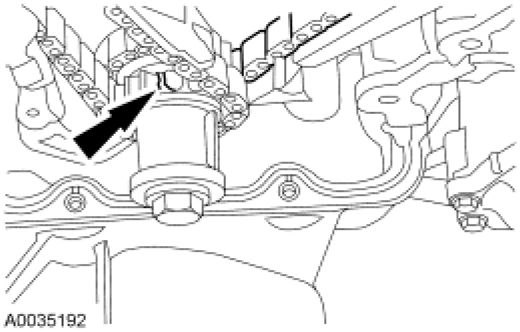


Fig. 3: Inspecting Sprockets For Damage
Courtesy of FORD MOTOR CO.

CAMSHAFT BEARING JOURNAL DIAMETER

NOTE: Refer to the SPECIFICATIONS.

1. Measure each camshaft journal diameter in 2 directions.

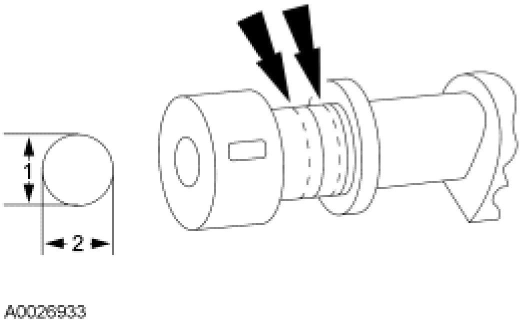


Fig. 4: Locating Areas For Measuring Camshaft Journal Diameter
Courtesy of FORD MOTOR CO.

CAMSHAFT JOURNAL TO BEARING CLEARANCE - OHC ENGINES

NOTE: Refer to the SPECIFICATIONS.

NOTE: The camshaft journals must meet specifications before checking camshaft journal clearance.

1. Measure each camshaft bearing in 2 directions.

- Subtract the camshaft journal diameter from the camshaft bearing diameter.

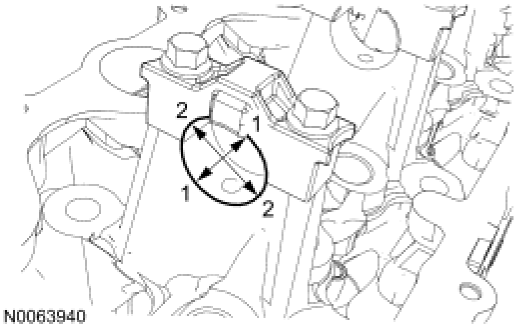
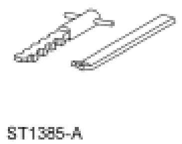


Fig. 5: Measuring Camshaft Bearing In 2 Directions
Courtesy of FORD MOTOR CO.

CAMSHAFT END PLAY - OHC ENGINES

Special Tools

Illustration	Tool Name	Tool Number
	Dial Indicator Gauge with Holding Fixture	100-002 (TOOL-4201-C) or equivalent

NOTE: **Refer to the SPECIFICATIONS.**

1. Using the Dial Indicator Gauge with Holding Fixture, measure the camshaft end play.
2. Position the camshaft to the rear of the cylinder head.
3. Zero the Dial Indicator Gauge.
4. Move the camshaft to the front of the cylinder head. Note and record the camshaft end play.
   - If camshaft end play exceeds specifications, install a new camshaft and recheck end play.
   - If camshaft end play exceeds specification after camshaft installation, install a new cylinder head.

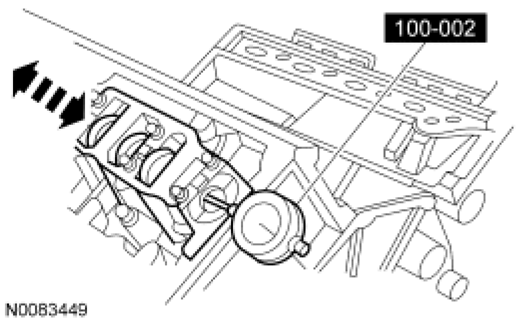


Fig. 6: Recording Camshaft End Play

Courtesy of FORD MOTOR CO.

CAMSHAFT SURFACE INSPECTION

1. Inspect camshaft lobes for pitting or damage in the contact area. Minor pitting is acceptable outside the contact area.

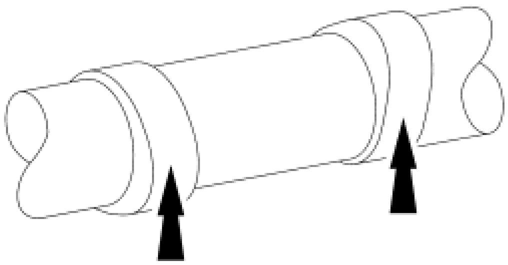


Fig. 7: Inspecting Camshaft Lobes
Courtesy of FORD MOTOR CO.

CAMSHAFT LOBE LIFT

Special Tools

Illustration	Tool Name	Tool Number
 ST1385-A	Dial Indicator Gauge with Holding Fixture	100-002 (TOOL-4201-C) or equivalent

NOTE: Refer to the SPECIFICATIONS.

1. Use the Dial Indicator Gauge with Holding Fixture to measure camshaft intake/exhaust lobe lift.
   - Rotate the camshaft and subtract the lowest indicator reading from the highest indicator reading to figure the camshaft lobe lift.

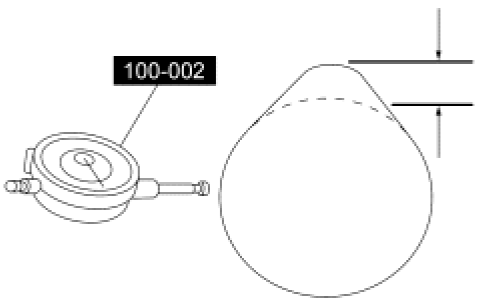


Fig. 8: Using Dial Indicator Gauge
Courtesy of FORD MOTOR CO.

CAMSHAFT RUNOUT

Special Tools

Illustration	Tool Name	Tool Number
 ST1385-A	Dial Indicator Gauge with Holding Fixture	100-002 (TOOL-4201-C) or equivalent

NOTE: Refer to the SPECIFICATIONS.

NOTE: Camshaft journals must be within specifications before checking runout.

1. Using the Dial Indicator Gauge with Holding Fixture, measure the camshaft runout.
   - Rotate the camshaft and subtract the lowest indicator reading from the highest indicator reading.

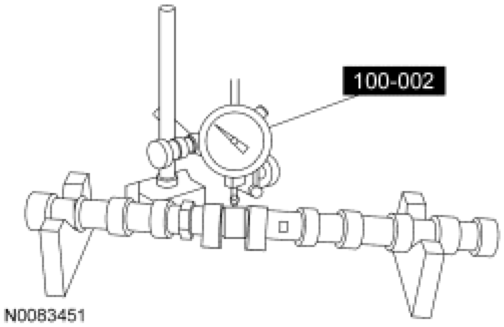


Fig. 9: Using Dial Indicator Gauge
Courtesy of FORD MOTOR CO.

CRANKSHAFT END PLAY

Special Tools

Illustration	Tool Name	Tool Number
 ST1385-A	Dial Indicator Gauge with Holding Fixture	100-002 (TOOL-4201-C) or equivalent

NOTE: Refer to the SPECIFICATIONS.

1. Install the Dial Indicator Gauge with Holding Fixture.
2. Position the crankshaft to the rear of the cylinder block.
3. Zero the Dial Indicator Gauge.
4. Move the crankshaft to the front of the cylinder block. Note and record the crankshaft end play.

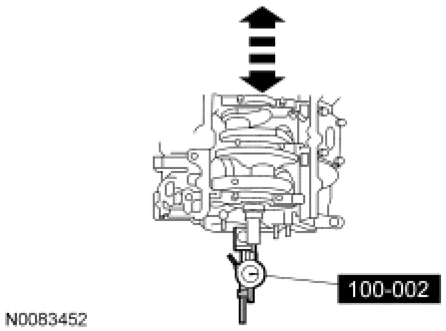


Fig. 10: Recording Crankshaft End Play
Courtesy of FORD MOTOR CO.

VALVE STEM DIAMETER

NOTE: **Refer to the SPECIFICATIONS.**

1. Measure the diameter of each intake and exhaust valve stem at the points shown. Verify the diameter is within specification.

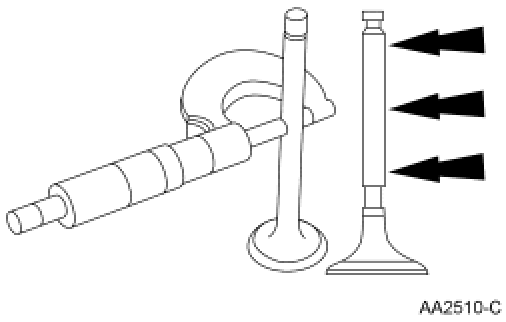


Fig. 11: Measuring Diameter Of Valve Stem
Courtesy of FORD MOTOR CO.

VALVE INSPECTION

1. Inspect the following valve areas:
    1. The end of the stem for grooves or scoring.
    2. The valve face and the edge for pits, grooves or scores.
    3. The valve head for signs of burning, erosion, warpage and cracking.
    4. The valve margin for wear.

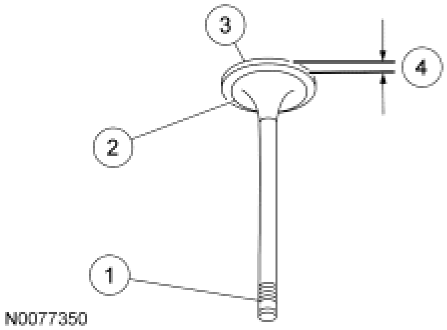


Fig. 12: Inspecting Valves
Courtesy of FORD MOTOR CO.

VALVE GUIDE INNER DIAMETER

NOTE: Refer to the SPECIFICATIONS.

NOTE: Valve guides tend to wear in an hourglass pattern. The ball gauge can be inserted into the combustion chamber side of the valve guide, if necessary.

1. Use a ball gauge to determine the inside diameter of the valve guides in 2 directions at the top, middle and bottom of the valve guide.

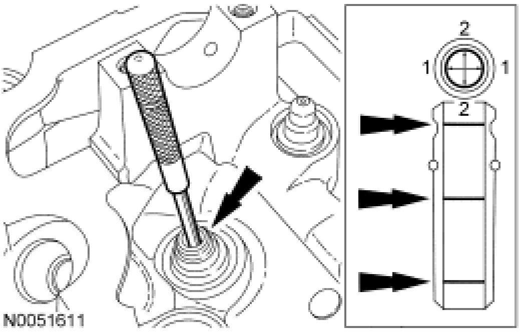


Fig. 13: Measuring Valve Guide Inner Diameter
Courtesy of FORD MOTOR CO.

2. Measure the ball gauge with a micrometer.

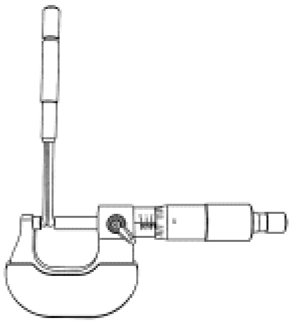
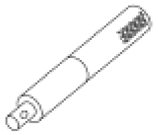
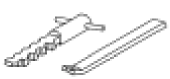


Fig. 14: Measuring Ball Gauge With Micrometer
Courtesy of FORD MOTOR CO.

3. If the valve guide is not within specifications, install a new cylinder head assembly.

VALVE STEM TO VALVE GUIDE CLEARANCE

Special Tools

Illustration	Tool Name	Tool Number
	Clearance Gauge, Valve Guide	303-004 (TOOL-6505-E) or equivalent
	Dial Indicator Gauge with Holding Fixture	100-002 (TOOL-4201-C) or equivalent

NOTE: Refer to the SPECIFICATIONS.

NOTE: The valve stem diameter must be within specifications before checking valve stem-to-valve guide clearance.

NOTE: If necessary, use a magnetic base.

1. Install a Valve Guide Clearance Gauge on the valve stem and install a Dial Indicator Gauge with Holding Fixture. Lower the valve until the clearance gauge contacts the upper surface of the valve guide.

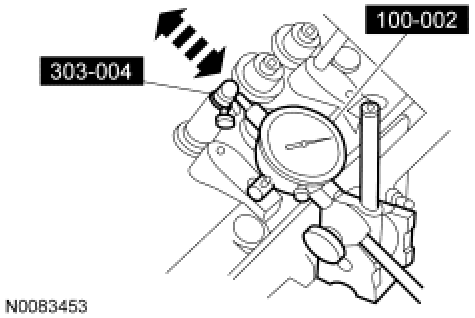


Fig. 15: Installing Valve Guide Clearance Gauge
Courtesy of FORD MOTOR CO.

2. Move the Valve Guide Clearance Gauge toward the Dial Indicator Gauge with Holding Fixture and zero the Dial Indicator Gauge. Move the Valve Guide Clearance Gauge away from the Dial Indicator Gauge with Holding Fixture and note the reading. The reading will be DOUBLE the valve stem-to-valve guide clearance.

VALVE SPRING INSTALLED LENGTH

NOTE: Refer to the SPECIFICATIONS.

1. Measure the installed length of each valve spring.

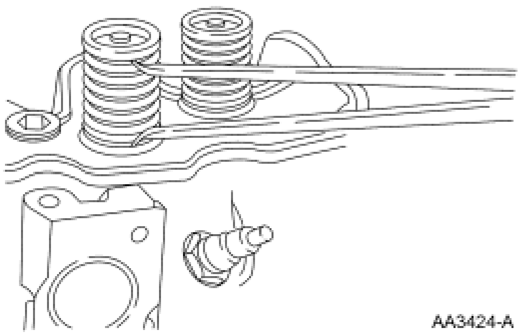


Fig. 16: Measuring Installed Length Of Valve Spring
Courtesy of FORD MOTOR CO.

VALVE SPRING FREE LENGTH

NOTE: Refer to the SPECIFICATIONS.

1. Measure the free length of each valve spring.

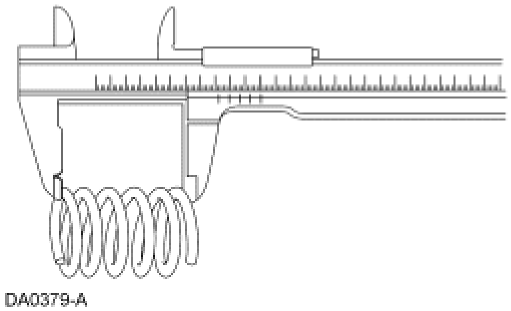


Fig. 17: Measuring Free Length Of Valve Spring
Courtesy of FORD MOTOR CO.

VALVE SPRING SQUARENESS

1. Measure the out-of-square on each valve spring.
    - Turn the valve spring and observe the space between the top of the valve spring and the square.

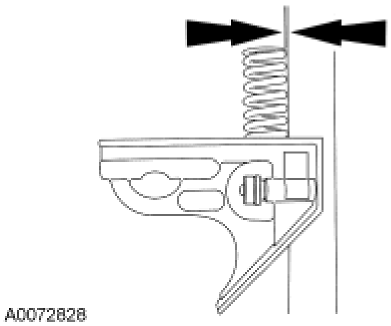


Fig. 18: Measuring Valve Spring Out-Of-Square
Courtesy of FORD MOTOR CO.

VALVE SPRING STRENGTH

Special Tools

Illustration	Tool Name	Tool Number
	Pressure Gauge, Valve/Clutch Spring	303-006 (TOOL-6513-DD) or equivalent

NOTE: **Refer to the SPECIFICATIONS.**

1. Use the Valve/Clutch Spring Pressure Gauge to check the valve spring for correct strength at the specified valve spring length.

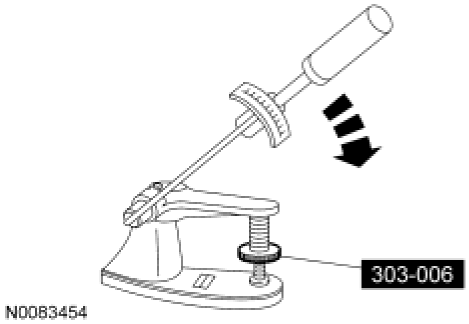


Fig. 19: Using Valve/Clutch Spring Pressure Gauge
Courtesy of FORD MOTOR CO.

VALVE SEAT INSPECTION

Valve and Seat Refacing Measurements

NOTE: Refer to the SPECIFICATIONS.

NOTE: After grinding valves or valve seats, check valve clearance.

1. Check the valve head and seat.
    - Check valve angles.
    - Check margin width.
    - Be sure margin width is within specification.

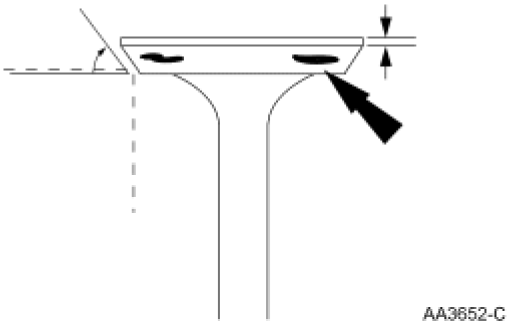


Fig. 20: Checking Valve Head And Seat
Courtesy of FORD MOTOR CO.

2. Inspect for abnormalities on the valve face and seat. Install a new cylinder head assembly if abnormalities are found.

VALVE SEAT WIDTH

NOTE: Refer to the SPECIFICATIONS.

1. Measure the valve seat width. If necessary, grind the valve seat to specification.
    - Measure the intake valve seat width.
    - Measure the exhaust valve seat width.
    - Recheck the valve spring installed length after the seats have been ground, and shim the valve springs as necessary to achieve the correct installed spring length.

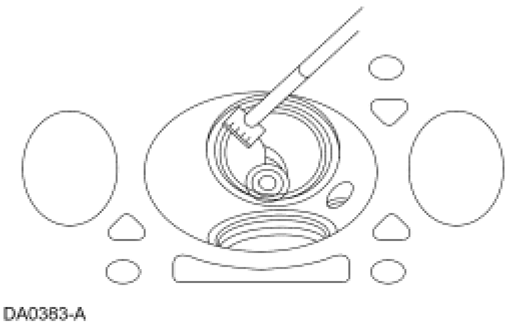


Fig. 21: Measuring Valve Seat Width
Courtesy of FORD MOTOR CO.

VALVE SEAT RUNOUT

NOTE: Refer to the SPECIFICATIONS.

1. Use a valve seat runout gauge to check valve seat runout.

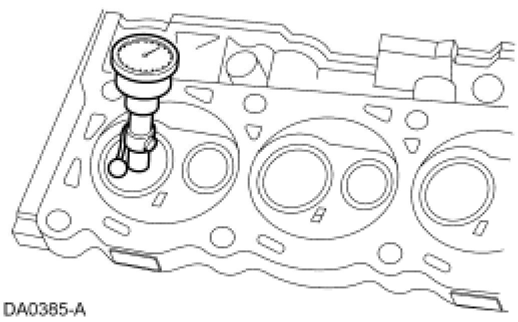


Fig. 22: Measuring Valve Seat Runout
Courtesy of FORD MOTOR CO.

FLEXPLATE INSPECTION

1. Inspect the flexplate for:
    1. any cracks.
    2. worn ring gear teeth.
    3. chipped or cracked ring gear teeth.

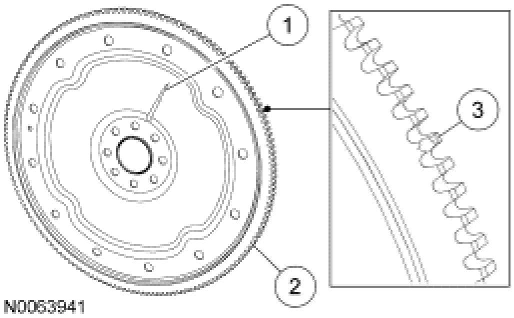


Fig. 23: Inspecting Flexplate
Courtesy of FORD MOTOR CO.

FLYWHEEL INSPECTION

NOTE: The flywheel cannot be resurfaced, it must be replaced.

1. Inspect the flywheel for:
    1. any cracks.
    2. worn ring gear teeth.
    3. chipped or cracked ring gear teeth.
    4. scratches, nicks and discoloration.

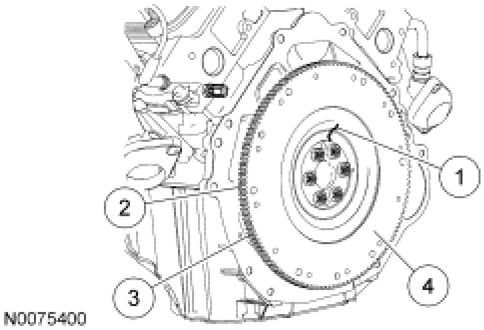
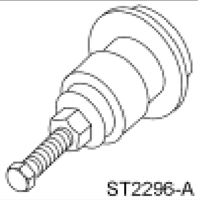


Fig. 24: Inspecting Flywheel For Damages
Courtesy of FORD MOTOR CO.

CYLINDER HEAD DISTORTION

Special Tools

Illustration	Tool Name	Tool Number
	Feeler Gauge Set	303-D027 (D81L-4201-A) or equivalent

NOTE: Refer to the SPECIFICATIONS.

NOTE: Make sure all cylinder head surfaces are clear of any gasket material, silicone sealant, oil and coolant. The cylinder head surface must be clean and dry before running a flatness check.

NOTE: Use a Straightedge that is calibrated by the manufacturer to be flat within 0.005 mm (0.0002 in) per running foot of length, such as Snap-On® GA438A or equivalent. For example, if the Straightedge is 61 cm (24 in) long, the machined edge must be flat within 0.010 mm (0.0004 in) from end to end.

1. Using a Straightedge and a Feeler Gauge Set, inspect the cylinder head for flatness in the sequence shown.

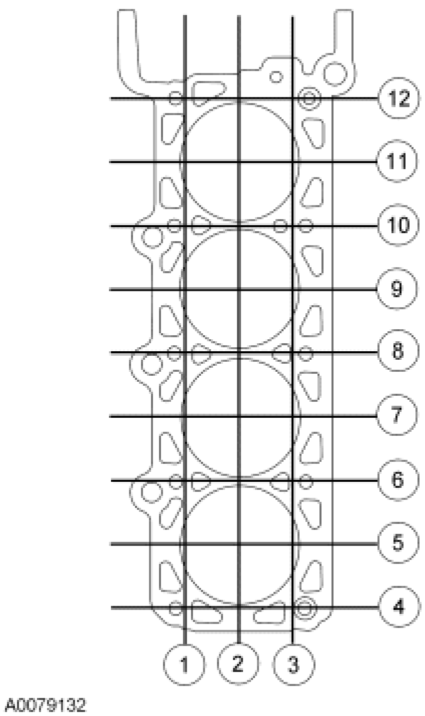
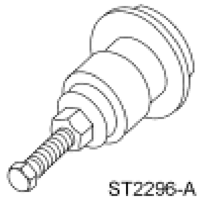


Fig. 25: Inspecting Cylinder Head For Flatness
Courtesy of FORD MOTOR CO.

CYLINDER BLOCK DISTORTION

Special Tools

Illustration	Tool Name	Tool Number
	Feeler Gauge Set	303-D027 (D81L-4201-A) or equivalent

NOTE: Refer to the SPECIFICATIONS.

NOTE: Use a Straightedge that is calibrated by the manufacturer to be flat within 0.005 mm (0.0002 in) per running foot of length, such as Snap-On® GA438A or equivalent. For example, if the Straightedge is 61 cm (24 in) long, the machined edge must be flat within 0.010 mm (0.0004 in) from end to end.

1. Use a Straightedge and a Feeler Gauge Set to inspect the cylinder block for flatness.

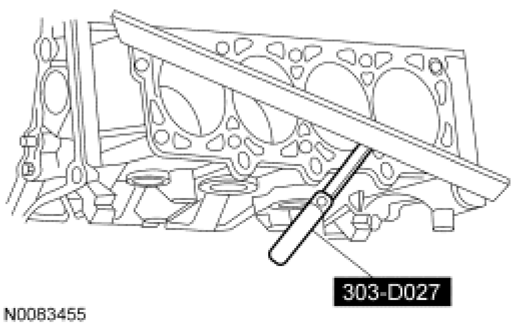
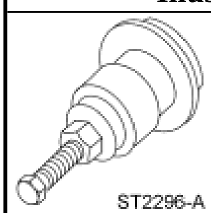


Fig. 26: Inspecting Cylinder Block
Courtesy of FORD MOTOR CO.

EXHAUST MANIFOLD CLEANING AND INSPECTION

Special Tools

Illustration	Tool Name	Tool Number
	Feeler Gauge Set	303-D027 (D81L-4201-A) or equivalent

1. Clean the exhaust manifold using a suitable solvent. Use a plastic scraping tool to clean the gasket sealing surfaces.

NOTE: New exhaust manifold gaskets, studs, nuts and/or bolts must be installed when an exhaust manifold is serviced.

NOTE: Use a Straightedge that is calibrated by the manufacturer to be flat within 0.005 mm (0.0002 in) per running foot of length, such as Snap-On® GA438A or equivalent. For example, if the Straightedge is 61 cm (24 in) long, the machined edge must be flat within 0.010 mm (0.0004 in) from end to end.

2. Using the Straightedge and a Feeler Gauge Set, check the exhaust manifold sealing surface for warpage. If the warpage is greater than 0.76 mm (0.0299 in), install a new exhaust manifold.

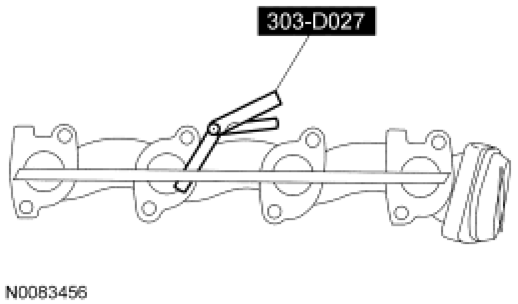
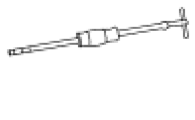


Fig. 27: Checking Exhaust Manifold Sealing Surface For Warpage
Courtesy of FORD MOTOR CO.

CORE PLUG REPLACEMENT

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	Slide Hammer	100-001 (T50T-100-A)

Material

Item	Specification
LOCTITE® Retaining Compound 620 High Temperature Loctite 620/Permatex 62050	WSK-N2G349-A9
Threadlock 262 TA-26	WSK-M2G351-A6

NOTE: It is necessary to use Loctite® Retaining Compound 620 High Temperature sealant on all 3 valve modular engine cylinder head cup plugs. If not used, the cylinder head cup plugs could leak or seep, causing serious engine damage.

All core plugs

NOTE: Cylinder block core plug shown, cylinder head core plug similar.

1. Use the Slide Hammer or a suitable tool to remove the core plug.

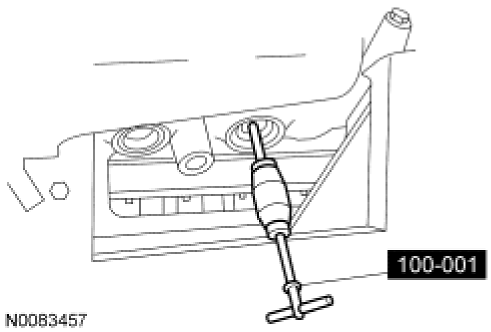


Fig. 28: Identifying Cylinder Block Core Plug
Courtesy of FORD MOTOR CO.

NOTE: Oversize plugs are identified by the OS stamped in the flat located on the cup side of the plug.

2. Inspect the core plug bore for any damage that would interfere with the correct sealing of the plug. If the core plug bore is damaged, bore for the next oversize plug.

Cup-type

NOTE: Use care during this procedure so as not to disturb or distort the cup sealing surface.

NOTE: When installed, the flanged edge must be below the chamfered edge of the bore to effectively seal the bore.

3. Coat the cup-type core plug and bore lightly with sealant and install the core plug.
   - Use a suitable tool to seat the cup-type core plug.

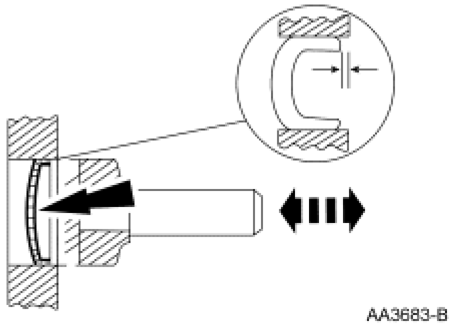


Fig. 29: Seating Cup-Type Cylinder Block Core Plug
Courtesy of FORD MOTOR CO.

Expansion-type

NOTE: Do not contact the crown when installing an expansion-type core plug. This could expand the plug before seating and result in leakage.

4. Coat the expansion-type core plug and bore lightly with sealant and install the core plug.
    - Use a suitable tool to seat the expansion-type core plug.

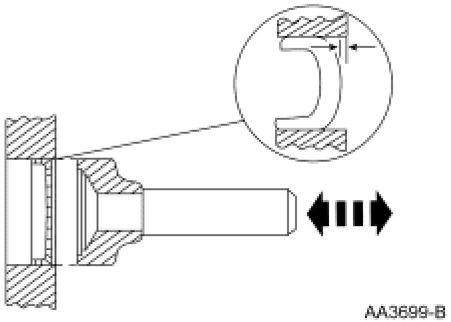


Fig. 30: Seating Cup-Type Cylinder Block Core Plug
Courtesy of FORD MOTOR CO.

SPARK PLUG INSPECTION

1. Inspect the spark plug for a bridged gap.
    - Check for deposit build-up closing the gap between the electrodes. Deposits are caused by oil or carbon fouling.
    - Install a new spark plug.

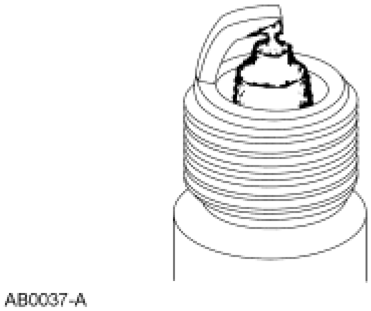


Fig. 31: Identifying Spark Plug With Bridged Gap
Courtesy of FORD MOTOR CO.

2. Check for oil fouling.
    - Check for wet, black deposits on the insulator shell bore electrodes, caused by excessive oil entering the combustion chamber through worn rings and pistons, excessive valve-to-guide clearance or worn or loose bearings.
    - Correct the oil leak concern.

- Install a new spark plug.

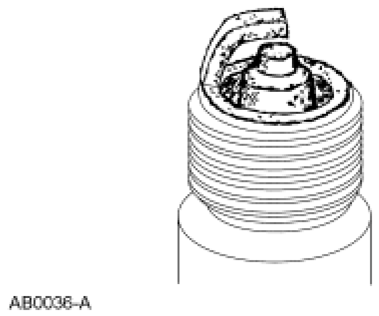


Fig. 32: Identifying Oil Fouled Spark Plug
Courtesy of FORD MOTOR CO.

3. Inspect for carbon fouling. Look for black, dry, fluffy carbon deposits on the insulator tips, exposed shell surfaces and electrodes, caused by a spark plug with an incorrect heat range, dirty air cleaner, too rich a fuel mixture or excessive idling.
    - Install new spark plugs.

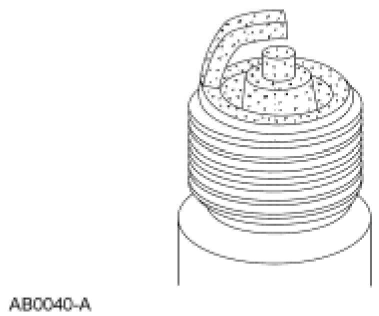


Fig. 33: Identifying Spark Plug Carbon Fouling
Courtesy of FORD MOTOR CO.

4. Inspect for normal burning.
    - Check for light tan or gray deposits on the firing tip.

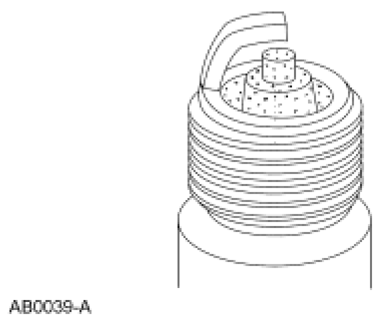


Fig. 34: Identifying Normal Burning Spark Plug

Courtesy of FORD MOTOR CO.

5. Inspect for pre-ignition, identified by melted electrodes and a possibly damaged insulator. Metallic deposits on the insulator indicate engine damage. This may be caused by incorrect ignition timing, wrong type of fuel or the unauthorized installation of a heli-coil insert in place of the spark plug threads.
    - Install a new spark plug.

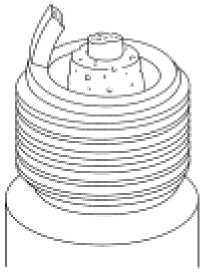


Fig. 35: Identifying Spark Plug With Pre-Ignition Condition
Courtesy of FORD MOTOR CO.

6. Inspect for overheating, identified by white or light gray spots and with a bluish-burnt appearance of electrodes. This is caused by engine overheating, wrong type of fuel, loose spark plugs, spark plugs with an incorrect heat range, low fuel pump pressure or incorrect ignition timing.
    - Install a new spark plug.

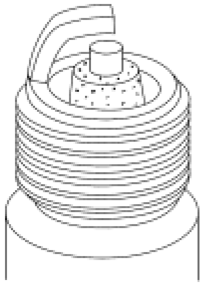


Fig. 36: Identifying Overheated Spark Plug
Courtesy of FORD MOTOR CO.

7. Inspect for fused deposits, identified by melted or spotty deposits resembling bubbles or blisters. These are caused by sudden acceleration.
    - Install new spark plugs.

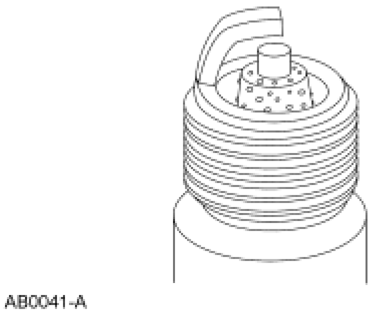


Fig. 37: Identifying Spark Plug With Fused Deposits
Courtesy of FORD MOTOR CO.

VALVE TAPPET INSPECTION

1. Inspect the valve tappet for damage, especially in the indicated areas. If any damage is evident, inspect the camshaft lobes and valves for damage. Install new components as necessary.

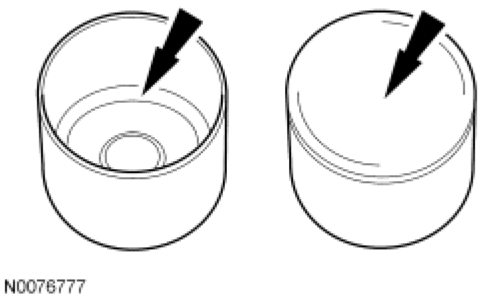


Fig. 38: Inspecting Valve Tappet
Courtesy of FORD MOTOR CO.

ROLLER FOLLOWER INSPECTION

1. Inspect the roller follower for flat spots or scoring. If any damage is found, inspect the camshaft lobes and hydraulic lash adjuster for damage.

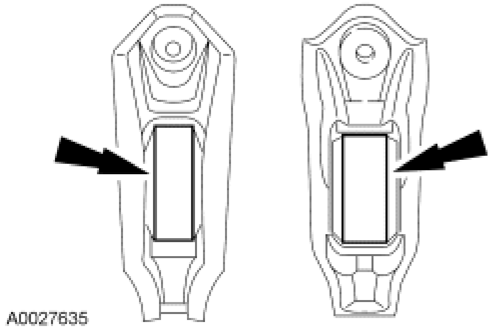


Fig. 39: Inspecting Roller Follower For Flat Spots/Scoring
Courtesy of FORD MOTOR CO.

HYDRAULIC LASH ADJUSTER INSPECTION

1. Inspect the hydraulic lash adjuster and roller follower for damage. If any damage is found, inspect the camshaft lobes and valves for damage.

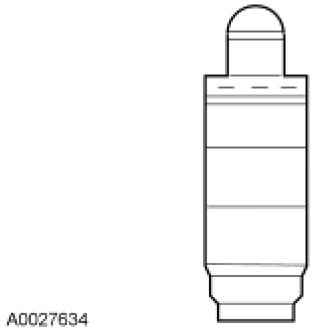


Fig. 40: Identifying Roller Follower/Valve Tappet
Courtesy of FORD MOTOR CO.

POWERTRAIN/DRIVETRAIN MOUNT NEUTRALIZING

NOTE: Refer to the appropriate part and procedure for special instructions on loosening and tightening mount fasteners.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Loosen, but do not remove, the powertrain/drivetrain mount fasteners.
3. Lower the vehicle.

NOTE: Do not twist or strain the powertrain/drivetrain mounts or damage to the mounts may occur.

4. Start the vehicle and move it in forward 0.6-1.2 m (2-4 ft). Then move the vehicle in reverse the same distance.
5. Raise and support the vehicle.
6. Tighten the powertrain/drivetrain mount fasteners.
7. Lower the vehicle.
8. Test the system for normal operation.

2008 ENGINE PERFORMANCE

Evaporative Emissions - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Evaporative Emission (EVAP) canister bolts	6	-	53
EVAP canister nuts	6	-	53
Fuel tank filler pipe heat shield nuts	10	-	89
Fuel tank filler pipe hose clamp	4	-	35
Fuel tank strap bolts	40	30	-

DESCRIPTION AND OPERATION

EVAPORATIVE EMISSIONS

NOTE: **The vehicle emission vacuum routing diagrams are contained in the Description and Operation subsection of the Engine Emissions Control section. Refer to the appropriate Section 303-08.**

The Evaporative Emission (EVAP) system consists of the:

- EVAP canister purge valve.
- EVAP canister (includes the dust separator and the vent solenoid).
- fuel vapor tube assembly (includes the Fuel Tank Pressure (FTP) sensor).
- fuel tank filler cap.

The EVAP system:

- prevents hydrocarbon emissions from reaching the atmosphere.
- stores fuel vapors in the EVAP canister, that are generated during vehicle operation or hot soak, until they can be consumed by the engine during normal engine operation.
- routes the stored fuel vapors to the engine during engine operation.
- is controlled by the PCM which, using various sensor inputs, calculates the desired amount of purge flow. The PCM regulates the purge flow, induced by the application of intake manifold vacuum, by varying the duty cycle applied to the vapor tube.

The fuel vapors are routed:

- from the fuel tank through the fuel vapor vent valve.

- to the EVAP canisters through a vapor tube.
- from the EVAP canister to the engine when the EVAP canister purge valve is opened by the PCM.

The FTP sensor (part of fuel vapor tube assembly):

- monitors the pressure levels in the fuel tank.
- communicates the pressure reading to the PCM during the OBD II leak test.

The fuel vapor tube assembly:

- is located under the rear of the vehicle.
- is used to monitor fuel pressure and relay information to the PCM.
- includes the FTP sensor.

The EVAP canister:

- is located under the rear of the vehicle.
- includes the dust separator and vent solenoid.
- contains activated carbon.
- stores fuel vapors.

The fuel tank filler cap:

- relieves system vacuum below -3.5 kPa (-16.00 in H_2O).

The EVAP canister vent solenoid:

- is normally open.
- seals the EVAP system for the inspection and maintenance (I/M 240) test and OBD II leak and pressure tests.
- is serviced as part of the EVAP canister.

The EVAP canister purge valve:

- is normally closed.
- regulates the purging of the EVAP canisters.
- is controlled by the PCM.
- is repaired as a separate item.
- is mounted on the cowl.

The dust separator:

- is attached to the EVAP canister vent solenoid.

- prevents suspended dust and dirt particles from entering the EVAP system.
- is serviced as part of the EVAP canister.

The EVAP system monitor:

- is a self-test strategy within the PCM which tests the integrity of the EVAP system.
- monitors the EVAP system for leaks.
- monitors electronic EVAP components for irrationally high or low voltages.
- monitors for correct EVAP system operation.
- uses negative and positive leak test methods to test and activate the EVAP system.

The engine ON EVAP leak-check monitor:

- is executed by the individual components of the enhanced EVAP system. Intake manifold vacuum is utilized to reach a target vacuum on the EVAP system. The FTP sensor is used by the engine ON EVAP leak-check monitor to determine if the target vacuum necessary to carry out the leak-check on the EVAP system has been reached. Once target vacuum on the EVAP system is achieved, the change in EVAP system vacuum over a calibrated period of time determines if a leak exists.

The Engine Off Natural Vacuum (EONV) EVAP leak-check monitor is executed:

- once the engine ON EVAP leak-check monitor is completed and the key is turned OFF. The EONV EVAP leak-check monitor determines if a leak is present when the naturally occurring change in the fuel tank pressure or vacuum does not exceed a calibrated limit during a calibrated amount of time. A separate, low-power consuming microprocessor in the PCM manages the Engine Off Natural Vacuum (EONV) leak-check. The engine OFF EVAP leak-check monitor is executed by the individual components of the enhanced EVAP system.

DIAGNOSTIC TESTS

EVAPORATIVE EMISSIONS

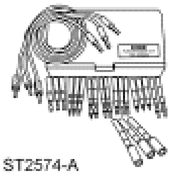
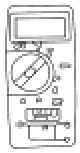
Refer to the **Introduction - Gasoline Engines** article.

GENERAL PROCEDURES

EVAPORATIVE EMISSION SYSTEM LEAK TEST

Special Tools

Illustration	Tool Name	Tool Number
	VACUTEC Smoke Machine Fuel Evaporative Emission System Tester	218-0002 or equivalent

 ST2574-A		
 ST1137-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

Phase 1 - Leak Verification

1. Run the EVAP Test with the scan tool.

NOTE: Some small leaks may not be detected using the EVAP Test. If the system has passed the test but a leak is still suspected, then proceed to Phase 2.

2. If the Evaporative Emission (EVAP) system failed the EVAP Test, then proceed to Phase 2.

Phase 2 - System Leak Check

1. Disconnect the upper vapor tube-to-EVAP canister purge valve quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
2. Connect the VACUTEC Smoke Machine Fuel Evaporative Emission System Tester to the upper EVAP canister purge valve fitting. For additional information, refer to the manufacturer's instructions.

NOTE: The battery ground cable was previously disconnected in the vapor tube quick connect coupling procedure.

3. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

NOTE: In the scan tool, the EVAP canister purge valve is referred to as the EVAP vapor management valve.

4. Open the EVAP canister purge valve with the scan tool.
5. Close the canister vent solenoid with the scan tool.
6. Carefully turn the fuel tank filler cap counterclockwise until the thread disengages and position aside.

NOTE: If smoke does not exit the fuel tank filler pipe neck area after the system is pressurized, open the canister vent solenoid with the scan tool to allow the air to purge. Once smoke is seen at the canister vent solenoid, close the canister vent solenoid with the scan tool.

7. Introduce smoke from the VACUTEC Smoke Machine Fuel Evaporative Emission System Tester into the EVAP system and verify that smoke is exiting the fuel tank filler pipe neck area. For additional information, refer to the manufacturer's instructions.
8. Install the fuel tank filler cap once smoke is observed exiting the fuel tank filler pipe neck area.
9. Continue to enter smoke into the system for 60 seconds to obtain pressure.
10. Press and release the remote start button in intervals of 15 seconds ON and 15 seconds OFF while checking for exiting smoke.
11. Use the halogen light provided with the VACUTEC Smoke Machine Fuel Evaporative Emission System Tester to follow the EVAP system path and look for smoke exiting at the source of the leak(s).
12. Repair any leaks as necessary.
13. Repeat the leak test until the system passes.

REMOVAL AND INSTALLATION

EVAPORATIVE EMISSION CANISTER PURGE VALVE

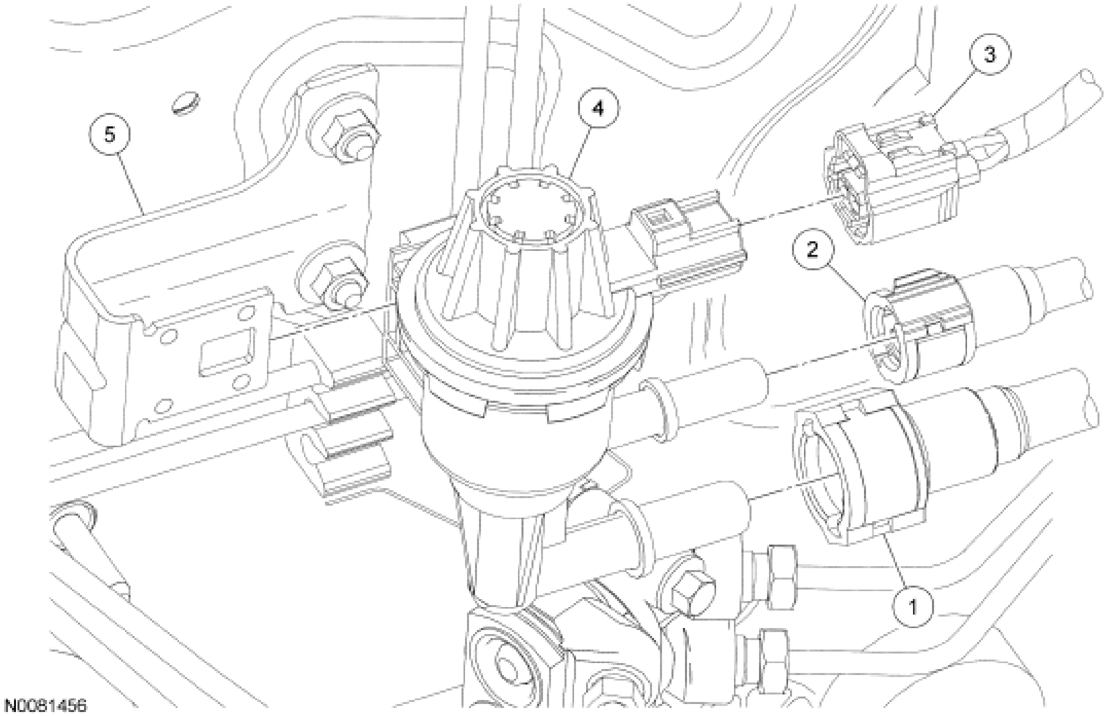


Fig. 1: Exploded View Of Evaporative Emission Canister Purge Valve
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Vapor jumper tube-to-Evaporative Emission (EVAP) canister purge valve quick connect coupling (part of 9G279)
2	-	Vapor jumper tube-to-EVAP canister purge valve quick connect coupling (part of 9G271)

3	14A464	EVAP canister purge valve electrical connector (part of 14290)
4	9G641	EVAP canister purge valve
5	9F931	EVAP canister purge valve bracket

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

3.0L and 3.5L vehicles

NOTE: The lower cowl panel grille must be removed to access the Evaporative Emission (EVAP) canister purge valve.

1. Remove the lower cowl panel grille. For additional information, refer to the Cowl Panel Grille procedure in **FRONT END BODY PANELS** article.

   All vehicles

2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Disconnect the EVAP canister purge valve electrical connector.
4. Disconnect the 2 vapor jumper tube-to-EVAP canister purge valve quick connect couplings. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
5. Depress the tab and remove the EVAP canister purge valve from the bracket.

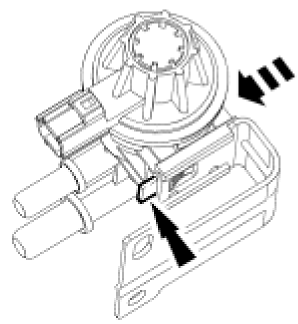


Fig. 2: Removing EVAP Canister Purge Valve From Bracket
Courtesy of FORD MOTOR CO.

6. To install, reverse the removal procedure.
   - Carry out the Evaporative Emission System Leak Test. For additional information, refer to **Evaporative Emission System Leak Test**.

EVAPORATIVE EMISSION CANISTER

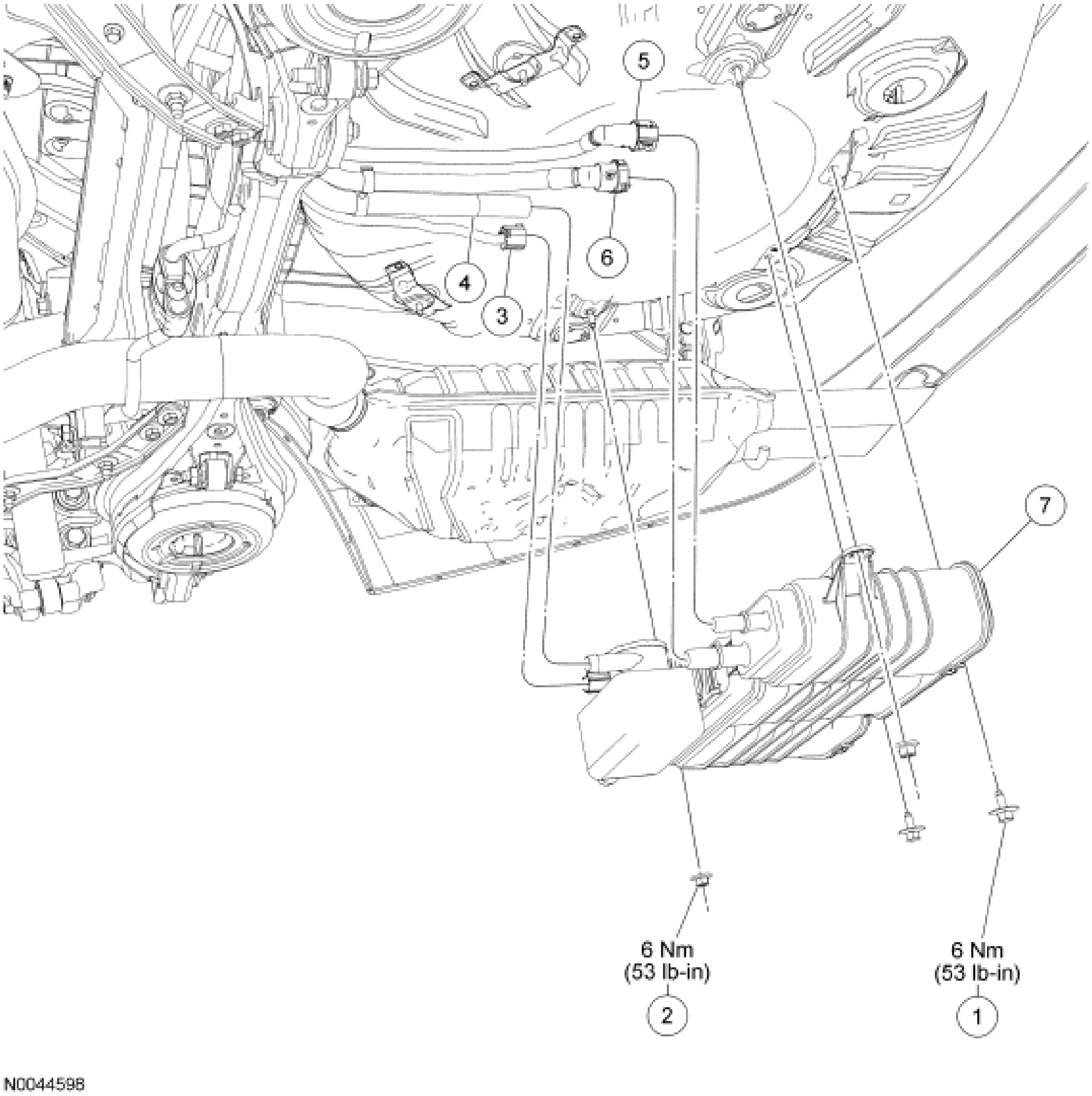


Fig. 3: Exploded View Of Evaporative Emission Canister With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W708029	Evaporative Emission (EVAP) canister bolt (2 required)
2	W707142	EVAP canister nut (2 required)
3	14A464	EVAP canister vent solenoid electrical connector (part of 14A005)
4	-	Fresh air hose (part of 9034)
5	-	Vapor tube-to-EVAP canister quick connect coupling (part of 9J279)
6	-	Fuel vapor tube assembly-to-EVAP canister quick connect coupling (part of 9A228)
7	9E857	EVAP canister assembly

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

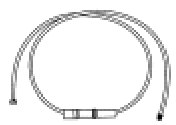
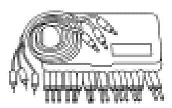
NOTE: Clean the Evaporative Emission (EVAP) canister vent solenoid electrical connector and the immediate surrounding area of any dirt or foreign material.

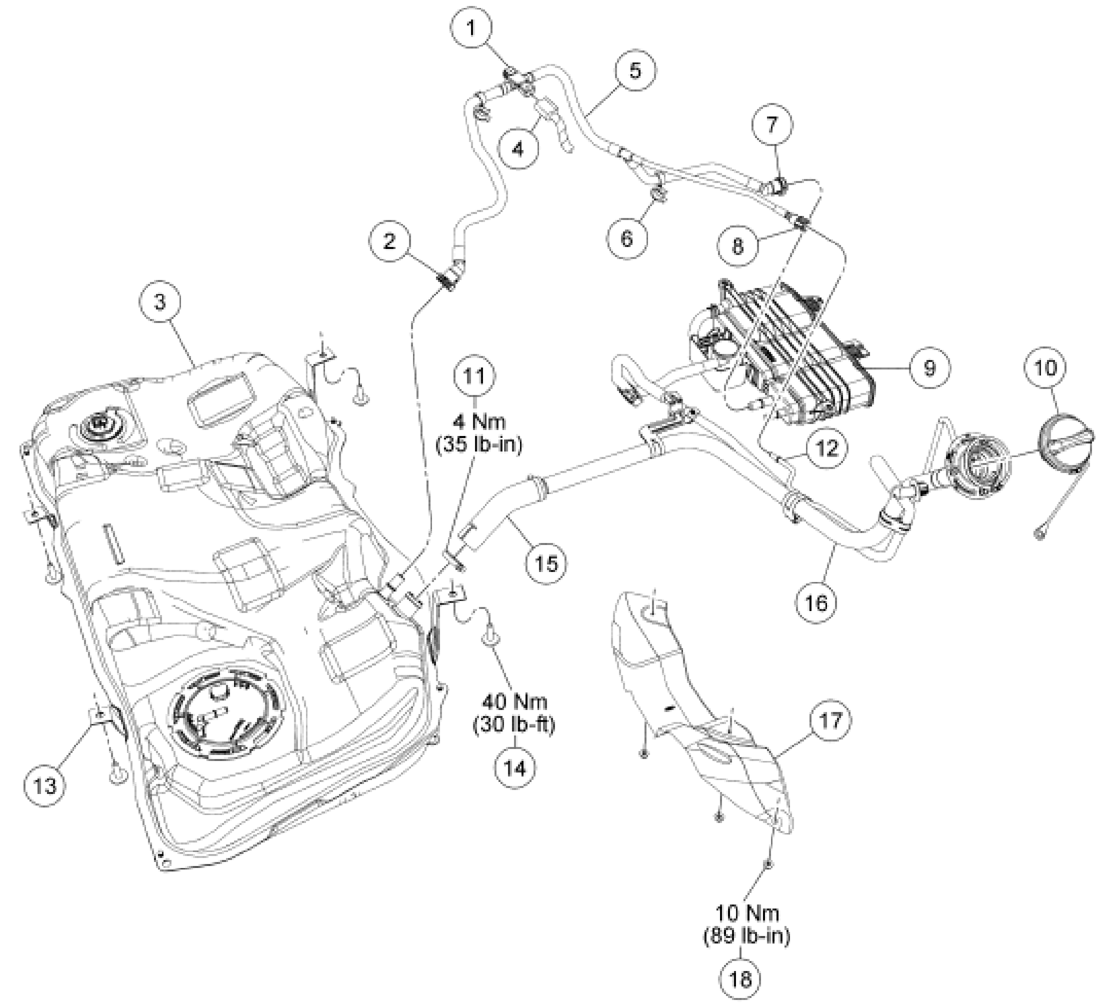
3. Disconnect the EVAP canister vent solenoid electrical connector.
4. Disconnect the fresh air hose from the dust separator.
5. Disconnect the fuel vapor tube assembly-to-EVAP canister quick connect couplings. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
6. Disconnect the vapor tube-to-EVAP canister quick connect couplings. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
7. Remove the 2 nuts, 2 bolts and the EVAP canister assembly.
   - To install, tighten to 6 Nm (53 lb-in).
8. To install, reverse the removal procedure.
   - Carry out the Evaporative Emission System Leak Test. For additional information, refer to **Evaporative Emission System Leak Test**.

FUEL VAPOR TUBE ASSEMBLY - ALL WHEEL DRIVE (AWD)

Special Tools

Illustration	Tool Name	Tool Number

 ST3022-A	Fuel Draining Hose	310-102
 ST1138-A	Fuel Storage Tanker	164-R3202 or equivalent



N0076211

Fig. 4: Exploded View Of Fuel Vapor Tube Assembly With Torque Specifications - All Wheel Drive (AWD)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Fuel Tank Pressure (FTP) sensor (part of 9A228)
2	-	Fuel vapor tube assembly-to-fuel tank quick connect coupling (part of 9A228)
3	9002	Fuel tank
4	14A464	FTP sensor electrical connector
5	9A228	Fuel vapor tube assembly
6	W710096	Swivel clip (2 required)
7	-	Fuel vapor tube assembly-to-Evaporative Emission (EVAP) canister quick connect coupling (part of 9A228)
8	-	Fuel vapor tube assembly-to-recirculation tube quick connect coupling (part of 9A228)
9	9E857	EVAP canister assembly
10	9030	Fuel tank filler cap
11	W525937	Fuel tank filler pipe hose clamp
12	-	Fuel tank filler pipe recirculation tube (part of 9034)
13	9092	Fuel tank strap (2 required)
14	W505444	Fuel tank strap bolt (4 required)
15	-	Fuel tank filler pipe hose (part of 9034)
16	9034	Fuel tank filler pipe
17	5411268	Fuel tank filler pipe heat shield
18	W707142	Fuel tank filler pipe heat shield nut (3 required)

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise,**

fuel may spray out. Failure to follow these instructions may result in serious personal injury.

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Carefully turn the fuel tank filler cap counterclockwise approximately one-fourth turn until the thread disengages and position aside.

NOTE: **When the Fuel Draining Hose is removed, the fitting on the end of the hose can become detained by the safety valve. Carefully remove the hose using a gentle agitating motion to avoid detaching the hose from the fitting.**

NOTE: **The Fuel Draining Hose must be inserted into the fuel tank filler pipe until the fitting on the end of the hose enters into the fuel tank, opening the safety valve.**

4. Insert the Fuel Draining Hose into the fuel tank filler pipe.

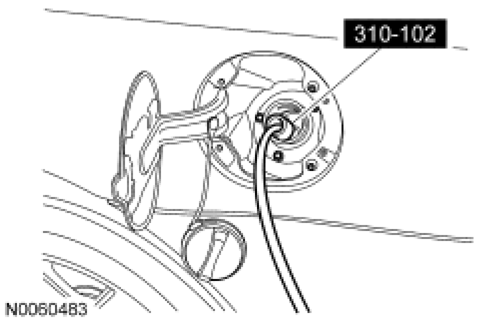


Fig. 5: Inserting Special Tool (310-102) Into Fuel Tank Filler Pipe
Courtesy of FORD MOTOR CO.

NOTE: **This step will remove approximately one-eighth tank of the fuel from a completely full fuel tank and the majority of any residual fuel in the fuel tank filler pipe.**

5. Attach the Fuel Storage Tanker to the Fuel Draining Hose and remove as much fuel as possible from the fuel tank and fuel tank filler pipe.

6. Remove the 3 nuts and the fuel tank filler pipe heat shield.
   - To install, tighten to 10 Nm (89 lb-in).
7. Disconnect the Fuel Tank Pressure (FTP) sensor electrical connector.
8. Disconnect the fuel vapor tube assembly-to-Evaporative Emission (EVAP) canister quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
9. Disconnect the fuel vapor tube assembly-to-recirculation tube quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
10. Release the 2 swivel clips.
11. Install a suitable lifting device under the fuel tank.
12. Remove the 4 bolts and the fuel tank straps.
    - To install, tighten to 40 Nm (30 lb-ft).
13. Partially lower the fuel tank enough to access the fuel tank filler pipe hose clamp.

NOTE:	**Some residual fuel may remain in the fuel tank filler pipe. When removing the filler pipe, carefully drain the fuel into a suitable container.**

14. Release the clamp and disconnect the fuel tank filler pipe hose from the fuel tank.
    - To install, tighten to 4 Nm (35 lb-in).
15. Disconnect the fuel vapor tube assembly-to-fuel tank quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
16. Remove the fuel vapor tube assembly.
17. To install, reverse the removal procedure.
    - Carry out the Evaporative Emission System Leak Test. For additional information, refer to **Evaporative Emission System Leak Test**.

FUEL VAPOR TUBE ASSEMBLY - FRONT WHEEL DRIVE (FWD)

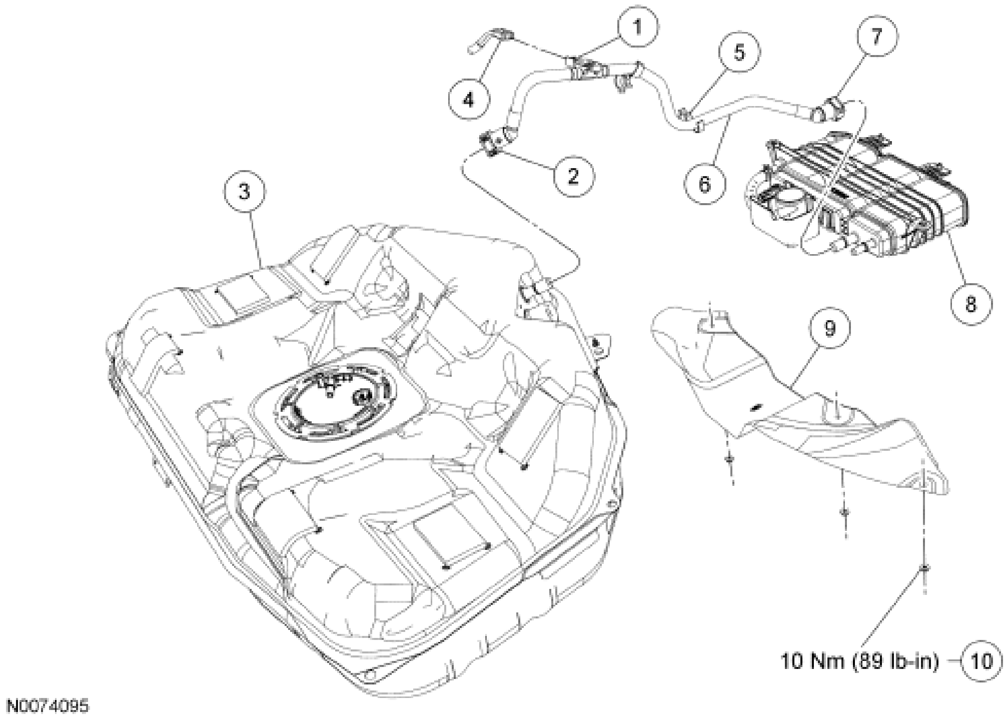


Fig. 6: Exploded View Of Fuel Vapor Tube Assembly With Torque Specification - Front Wheel Drive (FWD)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Fuel Tank Pressure (FTP) sensor (part of 9A228)
2	-	Fuel vapor tube assembly-to-fuel tank quick connect coupling (part of 9A228)
3	9002	Fuel tank
4	14A464	FTP sensor electrical connector
5	W710096	Swivel clip (2 required)
6	9A228	Fuel vapor tube assembly
7	-	Fuel vapor tube assembly-to-Evaporative Emission (EVAP) canister quick connect coupling (part of 9A228)
8	9E857	EVAP canister assembly
9	5411268	Fuel tank filler pipe heat shield
10	W707142	Fuel tank filler pipe heat shield nut (3 required)

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Remove the 3 nuts and the fuel tank filler pipe heat shield.
   - To install, tighten to 10 Nm (89 lb-in).
4. Disconnect the Fuel Tank Pressure (FTP) sensor electrical connector.
5. Disconnect the fuel vapor tube assembly-to-fuel tank quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
6. Disconnect the fuel vapor tube assembly-to-Evaporative Emission (EVAP) canister quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
7. Release the 2 swivel clips and remove the fuel vapor tube assembly.
8. To install, reverse the removal procedure.
   - Carry out the Evaporative Emission System Leak Test. For additional information, refer to **Evaporative Emission System Leak Test**.

2008 ENGINE

Exhaust System - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A	-

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Bracket-to-catalytic converter bolts (3.5L)	20	15	-
Catalytic converter manifold bracket bolts (2.3, 3.0L)	20	15	-
Catalytic converter manifold nuts (2.3L)	55	41	-
Catalytic converter manifold shield bracket bolts (2.3, 3.0L)	20	15	-
Catalytic converter manifold shield bolts (2.3L, 3.0L)	10	-	89
Catalytic converter manifold studs (2.3L)	17	13	-
Catalytic converter nuts (3.0L) all wheel drive (AWD)	40	30	-
Catalytic converter support bracket-to-engine block nuts (3.5L)	40	30	-
Catalytic converter support bracket-to-transmission bolts (3.5L)	48	35	-
Catalytic converter-to-exhaust flexible pipe bolts (3.0L)	40	30	-
Catalytic converter-to-exhaust flexible pipe nuts[a]	-	-	-
Catalytic converter-to-exhaust manifold nuts (3.5L)	40	30	-
Catalytic converter-to-exhaust manifold studs (3.0L AWD, 3.5L)	25	18	-
Catalyst monitor sensor and heated oxygen sensors (HO2S)	47	35	-
Exhaust flexible pipe-to-catalytic converter nuts (2.3, 3.0L)	40	30	-
Exhaust Y-pipe-to-resonator nuts (3.5L)	40	30	-
Heat shield bracket nuts (3.0L) (AWD)	20	15	-
Heat shield bolts (3.0L AWD, 3.5L)	10	-	89
LH and RH catalytic converter manifold bracket bolts (3.0L)	20	15	-
Oil filter[a]	-	-	-
Power steering rack shield bolts (3.5L)	15	11	-
RH and LH catalytic converter manifold nuts (3.0L)	20	15	-
RH and LH catalytic converter manifold studs (3.0L)	11	8	-
Roll restrictor bolt (3.5L)	90	66	-

Torca® clamp	47	35	-

[a] Refer to the procedure.

DESCRIPTION AND OPERATION

EXHAUST SYSTEM

The 2.3L exhaust system consists of:

- a one-piece catalytic converter manifold.
- an exhaust flexible pipe.
- an underbody catalytic converter.
- a production muffler and tailpipe assembly.
- isolators installed on the body and muffler hangers.

The 3.0L exhaust system consists of:

- a one-piece catalytic converter manifold(s) (LH on all vehicles, RH on front wheel drive [FWD] vehicles).
- an exhaust manifold mounted catalytic converter (RH on all wheel drive [AWD] vehicles).
- an exhaust flexible pipe.
- an underbody catalytic converter.
- a production muffler and tailpipe assembly.
- isolators installed on the body and muffler hangers.

The 3.5L exhaust system consists of:

- two exhaust manifold mounted catalytic converters.
- an exhaust Y-pipe.
- a resonator and flex assembly.
- a production muffler and tailpipe assembly.
- isolators installed on the body and muffler hangers.

The exhaust system provides an exit for exhaust gases and reduces engine noise by passing exhaust gases through the catalytic converters, a muffler assembly and resonator. Rubber exhaust hanger isolators attach the exhaust system to the hangers welded on the body.

Catalytic Converter

The catalytic converter plays a major role in the emission control system. The catalytic converter operates as a gas reactor. Its catalytic function is to speed the heat-producing chemical reaction of components in the exhaust gases in order to reduce air pollutants.

The catalyst material inside the catalytic converter consists of a ceramic substrate.

The catalytic converter is designed to provide a long life. No maintenance is necessary for the catalytic converter.

Sound Insulators and Shields

Sound insulators and shields, attached to the underbody, protect the vehicle from exhaust system heat and should be inspected at regular intervals to make sure they are not dented or out of position. If a sound insulator and shield is damaged or shows evidence of deterioration, it should be replaced. The sound insulators and shields for the muffler, muffler pipe, resonator and catalytic converter pipe are installed separately.

Precautions

CAUTION: **Do not use leaded fuel in a vehicle equipped with a catalytic converter. In a vehicle that is continually misfueled, the lead in the fuel will be deposited in the catalytic converter and completely blanket the catalyst. Lead reacts with platinum to "poison" the catalyst. Continuous use of leaded fuel can destroy the catalyst and render the catalytic converter useless. The addition of lead to the catalytic converter can also solidify the catalyst, causing excessive back pressure in the exhaust system and possibly causing engine damage.**

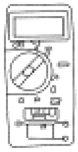
CAUTION: **Extremely high temperatures of 1,100°C (2,012°F) or above due to misfiring or an over-rich fuel/air mixture will cause the ceramic substrate to sinter or burn, destroying the catalytic converter. Do not continue to operate the vehicle if the engine is misfiring, there is a power loss or other unusual operating conditions, such as engine overheating and backfiring.**

Some exhaust fasteners must be discarded and new ones installed as indicated in the procedures. Also, any damaged or heavily corroded fasteners should be discarded and new ones installed. Some exhaust fasteners are of a prevailing torque design. Use only new fasteners with the same part number as the original. Torque values must be used as specified during reassembly to make sure of correct retention of exhaust components.

DIAGNOSTIC TESTS

EXHAUST SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	Electronic Vibration Analyzer or equivalent	100-F027 (014-00344)

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect the components of the exhaust system and related controls that may affect exhaust gas quality or loss of power.
3. Visually inspect for obvious signs of mechanical damage. Refer to the following chart.

VISUAL INSPECTION CHART

Mechanical
• Exhaust pipe pinched or crushed • Damaged muffler • Broken or damaged exhaust hanger brackets or isolators • Damaged catalytic converter • Cracked exhaust manifold • Loose or damaged heat shields

4. Verify that the exhaust system is installed correctly, with clamps correctly located and tightened to specification.
5. If the fault is not visually evident, determine the symptom. Go to **Symptom Chart - Exhaust System** or Go to **Symptom Chart - Noise, Vibration and Harshness (NVH)**.

Symptom Chart - Exhaust System

Symptom Chart - Exhaust System

Condition	Possible Sources	Action
• Vehicle has low or no power - vehicle performance complaint	• Exhaust pipe pinched or crushed • Damaged catalytic converter • Loose obstruction in exhaust	• INSPECT the exhaust components for damage. REPAIR or INSTALL new components as necessary. TEST the system for normal operation. If the concern is still present, REFER to the **Introduction - Gasoline Engines** article.
	• Restricted exhaust (possible frozen condensate in muffler)	• CHECK drain holes for foreign material. PARK the vehicle inside to thaw. TEST the vehicle for normal operation. If the concern is still present, REFER to the **Introduction - Gasoline Engines** article.

• Burning smell - usually occurs at idle, with possible traces of smoke	• Foreign material caught in exhaust system • Missing heat shields	• INSPECT the exhaust system for foreign material or missing heat shields. REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.
• Odor - described as a sulfur or rotten egg smell	• Catalytic converter • Excessive sulfur content in fuel	• At times, a slight sulfur smell is normal for catalytic converters. The cause is the sulfur content in the gasoline being used. ADVISE the customer no repair is required.
	• Rich fuel conditions • Misfire conditions	• REFER to the **Introduction - Gasoline Engines** article.
• Visible rust on surface of exhaust pipes	• Catalytic converter/exhaust system	• Surface rust is a characteristic of materials used on exhaust systems. Exposure to heat or road salt may result in surface rust. INSPECT for perforations. If there are no perforations, the condition is normal.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: **Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.**

Symptom Chart - Noise, Vibration and Harshness (NVH)

Condition	Possible Sources	Action
		• INSPECT the exhaust system for loose or missing heat shields or foreign material

		trapped between the heat shields and the exhaust system components. If any heat shields are loose, INSTALL worm gear clamp 7L5Z-5A231-AA and tighten to 7 Nm (62 lb-in). If the heat shields are missing, INSTALL new heat shields or exhaust system components as necessary. If a rattle, noise or buzz condition persists, INSTALL a new heat shield or component as necessary. TEST the system for normal operation after the repair.
• Rattle, squeaks or buzz type noise - from the bottom of the vehicle	• Loose or damaged heat shield	
	• Loose or damaged exhaust isolators	• VERIFY that the exhaust isolators are correctly installed. INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary. TEST the system for normal operation after the repair.
	• Damaged exhaust isolator hanger bracket	• INSPECT the exhaust system components for damage or broken hangers. INSTALL new components as necessary. CHECK for loose or damaged exhaust hanger brackets. INSTALL new components as necessary. TEST the system for normal operation after the repair.
	• Loose or damaged catalytic converter or muffler	• MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP on the exhaust components (except the exhaust flexible pipe) to duplicate the noise concern. Lightly TAP on the muffler, then the catalytic converter. DETERMINE if there are loose or broken

		baffles in the muffler or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.
	• Exhaust grounded to chassis	• INSPECT for signs of exhaust components-to-body contact. If necessary, CARRY OUT the **Exhaust System Alignment**.
• Drone or clunk type noise - from the bottom of the vehicle	• Loose or damaged exhaust isolators	• INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary. TEST the system for normal operation after the repair.
	• Exhaust grounded to chassis	• INSPECT for signs of exhaust components-to-body contact. If necessary, CARRY OUT the **Exhaust System Alignment**.
• Whistles, boom, hum or ticking type noise - noise tends to change as the engine warms. The noises are often accompanied by exhaust fumes	• Exhaust system leak	• INSPECT the entire exhaust system for leaks. CHECK for punctures, loose or damaged clamps/fasteners, gaskets, sensors or broken welds. EXAMINE the chassis for grayish-white or black exhaust soot, which indicates exhaust leakage at that point. To magnify a small leak, have an assistant hold a rag over the tailpipe outlet while listening for a leak. REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.
		• MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP

	• Catalytic converter	on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler and the catalytic converter. DETERMINE if there are loose or broken baffles in the muffler, or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.
	• Exhaust muffler/resonator drain hole enlarged due to corrosion	• CONFIRM the drain holes are the noise source. INSTALL new components as necessary. TEST the system for normal operation after the repair.
• Hissing or rushing noise - high frequency sound. Vehicle performance is unaffected	• Exhaust system. Exhaust flow through pipes	• CHECK the exhaust system for leaks. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler and the catalytic converter. DETERMINE if there are loose or broken baffles in the muffler, or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary. TEST the system for normal operation after the repair.
• Pinging noise - occurs when exhaust system is hot, engine turned off	• Catalytic converter/exhaust system	• Cool down pinging is a result of the exhaust system expanding and contracting during heating and cooling. This is a normal condition.
• Vibration - occurs at idle and at low speeds. Also accompanied by a clunk or buzz type noise	• Loose or damaged exhaust isolator	• INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary. TEST the system for normal operation after the repair. • INSPECT the exhaust isolator

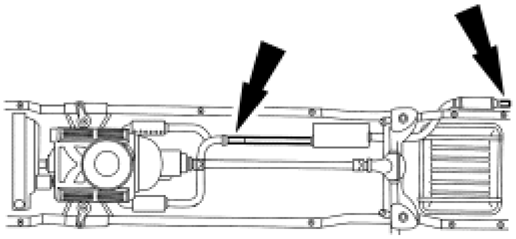
	• Loose or damaged exhaust isolator hanger brackets • Exhaust system grounded to chassis	hanger brackets for wear or damage. INSTALL or REPAIR as necessary. TEST the system for normal operation after the repair. • CARRY OUT the **Exhaust System Alignment**.
• Engine drumming noise - normally accompanied by vibration	• Damaged or misaligned exhaust system	• INSPECT the exhaust system for loose or damaged fasteners, Torca® clamps or isolators. CARRY OUT the **Exhaust System Alignment**.
• Sputter type noise - noise worse when cold, lessens or disappears when the vehicle is at operating temperature	• Damaged or worn exhaust system	• INSPECT the exhaust system for leaks or damage. REPAIR as necessary. TEST the system for normal operation after the repair.
• Thumping noise - from the bottom of the vehicle, worse at acceleration • Engine vibration - is felt with increases and decreases in engine RPM	• Misaligned exhaust system • Loose or damaged body shield • Strain on exhaust system isolators	• CHECK the exhaust system to chassis clearance. CHECK the exhaust system isolators for damage. REPAIR as necessary. TEST the system for normal operation after the repair. • CHECK the body shield for damaged, loose or missing fasteners. REPAIR or REPLACE as necessary. TEST the system for normal operation after the repair. • CARRY OUT the **Exhaust System Alignment**. REPAIR as necessary. TEST the system for normal operation after the repair.
• Drumming noise - occurs inside the vehicle during idle or high idle, hot or cold. Very low-frequency drumming is very RPM dependent	• Exhaust system vibration excites the body resonances inducing interior noise	• Go to **Pinpoint Test A**.

Pinpoint Test

PINPOINT TEST A: DRUMMING NOISE

A1 CHECK THE EXHAUST SYSTEM

- Key in START position.
- Increase the engine RPM until the noise is the loudest. Note the engine RPM.
- Key in OFF position.



DF1768-A

Fig. 1: Exhaust System
Courtesy of FORD MOTOR CO.

- Add approximately 9 kg (20 lb) of weight to the exhaust system. First place the weight at the tail pipe and test, then at the front pipe.
- Key in START position.
- Increase the engine RPM and listen for the drumming noise. Note the engine RPM if the noise occurs.
- Key in OFF position.
- Using a vibration analyzer (VA), determine the amount of vibration that occurs with the drumming noise.
- **Is the noise/vibration reduced or eliminated, or does the noise/vibration occur at a different RPM?**

  YES : REFER to **Exhaust System Alignment**. TEST the system for normal operation.

  NO : CONDUCT a diagnosis on other suspect systems. REFER to **NOISE, VIBRATION AND HARSHNESS** article.

GENERAL PROCEDURES

EXHAUST SYSTEM ALIGNMENT

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Loosen all fasteners joining the exhaust system components.
3. Beginning at the front of the vehicle, align the exhaust system to establish the maximum clearance. Make sure all fit pipes are pushed all the way into the preceding pipe and the notches are correctly lined up with the tabs.

4. Beginning at the front of the vehicle, tighten all fasteners and clamps to specification. For additional information, refer to **SPECIFICATIONS**.
5. Start the engine and check the exhaust system for leaks.

TORCA® CLAMP

1. Remove the nut from the Torca® clamp.
2. Grind the spot weld from the Torca® clamp and remove the clamp.
3. Clean the uneven surface area and position a Torca® clamp.

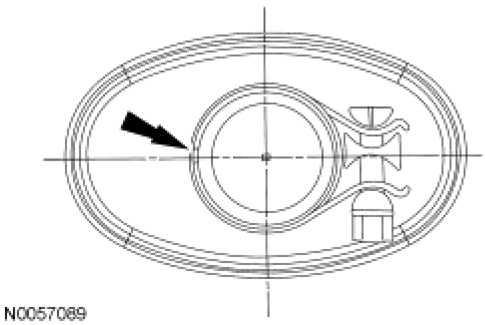


Fig. 2: Locating Uneven Surface Area
Courtesy of FORD MOTOR CO.

NOTE: **Make sure the clamp position is no more than 27.5 mm (1.08 in) or less than 25.5 mm (1 in) from the inlet of the resonator pipe.**

4. Make sure the back of the slot is covered by the clamp and the button is fully seated inside the notch.

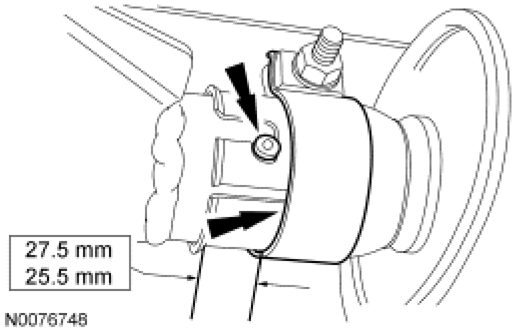


Fig. 3: Making Sure Back Of Slot Is Covered By Clamp & Button Is Fully Seated Inside Notch
Courtesy of FORD MOTOR CO.

NOTE: **Do not tighten the clamp until the exhaust system has been aligned.**

5. Tighten the Torca® clamp.
   - Tighten to 47 Nm (35 lb-ft).

REMOVAL AND INSTALLATION

EXHAUST SYSTEM - EXPLODED VIEW

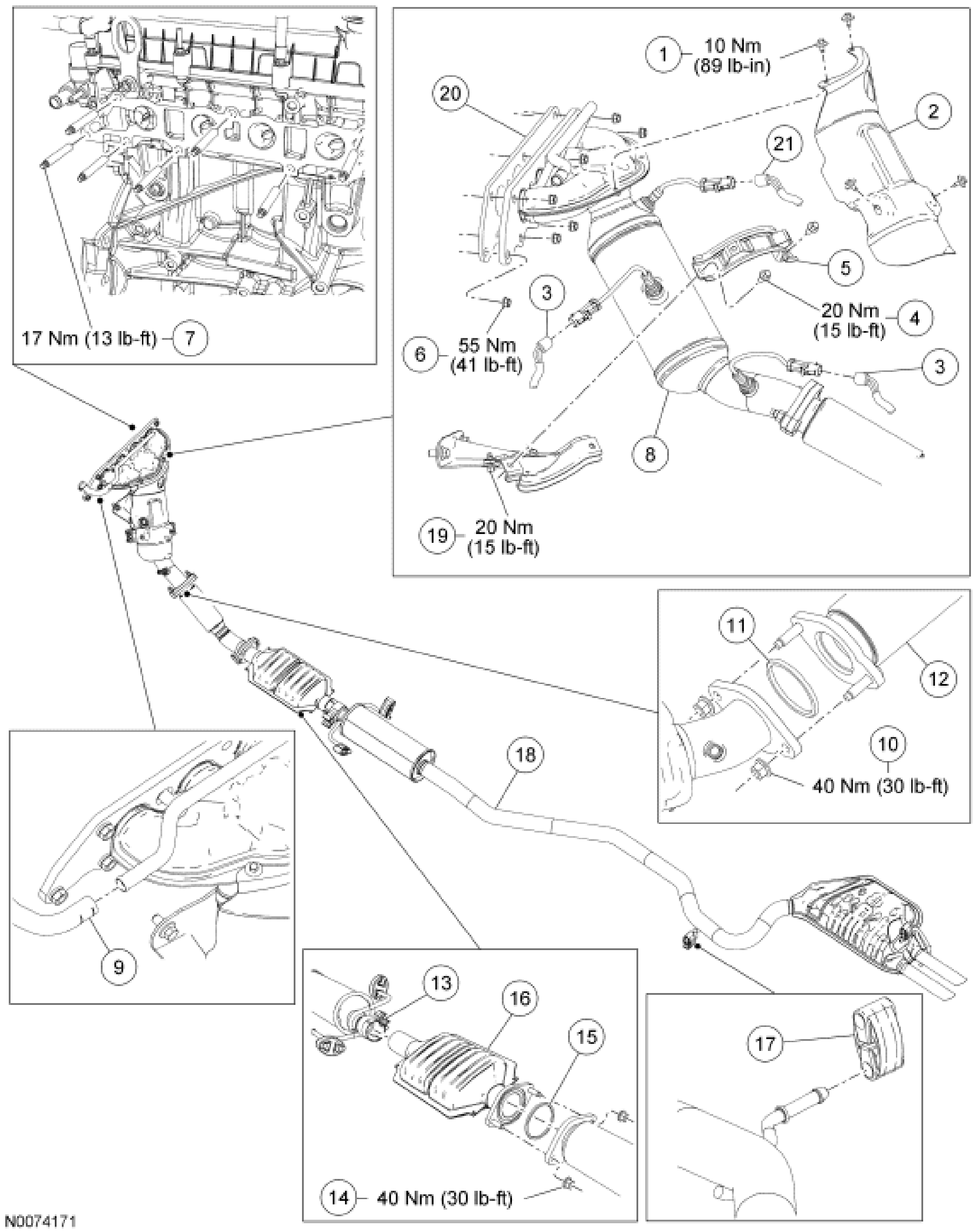


Fig. 4: Exploded View Of Exhaust System With Torque Specifications - 2.3L Partial Zero Emissions Vehicle (PZEV) (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W503921	Catalytic converter manifold shield bolt (4 required)
2	5K282	Catalytic converter manifold shield
3	14A464	Catalyst monitor sensor electrical connector (2 required)
4	W500021	Catalytic converter manifold shield bracket bolt (2 required)
5	5K291	Catalytic converter manifold shield bracket
6	W708176	Catalytic converter manifold nut (7 required)
7	W704474	Catalytic converter manifold stud (7 required)
8	5G236	Catalytic converter manifold
9	9B466	Secondary air injection hose
10	W705443	Catalytic converter-to-exhaust flexible pipe nut (2 required)
11	9451	Gasket
12	5G203	Exhaust flexible pipe
13	5221	Torca® clamp
14	W705443	Exhaust flexible pipe-to-catalytic converter nut (2 required)
15	9451	Gasket
16	5E212	Catalytic converter
17	5F262	Muffler and tailpipe isolator (4 required)
18	5C257	Muffler and tailpipe
19	-	Catalytic converter manifold bracket bolt (2 required)
20	9448	Catalytic converter manifold gasket
21	14A464	Heated oxygen sensor (HO2S) electrical connector

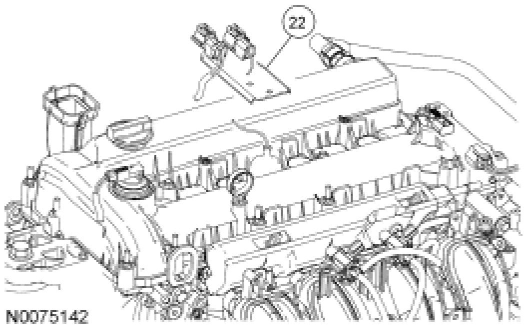


Fig. 5: Exploded View Of Exhaust System - 2.3L Partial Zero Emissions Vehicle (PZEV) (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
22	14W163	Wiring harness bracket

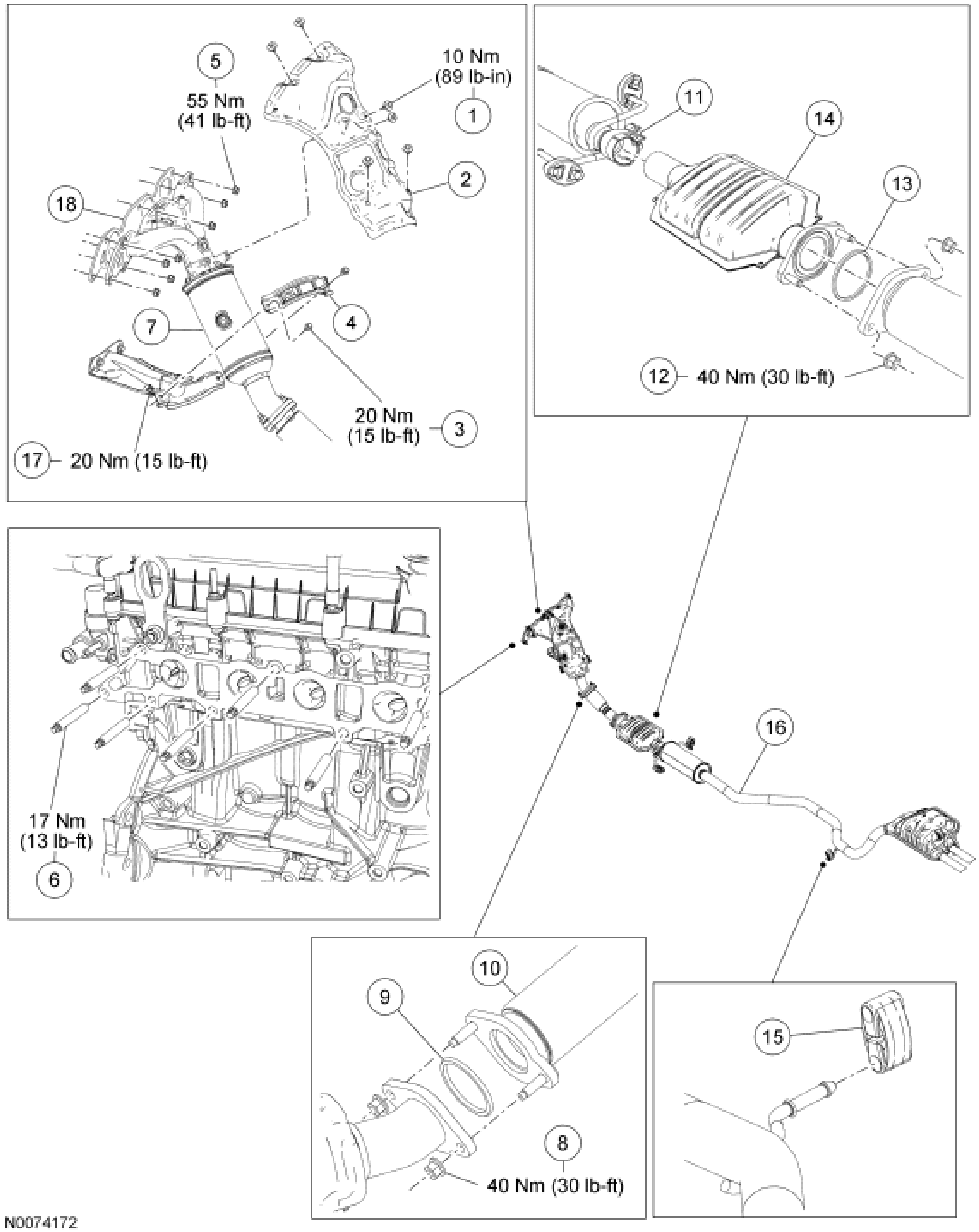


Fig. 6: Exploded View Of Exhaust System With Torque Specifications - 2.3L Non-PZEV
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W503921	Catalytic converter manifold shield bolt (6 required)
2	9N454	Catalytic converter manifold shield
3	W500021	Catalytic converter manifold shield bracket bolt (2

		required)
4	5K291	Catalytic converter manifold shield bracket
5	W708176	Catalytic converter manifold nut (7 required)
6	W704474	Catalytic converter manifold stud (7 required)
7	5G236	Catalytic converter manifold
8	W705443	Catalytic converter manifold-to-exhaust flexible pipe nut (2 required)
9	9451	Gasket
10	5G203	Exhaust flexible pipe
11	5221	Torca® clamp
12	W705443	Exhaust flexible pipe-to-catalytic converter nut (2 required)
13	9451	Gasket
14	5E212	Catalytic converter
15	5F262	Muffler and tailpipe isolator (4 required)
16	5C257	Muffler and tailpipe
17	-	Catalytic converter manifold bracket bolt (2 required)
18	9448	Catalytic converter manifold gasket

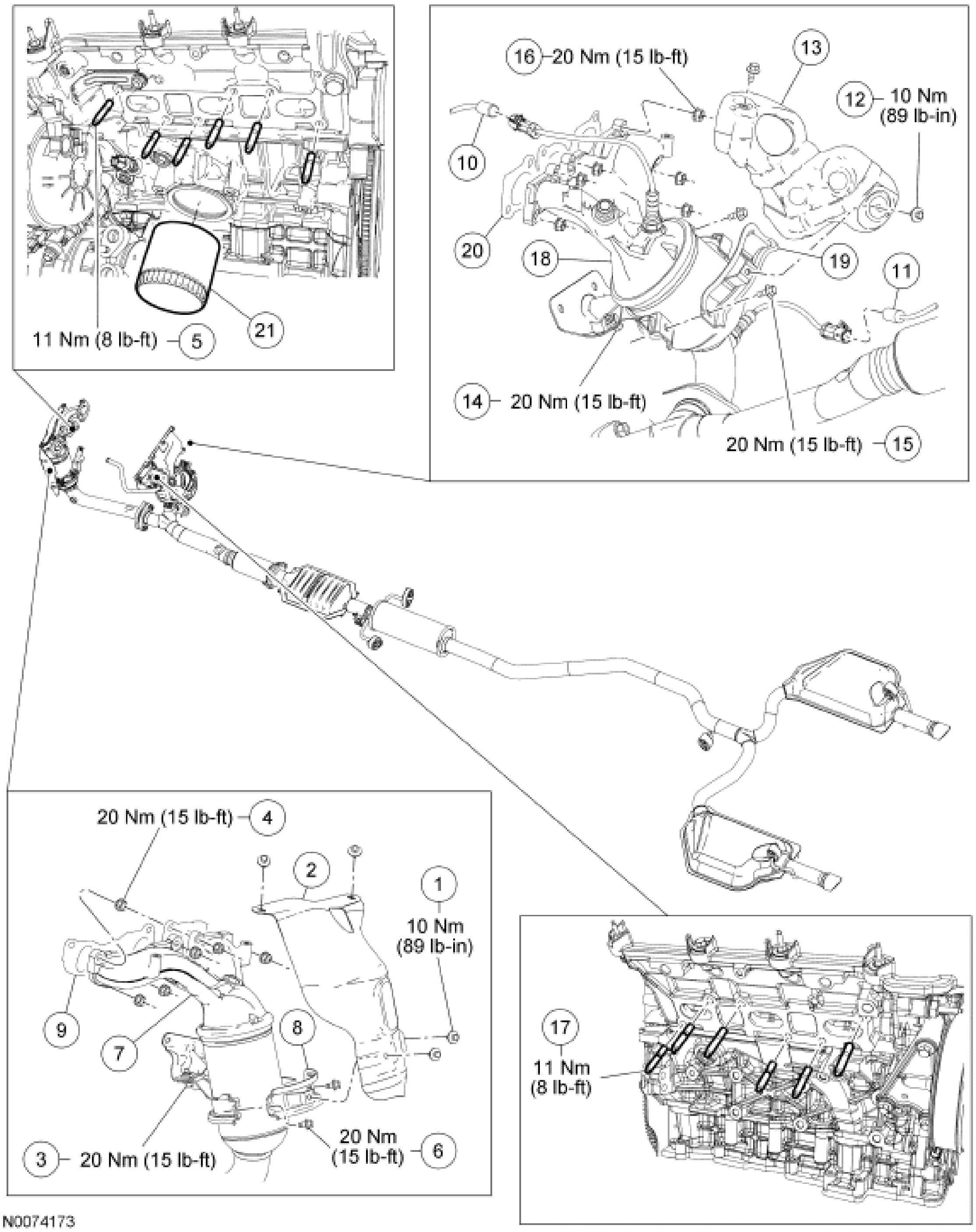


Fig. 7: Exploded View Of Exhaust System With Torque Specifications - 3.0L (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W503921	LH catalytic converter manifold shield bolt (4 required)
2	5K282	LH catalytic converter manifold shield

3	-	LH catalytic converter manifold bracket bolt (2 required)
4	W701706	LH catalytic converter manifold nut (6 required)
5	W701732	LH catalytic converter manifold stud (6 required)
6	W500021	LH catalytic converter manifold shield bracket bolt (2 required)
7	5G232	LH catalytic converter manifold
8	5K292	LH catalytic converter manifold shield bracket
9	9448	LH catalytic converter manifold gasket
10	14A464	Heated oxygen sensor (HO2S) electrical connector
11	14A464	Catalyst monitor sensor electrical connector
12	W503921	RH catalytic converter manifold shield bolt (2 required)
13	5K282	RH catalytic converter manifold shield
14	-	RH catalytic converter manifold bracket bolt (2 required)
15	W500021	RH catalytic converter manifold shield bracket bolt (2 required)
16	W701706	RH catalytic converter manifold nut (6 required)
17	W701732	RH catalytic converter manifold stud (6 required)
18	5G236	RH catalytic converter manifold
19	5K291	RH catalytic converter manifold shield bracket
20	9448	RH catalytic converter manifold gasket
21	-	Oil filter

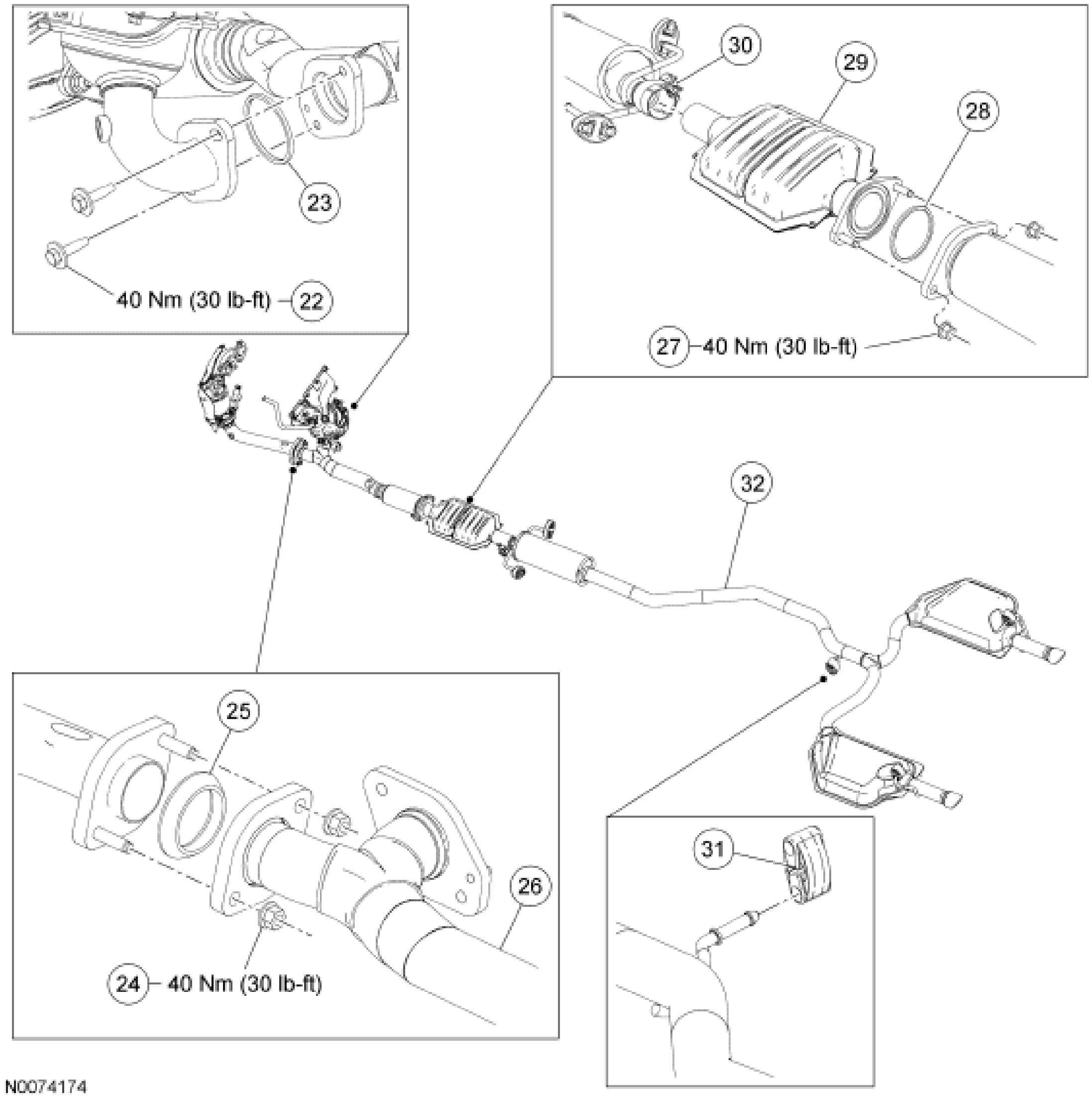


Fig. 8: Exploded View Of Exhaust System With Torque Specifications - 3.0L (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
22	W713002	RH catalytic converter manifold-to-exhaust flexible pipe bolt (2 required)
23	9451	Gasket
24	W705443	LH catalytic converter-to-exhaust flexible pipe nut (2 required)
25	5E241	Gasket
26	5G274	Exhaust flexible pipe
27	W705443	Exhaust flexible pipe-to-catalytic converter nut (2 required)
28	9451	Gasket
29	5E212	Catalytic converter

30	5221	Torca® clamp
31	5F262	Muffler and tailpipe isolator (5 required)
32	5G213	Muffler and tailpipe

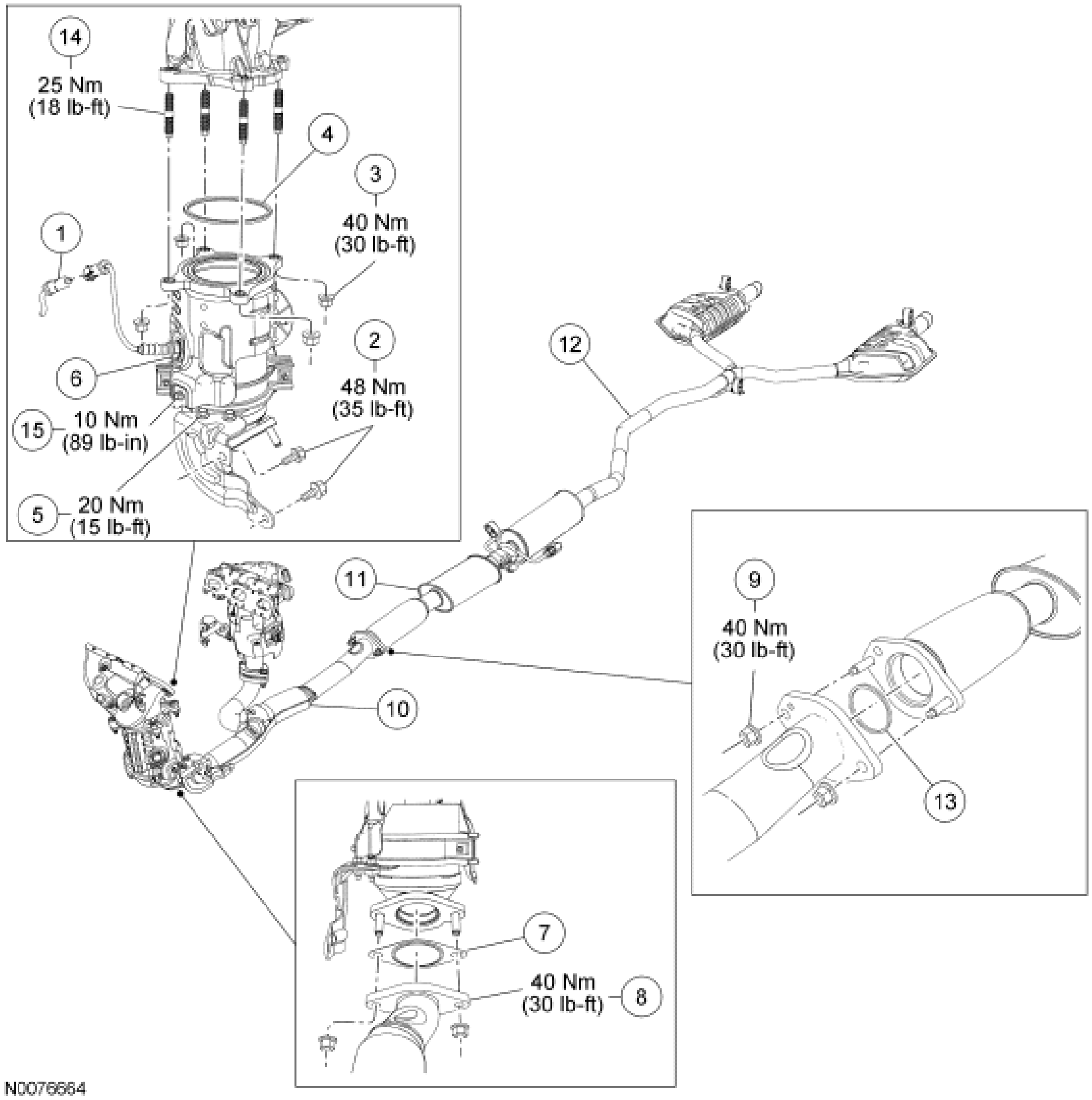


Fig. 9: Exploded View Of Exhaust System With Torque Specifications - 3.5L (1 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Catalyst monitor sensor electrical connector
2	-	Catalytic converter support bracket-to-transmission bolts (2 required)
3	W705443	LH catalytic converter-to-exhaust manifold nut (4 required)
4	5F263	Gasket

5	W500222	Bracket-to-LH catalytic converter bolt (2 required)
6	5E213	LH catalytic converter
7	9451	Gasket
8	W705443	Exhaust Y-pipe-to-LH catalytic converter nut (2 required)
9	W705443	Exhaust Y-pipe-to-resonator nut (2 required)
10	5G274	Exhaust Y-pipe
11	5H292	Resonator
12	5G213	Muffler and tailpipe
13	9451	Gasket
14	W712458	LH catalytic converter-to-exhaust manifold stud (4 required)
15	W500211	LH catalytic converter heat shield bolt (3 required)

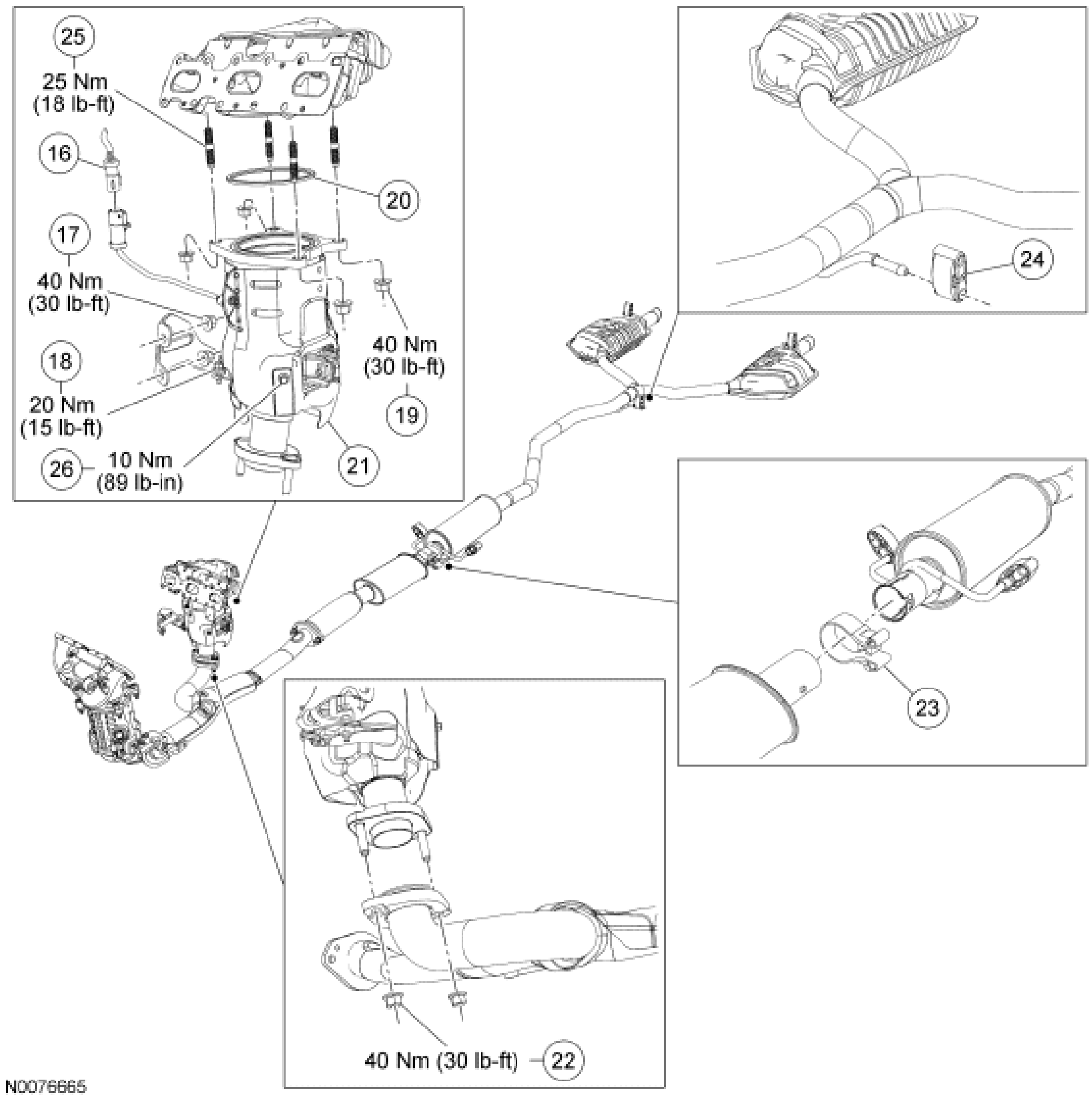


Fig. 10: Exploded View Of Exhaust System With Torque Specifications - 3.5L (2 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
16	14A464	RH catalyst monitor sensor electrical connector
17	W710512/ W705443	Catalytic converter support bracket-to-engine block nut (2 required)/(front wheel drive [FWD] bolt)
18	W500222	Bracket-to-RH catalytic converter bolt (2 required)
19	W705443	RH catalytic converter-to-exhaust manifold nut (4 required)
20	5F263	Gasket
21	5E211	RH catalytic converter
22	W705443	Exhaust Y-pipe-to-RH catalytic converter nut (2 required)
23	5221	Torca® clamp
24	5F262	Muffler and tailpipe isolator (5 required)
25	W712458	RH catalytic converter-to-exhaust manifold stud (4 required)
26	W500211	RH catalytic converter heat shield bolt (3 required)

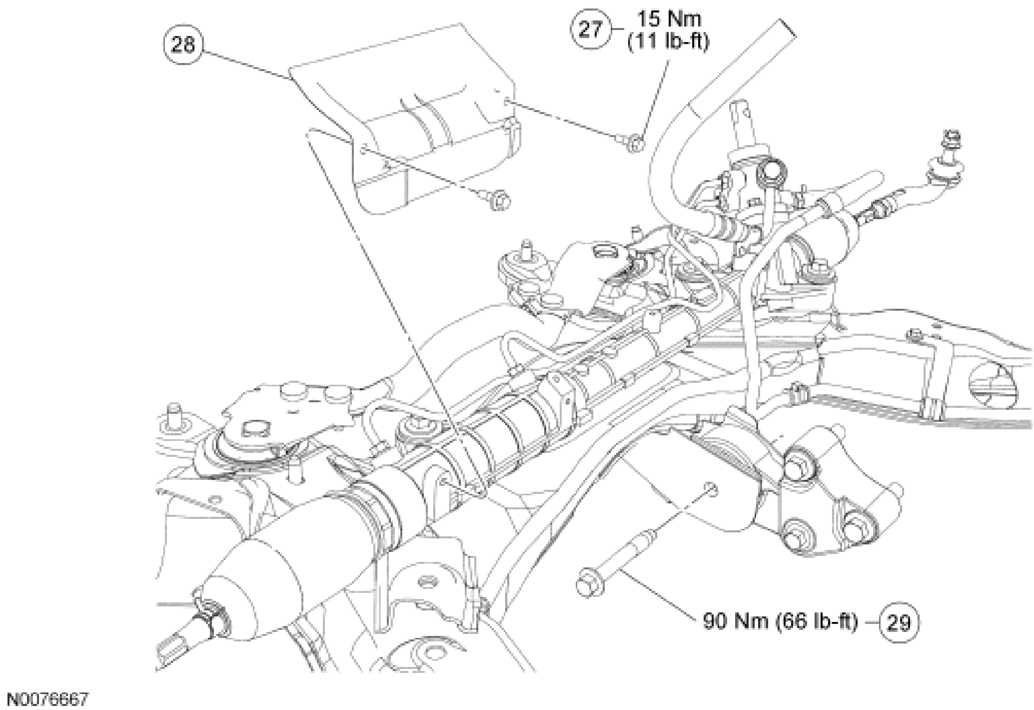


Fig. 11: Exploded View Of Exhaust System With Torque Specifications - 3.5L (3 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description

27	W500210	Power steering gear shield bolts (2 required)
28	-	Power steering gear shield
29	W706674	Roll restrictor bolt

1. For additional information, refer to the procedures.

CATALYTIC CONVERTER - 2.3L PZEV MANIFOLD

REMOVAL

NOTE: Always install new fasteners and gaskets as indicated. Clean flange faces prior to new gasket installation to make sure of proper sealing.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the generator air inlet duct.

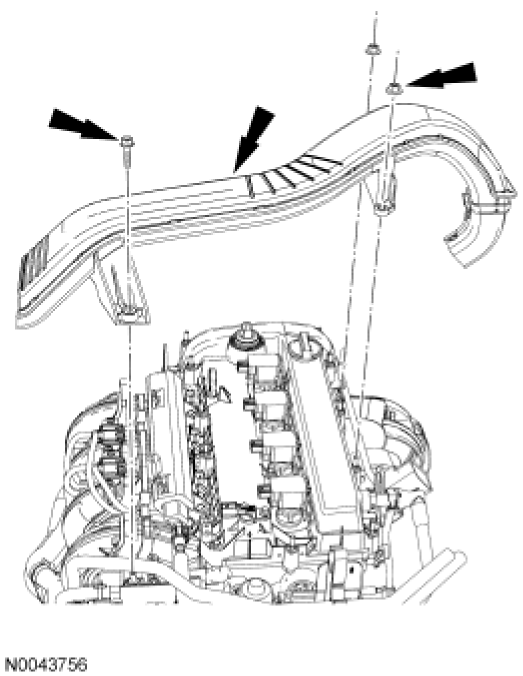


Fig. 12: Locating Generator Air Inlet Duct And Bolts
Courtesy of FORD MOTOR CO.

3. Disconnect the heated oxygen sensor (HO2S) and 2 catalyst monitor sensor electrical connectors.
4. Remove the wiring harness bracket off the stud and position it aside.
5. Remove the 2 catalytic converter manifold-to-exhaust flexible pipe nuts.
    - Discard the gasket and the 2 nuts.

6. Remove the 4 heat shield bolts and the heat shield.
7. Remove the 2 catalytic converter manifold shield bracket bolts and the bracket.
8. Loosen the 2 catalytic converter manifold bracket bolts.
9. Disconnect the secondary injection hose from the catalytic converter manifold.

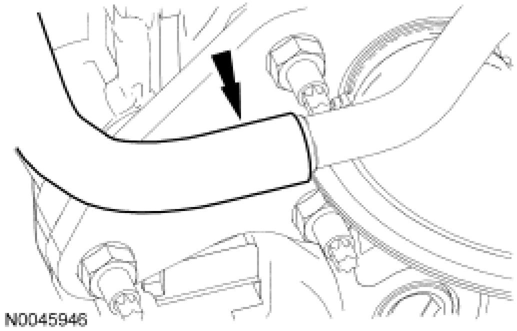


Fig. 13: Locating Secondary Injection Hose
Courtesy of FORD MOTOR CO.

10. Remove the 7 catalytic converter manifold nuts and remove it from the vehicle.
    - Discard the 7 nuts and the gasket.
11. Remove and discard the 7 catalytic converter manifold studs.
12. Clean and inspect the catalytic converter manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.

INSTALLATION

1. Install the 7 new catalytic converter manifold studs.
   - Tighten to 17 Nm (13 lb-ft).
2. Position a new catalytic converter manifold gasket on the studs.

CAUTION: Failure to tighten the catalytic converter manifold nuts to specification before installing the converter bracket bolts will cause the converter to develop an exhaust leak.

CAUTION: Failure to tighten the catalytic converter manifold nuts to specification a second time will cause the converter to develop an exhaust leak.

NOTE: Make sure to tighten the nuts in the following sequence in 2 stages.

3. Position the catalytic converter manifold and tighten the 7 new nuts in the sequence shown, in 2 stages.
   - Stage 1: Tighten to 55 Nm (41 lb-ft).
   - Stage 2: Tighten to 55 Nm (41 lb-ft).

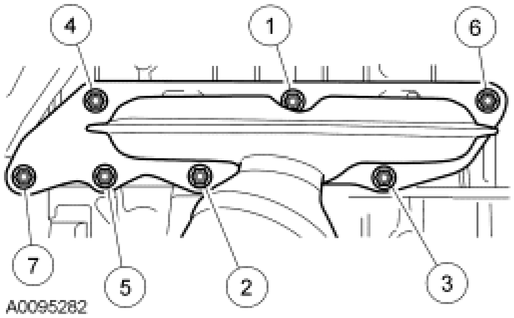


Fig. 14: Exhaust Manifold Nut Torque Sequence
Courtesy of FORD MOTOR CO.

4. Connect the secondary injection hose to the catalytic converter manifold.

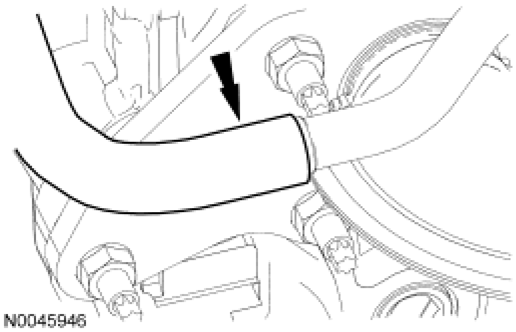


Fig. 15: Locating Secondary Injection Hose
Courtesy of FORD MOTOR CO.

5. Tighten the 2 catalytic converter manifold bracket bolts.
   - Tighten to 20 Nm (15 lb-ft).
6. Install the 2 catalytic converter manifold shield bracket bolts and the bracket.
   - Tighten to 20 Nm (15 lb-ft).
7. Position the heat shield and install the 4 heat shield bolts.
   - Tighten to 10 Nm (89 lb-in).
8. Install the 2 catalytic converter manifold-to-exhaust flexible pipe nuts.
   - Install a new gasket and nuts.
   - Tighten to 40 Nm (30 lb-ft).
9. Position the wiring harness bracket on the stud.
10. Connect the HO2S and 2 catalyst monitor sensor electrical connectors.
11. Install the generator air inlet duct.

CATALYTIC CONVERTER - 2.3L MANIFOLD

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the generator air inlet duct.

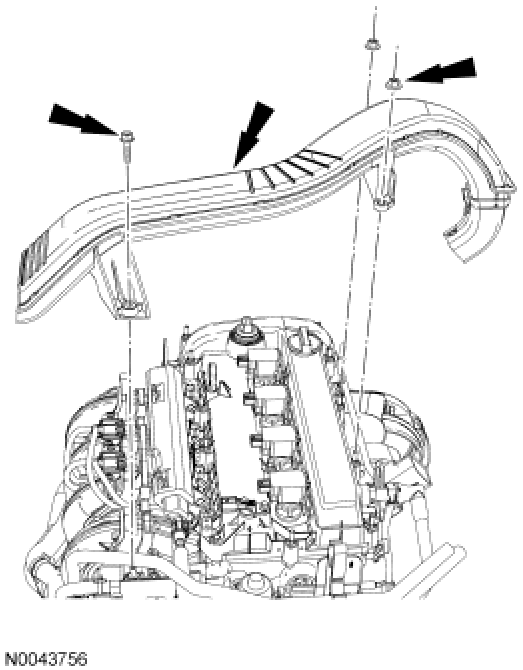


Fig. 16: Locating Generator Air Inlet Duct And Bolts
Courtesy of FORD MOTOR CO.

3. Remove the heated oxygen sensor (HO2S) and catalyst monitor sensor. For additional information, refer to **ELECTRONIC ENGINE CONTROLS - 2.3L** article.
4. Remove the wiring harness bracket from the valve cover stud and position it aside.
5. Remove the 2 catalytic converter manifold-to-exhaust flexible pipe nuts.
   - Discard the gasket and the 2 nuts.
6. Remove the 6 heat shield bolts and the heat shield.
7. Remove the 2 catalytic converter manifold shield bracket bolts and the bracket.
8. Loosen the 2 catalytic converter manifold bracket bolts.
9. Remove the 7 nuts and the catalytic converter manifold.
   - Discard the 7 nuts and the gasket.
10. Remove and discard the 7 catalytic converter manifold studs.
11. Clean and inspect the catalytic converter manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.

INSTALLATION

1. Install the 7 new catalytic converter manifold studs.

- Tighten to 17 Nm (13 lb-ft).

2. Position a new catalytic converter manifold gasket on the studs.

CAUTION: Failure to tighten the catalytic converter manifold nuts to specification before installing the converter bracket bolts will cause the converter to develop an exhaust leak.

CAUTION: Failure to tighten the catalytic converter manifold nuts to specification a second time will cause the converter to develop an exhaust leak.

NOTE: Make sure to tighten the nuts in the sequence shown in 2 stages.

3. Position the catalytic converter manifold and tighten the 7 new nuts in the sequence shown, in 2 stages.
   - Stage 1: Tighten to 55 Nm (41 lb-ft).
   - Stage 2: Tighten to 55 Nm (41 lb-ft).

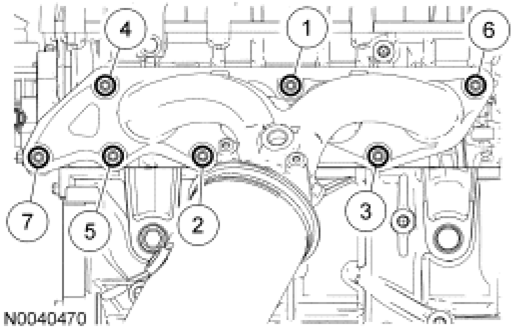


Fig. 17: Exhaust Manifold Nut Torque Sequence
Courtesy of FORD MOTOR CO.

4. Install the catalytic converter manifold shield bracket and the 2 bolts.
   - Tighten to 20 Nm (15 lb-ft).
5. Tighten the 2 catalytic converter manifold bracket bolts.
   - Tighten to 20 Nm (15 lb-ft).
6. Position the heat shield and install the 6 heat shield bolts.
   - Tighten to 10 Nm (89 lb-in).
7. Install the 2 catalytic converter manifold-to-exhaust flexible pipe nuts.
   - Install a new gasket and nuts.
   - Tighten to 40 Nm (30 lb-ft).
8. Position the wiring harness bracket on the stud.
9. Install the HO2S and catalyst monitor sensors. For additional information, refer to **ELECTRONIC ENGINE CONTROLS - 2.3L** article.
10. Install the generator air inlet duct.

CATALYTIC CONVERTER - 3.0L LH MANIFOLD

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove and discard the oil filter.
3. Remove the oil level indicator and tube. For additional information, refer to **ENGINE - 3.0L (4V)** article.
4. Remove the heated oxygen sensor (HO2S) and the catalyst monitor sensor. For additional information refer to **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article.
5. Remove the 2 LH catalytic converter-to-exhaust flexible pipe nuts.
   - Discard the gasket and the 2 nuts.
6. Remove the 4 bolts and the LH catalytic converter manifold shield.
7. Remove the 2 LH catalytic converter manifold shield bracket bolts and the shield bracket.
8. Loosen the 2 LH catalytic converter manifold bracket bolts.
9. Remove the 6 nuts and the LH catalytic converter manifold.
   - Discard the 6 LH catalytic converter manifold nuts and the gasket.
10. Remove and discard the 6 LH catalytic converter manifold studs.
11. Clean and inspect the catalytic converter manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.

INSTALLATION

1. Install the 6 new LH catalytic converter manifold studs.
   - Tighten to 11 Nm (8 lb-ft).
2. Position a new LH catalytic converter manifold gasket on the studs.
3. Position the LH catalytic converter manifold and finger tighten the 6 new nuts.
4. Install a new gasket and finger tighten 2 new nuts at the LH catalytic converter-to-exhaust flexible pipe.

CAUTION: Failure to tighten the catalytic converter manifold nuts to specification before installing the converter bracket bolts will cause the converter to develop an exhaust leak.

CAUTION: Failure to tighten the catalytic converter manifold nuts to specification a second time will cause the converter to develop an exhaust leak.

NOTE: Make sure to tighten the nuts in the sequence shown in 2 stages.

5. Position the LH catalytic converter manifold and tighten the 6 new nuts in the sequence shown, in 2 stages.
   - Stage 1: Tighten to 20 Nm (15 lb-ft).

- Stage 2: Tighten to 20 Nm (15 lb-ft).

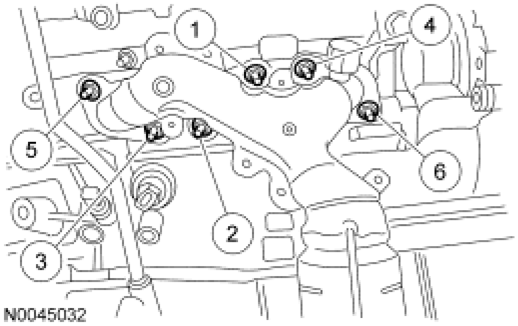


Fig. 18: Identifying Catalytic Converter Manifold Nuts Tightening Sequence
Courtesy of FORD MOTOR CO.

6. Install the shield bracket and the 2 LH catalytic converter manifold shield bracket bolts.
   - Tighten to 20 Nm (15 lb-ft).
7. Tighten the 2 LH catalytic converter manifold bracket bolts.
   - To install, tighten to 20 Nm (15 lb-ft).
8. Position the LH catalytic converter manifold shield and install the 4 bolts.
   - Tighten to 10 Nm (89 lb-in).
9. Tighten the 2 new LH catalytic converter-to-exhaust flexible pipe nuts in 3 stages:
   - Stage 1: Tighten the passenger side nut to 5 Nm (44 lb-in).
   - Stage 2: Tighten the driver side nut to 40 Nm (30 lb-ft).
   - Stage 3: Tighten the passenger side nut to 40 Nm (30 lb-ft).
10. Install the HO2S and the catalyst monitor sensor. For additional information refer to **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article.
11. Install the oil level indicator and tube. For additional information, refer to **ENGINE - 3.0L (4V)** article.
12. Install a new oil filter.
    - Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.

CATALYTIC CONVERTER - 3.0L RH MANIFOLD, FRONT WHEEL DRIVE (FWD)

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the exhaust flexible pipe. For additional information, refer to **Exhaust Flexible Pipe - 2.3L, 3.0L**.
3. Remove the EGR tube. For additional information, refer to **ENGINE EMISSION CONTROL - 3.0L (4V)** article.
4. Disconnect the heated oxygen sensor (HO2S) and catalyst monitor sensor electrical connectors.
5. Remove the 2 bolts and the RH catalytic converter manifold shield.

6. Remove the 2 RH catalytic converter manifold shield bracket bolts and the shield bracket.
7. Loosen the 2 RH catalytic converter manifold bracket bolts.
8. Remove the 6 nuts and the RH catalytic converter manifold.
   - Discard the 6 RH catalytic converter manifold nuts and gasket.
9. Remove the 6 RH catalytic converter manifold studs and discard.
10. Clean and inspect the catalytic converter manifold. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.

INSTALLATION

1. Install the 6 new RH catalytic converter manifold studs.
   - Tighten to 11 Nm (8 lb-ft).
2. Position a new RH catalytic converter manifold gasket on the studs.

CAUTION: Failure to tighten the catalytic converter nuts to specification before installing the converter bracket bolts will cause the converter to develop an exhaust leak.

CAUTION: Failure to tighten the catalytic converter nuts to specification a second time will cause the converter to develop an exhaust leak.

NOTE: Make sure to tighten the nuts in the sequence shown in 2 stages.

3. Position the RH catalytic converter manifold and tighten the 6 new nuts in the sequence shown, in 2 stages.
   - Stage 1: Tighten to 20 Nm (15 lb-ft).
   - Stage 2: Tighten to 20 Nm (15 lb-ft).

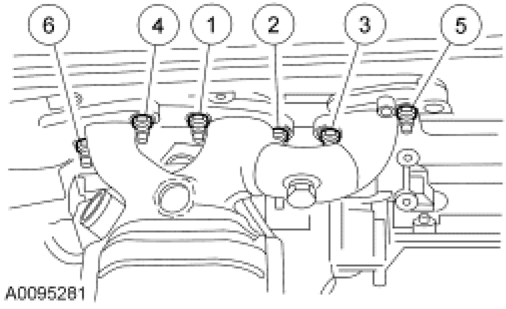


Fig. 19: Exhaust Manifold Nut Torque Sequence
Courtesy of FORD MOTOR CO.

4. Install the shield bracket and the 2 RH catalytic converter manifold shield bracket bolts.
   - Tighten to 20 Nm (15 lb-ft).

5. Tighten the 2 RH catalytic converter manifold bracket bolts.
    - Tighten to 20 Nm (15 lb-ft).
6. Position the RH catalytic converter manifold shield and install the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).
7. Connect the HO2S and catalyst monitor sensor electrical connectors.
8. Install the EGR tube. For additional information, refer to **ENGINE EMISSION CONTROL - 3.0L (4V)** article.
9. Install the exhaust flexible pipe. For additional information, refer to **Exhaust Flexible Pipe - 2.3L, 3.0L**.

CATALYTIC CONVERTER - 3.0L RH, ALL WHEEL DRIVE (AWD)

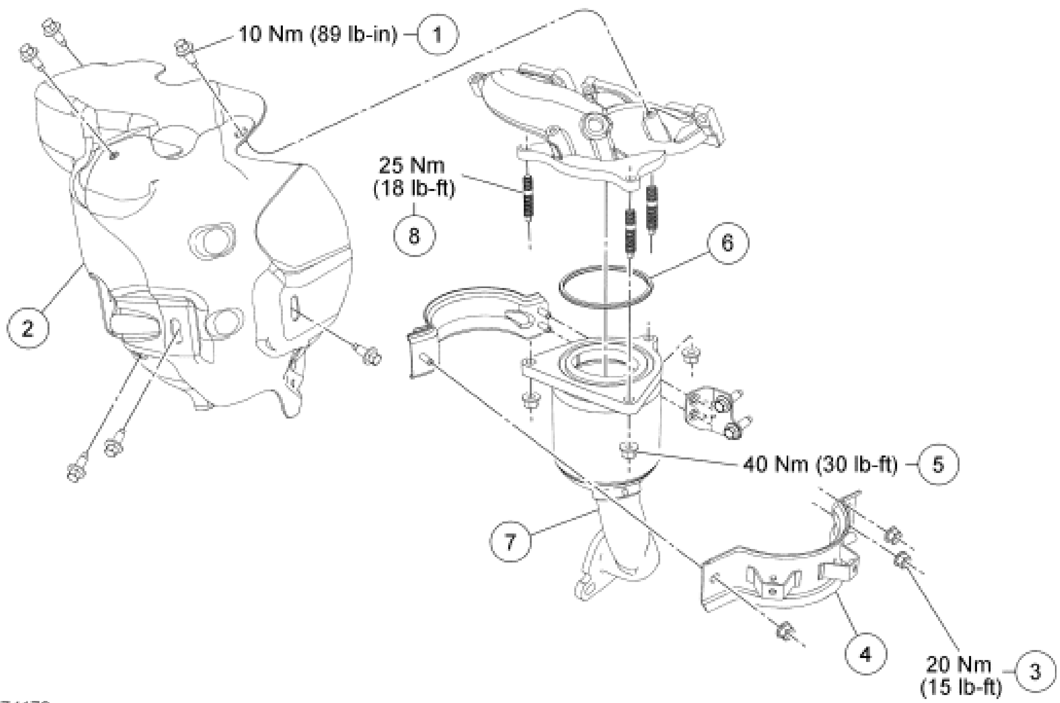


Fig. 20: Exploded View Of Catalytic Converter With Torque Specifications - 3.0L RH, All Wheel Drive (AWD)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W503921	Heat shield bolt (6 required)
2	5K282	Heat shield
3	W701706	Heat shield bracket nut (3 required)
4	5K291	Heat shield bracket
5	W705443	Catalytic converter nut (3 required)
6	5F263	Gasket
7	5E211	Catalytic converter

8	W711133	RH catalytic converter-to-exhaust manifold stud (3 required)

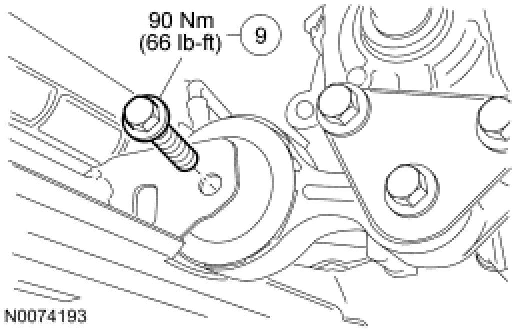


Fig. 21: Exploded View Of Catalytic Converter With Torque Specification - 3.0L RH, All Wheel Drive (AWD)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
9	W711575	Roll restrictor bolt

REMOVAL AND INSTALLATION

NOTE: Always install new fasteners and gaskets as indicated. Clean flange faces prior to new gasket installation to make sure of proper sealing.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the exhaust flexible pipe. For additional information, refer to **Exhaust Flexible Pipe - 2.3L, 3.0L**.
3. Remove the intermediate shaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.
4. Remove the heated oxygen sensor (HO2S) and catalyst monitor sensor. For additional information, refer to **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article.
5. Remove the roll restrictor bolt and rotate the engine forward.
   - To install, tighten to 90 Nm (66 lb-ft).
6. Remove the 6 bolts and position aside the heat shield.
   - To install, tighten to 10 Nm (89 lb-in).
7. Remove the 3 nuts and the heat shield brackets.
   - To install, tighten to 20 Nm (15 lb-ft).
8. Remove the 3 nuts and the RH catalytic converter.
   - Discard the 3 RH catalytic converter nuts and gasket.
   - To install, tighten to 40 Nm (30 lb-ft).
9. Remove and discard the 3 RH catalytic converter-to-exhaust manifold studs.

- To install, tighten to 25 Nm (18 lb-ft).

10. To install, reverse the removal procedure.
    - Install a new gasket, nuts and studs as indicated.

CATALYTIC CONVERTER - 3.5L RH

REMOVAL AND INSTALLATION

All vehicles

NOTE: Always install new fasteners and gaskets as indicated. Clean flange faces prior to new gasket installation to make sure of proper sealing.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the exhaust Y-pipe. For additional information, refer to **Exhaust Y-Pipe - 3.5L**.

All wheel drive (AWD)

3. Remove the intermediate shaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.

All vehicles

4. Remove the 2 bolts and the power steering gear shield.
    - To install, tighten to 15 Nm (11 lb-ft).

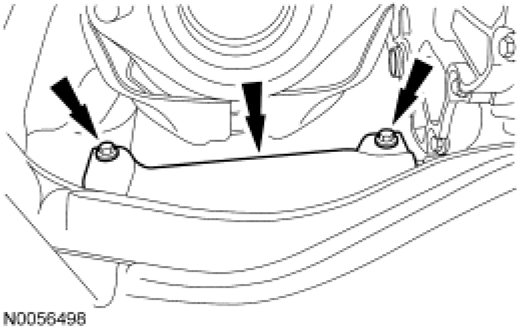


Fig. 22: Identifying Power Steering Rack Shield & Bolts
Courtesy of FORD MOTOR CO.

5. Remove the roll restrictor bolt and rotate the engine forward.
    - To install, tighten to 90 Nm (66 lb-ft).
6. Disconnect the catalyst monitor sensor electrical connector.
7. Remove the 2 bracket-to-RH catalytic converter bolts.
    - To install, tighten to 20 Nm (15 lb-ft).

8. Remove the 4 nuts and the RH catalytic converter.
    - Discard the 4 RH catalytic converter nuts and gasket.
    - To install, tighten in a cross pattern to 40 Nm (30 lb-ft).
9. To install, reverse the removal procedure.
    - Install a new gasket, nuts and studs as indicated.

CATALYTIC CONVERTER - 3.5L LH

REMOVAL AND INSTALLATION

NOTE: Always install new fasteners and gaskets as indicated. Clean flange faces prior to new gasket installation to make sure of proper sealing.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the catalyst monitor sensor electrical connector.
3. Remove the exhaust Y-pipe. For additional information, refer to **Exhaust Y-Pipe - 3.5L**.
4. Remove the 2 catalytic converter support bracket-to-transmission bolts.
    - To install, tighten to 48 Nm (35 lb-ft).
5. Remove the 4 nuts and the LH catalytic converter.
    - Discard the 4 LH catalytic converter nuts and gasket.
    - To install, tighten in a cross pattern to 40 Nm (30 lb-ft).
6. To install, reverse the removal procedure.
    - Install a new gasket, nuts and studs as indicated.

EXHAUST FLEXIBLE PIPE - 2.3L, 3.0L

REMOVAL

CAUTION: Do not excessively bend, twist or allow the exhaust to hang from the flexible pipe or damage to the exhaust system may occur.

All vehicles

NOTE: Always install new fasteners and gaskets as indicated. Clean flange faces prior to new gasket installation to make sure of proper sealing.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. If equipped, remove the 6 screws and the underbody shield.

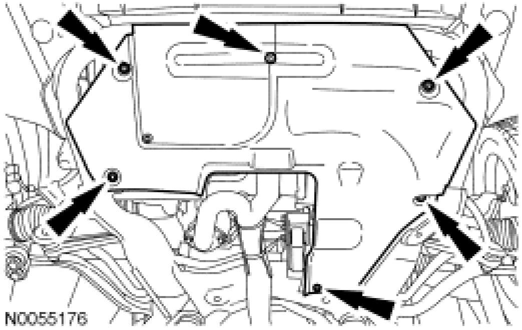


Fig. 23: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

3. Remove and discard the 2 exhaust flexible pipe-to-catalytic converter nuts.
    - Discard the gasket.

3.0L vehicles

4. Remove and discard the 2 RH catalytic converter-to-exhaust flexible pipe nuts.
    - Discard the gasket.
5. Remove and discard the 2 LH catalytic converter-to-exhaust flexible pipe nuts and remove the exhaust flexible pipe.
    - Discard the gasket.

2.3L vehicles

6. Remove and discard the 2 catalytic converter manifold-to-exhaust flexible pipe nuts and remove the exhaust flexible pipe.
    - Discard the gasket.

INSTALLATION

2.3L vehicles

1. Install the exhaust flexible pipe, a new gasket and the 2 new catalytic converter manifold-to-exhaust flexible pipe nuts.
    - Tighten to 40 Nm (30 lb-ft).

3.0L vehicles

2. Install the exhaust flexible pipe, a new gasket and hand tighten the 2 new LH catalytic converter-to-exhaust flexible pipe nuts.
    - Tighten the LH catalytic converter-to-exhaust flexible pipe in 3 stages:
        - Stage 1: Tighten the passenger side nut to 5 Nm (44 lb-in).
        - Stage 2: Tighten the driver side nut to 40 Nm (30 lb-ft).

- Stage 3: Tighten the passenger side nut to 40 Nm (30 lb-ft).

3. Install the 2 new RH catalytic converter-to-exhaust flexible pipe nuts.
   - Install a new gasket.
   - Tighten to 40 Nm (30 lb-ft).

All vehicles

4. Install a new gasket and 2 new exhaust flexible pipe-to-catalytic converter nuts.
   - Tighten to 40 Nm (30 lb-ft).
5. If equipped, install the underbody shield and the 6 screws.
6. Start the engine a check for exhaust leaks.

EXHAUST Y-PIPE - 3.5L

REMOVAL AND INSTALLATION

NOTE: Always install new fasteners and gaskets. Clean flange faces prior to new gasket installation to make sure of proper sealing.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. If equipped, remove the 6 screws and the underbody shield.

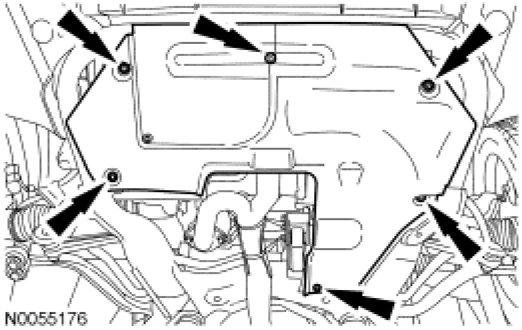


Fig. 24: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

3. Remove and discard the 2 exhaust Y-pipe-to-resonator nuts.
   - Discard the gasket.
   - To install, tighten to 40 Nm (30 lb-ft).
4. Remove and discard the 2 RH catalytic converter-to-exhaust Y-pipe nuts.
   - To install, tighten to 40 Nm (30 lb-ft).
5. Remove and discard the 2 LH catalytic converter-to-exhaust Y-pipe nuts and remove the exhaust Y-pipe.
   - Discard the gasket.

- Tighten in 3 stages:
  - Stage 1: Tighten the passenger side nut to 5 Nm (44 lb-in).
  - Stage 2: Tighten the driver side nut to 40 Nm (30 lb-ft).
  - Stage 3: Tighten the passenger side nut to 40 Nm (30 lb-ft).

6. To install, reverse the removal procedure.
   - Install new gaskets and nuts.
7. Start the engine and check for exhaust leaks.

CATALYTIC CONVERTER - 2.3L, 3.0L

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove and discard the 2 exhaust flexible pipe-to-catalytic converter nuts.
   - Discard the gasket.
   - To install, tighten to 40 Nm (30 lb-ft).
3. Remove the Torca® clamp. For additional information, refer to **Torca® Clamp**.
4. Separate the catalytic converter from the muffler and tailpipe and remove the catalytic converter.
5. To install, reverse the removal procedure.
   - Install a new gasket and nuts.
6. Start the engine and check for exhaust leaks.

RESONATOR - 3.5L

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove and discard the 2 exhaust Y-pipe-to-resonator nuts.
   - Discard the gasket.
   - To install, tighten to 40 Nm (30 lb-ft).
3. Remove the Torca® clamp. For additional information, refer to **Torca® Clamp**.
4. Separate the resonator from the muffler and tailpipe and remove the resonator.
5. To install, reverse the removal procedure.
   - Install a new gasket and nuts.
6. Start the engine and check for exhaust leaks.

MUFFLER AND TAILPIPE

REMOVAL AND INSTALLATION

CAUTION: Do not use oil or grease-based lubricants on the isolators. They may

cause deterioration of the rubber.

CAUTION: Oil or grease-based lubricants on the isolators may cause the exhaust hanger isolator to separate from the exhaust hanger bracket during vehicle operation.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Support the muffler and tailpipe with a suitable jackstand.

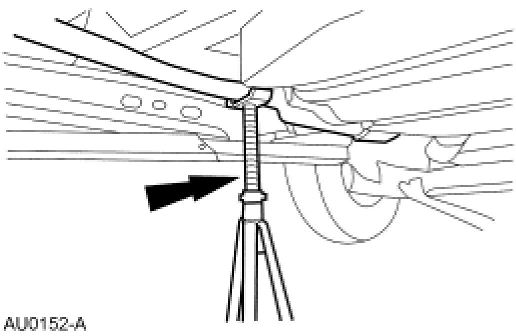


Fig. 25: Supporting Muffler & Tailpipe With A Suitable Jackstand
Courtesy of FORD MOTOR CO.

CAUTION: Do not excessively bend, twist or allow the exhaust to hang from the flexible pipe or damage to the exhaust system may occur.

3. Support the catalytic converter with a suitable jackstand.
4. Disconnect the ground clip from the exhaust hanger.

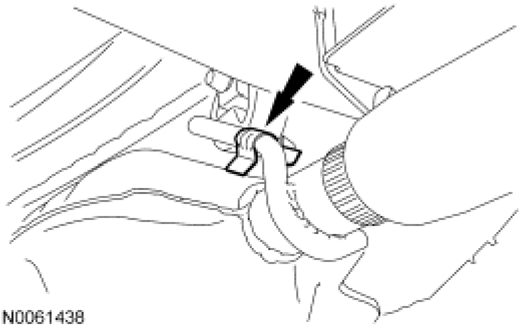


Fig. 26: Locating Ground Clip From Exhaust Hanger
Courtesy of FORD MOTOR CO.

5. Remove the Torca® clamp. For additional information, refer to **Torca® Clamp**.

NOTE: Do not damage or tear the isolators during removal.

6. Using soapy water, separate the 4 or 5 muffler and tailpipe isolators from the vehicle.
7. Separate the muffler and tailpipe from the catalytic converter and remove the muffler and tailpipe.
8. To install, reverse the removal procedure.
    - Inspect and replace any isolators damaged or torn during the removal process.
9. Start the engine and check for exhaust leaks.

2008 ACCESSORIES & BODY, CAB

Exterior Lighting - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Rear lamp assembly nuts	6	-	53
Reversing lamp switch	24	18	-

DESCRIPTION AND OPERATION

EXTERIOR LIGHTING

NOTE: **The smart junction box (SJB) is also known as the generic electronic module (GEM).**

Headlamps - Standard

The standard headlamp system is a quad-beam pattern system. It consists of replaceable low and high beam bulbs. The headlamp assembly has the park/turn indicator lamp integrated into the headlamp assembly. The SJB supplies voltage to the headlamps when demanded.

Headlamps - High Intensity Discharge (HID)

The HID headlamp system is a quad-beam pattern system. It consists of a ballast and replaceable low and high beam bulbs. The headlamp assembly has the park/turn indicator lamp integrated into the headlamp assembly. The SJB supplies voltage to the HID relays and the headlamps when demanded.

AUTOLAMPS

The autolamp system provides light sensitive automatic on/off control of the exterior lamps. The autolamp system keeps the exterior lamps on for a pre-selected period of time after the ignition switch is turned to the OFF position. The pre-selected time delay is adjustable up to approximately 3 minutes.

To program the AUTOLAMPS time delay, refer to **AUTOLAMPS Time Delay Adjustment**.

Vehicles equipped with AUTOLAMPS also have a feature that turns on the exterior lamps when the windshield wipers are turned on. For additional information, refer to **WIPERS AND WASHERS** article.

Stoplamp

The SJB monitors input from the stoplamp switch. The stoplamp are supplied voltage when the brake pedal is

applied.

Turn Signal/Hazard Lamps

When the multifunction switch is placed in the LH or RH TURN positions, the SJB routes voltage to the LH or RH turn signal lamps. The SJB then cycles the voltage on and off approximately 80 times per minute. If a front or rear turn bulb is inoperative, the SJB cycles the voltage on and off approximately 160 times per minute.

The hazard switch is located in the instrument panel center finish panel. When the hazard switch is engaged, the SJB supplies voltage to all the turn lamps. The SJB cycles the voltage on and off approximately 80 times per minute.

Parking Lamps

The SJB supplies voltage to the parking lamps when demanded. The front parking lamps are located in the headlamp assemblies. The rear parking lamps are located in the rear lamp assemblies (and in the reversing lamp assemblies for MKZ).

Fog Lamps

The fog lamp switch is integral to the headlamp switch. When the fog lamp switch is engaged, voltage is supplied by the SJB to the fog lamp relay coil, which then energizes and routes voltage to the fog lamps. The fog lamps can be turned on when the ignition switch is in the RUN or START position, the parking lamps and/or low beam headlamps are on, and the high beam headlamps are off.

Reversing Lamps

Automatic Transaxle

NOTE: The SJB receives a message from the transmission control module (TCM) when the transaxle is in REVERSE (R).

When the transaxle is placed in REVERSE (R), the SJB provides a ground for the reversing lamp relay coil (internal to the SJB). The reversing lamps receive voltage when the reversing lamp relay is energized. The reversing lamps are located within the rear lamp assemblies (Fusion), or the decklid (Milan and MKZ).

Manual Transaxle

When the transaxle is placed in REVERSE (R), the reversing lamp switch closes and provides voltage to the reversing lamps.

Daytime Running Lamps (DRL)

Fusion, Milan

NOTE: The DRL is not a programmable parameter for this vehicle.

This feature illuminates the low beam headlamps at a reduced intensity.

The SJB provides voltage to the DRL when the following conditions exist:

- The ignition switch is in the RUN position
- The low and high beam headlamps have not been activated by any other feature
- If equipped with a manual transaxle, the parking brake is not applied
- If equipped with an automatic transaxle, the transaxle is in any position except PARK (P)

The DRL feature does not affect the operation of any other exterior lighting feature.

MKZ

NOTE: The DRL is not a programmable parameter for this vehicle.

This feature continuously (not flashing) illuminates the front turn signal lamps.

The SJB provides voltage to the DRL when the following conditions exist:

- The ignition switch is in the RUN position
- The low and high beam headlamps have not been activated by any other feature
- The transaxle is in any position except PARK (P)

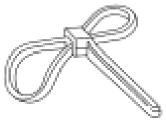
The DRL feature does not affect the operation of any other exterior lighting feature.

DIAGNOSTIC TESTS

HEADLAMPS

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	73III Automotive Meter	105-R0057 or equivalent
 ST1385-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
	Flex Probe Kit	105-R025C or equivalent

 ST1438-A		

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB monitors the headlamp switch position by sending voltage reference signals on multiple circuits to the headlamp switch. At any given time, one of the signal circuits is routed to ground. If the SJB detects any concern with the inputs from the headlamp switch for 5 seconds, the SJB may turn on the exterior lights and keep them on for 10 minutes after the ignition switch is turned off (or 10 minutes from the time the SJB detects any headlamp switch input concern if the ignition switch was already off).

If the SJB detects a concern with the headlamp switch inputs, the SJB implements a planned strategy depending on the inputs received. If this situation occurs, the SJB should **NOT** be ruled immediately as being at fault. This is normal behavior of the SJB design as it has detected a fault with the inputs from the headlamp switch.

The SJB also monitors the multifunction switch for a flash-to-pass or high beam request. There are 2 voltage reference circuits which monitor this. When the multifunction switch is in the FLASH-TO-PASS or HIGH BEAM position, the voltage signal is routed to ground.

NOTE: The flash-to-pass feature does not require any input from the headlamp switch.

When the SJB receives an input requesting the headlamps on, the SJB supplies voltage to the low beam and high beam bulbs as necessary.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
	• Battery junction box (BJB) fuse(s): ○ 19 (40A) (low beams) ○ 26 (15A) (LH high intensity discharge [HID] headlamp)

- Headlamp switch - Multifunction switch - Headlamp assembly	27 (15A) (RH HID headlamp) - Smart junction box (SJB) fuse 11 (15A) (high beams) - Bulb(s) - Wiring, terminals or connectors - Ballast - SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to

MULTIFUNCTION ELECTRONIC MODULES article.

10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1472	Lamp Headlamp Input Circuit Short to Ground	Go to **Pinpoint Test E**.
B1510	Flash To Pass Switch Circuit Short to Ground	Go to **Pinpoint Test E**.
B1570	Lamp Headlamp High-Beam Circuit Short to Ground	Go to **Pinpoint Test E**.
B1578	Lamp Park Input Circuit Short to Ground	Go to **Pinpoint Test E**.
B1795	Lamp Headlamp Low-Beam Circuit Open	If a low beam is inoperative, go to **Pinpoint Test C**. If a low beam is always on, go to **Pinpoint Test E**.
B1797	Lamp Headlamp Low-Beam Circuit Short to Ground	Go to **Pinpoint Test C**.
B2498	Headlamp Switch Multiple Signals Input Active	Go to **Pinpoint Test E**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Fuse(s) • Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• Both low beams are inoperative	• Fuse • Wiring, terminals or connectors • SJB	• Go to **Pinpoint Test A**.
• Both high beams are inoperative	• Wiring, terminals or connectors • Multifunction switch • SJB	• Go to **Pinpoint Test B**.
	• Fuse • Wiring, terminals or	

	connectors • High intensity discharge (HID) relay • HID bulb • Ballast • Headlamp assembly • SJB	
• One low beam headlamp is inoperative		• Go to **Pinpoint Test C**.
• One high beam headlamp is inoperative	• Wiring, terminals or connectors • Headlamp assembly	• Go to **Pinpoint Test D**.
• The headlamps are on continuously	• Wiring, terminals or connectors • HID relay • Headlamp switch • Multifunction switch • SJB	• Go to **Pinpoint Test E**.
• The flash-to-pass feature is inoperative	• Wiring, terminals or connectors • Multifunction switch • SJB	• Go to **Pinpoint Test F**.

Pinpoint Tests

Pinpoint Test A: Both Low Beams Are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Headlamps/AUTOLAMPS for schematic and connector information.

Normal Operation

The battery junction box (BJB) provides voltage to the smart junction box (SJB) through circuit SBB19 (BU/RD) for the low beam operation.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- SJB

PINPOINT TEST A: BOTH LOW BEAMS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 CHECK CIRCUIT SBB19 (BU/RD) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280a

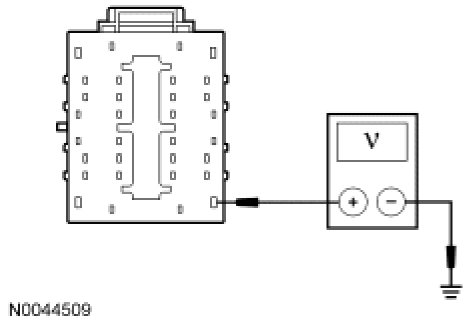


Fig. 1: Checking Circuit SBB19 (BU/RD) For Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the SJB C2280a-4, circuit SBB19 (BU/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A2.

  NO : VERIFY the BJB fuse 19 (40A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

A2 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: Both High Beams Are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Headlamps/AUTOLAMPS for schematic and

connector information.

Normal Operation

When the headlamp switch is placed in the HEADLAMPS ON position, the smart junction box (SJB) monitors the high beam request circuit from the multifunction switch through circuit CLF17 (WH/OG). When the multifunction switch is placed in the HIGH BEAM position, the signal is routed to ground through circuit GD116 (BK/VT). The SJB then energizes an internal relay which routes voltage to the high beam headlamps through circuit CLS08 (VT/GN).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Multifunction switch
- SJB

PINPOINT TEST B: BOTH HIGH BEAMS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Make sure the SJB fuse 11 (15A) is good before continuing diagnostics.

B1 CHECK THE MULTIFUNCTION SWITCH

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB multifunction switch (HBEAMSW) PID while placing the multifunction switch in the HIGH BEAM position.
- **Does the PID indicate the high beam switch is active?**

  YES : Go to B5.

  NO : Go to B2.

B2 CHECK THE MULTIFUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multifunction Switch C202

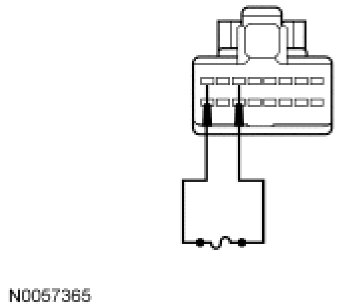


Fig. 2: Connecting Fused Jumper Wire
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the multifunction switch C202-6, circuit CLF17 (WH/OG), harness side and the multifunction switch C202-8, circuit GD145 (BK/BU), harness side.
- Place the headlamp switch in the HEADLAMPS ON position.
- Key in ON position.
- **Do the high beams illuminate?**

  YES : REMOVE the jumper wire. INSTALL a new multifunction switch. REFER to **STEERING COLUMN SWITCHES** article. CLEAR the DTCs. REPEAT the self-test.

  NO : REMOVE the jumper wire. Go to B3.

B3 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

- Key in OFF position.
- Place the headlamp switch in the OFF position.

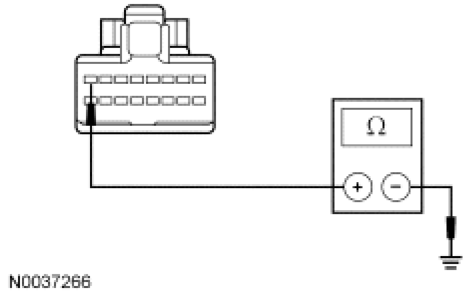


Fig. 3: Checking Circuit GD116 (BK/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the multifunction switch C202-8, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to B4.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B4 CHECK CIRCUIT CLF17 (WH/OG) FOR AN OPEN

- Disconnect: SJB C2280d

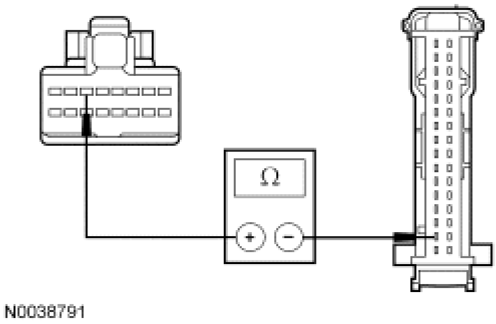


Fig. 4: Checking Circuit CLF17 (WH/OG) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the multifunction switch C202-6, circuit CLF17 (WH/OG), harness side and the SJB C2280d-15, circuit CLF17 (WH/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to B6.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B5 CHECK CIRCUIT CLS08 (VT/GN) FOR AN OPEN

- Disconnect: LH Headlamp C1021
- Disconnect: SJB C2280a

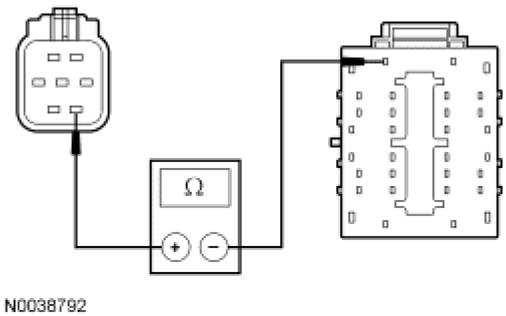


Fig. 5: Checking Circuit CLS08 (VT/GN) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the LH headlamp C1021-7, circuit CLS08 (VT/GN), harness side and the SJB C2280a-30, circuit CLS08 (VT/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to B6.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B6 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.

- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: One Low Beam Headlamp Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Headlamps/AUTOLAMPS for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Fuse and Relay Information for schematic and connector information.

Normal Operation

When the smart junction box (SJB) detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the LOW BEAM position, the SJB provides voltage to circuits CLF04 (BN/BU) and CLF05 (BU/GN).

Halogen Headlamps

Circuits CLF04 (BN/BU) and CLF05 (BU/GN) carry voltage to the LH and RH low beam headlamps, respectively. Ground is supplied on circuits GD121 (BK/YE) and GD123 (BK/GY) for the LH and RH headlamps, respectively.

High Intensity Discharge (HID) Headlamps

Circuits CLF04 (BN/BU) and CLF05 (BU/GN) carry voltage to the LH and RH HID relay coils, respectively. Ground for the HID relay coils is provided through circuit GD121 (BK/YE). Switched voltage for the LH and RH HID relays is provided from the battery junction box (BJB) through circuits SBB26 (YE/RD) and SBB27 (BU/RD), respectively. When the relays are energized, voltage is routed to the LH and RH headlamps through circuits CLF30 (VT/BN) and CLF31 (YE/GY), respectively. Ground is supplied on circuits GD121 (BK/YE) and GD123 (BK/GY) for the LH and RH headlamps, respectively.

- DTC B1795 (Lamp Headlamp Low-Beam Circuit Open) - is a continuous DTC and sets when the SJB detects an open in the LH or RH low beam output circuit.
- DTC B1797 (Lamp Headlamp Low-Beam Circuit Short To Ground) - is a continuous DTC and sets when

the SJB detects a short to ground in the LH or RH low beam output circuit.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- HID relay
- HID bulb
- Ballast
- Headlamp assembly
- SJB

PINPOINT TEST C: ONE LOW BEAM HEADLAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CHECK THE HEADLAMP GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.
- Disconnect: Inoperative Headlamp

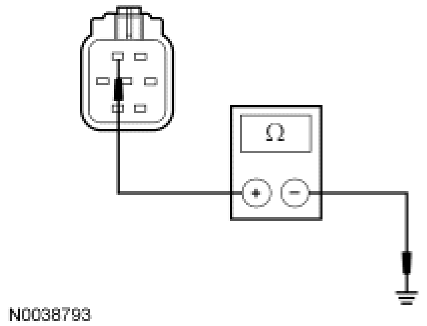


Fig. 6: Checking Headlamp Ground Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the LH headlamp C1021-1, circuit GD121 (BK/YE), harness side and ground; or between the RH headlamp C1041-1, circuit GD123 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to C2.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C2 CHECK FOR VOLTAGE TO THE HEADLAMP

- Place the headlamp switch in the HEADLAMPS ON position.

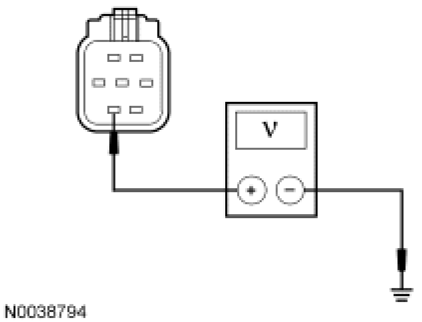


Fig. 7: Checking For Voltage To Headlamp
Courtesy of FORD MOTOR CO.

- Measure the voltage between the inoperative headlamp, harness side and ground as follows:

Inoperative Headlamp	Connector-Pin	Circuit
LH halogen LH HID	C1021-6	CLF04 (BN/BU) CLF30 (VT/BN)
RH halogen RH HID	C1041-6	CLF05 (BU/GN) CLF31 (YE/GY)

- **Is the voltage greater than 10 volts?**

  YES : For HID headlamps, go to C3.

  For halogen headlamps, REPAIR or INSTALL a new headlamp assembly. REFER to **Headlamp Assembly**. CLEAR the DTCs. REPEAT the self-test.

  NO : For HID headlamps, go to C5.

  For halogen headlamps, go to C10.

C3 CHECK THE BALLAST

- Place the headlamp switch in the OFF position.
- Install a known good ballast.
- Place the headlamp switch in the HEADLAMPS ON position.
- **Does the inoperative headlamp now illuminate?**

  YES : REMOVE the known good ballast. INSTALL a new ballast. REFER to **Ballast**. CLEAR the DTCs. REPEAT the self-test.

  NO : REMOVE the known good ballast. Go to C4.

C4 CHECK THE HID BULB

- Place the headlamp switch in the OFF position.
- Install the original ballast.
- Install a known good HID bulb.
- Place the headlamp switch in the HEADLAMPS ON position.
- **Does the inoperative headlamp now illuminate?**

  YES : INSTALL a new HID bulb. REFER to **Headlamp Bulb - LH** or **Headlamp Bulb - RH**. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR or INSTALL a new headlamp assembly. REFER to **Headlamp Assembly**. CLEAR the DTCs. REPEAT the self-test.

C5 CHECK CIRCUIT CLF04 (BN/BU) (LH HEADLAMP) OR CIRCUIT CLF05 (BU/GN) (RH HEADLAMP) FOR VOLTAGE

- Place the headlamp switch in the OFF position.
- Disconnect: Suspect HID Relay
- Place the headlamp switch in the HEADLAMPS ON position.

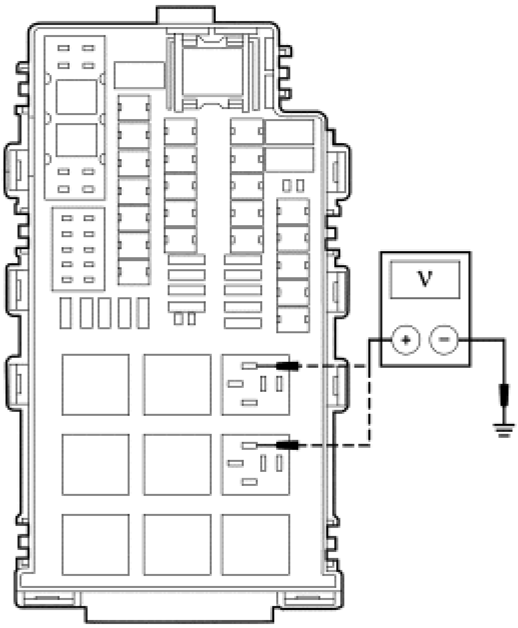


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Fig. 8: Checking Circuit CLF04 (BN/BU) (LH Headlamp) Or Circuit CLF05 (BU/GN) (RH Headlamp) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the LH HID relay pin 85, circuit CLF04 (BN/BU), BJB face side and ground; or between the RH HID relay pin 85, circuit CLF05 (BU/GN), BJB face side and ground.
- **Is the voltage greater than 10 volts?**

  YES : TURN the headlamps off. Go to C7.

NO : TURN the headlamps off. Go to C6.

C6 CHECK CIRCUIT CLF04 (BN/BU) (LH HEADLAMP) OR CIRCUIT CLF05 (BU/GN) (RH HEADLAMP) FOR AN OPEN OR SHORT TO GROUND (HID HEADLAMPS)

- Disconnect: SJB C2280a
- Measure the resistance between the suspect HID relay, BJB face side and the SJB, harness side; and between the suspect HID relay, BJB face side and ground as follows:

Inoperative Headlamp	Suspect Relay	SJB Connector-Pin	Circuit
LH	LH HID relay pin 85	C2280a-5	CLF04 (BN/BU)
RH	LH HID relay pin 85	C2280a-6	CLF05 (BU/GN)

- **Is the resistance less than 5 ohms between the HID relay and the SJB, and greater than 10,000 ohms between the HID relay and ground?**

  YES : Go to C11.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C7 CHECK CIRCUIT SBB26 (YE/RD) (LH HID RELAY) OR CIRCUIT SBB27 (BU/RD) (RH HID RELAY) FOR VOLTAGE

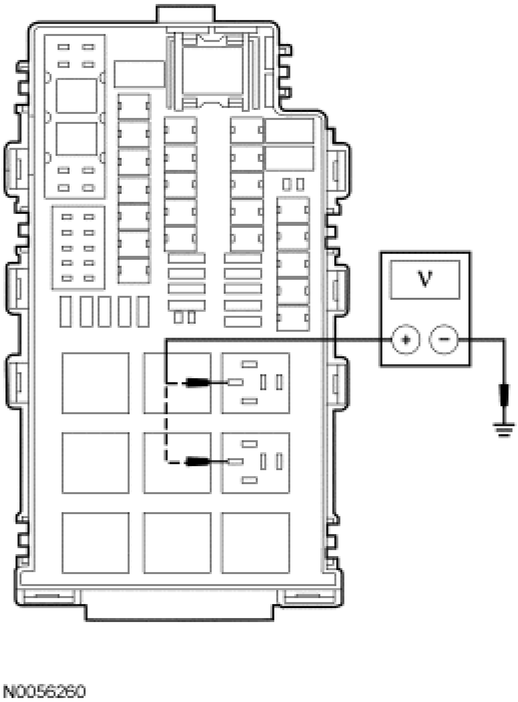

Fig. 9: Checking Circuit SBB26 (YE/RD) (LH HID Relay) Or Circuit SBB27 (BU/RD) (Rh HID Relay) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the LH HID relay pin 30, circuit SBB26 (YE/RD), BJB face side and ground; or between the RH HID relay pin 30, circuit SBB27 (BU/RD), BJB face side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to C8.

  NO : VERIFY the BJB fuse 26 (15A) (LH HID relay) or fuse 27 (15A) (RH HID relay) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C8 CHECK THE HID RELAY GROUND CIRCUIT FOR AN OPEN

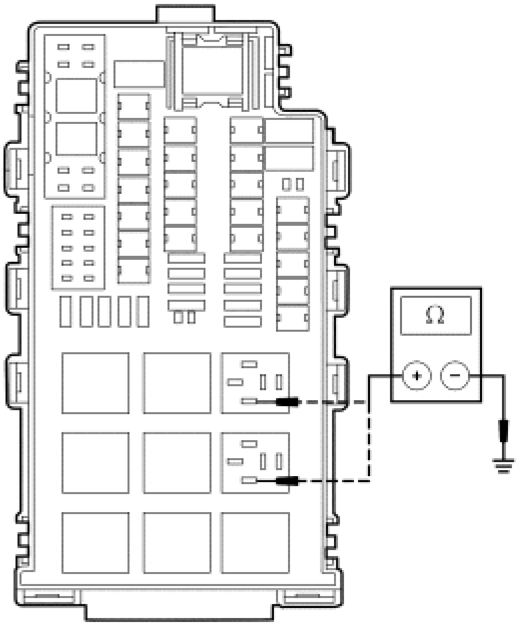

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Fig. 10: Checking HID Relay Ground Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the LH HID relay pin 86, circuit GD121 (BK/YE), BJB face side and ground; or between the RH HID relay pin 86, circuit GD121 (BK/YE), BJB face side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to C9.

  NO : REPAIR circuit GD121 (BK/YE). CLEAR the DTCs. REPEAT the self-test.

C9 CHECK THE HID RELAY

- Substitute a known good relay and recheck the headlamp operation.
- **Does the headlamp in question operate correctly?**

  YES : REMOVE the known good relay. INSTALL a new HID relay. CLEAR the DTCs. REPEAT the self-test.

  NO : REMOVE the known good relay. REPAIR circuit CLF30 (VT/BN) (LH HID relay) or circuit CLF31 (YE/GY) (RH HID relay) as necessary. CLEAR the DTCs. REPEAT the self-test.

C10 CHECK CIRCUIT CLF04 (BN/BU) (LH HEADLAMP) OR CIRCUIT CLF05 (BU/GN) (RH HEADLAMP) FOR AN OPEN OR SHORT TO GROUND (HALOGEN HEADLAMPS)

- Disconnect: SJB C2280a
- Measure the resistance between the inoperative headlamp, harness side and the SJB, harness side; and between the inoperative headlamp, harness side and ground as follows:

Inoperative	Headlamp Connector-	SJB Connector-	Circuit

Headlamp	Pin	Pin	
LH	C1021-6	C2280a-5	CLF04 (BN/BU)
RH	C1041-6	C2280a-6	CLF05 (BU/GN)

- **Is the resistance less than 5 ohms between the headlamp and the SJB, and greater than 10,000 ohms between the headlamp and ground?**

  YES : Go to C11.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C11 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: One High Beam Headlamp Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Headlamps/AUTOLAMPS for schematic and connector information.

Normal Operation

When the smart junction box (SJB) detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the HIGH BEAM position, the SJB energizes an internal relay which routes voltage through circuit CLS08 (VT/GN) to the high beam headlamps. Ground is supplied on circuits GD121 (BK/YE) and GD123 (BK/GY) for the LH and RH high beam headlamps, respectively.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Headlamp assembly

PINPOINT TEST D: ONE HIGH BEAM HEADLAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

D1 CHECK CIRCUIT GD121 (BK/YE) (LH HEADLAMP) OR CIRCUIT GD123 (BK/GY) (RH HEADLAMP) FOR AN OPEN

- Key in OFF position.
- Disconnect: Inoperative Headlamp

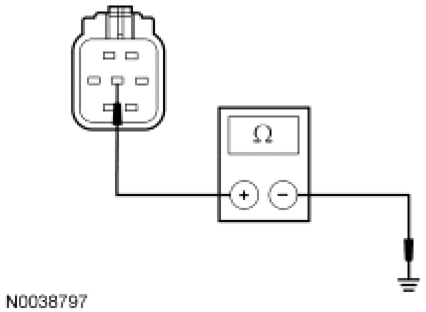

Fig. 11: Checking Circuit GD121 (BK/YE) (LH Headlamp) Or Circuit GD123 (BK/GY) (RH Headlamp) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the LH headlamp C1021-4, circuit GD121 (BK/YE), harness side and ground; or between the RH headlamp C1041-4, circuit GD123 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to D2.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

D2 CHECK CIRCUIT CLS08 (VT/GN) FOR AN OPEN

- Place the headlamp switch in the HEADLAMPS ON position.
- Place the multifunction switch in the HIGH BEAM position.

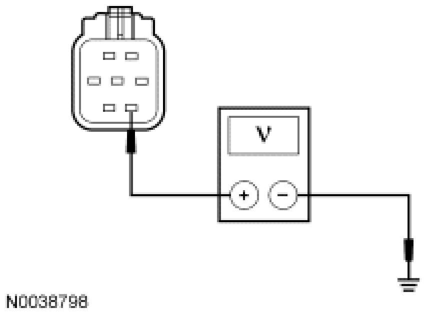

Fig. 12: Checking Circuit CLS08 (VT/GN) For Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the LH headlamp C1021-7, circuit CLS08 (VT/GN), harness side and ground; or between the RH headlamp C1041-7, circuit CLS08 (VT/GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : REPAIR or INSTALL a new headlamp assembly. REFER to **Headlamp Assembly**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test E: The Headlamps Are On Continuously

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Headlamps/AUTOLAMPS for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Fuse and Relay Information for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends reference signals to the headlamp switch through circuits CLF18 (BU/WH), CLF19 (VT/GN), CLF23 (WH/VT) and CLS34 (GY). At any given time, the headlamp switch routes one of the input circuits to ground through circuit GD116 (BK/VT). When the SJB detects the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the LOW BEAM position, the SJB provides voltage to circuits CLF04 (BN/BU) and CLF05 (BU/GN).

Halogen Low Beam Headlamps

Circuits CLF04 (BN/BU) and CLF05 (BU/GN) carry voltage to the LH and RH low beam headlamps, respectively.

High Intensity Discharge (HID) Low Beam Headlamps

Circuits CLF04 (BN/BU) and CLF05 (BU/GN) carry voltage to the LH and RH HID relay coils, respectively. When the relays are energized, voltage is routed to the LH and RH headlamps through circuit CLF30 (VT/BN) and circuit CLF31 (YE/GY), respectively.

High Beam Headlamps

The SJB sends a reference signal to the multifunction switch through circuits CLF27 (GN/BN) and CLF17 (WH/OG). When the multifunction switch is placed in the FLASH-TO-PASS or HIGH BEAM position, the voltage signal is routed to ground.

When the SJB detects a request for flash-to-pass (regardless of headlamp switch position), or the headlamp switch in the HEADLAMPS ON position and the multifunction switch in the HIGH BEAM position, the SJB energizes an internal relay which routes voltage through circuit CLS08 (VT/GN) to the high beam headlamps.

DTC - Description	Fault Trigger Conditions

B1472 - Lamp Headlamp Input Circuit Short to Ground	An on-demand DTC that sets when the SJB detects the headlamps on input circuit is short to ground.
B1510 - Flash To Pass Switch Circuit Short To Ground	An on-demand DTC that sets when the SJB detects the high beam request input circuit is short to ground.
B1570 - Lamp Headlamp High-Beam Circuit Short To Ground	An on-demand DTC that sets when the SJB detects the high beam request input circuit is short to ground.
B1578 - Lamp Park Input Circuit Short To Ground	An on-demand DTC that sets when the SJB detects a short to ground in the parking lamps on input circuit.
B1795 - Lamp Headlamp Low-Beam Circuit Open	A continuous DTC and sets when the SJB detects an open in the LH or RH low beam output circuit.
B2498 - Headlamp Switch Multiple Signals Input Active	A continuous DTC that sets when the SJB detects no inputs from the headlamp switch or multiple headlamp switch requests at the same time.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- HID relay
- Headlamp switch
- Multifunction switch
- SJB

PINPOINT TEST E: THE HEADLAMPS ARE ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

E1 VERIFY THE HEADLAMP OPERATION

- Key in ON position.
- **Are the low beams illuminated?**

  YES : Go to E2.

  NO : Go to E10.

E2 CHECK THE SJB HEADLAMP SWITCH PIDs

- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB headlamp switch PIDs while moving the headlamp switch through all positions. Refer to the following table.

SJB PIDs	Monitored Switch Position

AUTOLMP	AUTOLAMPS
HLMPOFF	Off
P_LMP_SW	Parking Lamps
LBEAMSW	Headlamps

- **Do the headlamp switch positions agree with the PIDs?**

  YES : Go to E7.

  NO : Go to E3.

E3 CHECK THE HEADLAMP SWITCH

- Key in OFF position.
- Disconnect: Headlamp Switch C205
- Carry out the headlamp switch component test. Refer to COMPONENT TESTING.
- **Is the headlamp switch OK?**

  YES : Go to E4.

  NO : INSTALL a new headlamp switch. REFER to **Headlamp Switch**. CLEAR the DTCs. REPEAT the self-test.

E4 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

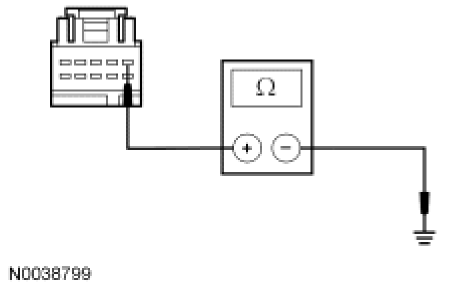

Fig. 13: Checking Circuit GD116 (BK/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the headlamp switch C205-1, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to E5.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

E5 CHECK THE HEADLAMP SWITCH INPUT CIRCUITS FOR A SHORT TO GROUND

- Disconnect: SJB C2280d
- Measure the resistance between the headlamp switch, harness side and ground as follows:

Headlamp Switch	Circuit

Connector-Pin	
C205-9 (if equipped with AUTOLAMPS)	CLF19 (VT/GN)
C205-4	CLF23 (WH/VT)
C205-3	CLS34 (GY)
C205-8	CLF18 (BU/WH)

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to E6.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E6 CHECK THE HEADLAMP SWITCH INPUT CIRCUITS FOR AN OPEN

- Measure the resistance between the headlamp switch, harness side and the SJB, harness side as follows:

Headlamp Switch Connector-Pin	SJB Connector-Pin	Circuit
C205-9 (if equipped with AUTOLAMPS)	C2280d-19	CLF19 (VT/GN)
C205-4	C2280d-30	CLF23 (WH/VT)
C205-3	C2280d-5	CLS34 (GY)
C205-8	C2280d-29	CLF18 (BU/WH)

- **Are the resistances less than 5 ohms?**

  YES : Go to E14.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E7 CHECK THE SJB OUTPUT

- Disconnect: SJB C2280a
- **Does the LH or RH headlamp continue to illuminate?**

  YES : For halogen headlamps, REPAIR circuit CLF04 (BN/BU) (LH headlamp) or circuit CLF05 (BU/GN) (RH headlamp) as necessary. CLEAR the DTCs. REPEAT the self-test.

  For HID headlamps, go to E8.

  NO : Go to E14.

E8 CHECK CIRCUITS CLF30 (VT/BN) (LH HEADLAMP) AND CLF31 (YE/GY) (RH HEADLAMP) FOR A SHORT TO VOLTAGE

- Disconnect: Suspect HID Relay
- **Does the LH or RH headlamp continue to illuminate?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to E9.

E9 CHECK THE HID RELAY

- Carry out the HID relay component test. Refer to COMPONENT TESTING.
- **Is the HID relay OK?**

  YES : REPAIR circuit CLF04 (BN/BU) (LH HID relay) or circuit CLF05 (BU/GN) (RH HID relay) as necessary. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL a new HID relay. CLEAR the DTCs. REPEAT the self-test.

E10 RETRIEVE THE RECORDED DTCs FROM THE SJB SELF-TEST

- Check the recorded results from the SJB self-test.
- **Is DTC B1510 or B1570 present?**

  YES : Go to E11.

  NO : Go to E13.

E11 CHECK THE MULTIFUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multifunction Switch C202
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB Self-Test
- Clear the DTCs and repeat the SJB on-demand self-test.
- **Is DTC B1510 or B1570 still present?**

  YES : Go to E12.

  NO : INSTALL a new multifunction switch. REFER to **STEERING COLUMN SWITCHES** article. CLEAR the DTCs. REPEAT the self-test.

E12 CHECK CIRCUIT CLF17 (WH/OG) (HIGH BEAM) OR CIRCUIT CLF27 (GN/BN) (FLASH-TO-PASS) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280d

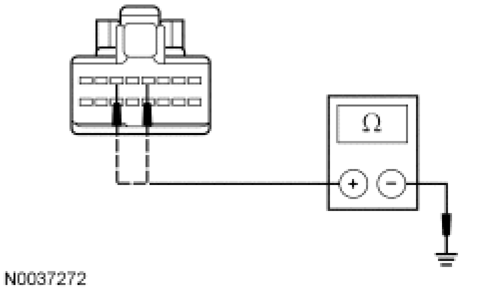

Fig. 14: Checking Circuit CLF17 (WH/OG) (High Beam) Or Circuit CLF27 (GN/BN) (Flash-To-Pass) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the multifunction switch C202-6, circuit CLF17 (WH/OG), harness side and ground; and between the multifunction switch C202-4, circuit CLF27 (GN/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to E14.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E13 CHECK CIRCUIT CLS08 (VT/GN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280a
- Key in ON position.
- **Do the headlamps continue to illuminate?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to E14.

E14 CHECK FOR CORRECT SJB OPERATION

- Key in OFF position.
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: The Flash-To-Pass Feature Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Headlamps/AUTOLAMPS for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a reference signal to the multifunction switch through circuit CLF27 (GN/BN). When the multifunction switch is placed in the FLASH-TO-PASS position, the voltage signal is routed to ground. When the SJB detects a request for the flash-to-pass, the SJB energizes an internal relay which routes voltage to the high beams.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Multifunction switch
- SJB

PINPOINT TEST F: THE FLASH-TO-PASS FEATURE IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

F1 VERIFY THE HIGH BEAM HEADLAMP OPERATION

- Key in ON position.
- Place the headlamp switch in the HEADLAMPS ON position.
- Place the multifunction switch in the HIGH BEAM position while observing the headlamps.
- **Do the high beam headlamps illuminate?**

  YES : Go to F2.

  NO : Go to **Pinpoint Test B**.

F2 CHECK THE MULTIFUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multifunction Switch C202

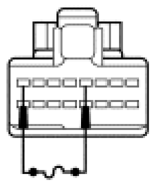

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Fig. 15: Checking Multifunction Switch
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the multifunction switch C202-4, circuit CLF27 (GN/BN), harness side and the multifunction switch C202-8, circuit GD116 (BK/VT), harness side.
- **Do the high beam headlamps illuminate?**

  YES : INSTALL a new multifunction switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

  NO : REMOVE the jumper wire. Go to F3.

F3 CHECK CIRCUIT CLF27 (GN/BN) FOR AN OPEN

- Disconnect: SJB C2280d

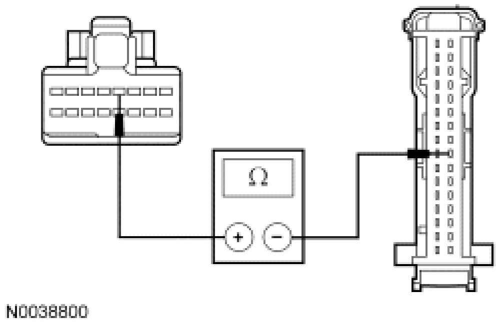


Fig. 16: Checking Circuit CLF27 (GN/BN) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the multifunction switch C202-4, circuit CLF27 (GN/BN), harness side and the SJB C2280d-25, circuit CLF27 (GN/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to F4.

  NO : REPAIR the circuit. TEST the system for normal operation.

F4 CHECK FOR CORRECT SJB OPERATION

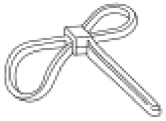
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

AUTOLAMPS

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	73III Automotive Meter	105-R0057 or equivalent
 ST1385-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST1438-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB monitors the headlamp switch position by sending voltage reference signals on multiple circuits to the headlamp switch. At any given time, one of the signal circuits is routed to ground. If the SJB detects any concern with the inputs from the headlamp switch for 5 seconds, the SJB may turn on the exterior lights and keep them on for 10 minutes after the ignition switch is turned off (or 10 minutes from the time the SJB detects any headlamp switch input concern if the ignition switch was already off).

If the SJB detects a concern with the headlamp switch inputs, the SJB implements a planned strategy depending on the inputs received. If this situation occurs, the SJB should **NOT** be ruled immediately as being at fault. This is normal behavior of the SJB design as it has detected a fault with the inputs from the headlamp switch.

The SJB also monitors the light sensor with a voltage reference signal. The light sensor input to the SJB varies with the ambient light conditions.

When the SJB receives an input from the headlamp switch indicating a request for the AUTOLAMPS, the SJB monitors the light sensor for the ambient light condition. If the SJB determines the ambient light level is dark, the SJB supplies voltage to the exterior lamps.

Vehicles equipped with AUTOLAMPS also have a feature that turns on the exterior lamps when the windshield wipers are on. When the SJB detects a ground signal from the windshield wiper motor, the SJB turns the exterior lamps on. For additional information, refer to **WIPERS AND WASHERS** article.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Headlamp switch	• Wiring, terminals or connectors • Light sensor • Smart junction box (SJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.

9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1472	Lamp Headlamp Input Circuit Short to Ground	Go to **Pinpoint Test H**.
B1578	Lamp Park Input Circuit Short to Ground	Go to **Pinpoint Test H**.
B1692	Autolamp Delay Circuit Short to Ground	Go to **Pinpoint Test H**.
B1791	Autolamp Sensor Input Circuit Open	Go to **Pinpoint Test H**.
B1793	Autolamp Sensor Input Circuit Short to Ground	Go to **Pinpoint Test G**.
B2498	Headlamp Switch Multiple Signals Input Active	Go to **Pinpoint Test H**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Fuse(s) • Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The AUTOLAMPS are inoperative	• Wiring, terminals or connectors • Light sensor • SJB	• Go to **Pinpoint Test G**.
• The AUTOLAMPS are on continuously	• Wiring, terminals or connectors • Light sensor • Headlamp switch • SJB	• Go to **Pinpoint Test H**.

Pinpoint Tests

Pinpoint Test G: The AUTOLAMPS Are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Headlamps/AUTOLAMPS for schematic and connector information.

Normal Operation

When the headlamp switch is in the AUTOLAMPS ON position, the smart junction box (SJB) monitors the light sensor by sending a voltage reference signal through circuit VLF14 (BU/BN). Ambient lighting to the light sensor changes the voltage by varying the resistance to ground. Ground for the light sensor is provided by circuit GD116 (BK/VT).

When the ambient level has reached a point (determined by the internal programming of the SJB), the SJB provides voltage to the exterior lamps.

- DTC B1793 (Autolamp Sensor Input Circuit Short To Ground) - is a continuous DTC that sets when the SJB detects a short to ground on the light sensor input circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Light sensor
- SJB

PINPOINT TEST G: THE AUTOLAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

G1 RETRIEVE THE RECORDED DTCs FROM THE SJB SELF-TEST

- Key in OFF position.
- Retrieve the recorded results from the SJB self-test.
- **Was DTC B1793 recorded?**

  YES : Go to G3.

  NO : Go to G2.

G2 CHECK THE MANUAL HEADLAMP OPERATION

- Place the headlamp switch in the HEADLAMPS ON position.
- **Do the headlamps operate correctly?**

  YES : Go to G3.

  NO : REFER to **Headlamps**.

G3 CHECK FOR VOLTAGE TO THE LIGHT SENSOR

- Disconnect: Light Sensor C286

- Key in ON position.
- Place the headlamp switch in the AUTOLAMPS ON position.

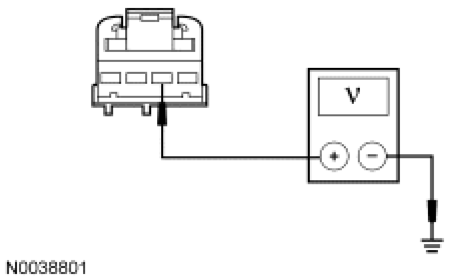


Fig. 17: Checking For Voltage To Light Sensor
Courtesy of FORD MOTOR CO.

- Measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.
- **Is the voltage approximately 5 volts?**

  YES : INSTALL a new light sensor. REFER to **Light Sensor**. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to G4.

G4 CHECK CIRCUIT VLF14 (BU/BN) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280d

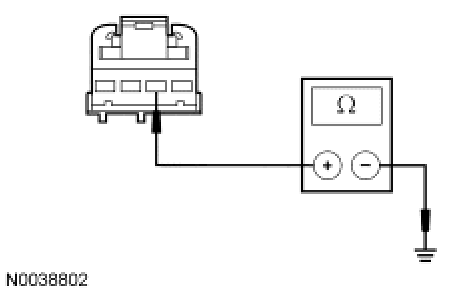


Fig. 18: Checking Circuit VLF14 (BU/BN) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to G5.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

G5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test H: The AUTOLAMPS Are On Continuously

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Headlamps/AUTOLAMPS for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends reference signals to the headlamp switch through circuits CLF18 (BU/WH), CLF19 (VT/GN), CLF23 (WH/VT) and CLS34 (GY). The SJB also sends a reference signal to the light sensor through circuit VLF14 (BU/BN). Ground for the light sensor is provided through circuit GD116 (BK/VT).

When the headlamp switch is placed in the AUTOLAMPS ON position, the voltage signal is routed to ground through circuit GD116 (BK/VT). The light sensor determines the amount of light based on the input received from the ambient sky conditions. When the ambient level has reached a point (determined by the internal programming of the SJB), the SJB provides voltage to the exterior lamps.

DTC Description	Fault Trigger Conditions
B1472 - Lamp Headlamp Input Circuit Short to Ground	An on-demand DTC that sets when the SJB detects the headlamps on input circuit is short to ground.
B1578 - Lamp Park Input Circuit Short To Ground	An on-demand DTC that sets when the SJB detects a short to ground in the parking lamps on input circuit.
B1692 - Autolamp Delay Circuit Short To Ground	An on-demand code that sets when the SJB detects a short to ground in the AUTOLAMPS on input circuit.
B1791 - Autolamp Sensor Input Circuit Open	A continuous code that sets when the SJB detects an open on the light sensor input circuit.
B2498 - Headlamp Switch Multiple Signals Input Active	A continuous DTC that sets when the SJB detects no inputs from the headlamp switch or multiple headlamp switch requests at the same time.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Light sensor
- Headlamp switch
- SJB

PINPOINT TEST H: THE AUTOLAMPS ARE ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

H1 RETRIEVE THE RECORDED DTCs FROM THE SJB SELF-TEST

- Retrieve the recorded results from the SJB self-test.
- **Is DTC B1791 recorded?**

  YES : Go to H7.

  NO : Go to H2.

H2 CHECK THE SJB HEADLAMP SWITCH PIDs

- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB headlamp switch PIDs while moving the headlamp switch through all positions. Refer to the following table.

SJB PIDs	Monitored Switch Position
AUTOLMP	AUTOLAMPS
HLMPOFF	Off
P_LMP_SW	Parking Lamps
LBEAMSW	Headlamps

- **Do the headlamp switch positions agree with the PIDs?**

  YES : Go to H7.

  NO : Go to H3.

H3 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN (HEADLAMP SWITCH)

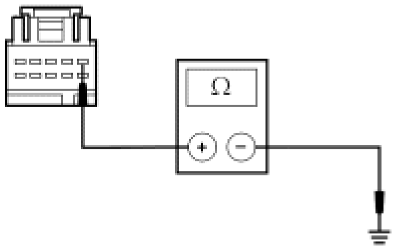


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Fig. 19: Checking Circuit GD116 (BK/VT) For An Open (Headlamp Switch)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the headlamp switch C205-1, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to H4.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

H4 CHECK THE HEADLAMP SWITCH

- Key in OFF position.
- Disconnect: Headlamp Switch C205
- Carry out the headlamp switch component test. Refer to COMPONENT TESTING.
- **Is the headlamp switch OK?**

  YES : Go to H5.

  NO : INSTALL a new headlamp switch. REFER to **Headlamp Switch**. CLEAR the DTCs. REPEAT the self-test.

H5 CHECK THE HEADLAMP SWITCH INPUT CIRCUITS FOR A SHORT TO GROUND

- Disconnect: SJB C2280d
- Measure the resistance between the headlamp switch, harness side and ground as follows:

Headlamp Switch Connector-Pin	Circuit
C205-9	CLF19 (VT/GN)
C205-4	CLF23 (WH/VT)
C205-3	CLS34 (GY)
C205-8	CLF18 (BU/WH)

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to H6.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

H6 CHECK THE HEADLAMP SWITCH INPUT CIRCUITS FOR AN OPEN

- Measure the resistance between the headlamp switch, harness side and the SJB, harness side as follows:

Headlamp Switch	SJB	

Connector-Pin	Connector-Pin	Circuit
C205-9	C2280d-19	CLF19 (VT/GN)
C205-4	C2280d-30	CLF23 (WH/VT)
C205-3	C2280d-5	CLS34 (GY)
C205-8	C2280d-29	CLF18 (BU/WH)

- **Are the resistances less than 5 ohms?**

  YES : Go to H11.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

H7 CHECK FOR VOLTAGE TO THE LIGHT SENSOR

- Key in OFF position.
- Disconnect: Light Sensor C286
- Key in ON position.
- Place the headlamp switch in the AUTOLAMPS ON position.

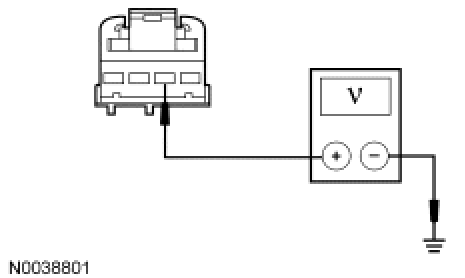

Fig. 20: Checking For Voltage To Light Sensor
Courtesy of FORD MOTOR CO.

- Measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.
- **Is the voltage approximately 5 volts?**

  YES : If DTC B1791 was **not** present, INSTALL a new light sensor. REFER to **Light Sensor**. TEST the system for normal operation.

  If DTC B1791 was present, go to H8.

  NO : Go to H9.

H8 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN (LIGHT SENSOR)

- Place the headlamp switch in the OFF position.

- Key in OFF position.

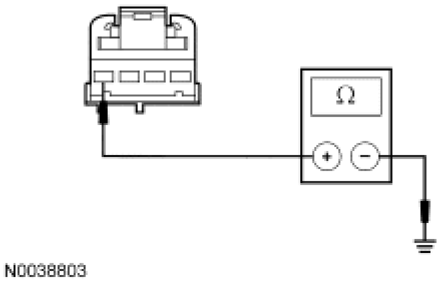

Fig. 21: Checking Circuit GD116 (BK/VT) For An Open (Light Sensor)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the light sensor C286-4, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new light sensor. REFER to **Light Sensor**. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

H9 CHECK CIRCUIT VLF14 (BU/BN) FOR A SHORT TO VOLTAGE

- Place the headlamp switch in the OFF position.
- Key in OFF position.
- Disconnect: SJB C2280d
- Key in ON position.

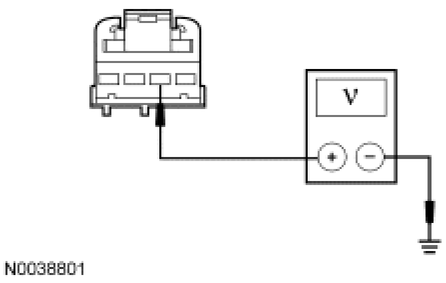

Fig. 22: Checking For Voltage To Light Sensor
Courtesy of FORD MOTOR CO.

- Measure the voltage between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to H10.

H10 CHECK CIRCUIT VLF14 (BU/BN) FOR AN OPEN

- Key in OFF position.

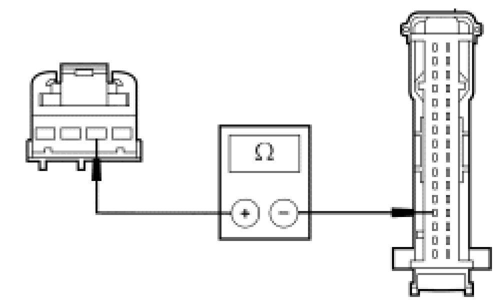

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Fig. 23: Checking Circuit VLF14 (BU/BN) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the light sensor C286-2, circuit VLF14 (BU/BN), harness side and the SJB C2280d-13, circuit VLF14 (BU/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to H11.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

H11 CHECK FOR CORRECT SJB OPERATION

- Key in OFF position.
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

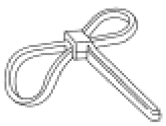
  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

STOPLAMP

Special Tools

Illustration	Tool Name	Tool Number

 ST1185-A	73III Automotive Meter	105-R0057 or equivalent
 ST1385-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST1438-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB monitors the input from the stoplamp switch. When the brake pedal is applied, voltage is routed to the SJB. The SJB then supplies voltage to the stoplamp.

On vehicles with combination rear stop/turn lamps, the turn and hazard lamp functions override the rear stoplamp function.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Stoplamp switch	• Smart junction box (SJB) fuse 21 (7.5A) (stoplamp switch) • Bulb(s) • Wiring, terminals or connectors • Rear lamp assembly • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1485	Brake Pedal Input Short to Battery	Go to **Pinpoint Test K**.
B2048	Left Rear Turn Lamp Circuit Short to Ground	For Fusion, go to **Pinpoint Test J**. For Milan or MKZ, REFER to **Turn Signal and Hazard Lamps**.

B2049	Left Rear Turn Lamp Circuit Open	For Fusion, if the lamp is inoperative, go to **Pinpoint Test J**. For Fusion, if the lamp is always on, go to **Pinpoint Test K**. For Milan or MKZ, REFER to **Turn Signal and Hazard Lamps**.
B2050	Right Rear Turn Lamp Circuit Short to Ground	For Fusion, go to **Pinpoint Test J**. For Milan or MKZ, REFER to **Turn Signal and Hazard Lamps**.
B2051	Right Rear Turn Lamp Circuit Open	For Fusion, if the lamp is inoperative, go to **Pinpoint Test J**. For Fusion, if the lamp is always on, go to **Pinpoint Test K**. For Milan or MKZ, REFER to **Turn Signal and Hazard Lamps**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Fuse(s) • Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• All the stoplamp are inoperative	• Fuse • Wiring, terminals or connectors • Stoplamp switch • SJB	• Go to **Pinpoint Test I**.
• One or more stoplamp are inoperative	• Wiring, terminals or connectors • High mounted stoplamp • Rear lamp assembly • SJB	• Go to **Pinpoint Test J**.
• The stoplamp are on continuously	• Wiring, terminals or connectors • Stoplamp switch • PCM	• Go to **Pinpoint Test K**.

	• SJB	

Pinpoint Tests

Pinpoint Test I: All The Stoplamp Are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

For all vehicles, the stoplamp switch is supplied voltage through circuit SBP04 (GN/RD) from the smart junction box (SJB). When the brake pedal is applied, the stoplamp switch routes voltage to the SJB through circuit CCB08 (VT/WH).

For Fusion, the SJB provides voltage to the rear stoplamp.

For Milan and MKZ, the voltage is routed through the SJB to all the stoplamp through circuit CLS17 (YE/GY).

This pinpoint test is intended to diagnose the following:

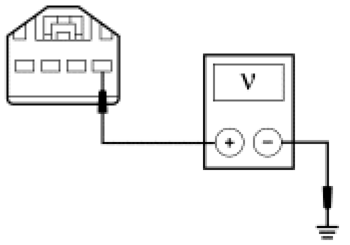
- Fuse
- Wiring, terminals or connectors
- Stoplamp switch
- SJB

PINPOINT TEST I: ALL THE STOPLAMP ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

I1 CHECK CIRCUIT SBP04 (GN/RD) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Stoplamp Switch C278



N0038805

Fig. 24: Checking Circuit SBP04 (GN/RD) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the stoplamp switch C278-1, circuit SBP04 (GN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to I3.

  NO : VERIFY the SJB fuse 21 (7.5A) is OK. If OK, go to I2.

I2 CHECK CIRCUIT SBP04 (GN/RD) FOR AN OPEN

- Disconnect: SJB C2280a

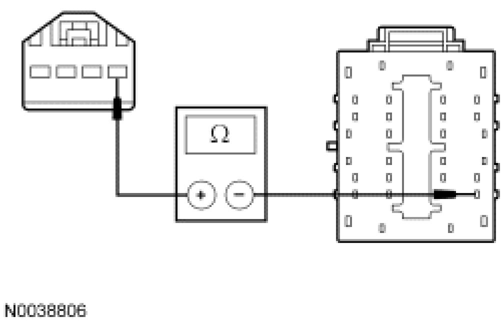


Fig. 25: Checking Circuit SBP04 (GN/RD) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the stoplamp switch C278-1, circuit SBP04 (GN/RD), harness side and the SJB C2280a-8, circuit SBP04 (GN/RD), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to I6.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

I3 CHECK THE STOPLAMP SWITCH

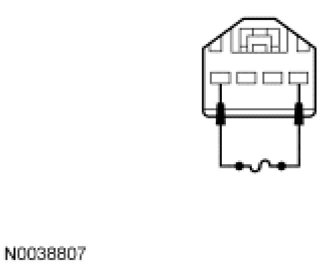


Fig. 26: Checking Stoplamp Switch
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the stoplamp switch C278-1, circuit SBP04 (GN/RD),

harness side and the stoplamp switch C278-4, circuit CCB08 (VT/WH), harness side.

- **Are the stoplamp illuminated?**

  YES : REMOVE the jumper wire. INSTALL a new stoplamp switch. REFER to **Stoplamp Switch**. CLEAR the DTCs. REPEAT the self-test.

  NO : REMOVE the jumper wire. Go to I4.

I4 CHECK CIRCUIT CCB08 (VT/WH) FOR AN OPEN

- Disconnect: SJB C2280a

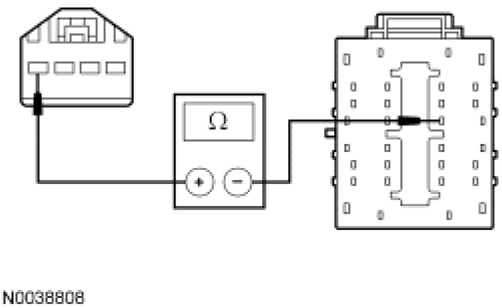


Fig. 27: Checking Circuit CCB08 (VT/WH) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the stoplamp switch C278-4, circuit CCB08 (VT/WH), harness side and the SJB C2280a-19, circuit CCB08 (VT/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : For Fusion, go to I6.

  For Milan or MKZ, go to I5.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

I5 CHECK CIRCUIT CLS17 (YE/GY) FOR AN OPEN

- Disconnect: SJB C2280e
- Disconnect: High Mounted Stoplamp C475 (Parcel Shelf) or C4111 (Spoiler)

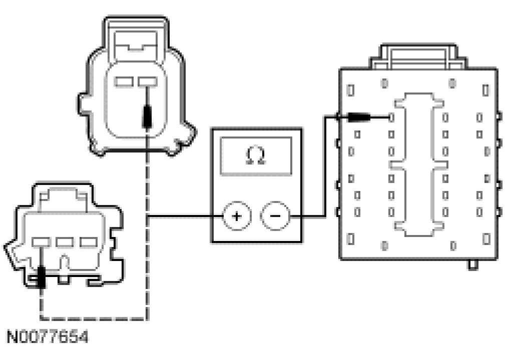


Fig. 28: Checking Circuit CLS17 (YE/GY) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the high mounted stoplamp C475-1 (parcel shelf) or C4111-1 (spoiler), circuit CLS17 (YE/GY), harness side and the SJB C2280e-26, circuit CLS17 (YE/GY), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to I6.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

I6 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test J: One Or More Stoplamp Are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation - Fusion

When the brake pedal is applied, the stoplamp switch routes voltage to the smart junction box (SJB). The voltage is then routed through the SJB to the high mounted stoplamp through circuit CLS17 (YE/GY). When the SJB detects the brake pedal applied, the SJB provides voltage to the LH and RH rear stoplamp through circuits CLS18 (GY/BN) and CLS19 (VT/OG), respectively. Ground for the rear stoplamp is provided through circuit GD171 (BK/GY).

Milan, MKZ

When the SJB detects the brake pedal applied, voltage is routed through the SJB to the stoplamp through circuit CLS17 (YE/GY). Ground for the stoplamp is provided through circuit GD171 (BK/GY).

The rear lamps contain electronics that modulate the voltage frequency to the LED bulbs.

DTC Description	Fault Trigger Conditions
B2048 - Left Rear Turn Lamp Circuit Short to	A continuous DTC that sets when the SJB detects a short to ground on the LH rear stop/turn lamp

Ground	voltage supply circuit.
B2049 - Left Rear Turn Lamp Circuit Open	A continuous DTC that sets when the SJB detects an open on the LH rear stop/turn lamp voltage supply circuit.
B2050 - Right Rear Turn Lamp Circuit Short to Ground	A continuous DTC that sets when the SJB detects a short to ground on the RH rear stop/turn lamp voltage supply circuit.
B2051 - Right Rear Turn Lamp Circuit Open	A continuous DTC that sets when the SJB detects an open on the RH rear stop/turn lamp voltage supply circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- High mounted stoplamp
- Rear lamp assembly
- SJB

PINPOINT TEST J: ONE OR MORE STOPLAMP ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

J1 DETERMINE THE INOPERATIVE STOPLAMP

- Key in OFF position.
- Apply the brake pedal.
- Check the high mounted stoplamp.
- **Is the high mounted stoplamp illuminated?**

  YES : Go to J5.

  NO : Go to J2.

J2 CHECK CIRCUIT GD171 (BK/GY) FOR AN OPEN (HIGH MOUNTED STOPLAMP)

- Disconnect: High Mounted Stoplamp C475 (Parcel Shelf) or C4111 (Spoiler)

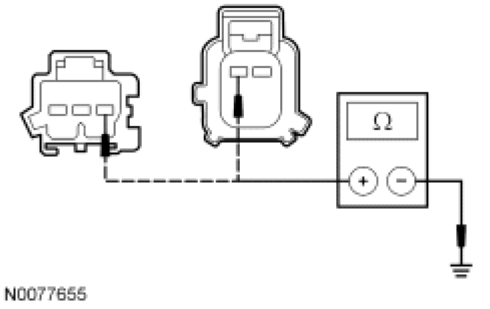


Fig. 29: Checking Circuit GD171 (BK/GY) For An Open (High Mounted Stoplamp)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the high mounted stoplamp C475-2 (parcel shelf) or C4111-3 (spoiler), circuit GD171 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to J3.

  NO : REPAIR the circuit. TEST the system for normal operation.

J3 CHECK CIRCUIT CLS17 (YE/GY) FOR VOLTAGE

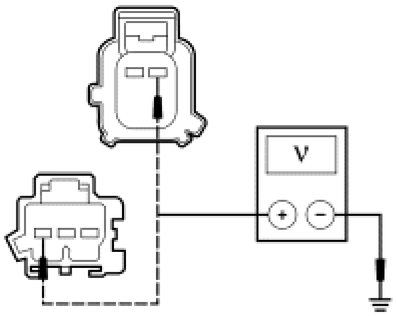


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Fig. 30: Checking Circuit CLS17 (YE/GY) For Voltage
Courtesy of FORD MOTOR CO.

- While applying the brake pedal, measure the voltage between the high mounted stoplamp C475-1 (parcel shelf) or C4111-1 (spoiler), circuit CLS17 (YE/GY), harness side and ground.
- **Is the voltage greater than 10 volts?**

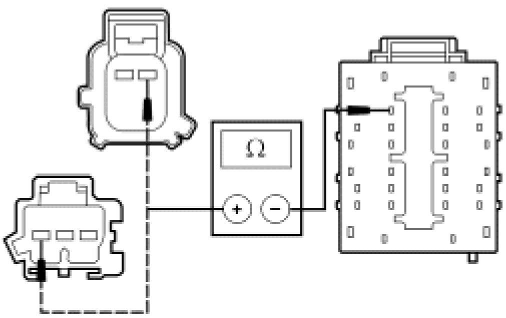
  YES : INSTALL a new high mounted stoplamp. REFER to **High Mounted Stoplamp**. TEST the system for normal operation.

  NO : For Fusion, go to J4.

  For Milan or MKZ, REPAIR circuit CLS17 (YE/GY) for an open. TEST the system for normal operation.

J4 CHECK CIRCUIT CLS17 (YE/GY) FOR AN OPEN (HIGH MOUNTED STOPLAMP)

- Disconnect: SJB C2280e



N0077654

Fig. 31: Checking Circuit CLS17 (YE/GY) For An Open (High Mounted Stoplamp)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the high mounted stoplamp C475-1 (parcel shelf) or C4111-1 (spoiler), circuit CLS17 (YE/GY), harness side and the SJB C2280e-26, circuit CLS17 (YE/GY), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to J8.

  NO : REPAIR the circuit. TEST the system for normal operation.

J5 CHECK CIRCUIT GD171 (BK/GY) FOR AN OPEN (REAR STOPLAMP)

- Disconnect: Inoperative Rear Lamp
- Measure the resistance between the inoperative rear lamp, harness side and ground as follows:

Vehicle	Inoperative Stoplamp	Rear Lamp Connector-Pin	Circuit
Fusion	LH rear	C4035-1	GD171 (BK/GY)
Fusion	RH rear	C4032-1	GD171 (BK/GY)
Milan, MKZ	LH rear	C419-3	GD171 (BK/GY)
Milan, MKZ	RH rear	C418-3	GD171 (BK/GY)

- **Is the resistance less than 5 ohms?**

  YES : For Milan or MKZ, go to J6.

  For Fusion, go to J7.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

J6 CHECK CIRCUIT CLS17 (YE/GY) FOR AN OPEN (REAR STOPLAMP)

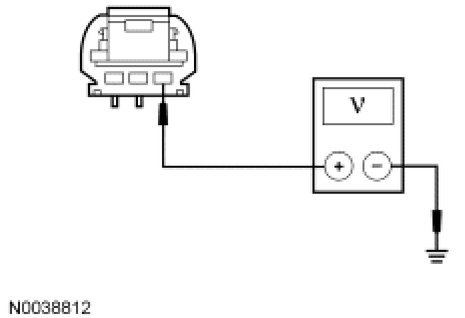


Fig. 32: Checking Circuit CLS17 (YE/GY) For Open (Rear Stoplamp)

Courtesy of FORD MOTOR CO.

- While applying the brake pedal, measure the voltage between the LH rear lamp C419-1, circuit CLS17 (YE/GY), harness side and ground; or between the RH rear lamp C418-1, circuit CLS17 (YE/GY), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new rear lamp assembly. REFER to **Rear Lamp Assembly**. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

J7 CHECK THE REAR STOPLAMP VOLTAGE SUPPLY CIRCUIT FOR AN OPEN AND A SHORT TO GROUND

- Disconnect: SJB C2280e

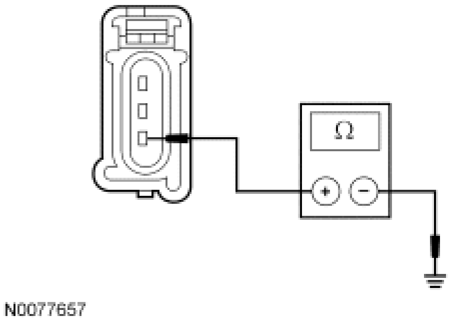


Fig. 33: Checking Rear Stoplamp Voltage Supply Circuit For An Open And A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative rear lamp, harness side and the SJB, harness side; and between the inoperative rear lamp, harness side and ground as follows:

Inoperative Stoplamp	Rear Lamp Connector-Pin	SJB Connector-Pin	Circuit
LH rear	C4035-3	C2280e-11	CLS18 (GY/BN)
RH rear	C4032-3	C2280e-7	CLS19 (VT/OG)

- **Is the resistance less than 5 ohms between the rear lamp and the SJB, and greater than 10,000 ohms between the rear lamp and ground?**

  YES : Go to J8.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

J8 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.

- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test K: The Stoplamp Are On Continuously

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

When the brake pedal is applied, the stoplamp switch routes voltage to the smart junction box (SJB) and the PCM through circuit CCB08 (VT/WH).

Fusion

The voltage is then routed through the SJB to the high mounted stoplamp through circuit CLS17 (YE/GY). The SJB also supplies voltage to the LH and RH rear stoplamp through circuits CLS18 (GY/BN) and CLS19 (VT/OG), respectively.

Milan, MKZ

The voltage is then routed through the SJB to the stoplamp through circuit CLS17 (YE/GY).

The rear lamps contain electronics that modulate the voltage frequency to the LED bulbs.

- DTC B1485 (Brake Pedal Input Short to Battery) - is an on-demand DTC that sets when the SJB detects a short to voltage from the stoplamp switch input circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Stoplamp switch
- PCM
- SJB

PINPOINT TEST K: THE STOPLAMP ARE ON CONTINUOUSLY

K1 DETERMINE IF ALL THE STOPLAMP ARE ILLUMINATED

- Key in OFF position.
- Observe the stoplamp with the brake pedal released.
- **Are all of the stoplamp illuminated?**

YES : Go to K2.

NO : Go to K7.

K2 CHECK THE STOPLAMP SWITCH

- Disconnect: Stoplamp Switch C278
- **Do the stoplamp continue to illuminate?**

YES : Go to K3.

NO : INSTALL a new stoplamp switch. REFER to **Stoplamp Switch**. CLEAR the DTCs. REPEAT the self-test.

K3 CHECK THE PCM

- Disconnect: PCM C175b
- **Do the stoplamp continue to illuminate?**

YES : Go to K4.

NO : Go to K8.

K4 CHECK CIRCUIT CCB08 (VT/WH) FOR A SHORT TO VOLTAGE

- Disconnect: SJB C2280a
- **Do the stoplamp continue to illuminate?**

YES : For Fusion, go to K5.

For Milan or MKZ, go to K6.

NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

K5 CHECK THE SJB

- Disconnect: SJB C2280c
- **Do the stoplamp continue to illuminate?**

YES : Go to K6.

NO : Go to K9.

K6 CHECK CIRCUIT CLS17 (YE/GY) FOR A SHORT TO VOLTAGE

- Disconnect: SJB C2280e
- **Does the high mounted stoplamp continue to illuminate?**

YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

NO : Go to K9.

K7 CHECK THE STOPLAMP VOLTAGE SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

- Disconnect: SJB C2280e

- **Do the stoplamp continue to illuminate?**

  YES : If the LH rear lamp continues to illuminate, REPAIR circuit CLS18 (GY/BN) for a short to voltage. CLEAR the DTCs. REPEAT the self-test.

  If the RH rear lamp continues to illuminate, REPAIR circuit CLS19 (VT/OG) for a short to voltage. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to K9.

K8 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article or **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

K9 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

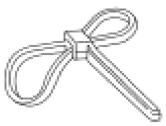
  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

TURN SIGNAL AND HAZARD LAMPS

Special Tools

Illustration	Tool Name	Tool Number

 ST1185-A	73III Automotive Meter	105-R0057 or equivalent
 ST1385-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST1436-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB monitors the multifunction switch position by sending multiple voltage reference signals to the multifunction switch. When the multifunction switch is in the LH or RH TURN positions, or the hazard flasher lamp switch is engaged, that input signal is routed to ground.

When the SJB receives a request for a turn signal or hazard lamps, the SJB supplies voltage to the appropriate turn lamps.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Multifunction switch • Hazard flasher lamp switch	• Bulb(s) • Wiring, terminals or connectors • Smart junction box (SJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1799	Lamp Turn Signal Front Output Circuit Open	Go to **Pinpoint Test N**.
B1801	Lamp Turn Signal Front Output Circuit Short to Ground	Go to **Pinpoint Test N**.
B1875	Turn Signal/Hazard Switch Signal Circuit Failure	Go to **Pinpoint Test O**.
B2048	Left Rear Turn Lamp Circuit Short	For Milan or MKZ, go to **Pinpoint Test N**. For Fusion, REFER to **Stoplamp** to continue

	to Ground	diagnosis of the turn lamp.
B2049	Left Rear Turn Lamp Circuit Open	For Milan or MKZ, go to **Pinpoint Test N**. For Fusion, REFER to **Stoplamp** to continue diagnosis of the turn lamp.
B2050	Right Rear Turn Lamp Circuit Short to Ground	For Milan or MKZ, go to **Pinpoint Test N**. For Fusion, REFER to **Stoplamp** to continue diagnosis of the turn lamp.
B2051	Right Rear Turn Lamp Circuit Open	For Milan or MKZ, go to **Pinpoint Test N**. For Fusion, REFER to **Stoplamp** to continue diagnosis of the turn lamp.
B2281	Right Turn Switch Short to Ground	Go to **Pinpoint Test M**.
B2282	Left Turn Switch Short to Ground	Go to **Pinpoint Test M**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Fuse(s) • Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The turn signal lamps are inoperative	• Wiring, terminals or connectors • Multifunction switch • SJB	• Go to **Pinpoint Test L**.
• The turn signal lamps are always on	• Wiring, terminals or connectors • Multifunction switch • SJB	• Go to **Pinpoint Test M**.
• One turn signal/hazard lamp is inoperative/always on	• Wiring, terminals or connectors • SJB	• Go to **Pinpoint Test N**.
• The hazard lamps are inoperative/always on	• Wiring, terminals or connectors • Hazard flasher lamp switch • SJB	• Go to **Pinpoint Test O**.

Pinpoint Tests

Pinpoint Test L: The Turn Signal Lamps Are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends reference signals to the multifunction switch through circuits CLS39 (VT/WH) (LH turn input) and CLS41 (GY/YE) (RH turn input). When the multifunction switch is switched to the LH or RH TURN positions, the voltage signal is routed to ground. When the SJB detects the multifunction switch in the LH or RH TURN position, the SJB provides on/off voltage to the appropriate turn lamps.

All the turn lamps are individually wired to the SJB. The timed on/off cycle is determined by the SJB and is set to flash approximately 80 times per minute if both, front and rear, turn lamps operate correctly. If an individual turn signal lamp is inoperative, the SJB flashes the remaining turn lamp approximately 160 times per minute.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Multifunction switch
- SJB

PINPOINT TEST L: THE TURN SIGNAL LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

L1 CHECK FOR CORRECT HIGH BEAM OPERATION

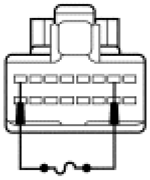
- Place the headlamp switch in the HEADLAMPS ON position.
- Place the multifunction switch in the HIGH BEAM position while observing the high beam headlamps.
- **Do the high beams operate correctly?**

  YES : PLACE the headlamp switch in the OFF position. Go to L2.

  NO : REFER to **Headlamps**.

L2 CHECK THE MULTIFUNCTION SWITCH

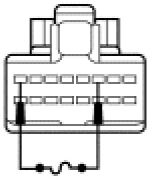
- Key in OFF position.
- Disconnect: Multifunction Switch C202



N0069012

Fig. 34: Connecting Fused (5A) Jumper Wire Between Multifunction Switch C202-2 & C202-8, CLS39 (VT/WH) & GD116 (BK/VT)
Courtesy of FORD MOTOR CO.

- For an inoperative LH turn signal, connect a fused (5A) jumper wire between the multifunction switch C202-2, circuit CLS39 (VT/WH), harness side and the multifunction switch C202-8, circuit GD116 (BK/VT), harness side.



N0069013

Fig. 35: Connecting Fused (5A) Jumper Wire Between Multifunction Switch C202-3, CLS41 (GY/YE) & GD116 (BK/VT)
Courtesy of FORD MOTOR CO.

- For an inoperative RH turn signal, connect a fused (5A) jumper wire between the multifunction switch C202-3, circuit CLS41 (GY/YE), harness side and the multifunction switch C202-3, circuit GD116 (BK/VT), harness side.
- Key in ON position.
- **Do the turn signals in question flash on and off?**

  YES : REMOVE the jumper wire. INSTALL a new multifunction switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

  NO : REMOVE the jumper wire. Go to L3.

L3 CHECK CIRCUIT CLS39 (VT/WH) (LH TURN SIGNAL) OR CIRCUIT CLS41 (GY/YE) (RH TURN SIGNAL) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280d

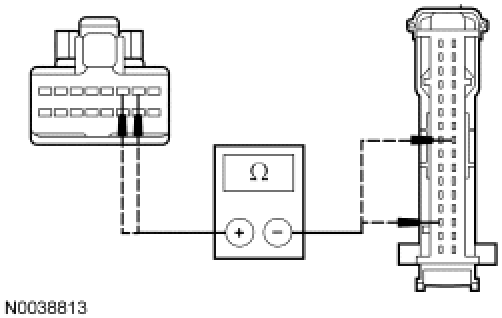


Fig. 36: Checking Circuit CLS39 (VT/WH) (LH Turn Signal) Or CLS41 (GY/YE) (RH Turn Signal) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the multifunction switch C202-2 (LH turn lamps), circuit CLS39 (VT/WH), harness side and the SJB C2280d-14, circuit CLS39 (VT/WH), harness side; or between the multifunction switch C202-3 (RH turn lamps), circuit CLS41 (GY/YE), harness side and the SJB C2280d-24, circuit CLS41 (GY/YE), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to L4.

  NO : REPAIR the circuit. TEST the system for normal operation.

L4 CHECK FOR CORRECT SJB OPERATION

- Key in OFF position.
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test M: The Turn Signal Lamps Are Always On

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends voltage reference signals to the multifunction switch through circuits CLS39 (VT/WH) (LH turn input) and CLS41 (GY/YE) (RH turn input). When the multifunction switch is switched to the LH or RH TURN positions, the voltage signal is routed to ground. When the SJB detects the multifunction switch in the LH or RH TURN position, the SJB provides on/off voltage to the appropriate turn lamps.

- DTC B2281 (Right turn switch short to ground) - is an on-demand DTC that sets when the SJB detects the RH turn signal switch input is short to ground.
- DTC B2282 (Left turn switch short to ground) - is an on-demand DTC that sets when the SJB detects the LH turn signal switch input is short to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Multifunction switch
- SJB

PINPOINT TEST M: THE TURN SIGNAL LAMPS ARE ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

M1 CHECK THE MULTIFUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multifunction Switch C202
- Key in ON position.
- **Do the turn lamps continue to flash on and off?**

  YES : Go to M2.

  NO : INSTALL a new multifunction switch. REFER to **STEERING COLUMN SWITCHES** article. CLEAR the DTCs. REPEAT the self-test.

M2 CHECK CIRCUIT CLS39 (VT/WH) (LH TURN SIGNAL) OR CIRCUIT CLS41 (GY/YE) (RH TURN SIGNAL) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280d

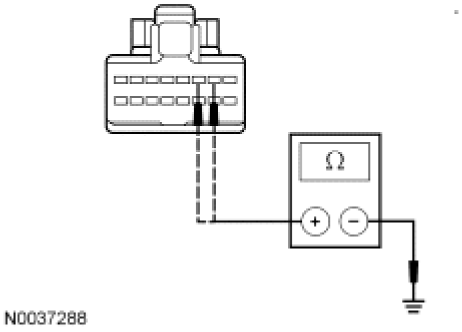


Fig. 37: Checking Circuit CLS39 (VT/WH) (LH Turn Signal) Or Circuit CLS41 (GY/YE) (RH Turn Signal) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the multifunction switch C202-2 (LH turn lamps), circuit CLS39 (VT/WH), harness side and ground; or between the multifunction switch C202-3 (RH turn lamps), circuit CLS41 (GY/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to M3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

M3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

Pinpoint Test N: One Turn Signal/Hazard Lamp Is Inoperative/Always On

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation - Fusion

When the smart junction box (SJB) detects the multifunction switch in the LH TURN position, the SJB provides on/off voltage through circuit CLS21 (BU/GN) to the LH front turn lamp. When the SJB detects the

multifunction switch in the RH TURN position, the SJB provides on/off voltage through circuit CLS25 (YE/VT) to the RH front turn lamp. Circuits GD123 (BK/GY) and GD121 (BK/YE) provide ground for the LH and RH front turn lamps, respectively. The rear turn lamps are controlled utilizing the rear stoplamp circuitry.

Milan, MKZ

When the SJB detects the multifunction switch in the LH TURN position, the SJB provides on/off voltage through circuit CLS21 (BU/GN) to the LH front turn lamp, and through circuit CLS18 (GY/BN) to the LH rear turn lamp. When the SJB detects the multifunction switch in the RH TURN position, the SJB provides on/off voltage through circuit CLS25 (YE/VT) to the RH front turn lamp, and through circuit CLS19 (VT/OG) to the RH rear turn lamp. Circuits GD123 (BK/GY) and GD121 (BK/YE) provide ground for the LH and RH front turn lamps, respectively. Circuit GD171 (BK/GY) provides ground for the rear turn lamps.

For MKZ vehicles equipped with daytime running lamps (DRL), the front turn lamps are utilized as the DRL.

DTC Description	Fault Trigger Conditions
B1799 - Lamp Turn Signal Front Output Circuit Open	A continuous DTC that sets when the SJB detects an open on either front turn lamp voltage supply circuit.
B1801 - Lamp Turn Signal Front Output Circuit Short To Ground	A continuous DTC that sets when the SJB detects a short to ground on either front turn lamp voltage supply circuit.
B2048 - Left Rear Turn Lamp Circuit Short to Ground	A continuous DTC that sets when the SJB detects a short to ground on the LH rear stop/turn lamp voltage supply circuit.
B2049 - Left Rear Turn Lamp Circuit Open	A continuous DTC that sets when the SJB detects an open on the LH rear stop/turn lamp voltage supply circuit.
B2050 - Right Rear Turn Lamp Circuit Short to Ground	A continuous DTC that sets when the SJB detects a short to ground on the RH rear stop/turn lamp voltage supply circuit.
B2051 - Right Rear Turn Lamp Circuit Open	A continuous DTC that sets when the SJB detects an open on the RH rear stop/turn lamp voltage supply circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB

PINPOINT TEST N: ONE TURN SIGNAL/HAZARD LAMP IS INOPERATIVE/ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

N1 DETERMINE IF A TURN LAMP IS ALWAYS ON

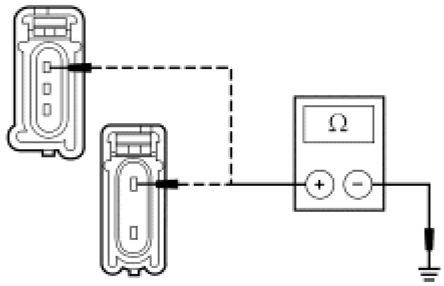
- Key in ON position.
- Monitor the turn lamps while placing the multifunction switch in the RH TURN, LH TURN and NEUTRAL positions.
- **Is any turn lamp always on?**

  YES : Go to N4.

  NO : Go to N2.

N2 CHECK THE TURN LAMP GROUND CIRCUITRY FOR AN OPEN

- Key in OFF position.
- Disconnect: Inoperative Turn Lamp



N0077658

Fig. 38: Checking Turn Lamp Ground Circuitry For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative turn lamp, harness side and ground as follows:

Inoperative Turn Lamp	Connector-Pin	Circuit
LH front	C1023-1	GD123 (BK/GY)
RH front	C1043-1	GD121 (BK/YE)
LH rear (Milan, MKZ)	C413-1	GD171 (BK/GY)
RH rear (Milan, MKZ)	C416-1	GD171 (BK/GY)

- **Is the resistance less than 5 ohms?**

  YES : Go to N3.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

N3 CHECK THE TURN LAMP VOLTAGE SUPPLY CIRCUITRY FOR AN OPEN AND A SHORT TO GROUND

- Disconnect: SJB C2280e (Rear Lamp) or C2280a (Front Lamp)
- Measure the resistance between the inoperative turn lamp, harness side and the SJB, harness side; and between the inoperative turn lamp, harness side and ground as follows:

Inoperative Turn Lamp Connector-Pin	SJB Connector-Pin	Circuit
LH front C1023-3	C2280a-21	CLS21 (BU/GN)
RH front C1043-3	C2280a-9	CLS25 (YE/VT)
LH rear (Milan, MKZ) C413-3	C2280e-11	CLS18 (GY/BN)
RH rear (Milan, MKZ) C416-3	C2280e-7	CLS19 (VT/OG)

- **Is the resistance less than 5 ohms between the inoperative turn lamp and the SJB, and greater than 10,000 ohms between the inoperative turn lamp and ground?**

  YES : Go to N5.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

N4 CHECK THE TURN LAMP VOLTAGE SUPPLY CIRCUITRY FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280e (Rear Lamp) or C2280a (Front Lamp)
- Key in ON position.
- **Does the turn lamp in question continue to illuminate?**

  YES : For the LH front turn lamp, REPAIR circuit CLS21 (BU/GN). CLEAR the DTCs. REPEAT the self-test.

  For the RH front turn lamp, REPAIR circuit CLS25 (YE/VT). CLEAR the DTCs. REPEAT the self-test.

  For the LH rear turn lamp, REPAIR circuit CLS18 (GY/BN). CLEAR the DTCs. REPEAT the self-test.

  For the RH rear turn lamp, REPAIR circuit CLS19 (VT/OG). CLEAR the DTCs. REPEAT the self-test.

NO : Go to N5.

N5 CHECK FOR CORRECT SJB OPERATION

- Key in OFF position.
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test O: The Hazard Lamps Are Inoperative/Always On

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Turn Signal/Stop/Hazard Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a voltage reference signal to the hazard flasher lamp switch through circuit CLS32 (BN/YE). When the hazard flasher lamp switch is pressed, the voltage signal is routed to ground through circuit GD116 (BK/VT). When the SJB detects a request for the hazard lamps, the SJB provides on/off voltage to the all the turn lamps.

The hazard flasher lamp switch is a momentary contact switch.

- DTC B1875 (Turn Signal/Hazard Switch Signal Circuit Failure) - is an on-demand DTC that sets when the SJB detects a short to ground from the hazard flasher lamp switch input circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Hazard flasher lamp switch
- SJB

PINPOINT TEST O: THE HAZARD LAMPS ARE INOPERATIVE/ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

O1 RETRIEVE THE RECORDED DTCs FROM THE SJB SELF-TEST

- Key in OFF position.
- Retrieve the recorded results from the SJB self-test.
- **Is DTC B1875 present?**

  YES : Go to O2.

  NO : Go to O4.

O2 CHECK THE HAZARD FLASHER LAMP SWITCH (DTC B1875)

- Disconnect: Hazard Flasher Lamp Switch C2355
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB Self-Test
- Clear the DTCs and repeat the SJB on-demand self-test.
- **Is DTC B1875 still present?**

  YES : Go to O3.

  NO : INSTALL a new hazard flasher lamp switch. REFER to **Hazard Flasher Lamp Switch**. TEST the system for normal operation.

O3 CHECK CIRCUIT CLS32 (BN/YE) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280d

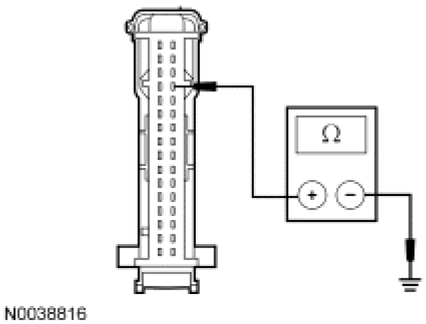


Fig. 39: Checking Hazard Lamp Switch
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280d-20, circuit CLS32 (BN/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to O7.

  NO : REPAIR the circuit. TEST the system for normal operation.

O4 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

- Key in OFF position.
- Disconnect: Hazard Flasher Lamp Switch C2355

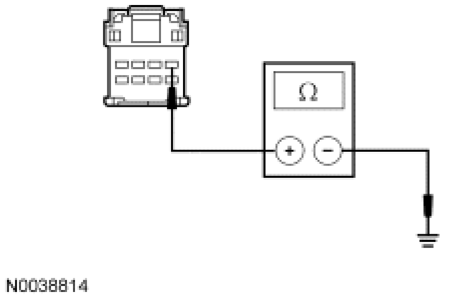


Fig. 40: Checking Circuit GD116 (BK/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the hazard flasher lamp switch C2355-1, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to O5.

  NO : REPAIR the circuit. TEST the system for normal operation.

O5 CHECK CIRCUIT CLS32 (BN/YE) FOR AN OPEN

- Disconnect: SJB C2280d

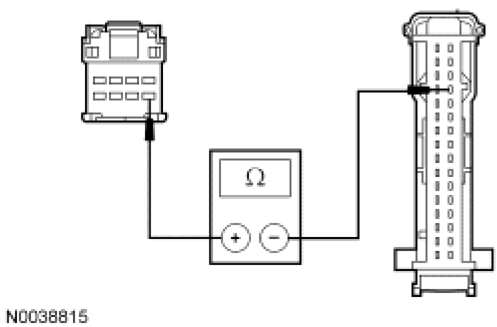


Fig. 41: Checking Circuit CLS32 (BN/YE) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the hazard flasher lamp switch C2355-5, circuit CLS32 (BN/YE), harness side and the SJB C2280d-20, circuit CLS32 (BN/YE), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to O6.

  NO : REPAIR the circuit. TEST the system for normal operation.

O6 CHECK THE HAZARD FLASHER LAMP SWITCH

- Connect: Hazard Flasher Lamp Switch C2355

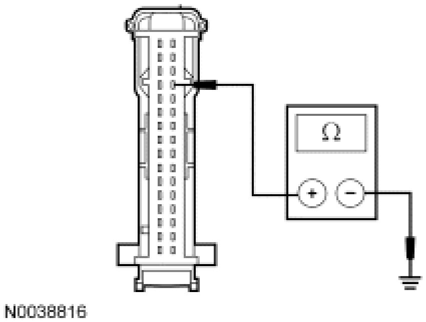


Fig. 42: Checking Hazard Lamp Switch
Courtesy of FORD MOTOR CO.

- While holding the hazard flasher lamp switch pressed, measure the resistance between the SJB C2280d-20, circuit CLS32 (BN/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to O7.

  NO : INSTALL a new hazard flasher lamp switch. REFER to **Hazard Flasher Lamp Switch**. TEST the system for normal operation.

O7 CHECK FOR CORRECT SJB OPERATION

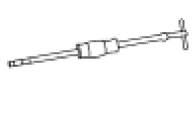
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

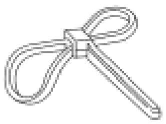
  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PARKING, REAR AND LICENSE PLATE LAMPS

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	73III Automotive Meter	105-R0057 or equivalent

 ST1385-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST1438-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB monitors the headlamp switch position by sending voltage reference signals on multiple circuits to the headlamp switch. At any given time, one of the signal circuits is routed to ground. If the SJB detects any concern with the inputs from the headlamp switch for 5 seconds, the SJB may turn on the exterior lights and keep them on for 10 minutes after the ignition switch is turned off (or 10 minutes from the time the SJB detects any headlamp switch input concern if the ignition switch was already off).

If the SJB detects a concern with the headlamp switch inputs, the SJB implements a planned strategy depending on the inputs received. If this situation occurs, the SJB should **NOT** be ruled immediately as being at fault. This is normal behavior of the SJB design as it has detected a fault with the inputs from the headlamp switch.

When the SJB receives an input from the headlamp switch indicating a request for the parking lamps, the SJB energizes the parking lamp relay, which supplies voltage to the exterior lamps.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Headlamp switch	• Smart junction box (SJB) fuse 4 (15A) (parking lamps) • Bulb(s) • Wiring, terminals or connectors • Rear lamp assembly • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1578	Lamp Park Input Circuit Short to Ground	REFER to **Headlamps**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Fuse(s) • Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• One or more parking, rear or license plate lamps is inoperative	• Fuse • Wiring, terminals or connectors • Rear lamp assembly • SJB	• Go to **Pinpoint Test P**.
• The parking, rear or license plate lamps are on continuously	• Wiring, terminals or connectors • Headlamp switch • SJB	• Go to **Pinpoint Test Q**.

Pinpoint Tests

Pinpoint Test P: One Or More Parking, Rear or License Plate Lamps Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Parking, Rear and License Lamps for schematic and connector information.

Normal Operation

When the headlamp switch is placed in the PARKING LAMPS ON position, the SJB provides a ground for the parking lamp relay coil (internal to the SJB). When the parking lamp relay is energized, voltage is sent through circuit CBP08 (GY/YE) to the rear and front parking lamps. Ground is provided to the rear parking and license plate lamps through circuit GD171 (BK/GY). Ground is provided to the front parking and side marker lamps through circuits GD121 (BK/YE) or GD123 (BK/GY).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Rear lamp assembly
- SJB

PINPOINT TEST P: ONE OR MORE PARKING, REAR OR LICENSE PLATE LAMPS IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

P1 CHECK THE STOPLAMP AND TURN LAMPS

- Key in ON position.
- Operate the turn signals and apply the brake pedal while observing the exterior lamps.
- **Do the stoplamp and turn lamps operate correctly?**

  YES : Go to P2.

  NO : REFER to **Stoplamp** or **Turn Signal and Hazard Lamps**.

P2 DETERMINE IF ALL THE PARKING LAMPS ARE INOPERATIVE

- Key in OFF position.
- Place the headlamp switch to the PARKING LAMPS ON position.
- **Are all the parking lamps inoperative?**

  YES : PLACE the headlamp switch in the OFF position. VERIFY the SJB fuse 4 (15A) is OK. If OK, go to P7.

  NO : PLACE the headlamp switch in the OFF position.

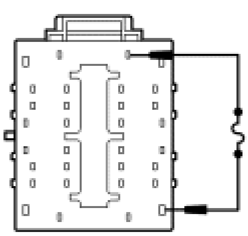
  If all front parking lamps are inoperative, go to P3.

  If all rear parking and license plate lamps are inoperative, go to P4.

  If an individual parking or license plate lamp is inoperative, go to P5.

P3 CHECK CIRCUIT CBP08 (GY/YE) FOR AN OPEN (FRONT LAMPS)

- Disconnect: SJB C2280a



N0038818

Fig. 43: Checking Circuit CBP08 (GY/YE) For Open (Front Lamps)
Courtesy of FORD MOTOR CO.

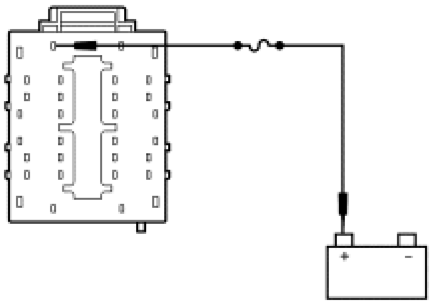
- Connect a fused (10A) jumper wire between the SJB C2280a-4, circuit SBB19 (RD/BU), harness side and the SJB C2280a-31, circuit CBP08 (GY/YE), harness side
- **Do the front parking lamps illuminate?**

  YES : REMOVE the jumper wire. Go to P7.

NO : REMOVE the jumper wire. REPAIR the circuit. TEST the system for normal operation.

P4 CHECK CIRCUIT CBP08 (GY/YE) FOR AN OPEN (REAR LAMPS)

- Disconnect: SJB C2280e



N0038819

Fig. 44: Checking Circuit CBP08 (GY/YE) For Open (Rear Lamps)
Courtesy of FORD MOTOR CO.

- Connect a fused (10A) jumper wire between the positive battery terminal and the SJB C2280e-30, circuit CBP08 (GY/YE), harness side.
- **Do the rear parking lamps illuminate?**

  YES : REMOVE the jumper wire. Go to P7.

  NO : REMOVE the jumper wire. REPAIR the circuit. TEST the system for normal operation.

P5 CHECK THE PARKING LAMP GROUND CIRCUIT FOR AN OPEN

- Disconnect: Inoperative Lamp
- Measure the resistance between the inoperative lamp, harness side and ground as follows:

FUSION

Inoperative Lamp	Connector-Pin	Circuit
LH front	C1023-1	GD123 (BK/GY)
RH front	C1043-1	GD121 (BK/YE)
LH front side marker	C1443-2	GD121 (BK/YE)
RH front side marker	C1444-2	GD123 (BK/GY)
LH rear	C4035-1	GD171 (BK/GY)
RH rear	C4032-1	GD171 (BK/GY)
LH rear side marker	C4328-2	GD171 (BK/GY)
RH rear		GD171

side marker	C4327-2	(BK/GY)
LH license plate	C454-2	GD171 (BK/GY)
RH license plate	C464-2	GD171 (BK/GY)

MILAN

Inoperative Lamp	Connector-Pin	Circuit
LH front	C1023-1	GD123 (BK/GY)
RH front	C1043-1	GD121 (BK/YE)
LH front side marker	C1443-2	GD121 (BK/YE)
RH front side marker	C1444-2	GD123 (BK/GY)
LH rear	C419-3	GD171 (BK/GY)
RH rear	C418-3	GD171 (BK/GY)
LH license plate	C452-2	GD171 (BK/GY)
RH license plate	C462-2	GD171 (BK/GY)

MKZ

Inoperative Lamp	Connector-Pin	Circuit
LH front	C1023-1	GD123 (BK/GY)
RH front	C1043-1	GD121 (BK/YE)
LH front side marker	C1113-2	GD121 (BK/YE)
RH front side marker	C1114-2	GD123 (BK/GY)
LH front redundant	C151-2	GD121 (BK/YE)
RH front redundant	C161-2	GD123 (BK/GY)
LH rear	C419-3	GD171 (BK/GY)
RH rear	C418-3	GD171

		(BK/GY)
LH rear decklid	C414a-2	GD171 (BK/GY)
LH rear decklid	C414b-2	GD171 (BK/GY)
LH rear decklid	C414c-2	GD171 (BK/GY)
LH rear decklid	C414d-2	GD171 (BK/GY)
RH rear decklid	C417a-2	GD171 (BK/GY)
RH rear decklid	C417b-2	GD171 (BK/GY)
RH rear decklid	C417c-2	GD171 (BK/GY)
RH rear decklid	C417d-2	GD171 (BK/GY)
LH license plate	C452-2	GD171 (BK/GY)
RH license plate	C462-2	GD171 (BK/GY)

- **Is the resistance less than 5 ohms?**

  YES : For a rear lamp on Milan or MKZ, go to P6.

  For all others, REPAIR circuit CBP08 (GY/YE) for an open. TEST the system for normal operation.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

P6 CHECK CIRCUIT CBP08 (GY/YE) FOR AN OPEN

- Place the headlamp switch in the PARKING LAMPS ON position.

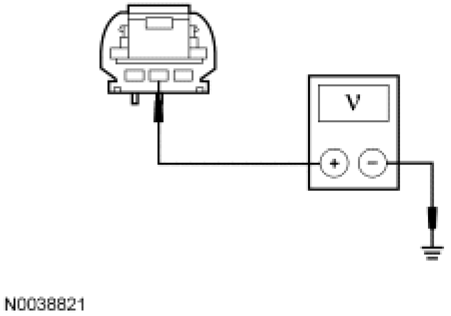


Fig. 45: Checking Circuit CBP08 (GY/YE) For Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the LH rear lamp C419-2, circuit CBP08 (GY/YE), harness side and ground; or between the RH rear lamp C418-2, circuit CBP08 (GY/YE), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new rear lamp assembly. REFER to **Rear Lamp Assembly**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

P7 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test Q: The Parking, Rear Or License Plate Lamps Are On Continuously

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Parking, Rear and License Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) provides a ground for the parking lamp relay coil when a request for the parking lamps is received. When the parking lamp relay is energized, voltage is sent through circuit CBP08 (GY/YE) to the rear and front parking lamps.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Headlamp switch
- SJB

PINPOINT TEST Q: THE PARKING, REAR OR LICENSE PLATE LAMPS ARE ON CONTINUOUSLY

Q1 CHECK CIRCUIT CBP08 (GY/YE) FOR A SHORT TO VOLTAGE (TO REAR LAMPS)

- Disconnect: SJB C2280e
- **Do the rear parking lamps continue to illuminate?**

YES : REPAIR the circuit. TEST the system for normal operation.

NO : Go to Q2.

Q2 CHECK CIRCUIT CBP08 (GY/YE) FOR A SHORT TO VOLTAGE (TO FRONT LAMPS)

- Disconnect: SJB C2280a
- **Do the front parking lamps continue to illuminate?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to Q3.

Q3 CHECK FOR CORRECT SJB OPERATION

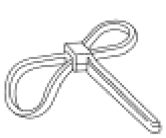
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

FOG LAMPS

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	73III Automotive Meter	105-R0057 or equivalent
 ST1385-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST1438-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB monitors the headlamp switch position by sending a voltage reference signal to the headlamp switch. When the fog lamp switch is engaged, the voltage reference signal is routed to ground.

The fog lamps can be turned on when the following pre-conditions are met:

- The ignition switch is in the RUN or START position
- The parking lamps are on
- The high beams are off

When the SJB receives an input from the headlamp switch indicating a request for the fog lamps (and the pre-conditions are met), the SJB provides voltage to the fog lamp relay. When the fog lamp relay is energized, voltage is routed to the fog lamps.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical
• Battery junction box (BJB) fuse 24 (15A) (fog lamp relay) • Bulb(s) • Fog lamp relay • Wiring, terminals or connectors • Headlamp switch • Smart junction box (SJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
    - Check the VCM connection to the vehicle.
    - Check the scan tool connection to the VCM.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
    - Verify the ignition key is in the ON position.
    - Verify the scan tool operation with a known good vehicle.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B2030	Front Fog Lamp Relay CKT Failure	Go to **Pinpoint Test R**.
B2254	Front Fog Lamp Switch Failure	Go to **Pinpoint Test T**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Fuse(s) • Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
	• Fuse	

• The fog lamps are inoperative	• Wiring, terminals or connectors • Fog lamp relay • Headlamp switch • SJB	• Go to **Pinpoint Test R**.
• An individual fog lamp is inoperative	• Wiring, terminals or connectors	• Go to **Pinpoint Test S**.
• The fog lamps are on continuously	• Wiring, terminals or connectors • Fog lamp relay • Headlamp switch • SJB	• Go to **Pinpoint Test T**.

Pinpoint Tests

Pinpoint Test R: The Fog Lamps Are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Fog Lamps for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Fuse and Relay Information for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a reference signal to the headlamp switch through circuit CLF21 (GY/VT). When the fog lamp switch is engaged, the voltage signal is routed to ground.

Voltage is supplied to the switched side of the fog lamp relay from the battery junction box (BJB) fuse 24 (15A) through circuit SBB24 (VT/RD).

When the SJB detects the fog lamps on request, the SJB provides voltage to the fog lamp relay coil through circuit CLF29 (BN). The fog lamp relay coil ground is provided through circuit GD121 (BK/YE). When the fog lamp relay is energized, voltage is routed through circuit CLF12 (BN/YE) to the fog lamps.

- DTC B2030 (Front Fog Lamp Relay CKT Failure) - is a continuous DTC that sets when the SJB detects a short to ground on the fog lamp relay coil voltage supply circuit.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors

- Fog lamp relay
- Headlamp switch
- SJB

PINPOINT TEST R: THE FOG LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

R1 CHECK THE HEADLAMP SWITCH PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB headlamp switch (FOG SW) PID while engaging the fog lamp switch.
- **Does the PID indicate the fog lamp switch is active?**

  YES : Go to R4.

  NO : Go to R2.

R2 CHECK THE HEADLAMP SWITCH

- Key in OFF position.
- Disconnect: Headlamp Switch C205
- Carry out the headlamp switch component test. Refer to COMPONENT TESTING.
- **Is the headlamp switch OK?**

  YES : Go to R3.

  NO : INSTALL a new headlamp switch. REFER to **Headlamp Switch**. TEST the system for normal operation.

R3 CHECK CIRCUIT CLF21 (GY/VT) FOR AN OPEN

- Disconnect: SJB C2280d

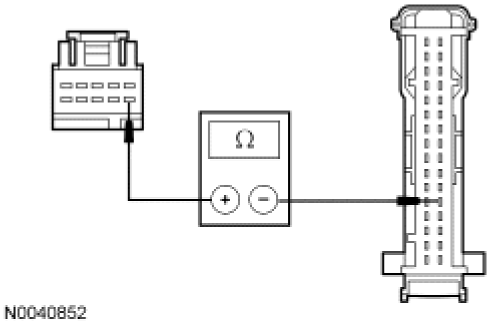


Fig. 46: Checking Circuit CLF21 (GY/VT) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the headlamp switch C205-6, circuit CLF21 (GY/VT), harness side and the SJB C2280d-28, circuit CLF21 (GY/VT), harness side.

- **Is the resistance less than 5 ohms?**

  YES : Go to R10.

  NO : REPAIR the circuit. TEST the system for normal operation.

R4 CHECK THE FOG LAMP RELAY

- Key in OFF position.
- Disconnect: Fog Lamp Relay
- Substitute a known good relay and recheck the fog lamp operation.
- **Do the fog lamps operate correctly?**

  YES : REMOVE the known good relay. INSTALL a new fog lamp relay. CLEAR the DTCs. REPEAT the self-test.

  NO : REMOVE the known good relay. Go to R5.

R5 CHECK CIRCUIT CLF29 (BN) FOR VOLTAGE

- Key in ON position.
- Place the headlamp switch in the HEADLAMPS ON position and engage the fog lamp switch.

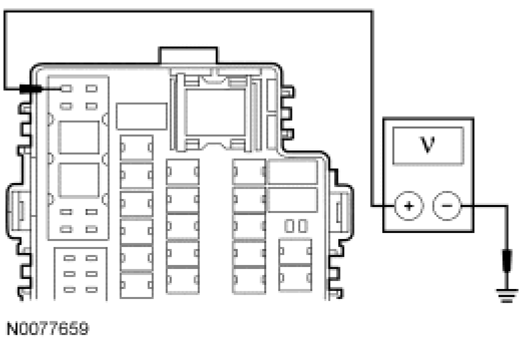


Fig. 47: Checking Circuit CLF29 (BN) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the fog lamp relay pin 86, circuit CLF29 (BN), BJB face side and ground.
- **Is the voltage greater than 10 volts?**

  YES : PLACE the headlamp switch in the OFF position. Go to R8.

  NO : PLACE the headlamp switch in the OFF position. Go to R6.

R6 CHECK CIRCUIT CLF29 (BN) FOR AN OPEN AND SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280a

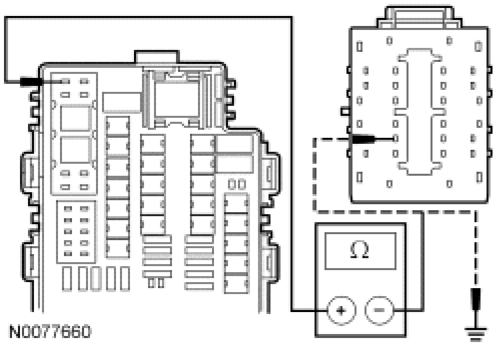


Fig. 48: Checking Circuit CLF29 (BN) For An Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the fog lamp relay pin 86, circuit CLF29 (BN), BJB face side and the SJB C2280a-10, circuit CLF29 (BN), harness side; and between the fog lamp relay pin 86, circuit CLF29 (BN), BJB face side and ground.
- **Is the resistance less than 5 ohms between the fog lamp relay and the SJB, and greater than 10,000 ohms between the fog lamp relay and ground?**

  YES : Go to R7.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

R7 CHECK CIRCUIT CLF28 (BN/WH) FOR A SHORT TO GROUND

- Disconnect: SJB C2280d
- Disconnect: Headlamp Switch C205

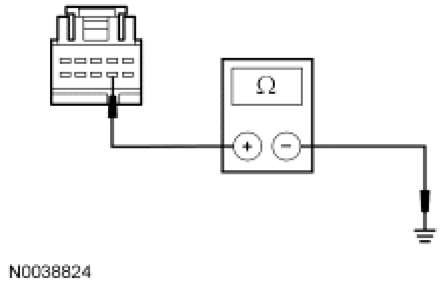


Fig. 49: Checking Circuit CLF28 (BN/WH) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the headlamp switch C205-7, circuit CLF28 (BN/WH), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to R10.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

R8 CHECK CIRCUIT SBB24 (VT/RD) FOR AN OPEN

- Key in OFF position.

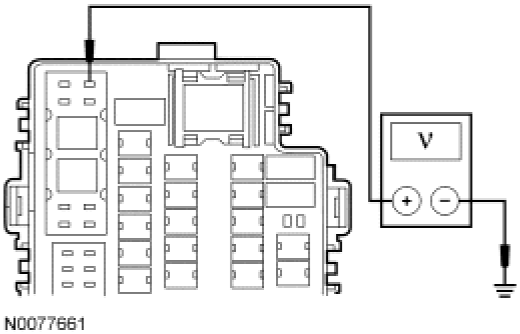


Fig. 50: Checking Circuit SBB24 (VT/RD) For An Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the fog lamp relay pin 30, circuit SBB24 (VT/RD), BJB face side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to R9.

  NO : VERIFY the BJB fuse 24 (15A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

R9 CHECK CIRCUIT GD121 (BK/YE) FOR AN OPEN

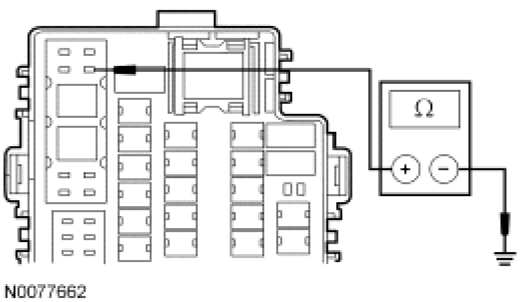


Fig. 51: Checking Circuit GD121 (BK/YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the fog lamp relay pin 85, circuit GD121 (BK/YE), BJB face side and ground.
- **Is the resistance less than 5 ohms?**

  YES : REPAIR circuit CLF12 (BN/YE). CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR circuit GD121 (BK/YE). CLEAR the DTCs. REPEAT the self-test.

R10 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins

  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs. REPEAT the self-test.

Pinpoint Test S: An Individual Fog Lamp Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Fog Lamps for schematic and connector information.

Normal Operation

When the fog lamp relay is energized, voltage is routed through circuit CLF12 (BN/YE) to the fog lamps. Ground is provided on circuits GD121 (BK/YE) and GD123 (BK/GY) to the LH and RH fog lamps, respectively.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

PINPOINT TEST S: AN INDIVIDUAL FOG LAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Make sure the fog lamp bulb is good before carrying out diagnostics.

S1 CHECK THE GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.
- Disconnect: Inoperative Fog Lamp

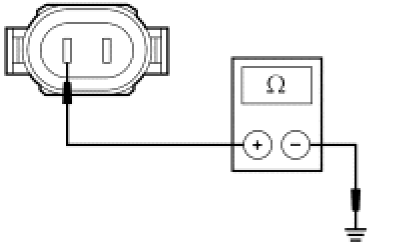


Fig. 52: Checking Ground Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the LH fog lamp C152-B, circuit GD121 (BK/YE), harness side and ground; or between the RH fog lamp C162-B, circuit GD123 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : REPAIR circuit CLF12 (BN/YE) for an open. TEST the system for normal operation.

  NO : REPAIR circuit GD121 (BK/YE) or circuit GD123 (BK/GY) for an open as necessary. TEST the system for normal operation.

Pinpoint Test T: The Fog Lamps Are On Continuously

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Fog Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a reference signal to the headlamp switch through circuit CLF21 (GY/VT). When the fog lamp switch is engaged, the voltage signal is routed to ground.

When the SJB detects the fog lamps on request, the SJB provides voltage to the fog lamp relay coil through circuit CLF29 (BN). When the fog lamp relay is energized, voltage is routed through circuit CLF12 (BN/YE) to the fog lamps.

- DTC B2254 (Front Fog Lamp Switch Failure) - is an on-demand DTC that sets when the SJB detects a short to ground on the fog lamp on input circuit.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Fog lamp relay
- Headlamp switch
- SJB

PINPOINT TEST T: THE FOG LAMPS ARE ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

T1 RETRIEVE THE RECORDED RESULTS FROM THE SJB ON-DEMAND SELF-TEST

- Key in OFF position.
- Retrieve the recorded results from the SJB self-test.
- **Is DTC B2254 present?**

  YES : Go to T2.

  NO : Go to T4.

T2 CHECK THE HEADLAMP SWITCH

- Disconnect: Headlamp Switch C205
- Carry out the headlamp switch component test. Refer to COMPONENT TESTING.
- **Is the headlamp switch OK?**

  YES : Go to T3.

  NO : INSTALL a new headlamp switch. REFER to **Headlamp Switch**. CLEAR the DTCs. REPEAT the self-test.

T3 CHECK CIRCUIT CLF21 (GY/VT) FOR A SHORT TO GROUND

- Disconnect: SJB C2280d

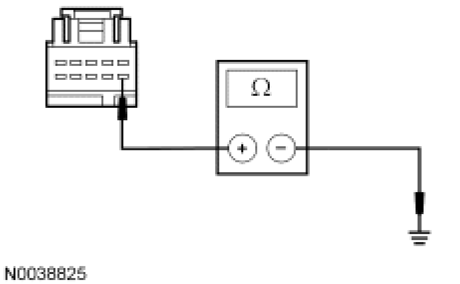


Fig. 53: Checking Circuit CLF21 (GY/VT) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the headlamp switch C205-6, circuit CLF21 (GY/VT), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to T9.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

T4 CHECK CIRCUIT CLF12 (BN/YE) FOR A SHORT TO VOLTAGE

- Disconnect: Fog Lamp Relay
- **Do the fog lamps continue to illuminate?**

  YES : REPAIR the circuit. TEST the system for normal operation.

NO : Go to T5.

T5 CHECK THE FOG LAMP RELAY

- Carry out the fog lamp relay component test. Refer to COMPONENT TESTING.
- **Is the fog lamp relay OK?**

  YES : Go to T6.

  NO : INSTALL a new fog lamp relay. TEST the system for normal operation.

T6 CHECK THE HEADLAMP SWITCH (SHORT TO VOLTAGE)

- Connect: Fog Lamp Relay
- Disconnect: Headlamp Switch C205
- **Do the fog lamps continue to illuminate?**

  YES : Go to T7.

  NO : INSTALL a new headlamp switch. REFER to **Headlamp Switch**. TEST the system for normal operation.

T7 CHECK CIRCUIT CLF29 (BN) FOR A SHORT TO VOLTAGE

- Disconnect: SJB C2280a
- **Do the fog lamps continue to illuminate?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to T8.

T8 CHECK CIRCUIT CLF28 (BN/WH) FOR A SHORT TO VOLTAGE

- Connect: SJB C2280a
- Disconnect: SJB C2280d
- **Do the fog lamps continue to illuminate?**

  YES : Go to T9.

  NO : REPAIR the circuit. TEST the system for normal operation.

T9 CHECK FOR CORRECT SJB OPERATION

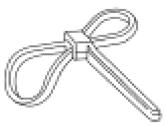
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

REVERSING LAMPS

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	73III Automotive Meter	105-R0057 or equivalent
 ST1385-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST1438-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

For vehicles equipped with an automatic transaxle, the transmission control module (TCM) sends gear status information (through the instrument cluster [IC] gateway) to the SJB over the communication network. When the ignition switch is in the RUN position and a message is sent over the communication network stating the transaxle is in REVERSE (R), the SJB energizes an internal relay which supplies voltage to the reversing lamps.

For vehicles equipped with a manual transaxle, the SJB supplies voltage to the reversing lamp switch when the ignition switch is in the RUN position. When the transaxle is placed in REVERSE (R), the switch routes the voltage to the reversing lamps.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
	• Smart junction box (SJB) fuse: ○ 1 (10A) (reversing lamps) (automatic transaxle)

• Reversing lamp switch (manual transaxle)	◦ 26 (7.5A) (reversing lamp switch) (manual transaxle) • Bulb(s) • Wiring, terminals or connectors • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure the headlamp switch is in the OFF position.

NOTE: Make sure the multifunction switch is in the LOW BEAM position.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
    - Check the VCM connection to the vehicle.
    - Check the scan tool connection to the VCM.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
    - Verify the ignition key is in the ON position.
    - Verify the scan tool operation with a known good vehicle.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the transmission control module (TCM).
9. If the DTCs retrieved are related to the concern, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.

10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the transmission control module (TCM)	• Fuse(s) • Wiring, terminals or connectors • TCM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The reversing lamps are inoperative	• Fuse • Wiring, terminals or connectors • Reversing lamp switch • SJB	• Go to **Pinpoint Test U**.
• An individual reversing lamp is inoperative	• Wiring, terminals or connectors	• Go to **Pinpoint Test V**.
• The reversing lamps are on continuously	• Wiring, terminals or connectors • Reversing lamp switch • Rear view mirror • SJB	• Go to **Pinpoint Test W**.

Pinpoint Tests

Pinpoint Test U: The Reversing Lamps Are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Reversing Lamps for schematic and connector information.

Normal Operation - Automatic Transaxle

When the transaxle is placed in REVERSE (R), the transmission control module (TCM) sends gear status information (through the instrument cluster [IC] gateway) to the smart junction box (SJB). When the SJB receives a message indicating the transaxle is in REVERSE (R), the SJB provides ground to an internal relay, which routes the voltage to circuit CBP12 (GN/WH) to the reversing lamps.

Manual Transaxle

Voltage is supplied to the reversing lamp switch through circuit CBP18 (GY/OG). When the transaxle is placed in REVERSE (R), the reversing lamp switch routes the voltage to circuit CBP12 (GN/WH) to the reversing

lamps.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Reversing lamp switch
- SJB

PINPOINT TEST U: THE REVERSING LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

U1 CHECK THE TRANSAXLE TYPE

- Key in OFF position.
- Check the transaxle type on the vehicle.
- **Is the vehicle equipped with a manual transaxle?**

  YES : Go to U2.

  NO : Go to U4.

U2 CHECK CIRCUIT CBP18 (GY/OG) FOR AN OPEN

- Disconnect: Reversing Lamp Switch C169
- Key in ON position.

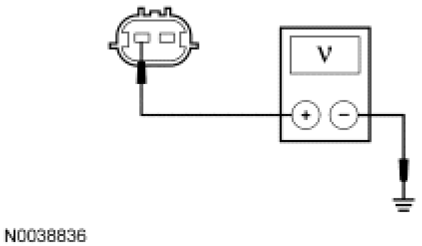


Fig. 54: Checking Circuit CBP18 (GY/OG) For Open
Courtesy of FORD MOTOR CO.

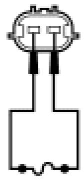
- Measure the voltage between the reversing lamp switch C169-1, circuit CBP18 (GY/OG), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to U3.

  NO : VERIFY the SJB fuse 26 (7.5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

U3 CHECK THE REVERSING LAMP SWITCH

- Key in OFF position.



N0038837

Fig. 55: Checking Reversing Lamp Switch
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the reversing lamp switch C169-1, circuit CBP18 (GY/OG), harness side and the reversing lamp switch C169-2, circuit CBP12 (GN/WH), harness side.
- Key in ON position.
- **Do the reversing lamps illuminate?**

  YES : INSTALL a new reversing lamp switch. REFER to **Reversing Lamp Switch**. TEST the system for normal operation.

  NO : REPAIR circuit CBP12 (GN/WH) for an open. TEST the system for normal operation.

U4 CHECK FOR TCM DTCs

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: TCM Self-Test
- Carry out the TCM on-demand self-test.
- **Are any TCM DTCs present?**

  YES : REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article or **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.

  NO : VERIFY the SJB fuse 1 (10A) is OK. If OK, go to U5.

U5 CHECK CIRCUIT CBP12 (GN/WH) FOR AN OPEN

- Disconnect: Inoperative Reversing Lamp
- Disconnect: SJB C2280e
- Measure the resistance between an inoperative reversing lamp, harness side and the SJB, harness side as follows:

Vehicle	Inoperative Reversing Lamp Connector-Pin	SJB Connector-Pin	Circuit

Fusion	LH C488-1	C2280e-21	CBP12 (GN/WH)
Fusion	RH C487-1	C2280e-21	CBP12 (GN/WH)
Milan, MKZ	LH C451-1	C2280e-21	CBP12 (GN/WH)
Milan, MKZ	RH C461-1	C2280e-21	CBP12 (GN/WH)

- **Is the resistance less than 5 ohms?**

  YES : Go to U6.

  NO : REPAIR the circuit. CLEAR the DTC. REPEAT the self-test.

U6 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test V: An Individual Reversing Lamp Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Reversing Lamps for schematic and connector information.

Normal Operation

When the transaxle is placed in REVERSE (R), voltage is supplied to the reversing lamps through circuit CBP12 (GN/WH). Ground to the reversing lamps is provided through circuit GD171 (BK/GY).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

PINPOINT TEST V: AN INDIVIDUAL REVERSING LAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

V1 CHECK CIRCUIT GD171 (BK/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: Inoperative Reversing Lamp
- Measure the resistance between the inoperative reversing lamp, harness side and ground as follows:

Vehicle	Inoperative Reversing Lamp Connector-Pin	Circuit
Fusion	LH C488-2	GD171 (BK/GY)
Fusion	RH C487-2	GD171 (BK/GY)
Milan, MKZ	LH C451-2	GD171 (BK/GY)
Milan, MKZ	RH C461-2	GD171 (BK/GY)

- **Is the resistance less than 5 ohms?**

  YES : REPAIR circuit CBP12 (GN/WH). TEST the system for normal operation.

  NO : REPAIR circuit GD171 (BK/GY). TEST the system for normal operation.

Pinpoint Test W: The Reversing Lamps Are On Continuously

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Reversing Lamps for schematic and connector information.

Normal Operation - Automatic Transaxle

When the transaxle is placed in REVERSE (R), the transmission control module (TCM) sends gear status information (through the instrument cluster [IC] gateway) to the smart junction box (SJB). When the SJB receives a message indicating the transaxle is in REVERSE (R), the SJB provides ground to an internal relay, which routes the voltage to circuit CBP12 (GN/WH) to the reversing lamps and the electrochromatic rear view mirror (if equipped).

Manual Transaxle

Voltage is supplied to the reversing lamp switch through circuit CBP18 (GY/OG). When the transaxle is placed in REVERSE (R), the reversing lamp switch routes the voltage to circuit CBP12 (GN/WH) to the reversing lamps and the electrochromatic rear view mirror (if equipped).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Reversing lamp switch
- Rear view mirror
- SJB

PINPOINT TEST W: THE REVERSING LAMPS ARE ON CONTINUOUSLY

W1 CHECK THE TRANSAXLE TYPE

- Key in OFF position.
- Check the transaxle type on the vehicle.
- **Is the vehicle equipped with a manual transaxle?**

  YES : Go to W2.

  NO : Go to W3.

W2 CHECK THE REVERSING LAMP SWITCH

- Disconnect: Reversing Lamp Switch C169
- Key in ON position.
- **Do the reversing lamps continue to illuminate?**

  YES : For vehicles equipped with an auto-dimming mirror, go to W4.

  REPAIR circuit CPB12 (GN/WH) for a short to voltage. TEST the system for normal operation.

  NO : INSTALL a new reversing lamp switch. REFER to **Reversing Lamp Switch**. TEST the system for normal operation.

W3 CHECK FOR TCM DTCs

- Key in ON position.
- Carry out the TCM on-demand self-test.
- **Are any TCM DTCs present?**

  YES : REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article or **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.

  NO : For vehicles equipped with an auto-dimming mirror, go to W4.

  For vehicles not equipped with an auto-dimming mirror, go to W5.

W4 CHECK THE REAR VIEW MIRROR

- Key in OFF position.
- Disconnect: Rear View Mirror C911 or C9030
- Key in ON position.
- **Do the reversing lamps continue to illuminate?**

  YES : For vehicles with an automatic transaxle, go to W5.

For vehicles with a manual transaxle, REPAIR circuit CPB12 (GN/WH) for a short to voltage. TEST the system for normal operation.

NO : INSTALL a new rear view mirror. REFER to **REAR VIEW MIRRORS** article. TEST the system for normal operation.

W5 CHECK CIRCUIT CBP12 (GN/WH) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280e
- Key in ON position.
- **Do the reversing lamps continue to illuminate?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to W6.

W6 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

DAYTIME RUNNING LAMPS (DRL)

Special Tools

Illustration	Tool Name	Tool Number
 ST1385-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

NOTE: The DRL is not a programmable parameter for this vehicle.

Fusion, Milan

The DRL feature operates the low beam headlamps at a reduced intensity when the ignition switch is in the RUN position, the headlamps are not on from any other input, and the transaxle is not in PARK (P) (automatic transaxle) or the parking brake is released (manual transaxle).

The SJB controls the DRL by using various inputs to determine whether or not the DRL should be illuminated. These inputs include:

- Ignition switch position
- Headlamp switch position
- Headlamps on or off
- Parking brake status (manual transaxle)
- Transaxle gear selection (automatic transaxle)

MKZ

The DRL feature operates the front turn lamps (on solidly, not flashing) when the ignition switch is in the RUN position, the headlamps are not on from any other input, and the transaxle is not in PARK (P).

The SJB controls the DRL by using various inputs to determine whether or not the DRL should be illuminated. These inputs include:

- Ignition switch position
- Headlamp switch position
- Headlamps on or off
- Transaxle gear selection

Inspection and Verification

1. Verify the customer concern.
2. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

   NOTE: Make sure the headlamp switch is in the OFF position.

   NOTE: Make sure the multifunction switch is not in the HIGH BEAM position.

   NOTE: Make sure to use the latest scan tool software release.

3. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

4. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
5. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
6. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
7. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The daytime running lamps (DRL) are inoperative	• Exterior lighting system input/output • Ignition switch input • Parking brake switch input (manual transaxle) • Transaxle gear input (automatic transaxle) • Smart junction box (SJB)	• Go to **Pinpoint Test X**.

Pinpoint Tests

Pinpoint Test X: The Daytime Running Lamps (DRL) Are Inoperative

Normal Operation - Fusion, Milan

When the ignition switch is in the RUN position, the headlamps are not on (from the autolamp system or manual control from the headlamp switch) and the transmission is not in PARK (P) (automatic transaxle) or the parking brake is released (manual transaxle), the smart junction box (SJB) provides a pulse-width modulated (PWM) voltage to the low beam headlamps. This illuminates the headlamps at a reduced intensity.

MKZ

When the ignition switch is in the RUN position, the headlamps are not on (from the autolamp system or manual control from the headlamp switch) and the transmission is not in PARK (P), the SJB provides voltage to the front turn lamps (on solidly, not flashing).

This pinpoint test is intended to diagnose the following:

- Exterior lighting system input/output
- Ignition switch input
- Parking brake switch input (manual transaxle)
- Transmission gear input (automatic transaxle)
- SJB

PINPOINT TEST X: THE DAYTIME RUNNING LAMPS (DRL) ARE INOPERATIVE

X1 VERIFY THE DRL OPERATION

- Key in ON position.
- Place the headlamp switch in the OFF position.
- For vehicles with a manual transaxle, release the parking brake.
- For vehicles with an automatic transaxle, place the gear selector lever in any gear other than PARK (P).
- **Are the DRL illuminated?**

  YES : The system is operating correctly. INFORM the customer of the conditions required for the DRL to operate correctly.

  NO : Go to X2.

X2 CHECK THE OPERATION OF THE HEADLAMPS OR FRONT TURN LAMPS

- For Fusion or Milan, place the headlamp switch in the HEADLAMPS ON position and observe the headlamps.
- For MKZ, turn the hazard flasher lamps on and observe the front turn lamps.
- **Do the headlamps or front turn lamps operate correctly?**

  YES : Go to X3.

  NO : REFER to **Headlamps** or **Turn Signal and Hazard Lamps**.

X3 CHECK THE IGNITION SWITCH INPUT

- Place the headlamp switch in the OFF position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB ignition switch (IGN_SW) PID while cycling the ignition switch through all its positions.
- **Does the PID agree with the ignition switch positions?**

  YES : For vehicles with an automatic transaxle, go to X4.

  For vehicles with a manual transaxle, go to X5.

NO : REFER to **STEERING COLUMN SWITCHES** article to diagnose the input from the ignition switch.

X4 CHECK THE TRANSAXLE GEAR INPUT

- Enter the following diagnostic mode on the diagnostic tool: Transmission Control Module (TCM) DataLogger
- Monitor the TCM transmission range (TR) PID while placing the gear selector lever through all its positions.
- **Does the PID agree with the gear selection?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article or **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article to diagnose the transmission range input.

X5 CHECK THE BRAKE WARNING INDICATOR OPERATION

- Apply and release the parking brake while observing the brake warning indicator.
- **Does the brake warning indicator operate correctly?**

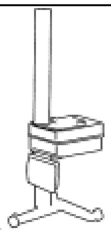
  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article to diagnose the parking brake switch input.

GENERAL PROCEDURES

HEADLAMP ADJUSTMENT

Special Tools

Illustration	Tool Name	Tool Number
 ST3041-A	Vision 100 Headlamp Aimer	196-00005 or equivalent

Headlamp Aiming

1. The headlamp aiming procedure depends on what type of beam pattern the headlamp is equipped with. Vehicles may come equipped with VOL or VOR headlamps. To identify the headlamp beam pattern, look on the headlamp lens. Molded in small letters on the headlamp lens is one of the following:
   - VOL and SAE
   - VOR and SAE
2. Once the headlamp beam pattern is identified, aim the headlamps using one of the following methods as applicable.

- Photometric aimers can aim VOL- and VOR- headlamps. This is the preferred method of headlamp aiming.
- Visual or screen method aiming can be used to aim VOL- and VOR- headlamps.
- Mechanical aimers cannot be used with VOR- or VOL-type headlamps. Aerodynamic lamps that can be aimed mechanically have 3 nibs molded into the lens of the lamp.

Photometric Aiming

1. For the photometric aiming procedure, refer to the appropriate photometric headlamp aimer instruction article.

Screen Method Aiming

All headlamp types

NOTE: Horizontal aim is not necessary for VOL or VOR headlamps.

NOTE: Consult your state vehicle inspection article for recommended tolerance ranges for visual aiming.

NOTE: The sight shield may need to be positioned or removed for access to the adjusters.

1. Before starting headlamp adjustment:
   - check the tire inflation.
   - check that no other load is in the vehicle other than a half tank of fuel.
   - check that the headlamps are clean.
   - check for correct headlamp operation.
   - check that the vehicle is on level ground.
   - if the vehicle is equipped with air suspension, make sure that the switch is on.

   NOTE: The vertical wall or screen must be a minimum of 2.4-m (8-ft) wide.

2. Park the vehicle on a level surface approximately 7.6-m (25-ft) from the vertical wall or screen directly in front of it.

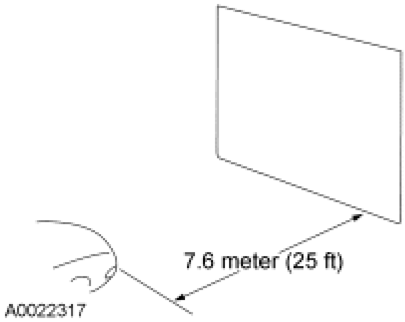


Fig. 56: Identifying Distance Between Vehicle And Vertical Wall Or Screen
Courtesy of FORD MOTOR CO.

NOTE: **The center of the lamp is marked either on the lens (circle, cross-hair or other mark) or on the bulb shield internal to the lamp (cross-hair or other mark).**

3. Mark a horizontal reference line on the vertical wall or screen.
    1. Measure the center of the headlamp height to ground and record the measurement.
    2. Make a 2.4-meter (8-ft) horizontal mark (using masking tape) on the vertical wall or screen at the same distance from the ground as previously recorded.

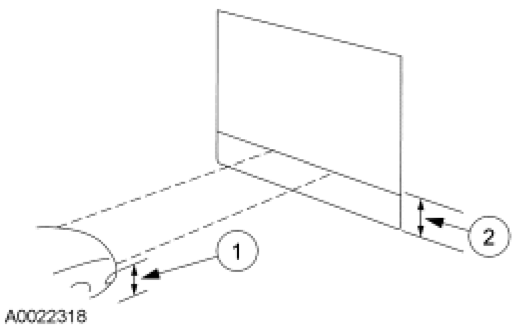


Fig. 57: Aiming Headlights
Courtesy of FORD MOTOR CO.

NOTE: **This procedure should be done in a dark environment to effectively see the headlamp beam pattern.**

4. Turn on the low beam headlamps to illuminate the wall or screen and open the hood.
5. On the wall or screen, locate the high intensity area of the beam pattern.

VOR-type headlamps

NOTE: **The appearance of the VOR beam pattern may vary between vehicles.**

6. Identify at the top edge of this high intensity area a distinct horizontal cutoff in the beam pattern. If the

top edge of this cutoff is not even with the horizontal reference line, the headlamp beam needs to be adjusted using the headlamp adjusting screw.

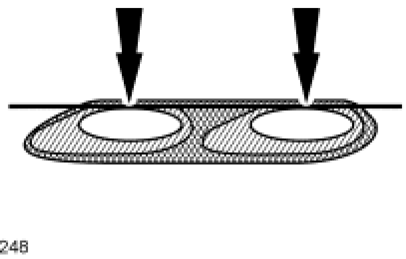


Fig. 58: Identifying High Intensity Area (VOR Type Headlamps)
Courtesy of FORD MOTOR CO.

VOL-type headlamps

7. For VOL-type headlamps, there is a distinct cutoff in the left portion of the beam pattern. The edge of this cutoff should be positioned 50.2 mm (2 in) below the horizontal reference line. Adjust the headlamp as necessary using the headlamp adjusting screw.
    1. Horizontal reference line.
    2. Top edge of the beam pattern.
    3. High intensity zone.

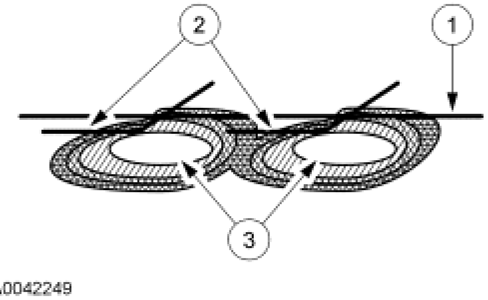


Fig. 59: Identifying VOL-Type Headlamps Beam Pattern
Courtesy of FORD MOTOR CO.

FRONT FOG LAMP ADJUSTMENT

NOTE:	**The adjuster screw can be accessed through an opening in the lower air deflector.**

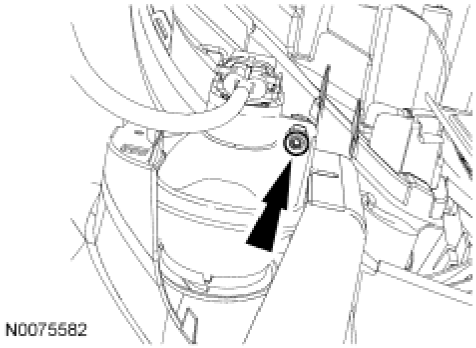


Fig. 60: Fog Lamp Adjustment Screw Location
Courtesy of FORD MOTOR CO.

NOTE: **Horizontal aim is not required for this vehicle and is not adjustable. Consult your state vehicle inspection center for recommended tolerance ranges for visual aiming.**

1. Before starting the fog lamp assembly adjustment:
   - check the tire inflation.
   - make sure there are no other loads in the vehicle other than a half tank of fuel.
   - make sure the vehicle is on level ground.
   - make sure the fog lamps and headlamps are clean.
   - make sure the headlamps are operating and are correctly aimed.

NOTE: **The vertical wall screen must be a minimum of 2.4-m (8-ft) wide.**

2. Park the vehicle on a level surface approximately 7.6 m (25 ft) from the vertical wall or screen directly in front of it.

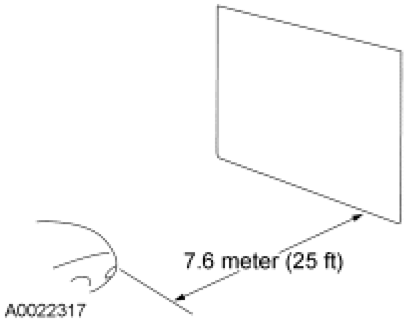


Fig. 61: Identifying Distance Between Vehicle And Vertical Wall Or Screen
Courtesy of FORD MOTOR CO.

3. The correct visual aim for the fog lamps is with the top edge of the high-intensity zone 10 cm (4 in) below the horizontal center of the fog lamps.

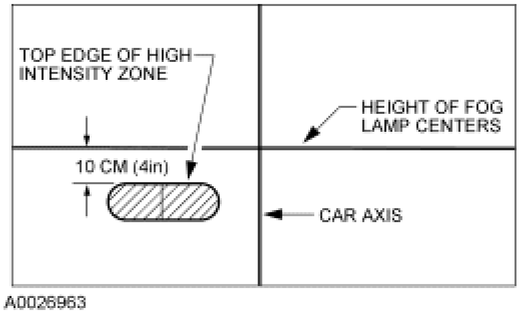


Fig. 62: Identifying Correct Visual Aim For Fog Lamps
Courtesy of FORD MOTOR CO.

4. If necessary, rotate the adjusting screw until the fog lamp beam is within specification.

AUTOLAMPS TIME DELAY ADJUSTMENT

NOTE: Steps 2 through 5 must be carried out within a 10-second period.

1. Start with the ignition switch off and the headlamp switch in the AUTOLAMPS ON position.
2. Place the headlamp switch in the OFF position.
3. Place the ignition switch in the RUN position.
4. Place the ignition switch in the OFF position.
5. Place the headlamp switch in the AUTOLAMPS ON position. The exterior lamps turn on at this point.
6. Wait the desired amount of time and place the headlamp switch in the OFF position (maximum of 3 minutes). The exterior lamps turn off and the autolamp time delay is now set.

REMOVAL AND INSTALLATION

HEADLAMP ASSEMBLY

NOTE: Fusion shown, Milan and MKZ similar.

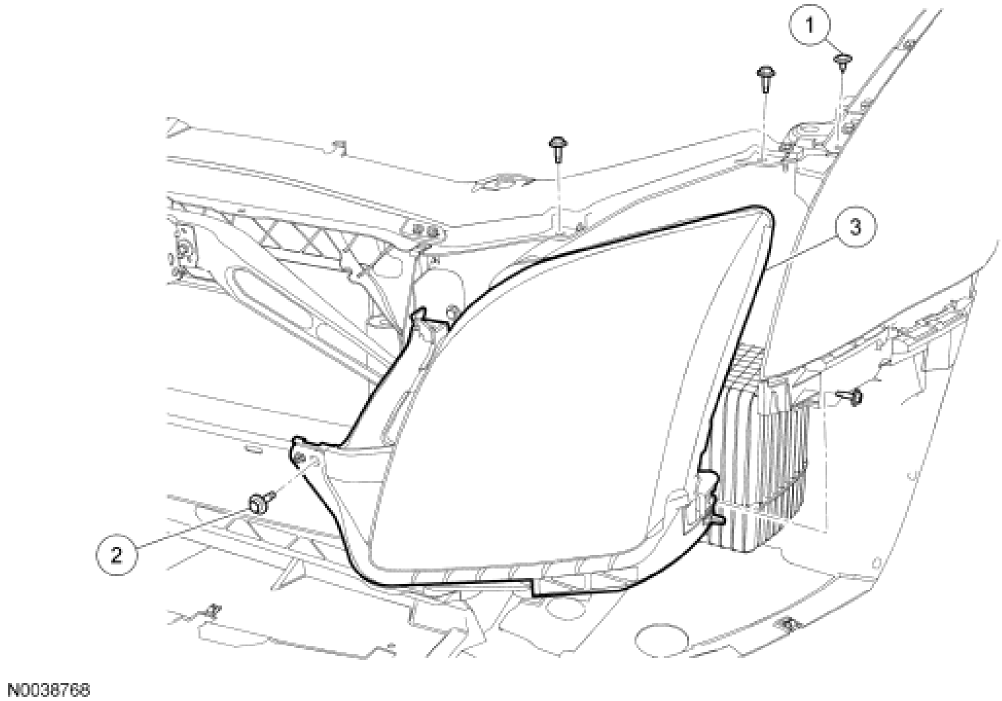


Fig. 63: Exploded View Of Headlamp Assembly
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Headlamp assembly pin-type retainer (part of 13005)
2	W711676	Headlamp assembly bolts (4 required)
3	13005/13006	Headlamp assembly (LH/RH)

REMOVAL AND INSTALLATION

NOTE: Make sure the headlamp switch and the ignition switch are in the OFF position.

1. Remove the front bumper cover. For additional information, refer to **BUMPERS** article.
2. Remove the headlamp assembly pin-type retainer.
3. Remove the 4 bolts and the headlamp assembly.
   - Disconnect the electrical connectors.
4. To install, reverse the removal procedure.

HEADLAMP BULB - LH

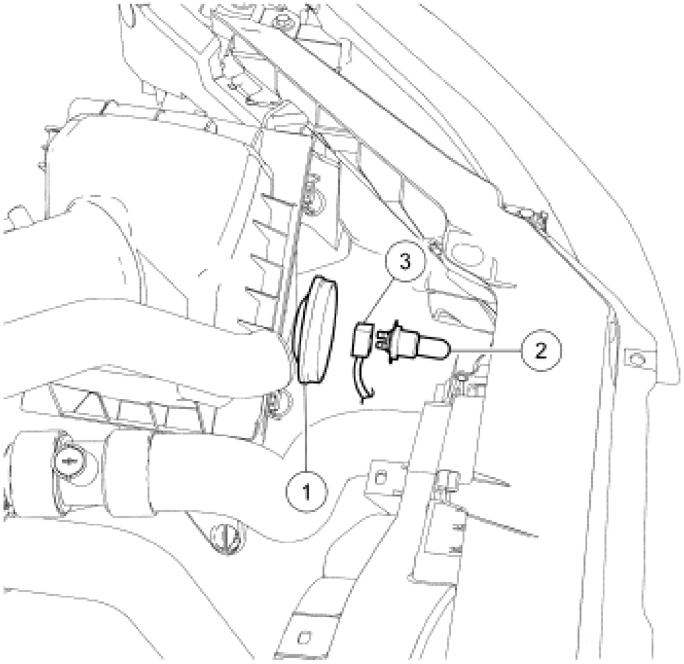


Fig. 64: Exploded View Of Headlamp Bulb - LH (High Beam)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13N019	Headlamp bulb protective cover
2	13N021	Headlamp high beam bulb
3	-	Headlamp high beam bulb electrical connector (part of 13005)

NOTE: **Standard headlamp bulb shown, high intensity discharge (HID) bulb similar.**

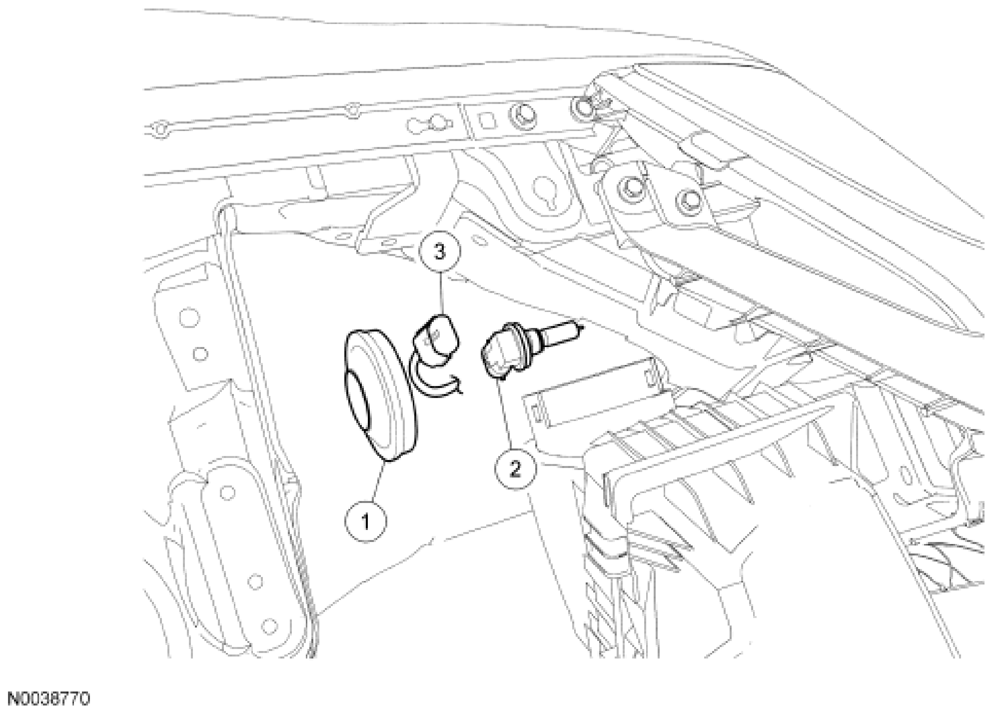


Fig. 65: Exploded View Of Headlamp Bulb - LH (Low Beam)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13N019	Headlamp bulb protective cover
2	13N021	Headlamp low beam bulb
3	-	Headlamp low beam bulb electrical connector (part of 13005)

REMOVAL AND INSTALLATION

WARNING: **The bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope. Failure to follow these instructions may result in personal injury.**

NOTE: The headlamp bulb should not be removed from the headlamp until just before a new bulb is installed. Removing the bulb for an extended period of time may affect headlamp bulb performance. Contaminants may enter the headlamp where they can settle on the lens and reflector. Never turn on the headlamps with the bulb removed from the headlamp.

NOTE: Make sure the headlamp switch and the ignition switch are in the OFF position.

Low beam bulb (vehicles equipped with a 2.3L or 3.0L engine)

1. Remove the air cleaner intake pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 2.3L** article or **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article.

   Low beam or high beam bulb

2. Remove the headlamp bulb protective cover.
3. Remove the headlamp bulb.
   - Disconnect the electrical connector.
4. To install, reverse the removal procedure.
   - Make sure the headlamp bulb protective cover is completely sealed.

HEADLAMP BULB - RH

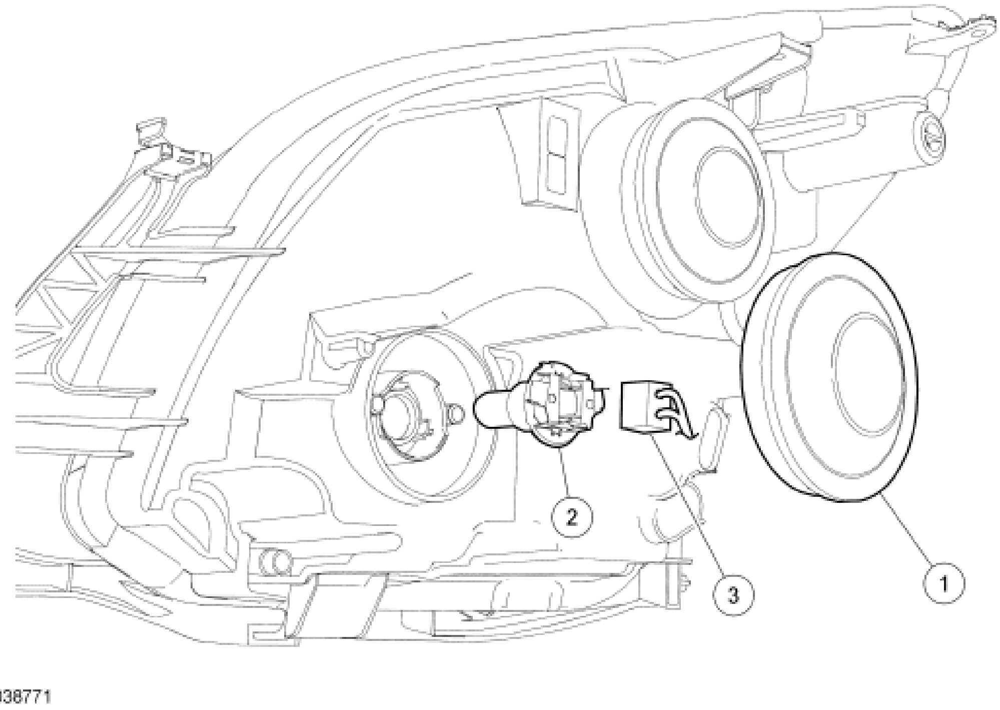


Fig. 66: Exploded View Of Headlamp Bulb - RH (High Beam)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13N019	Headlamp bulb protective cover
2	13N021	Headlamp high beam bulb
3	-	Headlamp high beam bulb electrical connector (part of 13006)

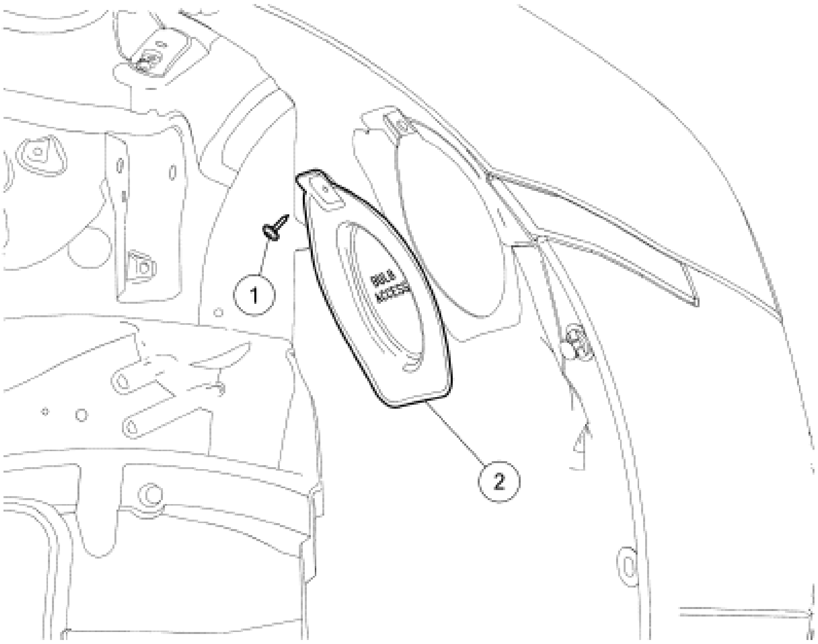


Fig. 67: Exploded View Of Headlamp Bulb - RH (Low Beam)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W706805	Fender splash shield access cover screw
2	16F029	Fender splash shield access cover

NOTE: Standard headlamp bulb shown, high intensity discharge (HID) bulb similar.

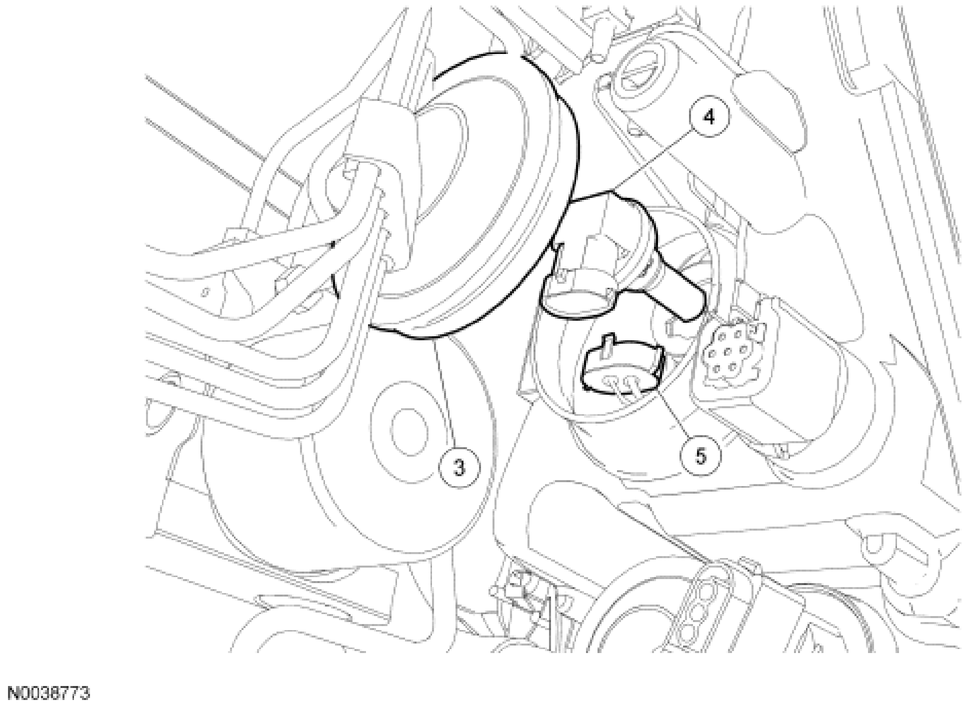


Fig. 68: Exploded View Of Standard Headlamp Bulb
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
3	13N019	Headlamp bulb protective cover
4	13N021	Headlamp low beam bulb
5	-	Headlamp low beam bulb electrical connector (part of 13006)

REMOVAL AND INSTALLATION

WARNING: **The bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope. Failure to follow these instructions may result in personal injury.**

NOTE: The headlamp bulb should not be removed from the headlamp until just before a new bulb is installed. Removing the bulb for an extended period of time may affect headlamp bulb performance. Contaminants may enter the headlamp where they can settle on the lens and reflector. Never turn on the headlamps with the bulb removed from the headlamp.

NOTE: Make sure the headlamp switch and the ignition switch are in the OFF position.

Low beam bulb

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the screw and the fender splash shield access cover.

High beam bulb, vehicles with ABS

NOTE: For vehicles with a 3.5L engine, remove the engine appearance cover.

3. Remove the bolt and the windshield washer reservoir filler tube.

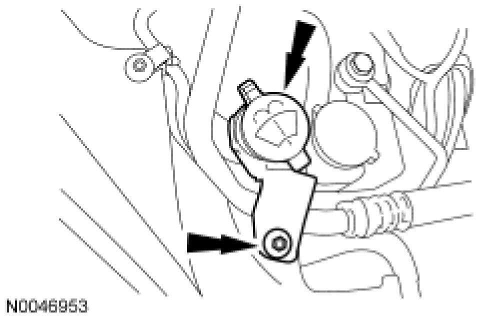


Fig. 69: Locating Bolt And Windshield Washer Reservoir Filler Tube
Courtesy of FORD MOTOR CO.

High beam bulb, vehicles without ABS

4. Disconnect the windshield washer reservoir filler tube.

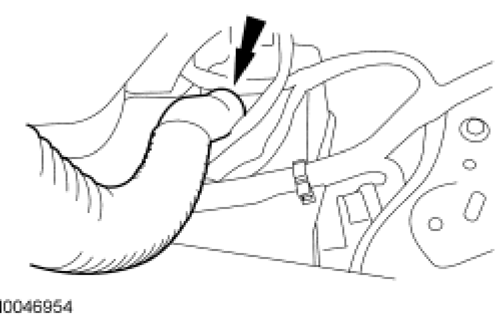


Fig. 70: Locating Windshield Washer Reservoir Filler Tube
Courtesy of FORD MOTOR CO.

Low beam or high beam bulb

5. Remove the headlamp bulb protective cover.
6. Remove the headlamp bulb.
   - Disconnect the electrical connector.
7. To install, reverse the removal procedure.

- Make sure the headlamp bulb protective cover is completely sealed.

BALLAST

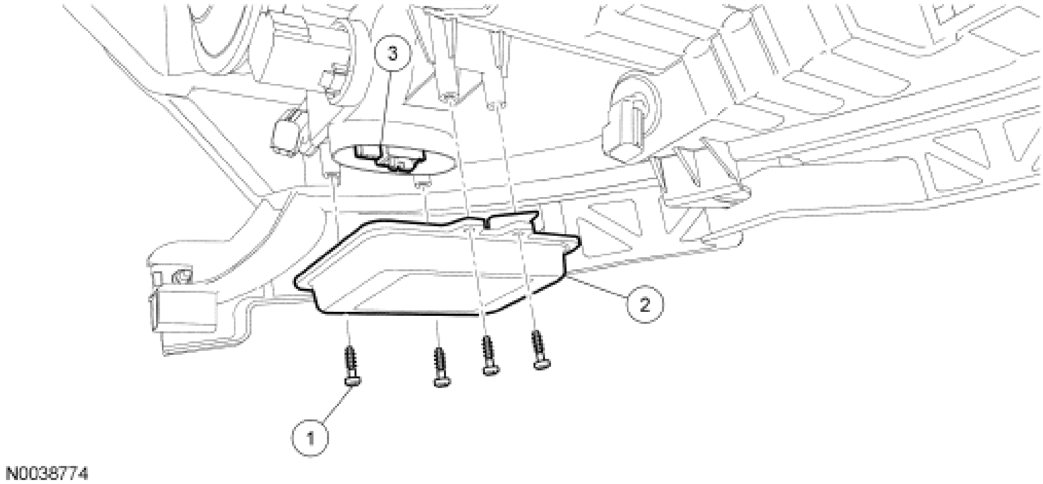


Fig. 71: Exploded View Of Ballast
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Ballast screws (4 required) (part of 13005)
2	13C170	Ballast
3	-	Ballast electrical connectors (part of 13005)

REMOVAL AND INSTALLATION

1. Remove the headlamp assembly. For additional information, refer to **Headlamp Assembly**.
2. Remove the 4 screws and the ballast.
   - Disconnect the electrical connectors.
3. To install, reverse the removal procedure.

FOG LAMP

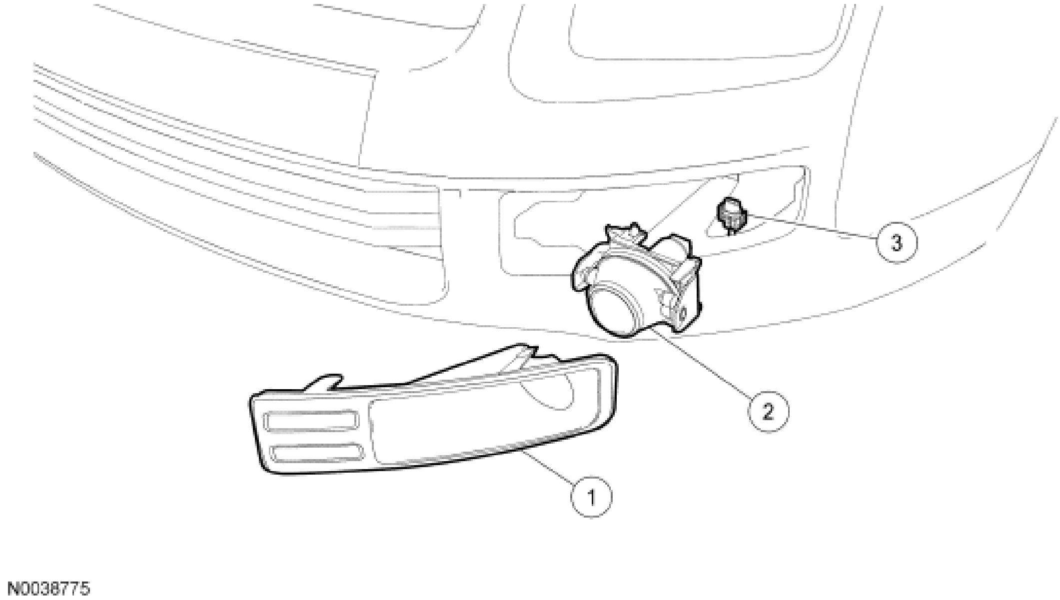


Fig. 72: Exploded View Of Fog Lamp
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	17K946	Fog lamp bezel
2	15K200	Fog lamp
3	-	Fog lamp electrical connector (part of 14290)

REMOVAL AND INSTALLATION

NOTE: Make sure the headlamp switch and the ignition switch are in the OFF position.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the 4 screws and position the fender splash shield aside.
3. Release the tabs and remove the fog lamp bezel.
4. Release the locking tabs and remove the fog lamp.
   - Disconnect the electrical connector.
5. To install, reverse the removal procedure.

FOG LAMP BULB

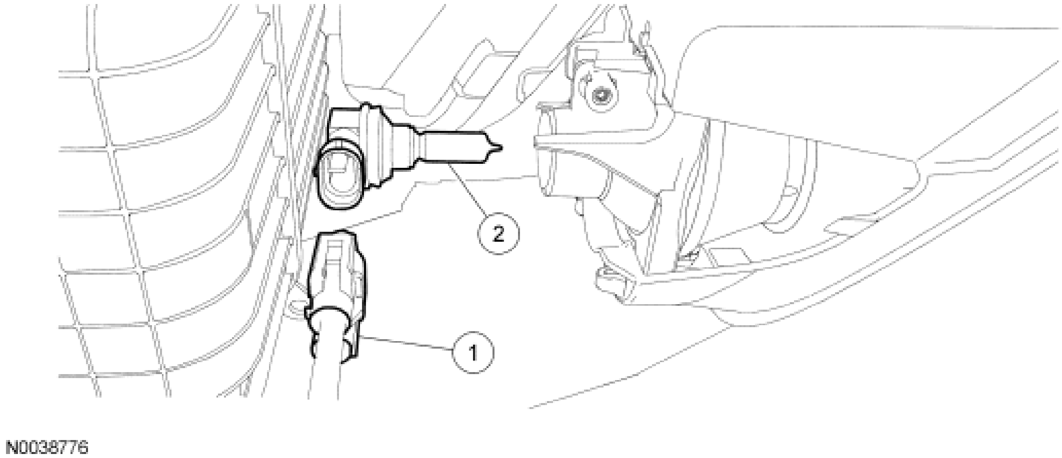


Fig. 73: Exploded View Of Fog Lamp Bulb
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Fog lamp electrical connector (part of 14290)
2	13N021	Fog lamp bulb

REMOVAL AND INSTALLATION

WARNING: **The bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope. Failure to follow these instructions may result in personal injury.**

NOTE: The fog lamp bulb should not be removed from the fog lamp until just before a new bulb is installed. Removing the bulb for an extended period of time may affect fog lamp bulb performance. Contaminants may enter the fog lamp where they can settle on the lens and reflector. Never turn on the fog lamps with the bulb removed.

NOTE: Make sure the headlamp switch and the ignition switch are in the OFF position.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the electrical connector and remove the fog lamp bulb.
3. To install, reverse the removal procedure.

PARKING LAMP BULB - FRONT

NOTE: LH shown, RH similar.

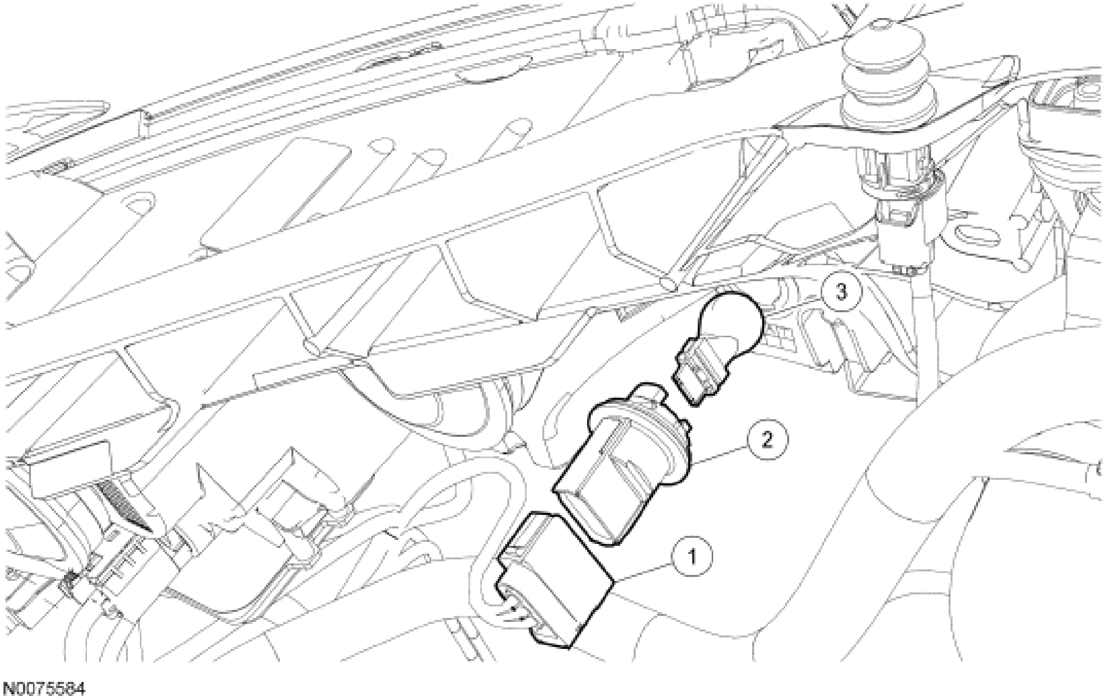


Fig. 74: Exploded View Of Front Parking Lamp Bulb - MKZ
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Front parking lamp electrical connector (part of 14290)
2	13411	Front parking lamp bulb socket
3	13466	Front parking lamp bulb

NOTE: **LH shown, RH similar.**

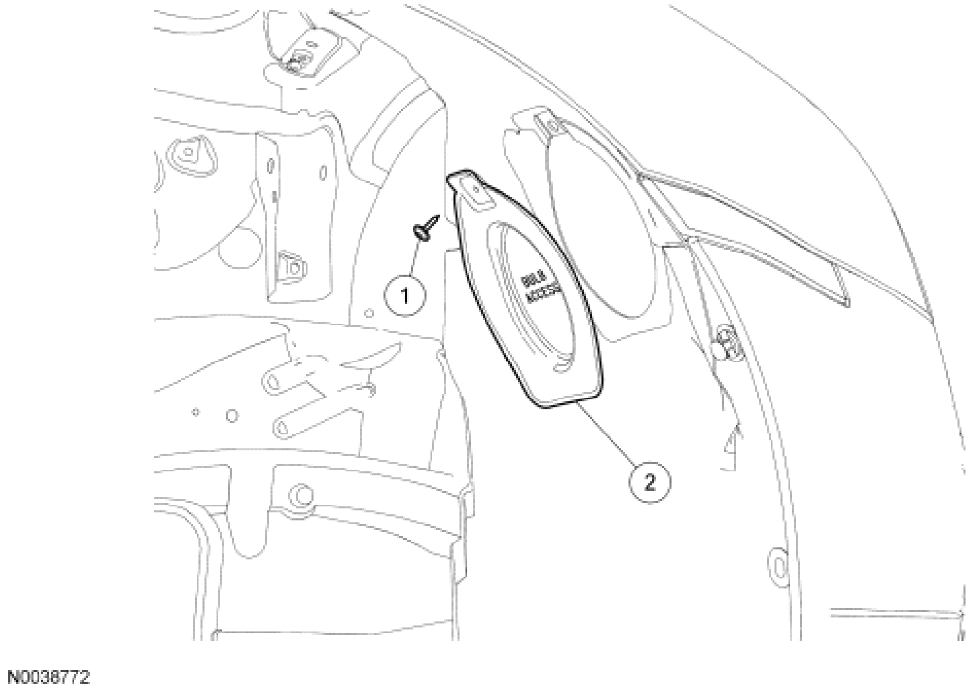


Fig. 75: Exploded View Of Front Parking Lamp Bulb - Fusion, Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W706805	Fender splash shield access cover screw
2	16F029	Fender splash shield access cover

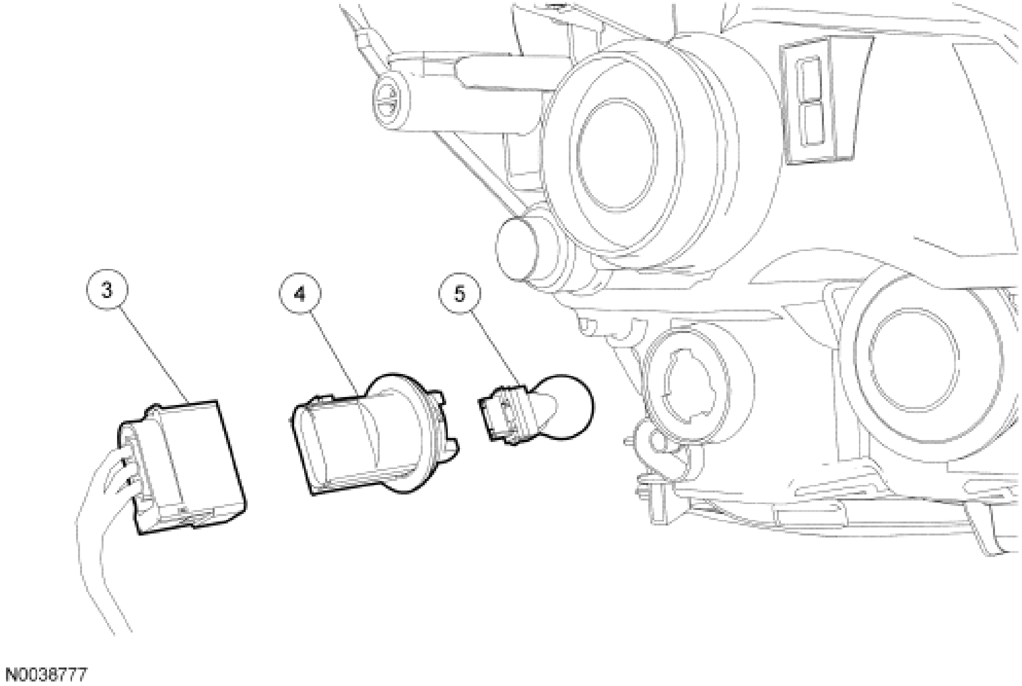


Fig. 76: Exploded View Of Front Parking Lamp Bulb Electrical Connector
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
3	-	Front parking lamp electrical connector (part of 14290)
4	13411	Front parking lamp bulb socket
5	13466	Front parking lamp bulb

REMOVAL AND INSTALLATION

MKZ LH front parking lamp bulb

1. Remove the air cleaner. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.

   MKZ LH or RH front parking lamp bulb

2. Remove the front parking lamp socket from the headlamp assembly.
   - Remove the front parking lamp bulb.

   Fusion, Milan RH front parking lamp bulb

3. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

4. Remove the screw and the fender splash shield access cover.

Fusion, Milan LH or RH front parking lamp bulb

5. Remove the front parking lamp socket from the headlamp assembly.
   - Remove the front parking lamp bulb.

All vehicles

6. To install, reverse the removal procedure.

SIDE MARKER LAMP

NOTE: LH shown, RH similar.

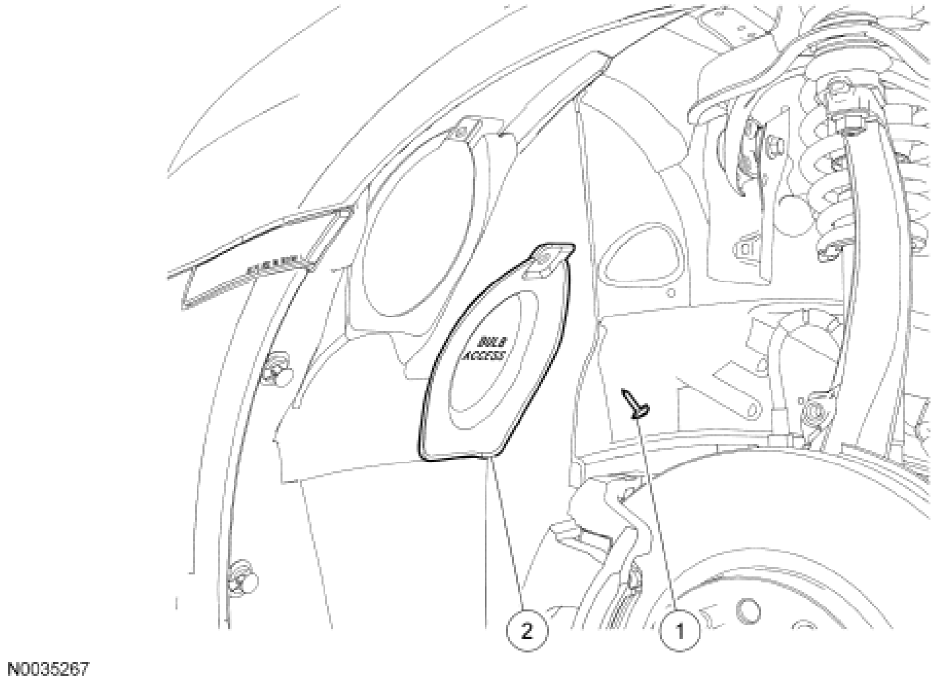


Fig. 77: Exploded View Of Side Marker Lamp - All vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W706805	Fender splash shield access cover screw
2	16F029	Fender splash shield access cover

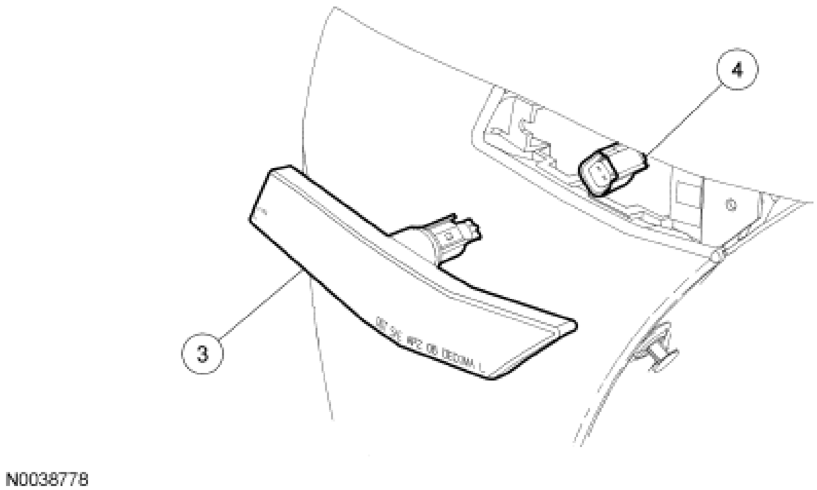


Fig. 78: Exploded View Of Side Marker Lamp - Fusion, Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
3	13200	Side marker lamp
4	-	Side marker lamp electrical connector (part of 14290)

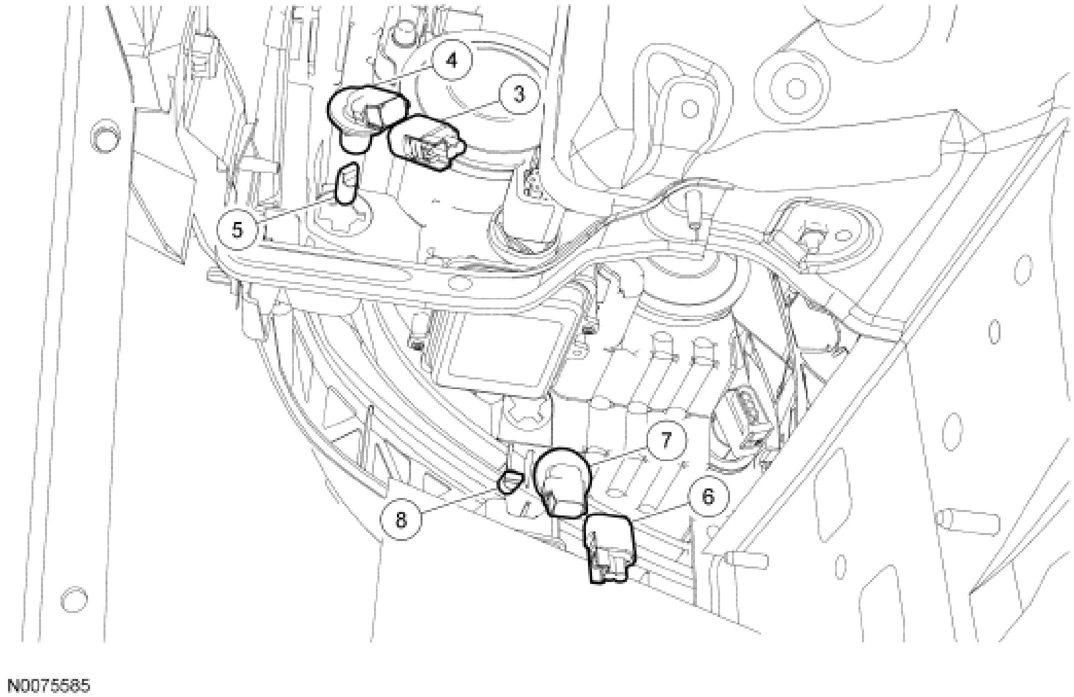


Fig. 79: Exploded View Of Side Marker Lamp - MKZ
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
3	-	Side marker lamp electrical connector (part of 14290)
4	13411	Side marker lamp bulb socket
5	13466	Side marker lamp bulb
6	-	Front marker lamp electrical connector (part of 14290)
7	13411	Front marker lamp bulb socket
8	13466	Front marker lamp bulb

REMOVAL AND INSTALLATION

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the screw and the fender splash shield access cover.

Fusion, Milan

3. Release the tabs and remove the side marker lamp.
   - Disconnect the electrical connector.

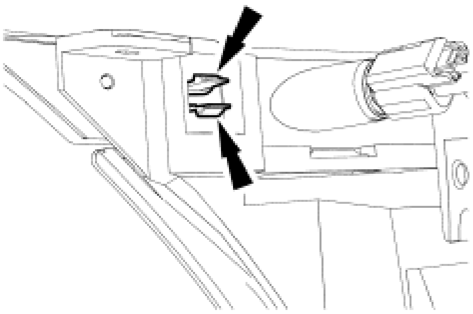


Fig. 80: Identifying Side Marker Lamp Electrical Connector
Courtesy of FORD MOTOR CO.

MKZ

NOTE: Rotate the bulb holder approximately one-eighth turn counterclockwise to remove.

4. Disconnect the electrical connector and remove the marker lamp from the headlamp assembly.

All vehicles

5. To install, reverse the removal procedure.

LIGHT SENSOR

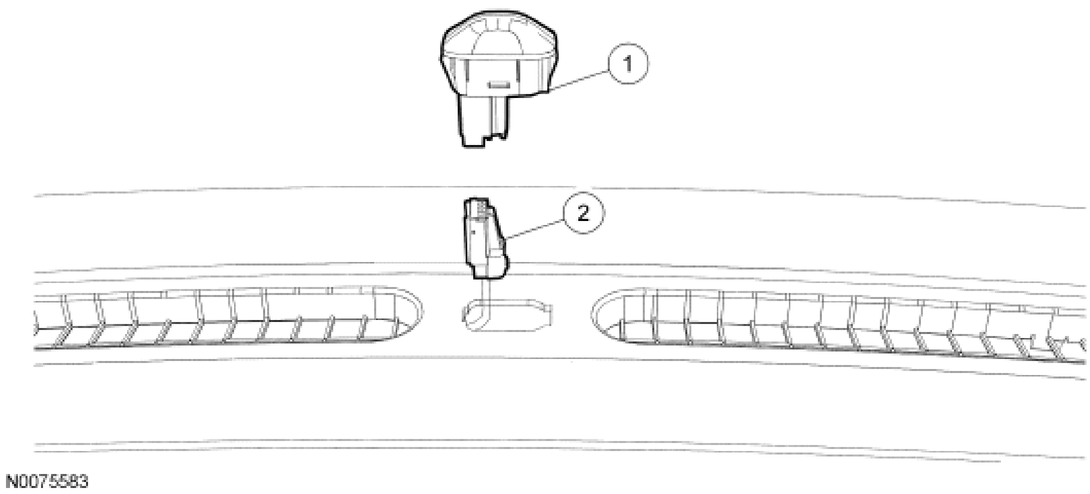


Fig. 81: Exploded View Of Light Sensor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13A018	Light sensor
2	-	Light sensor electrical connector (part of 14401)

REMOVAL AND INSTALLATION

1. Using a suitable tool, remove the light sensor from the defroster grille.
    - Disconnect the electrical connector.
2. To install, reverse the removal procedure.

STOPLAMP SWITCH

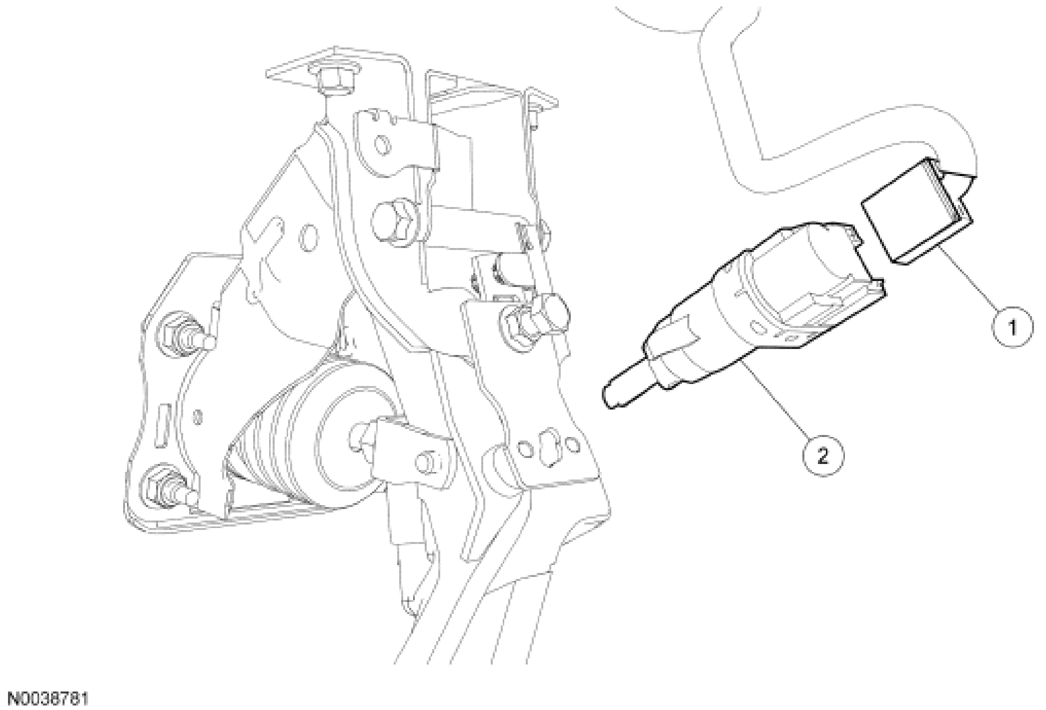


Fig. 82: Exploded View Of Stoplamp Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Stoplamp switch electrical connector (part of 14290)
2	13480	Stoplamp switch

REMOVAL AND INSTALLATION

CAUTION: Do not press, pull or otherwise move the brake pedal while removing or installing the stoplamp switch. The switch must be installed with the booster push rod attached to the brake pedal and with the brake pedal in the at-rest position. Installing the switch with the brake pedal in any other position results in incorrect adjustment and damage to the switch.

CAUTION: The switch plunger must be compressed for the switch to rotate in the bracket. Attempting to remove the switch with the plunger extended (during brake pedal apply) results in damage to the switch.

NOTE: Rotate the stoplamp switch clockwise approximately 1/8 turn to remove.

1. Rotate the stoplamp switch clockwise 45 degrees and remove the stoplamp switch.
   - Disconnect the electrical connector.
2. To install, reverse the removal procedure.

HEADLAMP SWITCH

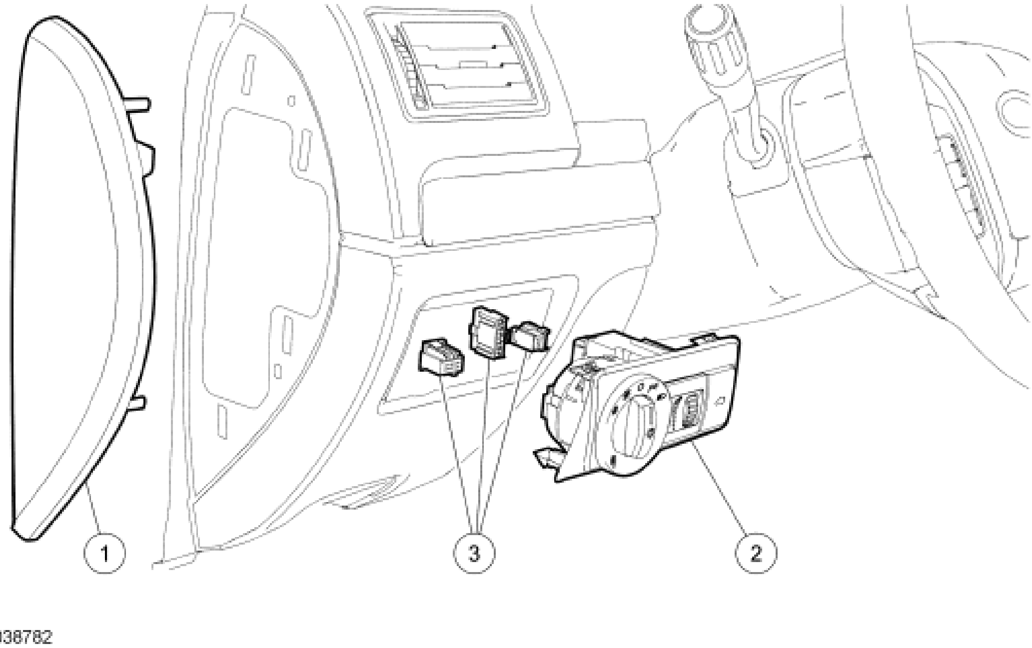


Fig. 83: Exploded View Of Headlamp Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5404481	Instrument panel side finish panel
2	11654	Headlamp switch
3	-	Headlamp switch electrical connectors (part of 14401)

REMOVAL AND INSTALLATION

1. Remove the instrument panel side finish panel.

NOTE: The headlamp switch is removed by pushing from behind.

2. Release the tabs and remove the headlamp switch.
   - Disconnect the electrical connectors.
3. To install, reverse the removal procedure.

HAZARD FLASHER LAMP SWITCH

NOTE: MKZ shown, Fusion and Milan similar.

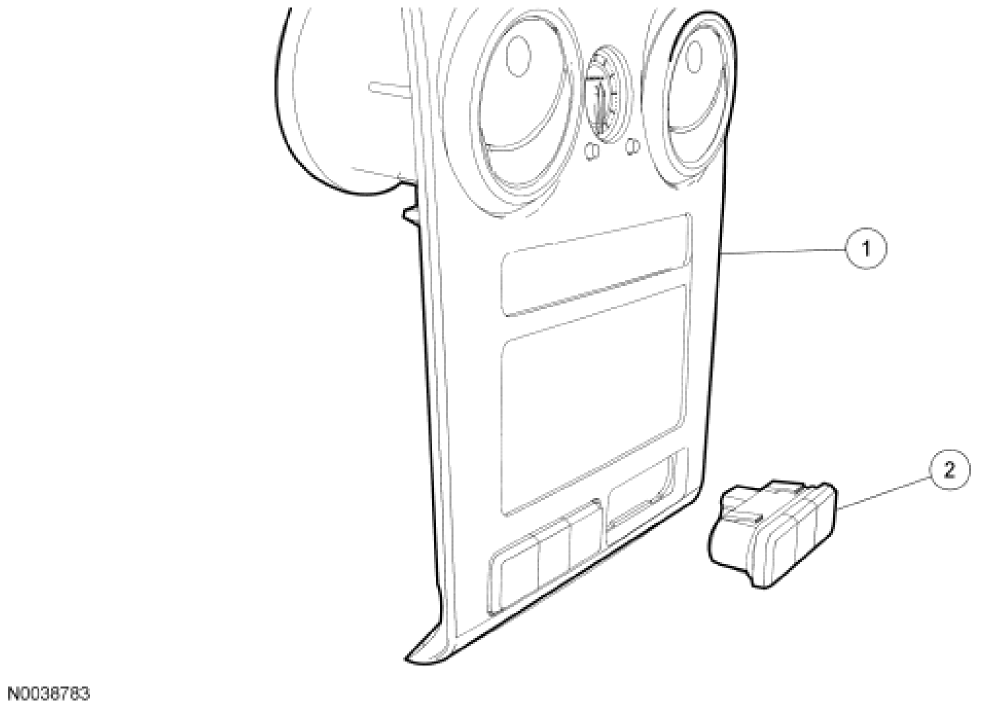


Fig. 84: Exploded View Of Hazard Flasher Lamp Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5404302	Instrument panel center finish panel
2	13D734	Hazard flasher lamp switch

REMOVAL AND INSTALLATION

1. Remove the instrument panel center finish panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Release the tabs and remove the hazard flasher lamp switch.
3. To install, reverse the removal procedure.

PUDDLE LAMP

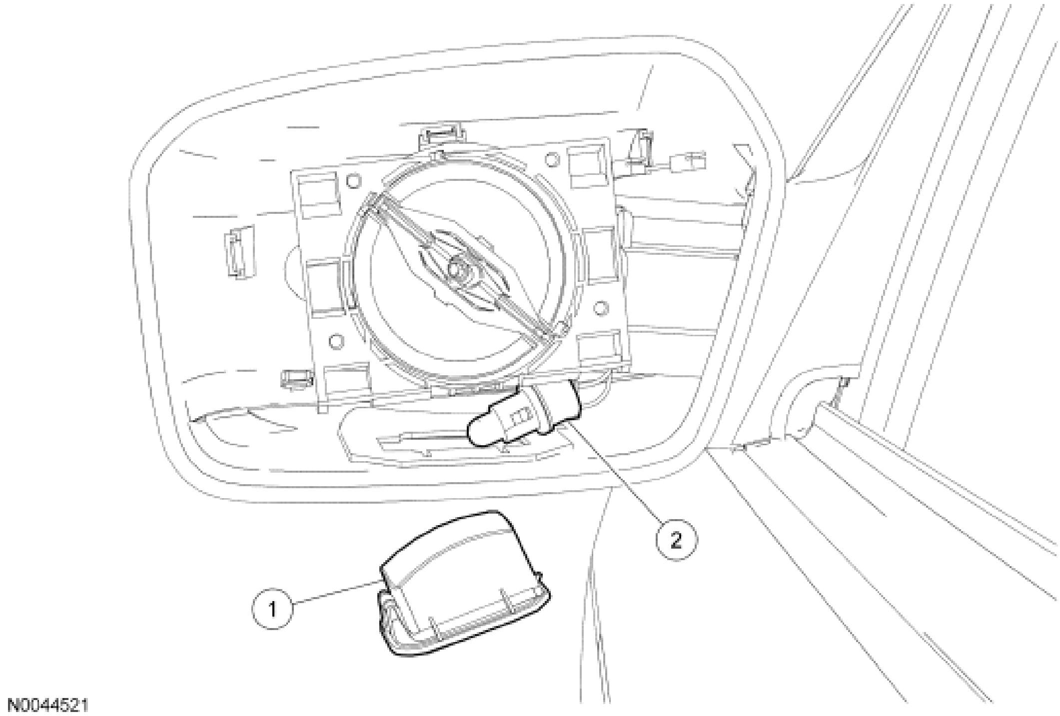


Fig. 85: Exploded View Of Puddle Lamp
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13B375	Puddle lamp
2	-	Puddle lamp bulb socket (part of 17683)

REMOVAL AND INSTALLATION

1. Remove the exterior mirror glass. For additional information, refer to **REAR VIEW MIRRORS** article.
2. Release the tab to remove the puddle lamp from the mirror housing.

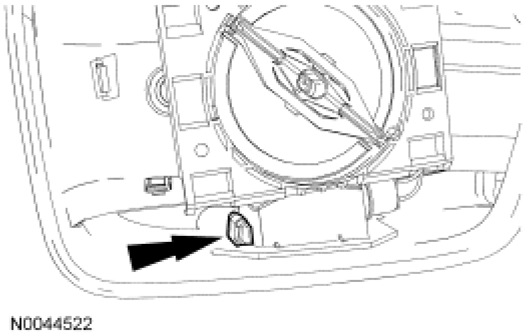


Fig. 86: Locating Puddle Lamp
Courtesy of FORD MOTOR CO.

NOTE: **The LH puddle lamp bulb socket is rotated clockwise to remove and the**

RH puddle lamp bulb socket is rotated counterclockwise to remove.

3. Rotate the puddle lamp bulb socket approximately 1/4 turn and remove it from the puddle lamp.

NOTE: **When rotating the bulb socket in the puddle lamp, the socket should come to a stop indicating it is completely installed.**

NOTE: **An audible click can be heard when the puddle lamp is fully seated.**

4. To install, reverse the removal procedure.

REVERSING LAMP SWITCH

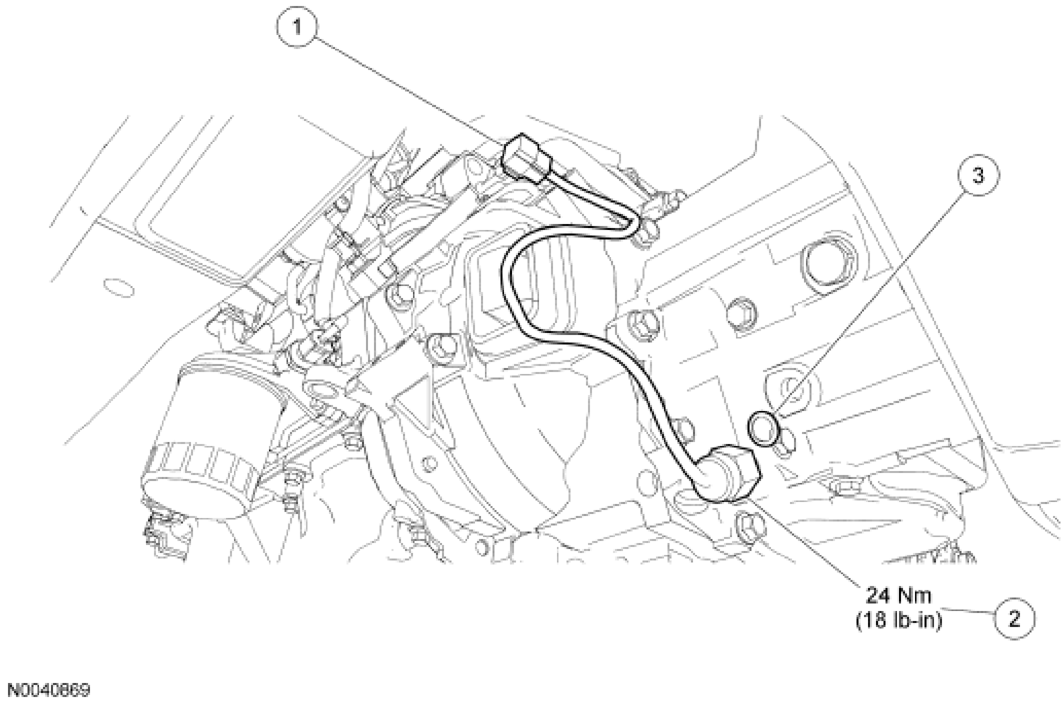


Fig. 87: Exploded View Of Reversing Lamp Switch With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Reversing lamp switch electrical connector (part of 7B229)
2	7B229	Reversing lamp switch
3	S995621	Reversing lamp switch gasket

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING**

AND LIFTING article.

2. Remove the fasteners and the lower engine splash shield.

NOTE: Discard the reversing lamp switch gasket.

3. Disconnect the electrical connector and remove the reversing lamp switch.
    - To install, tighten to 24 Nm (18 lb-ft).
4. To install, reverse the removal procedure.
    - Install a new reversing lamp switch gasket.
    - Check the transmission fluid and fill as necessary. For additional information, refer to **MANUAL TRANSAXLE/TRANSMISSION** article.

HIGH MOUNTED STOPLAMP

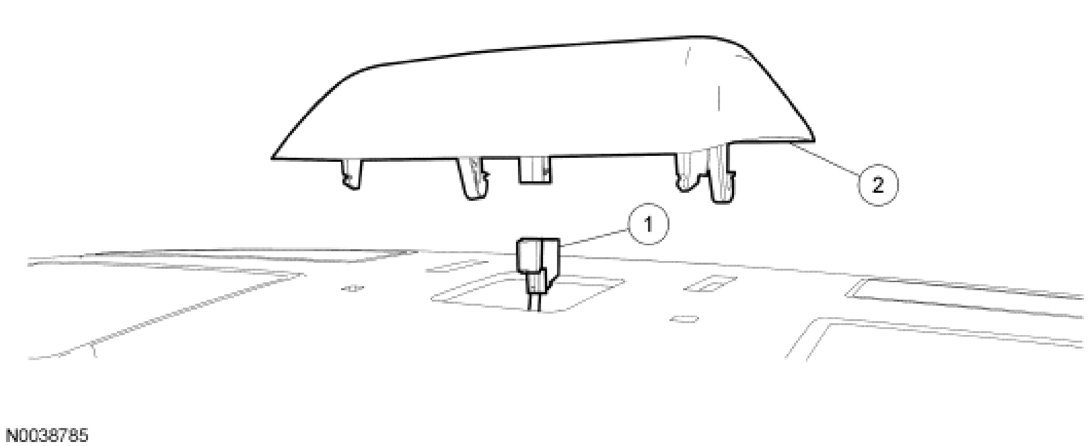


Fig. 88: Parcel Shelf Mounted
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	High mounted stoplamp electrical connector (part of 14A005)
2	13A613	High mounted stoplamp

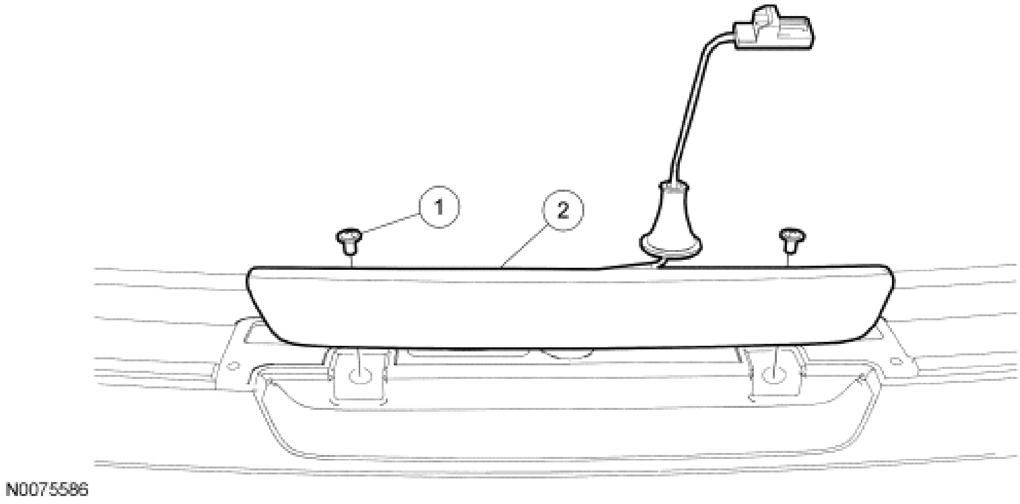


Fig. 89: Spoiler Mounted
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	High mounted stoplamp screws (2 required)
2	-	High mounted stoplamp

REMOVAL AND INSTALLATION

Parcel shelf mounted

1. Disconnect the high mounted stoplamp electrical connector from within the luggage compartment.
2. Push the high mounted stoplamp rearward to disengage the forward tabs and remove the high mounted stoplamp.

   Spoiler mounted

3. Remove the spoiler. For additional information, refer to **EXTERIOR TRIM AND ORNAMENTATION** article.
4. Remove the 2 screws and the high mounted stoplamp.

   All vehicles

5. To install, reverse the removal procedure.

REAR LAMP ASSEMBLY

NOTE: **Fusion shown, Milan and MKZ similar.**

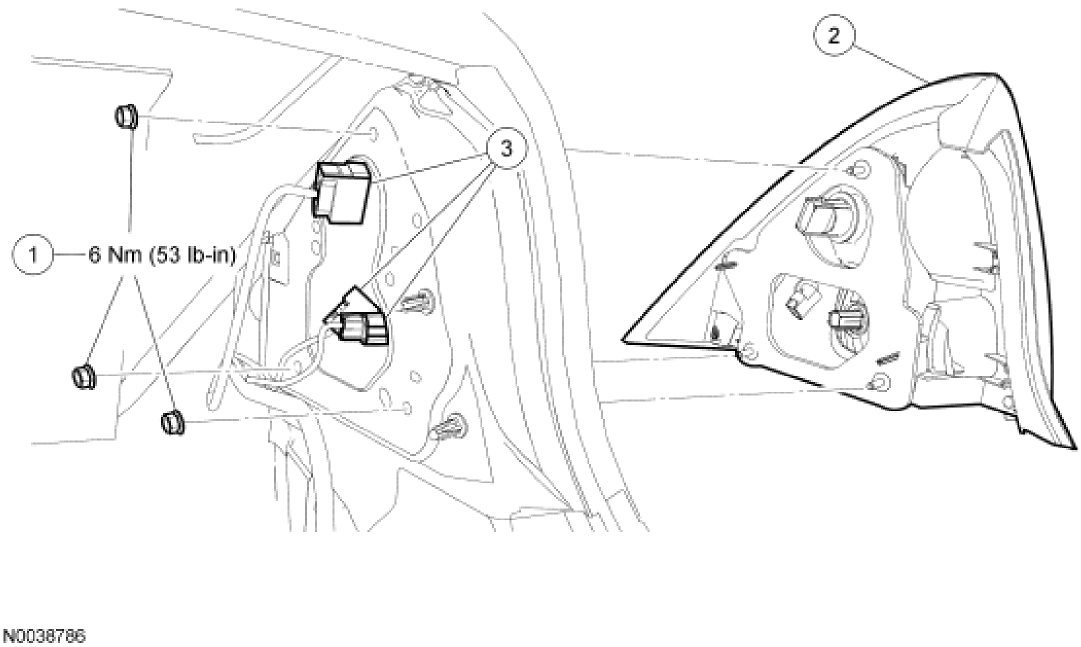


Fig. 90: Exploded View Of Rear Lamp Assembly With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W74141	Rear lamp assembly nuts (3 required)
2	13A505/13A504	Rear lamp assembly (LH/RH)
3	-	Rear lamp assembly electrical connectors (part of 14A005)

REMOVAL AND INSTALLATION

1. Remove the pin-type retainer and position the luggage compartment trim panel aside.
2. Remove the 3 nuts and the rear lamp assembly.
   - Disconnect the electrical connectors.
   - To install, tighten the nuts to 6 Nm (53 lb-in).
3. To install, reverse the removal procedure.

REVERSING LAMP

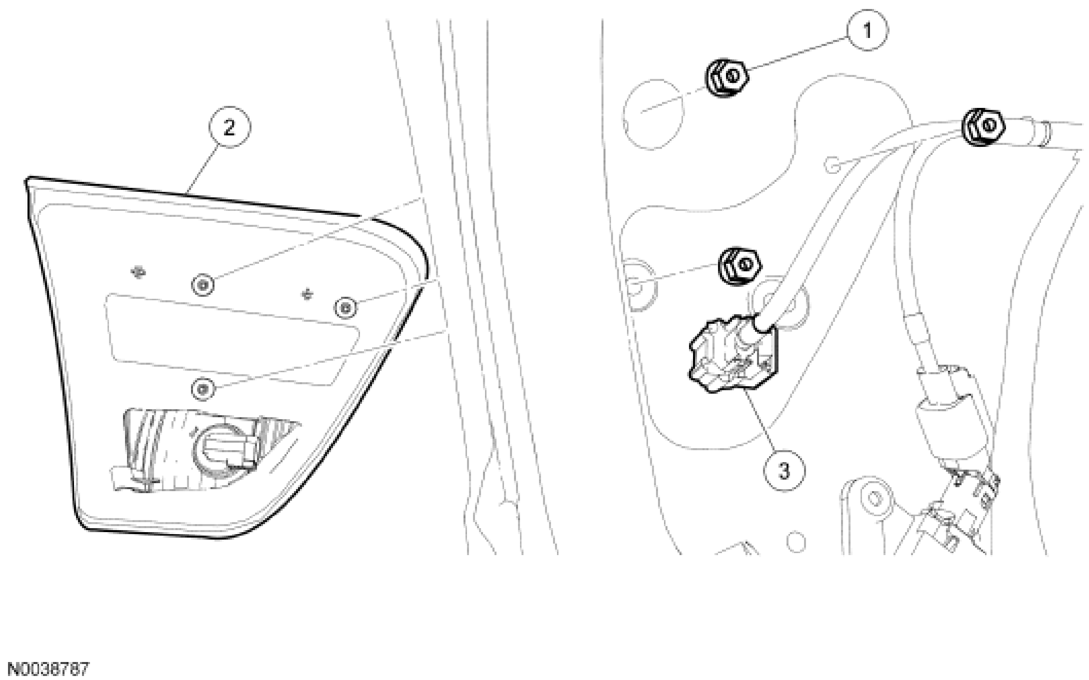


Fig. 91: Exploded View Of Reversing Lamp - Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701567	Reversing lamp nuts (3 required)
2	13404\13405	Reversing lamp (RH/LH)
3	-	Reversing lamp electrical connector (part of 14A005)

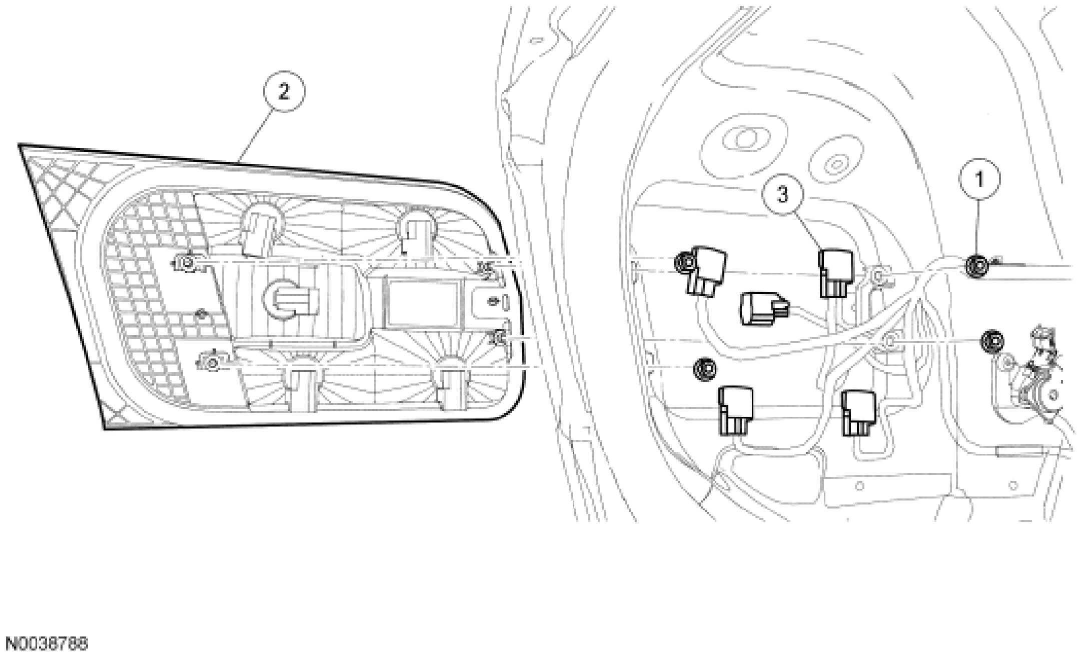


Fig. 92: Exploded View Of Reversing Lamp - MKZ
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701567	Reversing lamp nuts (4 required)
2	13404\13105	Reversing lamp (RH/LH)
3	-	Reversing lamp electrical connectors (part of 14A005)

REMOVAL AND INSTALLATION

1. Remove the pin-type retainers and the luggage compartment decklid trim panel.
2. Remove the 3 nuts (Milan) or 4 nuts (MKZ) and the reversing lamp.
   - Disconnect the electrical connector(s).
3. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Exterior Trim & Ornamentation - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Spoiler-to-luggage compartment lid nuts	6	53

REMOVAL AND INSTALLATION

RADIATOR GRILLE - MKZ

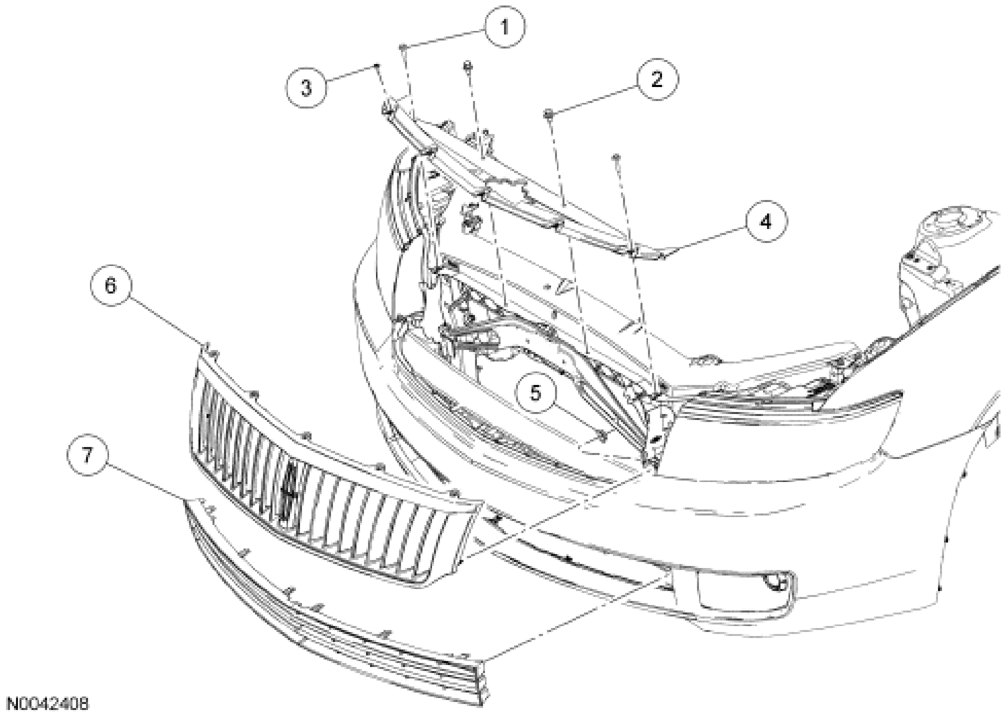


Fig. 1: Exploded View Of Radiator Grille - MKZ
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N808328	Upper radiator deflector shield screw (2 required)
2	N807389	Upper radiator deflector shield pin-type retainer (2 required)
3	-	Upper radiator deflector shield-to-grille bolt (5 required)

4	8A284	Upper radiator deflector shield
5	W706805	Radiator grille nut (2 required)
6	8200A	Upper radiator grille
7	8200B	Lower radiator grille

REMOVAL AND INSTALLATION

1. Remove the 2 screws from the upper radiator deflector shield.
2. Remove the 2 pin-type retainers from the upper radiator deflector shield.
3. Remove the 5 bolts from the top of the upper radiator grille.
4. Remove the upper radiator deflector shield.
5. Remove the 2 upper radiator grille nuts.
6. Remove the upper radiator grille.
7. Remove the lower radiator grille.
   - Remove the lower radiator grille from the clips on the bumper cover.
   - Remove the lower radiator grille from the bumper cover.
8. To install, reverse the removal procedure.

RADIATOR GRILLE - MILAN

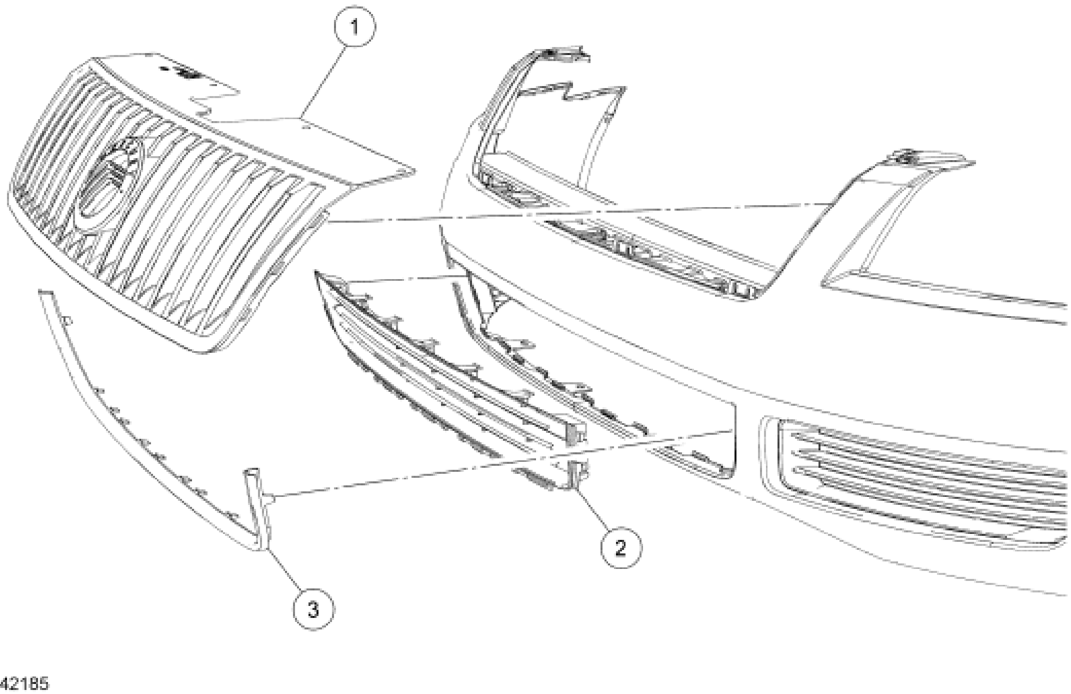


Fig. 2: Exploded View Of Radiator Grille - Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8200A	Upper radiator grille
2	8200B	Lower radiator grille
3	17K945	Lower radiator grille outer trim

1. Remove the front bumper cover. For additional information, refer to **BUMPERS** article.
2. Remove the upper radiator grille from the clips on the bumper cover.
3. Remove the lower radiator grille outer trim cover from the clips on the bumper cover.
4. Remove the lower radiator grille from the clips on the bumper cover.
5. To install, reverse the removal procedure.

RADIATOR GRILLE - FUSION

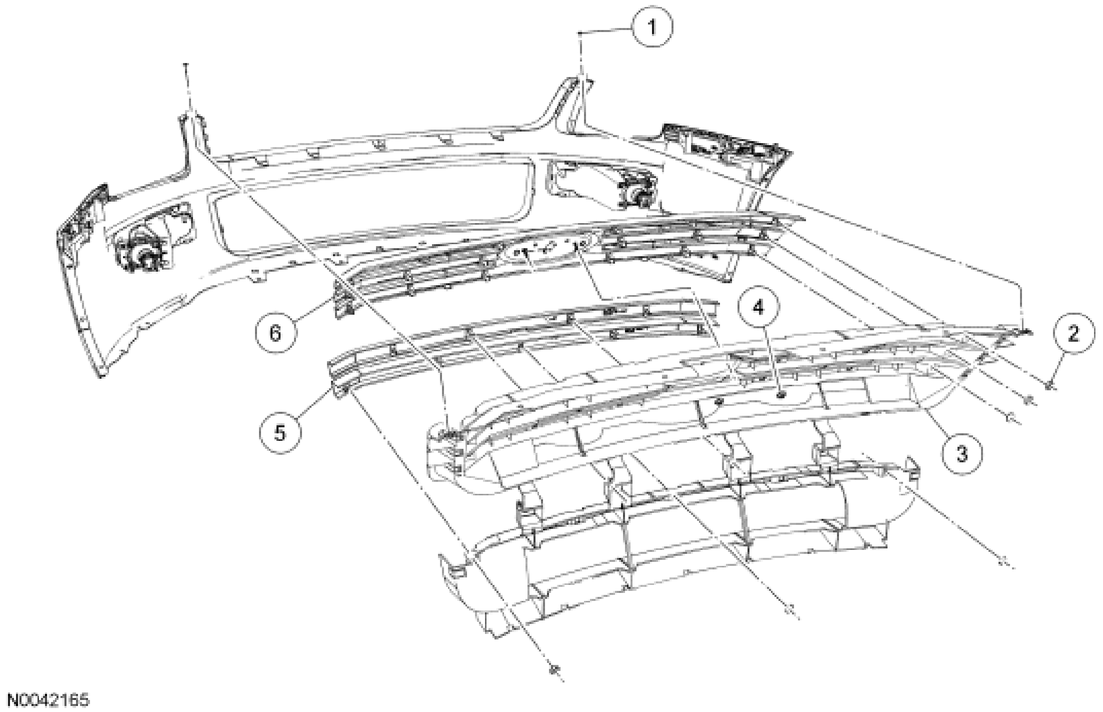


Fig. 3: Exploded View Of Radiator Grille - Fusion
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W706805	Radiator grille-to-bumper cover screw (2 required)
2	-	Radiator grille nut (9 required)
3	8A284	Radiator grille reinforcement
4	W707501	Radiator grille nameplate nut (2 required)
5	8200B/8200C	Lower radiator grille
6	8200A	Upper radiator grille

1. Remove the front bumper cover. For additional information, refer to **BUMPERS** article.
2. Remove the screws from the radiator grille-to-bumper cover.
3. Disengage the radiator grille from the clips on the bumper cover.
4. Remove the radiator grille.
5. To install, reverse the removal procedure.

SPOILER

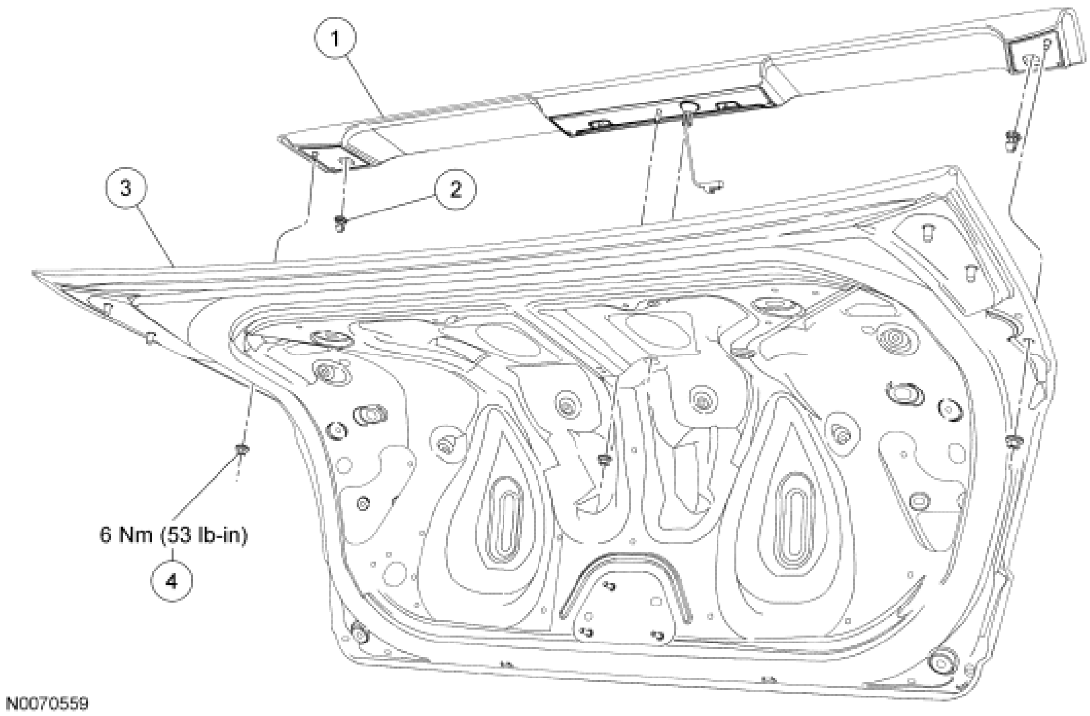


Fig. 4: Exploded View Of Spoiler
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5440602	Spoiler
2	-	Spoiler pin-type retainer (2 required)
3	5440110	Luggage compartment lid
4	N621926-S	Spoiler nut (3 required)

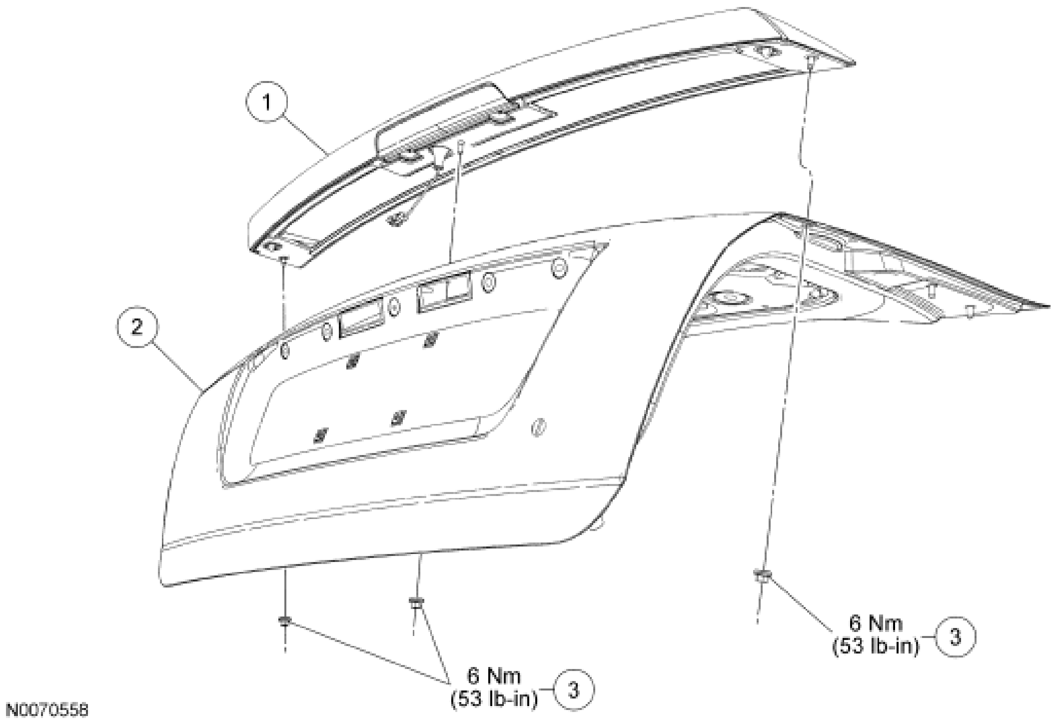


Fig. 5: Exploded View Of Spoiler With Torque Specifications - ST
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5444210	ST spoiler (less chimsel)
2	010303-40110	Luggage compartment lid
3	N621926-S	Spoiler nuts (3 required)

REMOVAL AND INSTALLATION

All vehicles

1. Open the luggage compartment lid.
2. Remove the luggage compartment lid.
   - Remove the push pin retainers.
   - Remove the insulator.
3. Disconnect the spoiler electrical connector.
4. Remove the spoiler-to-luggage compartment lid nuts.
   - To install, tighten to 6 Nm (53 lb-in).

ST spoiler only

5. Separate the tape from the luggage compartment lid along the front edge of the spoiler.

All vehicles

NOTE: **There are 2 pin-type retainers on the bottom of the spoiler. If the pin-type retainers break during removal, a new spoiler must be installed.**

NOTE: **Clean the luggage compartment lid surface prior to installing the spoiler, and press along the front edge of the spoiler after securing the fasteners to make sure of correct tape adhesion.**

6. Using a suitable tool, slide between the luggage compartment lid and the spoiler at each end until contact is made with the pin-type retainers. Push in the pin-type retainer and pull up on the spoiler to release the spoiler from the luggage compartment lid.
7. Remove the spoiler.
8. To install, reverse the removal procedure.

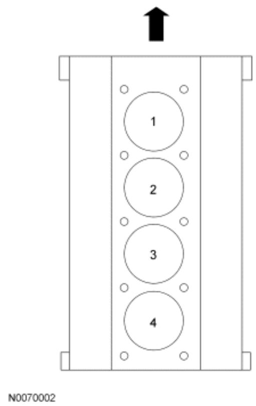
ENGINE PERFORMANCE

Firing Order & Cylinder Identification - Ford - All Models

FIRING ORDER & CYLINDER IDENTIFICATION

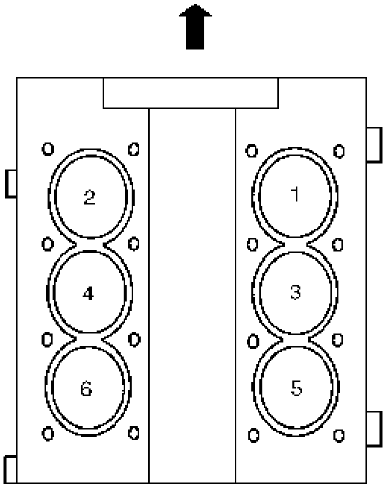
NOTE: **This information is intended as a quick reference for firing order and cylinder identification only. The information provided covers many vehicles and may include some information that does not apply to the vehicle you have currently selected.**

4 CYLINDER ENGINE

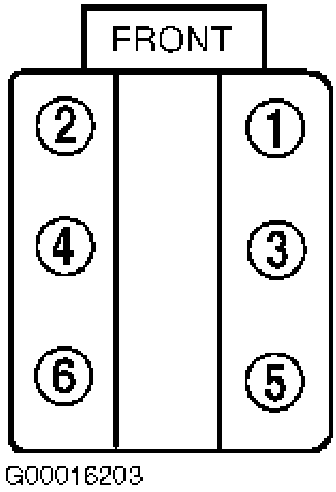
Engine Configuration	Firing Order	Cylinder Identification
In-Line 4	1-3-4-2	

V6 ENGINE

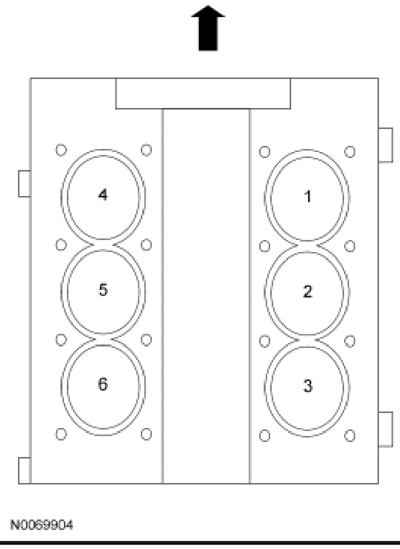
3.3L (VIN T) Engines

Engine Configuration	Firing Order	Cylinder Identification
3.3L (VIN T)	1-2-3-4-5-6	

3.0L Villager Engine

Engine Configuration	Firing Order	Cylinder Identification
3.0L Villager	1-2-3-4-5-6	

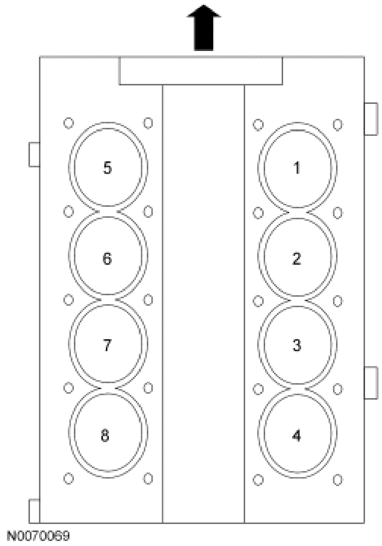
All Other V6 Engines

Engine Configuration	Firing Order	Cylinder Identification
All Others	1-4-2-5-3-6	

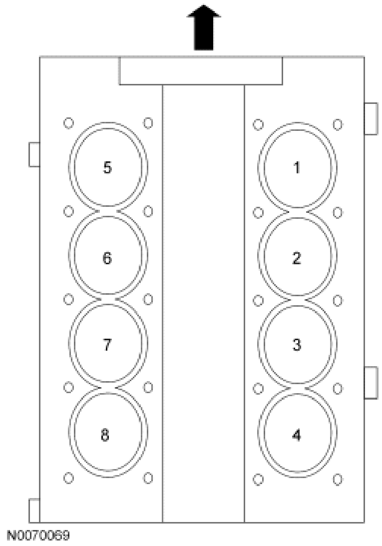
V8 ENGINE

3.9L (VIN A) V8 Engines

Engine Configuration	Firing Order	Cylinder Identification

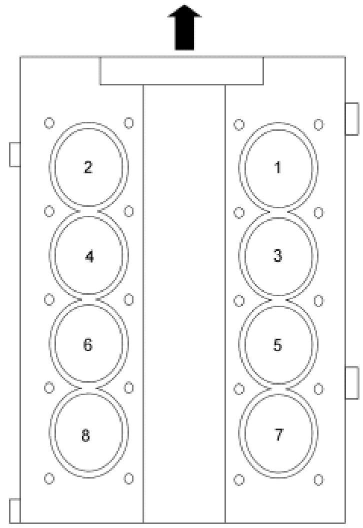
3.9L (VIN A)	1-5-4-2-6-3-7-8	

All Other Gasoline V8 Engines

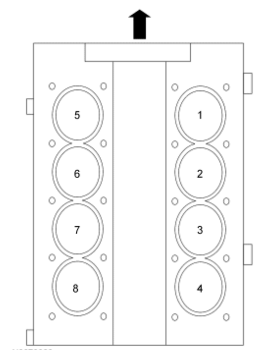
Engine Configuration	Firing Order	Cylinder Identification
All Others	1-3-7-2-6-5-4-8	

Diesel V8 Engine (To 2010)

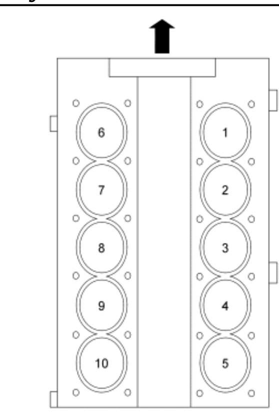
Engine Configuration	Firing Order	Cylinder Identification

Diesel to 2010	1-2-7-3-4-5-6-8	

6.7L Diesel V8 Engine (From 2011)

Engine Configuration	Firing Order	Cylinder Identification
Diesel from 2011	1-3-7-2-6-5-4-8	

V10 ENGINE

Engine Configuration	Firing Order	Cylinder Identification
V10	1-6-5-10-2-7-3-8-4-9	

2008 TRANSMISSIONS

Four Wheel Drive (4WD) Systems - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A	530 ml (18 oz)[a]
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A	1.15L (2.43 pt)[b]

[a] Power transfer unit (PTU)

[b] Rear differential unit (RDU)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
4X4 control module nut	9	80

DESCRIPTION AND OPERATION

FOUR WHEEL DRIVE (4WD) SYSTEMS

The All-Wheel Drive (AWD) system consists of the following:

- Power Transfer Unit (PTU)
- Rear driveshaft
- 4X4 control module (coupling device control module) (located behind the RH side instrument panel)
- Rear axle with coupling device

Torque from the engine is transferred through the transaxle to the PTU. This torque is transferred from the driveshaft to the rear axle, which drives the rear halfshafts. The AWD system, referred to as an Active Torque Coupling (ATC) system, is always active and requires no driver input.

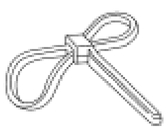
The AWD system continuously monitors vehicle conditions and automatically adjusts the torque distribution between the front and rear wheels. During normal operation, most of the torque is delivered to the front wheels. If wheel slip between the front and rear wheels is detected, or if the vehicle is under heavy acceleration, the AWD system increases torque to the rear wheels to prevent or control wheel slip.

Serviceable components of the PTU are limited to the output shaft seal and flange, intermediate shaft seal and deflector, and the PTU-transaxle compression seal. No internal components are serviced. There should be no need to remove the PTU cover. If any of the internal geared components, bearings, case cover or shafts are worn or damaged, a new PTU must be installed.

DIAGNOSTIC TESTS

FOUR WHEEL DRIVE (4WD) SYSTEMS

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	73III Automotive Meter	105-R0057 or equivalent
 ST1438-A	Flex Probe Kit	105-R025C
 ST1385-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

Principles of Operation

The vehicle is equipped with an All-Wheel Drive (AWD) system, **also referred to as active torque coupling (ATC)** , that is always active and requires no driver input. The system has no Mode Select Switch (MSS).

The system continuously monitors vehicle conditions and automatically adjusts the torque distribution between the front and rear wheels. During normal operation, most of the torque is sent to the front wheels. If wheel slip between the front and rear wheels is detected or if the vehicle is under heavy acceleration (high- throttle position), the AWD system increases torque to the rear wheels to prevent or control wheel slip.

The system consists of a Power Transfer Unit (PTU), 4X4 control module, rear axle and a solenoid actuated Active Torque Coupling (ATC) device. Based on the amount of current sent to the clutch, the module varies the torque sent to the rear wheels by sending a duty cycle to the ATCATC device, located inside the rear axle. For concerns with the PTU, refer to **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.

The 4X4 control module also provides the brake system with its current clutch duty cycle and determines whether or not the brake system may take command of the clutch duty cycle.

NOTE: The ATC solenoid is not repairable. If a new component is required, the ATC solenoid and rear axle are installed as an assembly. Refer to REAR DRIVE AXLE/DIFFERENTIAL article.

The active, on-demand AWD system uses data from other systems as inputs to the 4X4 control module. The 4X4 control module uses the inputs to determine the appropriate amount of current to send to the ATC solenoid that delivers the desired torque to the rear wheels. Specific inputs to the 4X4 control module are:

- Accelerator pedal position via the High Speed Controller Area Network (HS-CAN)
- Transaxle range from the Transmission Control Module (TCM) via the HS-CAN
- Brake system status from the ABS module via the HS-CAN
- Wheel speed from all 4 wheels from the ABS module via the HS-CAN

4X4 control module outputs are:

- Solid-state clutch (pulse-width modulated signal) to the ATC solenoid
- Percent of torque transfer commanded signal to the ABS module via the HS-CAN
- Torque request available signal to the ABS module via the HS-CAN

Heat Protection Mode - During very extreme off-road operation, the Pulse-Width Modulation (PWM) system utilizes a heat protection mode to protect the Active Torque Coupling (ATC) solenoid (part of rear axle) from damage. If the system detects an overheat condition, it enters a locked mode. If the heat in the system continues to rise once in the locked mode, the 4X4 control module disables the ATC solenoid. Allow the system to cool down at least 10 minutes with the ignition switch in the ON position.

Inspection and Verification

1. Verify the customer concern.
2. Inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical

• Active Torque Coupling (ATC) solenoid (part of rear axle)
• Power Transfer Unit (PTU)
• Rear Drive Unit (RDU)
• Halfshafts and CV joints
• Driveshaft and U-joints
• Fluid leaks
• Wheel/tire size and brand
	• Smart Junction Box (SJB) fuse(s):
	  ○ 20 (7.5A)
	  ○ 28 (10A)
	• 4X4 control module
	• Wiring harness
	• Connector(s)
	• Circuitry

• Matching tire size and brand • Tire pressure	

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

NOTE: The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition is in the ON position.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the DTCs and carry out the self-test diagnostics for the 4X4 control module.
9. If the DTCs retrieved are related to the concern, go to the 4X4 Control Module DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart - Four Wheel Drive System**.

DTC Charts

4X4 CONTROL MODULE DTC CHART

DTC	Description	Possible Causes	Source	Action
B1317	Battery Voltage High	• Generator	4X4 Control Module	Go to **Pinpoint Test B**.
B1318	Battery Voltage Low	• Open fuse (B+) • Intermittent open on power circuit • 4X4 control module	4X4 Control Module	Go to **Pinpoint Test B**.

		connector		
B1342	Electronic Control Unit (ECU) is Faulted	• Microprocessor or internal memory fault	4X4 Control Module	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new 4X4 control module. REFER to **4X4 Control Module**.
B2900	Vehicle Identification Number (VIN) Mismatch	• Incorrect VIN codes received from PCM	4X4 Control Module	CHECK the PCM configuration. REFER to **MODULE CONFIGURATION** article.
P1635	Tire/Axle Out of Acceptable Range	• Incorrect size tire installed on vehicle • Wheel speed sensor failure • Flat or under-inflated tire	4X4 Control Module	Go to **Pinpoint Test F**.
P1824	Four-Wheel Drive (4WD) Clutch Relay Circuit Failure	• Short to ground on Active Torque Coupling (ATC) solenoid (part of rear axle) high circuit • 4X4 control module failure	4X4 Control Module	Go to **Pinpoint Test D**.
P1825	4WD Clutch Relay Open Circuit	• 4X4 control module harness connector • Open in ATC solenoid (part of rear axle) low circuit • Open in ATC solenoid high circuit • Short to ground on ATC solenoid low circuit • Short to ground on ATC solenoid high circuit • Open coil inside ATC solenoid • Short to voltage in ATC solenoid low circuit	4X4 Control Module	Go to **Pinpoint Test D**.

		• 4X4 control module failure		
U0100	Lost Communication with PCM	• Controller Area Network (CAN) bus fault • No data received by 4X4 control module from PCM	4X4 Control Module	REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the lost communication with the PCM.
U0101	Lost Communication with Transmission Control Module (TCM)	• CAN bus fault • No data received by 4X4 control module from TCM module	4X4 Control Module	REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the lost communication with the TCM.
U0121	Lost Communication with Anti-lock Brake System (ABS) Control Module	• CAN bus fault • No data received by 4X4 control module from ABS module	4X4 Control Module	REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the lost communication with the ABS control module.
U0155	Lost Communication with IC Control Module	• High Speed Controller Area Network (HS-CAN) fault • No data received from the IC by the 4X4 control module	4X4 Control Module	REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the lost communication with the IC.
U0401	Invalid Data Received From PCM	• Invalid data received from PCM • Data out of range	4X4 Control Module	REFER to **Introduction - Gasoline Engines** article to diagnose the accelerator position, engine coolant or keep alive memory fault.
U0402	Invalid Data Received From TCM	• Invalid data received from TCM • Data out of range	4X4 Control Module	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article to diagnose the Transmission Range (TR).
U0415	Invalid Data Received From Anti-lock Brake System (ABS) Control Module	• Invalid data received from ABS module • Data out of range	4X4 Control Module	Go to **Pinpoint Test C**.
U2050	No Application Present	• Application software is not present • Application software update	4X4 Control Module	CONFIGURE the 4X4 control module. REFER to **MODULE CONFIGURATION** article to CARRY OUT Programmable Module Installation (PMI).

		failed • 4X4 control module failed		CLEAR the DTCs. RETRIEVE the DTCs and VERIFY successful module configuration. If DTC U2050 is retrieved again, INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. REPEAT the self-test.
U2051	One or More Calibration Files Missing/Corrupt	• Calibration software not present • Calibration software update failed • 4X4 control module failed	4X4 Control Module	CONFIGURE the 4X4 control module. REFER to **MODULE CONFIGURATION** article to CARRY OUT PMI. CLEAR the DTCs. RETRIEVE the DTCs and VERIFY successful module configuration. If DTC U2051 is retrieved again, INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. REPEAT the self-test.

Symptom Chart - Four-Wheel Drive (4WD) System

Symptom Chart - Four-Wheel Drive (4WD) System

Condition	Possible Sources	Action
• Unable to duplicate customer concern; no DTCs present	• The concern description is inaccurate	• CARRY OUT the AWD System Functional Test. Go to **Pinpoint Test A**.
• Battery voltage is high/low (4X4 control module)	• Concern with voltage regulator or generator • Smart Junction Box (SJB) fuse 20 (7.5A) • SJB fuse 28 (10A) • Intermittent open power circuit • 4X4 control module internal relay failure	• Go to **Pinpoint Test B**.
• 4X4 control module received no/invalid data from PCM	• Invalid data received from PCM • Data out of range	• REFER to **Introduction - Gasoline Engines** article to diagnose the accelerator position, engine coolant or keep alive memory fault.
• 4X4 control module received no/invalid data from ABS module	• Invalid data received from the ABS module • Data out of range	• Go to **Pinpoint Test C**.

• High Speed Controller Area Network (HS-CAN) communications bus fault	• HS-CAN bus fault • PCM fault • ABS fault • Instrument Cluster (IC) fault • Transmission Control Module (TCM) fault • 4X4 control module	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• Vehicle has no or inadequate torque at rear wheels	• Rear axle	• REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.
	• Power Transfer Unit (PTU) mechanical failure	• REFER to **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.

	• Wheels/tires
	• Active Torque Coupling (ATC) solenoid (part of rear axle)
	• SJB fuse(s):
	  • 20 (7.5A)
	  • 28 (10A)
	• 4X4 control module
		• Go to **Pinpoint Test F**.

	• Circuitry	• Go to **Pinpoint Test D**.
• Vehicle binds in a turn or resists turning/pulsates or shudders in a straight line	• Wheels/tires	• REFER to **WHEELS AND TIRES** article.
	• Brake system	• REFER to **BRAKE SYSTEM - GENERAL INFORMATION** article.
	• Wheel bearings	• REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.
	• Halfshafts	• REFER to **DRIVELINE SYSTEM - GENERAL INFORMATION** article.
	• Wheel speed sensor (s)	• REFER to **VEHICLE DYNAMIC SYSTEMS** article.
	• ABS module	• REFER to **VEHICLE DYNAMIC SYSTEMS** article.
	• 4X4 control module	

	• ATC solenoid (part of rear axle) • Circuitry	• Go to **Pinpoint Test E**.
• Tire/axle out of acceptable range	• Wheels/tires • Wheel speed sensors • ABS module • 4X4 control module	• Go to **Pinpoint Test F**.

Pinpoint Tests

Pinpoint Test A: All-Wheel Drive (AWD) System Functional Test

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, All Wheel Drive (AWD) for schematic and connector information.

Normal Operation

The All-Wheel Drive (AWD) system continuously monitors vehicle conditions and automatically adjusts the torque distribution between the front and rear wheels. During normal operation, most of the torque is delivered to the front wheels. If wheel slip between the front and rear wheels is detected, or if the vehicle is under heavy acceleration, the AWD system increases torque to the rear wheels to prevent or control wheel slip.

This pinpoint test is intended to diagnose the following:

- AWD system concern without on-demand or continuous DTCs

PINPOINT TEST A: All-Wheel Drive (AWD) SYSTEM FUNCTIONAL TEST

WARNING: **When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.**

NOTE: Carry out a thorough inspection and verification as outlined before carrying out this pinpoint test.

A1 CHECK FOR WRENCH LIGHT PROVE-OUT

- Turn the ignition to the ON position and observe the wrench light.
- **Does the wrench light illuminate for 3 seconds and then turn OFF?**

  YES : Go to A2.

  NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article for further diagnosis of the Instrument Cluster (IC).

A2 CHECK FOR Active Torque Coupling (ATC) SOLENOID (PART OF REAR AXLE) LOCK

- Drive the vehicle on a dry, hard surface in turns while applying the accelerator pedal.

- **Is driveline wind-up present in turns?**

  YES : With the ignition switch in ON position, allow the ATC solenoid to cool down for at least 10 minutes and repeat the test. CHECK for wind-up again. If no wind-up is found, Go to A3. If still present, go to **Pinpoint Test E**.

  NO : Go to A3.

A3 CHECK FOR VALID ACCELERATOR PEDAL POSITION MONITORING THE ACCELERATOR PEDAL POSITION (AP) PID

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- Monitor the AP PID while pressing the accelerator pedal.
- **Does the accelerator pedal position match the AP PID percent value?**

  YES : Go to A4.

  NO : REFER to the **Introduction - Gasoline Engines** article to diagnose the accelerator pedal position sensor concern.

A4 CHECK 4X4 CONTROL MODULE WHEEL SPEED SENSOR PIDs

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- While driving the vehicle at 48 km/h (30 mph), monitor the following wheel speed sensor PIDs:
  - Left Front Wheel Speed Sensor (LF_WSPD)
  - Left Rear Wheel Speed Sensor (LR_WSPD)
  - Right Front Wheel Speed Sensor (RF_WSPD)
  - Right Rear Wheel Speed Sensor (RR_WSPD)
- **Are all 4 wheel speeds within 2 km/h (1.2 mph) of each other?**

  YES : Go to A5.

  NO : Go to **Pinpoint Test F**.

A5 CHECK VEHICLE ACCELERATION IN A STRAIGHT LINE

- Carry out 3 accelerations from 0-48 km/h (0-30 mph) in a straight line (one each with low, medium and full accelerator pedal application).
- **Does the vehicle pulsate or shudder while accelerating?**

  YES : Go to **Pinpoint Test E**.

  NO : Go to A6.

A6 CHECK VEHICLE TURNING ABILITY

- Drive the vehicle in a fully locked turn, on dry pavement, at 8 km/h (5 mph).
- **Does the vehicle bind in the turn or resist turning?**

  YES : Go to **Pinpoint Test E**.

  NO : Go to A7.

A7 CHECK FOR TORQUE AT REAR WHEELS USING PWM OUTPUT CONTROL COMMAND #1 (CLCH_SOL) ACTIVE COMMAND

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- Using the scan tool, command CLCH_ SOL to energize the ATC solenoid to a constant 100% applied.

- Drive the vehicle in a fully locked turn, on dry pavement, at 8 km/h (5 mph).
- **Does the vehicle bind in the turn or resist turning?**

  YES : END the active command. The concern cannot be duplicated at this time. RETURN the vehicle to the customer.

  NO : END the active command. CHECK that the driveshaft rotates when the transaxle is in gear. If yes, go to **Pinpoint Test D**. If no, CHECK the Power Transfer Unit (PTU). REFER to **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.

Pinpoint Test B: DTC B1317/B1318 - Battery Voltage is High/Low (4X4 Control Module)

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, All Wheel Drive (AWD) for schematic and connector information.

Normal Operation

If the 4X4 control module observes an overpower or under power voltage condition, DTCs are set and the 4X4 control module may not allow Four-Wheel Drive (4WD) operation.

- DTC B1317 Battery Voltage High - When the 4X4 control module detects battery voltage greater than 16 volts for at least 10 seconds, this DTC is set.
- DTC B1318 Battery Voltage Low - When the 4X4 control module detects battery voltage less than 9 volts for at least 10 seconds, with the engine running at 1,500 RPM or greater, this DTC is set.

This pinpoint test is intended to diagnose the following:

- Fuses
- Wiring, terminals or connectors
- 4X4 control module

PINPOINT TEST B: DTC B1317/B1318 - BATTERY VOLTAGE IS HIGH/LOW (4X4 CONTROL MODULE)

NOTE:	**DTCs B1317, B1318 or B1676 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on.**

NOTE:	**Carry out a thorough inspection and verification before proceeding with the pinpoint test. Refer to Inspection and Verification.**

B1 RETRIEVE ALL CONTINUOUS MEMORY DTCs (CMDTCs) IN ALL MODULES

- Enter the following diagnostic mode on the diagnostic tool: Self Test - All CMDTCs
- **Is B1317, B1318 or B1676 present in more than one module AND P0563, P0620, P0625, P0626 or P065B present in the PCM?**

YES : REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article for diagnosis of the battery and charging system.

NO : Go to B2.

B2 CHECK BATTERY CONDITION

- Refer to **BATTERY, MOUNTING AND CABLES** article and carry out the Battery - Condition Test.
- **Does the battery pass the condition test?**

  YES : If the battery passed the condition test but required a recharge, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnose the charging system. CLEAR all continuous memory DTCs. TEST the system for normal operation.

  If the battery passed the condition test and did not require a recharge, go to B3.

  NO : INSTALL a new battery. CLEAR all continuous memory DTCs. TEST the system for normal operation.

B3 CHECK THE CHARGING SYSTEM VOLTAGE

NOTE:	**Do not allow the engine RPM to increase above 2,000 RPM while performing this step or the generator may self excite and result in default charging system output voltage. If engine RPM has gone above 2,000 RPM, shut the vehicle off and restart the engine before performing this step.**

- Start the engine.

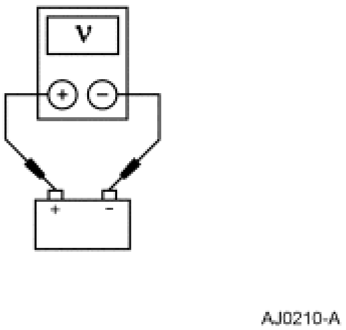


Fig. 1: Checking Charging System Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage of the battery.
  - For DTC B1317, turn off all accessories and run the engine at 1,500 RPM for a minimum of 2 minutes.
  - For DTC B1318, turn on headlights and HVAC fan on high and run engine at 1,500 RPM for a minimum of 2 minutes.
- **Is the battery voltage between 13-15.2 volts?**

  YES : Go to B4.

  NO : REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnose the

charging system. CLEAR all continuous memory DTCs. TEST the system for normal operation.

B4 CHECK FOR VOLTAGE BY MONITORING THE MODULE SUPPLY VOLTAGE (VBAT_4X4) PID

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- With the engine running, monitor the battery voltage VBAT_4X4 PID.
- **Is the battery voltage less than 9 or greater than 15.5 volts?**

  YES : If voltage is less than 9 volts, go to B5.

  If voltage is greater than 15.5 volts, INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. CLEAR all continuous memory DTCs. REPEAT the self-test.

  NO : Go to B7.

B5 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

- Key in OFF position.
- Disconnect: 4X4 Control Module C3253
- Measure the resistance between 4X4 control module C3253-15, circuit GD126 (BK/WH), harness side and ground.

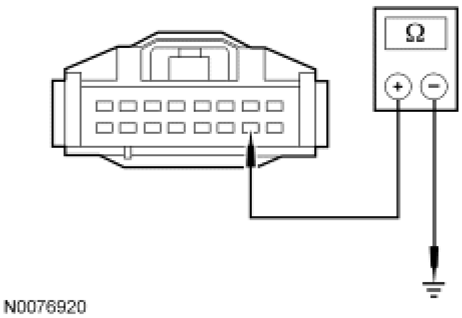


Fig. 2: Checking Circuit GD126 (BK/WH) For An Open
Courtesy of FORD MOTOR CO.

- Repeat this measurement while wiggling the harness.
- **Is the resistance less than 5 ohms?**

  YES : Go to B6.

  NO : REPAIR the circuit. CLEAR all continuous memory DTCs. REPEAT the self-test.

B6 CHECK POWER TO 4X4 CONTROL MODULE

- Key in ON position.

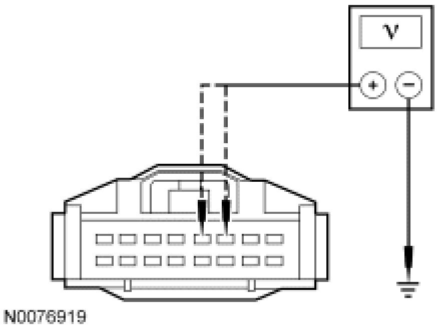


Fig. 3: Checking Power To 4X4 Control Module
Courtesy of FORD MOTOR CO.

- Measure the voltage between 4X4 control module C3253-6, circuit SBP15 (WH/RD), harness side and ground; and between 4X4 control module C3253-5, circuit CBP19 (BN/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to B7.

  NO : VERIFY the Smart Junction Box (SJB)fuse(s) 20 (7.5A) and 28 (10A) are OK. If fuse(s) are OK, REPAIR the circuit in question. If SJB fuse(s) are not OK, REFER to the Wiring Diagram Manual to identify possible causes of the circuit short. CLEAR all continuous memory DTCs. REPEAT the self-test.

B7 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION

- Disconnect the 4X4 control module.
- Check the harness and component side connectors for:
  - corrosion.
  - pushed-out/bent pins.
- Connect the 4X4 control module and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. CLEAR the continuous memory DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR all continuous memory DTCs. REPEAT the self-test.

Pinpoint Test C: DTC U0415 - 4X4 Control Module Received No/Invalid Data From ABS Module

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, All Wheel Drive (AWD) for schematic and connector information.

Normal Operation

The All-Wheel Drive (AWD) system uses data from other systems as inputs to the 4X4 control module. The 4X4 control module uses the inputs to determine the appropriate duty cycle to send to the Active Torque

Coupling (ATC) solenoid (part of rear axle) that delivers the desired torque to the rear wheels. Specific inputs to the 4X4 control module are: accelerator pedal position output from the PCM, transmission range from the Transmission Control Module (TCM), brake system status and all 4 wheel speeds from the ABS module. Communication between the 4X4 control module and other modules is obtained through the High Speed Controller Area Network (HS-CAN). If the 4X4 control module loses communication with, or receives invalid data from any of the necessary modules, DTCs are set and the 4X4 control module may not allow Four-Wheel Drive (4WD) operation.

- DTC U0415 Invalid Data Received from Anti-lock Brake System (ABS) Control Module - When the 4X4 control module receives invalid HS-CAN bus data or invalid wheel speed(s) from the ABS module for more than 5 seconds, this DTC is set.

This pinpoint test is intended to diagnose the following:

- ABS module

PINPOINT TEST C: DTC U0415 - 4X4 CONTROL MODULE RECEIVED NO/INVALID DATA FROM ABS MODULE

WARNING: **When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.**

NOTE: Carry out a thorough inspection and verification as outlined before carrying out this pinpoint test.

C1 CHECK FOR ABS MODULE DTCs

- Key in ON position.
- Carry out the ABS module self-test.
- Review the results of the ABS module self-test.
- **Are any DTCs present?**

  YES : REFER to **VEHICLE DYNAMIC SYSTEMS** article for further diagnosis of the ABS.

  NO : Go to C2.

C2 CHECK WHEEL SPEED SENSORS PIDs

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- While driving the vehicle at 48 km/h (30 mph), monitor the following wheel speed sensor PIDs:
  - Left Front Wheel Speed Sensor (LF_WSPD)
  - Left Rear Wheel Speed Sensor (LR_WSPD)
  - Right Front Wheel Speed Sensor (RF_WSPD)
  - Right Rear Wheel Speed Sensor (RR_WSPD)
- **Do the 4 wheel speed sensors match the speedometer and are they within 2 km/h (1.2 mph) of each other?**

  YES : The system is operating correctly at this time. CLEAR the DTCs. REPEAT the self-test.

  NO : INSPECT for proper tire size and tire inflation. If no concerns with the tires are found,

REFER to **VEHICLE DYNAMIC SYSTEMS** article for further diagnosis of the ABS.

Pinpoint Test D: DTCs P1824/P1825 - 4-Wheel Drive Clutch Relay Circuit Failure/4-Wheel Drive Clutch Relay Open Circuit or Inadequate Torque at Rear Wheels

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, All Wheel Drive (AWD) for schematic and connector information.

Normal Operation

The All-Wheel Drive (AWD) system uses data from other systems as inputs to the 4X4 control module. The 4X4 control module uses the inputs to determine the appropriate duty cycle to send to the Active Torque Coupling (ATC) solenoid (part of rear axle) that delivers the desired torque to the rear wheels. If the 4X4 control module loses communication with, or receives invalid data from any of the necessary modules, DTCs are set and the 4X4 control module may not allow Four-Wheel Drive (4WD) operation.

- DTC P1824 4-Wheel Drive Clutch Relay Circuit Failure - When the 4X4 control module detects a short to ground on the ATC solenoid feedback circuit, this DTC is set.
- DTC P1825 4-Wheel Drive Clutch Relay Open Circuit - When the 4X4 control module detects an open or short to ground on the ATC solenoid command or feedback circuit for more than 2 seconds, this DTC is set.

This pinpoint test is intended to diagnose the following:

- Tire/axle out of range
- ATC solenoid (part of rear axle)
- 4X4 control module
- Power Transfer Unit (PTU)
- Wiring, terminals or connectors

PINPOINT TEST D: DTCs P1824/P1825 - 4-WHEEL DRIVE CLUTCH RELAY CIRCUIT FAILURE/4-WHEEL DRIVE CLUTCH RELAY OPEN CIRCUIT OR INADEQUATE TORQUE AT REAR WHEELS

NOTE:	**Carry out a thorough inspection and verification as outlined before carrying out this pinpoint test.**

D1 CHECK FOR 4X4 CONTROL MODULE DTCs

- Key in ON position.
- Carry out the 4X4 control module self-test.
- **Are any DTCs received?**

  YES : For DTC P1824 or P1825, go to D2.

  For all other DTCs, REFER to the **DTC Charts**.

  NO : Go to D2.

D2 CHECK CIRCUITS CCF21 (VT/WH) AND RCF21 (WH/VT) FOR A SHORT TO GROUND WITH ATC SOLENOID (PART OF REAR AXLE) CONNECTED

- Key in OFF position.
- Disconnect: 4X4 Control Module C3253

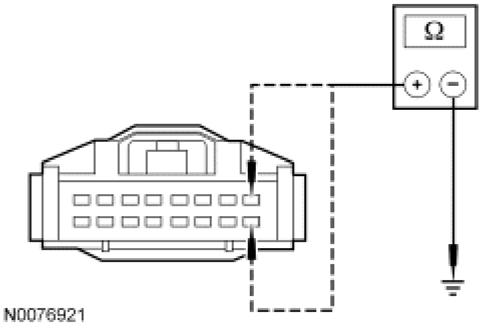


Fig. 4: Checking Circuits CCF21 (VT/WH) & RCF21 (WH/VT) For A Short To Ground With ATC Solenoid Connected
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C3253-8, circuit CCF21 (VT/WH), harness side and ground; and between 4X4 control module C3253-16, circuit RCF21 (WH/VT), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to D5.

  NO : Go to D3.

D3 CHECK CIRCUITS CCF21 (VT/WH) AND RCF21 (WH/VT) FOR A SHORT TO GROUND WITH C3051 DISCONNECTED

- Disconnect: ATC Solenoid Jumper Harness C3051

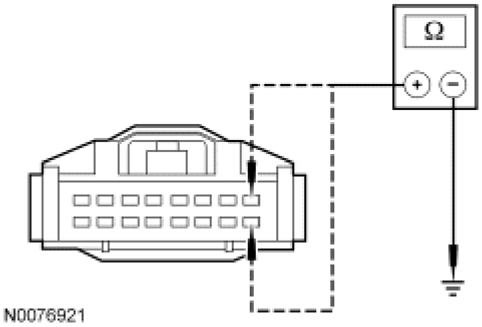


Fig. 5: Checking Circuits CCF21 (VT/WH) & RCF21 (WH/VT) For A Short To Ground With C3051 Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C3253-8, circuit CCF21 (VT/WH), harness side and ground; and between 4X4 control module C3253-16, circuit RCF21 (WH/VT), harness side and ground.

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to D4.

  NO : REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.

D4 CHECKING THE ATC SOLENOID JUMPER HARNESS

NOTE:	**The ATC solenoid jumper harness must be secured to prevent damage to the wiring.**

- Disconnect: ATC Solenoid C3254
- Inspect the ATC solenoid jumper harness for damage.
- **Is the ATC solenoid jumper harness damaged?**

  YES : REPAIR or INSTALL a new ATC solenoid jumper harness. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL a new rear axle assembly. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article. CLEAR the DTCs. REPEAT the self-test.

D5 CHECK CIRCUITS CCF21 (VT/WH) AND RCF21 (WH/VT) FOR AN OPEN WITH ATC SOLENOID CONNECTED

- Connect: ATC Solenoid C3254 and ATC Solenoid Jumper Harness C3051

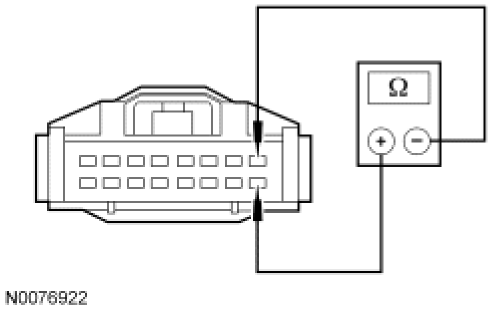


Fig. 6: Checking Circuits CCF21 (VT/WH) & RCF21 (WH/VT) For An Open With ATC Solenoid Connected
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C3253-8, circuit CCF21 (VT/WH), harness side and 4X4 control module C3253-16, circuit RCF21 (WH/VT), harness side.
- **Is the resistance less than 10 ohms?**

  YES : Go to D8.

  NO : Go to D6.

D6 CHECK CIRCUITS CCF21 (VT/WH) AND RCF21 (WH/VT) FOR AN OPEN AT C3051

- Disconnect: ATC Solenoid Jumper Harness C3051

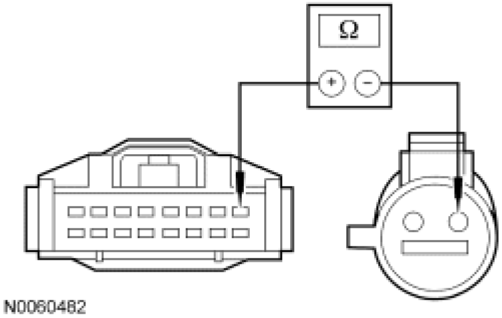


Fig. 7: Checking Circuits CCF21 (VT/WH) & RCF21 (WH/VT) For An Open At C3051
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C3253-8, circuit CCF21 (VT/WH), harness side and ATC solenoid jumper harness C3051-1, circuit CCF21 (VT/WH).
- Repeat this measurement while wiggling the harness.

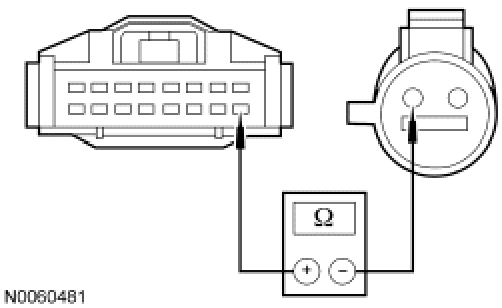


Fig. 8: Measuring Resistance Between 4X4 Control Module C3253-8, Circuit CCF21 (VT/WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C3253-16, circuit RCF21 (WH/VT), harness side and ATC solenoid jumper harness C3051-2, circuit RCF21 (WH/VT), harness side.
- Repeat this measurement while wiggling the harness.
- **Are the resistances less than 5 ohms?**

  YES : Go to D7.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D7 CHECK THE ATC SOLENOID CIRCUIT FOR AN INTERNAL OPEN

NOTE: The ATC solenoid jumper harness must be secured to prevent damage to the wiring.

- Disconnect: ATC Solenoid C3254

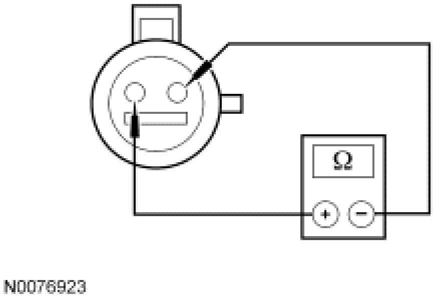


Fig. 9: Checking ATC Solenoid Circuit For An Internal Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between ATC solenoid C3254-1, circuit CCF21 (VT/WH), component side, and ATC solenoid C3254-2, circuit RCF21 (WH/VT), component side.
- Repeat this measurement while wiggling the harness.
- **Is the resistance less than 10 ohms?**

  YES : REPAIR or INSTALL a new ATC solenoid jumper harness. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL a new rear axle assembly. REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article. CLEAR the DTCs. REPEAT the self-test.

D8 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

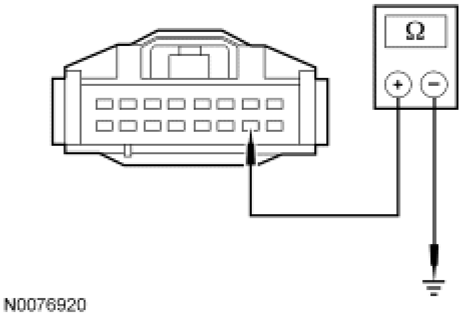


Fig. 10: Checking Circuit GD126 (BK/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C3253-15, circuit GD126 (BK/WH), harness side and ground.
- Repeat this measurement while wiggling the harness.
- **Is the resistance less than 5 ohms?**

  YES : Go to D9.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

D9 CHECK THE 4X4 CONTROL MODULE POWER CIRCUITS

- Key in ON position.

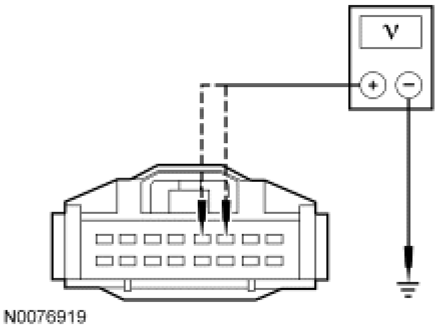


Fig. 11: Checking 4X4 Control Module Power Circuits
Courtesy of FORD MOTOR CO.

- Measure the voltage between 4X4 control module C3253-6, circuit SBP15 (WH/RD), harness side and ground; and between 4X4 control module C3253-5, circuit CBP19 (BN/WH), harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to D10.

  NO : CHECK Smart Junction Box (SJB) fuses 20 (7.5A) and 28 (10A). REPAIR the circuit in question for open or short to ground. CLEAR the DTCs. REPEAT the self-test.

D10 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION

- Disconnect: 4X4 Control Module C3253
- Check the harness and component side connectors for:
  - corrosion.
  - pushed-out/bent pins.
- Check the ATC solenoid jumper harness between the 4X4 control module and the ATC solenoid, located on the rear subframe.
- Connect the 4X4 control module and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: Vehicle Binds in a Turn or Resists Turning/Pulsates or Shudders in a Straight Line

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, All Wheel Drive (AWD) for schematic and connector information.

Normal Operation

The All-Wheel Drive (AWD) system continuously monitors vehicle conditions and automatically adjusts the

torque distribution between the front and rear wheels. During normal operation, most of the torque is sent to the front wheels. If wheel slip between the front and rear wheels is detected or the vehicle is under heavy acceleration, the AWD system increases torque to the rear wheels.

This pinpoint test is intended to diagnose the following:

- Rear axle
- Wheels/tires
- PCM
- ABS module
- 4X4 control module
- Circuitry

PINPOINT TEST E: VEHICLE BINDS IN A TURN OR RESISTS TURNING/PULSATES OR SHUDDERS IN A STRAIGHT LINE

NOTE: **Carry out a thorough inspection and verification as outlined before carrying out this pinpoint test.**

E1 CHECK FOR TORQUE AT THE REAR WHEELS

- Key in OFF position.
- Disconnect: Active Torque Coupling (ATC) Solenoid (part of rear axle) C3254
- Drive the vehicle in a straight line on dry pavement.
- **Is a pulsation or shudder still present?**

  YES : REFER to **DRIVELINE SYSTEM - GENERAL INFORMATION** article for additional axle diagnosis.

  NO : Go to E2.

E2 CHECK TO SEE IF THE ATC SOLENOID IS BEING COMMANDED ON MONITORING Four-Wheel Drive (4WD) CLUTCH PWM STATUS (4WDCPWMST) PID

- Key in OFF position.
- Connect: ATC Solenoid C3254
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- Monitor the 4WDCPWMST PID.
- Drive the vehicle no faster than 8 km/h (5 mph) in tight turns on dry pavement while monitoring the ATC solenoid duty cycle.
- **Is the duty cycle greater than 20%?**

  YES : Go to E3.

  NO : Go to **Pinpoint Test F**.

E3 CHECK FOR THE CORRECT WHEEL SPEEDS USING THE WHEEL SPEED SENSORS PIDs

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module

- While driving the vehicle at 48 km/h (30 mph), monitor the following wheel speed sensor PIDs:
  - Left Front Wheel Speed Sensor (LF_WSPD)
  - Left Rear Wheel Speed Sensor (LR_WSPD)
  - Right Front Wheel Speed Sensor (RF_WSPD)
  - Right Rear Wheel Speed Sensor (RR_WSPD)
- **Are all 4 wheel speeds within 2 km/h (1.2 mph) of each other?**

  YES : Go to E4.

  NO : Go to **Pinpoint Test F**.

E4 CHECK FOR VALID ACCELERATOR PEDAL POSITION MONITORING ACCELERATOR PEDAL POSITION (AP) PID

- Key ON Engine OFF (KOEO).
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- Monitor AP PID while pressing/releasing the accelerator pedal.
- **Does the accelerator position match the PID percent value?**

  YES : Go to E5.

  NO : REFER to the **Introduction - Gasoline Engines** article to diagnose the engine control system.

E5 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION

- Disconnect the 4X4 control module.
- Check the harness and component side connectors for:
  - corrosion.
  - pushed-out/bent pins.
- Check the ATC solenoid jumper harness between the 4X4 control module and the ATC solenoid, located on the rear subframe.
- Connect the 4X4 control module and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: DTC P1635 - Tire/Axle Out of Acceptable Range

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, All Wheel Drive (AWD) for schematic and connector information.

Normal Operation

The All-Wheel Drive (AWD) system continuously monitors vehicle conditions and automatically adjusts the

torque distribution between the front and rear wheels. During normal operation, most of the torque is sent to the front wheels. If wheel slip between the front and rear wheels is detected or the vehicle is under heavy acceleration, the AWD system increases torque to the rear wheels.

- DTC P1635 Tire/Axle Out of Acceptable Range - When the 4X4 control module detects inappropriate mini spare or road wheels/tires (greater than 7% across the front and rear axle or 14% at one wheel) installed, this DTC is set.

This pinpoint test is intended to diagnose the following:

- Wheels/tires
- Wheel speed sensors
- ABS module
- 4X4 control module

PINPOINT TEST F: DTC P1635 - TIRE/AXLE OUT OF ACCEPTABLE RANGE

WARNING: **When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.**

NOTE: Carry out a thorough inspection and verification as outlined before carrying out this pinpoint test.

F1 CHECK THE RECENT TIRE USAGE

- Check with customer about recent tire usage or installation.
- **Has a tire been installed on the vehicle recently that was not originally supplied with the vehicle?**

  YES : INFORM the customer to only use tires of the type supplied with the vehicle. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to F2.

F2 CHECK TIRE SIZE AND BRAND

- Check the tire size and the brand of tire.
- **Are all 4 tires the same size and brand?**

  YES : Go to F3.

  NO : INSTALL tires that are the same size and brand. INFORM the customer to only use the same size tires and brand. CLEAR the DTCs. REPEAT the self-test.

F3 CHECK TIRE AIR PRESSURES

- Check the air pressure in all 4 tires.
- **Are all 4 tires at the recommended air pressure?**

  YES : Go to F4.

  NO : ADJUST the tire air pressures. CLEAR the DTCs. REPEAT the self-test. INFORM the customer to maintain the correct tire air pressure.

F4 CHECK FOR CORRECT WHEEL SPEEDS

- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - 4X4 Control Module
- While driving the vehicle at 48 km/h (30 mph), monitor the following wheel speed sensor PIDs:
    - Left Front Wheel Speed Sensor (LF_WSPD)
    - Left Rear Wheel Speed Sensor (LR_WSPD)
    - Right Front Wheel Speed Sensor (RF_WSPD)
    - Right Rear Wheel Speed Sensor (RR_WSPD)
- **Are all 4 wheel speeds within 2 km/h (1.2 mph) of each other?**

  YES : Go to F5.

  NO : The ABS module is sending invalid wheel speed data to the 4X4 control module. REFER to **VEHICLE DYNAMIC SYSTEMS** article for additional ABS diagnosis.

F5 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION

- Disconnect: 4X4 Control Module C3253
- Check for:
    - corrosion.
    - pushed-out pins.
- Connect the 4X4 control module and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

REMOVAL AND INSTALLATION

4X4 CONTROL MODULE

REMOVAL AND INSTALLATION

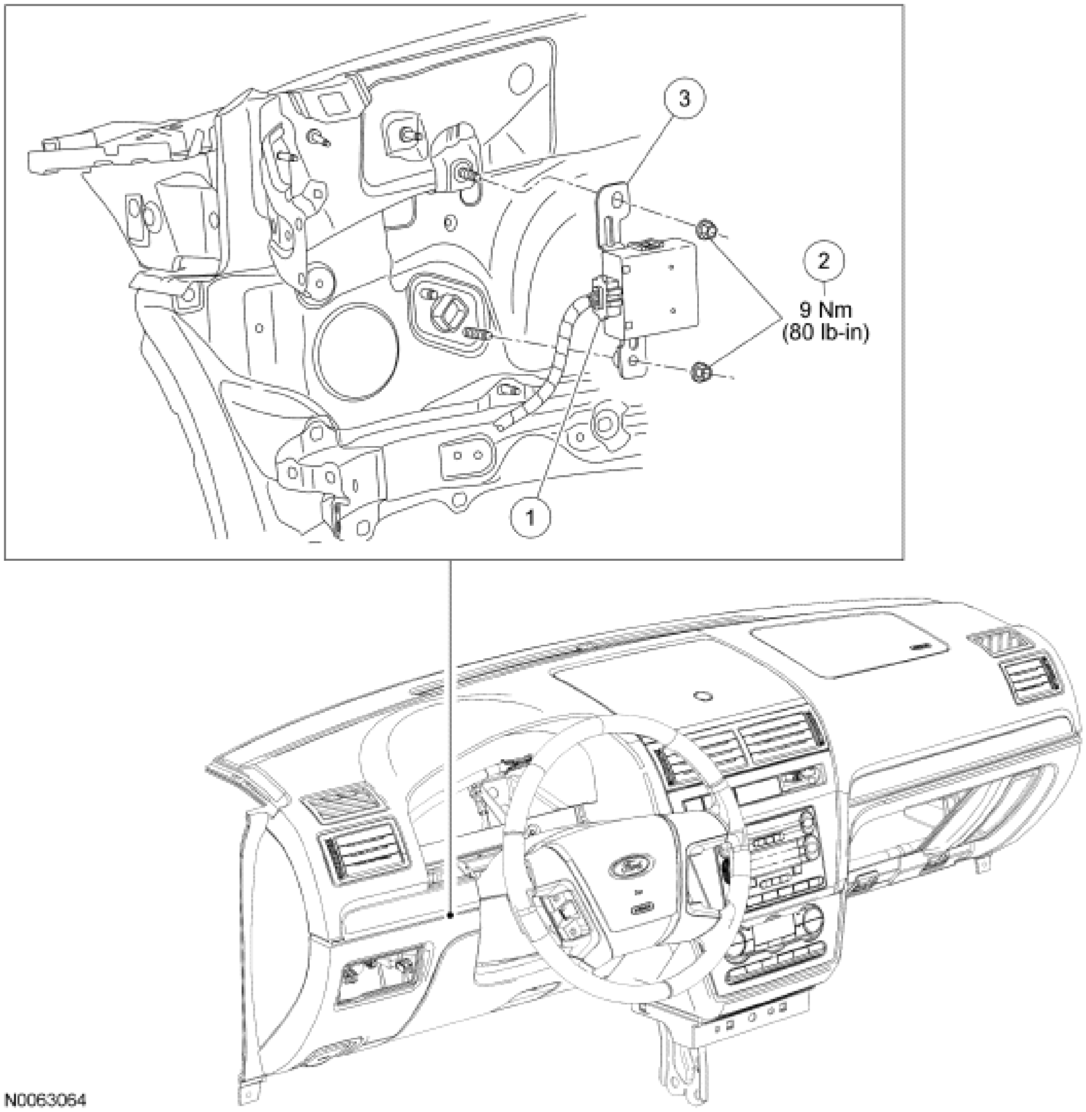


Fig. 12: Exploded View Of 4X4 Control Module With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Electrical connector (part of 14A005)
2	W706840-S	4X4 control module nuts and washers (2 required)
3	7E453	4X4 control module and bracket assembly

1. From below the LH side instrument panel, disconnect the 4X4 control module harness connector.
2. Remove the two 4X4 control module nuts.
   - To install, tighten to 9 Nm (80 lb-in).
3. Remove the 4X4 control module and bracket.

4. To install, reverse the removal procedure.

2008 BRAKES

Front Disc Brake - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	227.5 ml (0.48 pt)
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A	-
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Brake disc minimum thickness	23.0 mm (0.905 in)
Brake pad maximum taper wear (in any direction)	3.0 mm (0.118 in)
Brake pad minimum thickness	3.0 mm (0.118 in)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Bleeder screw	8	-	71
Brake caliper anchor plate bolts	90	66	-
Brake caliper flow bolt	25	18	-
Brake caliper guide pin bolts	27	20	-
Brake disc screws	20	-	177
Brake flexible hose bracket-to-body bolt	20	-	177
Brake flexible hose bracket-to-strut bolt	20	-	177
Brake tube fitting	17	-	150

DESCRIPTION AND OPERATION

FRONT DISC BRAKE

The front brake disc system consists of the following components:

- Brake caliper anchor plate
- Brake caliper
- Brake disc
- Brake disc shield
- Brake flexible hose

When mechanical force is applied by the driver to the brake pedal, the force is converted into hydraulic pressure by the master cylinder. The hydraulic force is directed to the disc brake calipers and transferred to the brake pads. The brake pads are then forced against the brake friction surfaces by the brake caliper pistons. The friction of the brake pads on the brake disc causes the slowing of wheel rotation and the vehicle.

DIAGNOSTIC TESTS

FRONT DISC BRAKE

Refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

BRAKE PADS

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

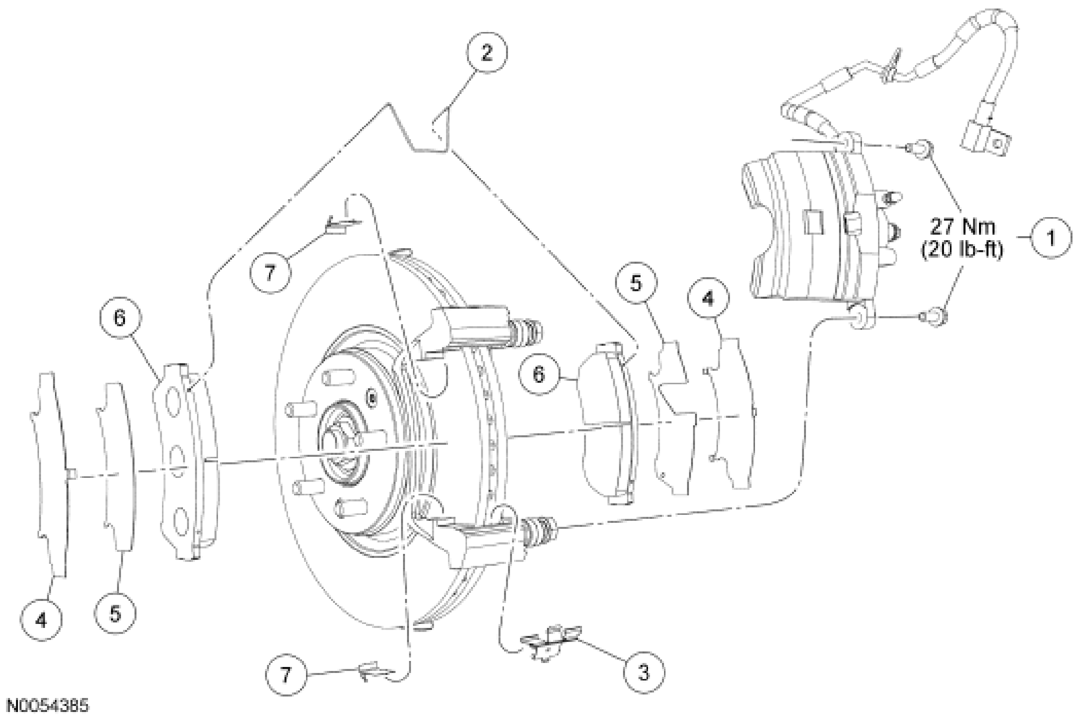


Fig. 1: Exploded View Of Brake Pads With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Brake caliper guide pin bolts (2 required) (part of 2L527)
2	-	Brake pad retraction spring (2 required) (part of 2001)
3	-	Brake pad slide (2 required) (part of 2001)
4	-	Stainless steel shims (2 required) (part of 2001)
5	-	Brake pad shims (2 required) (part of 2001)
6	2001	Brake pads (2 required)
7	-	Brake pad slide clips (4 required) (part of 2001)

REMOVAL

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information,**

consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: **Always install new brake shoes or pads at both ends of an axle to reduce the possibility of brakes pulling vehicle to one side. Failure to follow this instruction may result in uneven braking and serious personal injury.**

NOTE: Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.

1. Check the brake fluid level in the brake master cylinder reservoir.
   - If required, remove the fluid until the brake master cylinder reservoir is 1/2 full.
2. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

NOTE: Do not pry in the caliper sight hole to retract the pistons as this can damage the pistons and boots.

NOTE: Do not allow the brake caliper to hang from the brake hose or damage to the hose can occur.

3. Remove the 2 brake caliper guide pin bolts and position the caliper aside.
   - Support the caliper using mechanic's wire.
4. Remove the 2 brake pad retraction springs.
5. Remove the brake pads, brake pad shims and stainless steel shims.
   - Inspect the brake pads and shims for wear or contamination.
6. Remove the brake pad slides.
7. Remove the 4 brake pad slide clips.

INSTALLATION

1. Install the 4 brake pad slide clips.

NOTE: Protect the piston and boots when pushing the caliper piston into the caliper piston bores or damage to components may occur.

NOTE: Make sure that the caliper guide pin boots are fully seated or damage to the caliper guide pin boots can occur.

2. If installing new brake pads, using a C-clamp and a worn brake, compress the disc brake caliper pistons into the caliper.

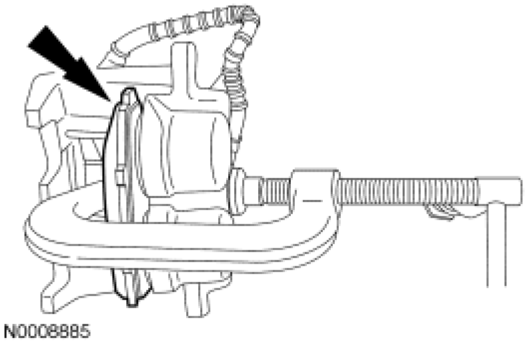


Fig. 2: Compressing Brake Caliper Pistons Into Caliper
Courtesy of FORD MOTOR CO.

3. Install the brake pad slides.
4. Apply grease that is supplied to the pad backing plate and shims in the areas indicated.
    1. Apply grease to the back of the brake pad.
    2. Apply grease to the inner piston side stainless steel shim.
    3. Apply grease to the outer stainless steel shim.

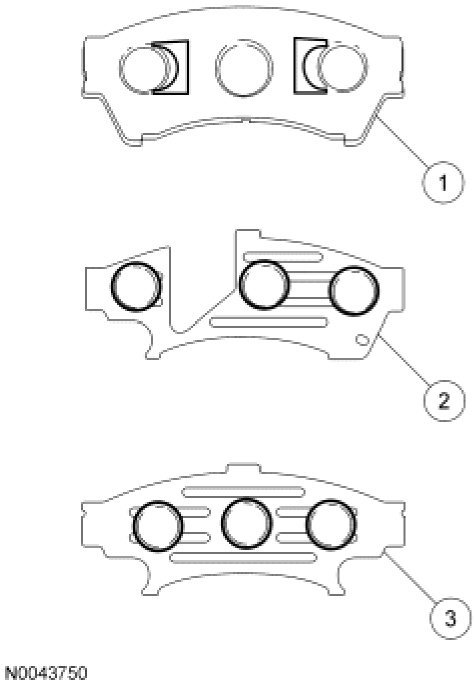


Fig. 3: Identifying Pad Backing Plate And Shims
Courtesy of FORD MOTOR CO.

NOTE: **LH inboard shim shown.**

NOTE: **The cut shim is directional and used on the inboard pad only. The cut is**

positioned toward the leading side. Correct installation can be verified if the shim hole is positioned on the bottom side.

5. Install the brake pad shims and the stainless steel shims to the brake pads.

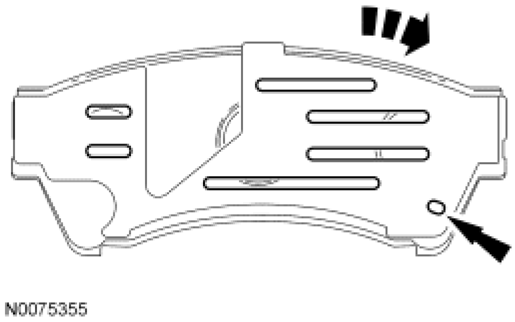


Fig. 4: Installing Brake Pad Shims & Stainless Steel Shims To Brake Pads
Courtesy of FORD MOTOR CO.

6. Install the 2 brake pad retraction springs.

NOTE: The caliper guide pin boots must be seated correctly on the anchor plate or the guide pins may become contaminated.

7. Inspect the guide pin boots and make sure they are seated on the anchor plate correctly. The boot has a lip that fits under the edge of the anchor plate extension.

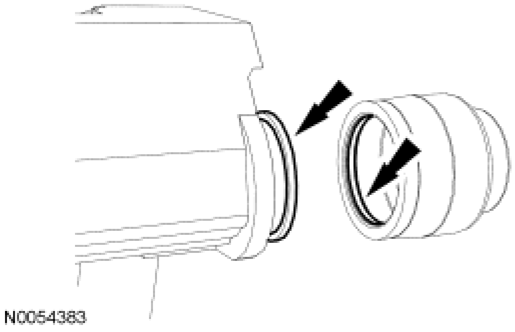


Fig. 5: Inspecting Guide Pin Boots & Making Sure They Are Seated On Anchor Plate Correctly
Courtesy of FORD MOTOR CO.

NOTE: Make sure that the brake caliper hose does not become twisted.

8. Position the brake caliper and install the 2 guide pin bolts.
   - Tighten to 27 Nm (20 lb-ft).
9. Fill the brake master cylinder reservoir with clean, specified brake fluid.
10. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
    - Apply brakes several times to verify correct brake operation.

BRAKE CALIPER

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

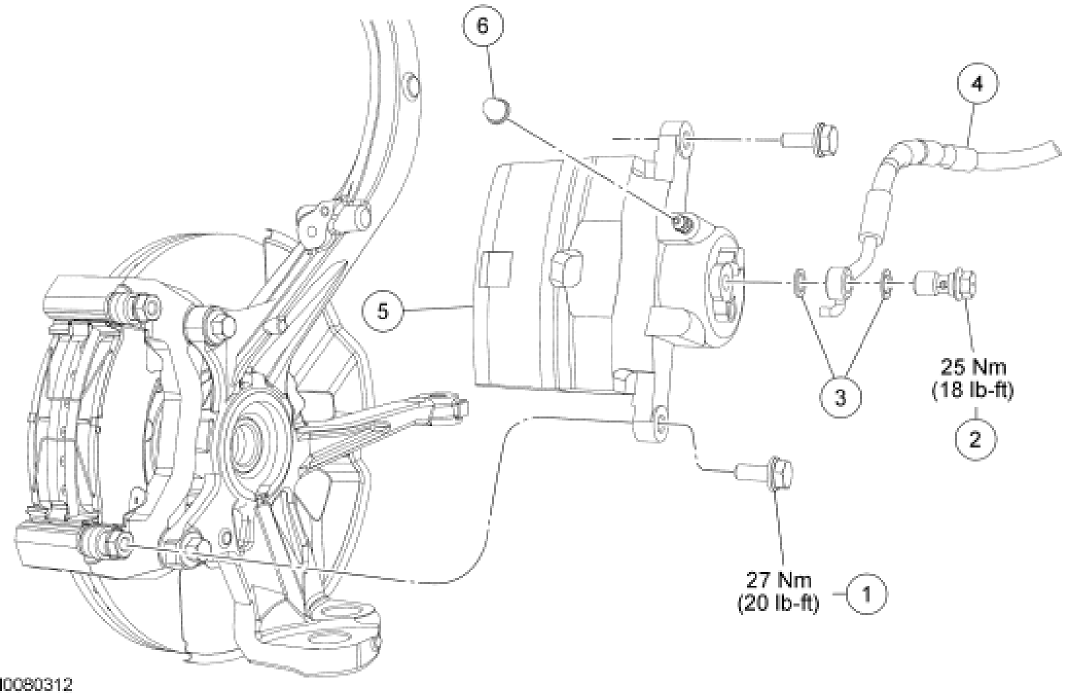


Fig. 6: Exploded View Of Brake Caliper With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Brake caliper guide pin bolt (2 required) (part of 2L527)
2	2M085	Brake caliper flow bolt
3	99562	Copper washers (2 required)
4	2078 RH/ 2B557 LH	Front brake hose
5	2B120 RH/ 2B121 LH	Brake caliper
6	2L126	Bleeder screw cap

REMOVAL AND INSTALLATION

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system**

contamination, brake component damage and the risk of serious personal injury.

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

NOTE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. Remove the brake caliper flow bolt and position the hose aside.
    - Discard the 2 copper washers.
    - To install, tighten to 25 Nm (18 lb-ft).
3. Remove the 2 brake caliper guide pin bolts.
    - To install, tighten to 27 Nm (20 lb-ft).
4. Remove the brake caliper.
    - If a leaking or damaged caliper piston boot is found, install a new brake caliper.

NOTE: **The caliper guide pin boots must be seated correctly on the anchor plate or the guide pins may become contaminated.**

5. Inspect the guide pin boots and make sure they are seated on the anchor plate correctly. The boot has a lip that fits under the edge of the anchor plate extension.

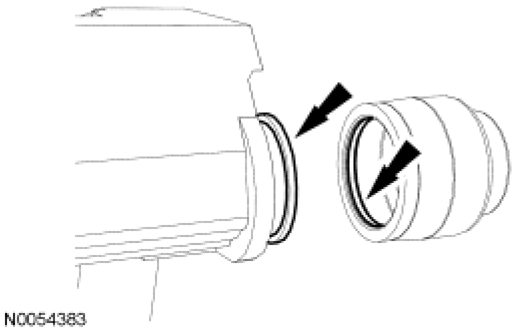


Fig. 7: Inspecting Guide Pin Boots & Making Sure They Are Seated On Anchor Plate Correctly
Courtesy of FORD MOTOR CO.

NOTE: **During installation, make sure that the brake caliper hose does not become twisted.**

6. To install, reverse the removal procedure.
   - Install new copper washers.
   - Bleed the brake caliper. For additional information, refer to Component Bleeding in **BRAKE SYSTEM - GENERAL INFORMATION** article.

BRAKE CALIPER ANCHOR PLATE

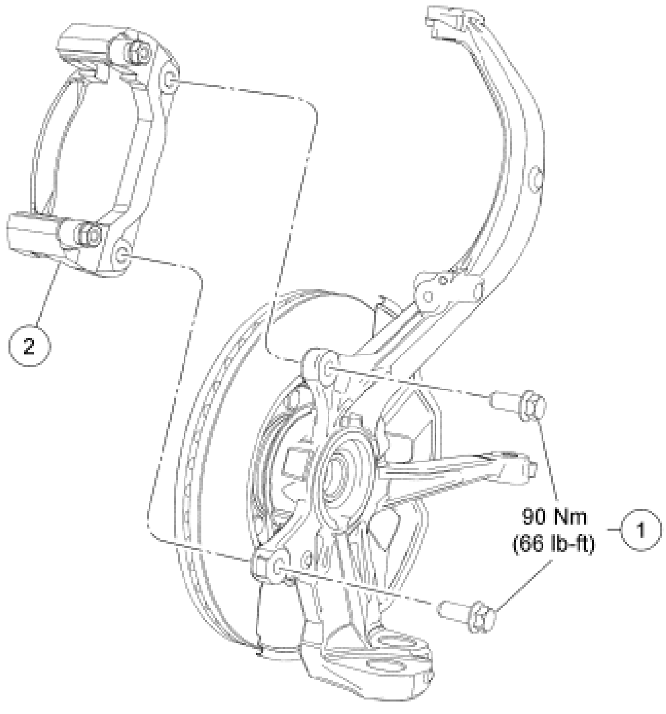


Fig. 8: Exploded View Of Brake Caliper Anchor Plate With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711241	Brake caliper anchor plate bolts (2 required)
2	-	Brake caliper anchor plate (part of 2B120)

REMOVAL AND INSTALLATION

1. Remove the brake pads. For additional information, refer to **Brake Pads**.
2. Remove the 2 brake caliper anchor plate bolts.
   - To install, tighten to 90 Nm (66 lb-ft).
3. Remove the brake caliper anchor plate.
4. To install, reverse the removal procedure.
   - Apply brakes several times to verify correct brake operation.

BRAKE DISC

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-

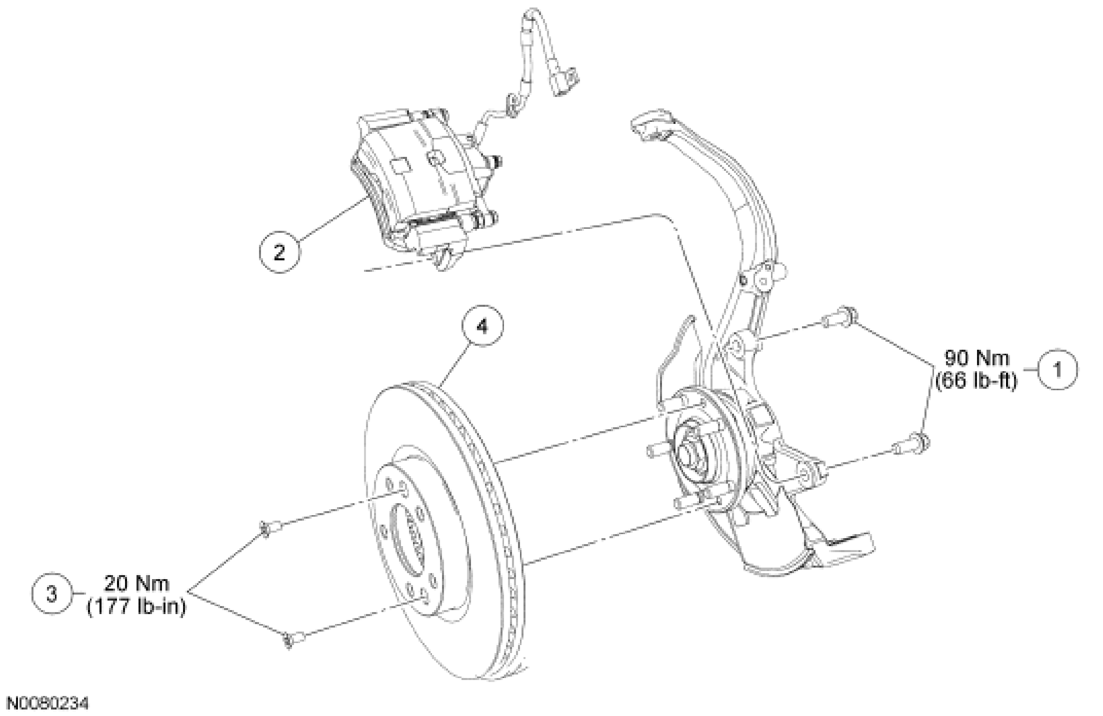


Fig. 9: Exploded View Of Brake Disc With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711241	Brake caliper anchor plate bolts (2 required)
2	2B292	Brake caliper and anchor plate assembly
3	W505741	Brake disc screws (2 required)
4	1032	Brake disc

REMOVAL AND INSTALLATION

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

NOTE: Do not allow the brake caliper to hang from the brake hose or damage to the hose can occur.

2. Remove the brake caliper anchor plate bolts and position the brake caliper, pads and anchor plate aside as an assembly.
   - Support the caliper using mechanic's wire.
   - To install, tighten the bolts to 90 Nm (66 lb-ft).
3. Remove the 2 brake disc screws.
   - To install, tighten to 20 Nm (177 lb-in).
4. Remove the brake disc.

NOTE: During installation, make sure that the brake caliper hose does not become twisted.

NOTE: Make sure the brake disc-to-hub mounting surface is free of rust and foreign material before applying anti-seize lubricant.

NOTE: Do not allow anti-seize to make contact with the wheel studs.

5. To install, reverse the removal procedure.
   - Using the specified brake cleaner, clean the mating surfaces.
   - Apply specified lubricant as shown.

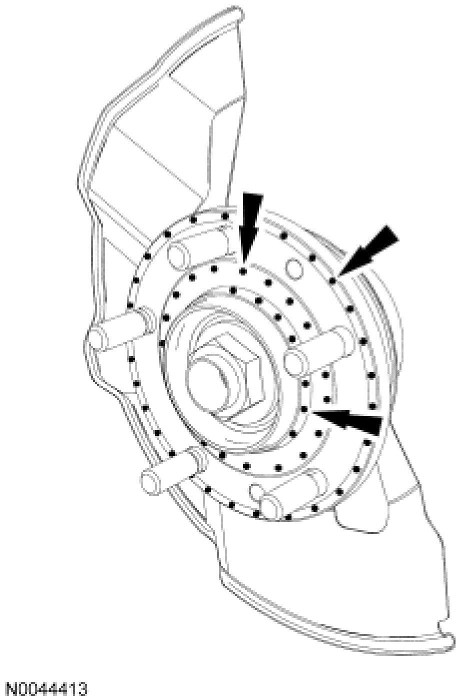


Fig. 10: Locating Disc Screws
Courtesy of FORD MOTOR CO.

BRAKE FLEXIBLE HOSE

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

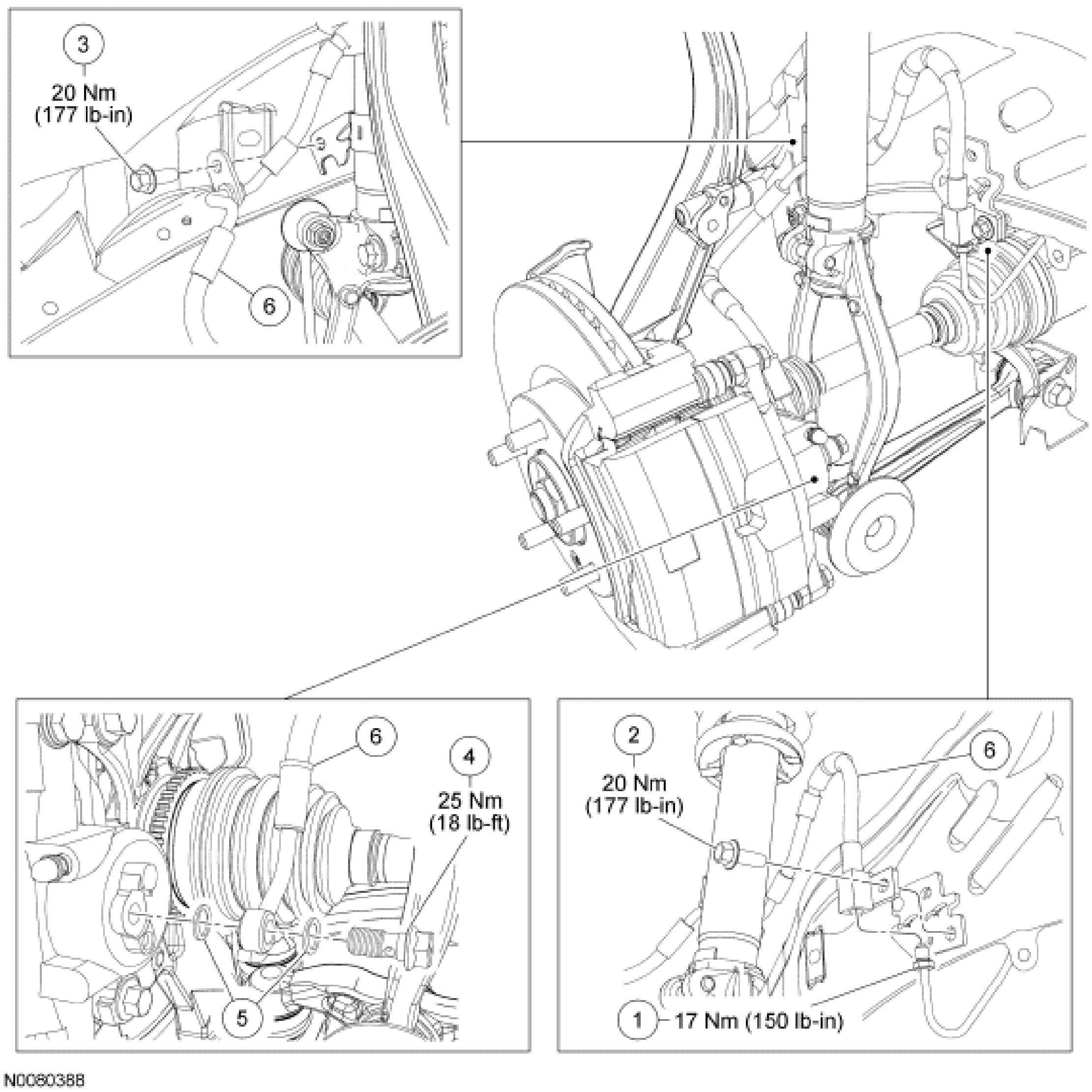


Fig. 11: Exploded View Of Brake Flexible Hose With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Brake tube fitting (part of 2263 RH/ 2264 LH)
2	W505263	Brake flexible hose bracket-to-body bolt
3	W505263	Brake flexible hose bracket-to-strut bolt
4	2L122	Brake caliper flow bolt

5	2149	Copper washers (2 required)
6	2078	Brake flexible hose

REMOVAL AND INSTALLATION

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

NOTE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

1. Remove the brake caliper flow bolt and discard the 2 copper washers.
   - To install, tighten to 25 Nm (18 lb-ft).
2. Disconnect the brake tube fitting from the brake flexible hose.
   - To install, tighten to 17 Nm (150 lb-in).
3. Remove the 2 brake flexible hose bracket bolts and the brake flexible hose.
   - To install, tighten to 20 Nm (177 lb-in).
4. To install, reverse the removal procedure.
   - Install new copper washers.
   - Bleed the brake system. For additional information, refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

2008 TRANSMISSIONS

Front Drive Halfshafts - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Brake caliper hose bolt	22	16
Catalytic converter support bracket bolts	20	15
Catalytic converter support bracket nuts	23	17
Damper fork bolt	109	80
Front lower control arm inner bolt	110	81
Front wheel hub nut	255	185
Halfshaft support bracket bolts	55	41
Intermediate shaft bearing support bolts	40	30
Lower arm ball joints nuts	200	148
Lower control arm bolt and nut	103	76

DESCRIPTION AND OPERATION

FRONT DRIVE HALFSHAFTS

The halfshaft and intermediate shaft consist of the following components:

- Inner constant velocity (CV) joints
- Outer CV joints
- Interconnecting shafts

The halfshafts are splined on the outboard stub shaft to drive the wheel hubs. They are retained in the wheel hubs by special wheel hub nuts which also control the wheel bearing preload. The LH halfshaft is splined on the inboard stub shaft and is retained in the differential side gear in the transaxle by a circlip. The RH halfshaft has internal splines which are driven by the intermediate shaft. The intermediate shaft has a circlip on the outboard end and is retained inside the inboard stub shaft. The circlips must be installed new whenever they are removed. The intermediate shaft is retained in the transaxle differential side gear by bolts that go through the intermediate shaft support bearing. The intermediate shaft also goes through the power transfer unit (PTU) on all wheel drive (AWD) vehicles. The outer seal of the PTU must be installed new whenever the intermediate shaft is removed.

The front drive halfshaft CV joints consist of the following components:

- CV joint boot clamps
- Convoluted CV joint boots

- Tripod joint housings
- Ball and cage housings
- Special CV high temperature grease
- On the LH side, the inboard CV joint is retained in the differential side gear with a unique retainer circlip. Install a new circlip every time the halfshaft is disconnected.
- On the RH side, a unique driveshaft bearing retainer circlip retains the splined inboard CV joint to the intermediate shaft. Install a new circlip every time the halfshaft is disconnected from the intermediate shaft.
- A staked front axle wheel hub retainer secures the splined outboard CV joint to the wheel hub.
- Do not over angle the CV joints.
- Damage will occur to an assembled inboard CV joint if it is over plunged outward from the joint housing.
- Never use a hammer to remove or install the halfshafts from the front hub.
- Never use the halfshaft assembly as a lever to position other components. Always support the free end of the halfshaft.
- Do not allow the boots to contact sharp edges or hot exhaust components.
- Handle the halfshaft only by the interconnecting shaft to avoid pull-apart and potential damage to the CV joints.
- Do not drop assembled halfshafts. The impact will cut the boots from the inside without evidence of external damage.
- Do not remove the outer CV joint by pulling on the interconnecting shaft.
- Inspect all machined surfaces and splines for damage.

The CV joint mates the interconnecting shaft with the stub shaft. The joint allows for smooth rotation of the interconnecting shaft and the stub shafts. They also adjust for length variances and angle requirements as the vehicle goes through jounce and rebound.

The halfshaft joints are not repairable and are serviced as assemblies only.

DIAGNOSTIC TESTS

FRONT DRIVE HALFSHAFTS

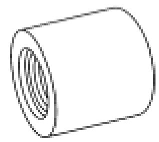
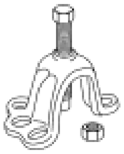
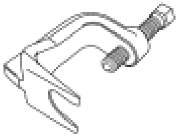
Refer to **DRIVELINE SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

HALFSHAFT - RH

Special Tools

Illustration	Tool Name	Tool Number

 ST2646-A	Adapter for 204-592	204-592/1
 ST2138-A	Installer, Halfshaft	204-161 (T97P-1175-A)
 ST2272-A	Remover, Front Wheel Hub	205-D070 (D93P-1175-B) or equivalent
 ST2945-A	Separator, Ball Joint	204-592

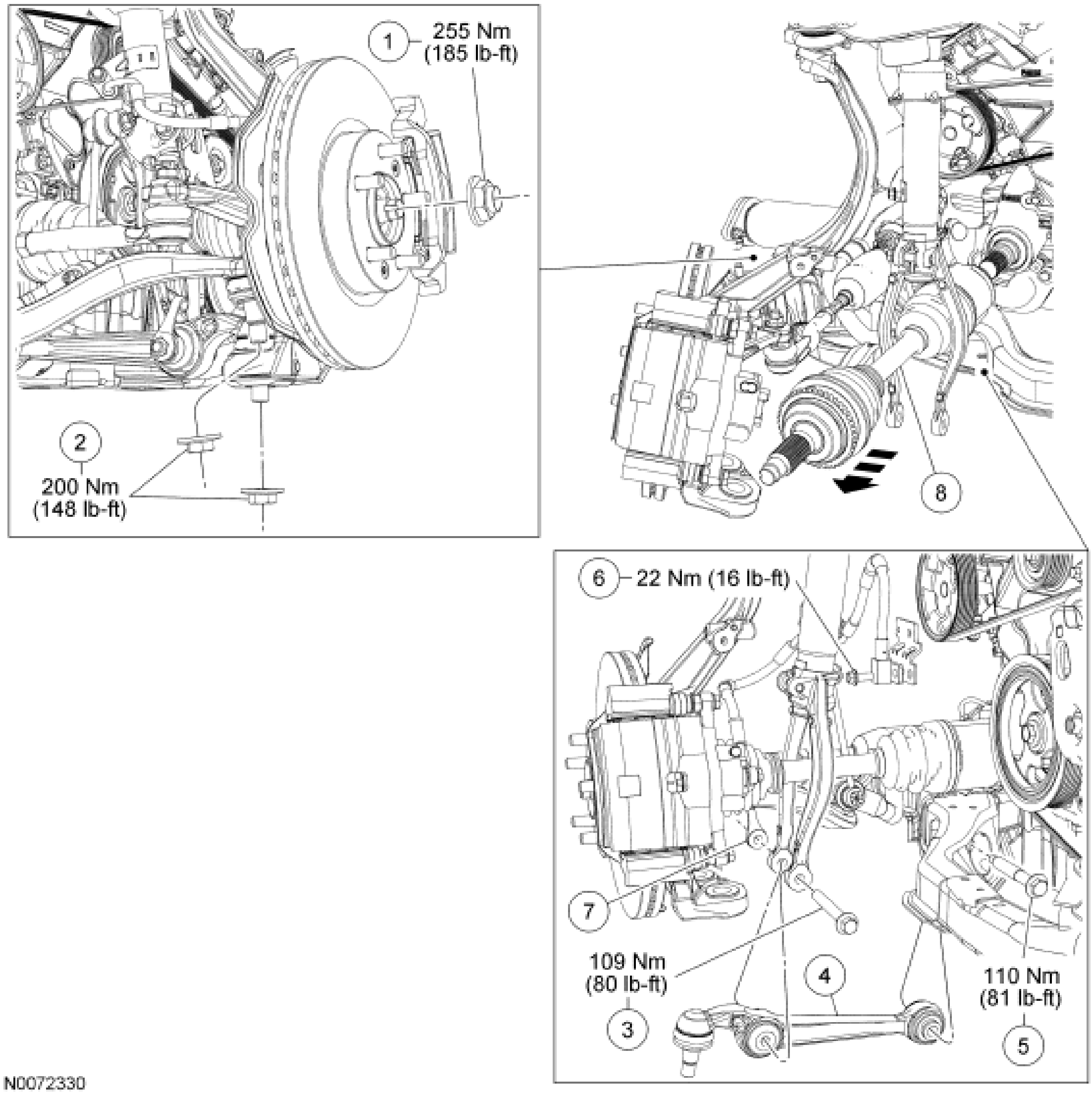


Fig. 1: Exploded View Of Halfshaft With Torque Specifications - RH
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3N405	Front wheel hub nut
2	3C499	Ball joint nuts (2 required)
3	W500550-S	Damper fork bolt
4	3A423	Front lower control arm
5	W712840-S	Front lower control arm inboard bolt
6	W505263-S	Brake tube bracket bolt
7	3C347	Damper fork bolt flag nut
8	3A427	Front halfshaft assembly

REMOVAL

1. Remove the front tire and wheel. For additional information, refer to **WHEELS AND TIRES** article.

NOTE: Apply the brake to keep the halfshaft from rotating.

2. Remove and discard the front wheel hub nut.

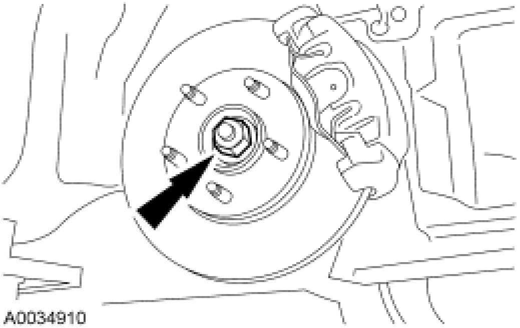


Fig. 2: Locating Front Wheel Hub Nut
Courtesy of FORD MOTOR CO.

3. Remove the front and rear lower control arm nuts.

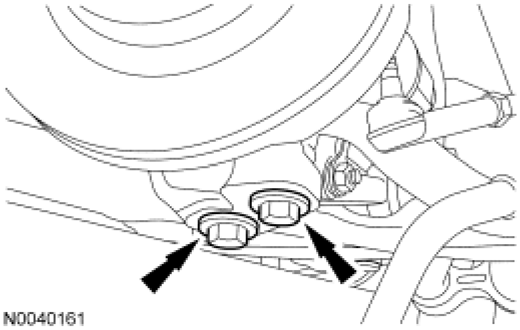


Fig. 3: Locating Front And Rear Lower Control Arm Nuts
Courtesy of FORD MOTOR CO.

NOTE: Once pressure is applied to the ball joint with the special tool, it may be necessary to tap the wheel knuckle at the ball joint area to separate the ball joint from the wheel knuckle.

4. Using the special tools, disconnect the 2 lower ball joints.

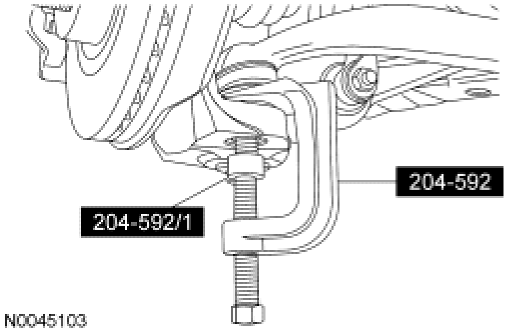


Fig. 4: Identifying Special Tools (204-592/1, 204-592)
Courtesy of FORD MOTOR CO.

5. Using the special tool, separate the halfshaft from the wheel hub.

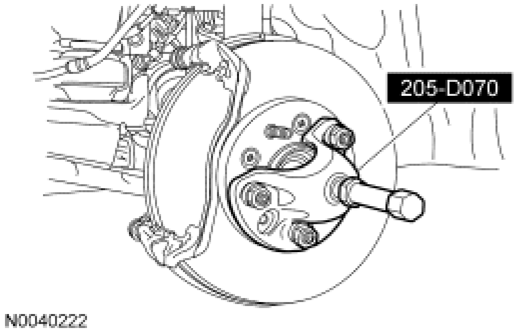


Fig. 5: Separating Halfshaft From Wheel Hub Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

CAUTION: When the lower ball joint is separated from the wheel knuckle, the lower arm may strike the outer constant velocity (CV) joint boot with enough force to damage the boot clamp. This will result in a loss of grease from the outer CV joint. Place a block of wood, or similar item, between the lower arm and the outer CV joint to prevent the lower arm from striking the outer CV joint.

6. Remove the damper fork bolt and flag nut connecting the damper fork to the lower control arm.

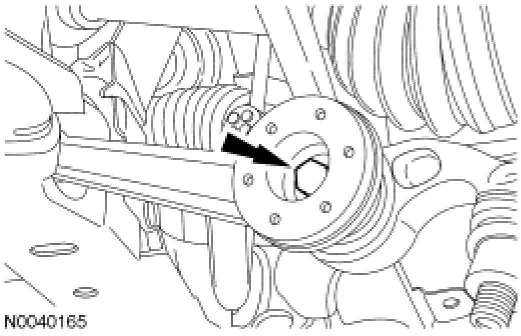


Fig. 6: Locating Damper Fork Bolt
Courtesy of FORD MOTOR CO.

7. Remove the brake caliper hose bolt.

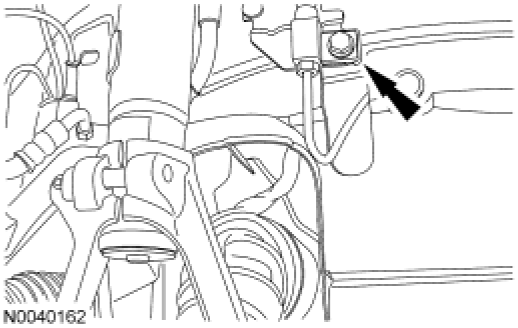


Fig. 7: Locating Brake Caliper Hose Bolt
Courtesy of FORD MOTOR CO.

NOTE: Support the knuckle with a suitable jackstand.

8. Pull the knuckle outboard and rotate it toward the rear of the vehicle.

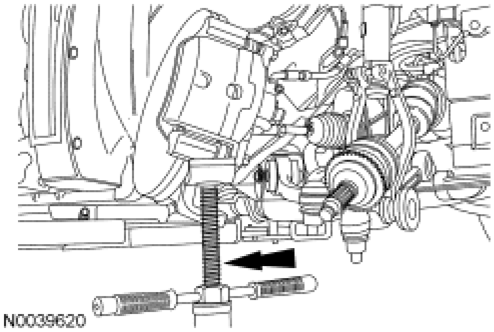


Fig. 8: Locating Jackstand
Courtesy of FORD MOTOR CO.

9. Remove the lower control arm-to-subframe bolt. Remove the lower control arm.

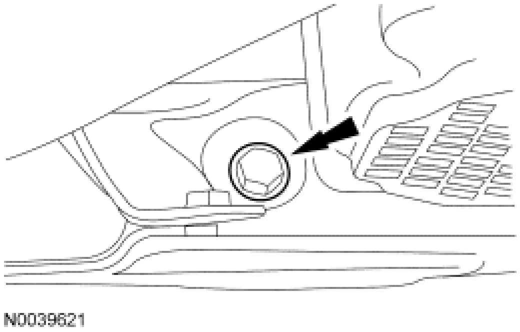


Fig. 9: Locating Lower Control Arm-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

10. Use a brass drift to strike the right side halfshaft in the indicated area and separate the RH halfshaft from the intermediate shaft.

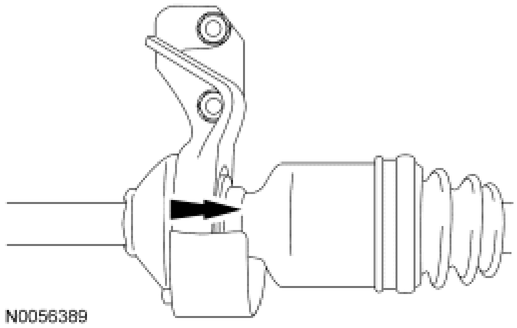


Fig. 10: Locating Brass Drift
Courtesy of FORD MOTOR CO.

11. Pull the strut forward, remove the halfshaft from the damper fork. Position the halfshaft in front of the damper fork towards the front of the vehicle and remove the halfshaft.

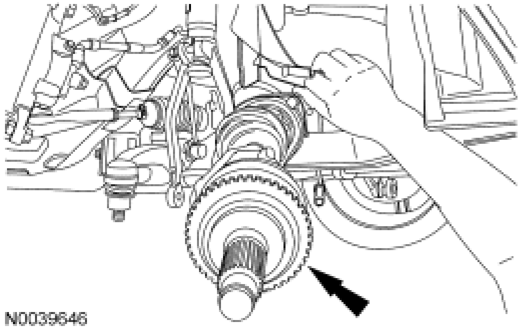


Fig. 11: Pulling Strut Forward & Removing Halfshaft From Damper Fork
Courtesy of FORD MOTOR CO.

12. Remove and discard the circlip from the intermediate shaft.

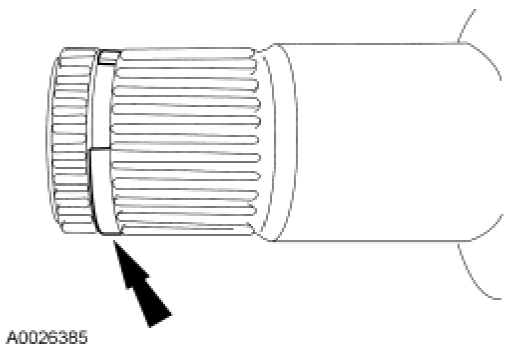


Fig. 12: Locating Halfshaft Circlip

Courtesy of FORD MOTOR CO.

INSTALLATION

CAUTION: Make sure to install the correct circlip for each application. Failure to use the correct diameter circlip may result in shaft removal concerns or shaft separation during vehicle operation.

1. Install a new intermediate shaft circlip.

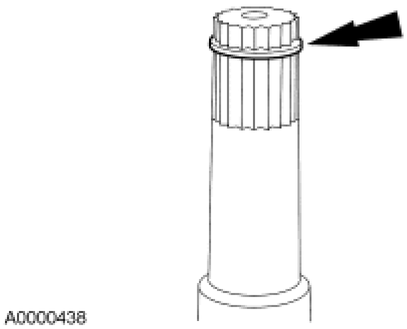


Fig. 13: Locating Intermediate Shaft Circlip
Courtesy of FORD MOTOR CO.

NOTE: Pull the right side shaft outward to make sure the circlip is locked.

2. Align the splines on the right side shaft with the intermediate shaft and push the stub shaft in until the circlip locks the shafts together.
3. Insert the halfshaft into the wheel hub.
4. Rotate the knuckle into position.
5. Install the lower control arm to subframe and install the bolt.
   - Tighten to 103 Nm (76 lb-ft).

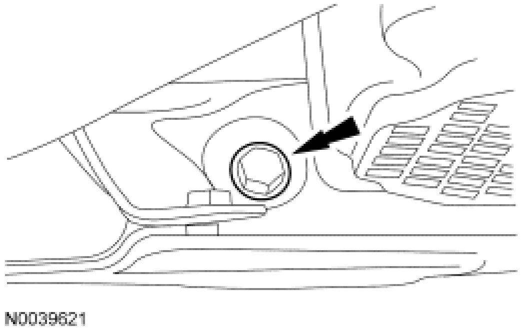


Fig. 14: Locating Lower Control Arm-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

6. Install the damper fork bolt and flag nut connecting the damper fork to the lower control arm.

- Tighten to 109 Nm (80 lb-ft).

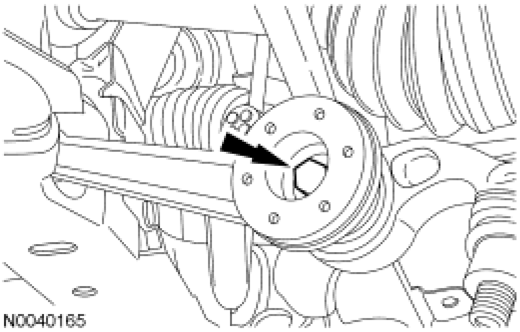


Fig. 15: Locating Damper Fork Bolt
Courtesy of FORD MOTOR CO.

7. Install the brake caliper hose bolt.
    - Tighten to 22 Nm (16 lb-ft).

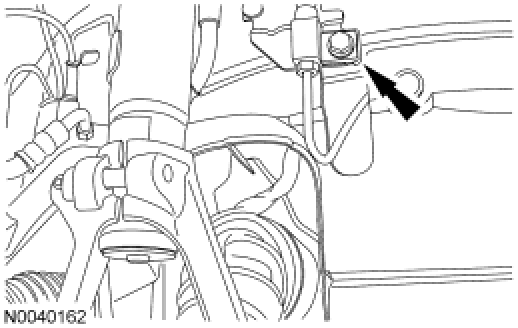


Fig. 16: Locating Brake Caliper Hose Bolt
Courtesy of FORD MOTOR CO.

8. Install the front and rear lower control arm nuts.
    - Tighten to 200 Nm (148 lb-ft).
9. Using the special tool, install the halfshaft in the wheel hub.

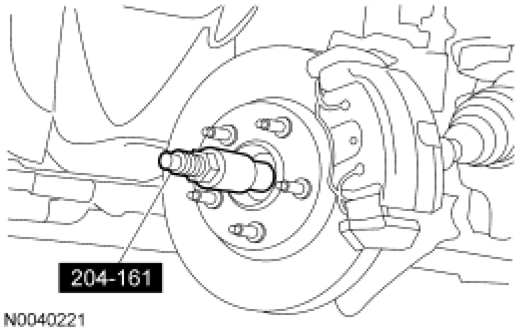


Fig. 17: Identifying Special Tool 204-161
Courtesy of FORD MOTOR CO.

CAUTION: Do not tighten the front wheel hub nut with the vehicle on the ground. The nut must be tightened to specification before the vehicle is lowered onto the wheels. Wheel bearing damage will occur if the wheel bearing is loaded with the weight of the vehicle applied.

NOTE: Apply the brake to keep the halfshaft from rotating.

10. Install a new front wheel hub nut.
    - Tighten to 255 Nm (185 lb-ft).
11. Stake the new nut in line with the keyway to a recommended minimum depth of 1 mm (0.039 in) below the keyway diameter to engage the locking feature.

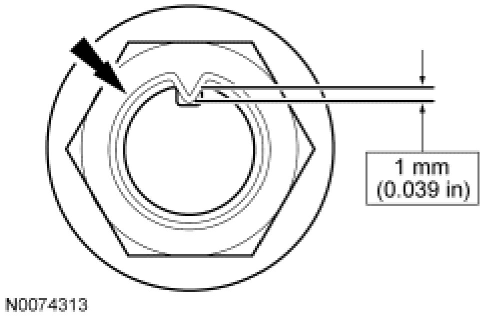
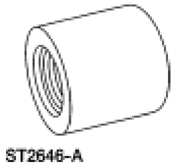


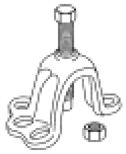
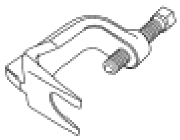
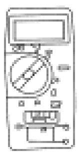
Fig. 18: Identifying Rear Wheel Hub Nut
Courtesy of FORD MOTOR CO.

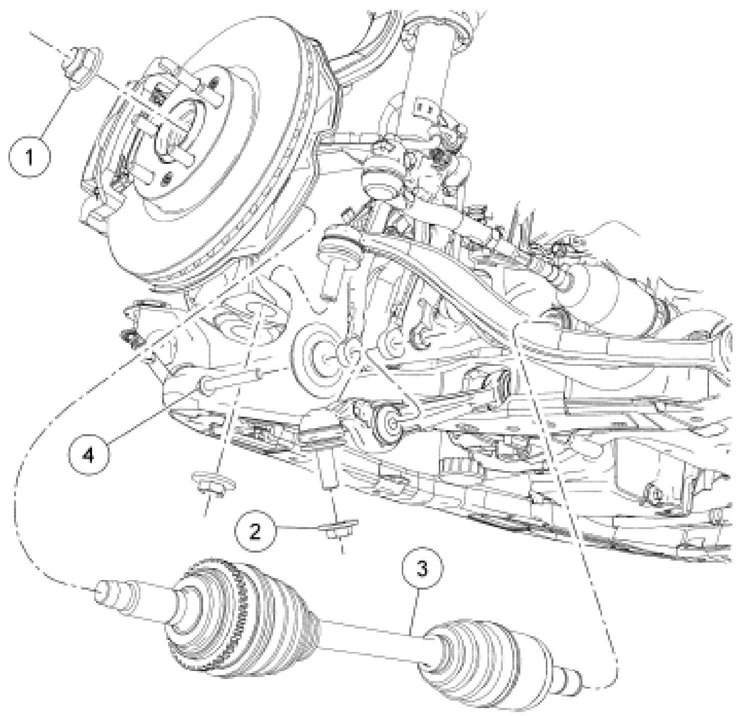
12. Install the front tires and wheels. For additional information, refer to **WHEELS AND TIRES** article.

HALFSHAFT - LH

Special Tools

Illustration	Tool Name	Tool Number
	Adapter for 204-592	204-592/1
	Halfshaft Remover	205-832
	Installer, Halfshaft	204-161 (T97P-1175-A)

 ST2136-A		
 ST2272-A	Remover, Front Wheel Hub	205-D070 (D93P-1175-B) or equivalent
 ST2945-A	Separator, Ball joint	204-592
 ST1137-A	Slide Hammer	100-001 (T50T-100-A)



N0039954

Fig. 19: Exploded View Of Halfshaft - LH
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3N405	Axle hub nut
2	3C499	Ball joint nut
3	3A424	Left halfshaft
4	W500550	Damper yoke bolt

REMOVAL

1. Remove the front tire and wheel. For additional information, refer to **WHEELS AND TIRES** article.

NOTE: Apply the brake to keep the halfshaft from rotating.

2. Remove and discard the front wheel hub nut.

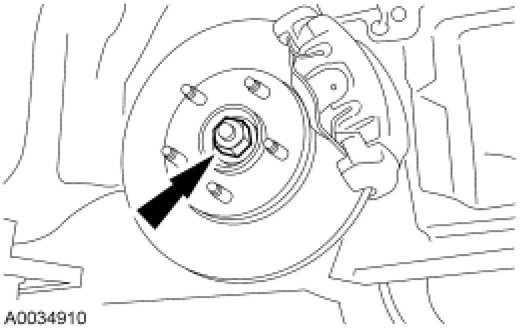


Fig. 20: Locating Front Wheel Hub Nut
Courtesy of FORD MOTOR CO.

3. Remove the front and rear lower control arm nuts.

NOTE: Once pressure is applied to the ball joint with the special tool, it may be necessary to tap the wheel knuckle at the ball joint area to separate the ball joint from the wheel knuckle.

4. Using the special tool, disconnect the 2 lower ball joints.

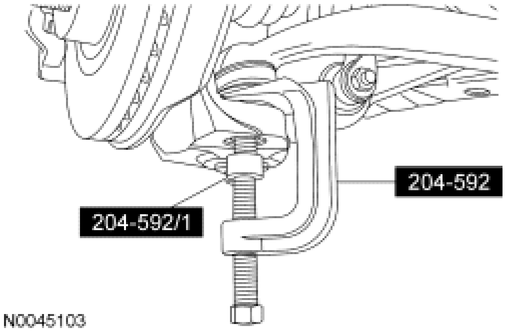


Fig. 21: Identifying Special Tools (204-592/1, 204-592)

Courtesy of FORD MOTOR CO.

5. Using the special tool, separate the halfshaft from the wheel hub.

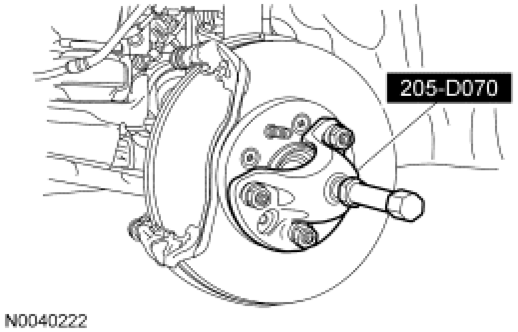


Fig. 22: Separating Halfshaft From Wheel Hub Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

CAUTION: When the lower ball joint is separated from the wheel knuckle, the lower arm may strike the outer constant velocity (CV) joint boot with enough force to damage the boot clamp. This will result in a loss of grease from the outer CV joint. Place a block of wood, or similar item, between the lower arm and the outer CV joint to prevent the lower arm from striking the outer CV joint.

6. Remove the damper fork bolt and flag nut connecting the damper fork to the lower control arm.

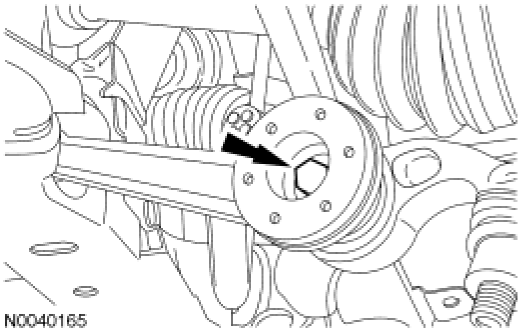


Fig. 23: Locating Damper Fork Bolt
Courtesy of FORD MOTOR CO.

7. Remove the brake caliper hose bolt.

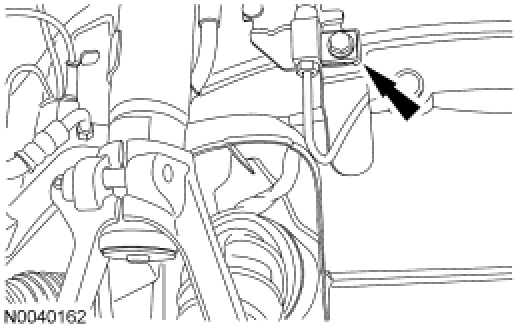


Fig. 24: Locating Brake Caliper Hose Bolt
Courtesy of FORD MOTOR CO.

NOTE: Support the knuckle with a suitable jackstand.

8. Pull the knuckle outboard and rotate it toward the rear of the vehicle.

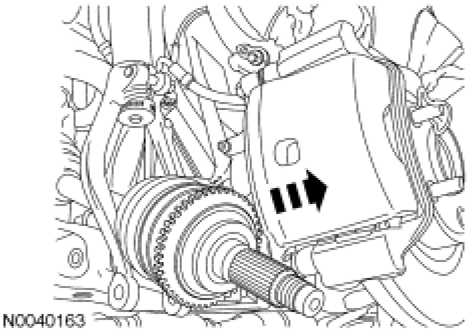


Fig. 25: Pulling Knuckle Outboard
Courtesy of FORD MOTOR CO.

9. Remove the lower control arm-to-subframe bolt. Remove the lower control arm.

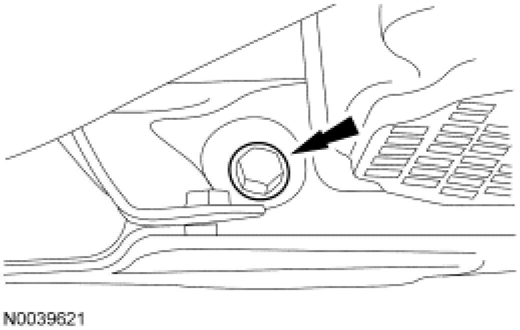


Fig. 26: Locating Lower Control Arm-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

10. Remove the 4 pushpins and position the splash shield aside.

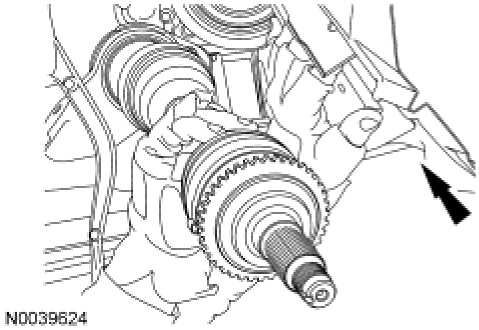


Fig. 27: Locating Pushpins
Courtesy of FORD MOTOR CO.

CAUTION: The sharp edges on the stub shaft splines can slice or puncture the oil seal. Use care when inserting the stub shaft into the transmission.

11. Using the special tools, remove the halfshaft from the transmission.

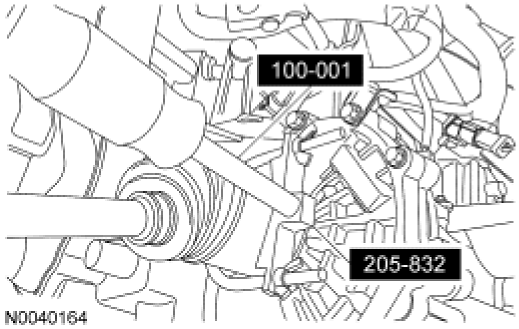


Fig. 28: Identifying Special Tools (100-001, 205-832)
Courtesy of FORD MOTOR CO.

12. Remove and discard the circlip from the stub shaft.

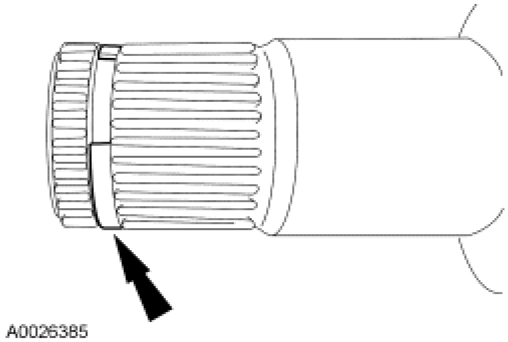


Fig. 29: Locating Halfshaft Circlip
Courtesy of FORD MOTOR CO.

INSTALLATION

CAUTION: Make sure to install the correct circlip for each application. Failure to use the correct diameter circlip may result in shaft removal concerns or shaft separation during vehicle operation.

1. Install a new stub shaft circlip.

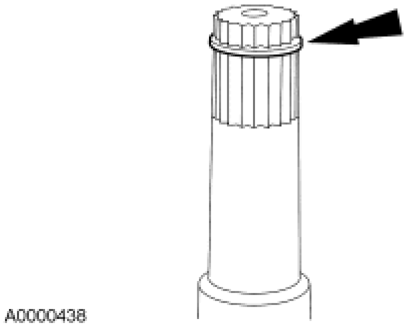


Fig. 30: Locating Intermediate Shaft Circlip
Courtesy of FORD MOTOR CO.

2. Insert the halfshaft into the wheel hub.

NOTE: After insertion, pull the halfshaft inner end to make sure the circlip is locked.

3. Push the stub shaft into the transmission so the circlip locks into the differential side gear.
4. Install the splash shield and pushpins.
5. Rotate the knuckle into position.
6. Install the lower control arm bolt and nut to the subframe.
   - Tighten to 103 Nm (76 lb-ft).

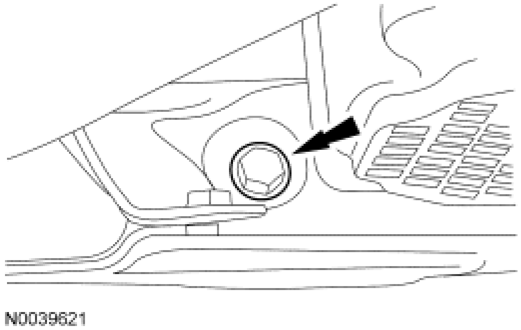


Fig. 31: Locating Lower Control Arm-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

7. Install the damper fork bolt connecting the damper fork to the lower control arm.
   - Tighten to 109 Nm (80 lb-ft).

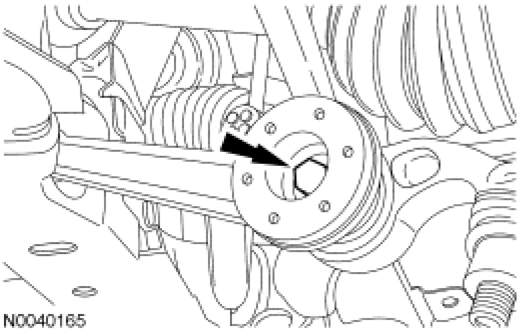


Fig. 32: Locating Damper Fork Bolt
Courtesy of FORD MOTOR CO.

8. Install the brake caliper hose bolt.
   - Tighten to 22 Nm (16 lb-ft).

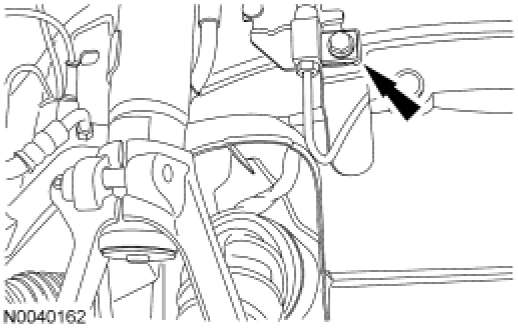


Fig. 33: Locating Brake Caliper Hose Bolt
Courtesy of FORD MOTOR CO.

9. Using the special tool, install the halfshaft in the wheel hub.

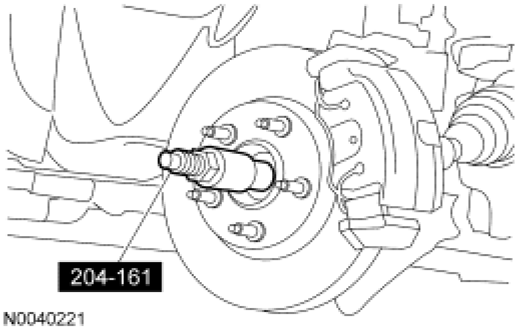


Fig. 34: Identifying Special Tool 204-161
Courtesy of FORD MOTOR CO.

10. Install the front and rear lower control arm nuts.
    - Tighten to 200 Nm (148 lb-ft).

CAUTION: Do not tighten the front wheel hub nut with the vehicle on the ground. The nut must be tightened to specification before the vehicle is lowered onto the wheels. Wheel bearing damage will occur if the wheel bearing is loaded with the weight of the vehicle applied.

NOTE: Apply the brake to keep the halfshaft from rotating.

11. Install the new front wheel hub nut.
    - Tighten to 255 Nm (185 lb-ft).

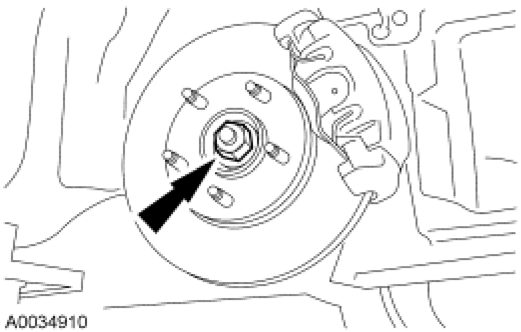


Fig. 35: Locating Front Wheel Hub Nut
Courtesy of FORD MOTOR CO.

12. Stake the new nut in line with the keyway to a recommended minimum depth of 1 mm (0.039 in) below the keyway diameter to engage the locking feature.

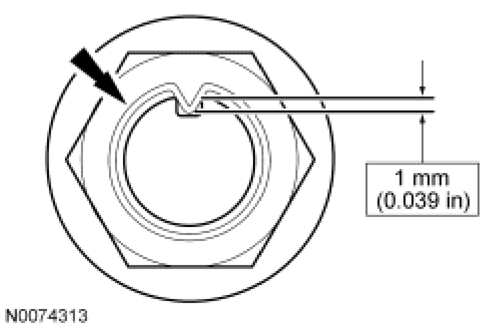


Fig. 36: Identifying Rear Wheel Hub Nut
Courtesy of FORD MOTOR CO.

13. Install the front tire and wheel. For additional information, refer to **WHEELS AND TIRES** article.

INTERMEDIATE SHAFT - FRONT WHEEL DRIVE (FWD)

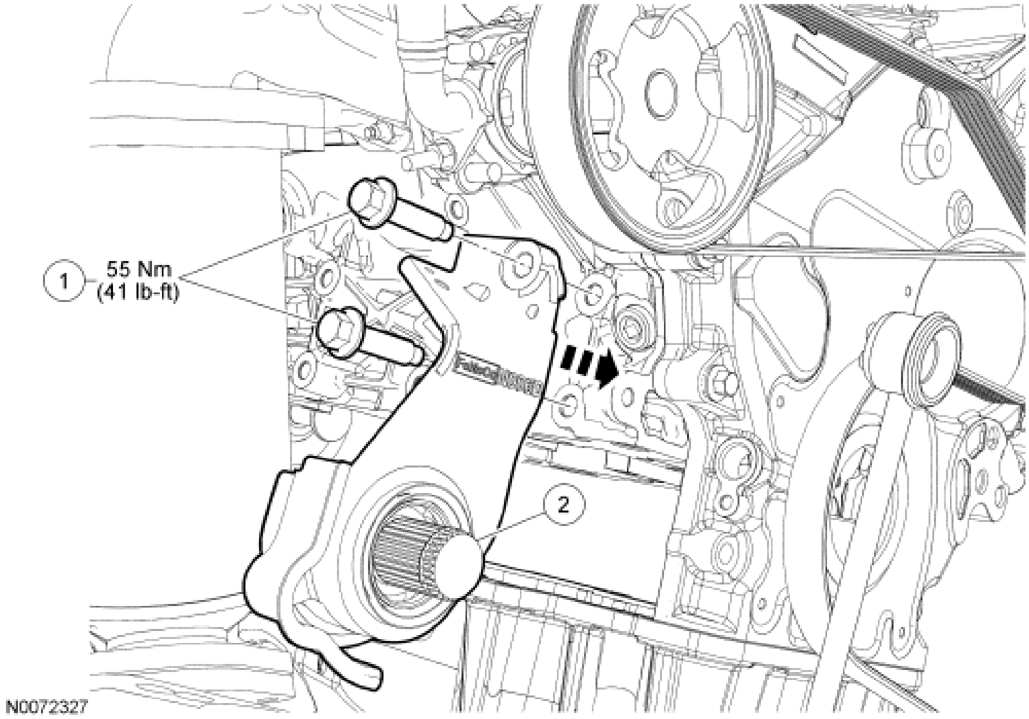


Fig. 37: Exploded View Of Intermediate Shaft With Torque Specification - Front Wheel Drive (FWD)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500235-S	Bracket-to-block bolts (2 required)
2	3K183	Intermediate shaft assembly

REMOVAL

All vehicles

1. Remove the RH halfshaft. For additional information, refer to **Halfshaft - RH** in this article.

   3.0L vehicles

2. Remove the 2 bolts from the intermediate shaft support bearing bracket.

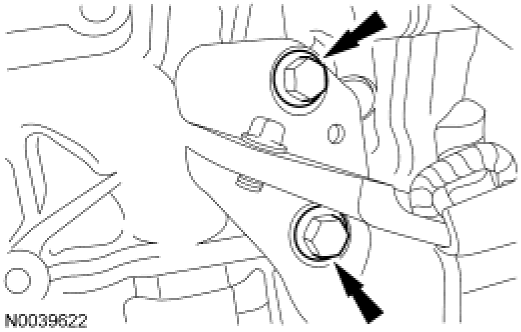


Fig. 38: Locating RH Halfshaft Carrier Bearing Bracket Bolts
Courtesy of FORD MOTOR CO.

3.5L vehicles

3. Remove the 2 catalytic converter bracket bolts.

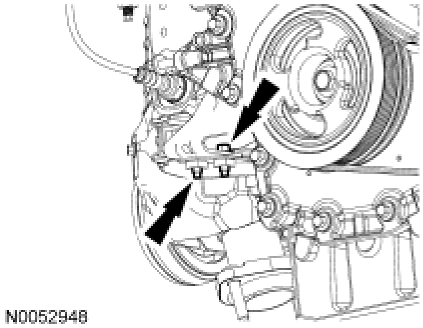


Fig. 39: Identifying Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

4. Remove the 2 nuts and remove the catalytic converter support bracket.

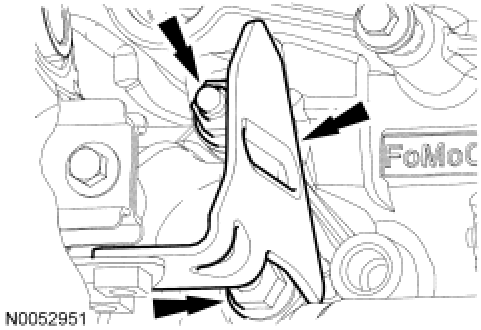


Fig. 40: Identifying Catalytic Converter Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

5. Remove the 3 bolts from the intermediate shaft bearing support bracket.

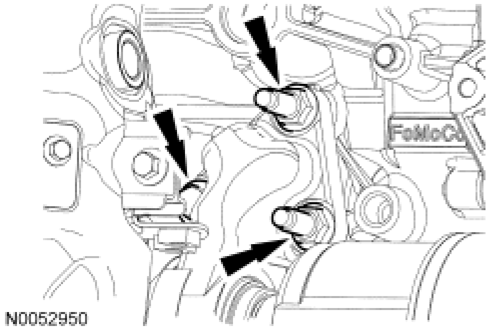


Fig. 41: Identifying Intermediate Shaft Bearing Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: Do not damage the transaxle seals when removing the intermediate shaft.

6. Carefully remove the intermediate shaft while supporting both ends of the intermediate shaft.

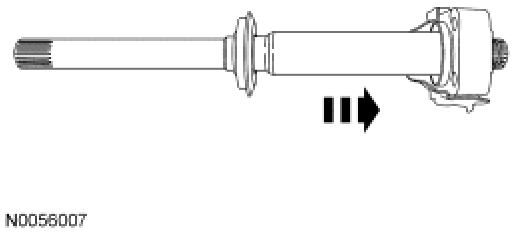


Fig. 42: Removing Intermediate Shaft While Supporting Both Ends Of Intermediate Shaft
Courtesy of FORD MOTOR CO.

7. Remove and discard the circlip from the outboard end of the intermediate shaft.

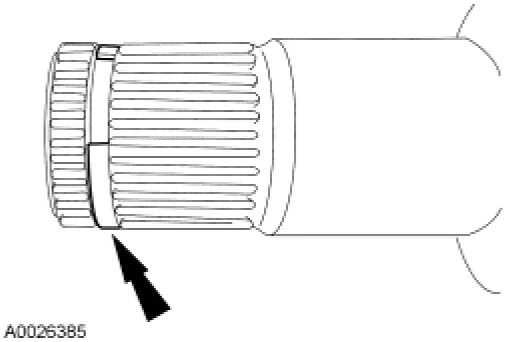


Fig. 43: Locating Halfshaft Circlip
Courtesy of FORD MOTOR CO.

INSTALLATION

All vehicles

CAUTION: Make sure to install the correct circlip for each application. Failure to use the correct diameter circlip may result in shaft removal concerns or shaft separation during vehicle operation.

1. Install as new circlip on the outboard end of the intermediate shaft.

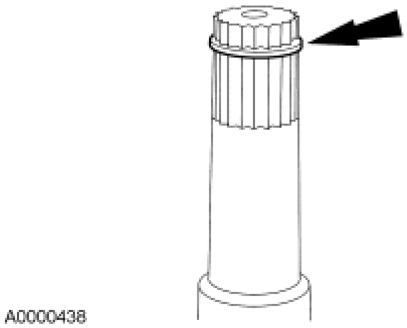


Fig. 44: Locating Intermediate Shaft Circlip
Courtesy of FORD MOTOR CO.

2. Position the intermediate shaft in the transaxle and engage the intermediate shaft splines with the transaxle side gears. Make sure the circlip is locked in the gear.

3.0L vehicles

3. Install the 2 intermediate shaft support bracket bolts.
   - Tighten to 40 Nm (30 lb-ft).

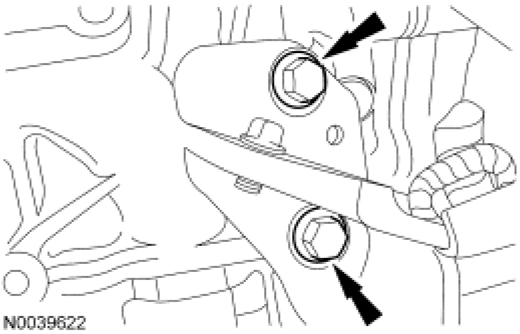


Fig. 45: Locating RH Halfshaft Carrier Bearing Bracket Bolts
Courtesy of FORD MOTOR CO.

3.5L vehicles

4. Install the 3 intermediate shaft bearing support bracket bolts.
   - Tighten to 40 Nm (30 lb-ft).

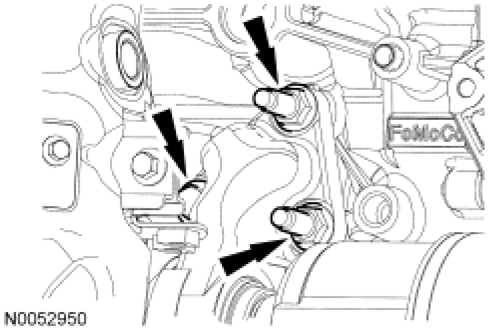


Fig. 46: Identifying Intermediate Shaft Bearing Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

5. Install the catalytic converter support bracket and the 2 nuts.
   - Tighten to 23 Nm (17 lb-ft).

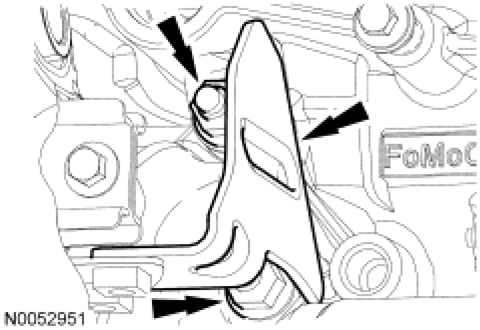


Fig. 47: Identifying Catalytic Converter Support Bracket & Nuts
Courtesy of FORD MOTOR CO.

6. Install the 2 catalytic converter bracket bolts.
   - Tighten to 20 Nm (15 lb-ft).

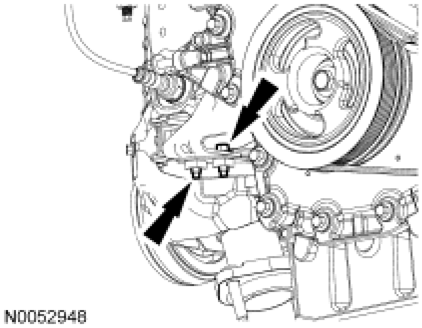


Fig. 48: Identifying Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

All vehicles

7. Install the RH halfshaft. For additional information, refer to **Halfshaft - RH** in this article.

INTERMEDIATE SHAFT - ALL WHEEL DRIVE (AWD)

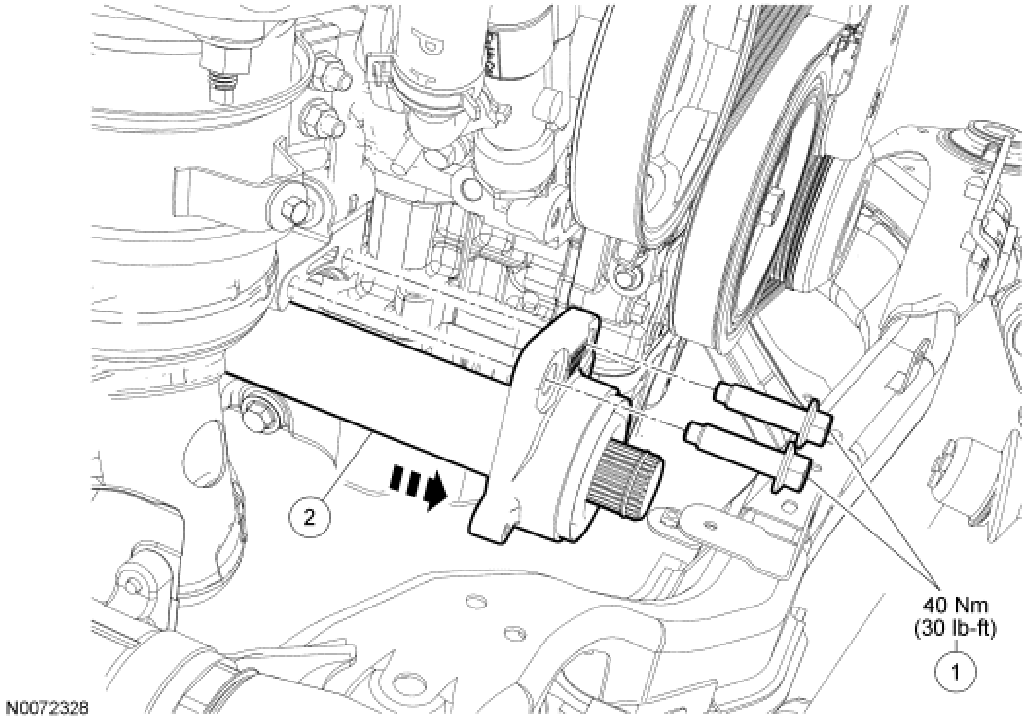


Fig. 49: Exploded View Of Intermediate Shaft With Torque Specification - All Wheel Drive (AWD)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500235-S	Halfshaft bearing support bolts (2 required)
2	3K183	Intermediate shaft assembly

REMOVAL

CAUTION: A new intermediate shaft seal in the power transfer unit (PTU) must be installed whenever the intermediate shaft is removed or leaks from the seal may occur. For additional information, refer to TRANSFER CASE - POWER TRANSFER UNIT (PTU) article.

1. Remove the RH halfshaft. For additional information, refer to **Halfshaft - RH** in this article.
2. Remove the 2 bolts from the intermediate shaft support bearing bracket.

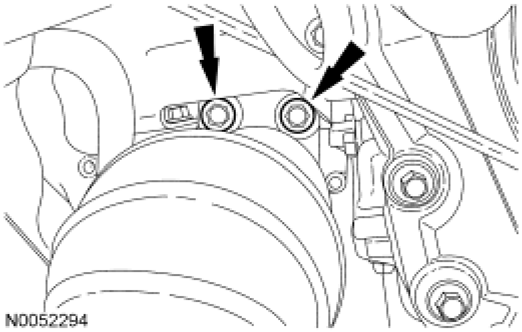


Fig. 50: Locating RH Halfshaft Bearing Support Bracket Bolts
Courtesy of FORD MOTOR CO.

NOTE: Do not damage the transaxle seals when removing the intermediate shaft.

3. Carefully remove the intermediate shaft while supporting both ends of the intermediate shaft.

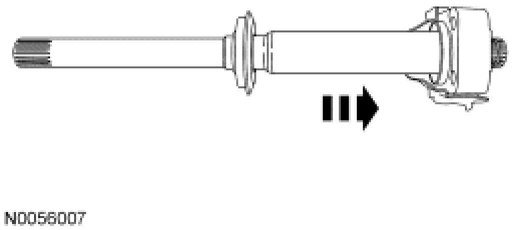


Fig. 51: Removing Intermediate Shaft While Supporting Both Ends Of Intermediate Shaft
Courtesy of FORD MOTOR CO.

4. Remove and discard the circlip from the outboard end of the intermediate shaft.

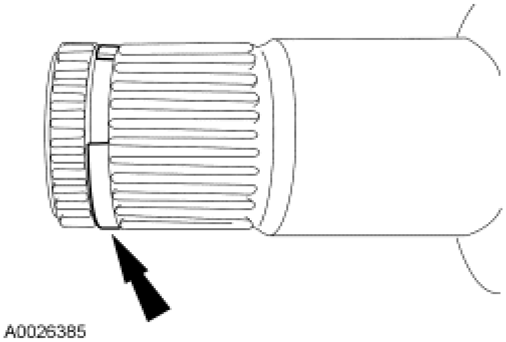


Fig. 52: Locating Halfshaft Circlip
Courtesy of FORD MOTOR CO.

INSTALLATION

CAUTION: Make sure to install the correct circlip for each application. Failure to use the correct diameter circlip may result in shaft removal concerns or shaft separation during vehicle operation.

1. Install a new circlip on the outboard end of the intermediate shaft.

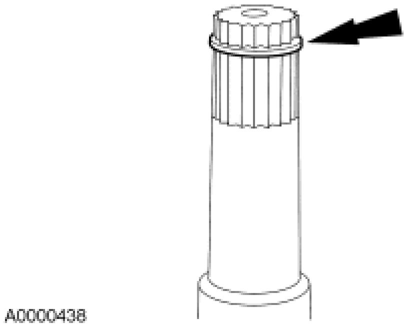


Fig. 53: Locating Intermediate Shaft Circlip
Courtesy of FORD MOTOR CO.

2. Install a new intermediate shaft seal. For additional information, refer to **TRANSFER CASE - POWER TRANSFER UNIT (PTU)** article.
3. Position the intermediate shaft in the transaxle and engage the intermediate shaft splines with the transaxle side gears. Make sure the circlip is locked in the gear.
4. Install the 2 intermediate shaft support bracket bolts.
    - Tighten to 40 Nm (30 lb-ft).
5. Install the RH halfshaft. For additional information, refer to **Halfshaft - RH** in this article.

2008 ACCESSORIES & BODY, CAB

Front End Body Panels - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Fender bolts (lower and upper rear)	9	-	80
Fender bolts (radiator support brace)	9	-	80
Fender bolts (upper)	9	-	80
Fender bolts (upper rear inner)	5	-	44
Wiper mounting arm and pivot shaft assembly bolts	5	-	44
Wiper pivot arm nuts	20	15	-
Hood hinge-to-hood bolts	22	16	-
Hood hinge-to-body bolts	22	16	-
Hood striker bolts	12	9	-

REMOVAL AND INSTALLATION

FRONT END BODY PANELS - EXPLODED VIEW

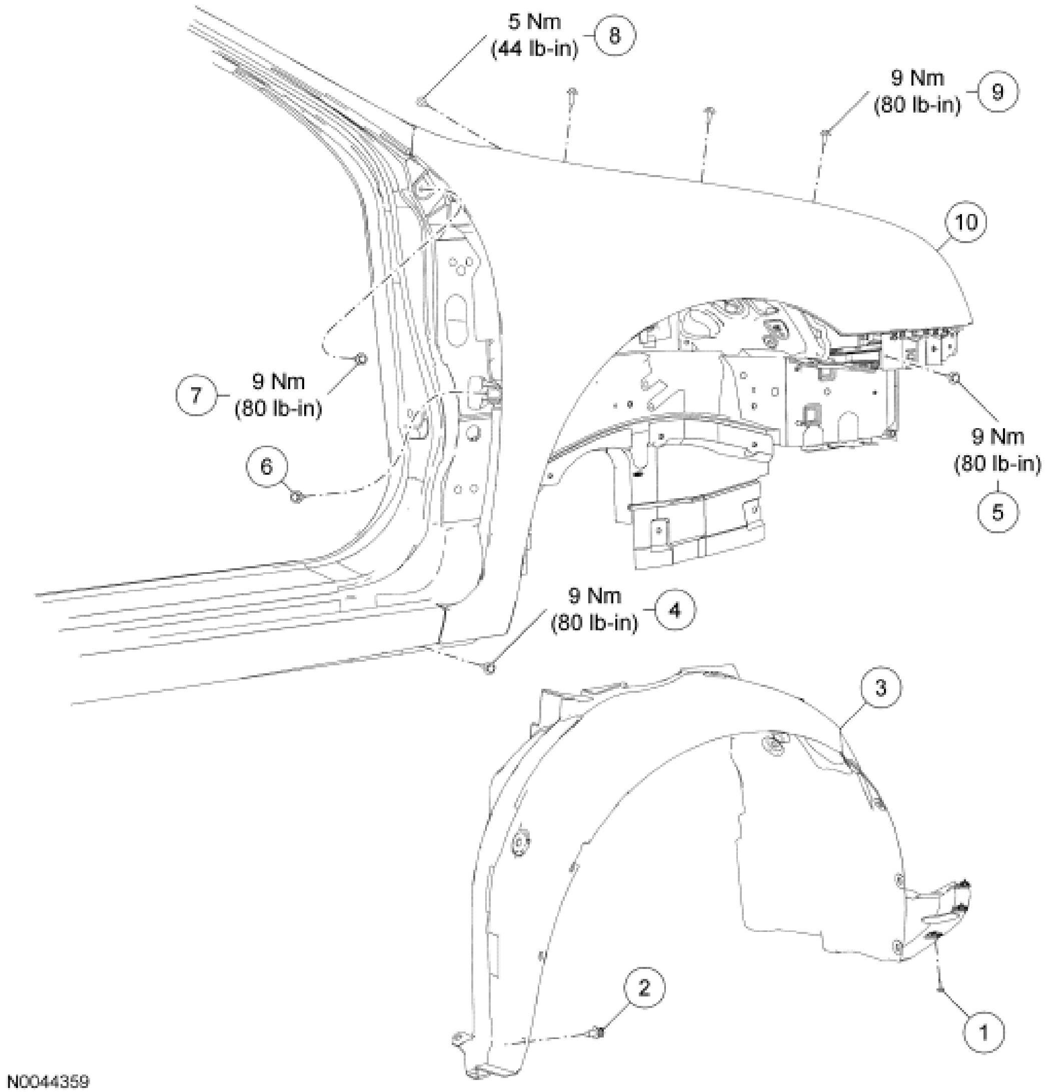


Fig. 1: Exploded View Of Front End Body Panels With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W706805	Splash shield screw (3 required)
2	N807389	Splash shield pin-type retainer (11 required)
3	5416034 RH/ 5416035 LH	Splash shield
4	W505421	Fender lower bolt (2 required)
5	W505421	Fender radiator support brace bolt
6	W505421	Fender rear lower bolt
7	W505421	Fender rear upper bolt
8	W505421	Fender rear inner bolt
9	W505421	Fender upper bolt (3 required)

10	16005 RH/ 16006 LH	Fender

1. For additional information, refer to the procedures.

FENDER

REMOVAL AND INSTALLATION

All vehicles

1. Remove the front fender splash shield. For additional information, refer to **Fender Splash Shield**.
2. Remove the insulator panel.

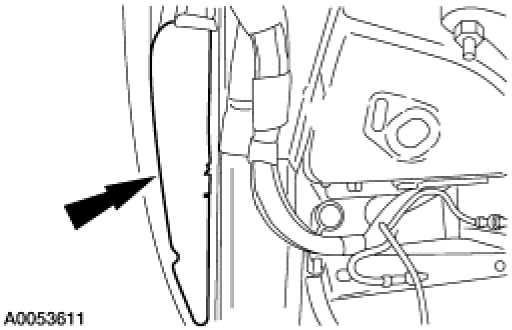


Fig. 2: Locating Insulator Panel
Courtesy of FORD MOTOR CO.

3. Remove the inner fender nut.
   - To install, tighten to 9 N.m (80 lb-in).
4. Remove the 2 lower fender bolts.
   - To install, tighten to 9 N.m (80 lb-in).

Fusion and Milan only

5. Remove the side turn signal lamp. For additional information, refer to **EXTERIOR LIGHTING** article.

All vehicles

NOTE: The front door must be open to gain access to the rear fender bolts.

6. Remove the upper rear fender bolt.
   - To install, tighten to 9 N.m (80 lb-in).

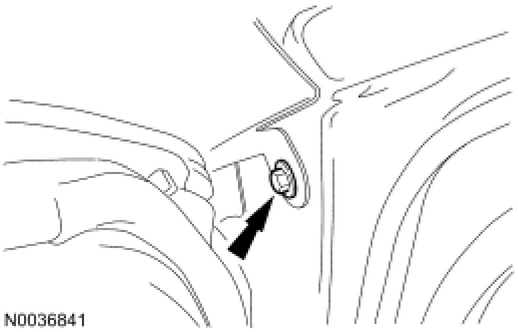


Fig. 3: Locating Upper Rear Fender Bolt
Courtesy of FORD MOTOR CO.

7. Remove the fascia bracket from the front fender.
    1. Remove the screw.
    2. Remove the bolt.
    3. Disconnect the clip from the fender.

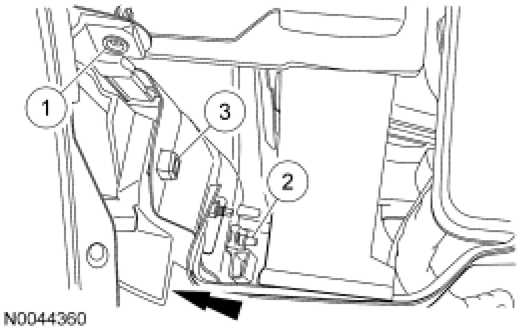


Fig. 4: Removing Fascia Bracket From Front Fender
Courtesy of FORD MOTOR CO.

NOTE: Two bolts required for Fusion and Milan, one bolt required for MKZ.

8. Remove the front support brace fender bolts.
    - To install, tighten to 9 N.m (80 lb-in).

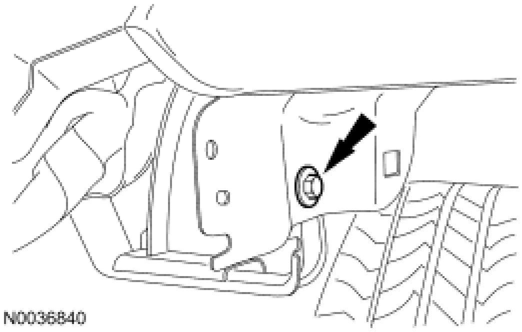


Fig. 5: Locating Front Support Brace Fender Bolts
Courtesy of FORD MOTOR CO.

9. Remove the push pin from the front fender to headlamp.
10. Remove the upper rear inner fender bolt.
    - To install, tighten to 5 N.m (44 lb-in).

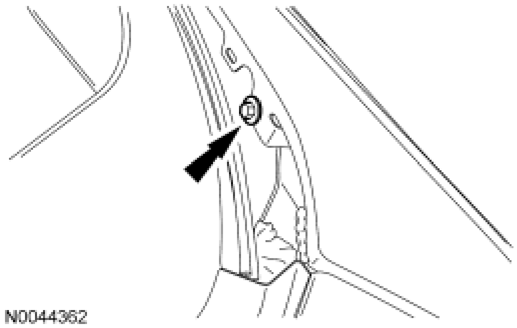


Fig. 6: Locating Upper Rear Inner Fender Bolt
Courtesy of FORD MOTOR CO.

11. Remove the 3 upper fender bolts and the front fender.
    - To install, tighten to 9 N.m (80 lb-in).
12. To install, reverse the removal procedure.

FENDER SPLASH SHIELD

REMOVAL AND INSTALLATION

1. Remove the fender splash shield screws.
2. Remove the 11 fender splash shield pin-type retainers.
3. Remove the fender splash shield.
4. To install, reverse the removal procedure.

COWL PANEL GRILLE

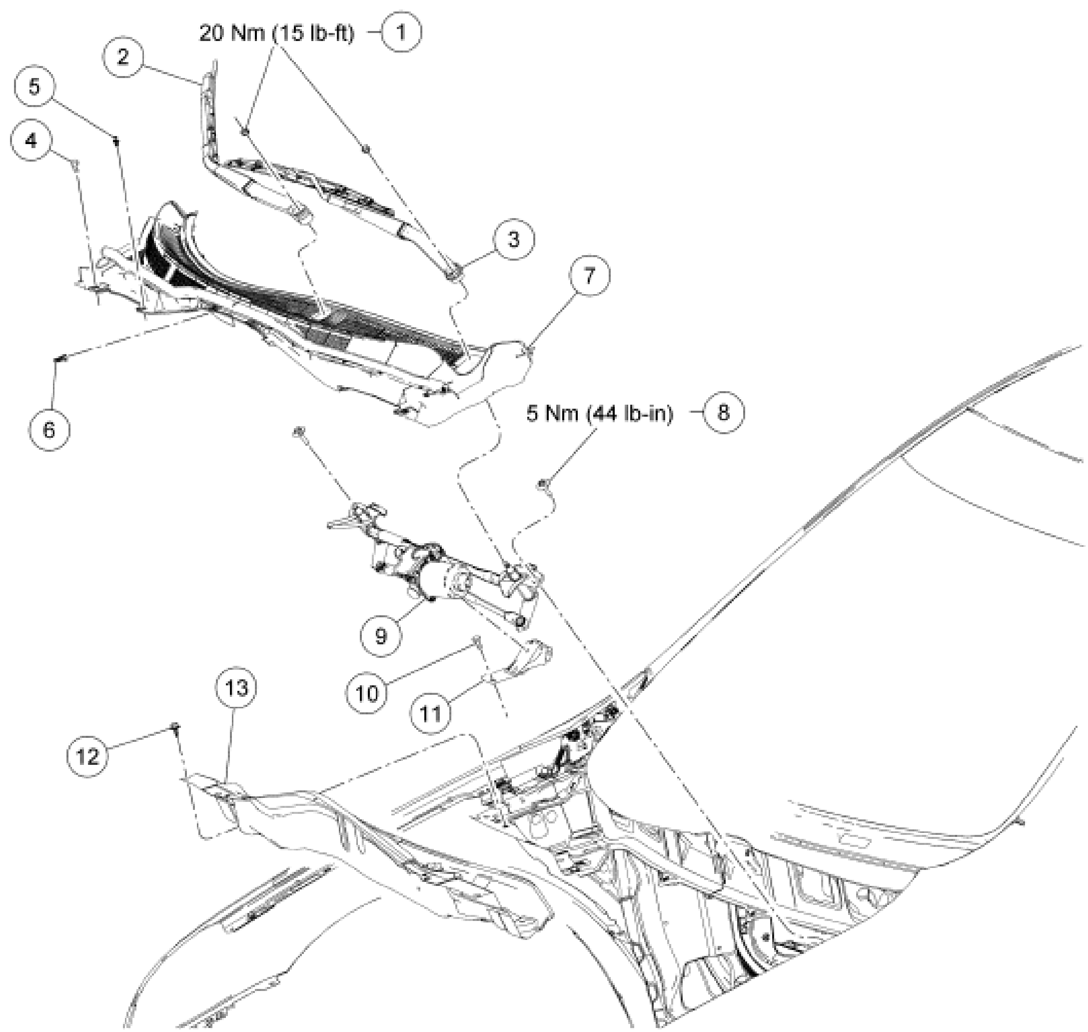


Fig. 7: Exploded View Of Cowl Panel Grille With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W520403-S	Wiper pivot arm nuts (2 required)
2	17526	Wiper pivot arm
3	17526	Wiper pivot arm
4	W701121-S	Cowl panel grille bolt (2 required)
5	1502316-A	Pin-type retainer (2 required)
6	W709919	Cowl panel retaining clip (2 required)
7	5402010	Upper cowl panel grille
8	W701121	Wiper mounting arm and pivot shaft assembly bolt (2 required)
9	17508	Wiper mounting arm and pivot shaft assembly

10	W707717	Cowl panel center brace bolt (3 required)
11	54022A06	Cowl panel center brace
12	W707717	Lower cowl panel grille bolt (10 required)
13	5402000-A	Lower cowl panel grille

Upper cowl panel grille

1. Remove the 2 wiper pivot arms nuts.
   - To install, tighten to 20 N.m (15 lb-ft).
2. Remove the LH and RH wiper pivot arms.
3. Remove the 2 pin-type retainers from the upper cowl panel grille.
4. Remove the 2 bolts from the upper cowl panel grille.
5. Remove the 2 retaining clips and the upper cowl panel grille.

   3.5L only

6. Insert a flat-blade screwdriver behind the power steering reservoir.

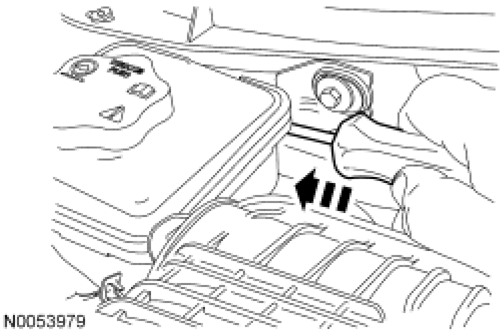


Fig. 8: Detaching Power Steering Reservoir From Bracket
Courtesy of FORD MOTOR CO.

7. Push the retainer rearward to remove the power steering reservoir. Position the reservoir aside.

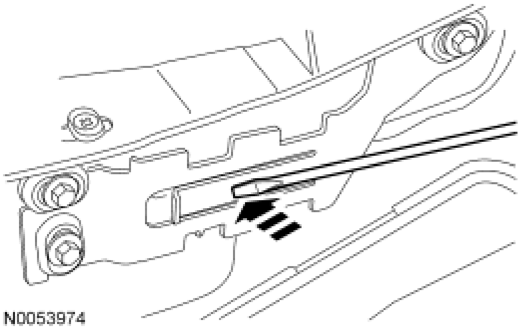


Fig. 9: Pushing Retainer Rearward To Remove Power Steering Reservoir
Courtesy of FORD MOTOR CO.

8. Remove the 2 brake fluid reservoir nuts and position the reservoir aside.

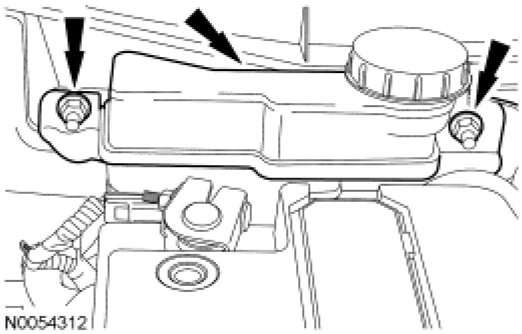


Fig. 10: Locating Brake Fluid Reservoir Nuts
Courtesy of FORD MOTOR CO.

Lower cowl panel grille

9. Remove the wiper mounting arm and wiper pivot shaft assembly.
    1. Disconnect the electrical connector.
    2. Remove the 2 bolts.
        - To install, tighten to 5 N.m (44 lb-in).
10. Remove the 3 bolts and the lower cowl panel center brace.
11. Remove the 10 lower cowl panel grille bolts.
12. Remove the lower cowl panel grille.
13. To install, reverse the removal procedure.
    - Adjust the pivot arms. For additional information, refer to **WIPERS AND WASHERS** article.

2008 SUSPENSION

Front Suspension - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Brake caliper anchor plate bolt	90	66	-
Brake disc bolt	20	-	177
Brake tube bracket bolt	23	17	-
Catalytic converter nut	40	30	-
Damper fork-to-front lower arm bolt	103	76	-
Front lower arm-to-subframe bolt[a]	-	-	-
Halfshaft nut	255	189	-
Lower ball joint nut	200	148	-
Rear driveshaft-to-Power Transfer Unit (PTU) bolts	70	52	-
Rear lower arm-to-subframe bolt[a]	-	-	-
Shock absorber rod nut	40	30	-
Shock absorber-to-damper fork bolt	48	35	-
Shock absorber upper mount nut	30	22	-
Stabilizer bar bracket nut	48	35	-
Stabilizer bar link lower nut	42	31	-
Stabilizer bar link upper nut	40	30	-
Steering column shaft bolt	25	18	-
Steering gear-to-subframe bolt	107	79	-
Subframe bracket-to-body bolt	103	76	-
Subframe bracket-to-subframe nut	150	111	-
Tie-rod end nut	48	35	-
Underbody cover shield bolts	7	-	62
Upper arm-to-body bolt	55	41	-
Upper ball joint nut	48	35	-
Wheel speed sensor bolt	23	17	-
Wheel speed sensor harness bolt	23	17	-

[a] Refer to the procedure.

DESCRIPTION AND OPERATION

FRONT SUSPENSION

The front suspension consists of the following components:

- Wheel bearings
- Wheel hubs
- Wheel studs
- Front and rear lower arms
- Upper arms
- Stabilizer bar
- Stabilizer bar bushings
- Stabilizer bar links
- Shock and spring assemblies
- Wheel knuckles

The front suspension is an independent suspension design. This front suspension uses 3 parallel arms (one upper arm and 2 lower arms). Each arm has a mounting position to the chassis and a ball joint attachment at the wheel knuckle. The shock absorber mounts to the lower arm and along with the spring, controls vertical movement. A stabilizer bar and links are included to control suspension lean/sway during turns. The multiple arm design allows for carefully controlled motion of the wheel throughout suspension travel, controlling such parameters as camber angle, caster angle and toe.

DIAGNOSTIC TESTS

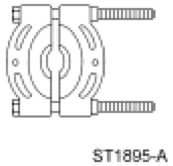
FRONT SUSPENSION

Refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

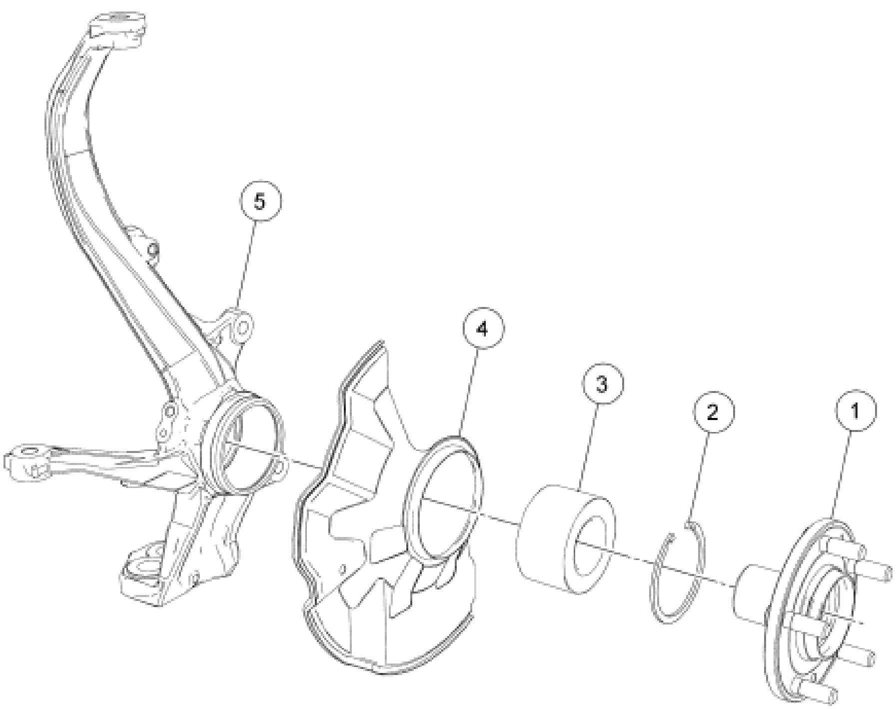
REMOVAL AND INSTALLATION

WHEEL BEARING AND WHEEL HUB

Special Tools

Illustration	Tool Name	Tool Number
	Installer, Wheel Hub Bearing Cup	205-147
	Pinion Bearing Cone Remover	205-D002 (D79L-4621-A) or equivalent

 ST2446-A	Remover/Installer, Wheel Hub Cup	204-020
 ST2446-A	Step Plate	205-117



N0042565

Fig. 1: Exploded View Of Wheel Bearing & Wheel Hub
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	1104	Wheel hub
2	3B625	Snap ring
3	1215	Wheel bearing
4	2K005 LH/ 2K004 RH	Disc brake shield
5	3K171 LH/ 3K170 RH	Wheel knuckle

REMOVAL

NOTE: If removing the wheel hub, a new wheel bearing must be installed.

1. Remove the wheel knuckle. For additional information, refer to **Wheel Knuckle**.
2. Using the Step Plate, press the wheel hub from the wheel bearing.

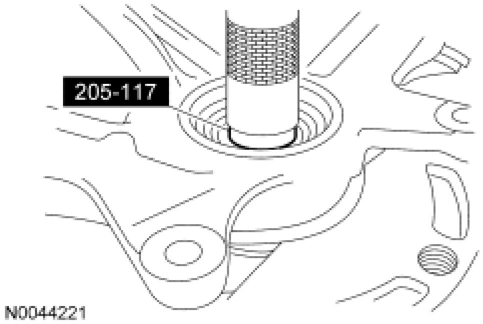


Fig. 2: Pressing Wheel Hub From Wheel Bearing Using Special Tool (205-117)
Courtesy of FORD MOTOR CO.

NOTE: **This step may not be necessary if the inner wheel bearing race remains on the wheel hub after removing the wheel hub.**

3. If necessary, using the Pinion Bearing Cone Remover, press the inner wheel bearing race from the wheel hub.

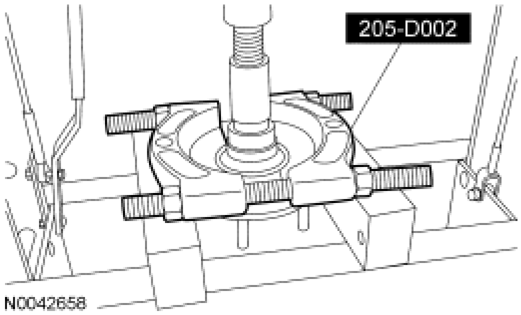


Fig. 3: Pressing Inner Wheel Bearing Race From Wheel Hub Using Special Tool (205-D002)
Courtesy of FORD MOTOR CO.

4. Remove the snap ring.
5. Using the Wheel Hub Cup Remover/Installer, press the wheel bearing from the wheel knuckle.

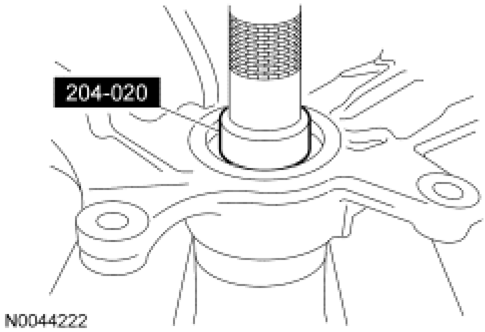


Fig. 4: Pressing Outer Wheel Bearing Race From Wheel Knuckle Using Special Tool (204-020)
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Using the Wheel Hub Bearing Cup Installer, press the wheel bearing into the wheel knuckle.

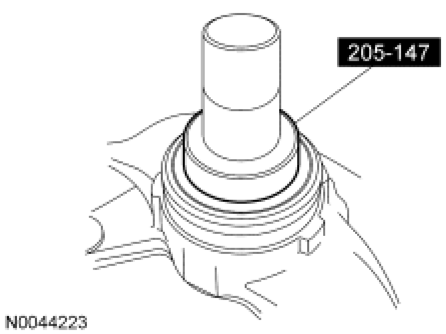


Fig. 5: Pressing Wheel Bearing Into Wheel Knuckle Using Special Tool (205-147)
Courtesy of FORD MOTOR CO.

2. Install the snap ring.
3. Using the Step Plate and Wheel Hub Bearing Cup Installer, press the wheel hub into the wheel bearing.

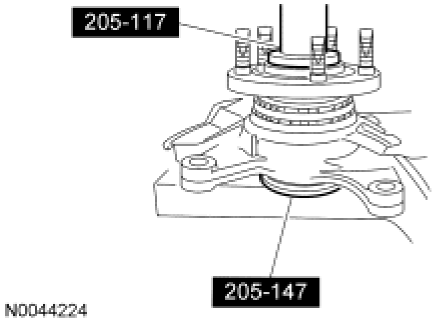


Fig. 6: Pressing Wheel Hub Into Wheel Bearing Using Special Tools (205-117) & (205-147)
Courtesy of FORD MOTOR CO.

4. Install the wheel knuckle. For additional information, refer to **Wheel Knuckle**.

WHEEL STUDS

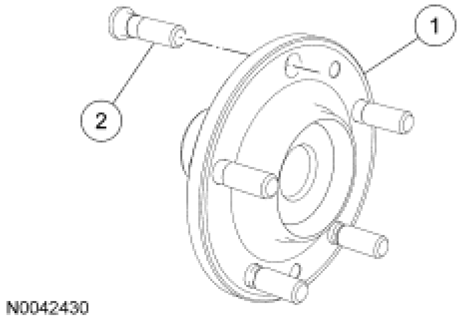


Fig. 7: Exploded View Of Wheel Studs
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	1104	Wheel hub
2	1107	Wheel stud

REMOVAL

1. Remove the wheel hub. For additional information, refer to **Wheel Bearing and Wheel Hub**.
2. Using a press, remove the wheel stud from the wheel bearing and hub assembly.

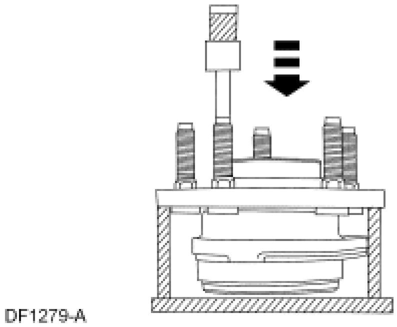


Fig. 8: Identifying Wheel Stud From Wheel Bearing & Hub Assembly
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Position the new wheel stud in the wheel hub, aligning the serrations in the wheel hub flange made by the original wheel stud.
2. Using a press, install a new wheel stud.

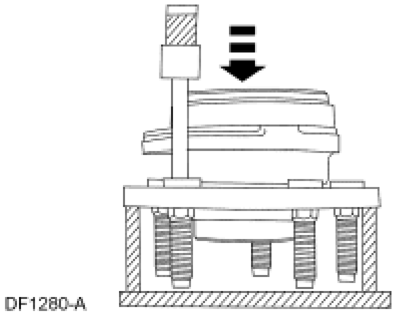
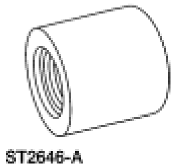
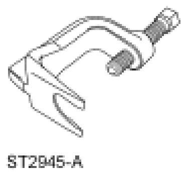


Fig. 9: Installing New Wheel Stud Using A Press
Courtesy of FORD MOTOR CO.

3. Install the wheel hub. For additional information, refer to **Wheel Bearing and Wheel Hub**.

LOWER ARM - FRONT

Special Tools

Illustration	Tool Name	Tool Number
	Adapter for 204-592	204-592/1
	Separator, Ball Joint	204-592

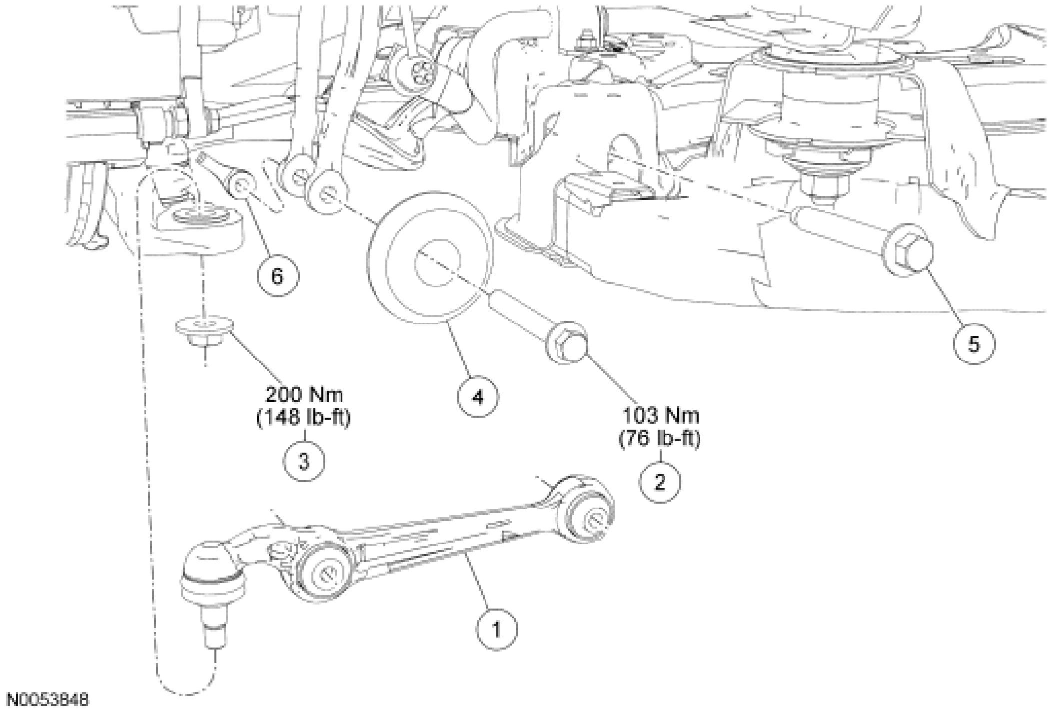


Fig. 10: Exploded View Of Front Lower Arm With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3A423	Lower arm (front)
2	W500550	Damper fork-to-lower arm bolt
3	3C499	Lower ball joint nut (front)
4	3C156	Damper
5	W712840	Front lower arm-to-subframe bolt
6	3C347	Damper fork-to-lower arm flag nut

REMOVAL AND INSTALLATION

NOTE: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Using a suitable jack, support the front wheel knuckle at the rear lower ball joint.
3. Remove the front lower arm-to-subframe bolt.
   - Discard the bolt.

- To install, tighten the new bolt to 110 Nm (81 lb-ft), then tighten an additional 90 degrees with the suspension at the bushing fastener tightening position.

4. Remove the damper fork-to-lower arm bolt flag nut and damper.
   - Discard the bolt and flag nut.
   - To install, tighten the new bolt and flag nut to 103 Nm (76 lb-ft) with the suspension at the bushing fastener tightening position.
5. Remove and discard the front lower ball joint nut.
   - To install, tighten the new nut to 200 Nm (148 lb-ft).

NOTE: When the lower ball joint is separated from the wheel knuckle, the lower arm may strike the outer constant velocity (CV) joint boot with enough force to damage the boot clamp. This will result in a loss of grease from the outer CV joint. Place a block of wood, or similar item, between the lower arm and the outer CV joint to prevent the lower arm from striking the outer CV joint.

NOTE: Once pressure is applied to the ball joint with the Ball Joint Separator and Adapter, it may be necessary to tap the wheel knuckle at the ball joint area to separate the ball joint from the wheel knuckle.

6. Using the Ball Joint Separator and Adapter, separate the front lower ball joint from the wheel knuckle and remove the front lower arm.

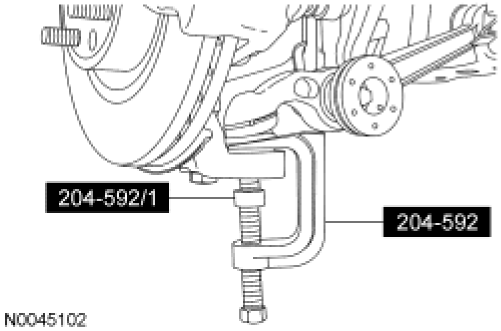


Fig. 11: Identifying Special Tool 204-592/1 And 204-592
Courtesy of FORD MOTOR CO.

NOTE: Before tightening any suspension bushing fasteners, the suspension must be at the bushing fastener tightening position. Use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to 402 mm (15.83 in). This will prevent incorrect clamp load and bushing damage.

7. To install, reverse the removal procedure.

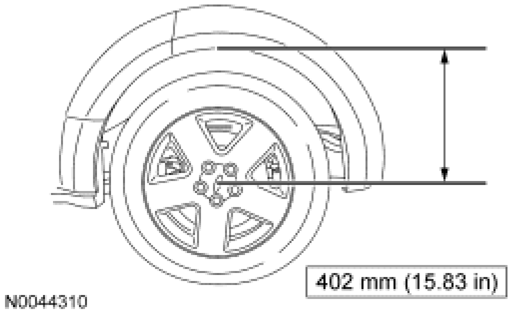
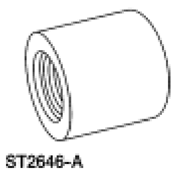
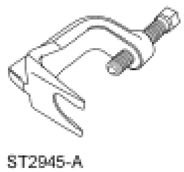


Fig. 12: Identifying Distance Between Center Of Hub And Lip Of Fender
Courtesy of FORD MOTOR CO.

LOWER ARM - REAR

Special Tools

Illustration	Tool Name	Tool Number
	Adapter for 204-592	204-592/1
	Separator, Ball Joint	204-592

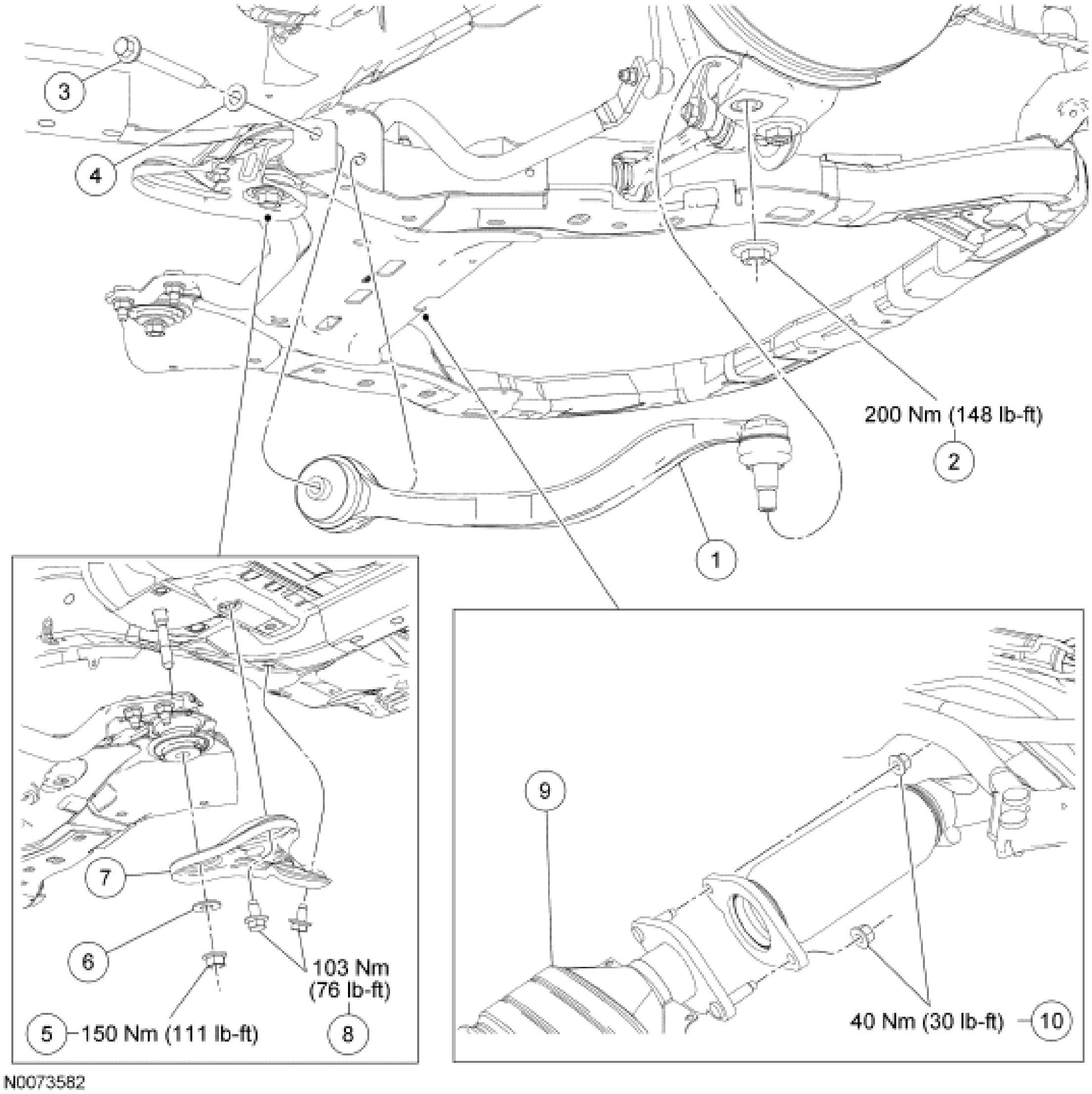


Fig. 13: Exploded View Of Rear Lower Arm With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3079 LH/ 3078 RH	Lower arm (rear)
2	3C499	Lower ball joint nut (rear)
3	W500752	Rear lower arm-to-subframe bolt
4	999581222	Washer
5	W520416	Subframe bracket-to-subframe nut (2 required)
6	5A552	Subframe bracket-to-subframe washer (2 required)
7	3B155 LH/ 3B154 RH	Subframe bracket (2 required)
8	3C496	Subframe bracket-to-body bolts (4

		required)
9	5E212	Catalytic converter
10	W705443	Catalytic converter manifold-to-exhaust flexible pipe nuts (2 required)

REMOVAL AND INSTALLATION

NOTE: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Place the steering wheel in the straight-ahead position and the ignition key in the OFF position.
2. Remove the 2 lower steering column shaft joint cover bolts and cover.

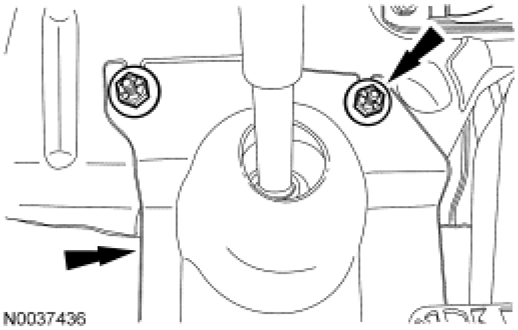


Fig. 14: Locating Steering Joint Cover And Nuts
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the steering column shaft to rotate while it is disconnected from the gear or damage to the clockspring can occur. If there is evidence that the steering column shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.

NOTE: Index-mark the steering column shaft position to the steering gear for reference during installation.

3. Remove the bolt and disconnect the steering column shaft from the steering gear.
   - Discard the bolt.
   - To install, align the index marks and tighten the new bolt to 25 Nm (18 lb-ft).

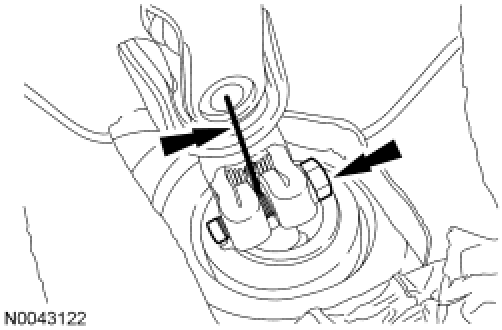


Fig. 15: Locating Steering Column Shaft Index Mark And Bolt
Courtesy of FORD MOTOR CO.

NOTE:	**Remove the steering column shaft-to-dash seal or damage to the seal can occur.**

NOTE:	**Make sure that the dash seal is correctly installed on the steering gear and the retaining clips are fully engaged into the body or damage to the steering gear can result.**

4. Remove the steering column shaft-to-dash seal.

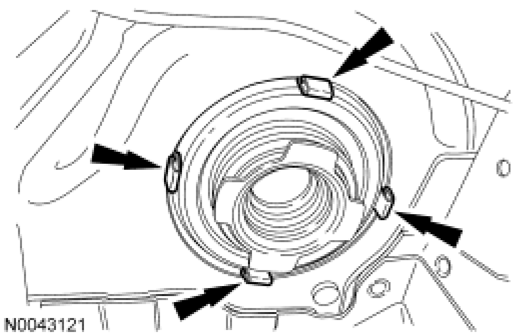


Fig. 16: Locating Steering Column Shaft-To-Dash Seal
Courtesy of FORD MOTOR CO.

5. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
6. Remove the 8 screws and position the LH and RH splash shields aside.

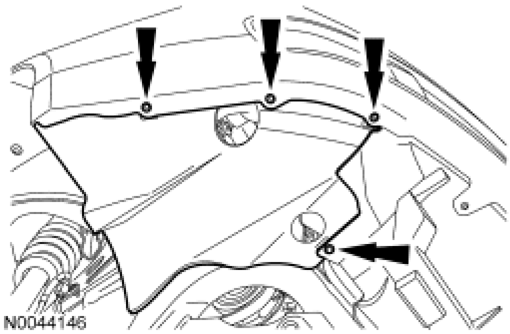


Fig. 17: Locating Screws And Position LH And RH Splash Shields Aside
Courtesy of FORD MOTOR CO.

7. Remove the 6 pin-type retainers (4 shown) and the RH splash shield.

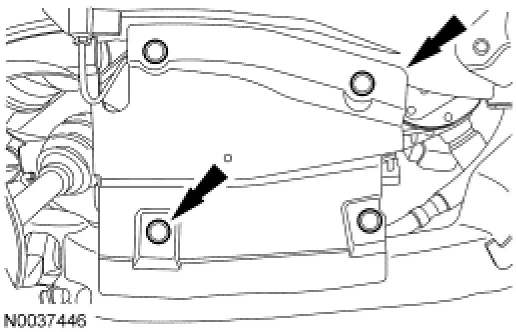


Fig. 18: Locating Splash Shield Pin-Type Retainers
Courtesy of FORD MOTOR CO.

8. Remove the 6 pin-type retainers (4 shown) and the LH splash shield.

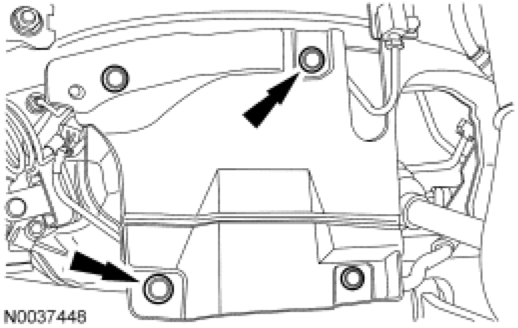


Fig. 19: Locating LH Splash Shield And Pin-Type Retainers
Courtesy of FORD MOTOR CO.

9. If equipped, remove the bolts and the underbody cover shield.
   - To install, tighten 7 Nm (62 lb-in).
10. Remove and discard the 2 catalytic converter manifold-to-exhaust flexible pipe nuts and separate the exhaust flexible pipe.

- To install, tighten the new nuts to 40 Nm (30 lb-ft).

11. Using 2 suitable jack stands, support the rear of the subframe assembly.
12. Remove and discard the 4 subframe bracket-to-body bolts, the 2 subframe bracket-to-subframe nuts and washers. Lower the rear of the subframe.
    - To install, tighten the new bolts to 103 Nm (76 lb-ft).
    - To install, tighten the new nuts to 150 Nm (111 lb-ft).
13. Remove and discard the rear lower ball joint nut.
    - To install, tighten the new nut to 200 Nm (148 lb-ft).

NOTE: When the lower ball joint is separated from the wheel knuckle, the lower arm may strike the outer constant velocity (CV) joint boot with enough force to damage the boot clamp. This will result in a loss of grease from the outer CV joint. Place a block of wood, or similar item, between the lower arm and the outer CV joint to prevent the lower arm from striking the outer CV joint.

NOTE: Once pressure is applied to the ball joint with the Ball Joint Separator and Adapter, it may be necessary to tap the wheel knuckle at the ball joint area to separate the ball joint from the wheel knuckle.

14. Using the Ball Joint Separator and Adapter, separate the rear lower ball joint from the wheel knuckle.

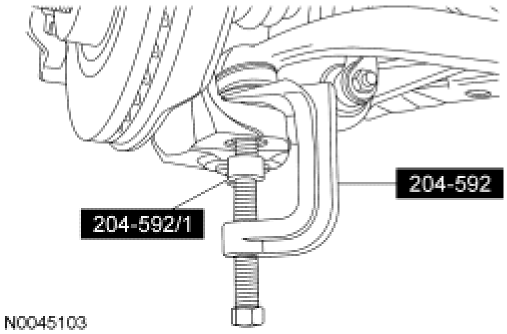


Fig. 20: Identifying Special Tools (204-592/1, 204-592)
Courtesy of FORD MOTOR CO.

15. Remove the rear lower arm-to-subframe bolt and washer and remove the rear lower arm.
    - Discard the bolt and washer.
    - To install, tighten the new bolt to 65 Nm (48 lb-ft), then tighten an additional 90 degrees.

NOTE: Before tightening any suspension bushing fasteners, the suspension must be at the bushing fastener tightening position. Use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to 402 mm (15.83 in). This will prevent incorrect clamp load and bushing damage.

16. To install, reverse the removal procedure.

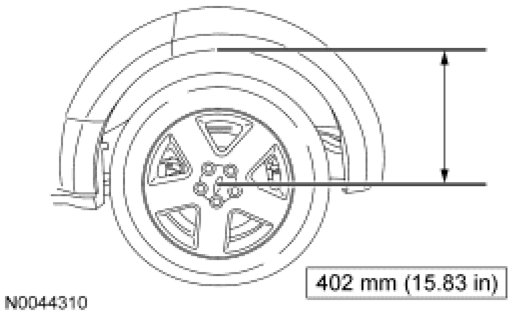
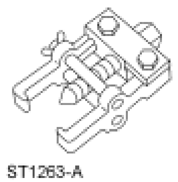


Fig. 21: Identifying Distance Between Center Of Hub And Lip Of Fender
Courtesy of FORD MOTOR CO.

UPPER ARM

Special Tools

Illustration	Tool Name	Tool Number
	Remover, Steering Arm	211-003 (T64P-3590-F)

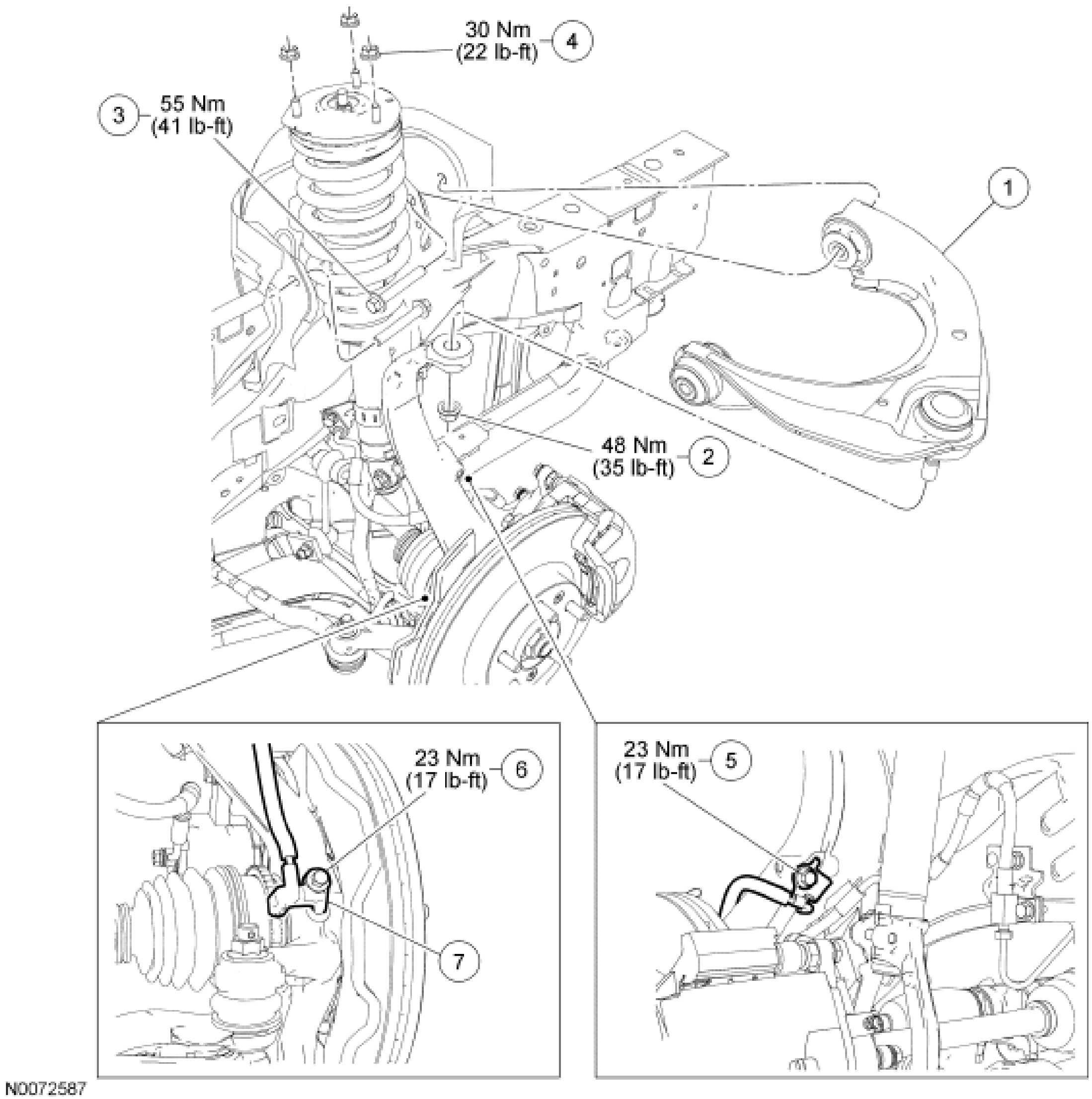


Fig. 22: Exploded View Of Upper Arm With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3091 LH/ 3084 RH	Upper arm
2	3C498	Upper ball joint nut
3	W500525	Upper arm-to-body bolt (2 required)
4	5B800	Shock absorber upper mount nut (3 required)
5	W500020	Wheel speed sensor harness bolt
6	W500222	Wheel speed sensor bolt
7	2C204 RH/ 2C205 LH	Wheel speed sensor

REMOVAL

NOTE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

1. Remove and discard the 3 shock absorber upper mount nuts.
2. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
3. If equipped, remove the wheel speed sensor bolt.

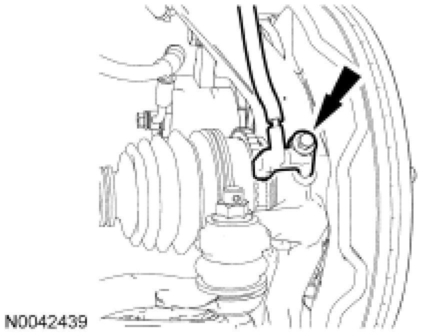


Fig. 23: Identifying Wheel Speed Sensor Bolt
Courtesy of FORD MOTOR CO.

4. If equipped, remove the wheel speed sensor harness bolt and position the wheel speed sensor aside.
5. Remove and discard the upper ball joint nut.
6. Using the Steering Arm Remover, separate the upper ball joint from the wheel knuckle.

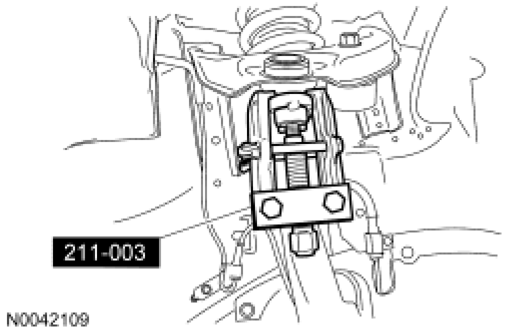


Fig. 24: Identifying Special Tool 211-003
Courtesy of FORD MOTOR CO.

7. Position the shock absorber and spring assembly toward the wheel knuckle to access the upper arm-to-body bolts.
8. Remove the 2 upper arm-to-body bolts and the upper arm.
    - Discard the bolts.

INSTALLATION

NOTE: Do not tighten the upper arm-to-body bolts at this time.

1. Position the upper arm and install the 2 new upper arm-to-body bolts.
2. Set the upper arm bushing fastener tightening position by aligning the hole in the upper arm with the hole in the body bracket and inserting a 6.35 mm (0.25 in) drill bit through both holes.

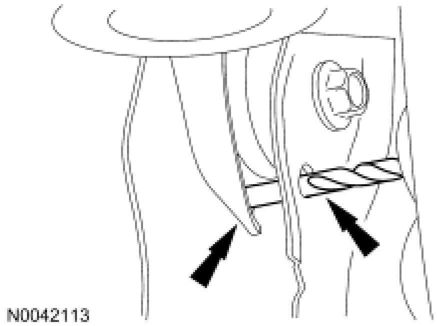


Fig. 25: Locating Upper Arm With Hole In Body Bracket
Courtesy of FORD MOTOR CO.

3. Tighten the upper arm-to-body bolts to 55 Nm (41 lb-ft) and remove the drill bit.
4. Position the shock and spring assembly and install the 3 new shock upper mount nuts.
   - Tighten to 30 Nm (22 lb-ft).
5. Position the upper ball joint and install a new nut.
   - Tighten to 48 Nm (35 lb-ft).
6. If equipped, position the wheel speed sensor harness and install the bolt.
   - Tighten to 23 Nm (17 lb-ft).
7. If equipped, position the wheel speed sensor and install the bolt.
   - Tighten to 23 Nm (17 lb-ft).
8. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
9. Check and, if necessary, align the front end. For additional information, refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

STABILIZER BAR LINK

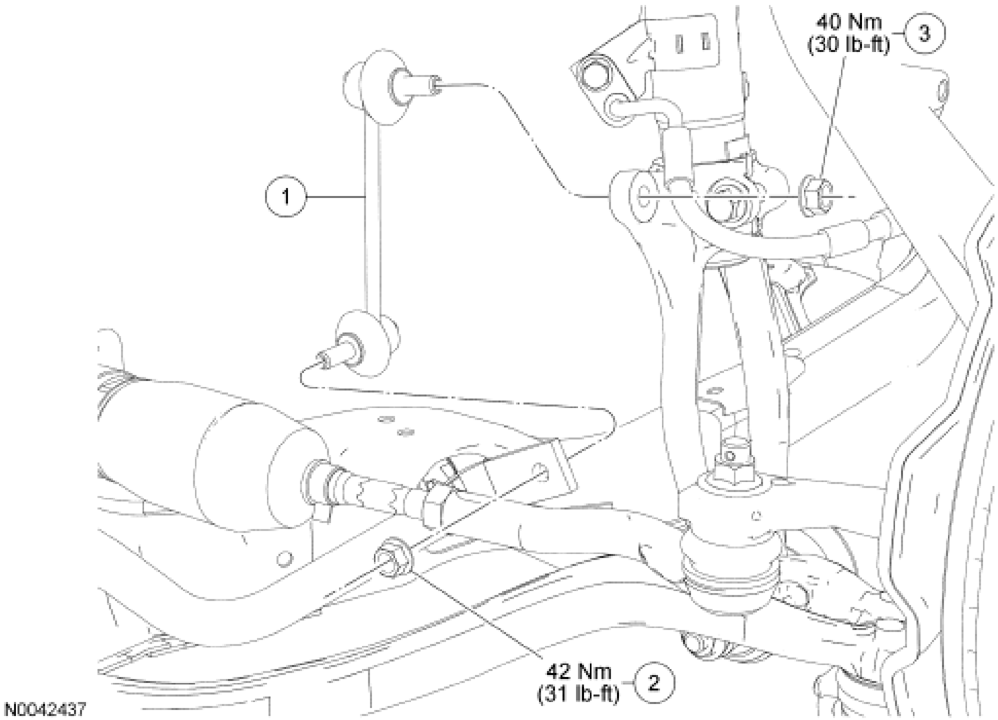


Fig. 26: Exploded View Of Stabilizer Bar Link With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3053 LH/ 3052 RH	Stabilizer bar link
2	3C494	Stabilizer bar link lower nut
3	3C494	Stabilizer bar link upper nut

REMOVAL AND INSTALLATION

NOTE: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

   NOTE: Use the hex-holding feature to prevent the ball stud from turning while removing or installing the stabilizer bar link nut.

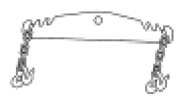
2. Remove and discard the stabilizer bar link upper nut.
   - To install, tighten the new nut to 40 Nm (30 lb-ft).

NOTE: Use the hex-holding feature to prevent the ball stud from turning while removing or installing the stabilizer bar link nut.

3. Remove and discard the stabilizer bar link lower nut and remove the stabilizer bar link.
   - To install, tighten the new nut to 42 Nm (31 lb-ft).
4. To install, reverse the removal procedure.

STABILIZER BAR BUSHING

Special Tools

Illustration	Tool Name	Tool Number
	Remover, Tie-Rod End	211-105 (T85M-3395-A)

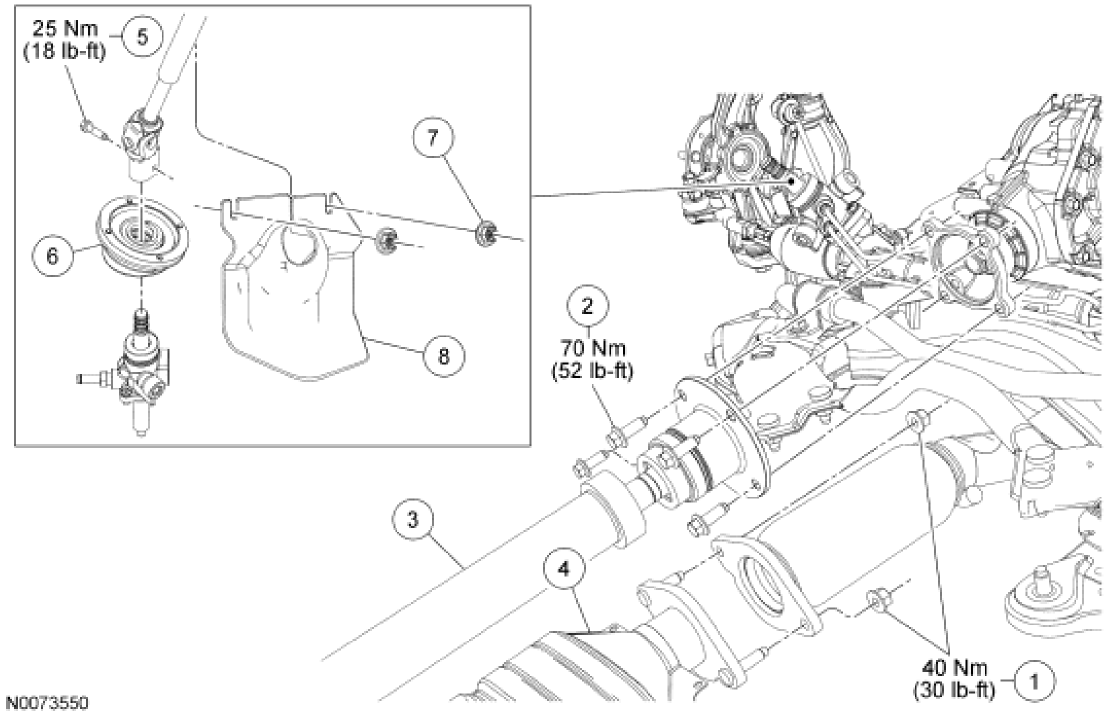


Fig. 27: Exploded View Of Stabilizer Bar Bushing With Torque Specifications (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W705443	Catalytic converter-to-exhaust flexible pipe nuts (2 required)
2	W711918	Rear driveshaft-to-Power Transfer Unit (PTU) bolt (4

		required)
3	5006930	Rear driveshaft assembly
4	5E212	Catalytic converter
5	3R827	Steering column shaft bolt
6	3C611B	Steering column shaft-to-dash seal
7	5801691	Lower steering column shaft joint cover nut (2 required)
8	3C611A	Lower steering column shaft joint cover

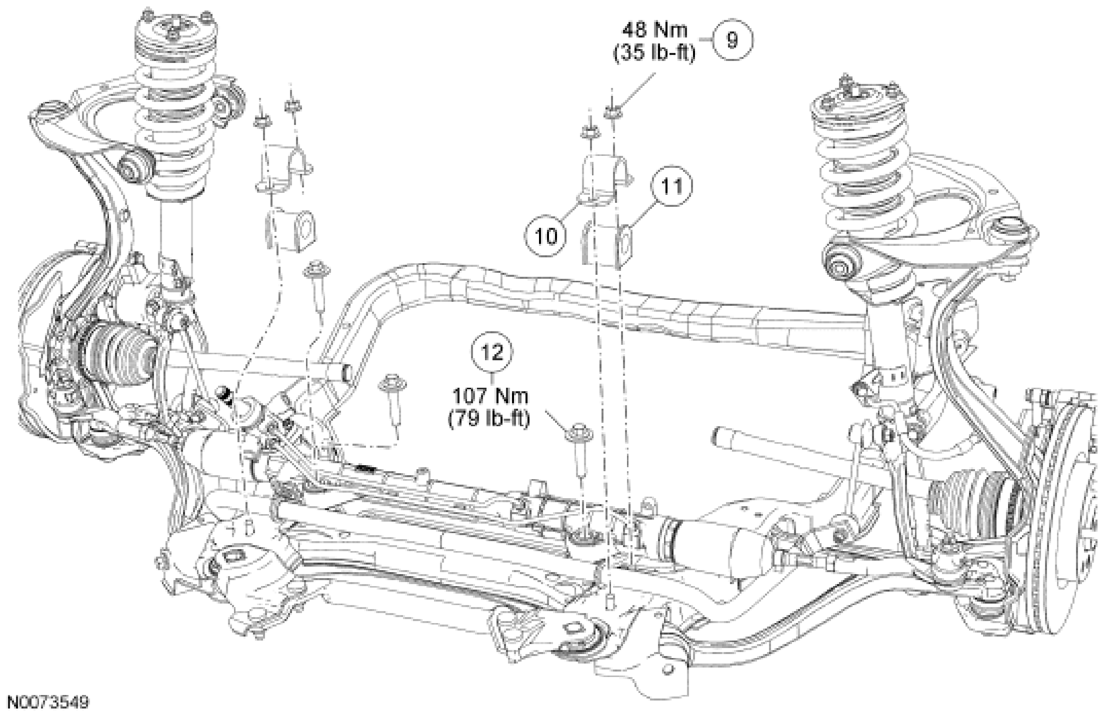


Fig. 28: Exploded View Of Stabilizer Bar Bushing With Torque Specifications (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
9	W520414	Stabilizer bar bracket nut (4 required)
10	5486	Stabilizer bar bushing bracket (2 required)
11	5484	Stabilizer bar bushing (2 required)
12	3C497	Steering gear-to-subframe bolt (3 required)

REMOVAL AND INSTALLATION

NOTE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if**

replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

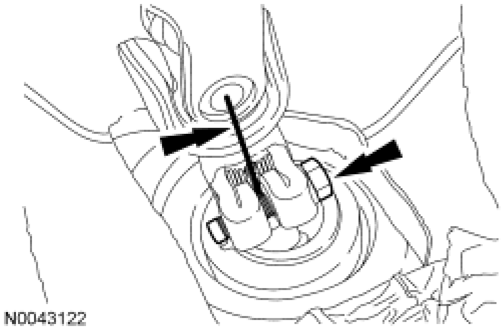
All vehicles

1. Place the steering wheel in the straight-ahead position and the ignition key in the OFF position.
2. Remove the 2 lower steering column shaft joint cover bolts and cover.

NOTE:	**Do not allow the steering column shaft to rotate while it is disconnected from the gear or damage to the clockspring can occur. If there is evidence that the steering column shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to <u>SUPPLEMENTAL RESTRAINT SYSTEM</u> article.**

NOTE:	**Index the steering column shaft position to the steering gear for reference during installation.**

3. Remove the bolt and disconnect the steering column shaft from the steering gear.
   - To install, align the index marks, tighten to 25 Nm (18 lb-ft).



<u>Fig. 29: Locating Steering Column Shaft Index Mark And Bolt</u>
Courtesy of FORD MOTOR CO.

NOTE:	**Remove the steering column shaft-to-dash seal or damage to the seal can occur.**

NOTE:	**Make sure that the dash seal is correctly installed on the steering gear and the retaining clips are fully engaged into the body or damage to the steering gear can result.**

4. Remove the steering column shaft-to-dash seal.

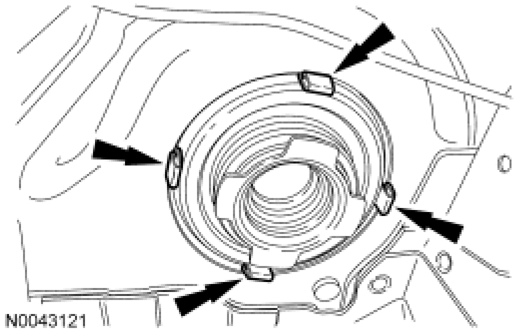


Fig. 30: Locating Steering Column Shaft-To-Dash Seal
Courtesy of FORD MOTOR CO.

5. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
6. Remove the 8 screws and position the LH and RH splash shields aside.

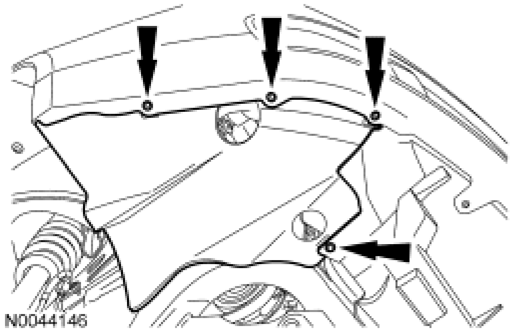


Fig. 31: Locating Screws And Position LH And RH Splash Shields Aside
Courtesy of FORD MOTOR CO.

7. Remove the 6 pin-type retainers (4 shown) and the RH splash shield.

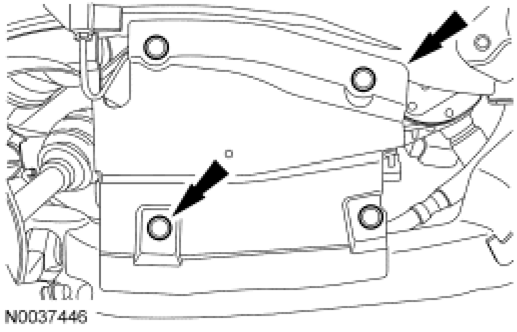


Fig. 32: Locating Splash Shield Pin-Type Retainers
Courtesy of FORD MOTOR CO.

8. Remove the 6 pin-type retainers (4 shown) and the LH splash shield.

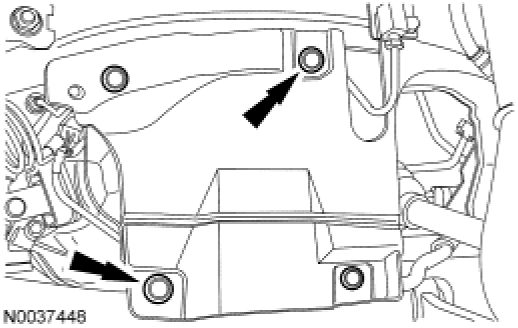


Fig. 33: Locating LH Splash Shield And Pin-Type Retainers
Courtesy of FORD MOTOR CO.

9. If equipped, remove the bolts and the underbody cover shield.
   - To install, tighten 7 Nm (62 lb-in).
10. Remove and discard the 2 tie-rod end cotter pins and nuts.
    - To install, tighten the new nuts to 48 Nm (35 lb-ft).
    - Install a new cotter pin.

NOTE: **Do not use a hammer to separate the tie-rod end from the wheel knuckle or damage to the wheel knuckle can result.**

NOTE: **RH shown, LH similar.**

11. Using the Tie-Rod End Remover, separate the 2 tie-rod ends from both wheel knuckles.

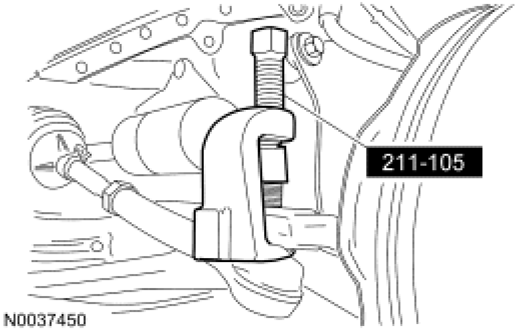


Fig. 34: Separating Tie-Rod Ends From Wheel Knuckles Using Special Tool (211-105)
Courtesy of FORD MOTOR CO.

12. Remove and discard the 2 catalytic converter-to-exhaust flexible pipe nuts and separate the exhaust flexible pipe.
    - To install, tighten the new nuts to 40 Nm (30 lb-ft).

All-Wheel Drive (AWD) vehicles

13. Index the rear driveshaft-to-Power Transfer Unit (PTU).

- Remove the 4 bolts and position the driveshaft aside.
- To install, tighten to 70 Nm (52 lb-ft).

All vehicles

14. Remove RH steering gear-to-subframe bolt.
    - To install, tighten to 107 Nm (79 lb-ft).
15. Remove the 2 LH steering gear-to-subframe bolts and position the steering gear to access the stabilizer bar LH bracket front nut.
    - To install, tighten to 107 Nm (79 lb-ft).
16. Remove and discard the 4 stabilizer bar bracket nuts and remove the 2 stabilizer bar brackets.
    - To install, tighten the new bracket nuts to 48 Nm (35 lb-ft).
17. Remove the 2 stabilizer bar bushings.

NOTE: **Before tightening the stabilizer bar bracket nuts, the suspension must be at the bushing fastener tightening position. Use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to 402 mm (15.83 in). This will prevent incorrect clamp load and bushing damage.**

18. To install, reverse the removal procedure.

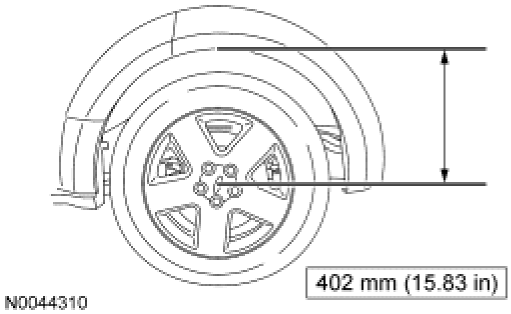
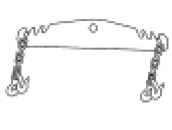


Fig. 35: Identifying Distance Between Center Of Hub And Lip Of Fender
Courtesy of FORD MOTOR CO.

STABILIZER BAR

Special Tools

Illustration	Tool Name	Tool Number
 ST1602-A	Remover, Tie-Rod End	211-105 (T85M-3395-A)

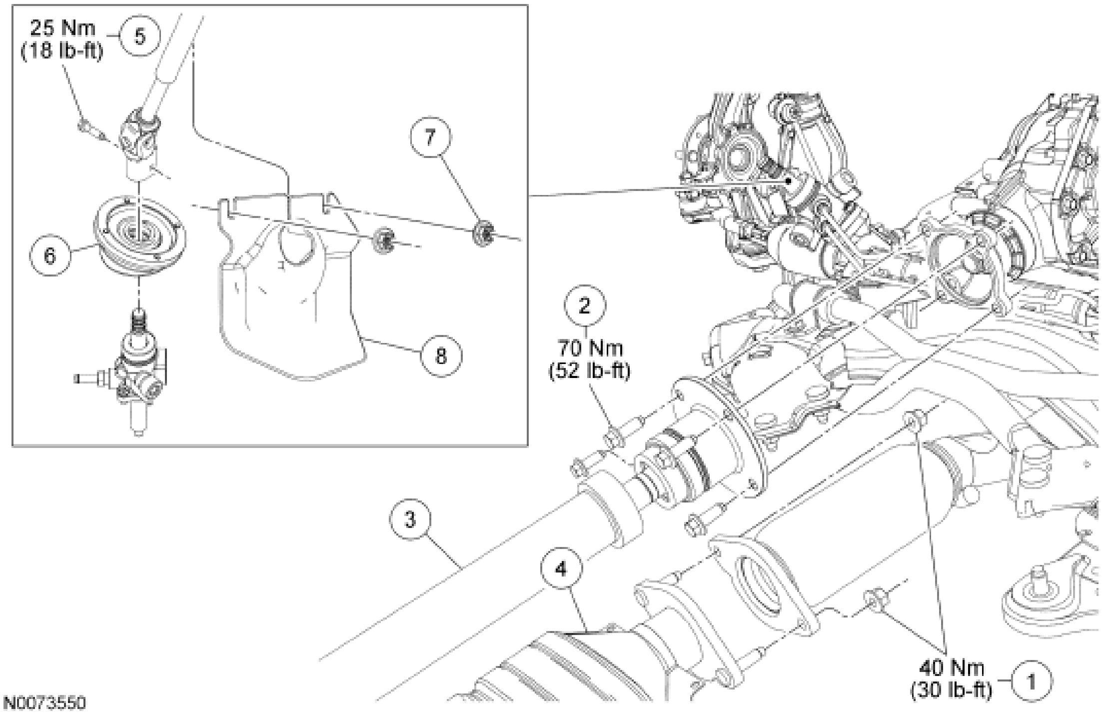


Fig. 36: Exploded View Of Stabilizer Bar With Torque Specifications (1 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W705443	Catalytic converter-to-exhaust flexible pipe nuts (2 required)
2	W711918	Rear driveshaft-to-Power Transfer Unit (PTU) bolt (4 required)
3	5006930	Rear driveshaft assembly
4	5E212	Catalytic converter
5	3R827	Steering column shaft bolt
6	3C611B	Steering column shaft-to-dash seal
7	5801691	Lower steering column shaft joint cover nut (2 required)
8	3C611A	Lower steering column shaft joint cover

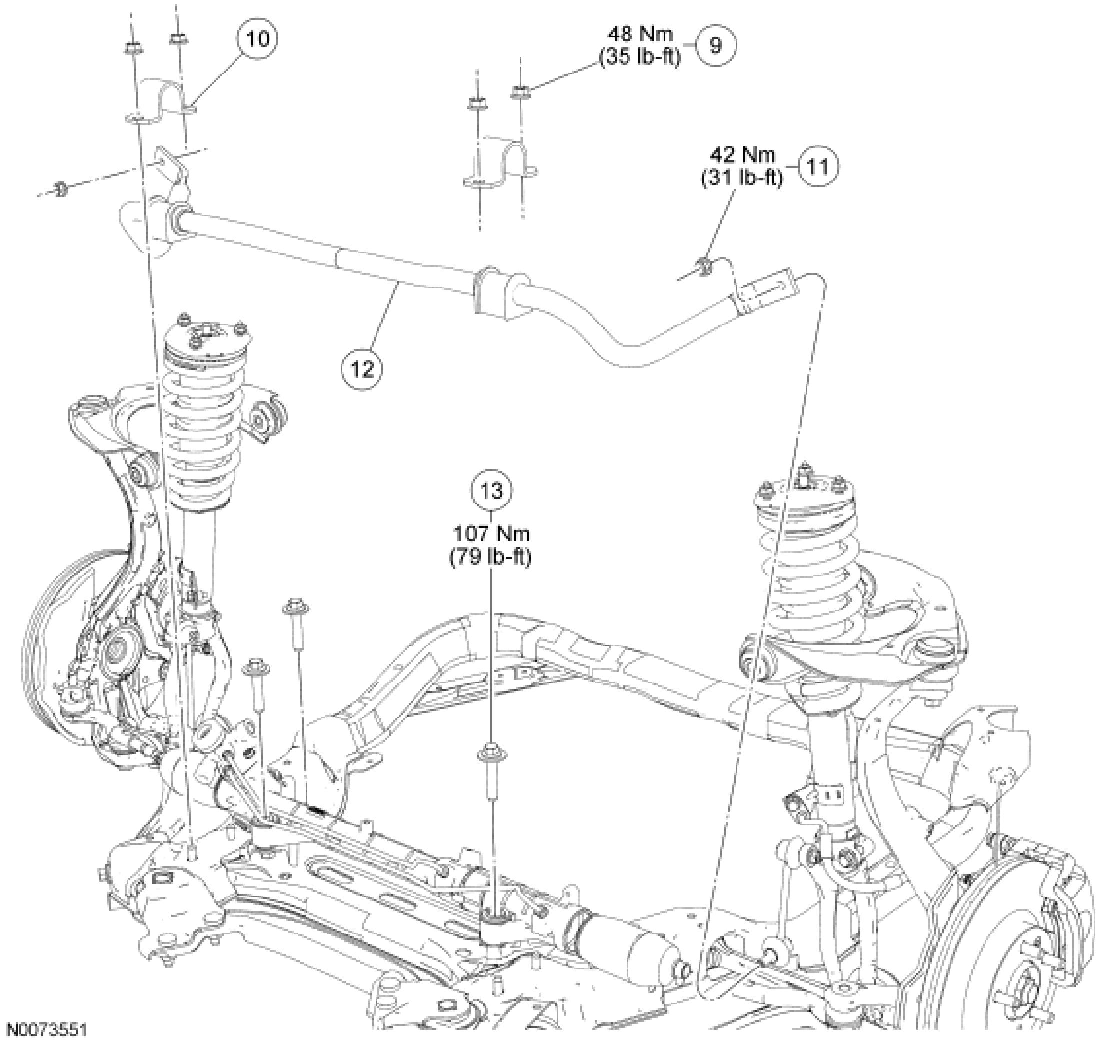


Fig. 37: Exploded View Of Stabilizer Bar With Torque Specifications (2 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
9	W520414	Stabilizer bar bracket nut (4 required)
10	5486	Stabilizer bar bracket (2 required)
11	3C494	Stabilizer bar link lower nut (2 required)
12	5494	Stabilizer bar
13	3C497	Steering gear-to-subframe bolt (3 required)

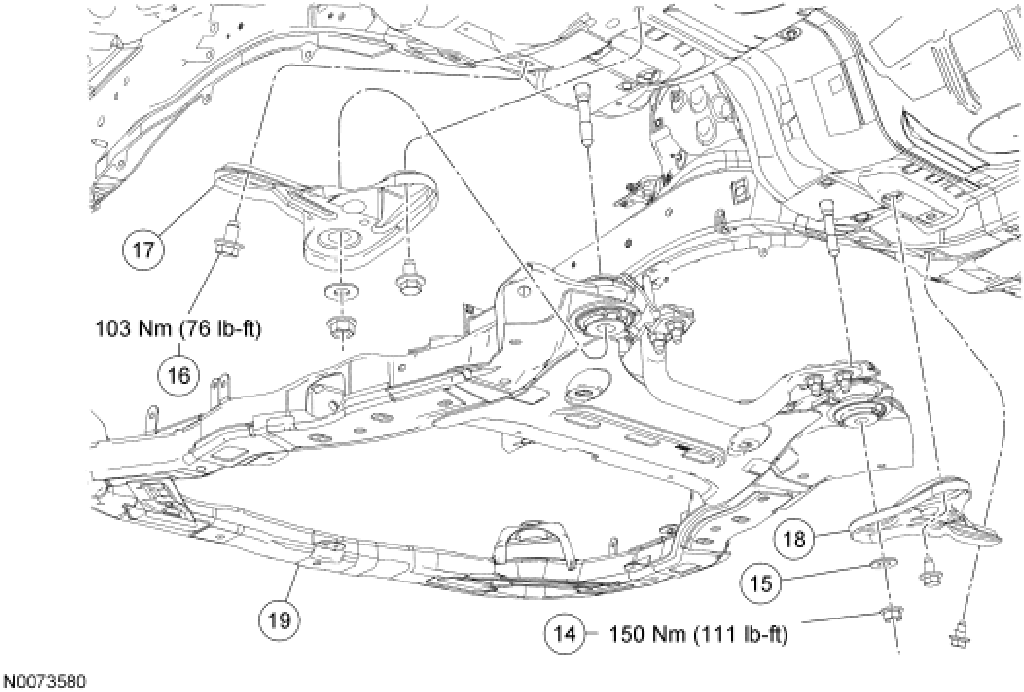


Fig. 38: Exploded View Of Stabilizer Bar With Torque Specifications (3 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
14	W520416	Subframe bracket-to-subframe nut (4 required)
15	5A552	Front subframe washer (4 required)
16	3C496	Subframe-to-body bolt (4 required)
17	3B154	RH front subframe support bracket
18	3B155	LH front subframe support bracket
19	5C145	Front subframe

REMOVAL AND INSTALLATION

NOTE: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

All vehicles

1. Place the steering wheel in the straight-ahead position and the ignition key in the OFF position.
2. Remove the 2 lower steering column shaft joint cover nuts and cover.

NOTE:	**Do not allow the steering column shaft to rotate while it is disconnected from the gear or damage to the clockspring can occur. If there is evidence that the steering column shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.**

NOTE:	**Index the steering column shaft position to the steering gear for reference during installation.**

3. Remove the bolt and disconnect the steering column shaft from the steering gear.
    - To install, align the index marks, tighten to 25 Nm (18 lb-ft).

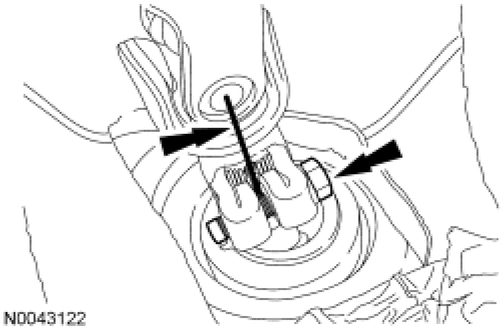


Fig. 39: Locating Steering Column Shaft Index Mark And Bolt
Courtesy of FORD MOTOR CO.

NOTE:	**Remove the steering column shaft-to-dash seal or damage to the seal can occur.**

NOTE:	**Make sure that the dash seal is correctly installed on the steering gear and the retaining clips are fully engaged into the body or damage to the steering gear can result.**

4. Remove the steering column shaft-to-dash seal.

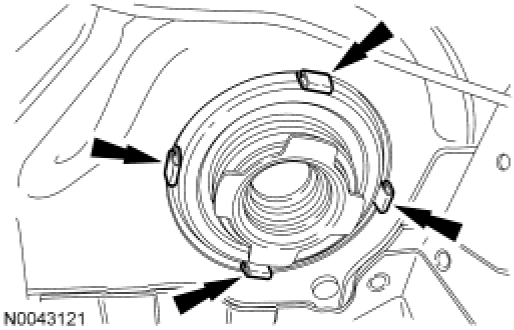


Fig. 40: Locating Steering Column Shaft-To-Dash Seal
Courtesy of FORD MOTOR CO.

5. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
6. Remove the 8 screws and position the LH and RH splash shields aside.

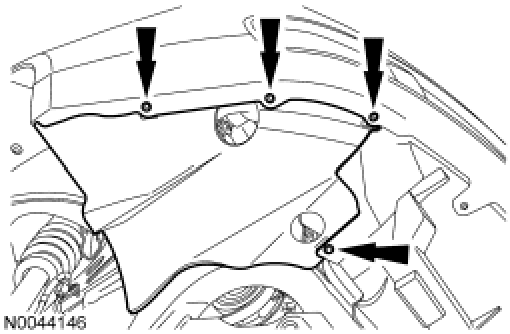


Fig. 41: Locating Screws And Position LH And RH Splash Shields Aside
Courtesy of FORD MOTOR CO.

7. Remove the 6 pin-type retainers (4 shown) and the RH splash shield.

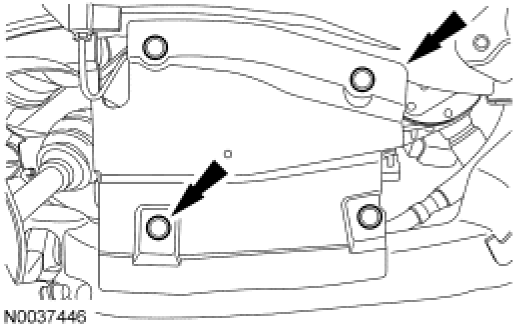


Fig. 42: Locating Splash Shield Pin-Type Retainers
Courtesy of FORD MOTOR CO.

8. Remove the 6 pin-type retainers (4 shown) and the LH splash shield.

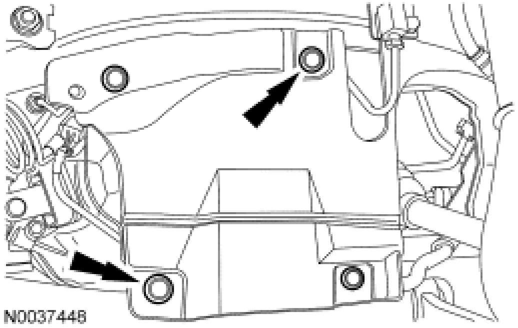


Fig. 43: Locating LH Splash Shield And Pin-Type Retainers
Courtesy of FORD MOTOR CO.

9. If equipped, remove the bolts and the underbody cover shield.

- To install, tighten 7 Nm (62 lb-in).

10. Remove and discard the 2 tie-rod end cotter pins and nuts.
    - To install, tighten the new nuts to 48 Nm (35 lb-ft) and install new cotter pins.

NOTE: Do not use a hammer to separate the tie-rod end from the wheel knuckle or damage to the wheel knuckle can result.

NOTE: RH shown, LH similar.

11. Using the Tie-Rod End Remover, separate the tie-rod ends from both wheel knuckles.

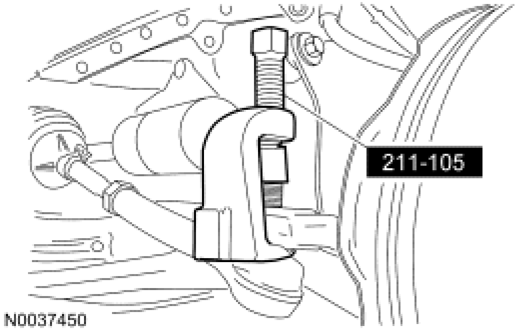


Fig. 44: Separating Tie-Rod Ends From Wheel Knuckles Using Special Tool (211-105)
Courtesy of FORD MOTOR CO.

NOTE: Use the hex-holding feature to prevent the ball stud from turning while removing or installing the stabilizer bar link nuts.

12. Remove and discard the 2 stabilizer bar link lower nuts and disconnect both stabilizer bar links from the stabilizer bar.
    - To install, tighten the new nuts to 42 Nm (31 lb-ft).
13. Remove and discard the 2 catalytic converter-to-exhaust flexible pipe nuts and separate the exhaust flexible pipe.
    - To install, tighten the new nuts to 40 Nm (30 lb-ft).

All-Wheel Drive (AWD) vehicles

14. Index the rear driveshaft-to-Power Transfer Unit (PTU).
    - Remove the 4 bolts and position the driveshaft aside.
    - To install, tighten the new bolts to 70 Nm (52 lb-ft).

All vehicles

15. Using 2 suitable jackstands, support the rear of the subframe assembly.
16. Remove and discard the 4 subframe bracket-to-body bolts, the 2 subframe bracket-to-subframe nuts and

lower the rear of the subframe.

- To install, tighten the new bolts to 103 Nm (76 lb-ft).
- To install, tighten the new nuts to 150 Nm (111 lb-ft).

17. Remove the RH steering gear-to-subframe bolt.
    - To install, tighten to 107 Nm (79 lb-ft).
18. Remove the 2 LH steering gear-to-subframe bolts and position the steering gear to access the stabilizer bar LH bracket front nut.
    - To install, tighten to 107 Nm (79 lb-ft).
19. Remove and discard the 4 stabilizer bar bracket nuts and remove the 2 stabilizer bar brackets.
    - To install, tighten the new bracket nuts to 48 Nm (35 lb-ft).
20. Remove the 2 stabilizer bar bushings.
21. Remove the stabilizer bar through the LH wheel opening.

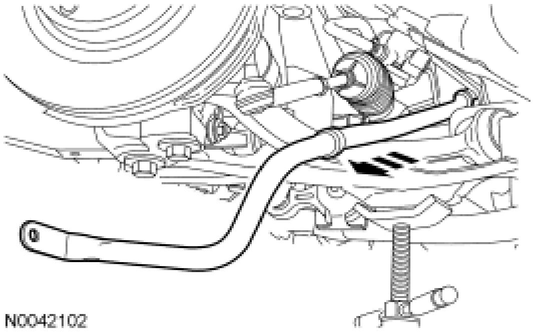


Fig. 45: Removing Stabilizer Bar LH Wheel Opening
Courtesy of FORD MOTOR CO.

NOTE:	**Before tightening the stabilizer bar bracket nuts, the suspension must be at the bushing fastener tightening position. Use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to 402 mm (15.83 in). This will prevent incorrect clamp load and bushing damage.**

22. To install, reverse the removal procedure.

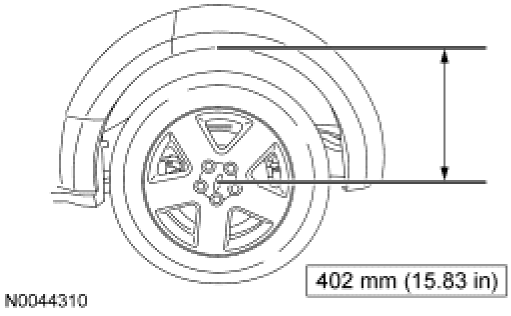
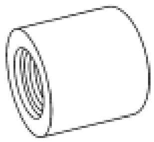
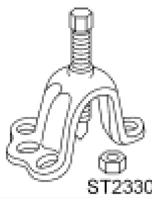
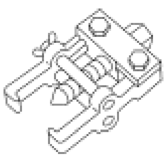
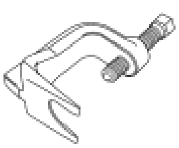


Fig. 46: Identifying Distance Between Center Of Hub And Lip Of Fender

Courtesy of FORD MOTOR CO.

WHEEL KNUCKLE

Special Tools

Illustration	Tool Name	Tool Number
 ST2646-A	Adapter for 204-592	204-592/1
 ST2138-A	Installer, Halfshaft	204-161 (T97P-1175-A)
 ST2330-A	Remover, Front Hub	205-D070 (D93P-1175-B) or equivalent
 ST1263-A	Remover, Steering Arm	211-003 (T64P-3590-F)
 ST1602-A	Remover, Tie-Rod End	211-105 (T85M-3395-A)
 ST2945-A	Separator, Ball Joint	204-592

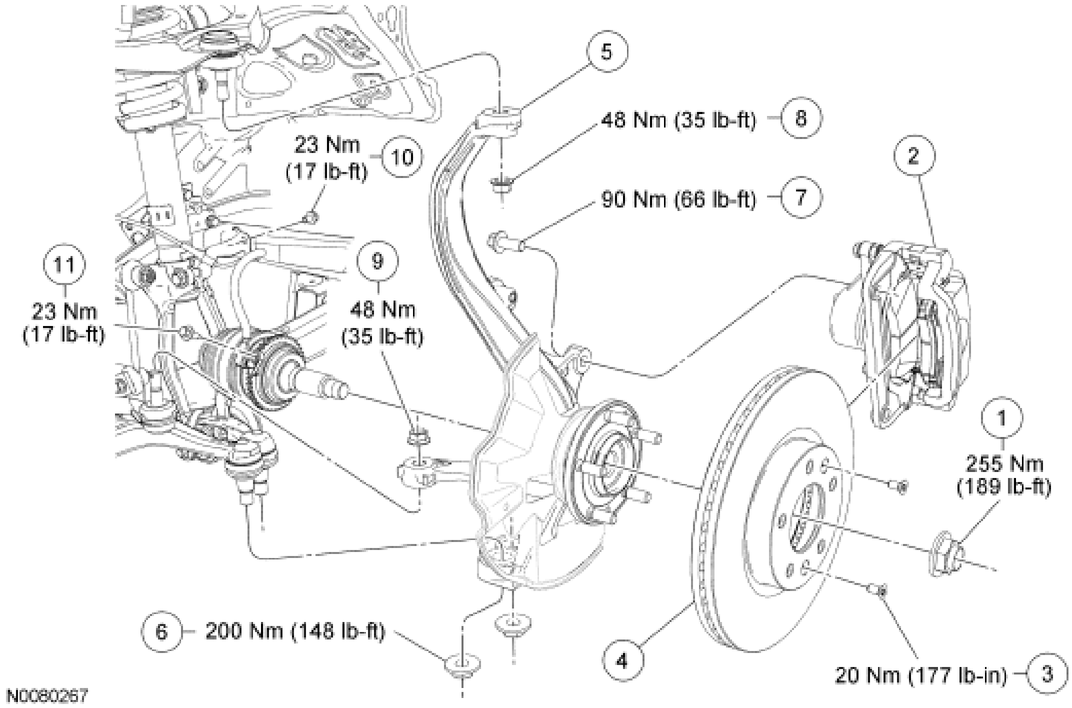


Fig. 47: Exploded View Of Wheel Knuckle With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3N405	Halfshaft nut
2	-	Brake caliper and anchor plate assembly
3	W505741	Brake disc bolt (2 required)
4	1032	Brake disc
5	3K171 LH/ 3K170 RH	Wheel knuckle
6	3C499	Lower ball joint nut (2 required)
7	W711241	Brake caliper anchor plate bolt (2 required)
8	3C498	Upper ball joint nut
9	3D000	Tie-rod end nut
10	W500020	Wheel speed sensor harness bolt
11	W500222	Wheel speed sensor bolt

REMOVAL

NOTE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. If equipped, remove the wheel speed sensor bolt.
3. If equipped, remove the wheel speed sensor harness bolt and position the wheel speed sensor aside.

NOTE: Apply the brake to keep the halfshaft from rotating.

4. Remove and discard the halfshaft nut.

NOTE: Do not allow the caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.

5. Remove the bolts and position the caliper and anchor plate assembly aside.
   - Support the caliper and anchor plate assembly using mechanic's wire.
6. Remove the 2 brake disc bolts and the brake disc.
7. Using the Front Hub Remover, separate the halfshaft from the wheel hub.

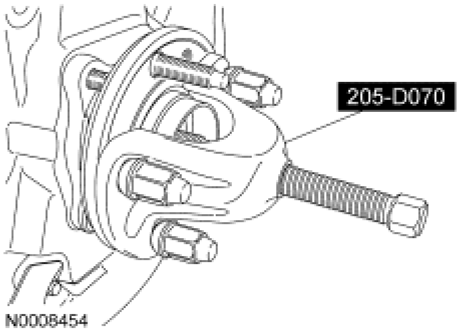


Fig. 48: Pressing Halfshaft From Wheel Bearing & Hub
Courtesy of FORD MOTOR CO.

8. Remove and discard the upper ball joint nut.
9. Using the Steering Arm Remover, separate the upper ball joint from the wheel knuckle.

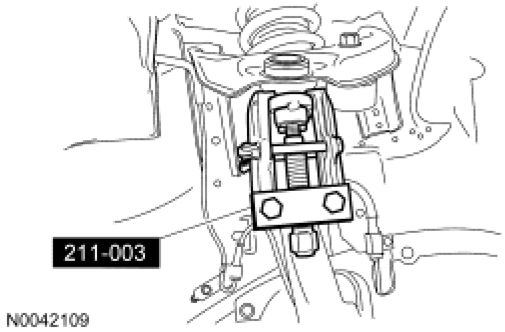


Fig. 49: Identifying Special Tool 211-003
Courtesy of FORD MOTOR CO.

10. Remove and discard the tie-rod end cotter pin and nut.

NOTE: Do not use a hammer to separate the tie-rod end from the wheel knuckle or damage to the wheel knuckle can result.

11. Using the Tie-Rod End Remover, separate the tie-rod end from the wheel knuckle.

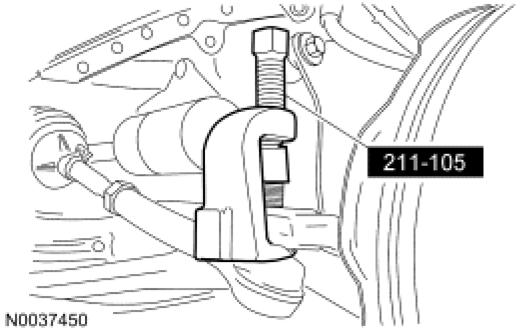


Fig. 50: Separating Tie-Rod Ends From Wheel Knuckles Using Special Tool (211-105)
Courtesy of FORD MOTOR CO.

12. Remove and discard the 2 lower ball joint nuts.

NOTE: When the lower ball joint is separated from the wheel knuckle, the lower arm may strike the outer constant velocity (CV) joint boot with enough force to damage the boot clamp. This will result in a loss of grease from the outer CV joint. Place a block of wood, or similar item, between the lower arm and the outer CV joint to prevent the lower arm from striking the outer CV joint.

NOTE: Once pressure is applied to the ball joint with the Ball Joint Separator and Adapter, it may be necessary to tap the wheel knuckle at the ball joint area to separate the ball joint from the wheel knuckle.

13. Using the Ball Joint Separator and Adapter, separate the 2 lower ball joints from the wheel knuckle and remove the wheel knuckle.

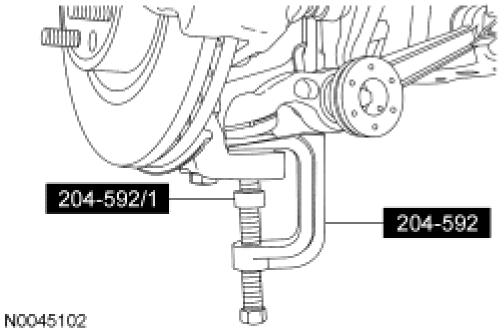


Fig. 51: Identifying Special Tool 204-592/1 And 204-592
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Position the wheel knuckle and install the 2 new lower ball joint nuts.
   - Tighten to 200 Nm (148 lb-ft).
2. Position the tie-rod end and install the new nut and cotter pin.
   - Tighten to 48 Nm (35 lb-ft).
3. Position the upper ball joint and install the new nut.
   - Tighten to 48 Nm (35 lb-ft).
4. If equipped, position the wheel speed sensor and install the bolt.
   - Tighten to 23 Nm (17 lb-ft).
5. If equipped, install the wheel speed sensor harness bolt.
   - Tighten to 23 Nm (17 lb-ft).
6. Position the brake caliper and anchor plate assembly and install the 2 bolts.
   - Tighten to 90 Nm (66 lb-ft).
7. Install the brake disc and the 2 brake disc bolts.
   - Tighten to 20 Nm (177 lb-in).
8. Using the Halfshaft Installer, install the halfshaft into the wheel hub.

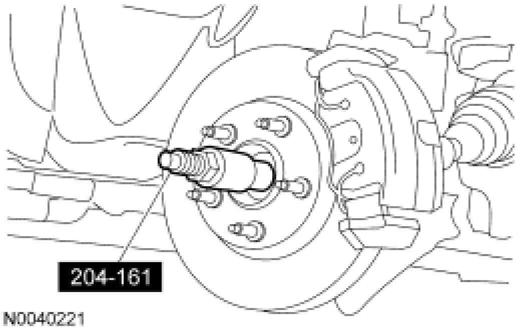


Fig. 52: Identifying Special Tool 204-161
Courtesy of FORD MOTOR CO.

NOTE:	**Do not tighten the halfshaft nut with the vehicle on the ground. The nut must be tightened to specification before the vehicle is lowered onto the wheels. Wheel bearing damage will occur if the wheel bearing is loaded with the weight of the vehicle applied.**

NOTE:	**Apply the brake to keep the halfshaft from rotating.**

9. Install the halfshaft nut.
   - Tighten to 255 Nm (189 lb-ft).

SHOCK ABSORBER AND SPRING ASSEMBLY

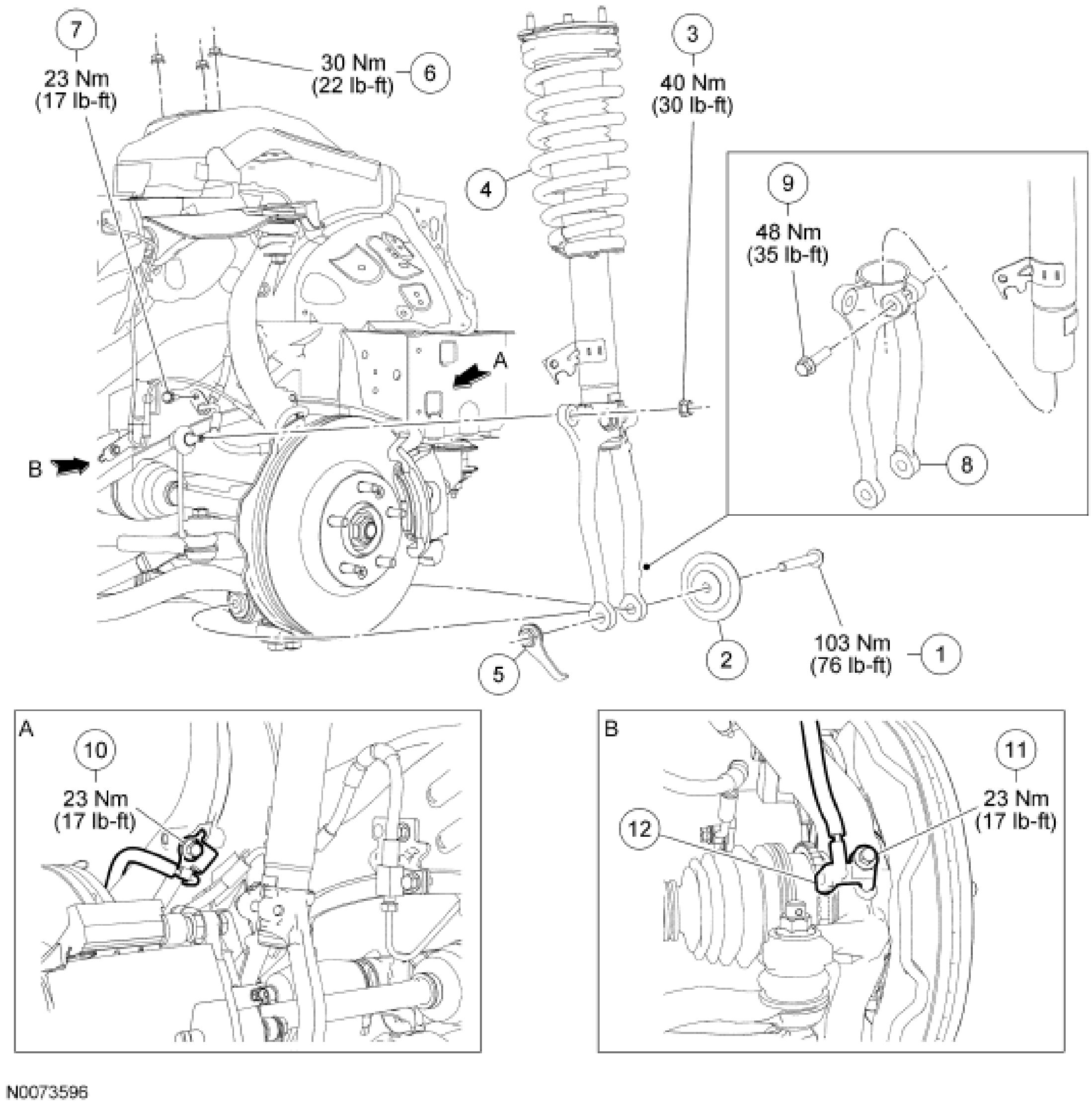


Fig. 53: Exploded View Of Shock Absorber & Spring Assembly With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500550	Damper fork-to-lower arm bolt
2	3C156	Damper
3	3C494	Stabilizer bar link upper nut
4	-	Shock absorber and spring assembly
5	W302117	Damper fork-to-lower arm flag nut
6	W302128	Shock absorber upper mount nut (3 required)
7	-	Brake tube bracket bolt

8	3462	Damper fork
9	W302119	Shock absorber-to-damper fork bolt
10	W500020	Wheel speed sensor harness bolt
11	W500222	Wheel speed sensor bolt
12	2C204 RH/ 2C205 LH	Wheel speed sensor

REMOVAL AND INSTALLATION

NOTE: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove and discard the 3 shock absorber upper mount nuts.
   - To install, tighten the new nuts to 30 Nm (22 lb-ft).
2. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
3. Remove the brake tube bracket bolt and position the brake line aside.
   - To install, tighten to 23 Nm (17 lb-ft).
4. If equipped, remove the wheel speed sensor bolt.
   - To install, tighten to 23 Nm (17 lb-ft).
5. If equipped, remove the wheel speed sensor harness bolt and position the wheel speed sensor aside.
   - To install, tighten to 23 Nm (17 lb-ft).
6. Using a suitable jack, support the wheel knuckle at the lower ball joints.

   NOTE: Use the holding feature to prevent the ball stud from turning while removing or installing the stabilizer bar link nut.

7. Remove and discard the stabilizer bar link upper nut.
   - To install, tighten the new nut to 40 Nm (30 lb-ft).
8. Remove the damper fork-to-front lower arm bolt, flag nut and damper.
   - Discard the bolt and flag nut.
   - To install, tighten the new bolt and flag nut to 103 Nm (76 lb-ft) with the suspension at the bushing fastener tightening position.
9. Remove and discard the shock absorber-to-damper fork bolt and separate the damper fork from the shock absorber and spring assembly.
   - To install, tighten the new bolt to 48 Nm (35 lb-ft).
10. Lower the wheel knuckle and remove the shock absorber and spring assembly.

    NOTE: Before tightening any suspension bushing fasteners, the suspension must

be at the bushing fastener tightening position. Use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to 402 mm (15.83 in). This will prevent incorrect clamp load and bushing damage.

11. To install, reverse the removal procedure.
12. For additional information on the disassembly and assembly of the shock absorber and spring assembly, refer to **Shock Absorber and Spring Assembly**.

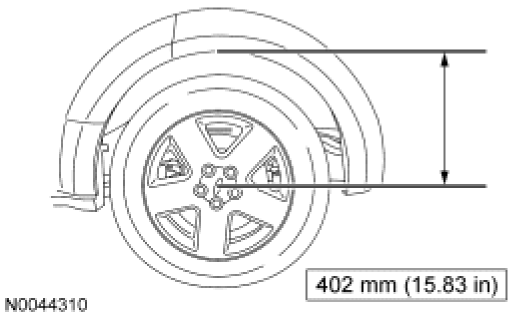


Fig. 54: Identifying Distance Between Center Of Hub And Lip Of Fender
Courtesy of FORD MOTOR CO.

DISASSEMBLY AND ASSEMBLY

SHOCK ABSORBER AND SPRING ASSEMBLY

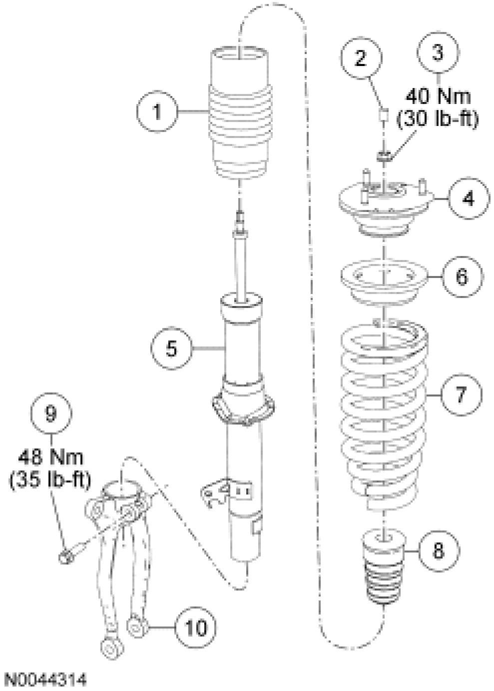


Fig. 55: Exploded View Of Shock Absorber & Spring Assembly With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3C239	Dust boot
2	18A179	Shock absorber rod protective cap
3	18A161	Shock absorber rod nut
4	18183	Shock absorber upper mount
5	18184	Shock absorber and lower mount assembly
6	5793	Spring upper seat
7	5310	Spring
8	18198	Jounce bumper
9	W302119	Shock absorber-to-damper fork bolt
10	3463 LH/ 3462 RH	Damper fork

DISASSEMBLY AND ASSEMBLY

WARNING: **Do not apply heat or flame to the shock absorber or strut tube. The shock absorber and strut tube are gas pressurized and could explode if heated. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Keep all body parts clear of shock absorbers or strut rods. Shock absorbers or struts can extend unassisted. Failure to follow this instruction may result in serious personal injury.**

WARNING: **The coil spring is under extreme load. Care must be taken at all times when removing or installing a loaded spring. Failure to follow this instruction may result in serious personal injury.**

NOTE: **The coil spring is coated with long-term corrosion protective paint. Do not damage the paint during component servicing or damage to the coil spring may occur.**

NOTE: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

1. Remove the shock absorber and spring assembly. For additional information, refer to **Shock Absorber and Spring Assembly**.

WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

2. Position the shock and spring assembly in a suitable spring compressor.
3. Compress the spring enough to relieve the tension on the shock and spring assembly.
4. Remove the shock rod protective cap.

NOTE: Do not use an impact wrench on the shock absorber rod nut or damage to the shock absorber may occur.

NOTE: Use the hex-holding feature to prevent the shock absorber rod from turning while removing or installing the nut.

5. While holding the shock absorber rod, remove and discard the nut.
    - To install, tighten the new nut to 40 Nm (30 lb-ft).
6. Remove the shock absorber and lower mount assembly.
7. Remove the dust boot.
8. Remove the shock absorber upper mount and spring upper seat.
9. Carefully release the tension on the spring compressor and remove the spring.
10. Remove and discard the shock absorber-to-damper fork bolt, then separate the shock and damper fork.
    - To install, tighten the new bolt to 48 Nm (35 lb-ft).

NOTE: Before tightening the shock absorber rod nut, position the end of the spring within 0-10 mm (0-0.39 in) of the step on the spring mount.

11. To assemble, reverse the disassembly procedure.

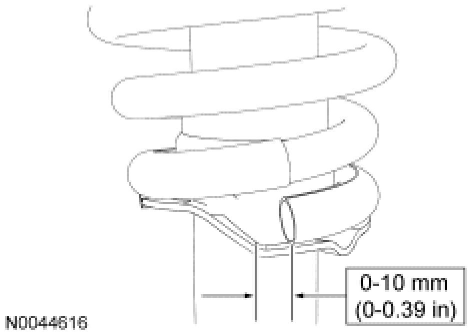


Fig. 56: Positioning End Of Spring Step On Spring Mount
Courtesy of FORD MOTOR CO.

2008 ENGINE PERFORMANCE

Fuel Charging & Controls - 3.5L - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Fuel rail bolts	10	89
Throttle body (TB) bolts	10	89

DESCRIPTION AND OPERATION

FUEL CHARGING AND CONTROLS

Sequential Multi-Port Fuel Injection (SFI)

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

The fuel charging and controls system consists of the:

- throttle body (TB).
- fuel injectors.
- fuel rail.

The fuel charging and controls system is:

- a sequential multi-port fuel injection (SFI) system.
- pulse-width modulated.

- mass air flow (MAF) controlled.

Fuel is metered into each intake port in a sequential firing order. Fuel injectors pulse to follow engine firing order, in accordance with engine demand, on a tuned intake manifold.

The basic fuel requirement of the engine is determined from the data supplied to the PCM by the MAF sensor, which measures the amount of air being drawn into the engine.

The various sensors detect any changes in the operating conditions and send signals to the PCM. This permits the PCM to control the opening duration (pulse width) of the fuel injectors and maintain optimum exhaust emission control and engine performance for all operating conditions.

Throttle Body (TB)

CAUTION: Do not hold the throttle plate open with any object that could scratch the bore or plate while servicing or cleaning the throttle body (TB). Refer to Throttle Body.

The TB:

- controls air supply to the intake manifold by electronically positioning the throttle plate.
- is not adjustable.
- must be removed from the vehicle to be cleaned.

Refer to **Throttle Body**.

Fuel Injectors

The fuel injectors:

- are electronically operated by the PCM.
- atomize the fuel as the fuel is delivered.
- each have an internal solenoid that opens a needle valve, which injects fuel into the intake port in the cylinder head.
- are deposit resistant.

For removal and installation, refer to **Fuel Rail and Fuel Injector - Exploded View** and **Fuel Rail**.

Fuel Rail

CAUTION: The fuel injectors and the fuel rail must be handled with extreme care to prevent damage to sealing areas and sensitive fuel-metering orifices.

The fuel rail:

- receives fuel from the fuel supply tube.
- delivers fuel to the fuel injectors.

For removal and installation, refer to **Fuel Rail and Fuel Injector - Exploded View** and **Fuel Rail**.

DIAGNOSTIC TESTS

FUEL CHARGING AND CONTROLS

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

THROTTLE BODY

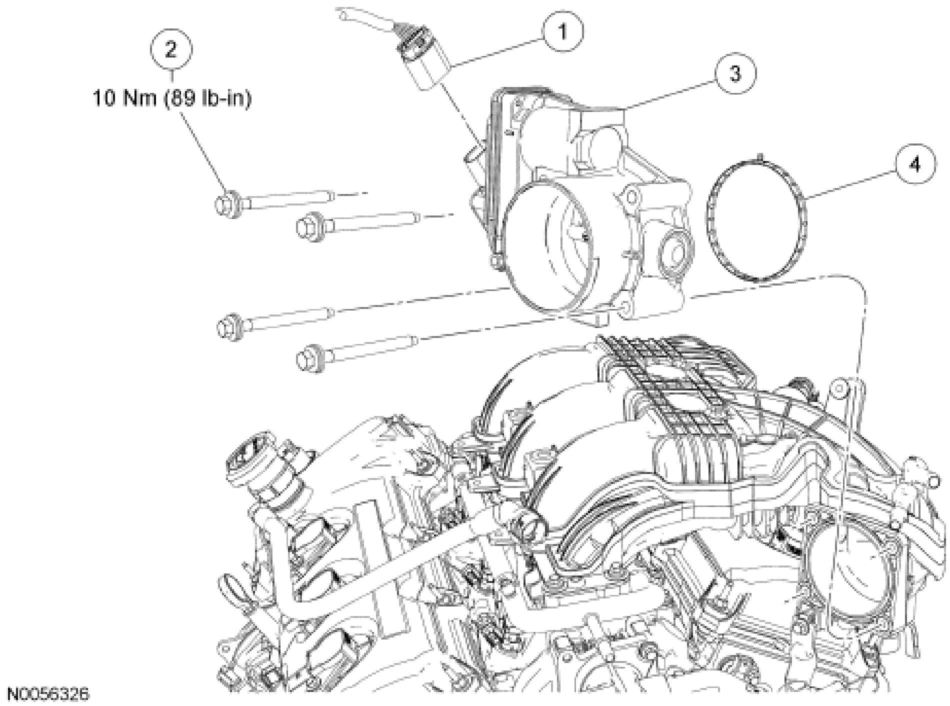


Fig. 1: Exploded View Of Throttle Body With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Electronic throttle control electrical connector (part of 12B637)
2	W503285	Throttle body (TB) bolt (4 required)
3	9E926	TB
4	9E936	TB gasket

REMOVAL AND INSTALLATION

CAUTION: The throttle body (TB) must be removed from the vehicle to be cleaned. Do not hold the throttle plate open with any object that could scratch the bore or plate while servicing or cleaning the TB.

1. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.
2. Disconnect the electronic throttle control electrical connector.
3. Remove the 4 bolts and the throttle body (TB).
    - Discard the TB gasket.
    - To install, tighten to 10 Nm (89 lb-in).

NOTE: Install a new TB gasket.

4. To install, reverse the removal procedure.

FUEL RAIL AND FUEL INJECTOR - EXPLODED VIEW

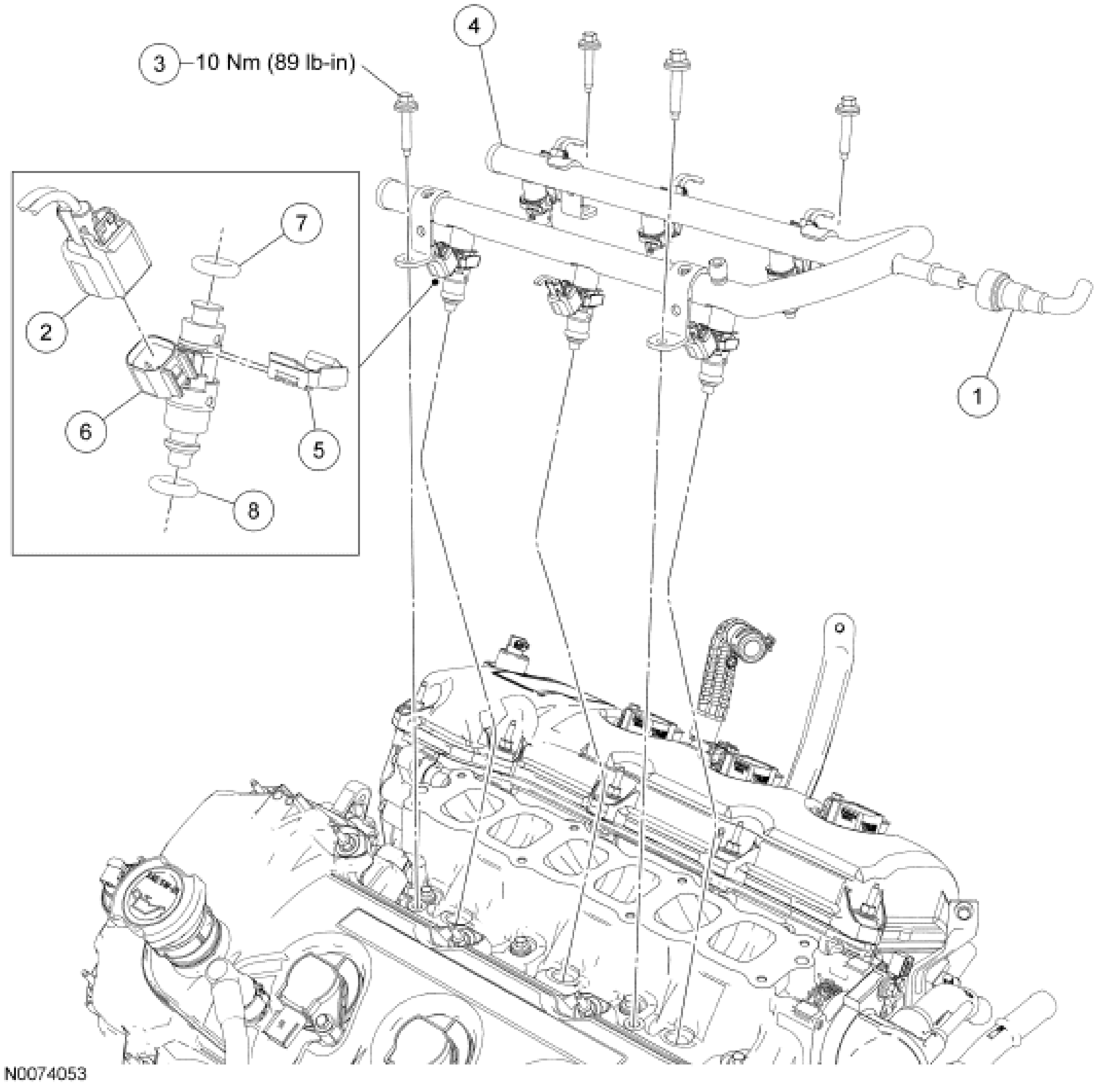


Fig. 2: Exploded View Of Fuel Rail & Fuel Injector With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9J285	Fuel tube-to-fuel rail spring lock coupling
2	14A464	Fuel injector electrical connector (6 required) (part of 12B637)
3	W713443	Fuel rail bolt (4 required)
4	9F792	Fuel rail
5	9N976	Fuel injector clip (6 required)
6	9F593	Fuel injector
7	9229	Upper fuel injector O-ring seal (6 required)
8	9229	Lower fuel injector O-ring seal (6 required)

1. For additional information, refer to the procedures.

FUEL RAIL

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

REMOVAL

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

1. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Remove the upper intake manifold. For additional information, refer to **ENGINE - 3.5L** article.
4. Disconnect the fuel tube-to-fuel rail spring lock coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
5. Disconnect the 6 fuel injector electrical connectors.
6. Remove the 4 fuel rail bolts.
7. Remove the fuel rail and injectors as an assembly.
8. Remove the 6 fuel injector clips and the 6 fuel injectors.
    - Remove and discard the 12 fuel injector O-ring seals.

INSTALLATION

CAUTION: **Use O-ring seals that are made of special fuel-resistant material. The use of ordinary O-ring seals can cause the fuel system to leak. Do not reuse the O-ring seals.**

NOTE: The upper and lower O-ring seals are not interchangeable.

NOTE: Install new fuel injector O-ring seals and lubricate them with clean engine oil.

1. Install the 6 fuel injectors and the 6 fuel injector clips into the fuel rail.
2. Install the fuel rail and fuel injectors as an assembly.
3. Install the 4 fuel rail bolts.
   - Tighten to 10 Nm (89 lb-in).
4. Connect the 6 fuel injector electrical connectors.
5. Connect the fuel tube-to-fuel rail spring lock coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
6. Install the upper intake manifold. For additional information, refer to **ENGINE - 3.5L** article.
7. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

2008 ENGINE PERFORMANCE

Fuel Pressure Specifications - 2008

FUEL SYSTEMS

FUEL PRESSURE - CARS

2008 FUEL PRESSURE SPECIFICATIONS - CARS

Engine	KOER psi (kg/cm^2)	KOEO psi (kg/cm^2)
Crown Victoria & Grand Marquis		
Gasoline	25-40 (1.8-2.8)	20-60 (1.4-4.2)
Focus	55 (3.9)	(1)
Fusion & Milan		
2.3L	57 (4.0)	(1)
3.0L	65 (4.6)	(1)
MKZ	65 (4.6)	(1)
Mustang	27-37 (1.9-2.6)	35-70 (2.4-4.9)
Sable, Taurus & Taurus X	65 (4.6)	65 (4.6)
Town Car	25-40 (1.8-2.8)	20-60 (1.4-4.2)

(1) Information is not available from manufacturer.

(2) With a manual gauge, the fuel pressure will be lower.

(3) Based on 60°C (140°F) fuel rail temperature, at fuel rail temperatures above 60°C (140°F), for example hot starts, the fuel rail pressure increases based on temperature up to 448 kPa (65 psi).

FUEL PRESSURE - TRUCKS

2008 FUEL PRESSURE SPECIFICATIONS - TRUCKS

Engine	KOER psi (kg/cm^2)	KOEO psi (kg/cm^2)
Econoline		
Diesel (6.0L)	38-51 (2.7-3.6)	0-51 (0-3.6)
Gasoline (4.6L, 5.4L)	28-45 (2.0-3.2)	35-45 (2.4-3.2)
Gasoline (6.8L)	55-65 (3.9-4.6) (1)	40-50 (2.8-3.5) (1)
Edge & MKX	65 (4.6)	(2)
Escape, Escape Hybrid, Mariner & Mariner Hybrid	39 (2.7)	39 (2.7)
Expedition & Navigator	65-71 (4.6-4.8)	62 (4.3)
Explorer & Mountaineer	30-40 (2.1-2.8)	30-40 (2.1-2.8)
Explorer Sport Trac	30-40 (2.1-2.8)	30-40 (2.1-2.8)
Mark LT & Pickup		

Diesel (6.4L)	4-7 (.28-.48)	4-7 (.28-.48) [3]
Gasoline (4.2L, 4.6L, 5.4L)	28-45 (2.0-3.2)	35-45 (2.4-3.2)
Gasoline (6.8L)	28-45 (2.0-3.2)	35-45 (2.4-3.2)
Ranger	60-65 (4.2-4.6)	60-65 (4.2-4.6)

(1) Measured by the fuel rail pressure (FRP) PID using the vehicle communication module (VCM) and integrated diagnostic system (IDS) with appropriate hardware, or equivalent scan tool. Mechanical gauge fuel pressure readings may vary from scan tool readings.

(2) Information is not available from manufacturer.

(3) After 30 seconds the fuel pump will shut off and the fuel pressure will begin to bleed down to 0 kPa (0 psi).

2008 GENERAL INFORMATION

Fuel System - General Information - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Fuel tank capacity (all wheel drive [AWD] vehicles)	62.46L (16.5 gal)
Fuel tank capacity (front wheel drive [FWD] vehicles)	66.24L (17.5 gal)
Fuel Pressure	**FUEL PRESSURE SPECIFICATIONS**

DESCRIPTION AND OPERATION

FUEL SYSTEM

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction**

may result in serious personal injury.

WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.**

The fuel system consists of:

- a mechanical returnless fuel system.
- a fuel rail.
- a fuel rail mounted Schrader valve on all 3.0L engines and early build 3.5L engines.
- a multi-port fuel injection (MFI) system.
- an all wheel drive (AWD) saddle-type or front wheel drive (FWD) standard fuel tank.
- fuel, vapor and brake tubes in an integrated bundle assembly attached to the underside of the vehicle by retaining clips.
- a fuel tank filler pipe assembly, which cannot be modified in any way, that also contains a restrictor plate to permit only unleaded fuel to be pumped into the tank.
- a 1/4 turn-type fuel tank filler cap.
- an inertia fuel shutoff (IFS) switch.
- a fuel pump (FP) module containing:
  - an electric FP, which provides pressurized fuel to the fuel rail.
  - a fuel level sender.
  - a check valve, which maintains system pressure after the FP is shut off.
  - a pressure relief valve for overpressure protection in the event of restricted fuel flow.
  - an in tank fuel filter providing filtration to protect the fuel injectors from foreign material.
- an individual fuel level sensor, AWD vehicles only.

The FP is controlled by the PCM. Electrical power to the FP is provided through the IFS switch located under the right front door scuff plate.

The engines are equipped with sequential multi-port fuel injection.

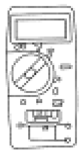
The fuel pressure is regulated to a constant pressure by a pressure regulator.

DIAGNOSTIC TESTS

FUEL SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module	

 ST1137-A	(VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operation

NOTE: The following procedure diagnoses a slow to fill concern only. For all other concerns refer to the Introduction - Gasoline Engines article.

The fuel tank filler pipe assembly is used to refuel the vehicle. The fuel tank inlet check valve prevents spit back of fuel during and after refueling. The fuel tank stores the fuel. The fuel tank contains a fuel pump (FP) module. The FP module consists of a fuel level sensor and a FP. The fuel level sender sends a signal to the fuel gauge informing the driver of how much fuel is in the fuel tank. The FP provides fuel to the fuel tubes which supply the fuel rail.

During refueling, the fuel tank vents to the atmosphere through the vent and filler pipes, on vehicles without on-board refueling vapor recovery (ORVR) systems. In vehicles equipped with ORVR the fuel tank and filler pipe are designed so that when the vehicle is being refueled, fuel vapors in the fuel tank travel to the evaporative emission (EVAP) canister, which absorbs the fuel vapors and vents the pressure from the fuel tank during refueling.

Inspection and Verification

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WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.**

1. Verify the customer's concern by refueling the vehicle and observe the fuel fill rate.
2. Inspect to determine if any of the following mechanical concerns apply.

VISUAL INSPECTION CHART

Mechanical
• Bent, kinked or damaged fuel tank filler pipe • Bent, kinked or damaged fuel tank filler pipe vent tube (if equipped) • Incorrect routing of the fuel tank filler pipe • Incorrect routing of the fuel tank filler pipe vent tube (if equipped) • Incorrect position of fuel tank filler pipe clamps • Incorrect position of fuel tank filler pipe vent tube clamps (if equipped) • Fuel tank mounted vapor tubes bent or damaged • Evaporative emission (EVAP) system tubes or hoses bent or damaged • Accident damage to the fuel tank • Accident damage to the vehicle effecting the fuel tank filler pipe-to-body connection • Unauthorized modifications and/or alterations to the vehicle • EVAP system fresh air tube plugged (dirt, spider webbing)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE**

COMMUNICATIONS NETWORK article.
- If the network test passes, retrieve and record continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the evaporative emission (EVAP) system.
9. If the DTCs retrieved are related to the concern, go to Evaporative Emission System DTC Chart. For PCM related DTCs, refer to the **Introduction - Gasoline Engines** article. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

Evaporative Emission System DTC Chart

EVAPORATIVE EMISSION SYSTEM DTC CHART

DTC	Description	Action
P0446	Evaporative Emission System Vent Control Circuit	Go to **Pinpoint Test A**.
P0451	Evaporative Emission System Pressure Sensor/Switch Range/Performance	Go to **Pinpoint Test A**.
P0452	Evaporative Emission System Pressure Sensor/Switch Low	Go to **Pinpoint Test A**.
P0453	Evaporative Emission System Pressure Sensor/Switch High	Go to **Pinpoint Test A**.
P0454	Evaporative Emission System Pressure Sensor/Switch Intermittent	Go to **Pinpoint Test A**.
P1443	Evaporative Emission System Control Valve (Low/No Flow)	Go to **Pinpoint Test A**.
P1450	Unable to Bleed up Fuel Tank Vacuum	Go to **Pinpoint Test A**.
P1451	Evaporative Emission System Vent Control Circuit	Go to **Pinpoint Test A**.
P260F	Emission System Monitoring Processor Performance	Go to **Pinpoint Test A**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Slow to fill	• Fuel tank filler pipe • Fuel tank filler pipe vent tube, if equipped • Evaporative emission (EVAP) system • Fuel tank inlet check valve (part of the fuel tank) • Fuel level vent valve (part of the fuel tank)	• Go to **Pinpoint Test A**.
• All other fuel system concerns	• Fuel system components	• REFER to the **Introduction - Gasoline Engines** article.

Pinpoint Test

Pinpoint Test A: Slow to Fill

Normal Operation

Under normal operation, fuel should flow at a steady rate through the fuel tank filler pipe into the fuel tank. As fuel enters the fuel tank air is vented through the filler pipe or the on-board refueling vapor recovery (ORVR) system.

This pinpoint test is intended to diagnose the following:

- Fuel tank filler pipe vent tube, if equipped
- Fuel tank filler pipe
- Evaporative emission (EVAP) system
- Fuel tank inlet check valve (part of the fuel tank)
- Fuel level vent valve (part of the fuel tank)

PINPOINT TEST A: SLOW TO FILL

A1 CARRY OUT INSPECTION AND VERIFICATION

- Carry out inspection and verification.
- **Was the cause of the concern found?**

  YES : REPAIR or INSTALL new components to correct the concern.

  NO : Go to A2.

A2 CHECK THE SYSTEM FOR ANY EVAP DTCs

- Connect the scan tool.
- Check the system for any of the following EVAP DTCs: P0446, P0451, P0452, P0453, P0454, P1443, P1450, P1451 and P260F.
- **Are any of these DTCs present?**

  YES : REFER to **Introduction - Gasoline Engines** article to diagnosis the EVAP system.

  NO : Go to A3.

A3 MONITOR THE FUEL TANK PRESSURE (FTP) WHILE FILLING THE FUEL TANK

- Monitor the FTP reference value while filling the fuel tank. REFER to **Introduction - Gasoline Engines** article.
- **Is FTP within specification?**

  YES : Go to A5.

  NO : Go to A4.

A4 MONITOR THE FTP WHILE FILLING THE FUEL TANK WITH THE EVAP SYSTEM DISCONNECTED

- Disconnect the fuel tank-to-EVAP canister quick connect coupling at the EVAP canister. Refer to **Quick Connect Coupling**.
- Monitor the FTP reference value while filling the fuel tank. REFER to **Introduction - Gasoline Engines** article.

- **Is FTP within specification?**

  YES : INSPECT the EVAP system for blockage or restrictions. REPAIR the blockage or restriction. If the restriction or blockage cannot be repaired, INSTALL new EVAP system components.

  NO : Go to A5.

A5 CHECK THE FUEL TANK FILLER PIPE ASSEMBLY FOR BLOCKAGE OR RESTRICTION

- Remove the fuel tank filler pipe assembly. REFER to **FUEL TANK AND LINES** article.
- Inspect the fuel tank filler pipe and fuel tank filler pipe vent tube (if equipped) for a blockage or restriction.
- **Is the fuel tank filler pipe or fuel tank filler pipe vent tube (if equipped) blocked or restricted?**

  YES : If possible, REPAIR the blockage or restriction. If the blockage or restriction cannot be repaired, INSTALL a new fuel tank filler pipe or fuel tank filler pipe vent tube.

  NO : Go to A6.

A6 CHECK THE FUEL TANK INLET CHECK VALVE

- Inspect the fuel tank inlet check valve for restriction or sticking.
- **Is the fuel tank filler pipe inlet check valve restricted or sticking?**

  YES : If possible, REPAIR the restriction. If the restriction cannot be repaired, INSTALL a new fuel tank. REFER to **FUEL TANK AND LINES** article.

  NO : INSTALL a new fuel tank. REFER to **FUEL TANK AND LINES** article.

GENERAL PROCEDURES

FUEL SYSTEM PRESSURE RELEASE

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WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

1. Remove the RH front door scuff plate.

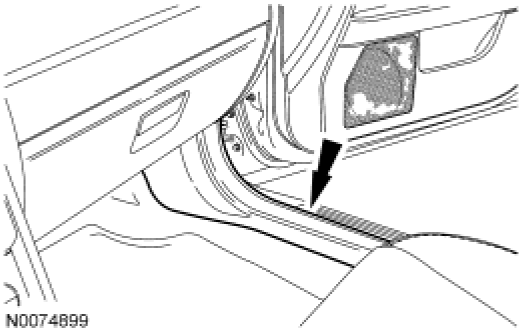


Fig. 1: Identifying RH Front Door Scuff Plate
Courtesy of FORD MOTOR CO.

2. Disconnect the inertia fuel shutoff (IFS) switch.

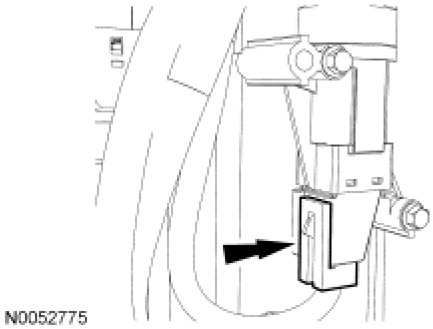


Fig. 2: Locating Inertia Fuel Shutoff (IFS) Switch Electrical Connector
Courtesy of FORD MOTOR CO.

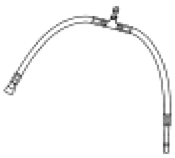
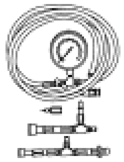
3. Start the engine and allow it to idle until it stalls.
4. After the engine stalls, crank the engine for approximately 5 seconds to make sure the fuel system pressure has been released.
5. Turn the ignition switch to the OFF position.
6. When fuel system service is complete, reconnect the IFS switch electrical connector.

NOTE: It may take more than one key cycle to pressurize the fuel system.

7. Cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.
8. Start the vehicle and check the fuel system for leaks.
9. Install the RH front door scuff plate.

FUEL SYSTEM PRESSURE TEST

Special Tools

Illustration	Tool Name	Tool Number
 ST3047-A	Adapter, Fuel Pressure Test	310-180
 ST3038-A	Fuel Pressure Test Kit	310-D009 (D95L-7211A)

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WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.**

2.3L engine

1. Release the fuel system pressure. For additional information, refer to **Fuel System Pressure Release**.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Disconnect the fuel jumper tube-to-fuel rail quick connect coupling. For additional information, refer to **Quick Connect Coupling**.
4. Install the Fuel Pressure Test Kit between the fuel jumper tube and the fuel rail.

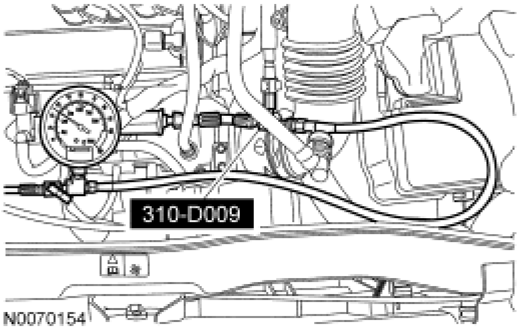


Fig. 3: Identifying Fuel Jumper Tube, Fuel Rail & Special Tool (310-D009)
Courtesy of FORD MOTOR CO.

3.0L (4V) engine

5. Remove the cap and install the Fuel Pressure Test Kit on the fuel rail Schrader valve test port.

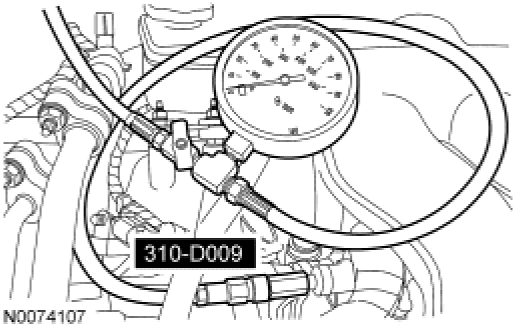


Fig. 4: Identifying Fuel Rail Schrader Valve Test Port & Special Tool (310-D009)
Courtesy of FORD MOTOR CO.

3.5L engine with a fuel rail mounted Schrader valve

6. Remove the cap and install the Fuel Pressure Test Kit on the fuel rail Schrader valve test port.

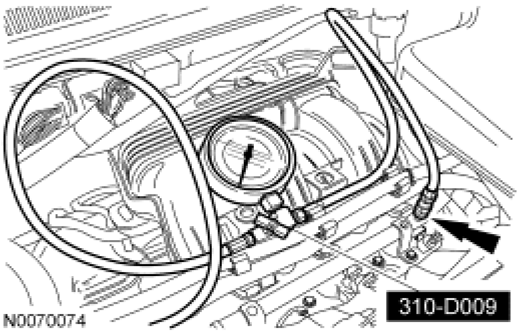


Fig. 5: Installing Special Tool (310-D009) & Slowly Open Manual Valve To Relieve Fuel System Pressure
Courtesy of FORD MOTOR CO.

3.5L engine without a fuel rail mounted Schrader valve

7. Release the fuel system pressure. For additional information, refer to **Fuel System Pressure Release**.
8. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
9. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.
10. Disconnect the fuel tube-to-fuel rail spring lock coupling. For additional information, refer to **Spring Lock Couplings**.
11. Install the Fuel Pressure Test Adapter and Fuel Pressure Test Kit between the fuel tube and the fuel rail.

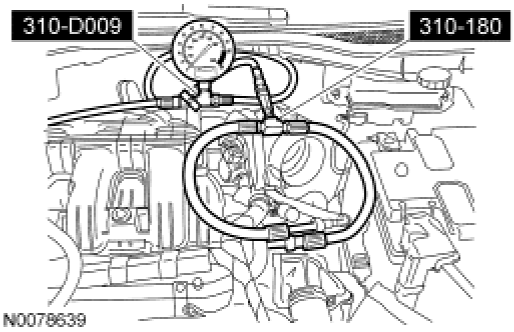


Fig. 6: Identifying Fuel Tube, Fuel Rail & Special Tool (310-D009, 310-180)
Courtesy of FORD MOTOR CO.

NOTE: The air cleaner outlet pipe must be installed prior to completing the fuel system pressure test.

12. Install the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.

3.5L engine without a fuel rail mounted Shrader valve and 2.3L engine

NOTE: The IFS switch was disconnected in the fuel system pressure release.

13. Connect the IFS switch electrical connector.
14. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

All engines

NOTE: Carry out a key ON engine OFF (KOEO) visual inspection for fuel leaks prior to completing the fuel system pressure test.

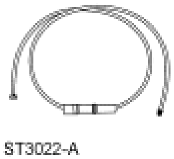
NOTE: After completion of the fuel system pressure test, open the drain valve on the special tool and release any residual fuel into a suitable container prior

to removing the tool.

15. Test the fuel system pressure to make sure it is within the specified range. For additional information, refer to **SPECIFICATIONS**.

FUEL TANK DRAINING

Special Tools

Illustration	Tool Name	Tool Number
	Fuel Storage Tanker	164-R3202 or equivalent
	Fuel Tank Lock Ring Wrench	310-123
	Fuel Draining Hose	310-102

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WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.**

All vehicles

1. Release the fuel system pressure. For additional information, refer to **Fuel System Pressure Release**.

2. Release the fuel tank filler cap and position it aside.

CAUTION: When removing the special tool, the fitting on the end of the hose can become detained by the one-way flapper valve. Carefully remove the hose using a gentle agitating motion to avoid detaching the hose from the fitting.

NOTE: The special tool must be inserted into the fuel tank filler pipe until the fitting on the end of the hose enters into the fuel tank spout, opening the one-way flapper valve.

3. Insert the special tool into the fuel tank filler pipe.

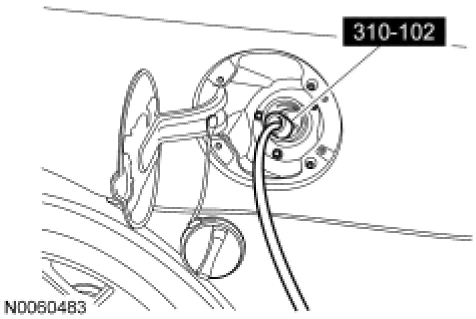


Fig. 7: Inserting Special Tool (310-102) Into Fuel Tank Filler Pipe
Courtesy of FORD MOTOR CO.

NOTE: This step will remove approximately 1/8 tank of the fuel from a completely full fuel tank and the majority of any residual fuel in the fuel tank filler pipe.

4. Attach the fuel storage tanker to the special tool and remove as much fuel as possible from the fuel tank and fuel tank filler pipe.
5. Remove the rear seat lower cushion. For additional information, refer to **SEATING** article.

Front wheel drive (FWD) vehicles

6. Remove the 4 screws and the fuel pump (FP) module access cover.

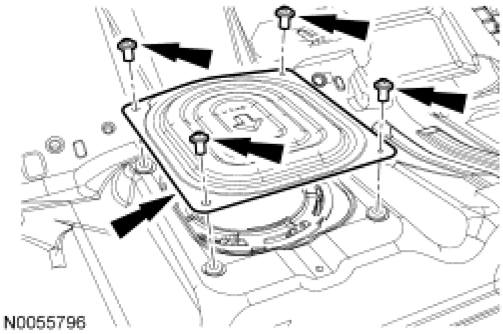


Fig. 8: Identifying Fuel Pump Module Access Cover & Screws
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

7. Remove the 3 screws and the FP module access cover.

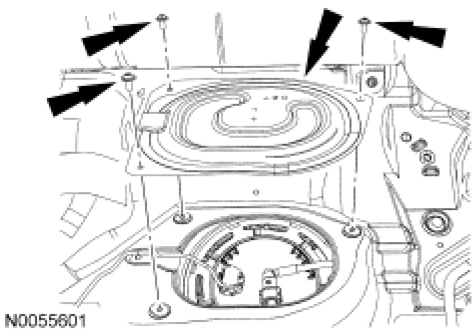


Fig. 9: Identifying Fuel Pump Module Access Cover & Screws
Courtesy of FORD MOTOR CO.

All vehicles

NOTE:	**Clean the FP module connections, couplings, flange surfaces and the immediate surrounding area of any dirt or foreign material.**

8. Disconnect the FP module electrical connector.

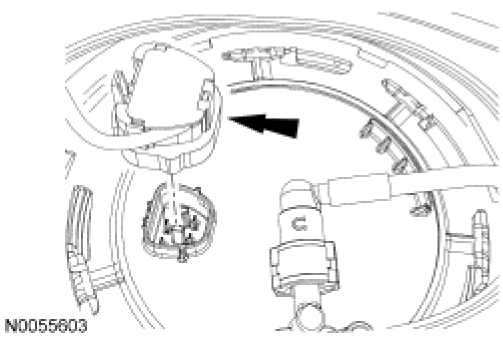


Fig. 10: Identifying Fuel Pump Module Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: Place absorbent toweling in the immediate surrounding area in case of fuel spillage.

9. Disconnect the fuel tube-to-FP module quick connect coupling.

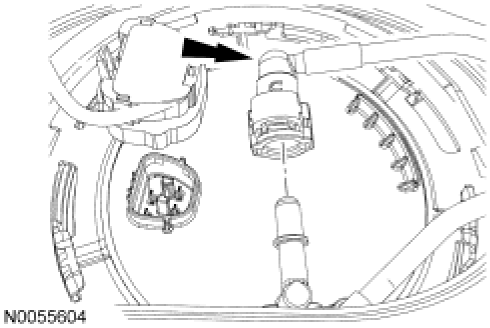


Fig. 11: Identifying Fuel Supply Tube-To-Fuel Pump Module Quick Connect Coupling
Courtesy of FORD MOTOR CO.

NOTE: Make sure to install a new FP module O-ring seal and lock ring.

10. Install the special tool, remove and discard the FP module lock ring.

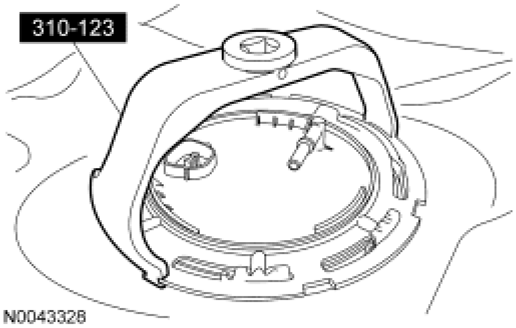


Fig. 12: Identifying Special Tool (310-123)
Courtesy of FORD MOTOR CO.

CAUTION: The fuel pump (FP) module must be handled carefully to avoid damage to the float arm.

11. Position the FP module aside and insert the tube from the fuel storage tanker into the FP module aperture and drain as much fuel from the fuel tank as possible.

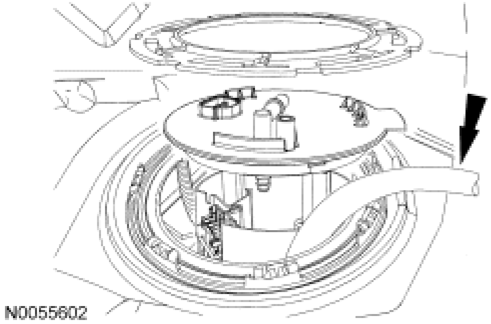


Fig. 13: Identifying Tube From Fuel Storage Tanker
Courtesy of FORD MOTOR CO.

AWD vehicles

12. Remove the 3 screws and the fuel level sensor access cover.

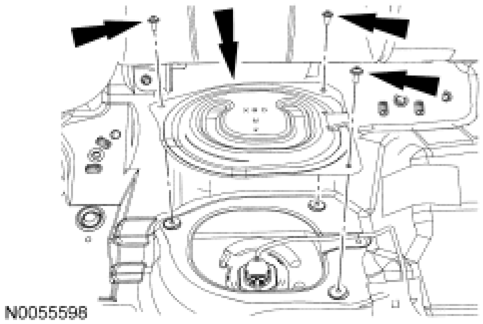


Fig. 14: Identifying Fuel Level Sensor Access Cover & Screws
Courtesy of FORD MOTOR CO.

NOTE: **Clean the fuel level sensor connection, flange surface and the immediate surrounding area of any dirt or foreign material.**

13. Disconnect the fuel level sensor electrical connector.

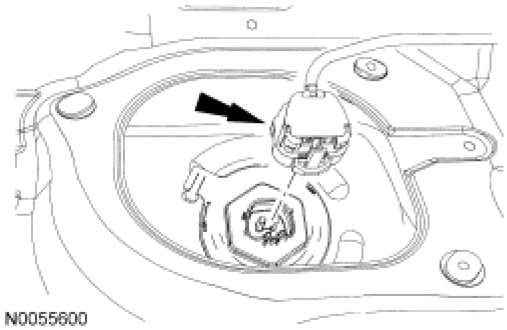


Fig. 15: Identifying Fuel Level Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: Place absorbent toweling in the immediate surrounding area in case of fuel spillage.

14. Release the lock tab, and using a suitable tool, rotate the fuel level sensor counterclockwise approximately 1/4 turn, lift and position aside.

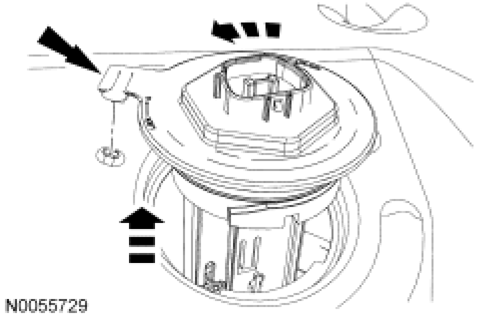


Fig. 16: Rotating Fuel Level Sensor Counterclockwise Approximately 1/4 Turn & Lift Upward
Courtesy of FORD MOTOR CO.

15. Insert the tube from the fuel storage tanker into the fuel level sensor aperture and drain the remainder of the fuel from the fuel tank.

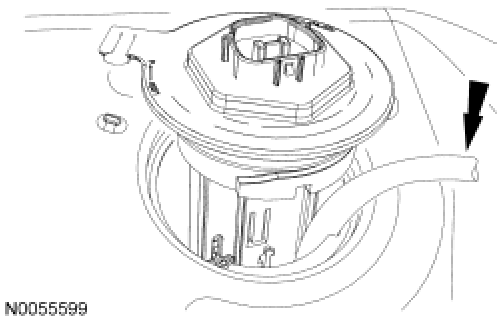
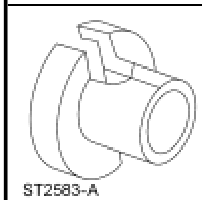


Fig. 17: Identifying Tube From Fuel Storage Tanker
Courtesy of FORD MOTOR CO.

QUICK CONNECT COUPLING

Special Tools

Illustration	Tool Name	Tool Number
	Disconnect Tool, Fuel Pipe (5/16")	310-040

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Disconnect - Type I

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

WARNING: When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip can occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage can occur. Always install plugs to any open orifices or tubes.

CAUTION: Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. If servicing a liquid fuel tube quick connect coupling, release the fuel system pressure. For additional information, refer to **Fuel System Pressure Release**.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Depress the locking tab and release the quick connect coupling from the tube.

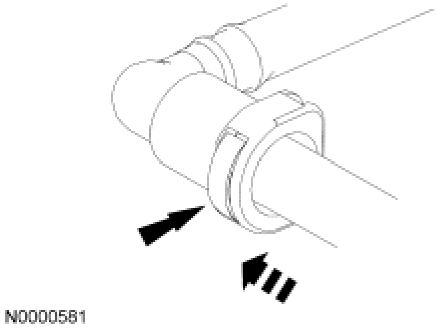


Fig. 18: Locating Fuel Tube Quick Connect Coupling Button
Courtesy of FORD MOTOR CO.

Connect - Type I

NOTE: **Make sure the retainer clip is fully seated and locked onto the tube by pulling on the quick connect coupling.**

1. Install the quick connect coupling onto the tube until it is fully seated.

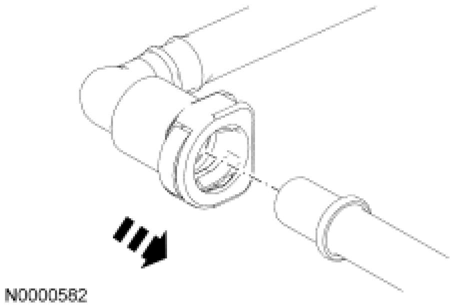


Fig. 19: Installing Quick Connect Coupling Onto Tube
Courtesy of FORD MOTOR CO.

2. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

Disconnect - Type II

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type**

when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

WARNING: When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip can occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage can occur. Always install plugs to any open orifices or tubes.

CAUTION: Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. Release the lock tab on the quick connect coupling.

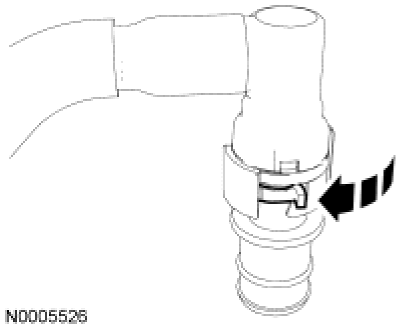


Fig. 20: Positioning Locking Tab Into Unlatched Position
Courtesy of FORD MOTOR CO.

2. Separate the quick connect coupling from the fitting.

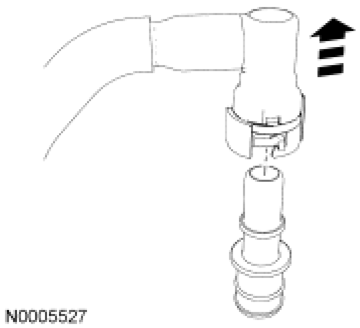


Fig. 21: Identifying Quick Connect Coupling
Courtesy of FORD MOTOR CO.

Connect - Type II

NOTE: **Apply clean engine oil to the O-ring seals.**

NOTE: **Make sure the retainer clip is fully seated and locked onto the tube by pulling on the quick connect coupling.**

1. Release the lock tab and install the quick connect coupling onto the fitting.

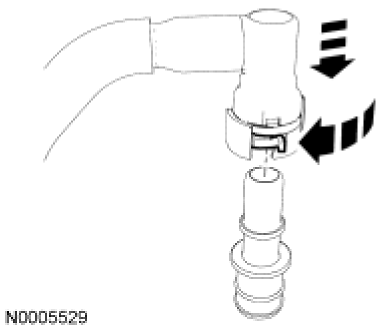


Fig. 22: Identifying Quick Connect Coupling
Courtesy of FORD MOTOR CO.

2. Apply the lock tab into the latched position.

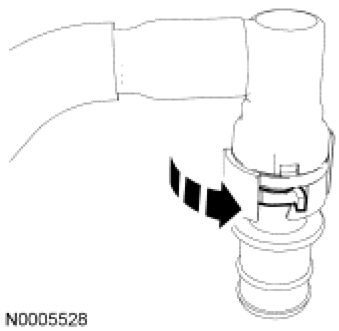


Fig. 23: Positioning Locking Tab Into Latched Position
Courtesy of FORD MOTOR CO.

Disconnect - Type III

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.**

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube

or connector retaining clip can occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage can occur. Always install plugs to any open orifices or tubes.

CAUTION: Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. If servicing a liquid fuel tube quick connect coupling, release the fuel system pressure. For additional information, refer to **Fuel System Pressure Release**.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Release the quick connect coupling lock tab.

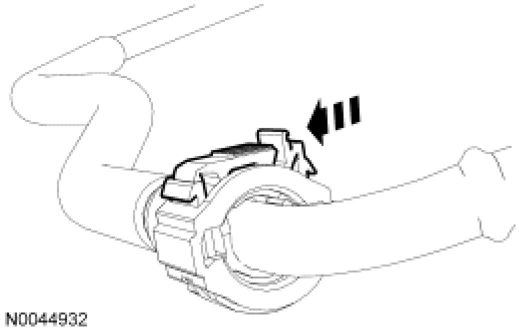


Fig. 24: Releasing Quick Connect Coupling Lock Tab
Courtesy of FORD MOTOR CO.

4. Rotate the primary locking tab to the fully opened position and squeeze the secondary locking tabs to release the locking mechanism.

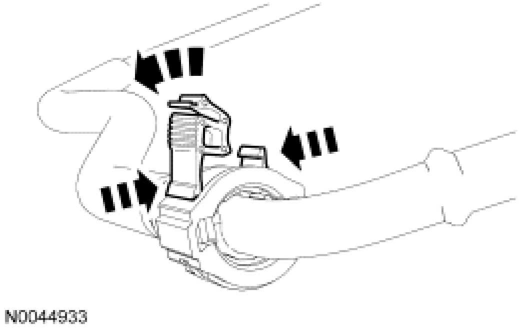
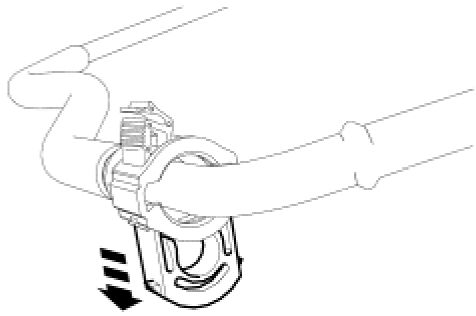


Fig. 25: Releasing Locking Mechanism
Courtesy of FORD MOTOR CO.

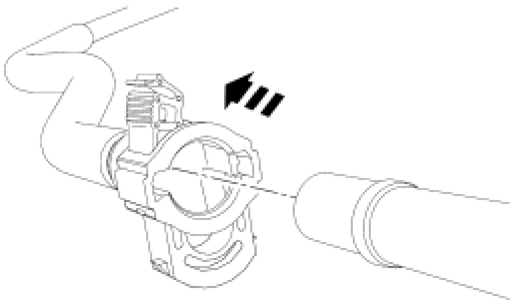
5. Push the locking mechanism outward and release the tube.



N0044934

Fig. 26: Pushing Locking Mechanism Outward And Releasing Fuel Supply Tube
Courtesy of FORD MOTOR CO.

6. Remove the quick connect coupling from the tube.



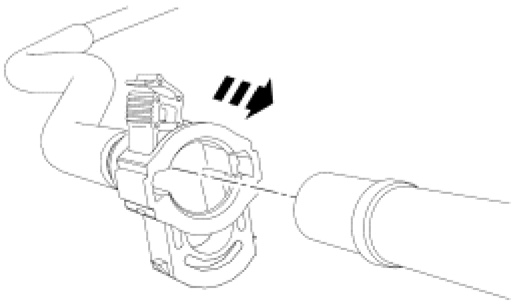
N0056364

Fig. 27: Removing Quick Connect Coupling From Tube
Courtesy of FORD MOTOR CO.

Connect - Type III

NOTE: Apply clean engine oil to the O-ring seals.

1. Install the quick connect coupling onto the tube until it is fully seated.



N0056365

Fig. 28: Installing Quick Connect Coupling Onto Tube

Courtesy of FORD MOTOR CO.

2. Depress the retainer clip until it is flush with the quick connect coupler housing and is fully seated on the tube.

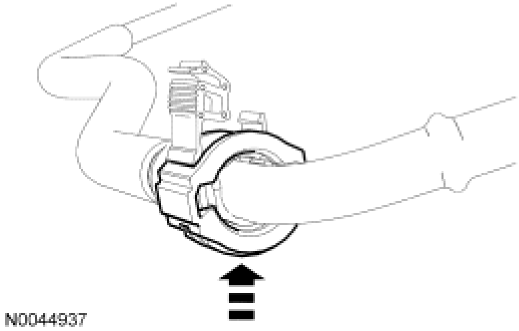


Fig. 29: Depressing Retainer Clip
Courtesy of FORD MOTOR CO.

NOTE: Make sure the retainer clip is fully seated and locked onto the tube by pulling on the quick connect coupling.

3. Rotate the primary locking tab on the retainer clip to the closed position.

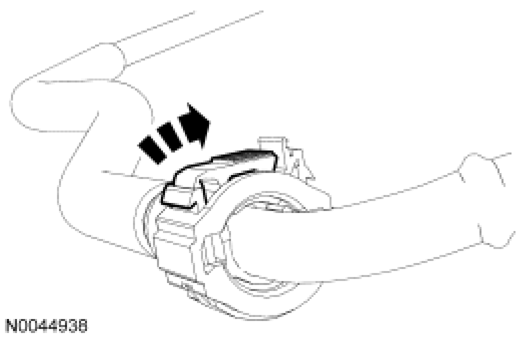


Fig. 30: Rotating Primary Locking Tab On Retainer Clip To Closed Position
Courtesy of FORD MOTOR CO.

4. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

Disconnect - Type IV

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or

audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.**

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip can occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage can occur. Always install plugs to any open orifices or tubes.

CAUTION: Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. If servicing a liquid fuel tube quick connect coupling, release the fuel system pressure. For additional information, refer to **Fuel System Pressure Release**.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Squeeze the quick connect coupling retainer clip tabs to release the locking mechanism.

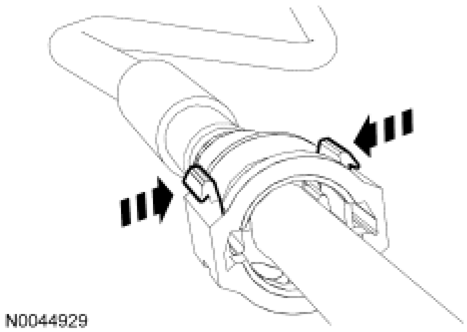


Fig. 31: Releasing Locking Mechanism
Courtesy of FORD MOTOR CO.

4. Push the locking mechanism outward to release the tube.

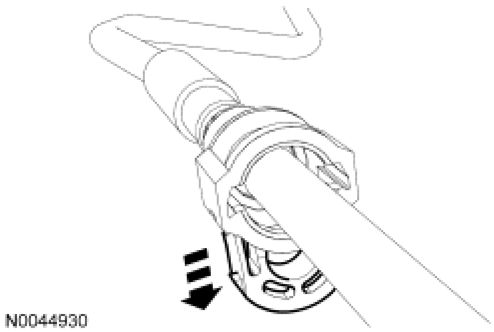


Fig. 32: Pushing Locking Mechanism Outward To Releasing Tube
Courtesy of FORD MOTOR CO.

5. Remove the quick connect coupling from the tube.

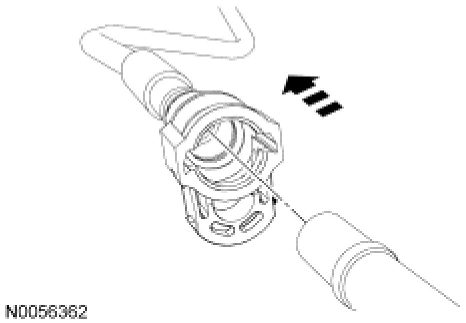


Fig. 33: Removing Quick Connect Coupling From Tube
Courtesy of FORD MOTOR CO.

Connect - Type IV

NOTE: **Apply clean engine oil to the O-ring seals.**

1. Install the quick connect coupling onto the tube.

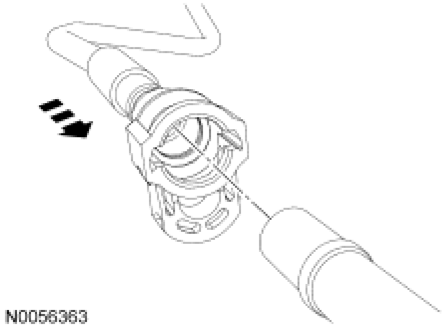


Fig. 34: Installing Quick Connect Coupling Onto Tube
Courtesy of FORD MOTOR CO.

2. Depress the quick connect coupling locking mechanism into the locked position.

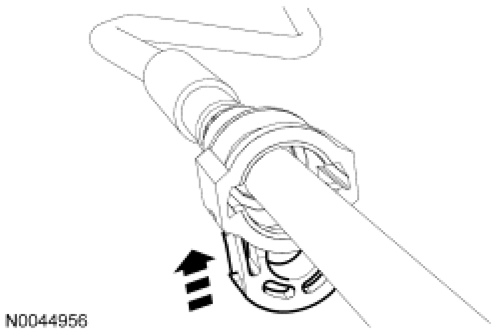


Fig. 35: Depressing Quick Connect Coupling Locking Mechanism Into Locked Position
Courtesy of FORD MOTOR CO.

NOTE: Make sure the retainer clip is fully seated and locked onto the tube by pulling on the quick connect coupling.

3. Visually inspect and verify that the locking mechanism is flush with the quick connect coupling housing and that the tabs are locked in place.

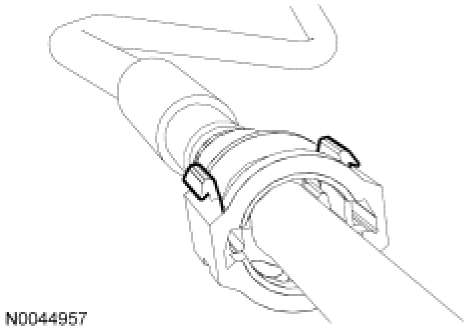


Fig. 36: Identifying Locking Mechanism And Quick Connect Coupling Housing
Courtesy of FORD MOTOR CO.

4. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

Disconnect - Type V

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.**

CAUTION: **When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip can occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.**

CAUTION: **Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage can occur. Always install plugs to any open orifices or tubes.**

1. If servicing a liquid fuel tube quick connect coupling, release the fuel system pressure. For additional information, refer to **Fuel System Pressure Release**.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Install the special tool on the tube and push into the quick connect coupling locking clip to release.

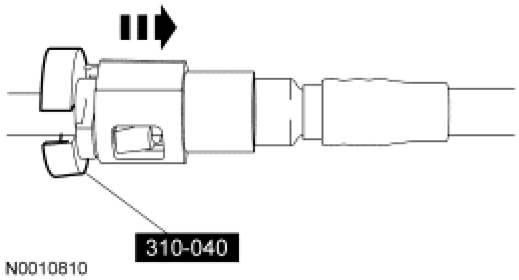


Fig. 37: Disconnecting Quick Connect Coupling From Tube Using Special Tool (310-040)
Courtesy of FORD MOTOR CO.

4. Remove the quick connect coupling from the tube.

Connect - Type V

NOTE: Apply clean engine oil to the O-ring seals.

NOTE: Make sure the retainer clip is fully seated and locked onto the tube by pulling on the quick connect coupling.

1. Install the quick connect coupling onto the tube until it is fully seated.

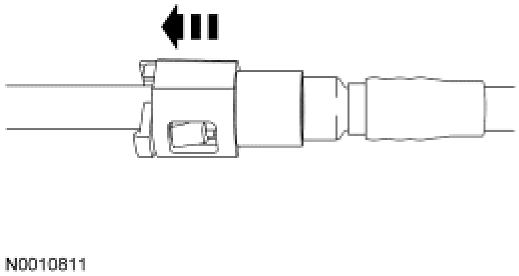


Fig. 38: Installing Quick Connect Coupling Onto Tube Until Fully Seated
Courtesy of FORD MOTOR CO.

2. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

Disconnect - Type VI

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.**

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip can occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage can occur. Always install plugs to any open orifices or tubes.

CAUTION: Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. If servicing a liquid fuel tube quick connect coupling, release the fuel system pressure. For additional information, refer to **Fuel System Pressure Release**.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Depress the legs of the retainer clip and position the clip in an outward position.

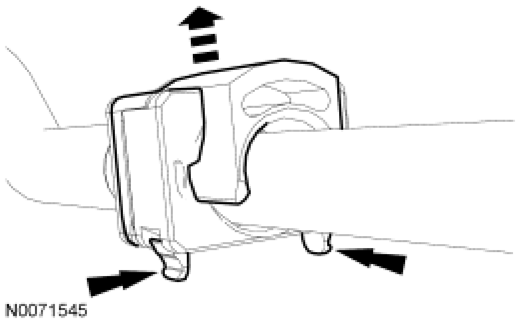


Fig. 39: Depressing Legs Of Retainer Clip & Positioning Clip In An Outward Position
Courtesy of FORD MOTOR CO.

4. Disconnect the quick connect coupling from the tube.

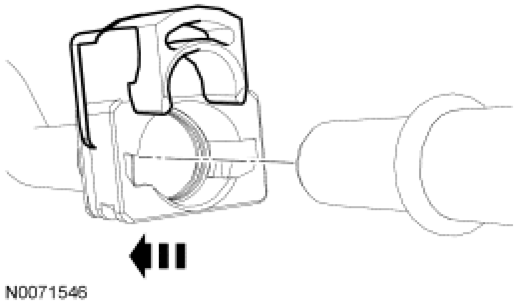


Fig. 40: Disconnecting Quick Connect Coupling From Tube
Courtesy of FORD MOTOR CO.

Connect - Type VI

NOTE: Apply clean engine oil to the end of the tube and quick connect coupling O-ring seals.

1. Install the quick connect coupling onto the tube until fully seated.

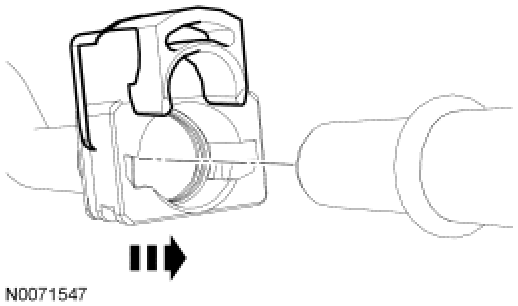


Fig. 41: Installing Quick Connect Coupling Onto Tube Until Fully Seated
Courtesy of FORD MOTOR CO.

NOTE: Make sure the retainer clip is fully seated and locked onto the tube by pulling on the quick connect coupling.

2. Press the retainer clip into the quick connect coupling body until flush and the legs are locked in place.

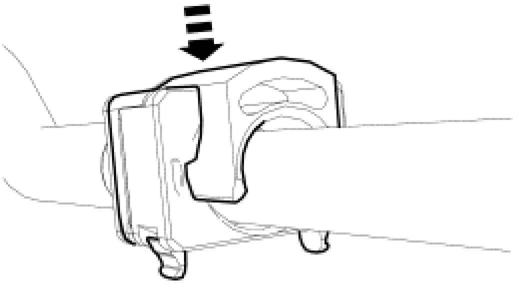


Fig. 42: Pressing Retainer Clip Into Quick Connect Coupling Body
Courtesy of FORD MOTOR CO.

3. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

SPRING LOCK COUPLINGS

Special Tools

Illustration	Tool Name	Tool Number
	Disconnect Tool, Spring Lock Coupling	310-S039 (T90T-9550-S) or equivalent

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Disconnect

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

WARNING: When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.

CAUTION: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip can occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

CAUTION: Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage can occur. Always install plugs to any open orifices or tubes.

1. Release the fuel system pressure. For additional information, refer to **Fuel System Pressure Release**.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Install the special tool on the tube and push into the spring lock coupling to release.

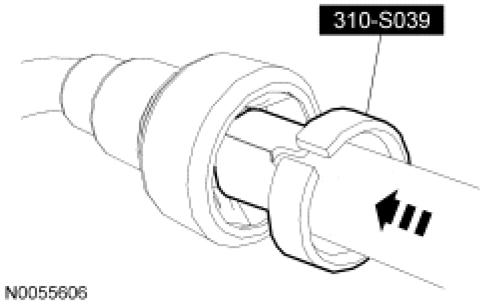


Fig. 43: Installing Special Tool (310-S039) On Tube And Pushing Into Spring Lock Coupling To

Release
Courtesy of FORD MOTOR CO.

4. Separate the spring lock coupling from the tube.

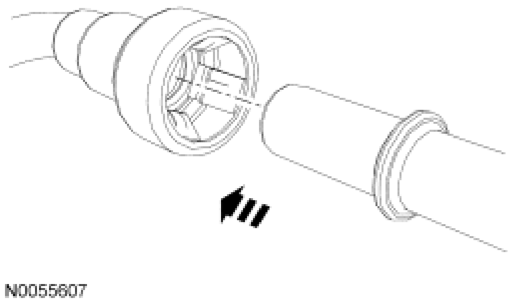


Fig. 44: Separating Spring Lock Coupling From Tube
Courtesy of FORD MOTOR CO.

Connect

NOTE: **Lubricate the fuel tube with clean engine oil.**

1. Align and push the spring lock coupling onto the tube until you hear a click.

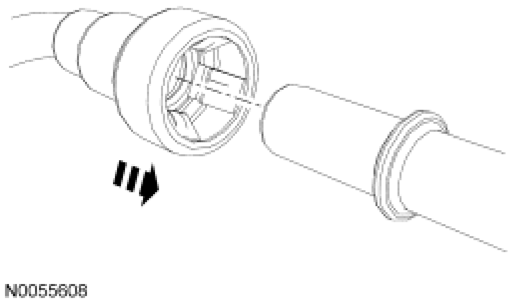


Fig. 45: Aligning & Pushing Spring Lock Coupling Onto Tube Until You Hear A Click
Courtesy of FORD MOTOR CO.

2. Pull on the coupling to make sure it is fully engaged.
3. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

2008 ENGINE

Fuel Tank & Lines - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Fuel tank capacity (All-Wheel Drive (AWD) vehicles)	62.46L (16.5 gal)
Fuel tank capacity (Front Wheel Drive (FWD) vehicles)	66.24L (17.5 gal)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Fuel level sensor access cover screws	2	-	18
Fuel Pump (FP) module access cover screws	2	-	18
Fuel tank filler pipe bracket nut	10	-	89
Fuel tank filler pipe heat shield nuts	9	-	80
Fuel tank filler pipe hose clamp	4	-	35
Fuel tank filler pipe retaining screws	2	-	18
Fuel tank strap bolts	40	30	-
Inertia Fuel Shutoff (IFS) switch mounting bolt	2	-	18
LH rear parking brake cable assembly bracket bolts	23	17	-
Lower crossover support brace nuts	76	56	-

DESCRIPTION AND OPERATION

FUEL TANK AND LINES

The fuel system consists of:

- a Mechanical Returnless Fuel System (MRFS).
- an All-Wheel Drive (AWD) saddle-type or Front Wheel Drive (FWD) L-shaped fuel tank.
- fuel, vapor and brake tubes in an integrated bundle assembly attached to the underside of the vehicle by retaining clips.
- a fuel tank filler pipe assembly, which cannot be modified in any way, that also contains a restrictor plate to permit only unleaded fuel to be pumped into the tank.
- a one-fourth turn-type fuel tank filler cap.
- an Inertia Fuel Shutoff (IFS) switch.
- a Fuel Pump (FP) module containing:
  - an electric FP, which provides pressurized fuel to the fuel rail.
  - a fuel level sender.
  - a check valve, which maintains system pressure after the FP is shut off.
  - a pressure relief valve for overpressure protection in the event of restricted fuel flow.
  - an in-tank fuel filter providing filtration to protect the fuel injectors from foreign material.
- an individual fuel level sensor, AWD vehicles only.

The FP is controlled by the PCM. Electrical power to the FP is provided through the IFS switch located under the right front door scuff plate.

DIAGNOSTIC TESTS

FUEL TANK AND LINES

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

FUEL TANK AND FILLER PIPE - EXPLODED VIEW

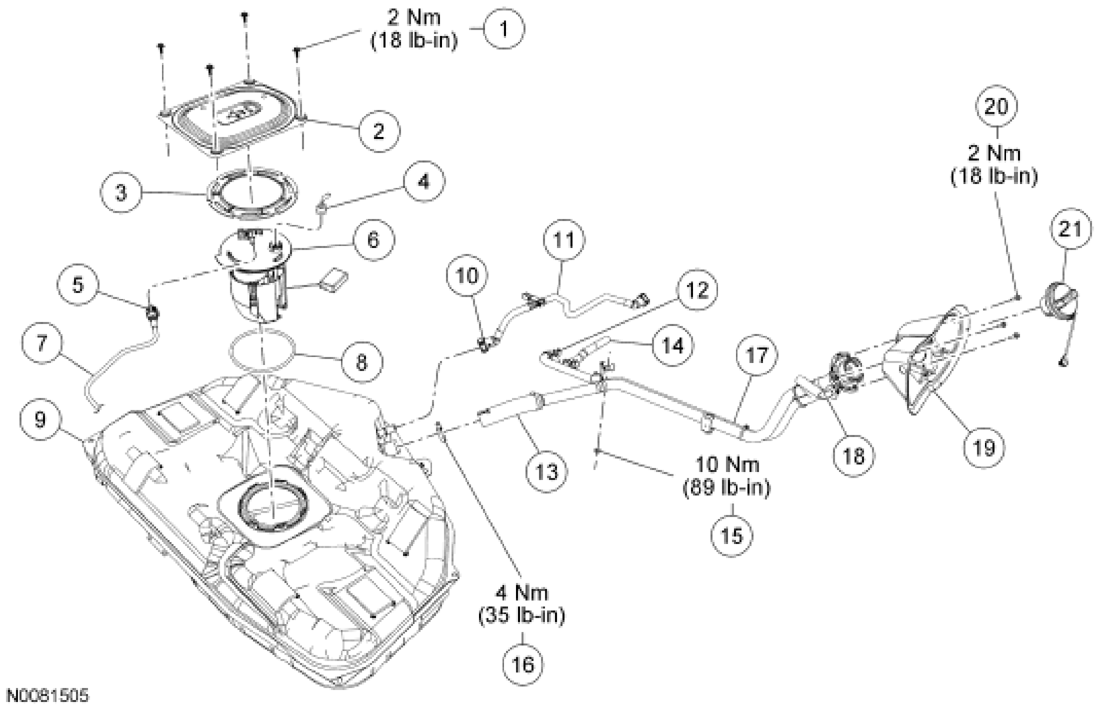


Fig. 1: Exploded View Of Fuel Tank & Filler Pipe With Torque Specifications - Front Wheel Drive (FWD) Vehicles (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W705909	Fuel Pump (FP) module access cover screw (4 required)
2	9C355	FP module access cover
3	9C385	FP module lock ring
4	14A464	FP module electrical connector
5	-	Fuel tube-to-FP module quick connect coupling (part of 9J279)
6	9H307	FP module
7	9J279	Fuel tube
8	9276	FP module O-ring seal
9	9K007	Fuel tank
10	-	Fuel vapor tube assembly-to-fuel tank quick connect coupling (part of 9A228)
11	9A228	Fuel vapor tube assembly
12	W710096	Swivel clip (2 required)
13	-	Fuel tank filler pipe hose (part of 9034)
14	-	Fresh air hose (part of 9034)
15	N806543	Fuel tank filler pipe bracket nut
16	W525937	Fuel tank filler pipe hose clamp

17	9034	Fuel tank filler pipe
18	-	Fresh air hose fitting (part of 9034)
19	5440354	Fuel tank filler pipe housing
20	W505154	Fuel tank filler pipe retaining screw (3 required)
21	9030	Fuel tank filler cap

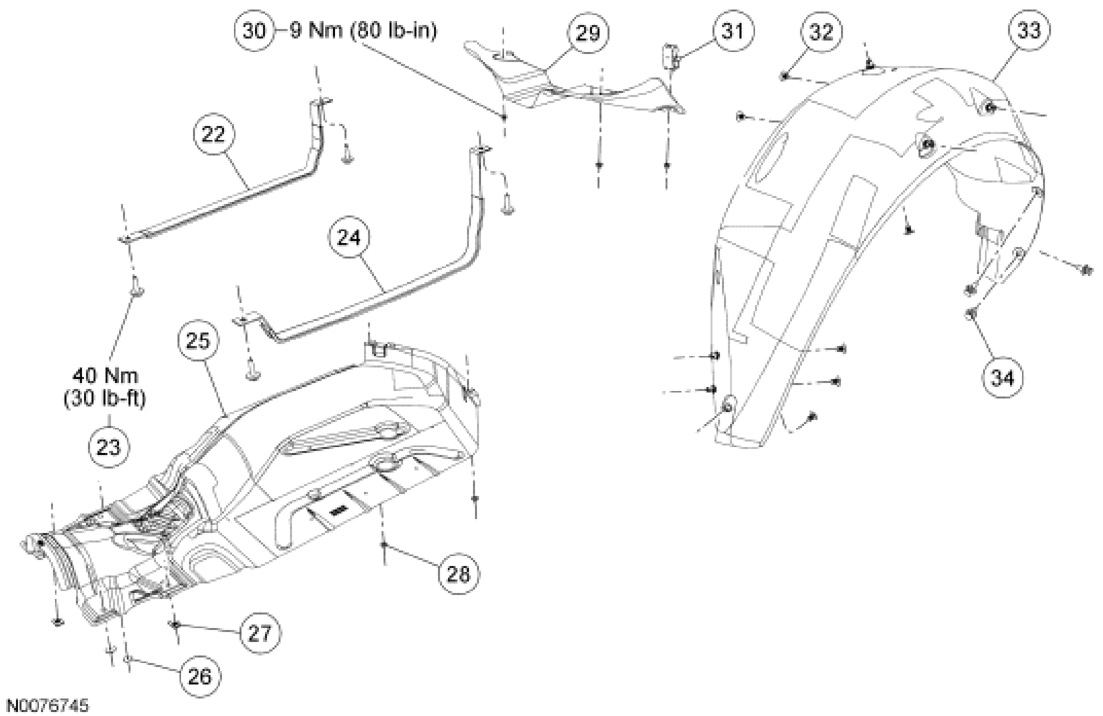


Fig. 2: Exploded View Of Fuel Tank & Filler Pipe With Torque Specifications - FWD Vehicles (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
22	9092	RH fuel tank strap
23	W505444	Fuel tank strap bolt (4 required)
24	9092	LH fuel tank strap
25	9A031	Fuel tank heat shield
26	W700430	Fuel tank heat shield nut (2 required)
27	9B328	Fuel tank heat shield clip (2 required)
28	W712232	Fuel tank heat shield nut (2 required)
29	5411268	Fuel tank filler pipe heat shield
30	W707142	Fuel tank filler pipe heat shield nut (3 required)
31	529330	Fuel tank filler pipe heat shield bracket
32	W701259	Splash shield pin-type retainer (6 required)
33	5428371	LH splash shield

34	N807379	Splash shield rivet (3 required)

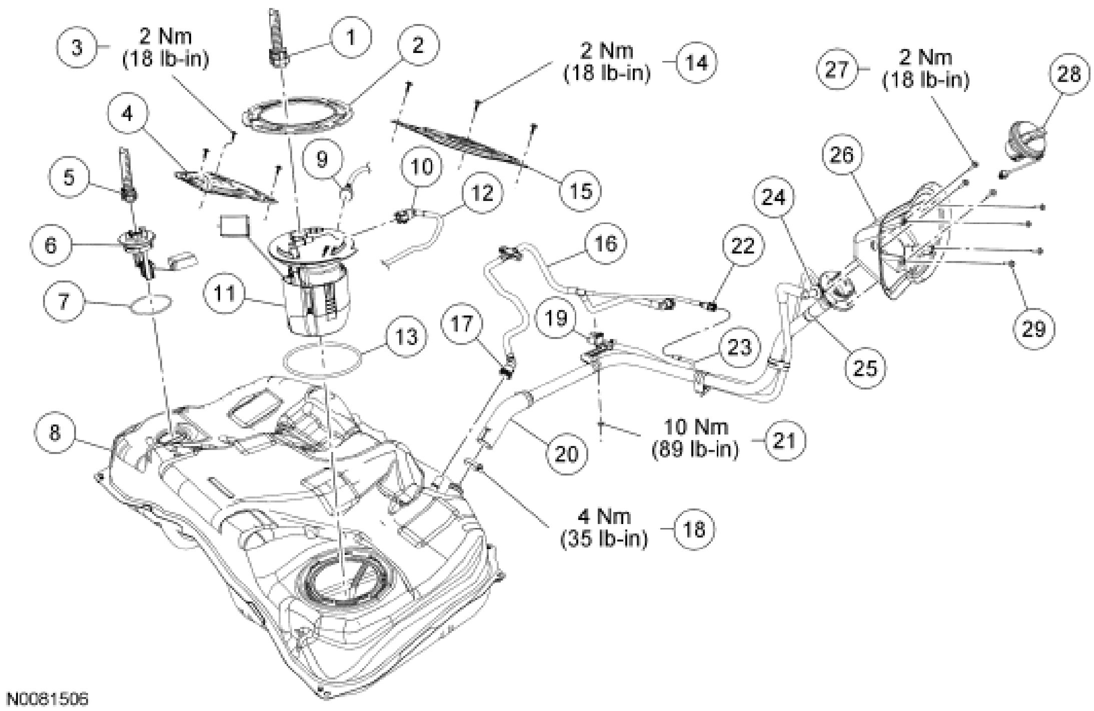


Fig. 3: Exploded View Of Fuel Tank & Filler Pipe With Torque Specifications - All-Wheel Drive (AWD) Vehicles (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Fuel Pump (FP) module electrical connector
2	9C385	FP module lock ring
3	W705909	Fuel level sensor access cover screw (3 required)
4	9C355	Fuel level sensor access cover
5	14A464	Fuel level sensor electrical connector
6	9275	Fuel level sensor
7	9276	Fuel level sensor O-ring seal
8	9K007	Fuel tank
9	-	Internal fuel tube-to-FP module quick connect coupling
10	-	Fuel tube-to-FP module quick connect coupling (part of 9J279)
11	9H307	FP module
12	9J279	Fuel tube
13	9276	FP module O-ring seal
14	W705909	FP module access cover screw (3 required)
15	9C355	FP module access cover
16	9A228	Fuel vapor tube assembly

17	-	Fuel vapor tube assembly-to-fuel tank quick connect coupling (part of 9A228)
18	W525937	Fuel tank filler pipe hose clamp
19	-	Fresh air hose (part of 9034)
20	-	Fuel tank filler pipe hose (part of 9034)
21	N806543	Fuel tank filler pipe bracket nut
22	-	Fuel vapor tube assembly-to-recirculation tube quick connect coupling (part of 9A228)
23	-	Recirculation tube (part of 9034)
24	-	Fresh air hose fitting (part of 9034)
25	9034	Fuel tank filler pipe
26	5440354	Fuel tank filler pipe housing
27	N802826	Fuel tank filler pipe retaining screw (3 required)
28	9030	Fuel tank filler cap
29	N802826	Fuel tank filler pipe housing screw (4 required)

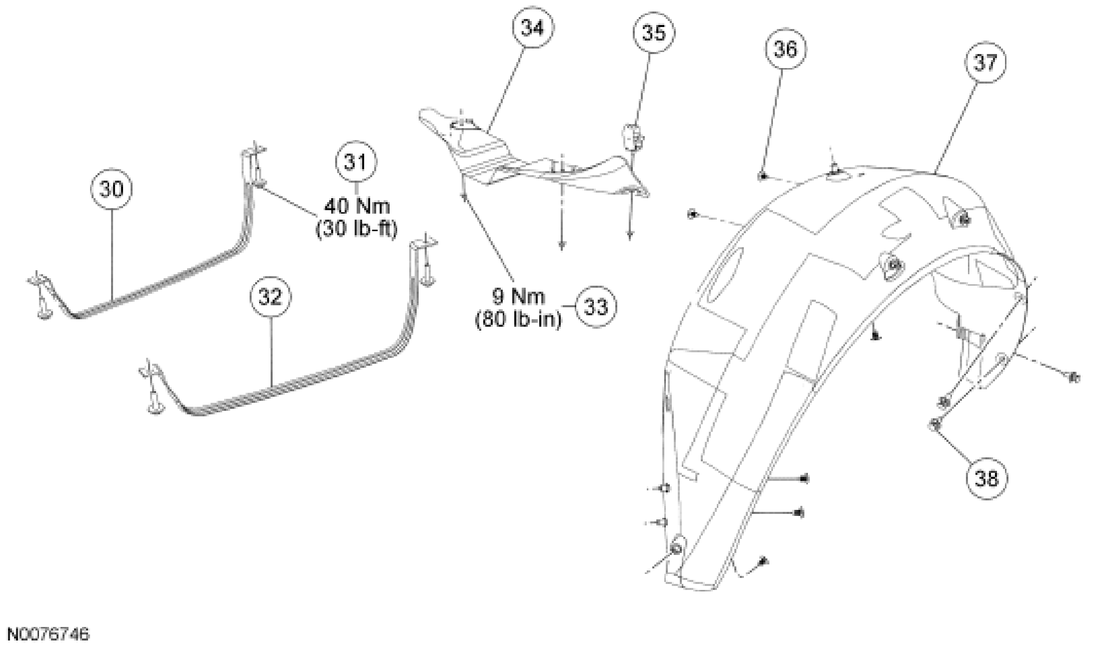


Fig. 4: Exploded View Of Fuel Tank & Filler Pipe With Torque Specifications - AWD Vehicles (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
30	9092	RH fuel tank strap
31	W505444	Fuel tank strap bolt (4 required)
32	9092	LH fuel tank strap
		Fuel tank filler pipe heat shield nut (3

33	W707142	required)
34	5411268	Fuel tank filler pipe heat shield
35	529330	Fuel tank filler pipe heat shield bracket
36	W701259	Splash shield pin-type retainer (6 required)
37	5428371	LH splash shield
38	N807379	Splash shield rivet (3 required)

1. For additional information, refer to the procedures.

FUEL TANK - FRONT WHEEL DRIVE (FWD)

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Drain the fuel tank. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

3. Remove the muffler and tailpipe. For additional information, refer to **EXHAUST SYSTEM** article.

NOTE: Some residual fuel may remain in the fuel tank filler pipe after draining the fuel tank. Carefully drain any remaining fuel into a suitable container.

4. Release the clamp and disconnect the fuel tank filler pipe hose from the fuel tank.
   - To install, tighten to 4 Nm (35 lb-in).
5. Disconnect the fuel vapor tube assembly-to-fuel tank quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
6. Remove the 4 nuts, 2 clips and the fuel tank heat shield.
7. Install a suitable lifting device below the fuel tank.
8. Remove the 4 bolts and the 2 fuel tank straps.
   - To install, tighten to 40 Nm (30 lb-ft).
9. Carefully lower and remove the fuel tank from the vehicle.
10. To install, reverse the removal procedure.

FUEL TANK - ALL WHEEL DRIVE (AWD)

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Always disconnect the battery ground cable at the battery when working**

on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

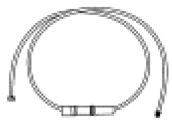
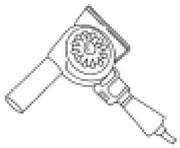
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Drain the fuel tank. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Remove the muffler and tailpipe. For additional information, refer to **EXHAUST SYSTEM** article.
4. Remove the driveshaft. For additional information, refer to **DRIVESHAFT** article.
5. Position a suitable lifting device under the fuel tank.
6. Remove the 4 bolts and the 2 fuel tank straps.
   - To install, tighten to 40 Nm (30 lb-ft).
7. Partially lower the fuel tank enough to access the fuel tank filler pipe hose clamp.

NOTE: **Some residual fuel may remain in the fuel tank filler pipe after draining the fuel tank. Carefully drain any remaining fuel into a suitable container.**

8. Release the clamp and disconnect the fuel tank filler pipe hose from the fuel tank.
   - To install, tighten to 4 Nm (35 lb-in).
9. Disconnect the fuel vapor tube assembly-to-fuel tank quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
10. Carefully lower and remove the fuel tank from the vehicle.
11. To install, reverse the removal procedure.

FUEL TANK FILLER PIPE - FRONT WHEEL DRIVE (FWD)

Special Tools

Illustration	Tool Name	Tool Number
 ST3022-A	Fuel Draining Hose	310-102
 ST1073-A	Fuel Storage Tanker	164-R3202 or equivalent

REMOVAL AND INSTALLATION

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

WARNING: Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.

WARNING: Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Carefully turn the fuel tank filler cap counterclockwise approximately one-fourth turn until the thread disengages and position aside.

NOTE: When removing the Fuel Draining Hose, the fitting on the end of the hose can become detained by the safety valve. Carefully remove the hose using a gentle agitating motion to avoid detaching the hose from the fitting.

NOTE: The Fuel Draining Hose must be inserted into the fuel tank filler pipe until the fitting on the end of the hose enters into the fuel tank, opening the safety valve.

4. Insert the Fuel Draining Hose into the fuel tank filler pipe.

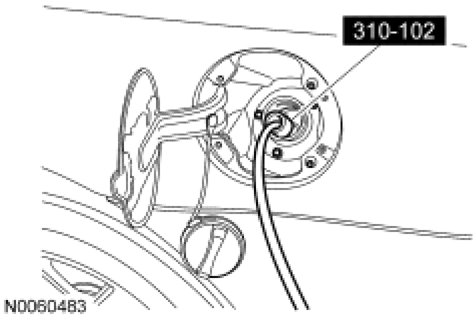


Fig. 5: Inserting Special Tool (310-102) Into Fuel Tank Filler Pipe
Courtesy of FORD MOTOR CO.

NOTE: **This step will remove approximately one-eighth tank of fuel from a completely full fuel tank and the majority of any residual fuel from the fuel tank filler pipe. Also, the fuel in the fuel tank will be below the fuel tank inlet for fuel tank filler pipe removal without fuel spillage.**

5. Attach the Fuel Storage Tanker to the Fuel Draining Hose and remove approximately one-eighth tank of fuel (from a completely full tank), lowering the fuel level below the fuel tank inlet.
6. Remove the 3 fuel tank filler pipe retaining screws.
7. Remove the LH rear wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
8. Remove the 3 rivets, 6 pin-type retainers and the LH wheel splash shield.
9. Remove the fresh air hose fitting from the fuel tank filler pipe housing.
10. Remove the 3 nuts and the fuel tank filler pipe heat shield.
    - To install, tighten to 9 Nm (80 lb-in).
11. Remove the fresh air hose from the dust separator.
12. Remove the fuel tank filler pipe bracket nut.
    - To install, tighten to 10 Nm (89 lb-in).
13. Release the 2 swivel clips.

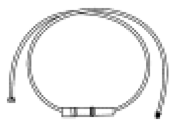
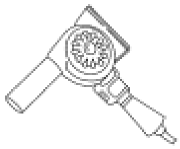
NOTE: **Some fuel may remain in the fuel tank filler pipe after the initial drain. Carefully drain any residual fuel into a suitable container.**

14. Release the clamp and disconnect the fuel tank filler pipe hose from the fuel tank.
    - To install, tighten to 4 Nm (35 lb-in).
15. Remove the fuel tank filler pipe assembly from the vehicle.
16. To install, reverse the removal procedure.

FUEL TANK FILLER PIPE - ALL WHEEL DRIVE (AWD)

Special Tools

Illustration	Tool Name	Tool Number

 ST3022-A	Fuel Draining Hose	310-102
 ST1073-A	Fuel Storage Tanker	164-R3202 or equivalent

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the muffler and tailpipe. For additional information, refer to **EXHAUST SYSTEM** article.

3. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
4. Carefully turn the fuel tank filler cap counterclockwise approximately one-fourth turn until the thread disengages and position aside.

NOTE: **When removing the Fuel Draining Hose, the fitting on the end of the hose can become detained by the safety valve. Carefully remove the hose using a gentle agitating motion to avoid detaching the hose from the fitting.**

NOTE: **The Fuel Draining Hose must be inserted into the fuel tank filler pipe until the fitting on the end of the hose enters into the fuel tank, opening the safety valve.**

5. Insert the Fuel Draining Hose into the fuel tank filler pipe.

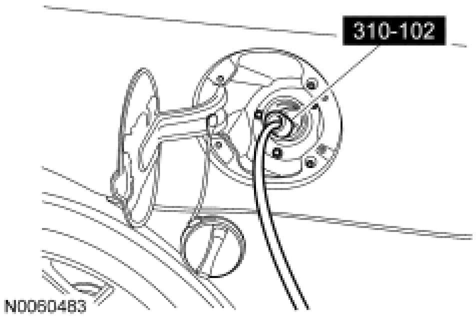


Fig. 6: Inserting Special Tool (310-102) Into Fuel Tank Filler Pipe
Courtesy of FORD MOTOR CO.

NOTE: **This step will remove approximately one-eighth tank of fuel from a completely full fuel tank and the majority of any residual fuel from the fuel tank filler pipe. Also, the fuel in the fuel tank will be below the fuel tank inlet for fuel tank filler pipe removal without fuel spillage.**

6. Attach the Fuel Storage Tanker to the Fuel Draining Hose and remove approximately one-eighth tank of fuel (from a completely full tank), lowering the fuel level below the fuel tank inlet.
7. Remove the 3 fuel tank filler pipe retaining screws.
8. Remove the LH rear wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
9. Remove the 3 rivets, 6 pin-type retainers and the LH wheel splash shield.
10. Remove the fresh air hose fitting from the fuel tank filler pipe housing.
11. Remove the 3 nuts and the fuel tank filler pipe heat shield.
    - To install, tighten to 9 Nm (80 lb-in).
12. Disconnect the fuel vapor tube assembly-to-recirculation tube quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
13. Remove the fresh air hose from the dust separator.

14. Remove the fuel tank filler pipe bracket retaining nut.
    - To install, tighten to 10 Nm (89 lb-in).
15. Release the 2 swivel clips.
16. Remove the 4 screws and the fuel tank filler pipe housing.
17. Loosen the LH fuel tank strap bolts.
    - To install, tighten to 40 Nm (30 lb-ft).
18. Partially lower the LH side of the fuel tank to allow access to the fuel tank filler hose and clamp.

NOTE: Some fuel may remain in the fuel tank filler pipe after the initial drain. Carefully drain any residual fuel into a suitable container.

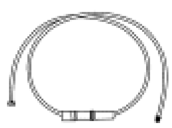
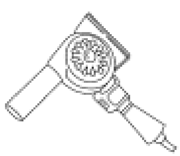
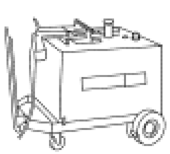
19. Release the clamp and disconnect the fuel tank filler pipe hose from the fuel tank.
    - To install, tighten to 4 Nm (35 lb-in).

NOTE: The fuel tank filler pipe assembly has to be directed upward and partially out of the fuel door opening, then it can be lowered and maneuvered out of the vehicle.

20. Remove the fuel tank filler pipe assembly from the vehicle.
21. To install, reverse the removal procedure.

FUEL PUMP MODULE

Special Tools

Illustration	Tool Name	Tool Number
 ST3022-A	Fuel Draining Hose	310-102
 ST1073-A	Fuel Storage Tanker	164-R3202 or equivalent
 ST1134A	Fuel Tank Sender Unit Wrench	310-123

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.**

All vehicles

1. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Carefully turn the fuel tank filler cap counterclockwise approximately one-fourth turn until the thread disengages and position aside.

NOTE: When removing the Fuel Draining Hose, the fitting on the end of the hose can become detained by the safety valve. Carefully remove the hose using a gentle agitating motion to avoid detaching the hose from the fitting.

NOTE: The Fuel Draining Hose must be inserted into the fuel tank filler pipe until the fitting on the end of the hose enters into the fuel tank, opening the safety valve.

4. Insert the Fuel Draining Hose into the fuel tank filler pipe.

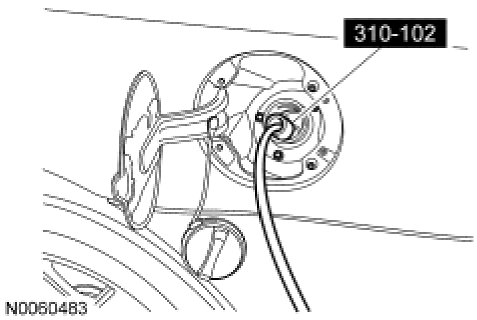


Fig. 7: Inserting Special Tool (310-102) Into Fuel Tank Filler Pipe
Courtesy of FORD MOTOR CO.

NOTE: This step will remove approximately one-eighth tank of fuel from a completely full fuel tank and the majority of any residual fuel from the fuel tank filler pipe. Also the fuel in the fuel tank will be below the Fuel Pump (FP) module mounting flange for FP module removal without fuel spillage.

5. Attach the Fuel Storage Tanker to the Fuel Draining Hose and remove approximately one-eighth tank of fuel (from a completely full tank), lowering the fuel level below the FP module mounting flange.
6. Remove the rear seat lower cushion. For additional information, refer to **SEATING** article.

Front Wheel Drive (FWD) vehicles

7. Remove the 4 screws and the FP module access cover.
   - To install, tighten to 2 Nm (18 lb-in).

All-Wheel Drive (AWD) vehicles

8. Remove the 3 screws and the FP module access cover.
   - To install, tighten to 2 Nm (18 lb-in).

All vehicles

9. Disconnect the FP module electrical connector.

10. Disconnect the fuel tube-to-FP module quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

NOTE:	**Place absorbent pads on the floor pan in the immediate area in case of fuel spills. Carefully remove the FP module from the vehicle to avoid fuel spillage inside the vehicle.**

NOTE:	**Make sure to install a new FP module O-ring seal and lock ring.**

11. Install the Fuel Tank Sender Unit Wrench. Remove and discard the FP module lock ring.

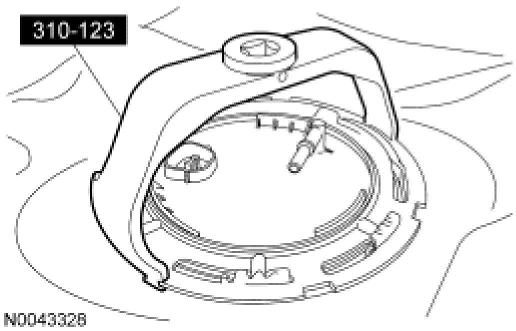


Fig. 8: Identifying Special Tool (310-123)
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

12. Carefully lift the FP module out of the fuel tank enough to access and release the internal fuel tube-to-FP module quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.

All vehicles

NOTE:	**The Fuel Pump (FP) module must be handled carefully to avoid damage to the float arm.**

NOTE:	**The FP module will have residual fuel remaining internally, drain into a suitable container.**

13. Completely remove the FP module from the fuel tank.

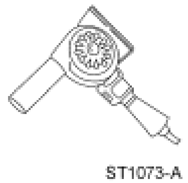
NOTE:	**Inspect the mating surfaces of the FP module flange and the fuel tank O-ring seal contact surfaces. Do not polish or adjust the O-ring seal contact area of the fuel tank flange or the fuel tank. Install a new FP module or fuel tank if the O-ring seal contact area is bent, scratched or corroded.**

NOTE: To install, apply clean engine oil to the new O-ring seal.

14. Remove and discard the FP module O-ring seal.
15. To install, reverse the removal procedure.
    - Make sure the alignment tab on the FP module and the fuel tank meet before tightening the FP module lock ring.

FUEL LEVEL SENSOR

Special Tools

Illustration	Tool Name	Tool Number
	Fuel Draining Hose	310-102
	Fuel Storage Tanker	164-R3202 or equivalent

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

REMOVAL AND INSTALLATION

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.**

1. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Carefully turn the fuel tank filler cap counterclockwise approximately one-fourth turn until the thread disengages and position aside.

NOTE: When removing the Fuel Draining Hose, the fitting on the end of the hose can become detained by the safety valve. Carefully remove the hose using a gentle agitating motion to avoid detaching the hose from the fitting.

NOTE: The Fuel Draining Hose must be inserted into the fuel tank filler pipe until the fitting on the end of the hose enters into the fuel tank, opening the safety valve.

4. Insert the Fuel Draining Hose into the fuel tank filler pipe.

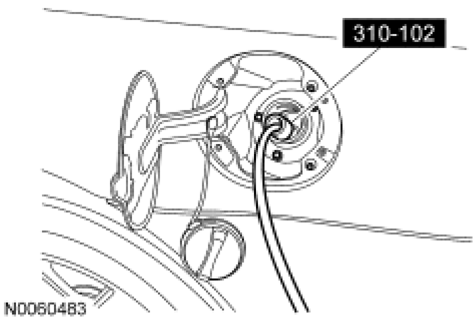


Fig. 9: Inserting Special Tool (310-102) Into Fuel Tank Filler Pipe
Courtesy of FORD MOTOR CO.

NOTE: This step will remove approximately one-eighth tank of the fuel from a completely full fuel tank and the majority of any residual fuel in the fuel tank filler pipe.

5. Attach the Fuel Storage Tanker to the Fuel Draining Hose and remove approximately one-eighth tank of fuel (from a completely full tank), lowering the fuel level below the fuel level sensor mounting flange.
6. Remove the rear seat lower cushion. For additional information, refer to **SEATING** article.
7. Remove the 3 screws and the fuel level sensor access cover.
   - To install, tighten to 2 Nm (18 lb-in).
8. Disconnect the fuel level sensor electrical connector.

NOTE: Place absorbent pads in the general work area in case of fuel spillage.

9. Release the lock tab, rotate the fuel level sensor counterclockwise approximately one-fourth turn and lift upward.

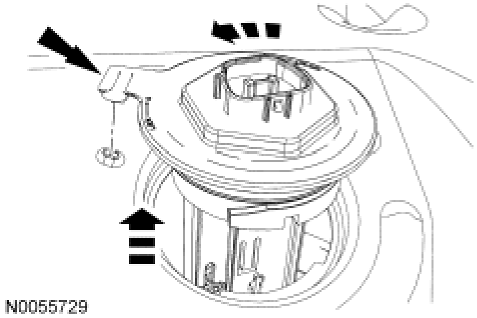


Fig. 10: Rotating Fuel Level Sensor Counterclockwise Approximately 1/4 Turn & Lift Upward
Courtesy of FORD MOTOR CO.

NOTE: The fuel level sensor must be handled carefully to avoid damage to the float arm.

NOTE: Carefully remove the fuel level sensor from the fuel tank to avoid fuel spillage inside the vehicle.

10. Carefully lift and remove the fuel level sensor from the fuel tank.

NOTE: Inspect the mating surfaces of the fuel level sensor flange and the fuel tank O-ring seal contact surfaces. Do not polish or adjust the O-ring seal contact area of the fuel tank flange or the fuel tank. Install a new fuel level sensor or fuel tank if the O-ring seal contact area is bent, scratched or corroded.

NOTE: Make sure to install a new fuel level sensor O-ring seal.

NOTE: To install, apply clean engine oil to the new O-ring seal.

11. Remove and discard the fuel level sensor O-ring seal.

12. To install, reverse the removal procedure.
    - Make sure the fuel level sensor locking tab is correctly positioned.

FUEL LINES - FRONT WHEEL DRIVE (FWD)

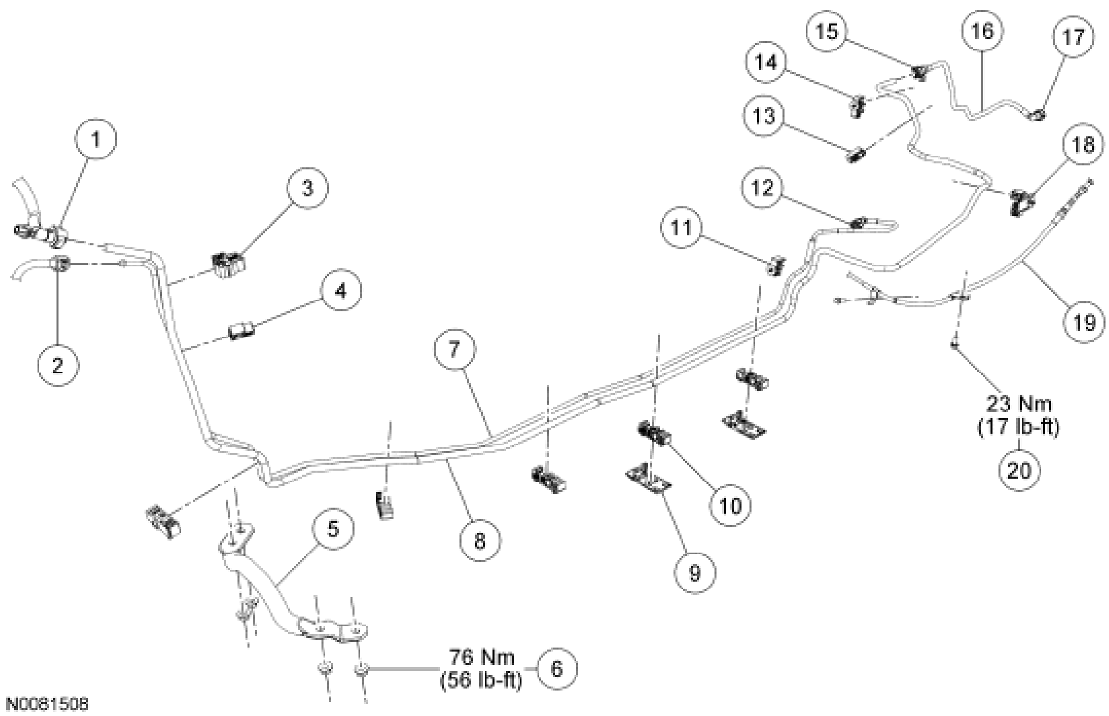


Fig. 11: Exploded View Of Fuel Lines With Torque Specifications - Front Wheel Drive (FWD)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Vapor jumper tube-to-vapor tube quick connect coupling (part of 9G279)
2	-	Fuel jumper tube-to-fuel tube quick connect coupling (part of 9J285)
3	-	Fuel tube bundle retaining clip (part of 9J279)
4	-	Fuel tube bundle retaining clip (part of 9J279)
5	5884	Lower crossover support brace
6	W580415	Lower crossover support brace nut (4 required)
7	9J279	Fuel tube
8	9J279	Vapor tube
9	-	Fuel tube bundle retaining clip shield (part of 9J279) (2 required)
10	-	Fuel tube bundle retaining clip (part of 9J279) (5 required)
11	-	Fuel tube bundle retaining clip (part of 9J279)
12	-	Fuel tube-to-Fuel Pump (FP) module quick connect coupling (part of 9J279)
13	-	Fuel tube bundle retaining clip (part of 9J279)
14	-	Fuel tube bundle retaining clip (part of 9J279)
15	-	Vapor jumper tube-to-vapor tube quick connect coupling (part of 9J279)

16	9J279	Vapor jumper tube
17	-	Vapor jumper tube-to-Evaporative Emission (EVAP) canister quick connect coupling (part of 9J279)
18	-	Fuel tube bundle retaining clip (part of 9J279)
19	2A815	LH rear parking brake cable assembly
20	W505263	Rear parking brake cable assembly bolt

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.**

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

3.0L and 3.5L vehicles

4. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article or **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.

NOTE:	**The lower cowl panel must be removed to access the fuel and vapor tube quick connect couplings.**

5. Remove the lower cowl panel. For additional information, refer to the Cowl Panel Grille procedure in **FRONT END BODY PANELS** article.

All vehicles

NOTE:	**Some residual fuel may remain in the fuel tubes after releasing the fuel system pressure. When disconnecting or removing any fuel tubes, carefully drain any residual fuel into a suitable container.**

6. Disconnect the fuel jumper tube-to-fuel tube quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
7. Disconnect the vapor jumper tube-to-vapor tube quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
8. Remove the 4 nuts and the lower crossover support brace.
   - To install, tighten to 76 Nm (56 lb-ft).
9. Remove the fuel tank. For additional information, refer to **Fuel Tank - Front Wheel Drive (FWD)**.

NOTE:	**The front parking brake cable bolt also retains a stone shield. Position the cable and shield aside.**

10. Remove the 2 bolts and position the LH rear parking brake cable assembly aside.
    - To install, tighten to 23 Nm (17 lb-ft).

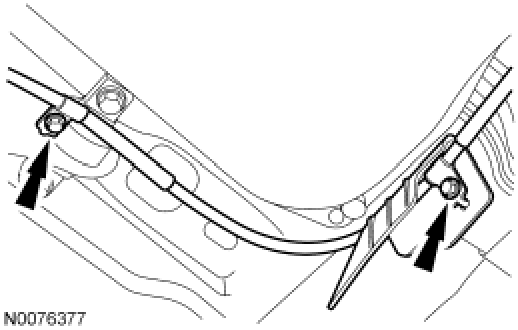


Fig. 12: Locating Bolts On LH Rear Parking Brake Cable Assembly Aside
Courtesy of FORD MOTOR CO.

11. Disconnect the vapor jumper tube-to-vapor tube quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
12. Release the fuel tube bundle retaining clips and remove the fuel and vapor tubes.
13. Disconnect the vapor jumper tube-to-Evaporative Emission (EVAP) canister quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
14. Release the fuel bundle retaining clips and remove the vapor jumper tube.
15. To install, reverse the removal procedure.

FUEL LINES - ALL WHEEL DRIVE (AWD)

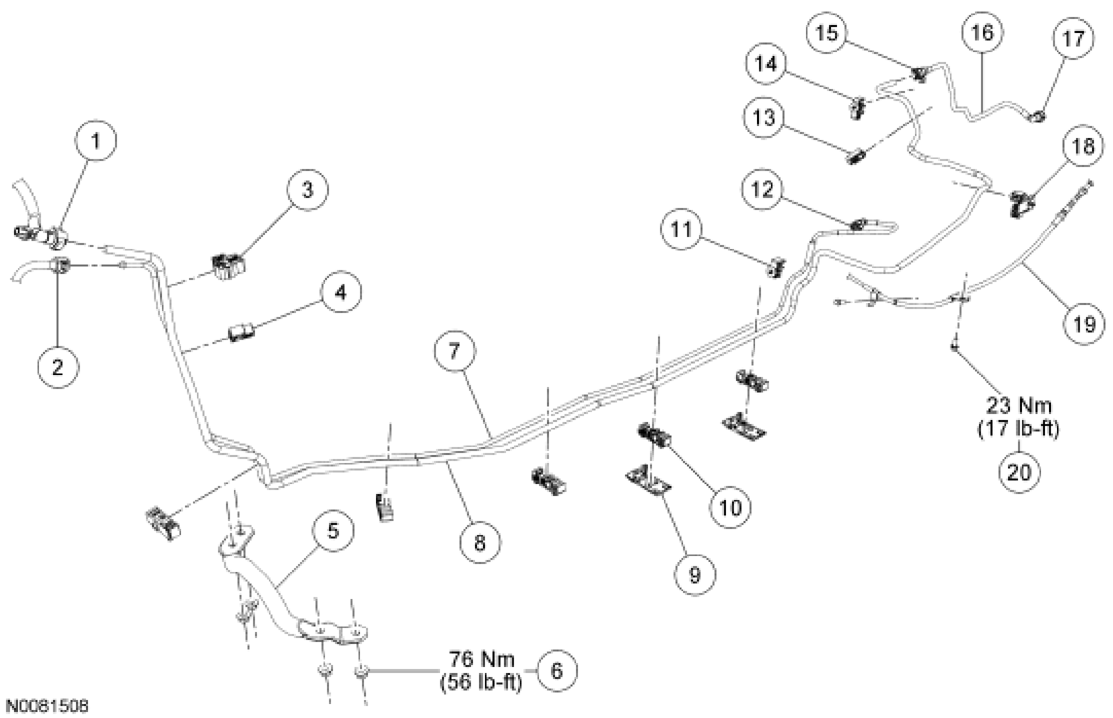


Fig. 13: Exploded View Of Fuel Lines With Torque Specifications - All Wheel Drive (AWD)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Vapor jumper tube-to-vapor tube quick connect coupling (part of 9G279)
2	-	Fuel jumper tube-to-fuel tube quick connect coupling (part of 9J285)
3	-	Fuel tube bundle retaining clip (part of 9J279)
4	-	Fuel tube bundle retaining clip (part of 9J279)
5	5884	Lower crossover support brace
6	W580415	Lower crossover support brace nut (4 required)
7	9J279	Fuel tube
8	9J279	Vapor tube
9	-	Fuel tube bundle retaining clip shield (part of 9J279) (2 required)
10	-	Fuel tube bundle retaining clip (part of 9J279) (5 required)

11	-	Fuel tube bundle retaining clip (part of 9J279)
12	-	Fuel tube-to-Fuel Pump (FP) module quick connect coupling (part of 9J279)
13	-	Fuel tube bundle retaining clip (part of 9J279)
14	-	Fuel tube bundle retaining clip (part of 9J279)
15	-	Vapor jumper tube-to-vapor tube quick connect coupling (part of 9J279)
16	9J279	Vapor jumper tube
17	-	Vapor jumper tube-to-Evaporative Emission (EVAP) canister quick connect coupling (part of 9J279)
18	-	Fuel tube bundle retaining clip (part of 9J279)
19	2A815	LH rear parking brake cable assembly
20	W505263	Rear parking brake cable assembly bolt

REMOVAL AND INSTALLATION

WARNING: **Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Always disconnect the battery ground cable at the battery when working on an evaporative emission (EVAP) system or fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.**

WARNING: **When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL**

INFORMATION article.

3. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
4. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article or **INTAKE AIR DISTRIBUTION AND FILTERING - 3.5L** article.

NOTE: The lower cowl panel must be removed to access the fuel and vapor tube quick connect couplings.

5. Remove the lower cowl panel. For additional information, refer to the Cowl Panel Grille procedure in **FRONT END BODY PANELS** article.

NOTE: Some residual fuel may remain in the fuel tubes after releasing the fuel system pressure. When disconnecting or removing any fuel tubes, carefully drain any residual fuel into a suitable container.

6. Disconnect the fuel jumper tube-to-fuel tube quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
7. Disconnect the vapor jumper tube-to-vapor tube quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
8. Remove the 4 nuts and the lower crossover support brace.
   - To install, tighten to 76 Nm (56 lb-ft).
9. Remove the fuel tank. For additional information, refer to **Fuel Tank - All Wheel Drive (AWD)**.

NOTE: The front parking brake cable bolt also retains a stone shield. Position the cable and shield aside.

10. Remove the 2 bolts and position the LH rear parking brake cable assembly aside.
    - To install, tighten to 23 Nm (17 lb-ft).

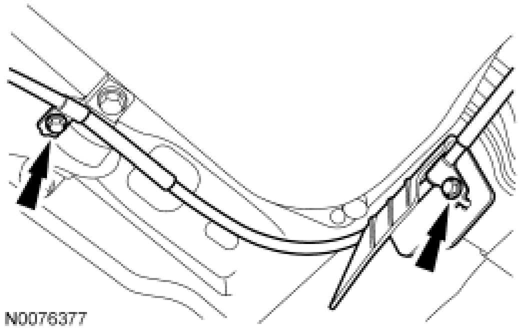


Fig. 14: Locating Bolts On LH Rear Parking Brake Cable Assembly Aside
Courtesy of FORD MOTOR CO.

11. Disconnect the vapor jumper tube-to-vapor tube quick connect coupling. For additional information, refer

to **FUEL SYSTEM - GENERAL INFORMATION** article.

12. Release the fuel tube bundle retaining clips and remove the fuel and vapor tubes.
13. Disconnect the vapor jumper tube-to-Evaporative Emission (EVAP) canister quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
14. Release the fuel bundle retaining clips and remove the vapor jumper tube.
15. To install, reverse the removal procedure.

INERTIA FUEL SHUTOFF (IFS) SWITCH

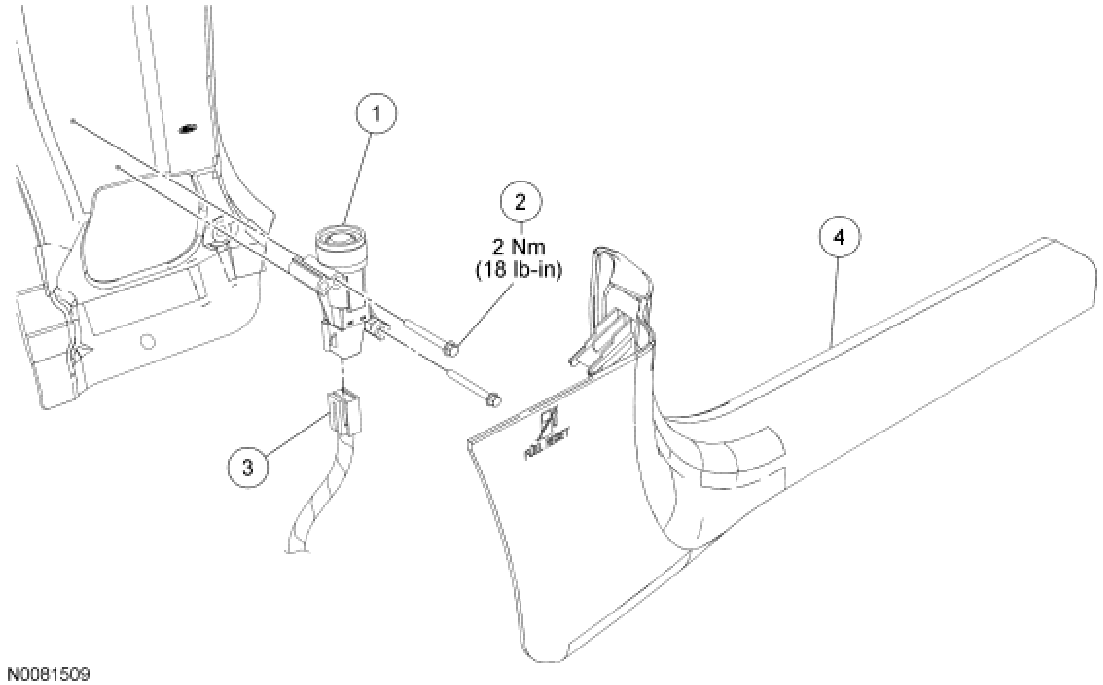


Fig. 15: Exploded View Of Inertia Fuel Shutoff (IFS) Switch With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9341	Inertia Fuel Shutoff (IFS) switch
2	W504148	IFS bolt (2 required)
3	14489A	IFS switch electrical connector
4	5413200	RH front door scuff plate

REMOVAL AND INSTALLATION

1. Remove the RH front door scuff plate.
2. Disconnect the Inertia Fuel Shutoff (IFS) switch electrical connector.

NOTE: Do not overtighten the fasteners or damage to the switch will occur.

3. Remove the 2 bolts and the IFS switch.
    - To install, tighten to 2 Nm (18 lb-in).
4. To install, reverse the removal procedure.

2008 ELECTRICAL

Fuse & Relay Information - Fusion, Milan & MKZ

IDENTIFICATION

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

BATTERY JUNCTION BOX (BJB)

NOTE: For component location, see ELECTRICAL COMPONENT LOCATOR article.

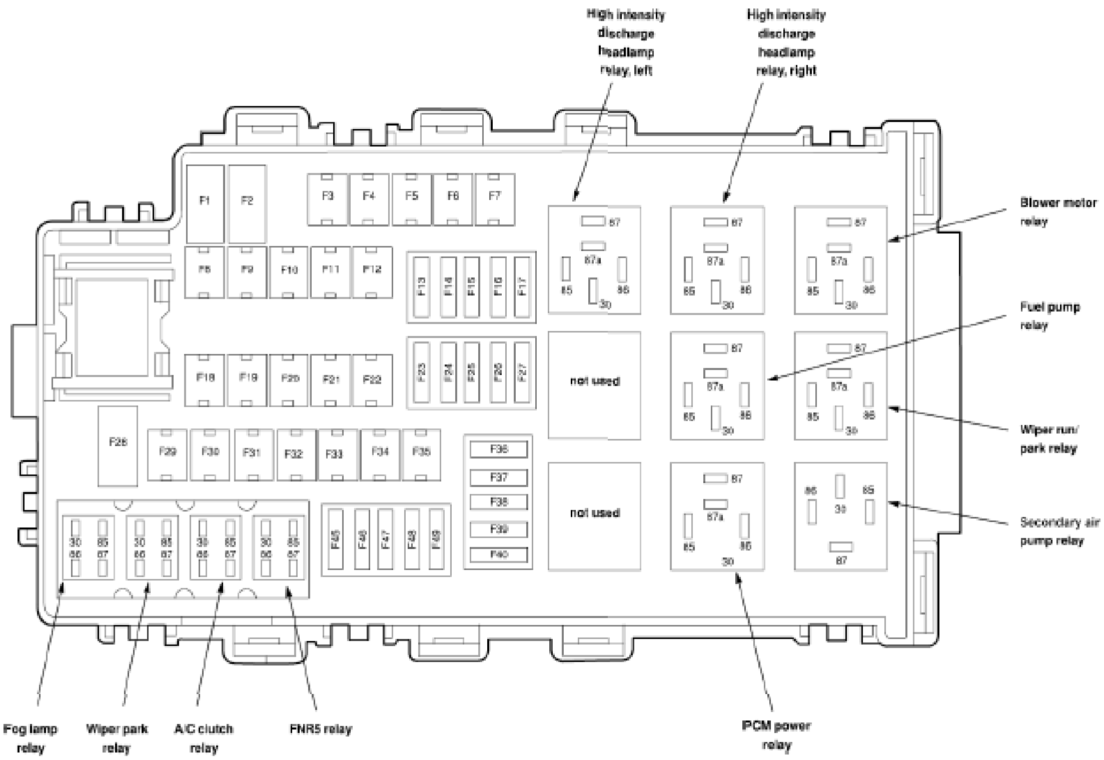


Fig. 1: Battery Junction Box Components

BATTERY JUNCTION BOX COMPONENTS LEGEND

Fuse	Amps	Circuits protected
F1	60	Smart Junction Box (SJB)-F12, F13, F14, F15, F16, F17, F18, F20, F21, Circuit breaker
F2	60	Park lamp relay, Horn relay, F10, F11, F3
F3	40	PCM power relay
F4	40	Blower motor relay

F5	-	not used
F6	40	Defrost relay
F7	40	Secondary Air pump relay
F8	40	ABS module
F9	20	Wiper park relay, wiper run/park relay
F10	30	ABS module
F11	(1)20 (2)30	Heated seat module, Heated/cooled seat module
F12	30	Heated/cooled seat module
F13	10	Accessory Protocol Interface Module (APIM)
F14	15	Ignition switch
F15	10	Driver seat module, Seat control switch, driver side front
F16	15	6 Speed transmission, FNR5 relay
F17	10	Generator
F18		not used
F19	40	Smart Junction Box (SJB) logic
F20	20	DSP Module
F21	20	DSP Module
F22	20	Power point
F23	10	Powertrain Control Module (PCM), EVAP canister vent, FNR5 Trans
F24	15	Fog lamp relay
F25	10	A/C clutch relay
F26	15	High intensity discharge headlamp relay, left
F27	15	High intensity discharge headlamp relay, right
F28	(1)60	Engine cooling fan motor
	(2)80	Engine cooling fan motor
F29	-	not used
F30	30	Fuel pump relay
F31	30	Seat control switch, passenger side
F32	30	Seat control switch, driver side, Driver seat module
F33	20	Roof opening panel module
F34	30	Power window motor, left front
F35	30	Power window motor, right front
F36	-	PCM diode
F37	-	not used
F38	-	not used
F39	-	not used
F40	-	not used
F45	5	Secondary Air pump
F46	15	Fuel injectors
F47	15	A/C clutch relay, Powertrain Control Module (PCM)

F48	15	Coil on plugs, Ignition transformer capacitor 1 and 2
F49	15	EVAP canister purge valve, Variable Camshaft Timing (VCT) valve 1 and 2, Heated Positive Crankcase Ventilation (PCV) valve, Heated Positive Crankcase Ventilation (PCV) fitting, Heated Oxygen Sensor (HO2S) #11, 12, 21, 22, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Brake pedal position switch

(1) Fusion/Milan

(2) MKZ

FUSIBLE LINKS A & B

NOTE: For component location, see ELECTRICAL COMPONENT LOCATOR article.

NOTE: Fusible links A and B are 12-gauge, Gray wires.

SMART JUNCTION BOX (SJB)

NOTE: For component location, see ELECTRICAL COMPONENT LOCATOR article.

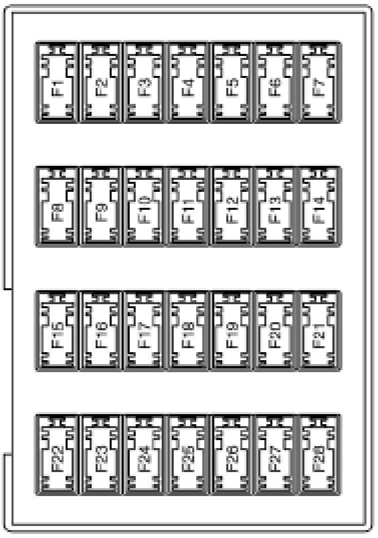


Fig. 2: Smart Junction Box Components (1 Of 2)

SMART JUNCTION BOX COMPONENTS LEGEND

Fuse	Amps	Circuits protected
F1	10	Reversing lamps, Electrochromatic inside mirror unit
F2	20	Horn
F3	15	Interior Lamps, Luggage compartment lamp, Glove box lamp, puddle lamps, Vanity mirror lamp
F4	15	Park lamps, Side lamps, License plate lamps
F5	-	not used

F6	-	not used
F7	-	not used
F8	30	Heated rear window
F9	10	Heated mirrors
F10	30	Starter motor, Powertrain Control Module (PCM)
F11	15	Headlamps - High beams
F12	7.5	Audio Control module, Roof opening panel, Power Door Locks, Power windows, Electrochromatic inside mirror unit
F13	7.5	Instrument cluster, Powertrain Control Module (PCM), Clock, Manual climate control module, Electronic Automatic Temperature Control (EATC) module, Dual Automatic Temperature Control (DATC) module, EVAP canister vent control solenoid, FNR5 transmission
F14	15	washer pump
F15	20	Cigar lighter
F16	15	Lock/unlock relays, Decklid release relay
F17	20	Subwoofer amplifier
F18	20	Audio control module, Data Link Connector (DLC)
F19	7.5	not used
F20	7.5	Power mirrors, Satellite Digital Audio Receiver System (SDARS) module, Driver Door Module
F21	7.5	Brake pedal position switch, Stoplamps, High mounted stoplamp
F22	7.5	Audio Control module, Powertrain Control Module (PCM)
F23	7.5	Wiper run/park relay, Instrument cluster, Blower motor relay
F24	7.5	Occupant Classification Sensor (OCS), Hazard/PAD/Traction switch
F25	7.5	Restraints control module
F26	7.5	Passive anti-theft transceiver module, Powertrain Control Module (PCM), 6 Speed transmission, Reversing lamps switch
F27	7.5	Instrument cluster, Manual climate control module, Electronic Automatic Temperature Control (EATC) module, Dual Automatic Temperature Control (DATC) module
F28	10	ABS module, Heated seat module, Compass module, 4x4 module
C/3	30	Power window motors, Accessory delay relay

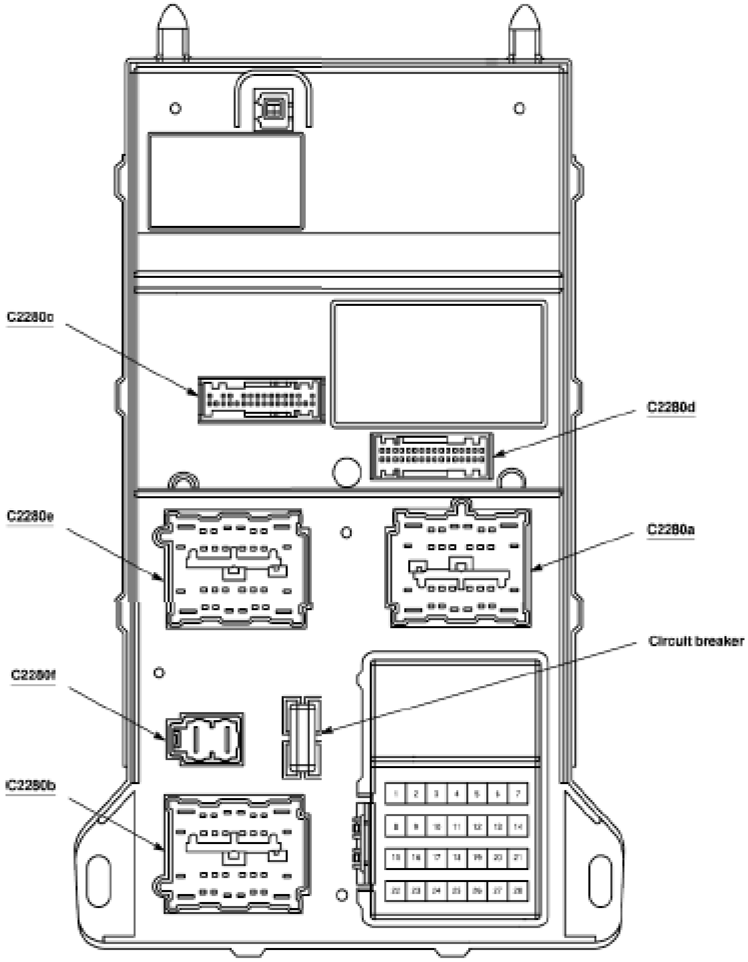


Fig. 3: Smart Junction Box Components (2 Of 2)

2008 ELECTRICAL

Generator & Regulator - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Generator, 2.3L	
Generator pulley ratio	2.45:1
Rating	90/150 amp (max) @ 1,800-6,000 generator RPM, approximately 700-2,500 engine RPM
Voltage regulator type	Electronic internal with generator
Generator, 3.0L	
Generator pulley ratio	2.60:1
Rating	90/150 amp (max) @ 1,800-6,000 generator RPM, approximately 500-2,000 engine RPM
Voltage regulator type	Electronic internal with generator
Generator, 3.5L	
Generator pulley ratio	2.66:1
Rating	90/150 amp (max) @ 1,800-6,000 generator RPM, approximately 500-2,000 engine RPM
Voltage regulator type	Electronic internal with generator

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Generator B+ terminal nut	12	9	-
Generator bolts	47	35	-
Generator lower air duct bolts (2.3L)	4	-	35
Generator nuts	47	35	-

Generator shield nuts (2.3L)	25	18	-
Generator stud bolts (2.3L)	24	18	-
Generator stud bolt (3.0L)	47	35	-
Generator stud (3.5L)	8	-	71
Generator upper air duct bolt (2.3L)	8	-	71
Generator upper air duct nuts (2.3L)	8	-	71

DESCRIPTION AND OPERATION

GENERATOR

The charging system consists of the following components:

- Generator
- Integral voltage regulator

The generator is belt-driven by the engine accessory drive system. The generator has an internal voltage regulator that is not replaced separately. The generator and voltage regulator are repaired as an assembly.

DIAGNOSTIC TESTS

GENERATOR

Refer to **CHARGING SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

GENERATOR - 2.3L

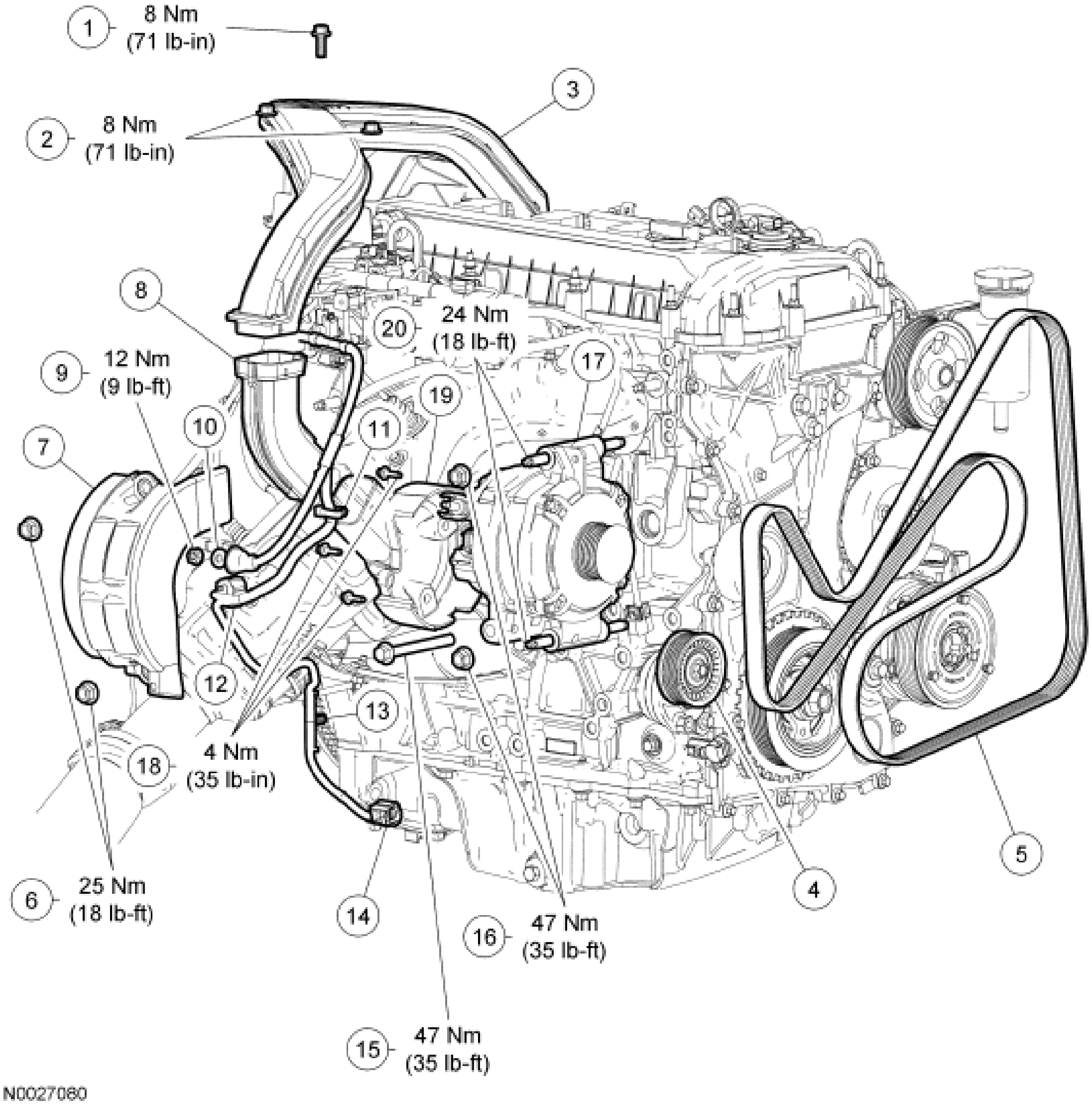


Fig. 1: Exploded View Of Generator With Torque Specifications - 2.3L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Generator upper air duct bolt
2	W707944	Generator upper air duct nuts (2 required)
3	10C392	Generator upper air duct
4	6A228	Front end accessory drive (FEAD) belt tensioner
5	6C301	FEAD belt
6	W520414	Generator shield nuts (2 required)
7	10A346	Generator shield
8	10C392	Generator intermediate air duct
9	W706414	Generator B+ terminal nut
10	-	Generator B+ terminal (part of 14B060)

11	-	Generator harness locator (part of 12B637)
12	-	Generator electrical connector (part of 12B637)
13	-	Generator harness locator (part of 12B637)
14	-	Crankshaft position (CKP) electrical connector (part of 12B637)
15	W500131	Generator bolt
16	W520414	Generator nuts (2 required)
17	10300	Generator
18	W503254	Generator lower air duct bolts (3 required)
19	10C392	Generator lower air duct
20	W712013	Generator stud bolts (2 required)

REMOVAL AND INSTALLATION

1. Disconnect the battery. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
2. Remove the bolt, the 2 nuts and the generator upper air duct.
    - To install, tighten to 8 Nm (71 lb-in).
3. Rotate the front end accessory drive (FEAD) belt tensioner clockwise and position the accessory drive belt aside.
4. Remove the 2 nuts and the generator shield.
    - To install, tighten to 25 Nm (18 lb-ft).
5. Press the locking tabs and remove the generator intermediate air duct.
6. Position the generator protective cover aside, remove the nut and position the generator B+ terminal aside.
    - To install, tighten to 12 Nm (9 lb-ft).
7. Release the generator harness locator from the generator.
8. Disconnect the generator electrical connector.
9. Release the generator harness locator from the engine block.
10. Disconnect the crankshaft position (CKP) sensor connector and position the generator harness aside.
11. Remove the bolt, 2 nuts and the generator.
    - To install, tighten to 47 Nm (35 lb-ft).
12. If necessary, remove the 3 bolts and the generator lower air duct.
    - To install, tighten to 4 Nm (35 lb-in).
13. If necessary, remove the 2 generator stud bolts.
    - To install, tighten to 24 Nm (18 lb-ft).
14. To install, reverse the removal procedure.

GENERATOR - 3.0L

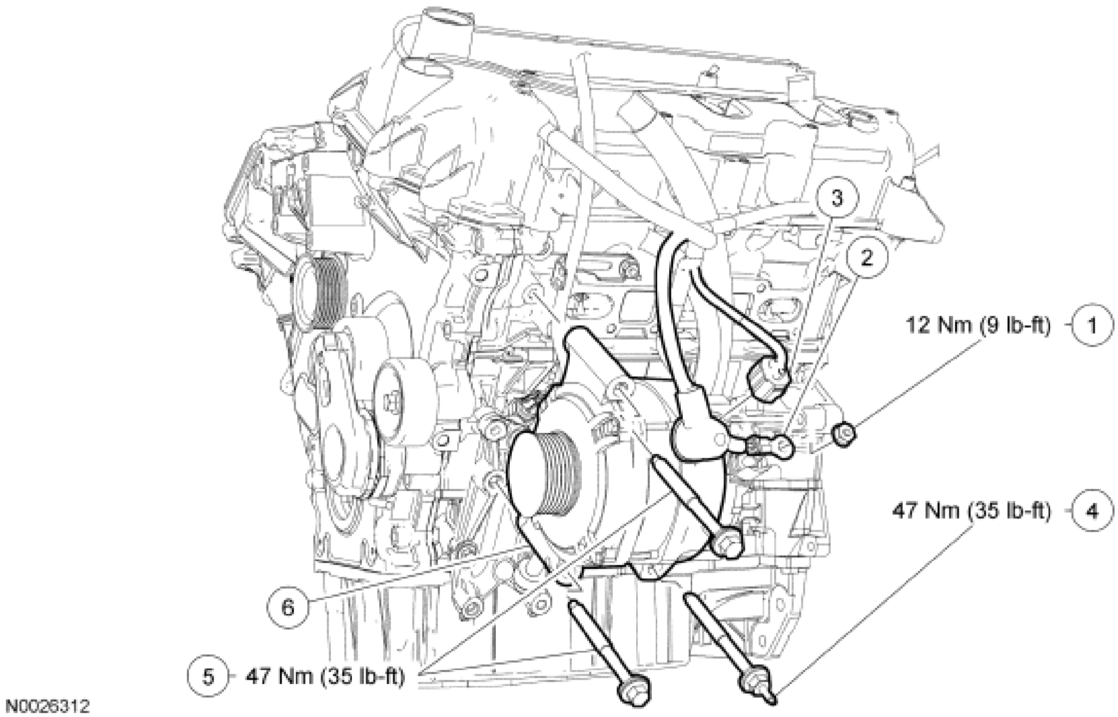


Fig. 2: Exploded View Of Generator With Torque Specifications - 3.0L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W706414	Generator B+ terminal nut
2	-	Generator B+ terminal (part of 14B060)
3	-	Generator electrical connector (part of 12B637)
4	W707669	Generator stud bolt
5	W704747	Generator bolts (2 required)
6	10300	Generator

REMOVAL AND INSTALLATION

1. Remove the A/C compressor. For additional information, refer to **CLIMATE CONTROL** article.
2. Disconnect the battery. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Position the generator protective cover aside, remove the nut and position the generator B+ terminal aside.
    - To install, tighten to 12 Nm (9 lb-ft).
4. Disconnect the generator electrical connector.
5. Remove the 3 bolts and the generator.
    - To install, tighten to 47 Nm (35 lb-ft).
6. To install, reverse the removal procedure.

GENERATOR - 3.5L

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

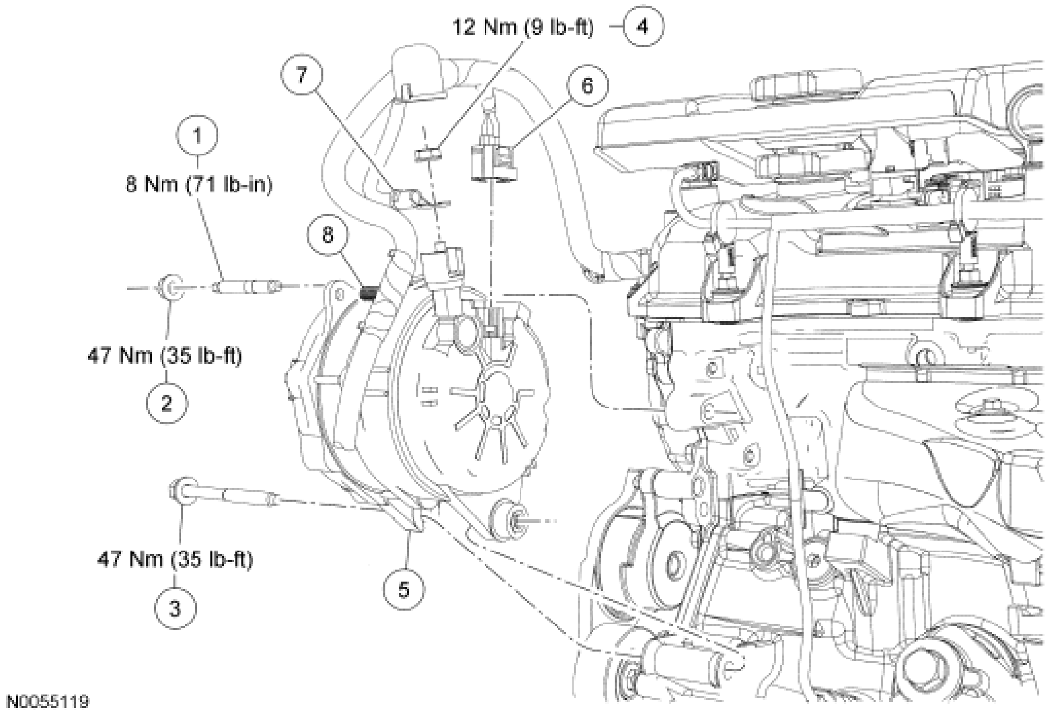


Fig. 3: Exploded View Of Generator Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W712609	Generator stud
2	W520414	Generator nut
3	W709986	Generator bolt
4	W706414	Generator B+ terminal nut
5	10300	Generator
6	-	Generator electrical connector (part of 14B060)
7	-	Generator B+ terminal (part of 14B060)
8	-	Pin-type retainer, wiring harness

REMOVAL AND INSTALLATION

1. Remove the A/C compressor. For additional information, refer to **CLIMATE CONTROL** article.
2. Disconnect the battery. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Position the generator protective cover aside, remove the nut and position the generator B+ terminal aside.
    - To install, tighten to 12 Nm (9 lb-ft).
4. Disconnect the generator electrical connector.
    - Detach the pin-type retainer and wiring harness.
5. Remove the oil filter.
    - Lubricate the oil filter seal with clean engine oil before installation.
6. Position the engine wiring harness aside.
7. Remove the generator stud nut.
    - To install, tighten to 47 Nm (35 lb-ft).
8. Remove the generator bolt and the generator.
9. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Glass, Frames & Mechanisms - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Dow Urethane Adhesive Betaseal® Express	-	-
Dow Urethane One Step Glass Primer Betaprime® 5500 / 5500A / 5500SA	-	-
Lacquer Touch-Up Paint (match color to exterior grid wire) PM-19500-XXXX	ESR-M2P100-C	-
Rear Window Defroster Repair PM-11 (US); CPM-11 (Canada)	-	-
Sika Urethane Adhesive Sika Tack ASAP	-	-
Sika Urethane Metal and Glass Primer Sika 206 G+P	-	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Terminal Kit - Back Glass 4F1Z-14421-AA	-

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Front and rear interior door handle bolt	8	71
Front door module bolts	11	97
Front window glass clamp bolts	6	53
Rear door module bolts	11	97
Rear window glass clamp bolt	6	53

DESCRIPTION AND OPERATION

GLASS, FRAMES AND MECHANISMS

NOTE: The smart junction box (SJB) may also be identified as the generic electronic module (GEM).

The glass, frames and mechanisms consist of:

- window regulators.
- door window regulator motors.
- front door glass top run.
- front door window glass.
- rear door window glass.
- rear window glass.
- rear fixed window glass.
- rear window regulator and motor - run and brackets.
- window control switches.
- accessory delay relay.
- SJB.
- windshield glass.
- heated rear window grid.
- heated rear window grid relay.

The glass, frames and mechanisms include:

- standard plastic and laminate safety glass.
- windshield glass which is bonded to the opening flange with a urethane sealant.
- standard power windows which include one-touch up, one-touch down and lock-out feature (left front only).

The window regulator control switch:

- is located on each door trim panel.
- may be used to manually raise or lower all windows from the left front window control switch or the individual side window from the corresponding individual door switch.
- for Fusion and Milan, can lock out passenger front and rear window control switches when the lock-out switch on the left front window control switch is turned on.
- for MKZ, can lock out rear window control switches when the lock-out switch on the left front window control switch is turned on.
- can manually lower the driver side window when the left front window control switch is pressed and held in the DOWN position.

- can automatically lower the driver side window when the left front window control switch is momentarily pressed to the DOWN position and released.

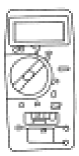
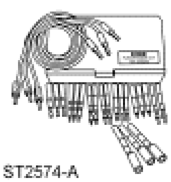
Global Open - MKZ Only

The SJB sends a signal on the global open circuit, to both front door window motors and the roof opening panel motor, to open or close the windows based on a signal received from the remote keyless entry (RKE) transmitter. If the accessory delay relay is active, the global open feature will not operate.

DIAGNOSTIC TESTS

GLASS, FRAMES AND MECHANISMS

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2574-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operation

LH and RH Front Power Window Control - MKZ

The LH and RH front window motors contain integral electronics which must be initialized whenever a new window motor has been installed. Initialization is required to learn both the full up and full down positions of the glass as it travels through the glass channel. Once initialized, obstacle detection is enabled. When mechanical repairs have been carried out on either front window regulator or glass run, the applicable front window motor must be de-initialized, and then initialized. Both the LH and RH front window control switches send 3 separate signals to the front window motors: up, down and auto. The front window control switches provide a 12-volt signal to the front window motor to request an up or down operation. When auto up or auto down is requested, the front window control switches provide a 12-volt signal on the up or down line and a ground signal on the auto line simultaneously. The up, down and auto feeds to the front window motors are all low current.

The LH and RH front window motors operate with the ignition switch in the RUN or ACCESSORY positions, or when the accessory delay relay is active. The high current required to move the front windows are supplied through the B+ and motor ground input.

When the LH or RH front window motor is operating in auto up or auto down mode, movement of the front

window can be stopped by pressing the switch to any position (UP, DOWN, AUTO up, AUTO down). The front window control switches must be released before the window will move again.

The LH and RH front window motors have a security override feature. If an obstacle has been detected in the window opening as the window glass is moving upward, the window motor will automatically reverse direction and move the glass toward the fully open position (in both manual up and one-touch up modes). This is known as "bounce-back". Once the window motor stops the glass at its bounce-back position, and within 2 seconds the switch is released then held in the AUTO up position, the window motor will move the glass up with no bounce-back protection (security override). If the switch is released before the window glass reaches the fully closed position, the window motor will stop with bounce-back automatically enabled for the next window up movement. If the ignition switch is turned to OFF or START (without delayed accessory), the window motor will stop. The only exception is when an obstacle is detected in the window opening while delayed accessory power is not present. In this case the window motor will bounce back, then stop. Ice, contaminant buildup and environmentally induced tight spots in the front window seals are all possible conditions that will activate the security override feature. If an obstruction occurs between 4 mm (0.15 in) and 200 mm (7.87 in) of window opening, the bounce-back position will be 250 mm (9.84 in) of window opening. If an obstruction occurs at a position greater than 200 mm (7.87 in) of window opening, the bounce-back position will be 50 mm (1.96 in) below where the obstruction occurred.

The LH and RH front window control switches have illumination and illumination ground inputs, which are used to illuminate the switch when the headlamp switch is turned to the PARK or ON position (the AUTOLAMP position may also energize this input). These switch inputs do not directly affect operation of the front windows. The front window control switches use the delayed accessory power input, which is transferred to the up or down outputs when the corresponding switch contact is closed. The front window control switches are grounded to the chassis through the main switch ground input, which is transferred to the auto output when the corresponding front window control switch contact is closed. If the delayed accessory feed to the front window control switch is missing, the window will not function. If the main ground signal is missing, the auto functions will be inoperative and the window will also be inoperative.

If there is an open in the LH or RH front window control switch or the associated wiring, the related function will become inoperative. If the up contact of the switch or the associated wiring develops an open circuit, the front window will only operate in the down direction, or in the one-touch down mode. If the down contact of the switch or the associated wiring develops an open circuit, the window will only operate in the up direction or in the one-touch up mode. If the auto contact of the switch or the associated wiring develops an open circuit, the window will only move proportionally up or down.

A new LH or RH front window motor will not operate in one-touch up mode and the bounce-back feature will be disabled prior to initialization. If the switch is actuated to the AUTO up or AUTO down position and released, window movement will stop when the up or down contact in the front window control switch is released. If the front window motor is removed from the window regulator drum housing, or if a new front window motor is installed, it must be initialized. Refer to **Window Motor Initialization**.

LH Front Power Window Control - Fusion and Milan

The one-touch down feature is controlled by the driver window control switch.

Passenger Window Operation

Passenger windows may be raised or lowered using the LH front window control switch or the corresponding passenger window control switch. Passenger window control switches receive power when the accessory delay relay is active and the LH front window lock switch is in the unlock position. For Fusion and Milan, when the LH front window lock switch is in the LOCK position, all passenger windows will not operate. For MKZ, when the LH front window lock switch is in the LOCK position, only the rear passenger windows will not operate.

Global Open

NOTE: The smart junction box (SJB) may also be identified as the generic electronic module (GEM).

When the unlock button of the remote keyless entry (RKE) transmitter is held for 2 seconds, the global open activates. The SJB sends a signal to activate the one-touch down operation of both front windows. The global open feature does not operate if the delay accessory is active.

Delayed Accessory Power

The SJB activates the accessory delay relay whenever the ignition switch is in the RUN or the ACCESSORY position, or when the ignition switch is changed from RUN or ACCESSORY to the off/lock position and the LH and RH front doors are closed. When energized, the accessory delay relay supplies voltage to the power window system.

The SJB will deactivate the delayed accessory feature when:

- the LF door is ajar and the ignition switch is in the off/lock or key-out position.
- the RF door is ajar and the ignition switch is in the off/lock or key-out position.
- ten minutes have elapsed since the ignition switch was changed from ACC or RUN to the off/lock position.

Rear Window Defrost

The SJB controls power to the heated backlight by controlling the state of the heated backlight relay (integral to the SJB module). When the rear window defrost switch is pressed, the SJB will activate the heated backlight relay. When the heated backlight relay is active, the heated backlight will be energized.

The SJB will deactivate the heated backlight relay when one of the following conditions is met:

- The rear window defrost switch is pressed when the feature is active
- Ignition switch state is changed from RUN to OFF/LOCK
- The 17-minute timer completes

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical

• Door window regulator and motor
• Door glass run
• Door window glass
	• Loose, corroded connectors
	• Circuitry
	• Window control switch
	• Battery junction box (BJB) fuses:
	  ○ 1 (60A)
	  ○ 6 (40A)
	  ○ 34 (30A)
	  ○ 35 (30A)
	• Smart junction box (SJB) fuses:
	  ○ 3 (15A)
	  ○ 8 (30A)
	  ○ 12 (7.5A) (MKZ only)
	• Accessory delay relay
	• Circuit breaker
	• Heated backlight grid

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the

smart junction box (SJB).

7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to Smart Junction Box (SJB) DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1345	Heated Rear Window Input Circuit Short to Ground	Go to **Pinpoint Test J**.
B2947	Global Opening/Closing Circuit Open	Go to **Pinpoint Test I**.
B2949	Global Opening/Closing Circuit Short to Battery	Go to **Pinpoint Test I**.
All Other DTCs	-	REFER to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB) module	• Circuitry • SJB	• REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.
• All power windows are inoperative - MKZ	• Fuse • Circuitry • Window control switch • SJB	• Go to **Pinpoint Test A**.
• All power windows are inoperative - Fusion, Milan	• Circuitry • Window control switch • SJB	• Go to **Pinpoint Test B**.
• A single power window is inoperative - MKZ, LH	• Fuse • Circuitry • LH front window control switch	• Go to **Pinpoint Test C**.

front	• LF power window motor • SJB	
• A single power window is inoperative - Fusion, Milan, LH front	• Circuitry • LH front window control switch • LF power window motor • SJB	• Go to **Pinpoint Test D**.
• A single power window is inoperative - MKZ, RH front	• Fuse • Circuitry • LH or RH front window control switch • RH front power window motor	• Go to **Pinpoint Test E**.
• A single power window is inoperative - MKZ, LH or RH rear	• Fuse • Circuitry • LH or RH front window control switch • LH or RH rear power window motor	• Go to **Pinpoint Test F**.
• A single power window is inoperative - Fusion, Milan, RH front, LH or RH rear	• Circuitry • LH or RH front window control switch • LH or RH rear window control switch • RH front, LH or RH rear power window motor	• Go to **Pinpoint Test G**.
• The one-touch up/down feature is inoperative -	• Circuitry • LH or RH front power window motor • LH or RH front window control switch	• Go to **Pinpoint Test H**.

MKZ, LH or RH front	• LH or RH front motor not initialized • Battery power was lost while LH or RH front window was operating	
• The one-touch down feature is inoperative - Fusion, Milan, LH front	• LH front window control switch	• INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.
• The global open function is inoperative/does not operate correctly - MKZ	• Remote keyless entry (RKE) transmitters • Circuitry • SJB • Door window motors not initialized	• Go to **Pinpoint Test I**.
• The defrost system is inoperative - MKZ	• Fuse(s) • Circuitry • Rear window defrost grid • HVAC • Antenna module • SJB • Battery junction box (BJB)	• Go to **Pinpoint Test J**.
• The defrost system will not shut off automatically - MKZ	• Circuitry • SJB • HVAC	• Go to **Pinpoint Test K**.
• The delayed accessory is inoperative/does not operate correctly	• Fuse • Circuitry • SJB circuit breaker • SJB	• Go to **Pinpoint Test L**.
• The defrost system is inoperative - Fusion, Milan	• Fuse(s) • Circuitry • Rear window defrost grid • HVAC • SJB	• Go to **Pinpoint Test M**.

	• BJB	
• The defrost system will not shut off automatically - Fusion, Milan	• Circuitry • SJB • HVAC	• Go to **Pinpoint Test N**.

Pinpoint Tests

Pinpoint Test A: All Power Windows are Inoperative - MKZ

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Windows for schematic and connector information.

Normal Operation

Under normal operation, the LH front power window control switch receives power through circuits CBP02 (GN) and CPW30 (GY/YE), which is the accessory delay relay output from the smart junction box (SJB). The accessory delay relay is integral to the SJB module. The LH and RH front power window motors each have their own separate power feeds and grounds and do not share any circuits with the LH or RH rear power window motors, except through the master window control switch.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- LH front window control switch
- SJB

PINPOINT TEST A: ALL POWER WINDOWS ARE INOPERATIVE - MKZ

A1 CHECK CIRCUITS CBP02 (GN) AND CPW30 (GY/YE) FOR VOLTAGE

- Disconnect: LH Front Window Control Switch C535A
- Disconnect: LH Front Window Control Switch C535B
- Key in ON position.

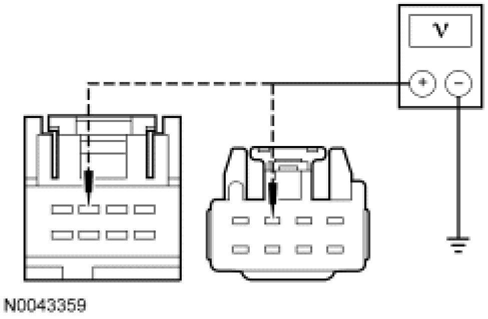


Fig. 1: Checking Circuit CBP02 (GN) And CPW30 (GY/YE) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH front window control switch C535A-3, circuit CBP02 (GN), harness side and ground; and between LH front window control switch C535B-3, circuit CPW30 (GY/YE), harness side and ground.
- **Is the voltage greater than 10 volts for both measurements?**

  YES : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : VERIFY SJB fuse 12 (7.5A) is OK. If OK, go to A2. If not OK, REFER to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ to identify the possible causes of the circuit short.

A2 CHECK CIRCUITS CBP02 (GN) AND CPW30 (GY/YE) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280E

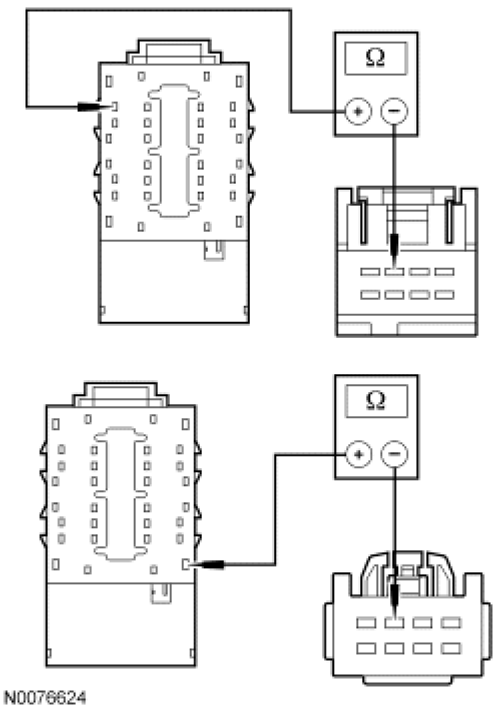


Fig. 2: Checking Circuit CBP02 (GN) And CPW30 (GY/YE) For Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window control switch C535A-3, circuit CBP02 (GN), harness side and SJB C2280E-25, circuit CBP02 (GN), harness side; and between LH front window control switch C535B-3, circuit CPW30 (GY/YE), harness side and SJB C2280E-4, circuit CPW30 (GY/YE), harness side.
- **Are the resistances less than 5 ohms for both measurements?**

YES : Go to **Pinpoint Test L** to diagnose the accessory delay relay circuit.

NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test B: All Power Windows are Inoperative - Fusion, Milan

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Windows for schematic and connector information.

Normal Operation

Under normal operation, the LH front power window control switch receives power through circuit CPW30 (GY/YE), which is the accessory delay relay output from the smart junction box (SJB). The accessory delay relay is integral to the SJB module. The LH front power window control switch is grounded to the chassis through circuit CD126 (BK/WH).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- LH front window control switch
- SJB

PINPOINT TEST B: ALL POWER WINDOWS ARE INOPERATIVE - FUSION, MILAN

B1 CHECK CIRCUIT CPW30 (GY/YE) FOR VOLTAGE

- Disconnect: LH Front Window Control Switch C504A
- Key in ON position.

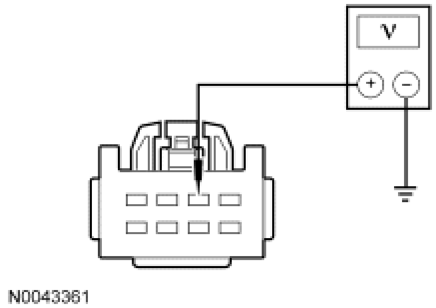


Fig. 3: Checking Circuit CPW30 (GY/YE) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH front window control switch C504A-2, circuit CPW30 (GY/YE), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to B3.

  NO : Go to B2.

B2 CHECK CIRCUIT CPW30 (GY/YE) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280E

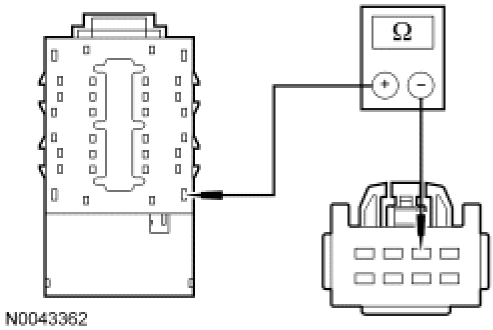


Fig. 4: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window control switch C504A-2, circuit CPW30 (GY/YE), harness side and SJB C2280E-4, circuit CPW30 (GY/YE), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to **Pinpoint Test L** to diagnose the accessory delay relay circuit.

  NO : REPAIR the circuit. TEST the system for normal operation.

B3 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

- Key in OFF position.
- Disconnect: LH Front Window Control Switch C504B

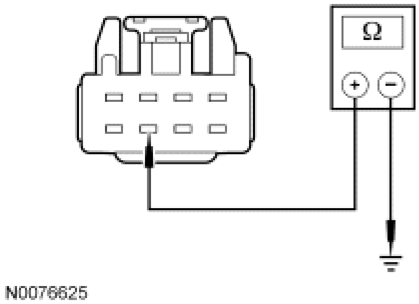


Fig. 5: Checking Circuit GD126 (BK/WH) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window control switch C504B-7, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test C: A Single Power Window is Inoperative - MKZ, LH Front

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Windows for schematic and connector information.

NOTE:	**A new LH front power window motor will not operate in one-touch up or one-touch down mode until initialized. Refer to Window Motor Initialization.**

NOTE:	**The LH front power window motor must be initialized whenever a new motor is installed.**

NOTE:	**The LH front power window motor must be de-initialized, then initialized whenever the LH front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.**

Normal Operation

Under normal operation, the LH front power window control switch receives power from the delay accessory relay through circuit CBP02 (GN). The LH window motor receives battery power through circuit SBB34 (YE/RD) at all times and ground through circuit GD126 (BK/WH). When the LH front window control switch is operated in the UP position, the LH front window motor receives a voltage signal through circuit CPW11 (BU/GY). When the LH front window control switch is operated in the DOWN position, the LH front window motor receives a voltage signal through circuit CPW10 (YE/VT). When the LH front window motor receives a ground signal on circuit CPW29 (VT/GY), the LH front window motor will enter one-touch up/down mode.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- LH front window motor
- LH front window control switch
- LH front window motor not initialized

PINPOINT TEST C: A SINGLE POWER WINDOW IS INOPERATIVE - MKZ, LH FRONT

C1 CHECK THE POWER TO THE WINDOW MOTOR

- Key in OFF position.
- Disconnect: LH Front Window Motor C540

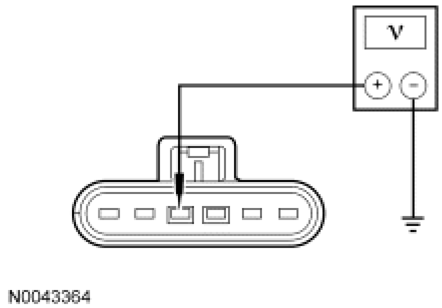


Fig. 6: Checking Power To Window Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH front window motor C540-4, circuit SBB34 (YE/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to C2.

  NO : VERIFY battery junction box (BJB) fuse 34 (30A) is OK. If OK, REPAIR the circuit. If not OK, REFER to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ to identify the possible causes of the circuit short. DE-INITIALIZE, then INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

C2 CHECK THE LH FRONT WINDOW MOTOR GROUND

- Key in OFF position.

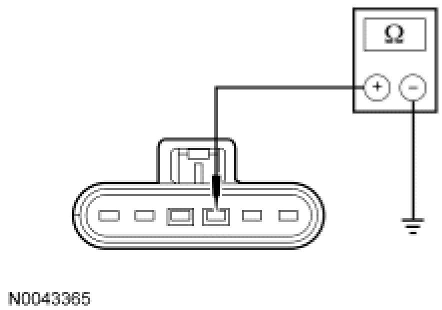


Fig. 7: Checking LH Front Window Motor Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window motor C540-3, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to C3.

  NO : REPAIR the circuit. DE-INITIALIZE then INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

C3 CHECK THE LH FRONT WINDOW CONTROL SWITCH-TO-LH FRONT WINDOW

MOTOR FEEDS

- Disconnect: LH Front Window Control Switch C535A

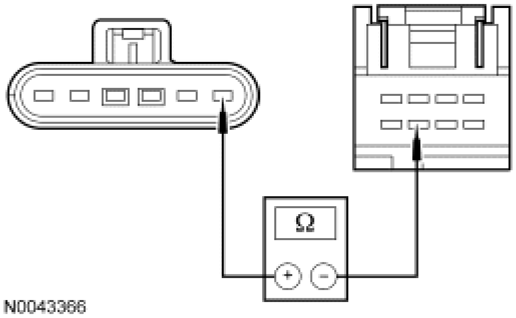


Fig. 8: Checking LH Front Window Control Switch-To-LH Front Window Motor Feeds (1 Of 3)
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window motor C540-1, circuit CPW10 (YE/VT), harness side and LH front window control switch C535A-7, circuit CPW10 (YE/VT), harness side.

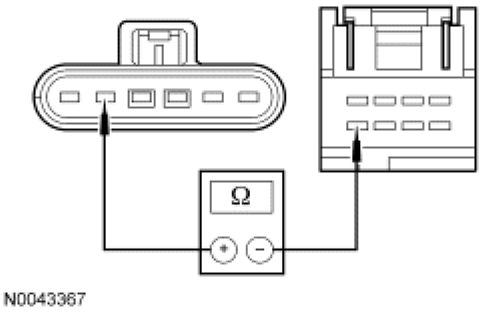


Fig. 9: Checking Circuit CPW29 (VT/GY) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window motor C540-5, circuit CPW29 (VT/GY), harness side and LH front window control switch C535A-8, circuit CPW29 (VT/GY), harness side.

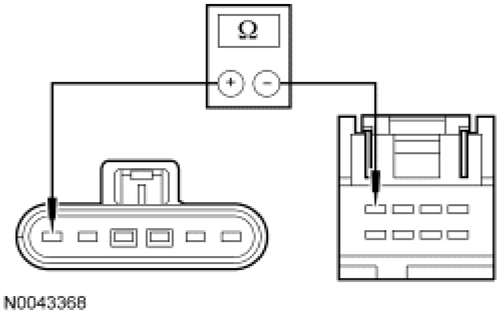


Fig. 10: Checking LH Front Window Control Switch-To-LH Front Window Motor Feeds (3 Of 3)

Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window motor C540-6, circuit CPW11 (BU/GY), harness side and LH front window control switch C535A-4, circuit CPW11 (BU/GY), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to C4.

  NO : REPAIR the circuit. DE-INITIALIZE then INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

C4 CHECK THE LH FRONT WINDOW CONTROL SWITCH

- Carry out the Master Window Adjust Switch Component Test. Refer to COMPONENT TESTING.
- **Did the window control switch pass the component test?**

  YES : INSTALL a new LH front window motor. REFER to **Glass, Frames and Mechanisms - Exploded View, Front Door** and **Window Regulator and Motor - Front Door**. INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

  NO : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

Pinpoint Test D: A Single Power Window is Inoperative - Fusion, Milan, LH Front

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Windows for schematic and connector information.

Normal Operation

Under normal operation, the LH front power window control switch receives power from the delay accessory relay through circuit CPW30 (GY/YE) and is grounded to chassis through circuit GD126 (BK/WH). When the LH front window control switch is operated in the UP position, the LH front window motor receives power through circuit CPW11 (BY/GY) and ground through circuit CPW10 (YE/VT). When the LH front window control switch is operated in the DOWN position, the LH front window motor receives power through circuit CPW10 (YE/VT) and ground through circuit CPW11 (BY/GY). The one-touch down feature is integral to the driver window control switch.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- LH front window motor
- LH front window control switch

PINPOINT TEST D: A SINGLE POWER WINDOW IS INOPERATIVE - FUSION, MILAN, LH FRONT

D1 CHECK THE LH FRONT POWER WINDOW MOTOR

- Disconnect: LH Front Window Control Switch C504A and C504B

- Key in ON position.

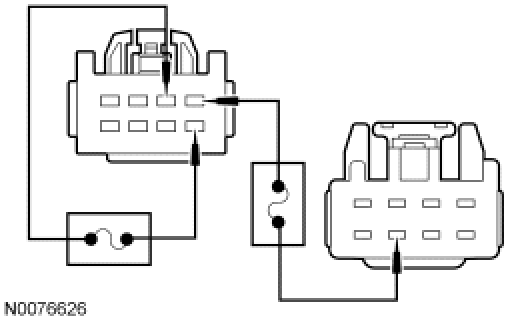


Fig. 11: Connecting Fused Jumper Wire Between LH Front Window Control Switch C504A-5 & C504A-2, CPW11 (BU/GY) & CPW30 (GY/YE)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between LH front window control switch C504A-5, circuit CPW11 (BU/GY), harness side and LH front window control switch C504A-2, circuit CPW30 (GY/YE), harness side. Connect a second fused jumper wire between LH front window control switch C504A-1, circuit CPW10 (YE/VT) and LH front window control switch C504B-7, circuit GD126 (BK/WH). The LH front window should operate in the up direction.

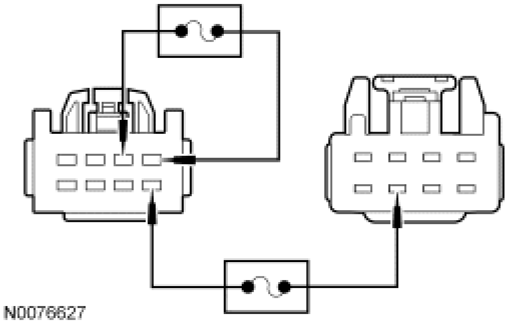


Fig. 12: Connecting Fused Jumper Wire Between LH Front Window Control Switch C504A-1 & C504A-2, CPW10 (YE/VT) & CPW30 (GY/YE)
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between LH front window control switch C504A-1, circuit CPW10 (YE/VT), harness side and LH front window control switch C504A-2, circuit CPW30 (GY/YE), harness side. Connect a second fused jumper wire between LH front window control switch C504A-5, circuit CPW11 (BU/GY) and LH front window control switch C504B-7, circuit GD126 (BK/WH). The LH front window should operate in the down direction.
- **Does the LH front window operate correctly?**

  YES : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : Go to D2.

D2 CHECK FOR OPEN IN CIRCUIT CPW10 (YE/VT) OR CPW11 (BU/GY)

- Key in OFF position.
- Disconnect: LH Front Window Motor C518

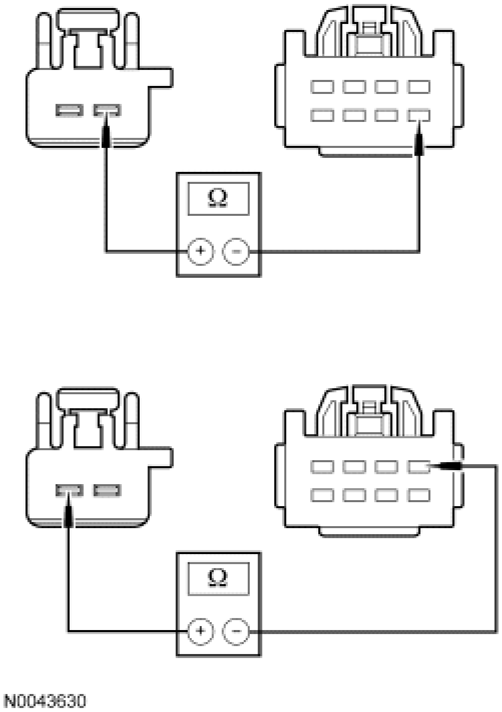


Fig. 13: Checking For Open In Circuit CPW10 (YE/VT) Or CPW11 (BU/GY)
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window motor C518-1, circuit CPW11 (BU/GY), harness side and LH front window control switch C504A-5, circuit CPW11 (BU/GY), harness side; and between LH front window motor C518-2, circuit CPW10 (YE/VT), harness side and LH front window control switch C504A-1, circuit CPW10 (YE/VT), harness side.
- **Are the resistances less than 5 ohms for both measurements?**

  YES : INSTALL a new LH front window motor. REFER to **Glass, Frames and Mechanisms - Exploded View, Front Door** and **Window Regulator and Motor - Front Door**. TEST the system for normal operation.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

Pinpoint Test E: A Single Power Window is Inoperative - MKZ, RH Front

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Windows for schematic and connector information.

NOTE:	**A new RH front power window motor will not operate in one-touch up or one-touch down mode until initialized. Refer to Window Motor Initialization.**

NOTE: **The RH front power window motor must be initialized whenever a new motor is installed.**

NOTE: **The RH front power window motor must be de-initialized, then initialized whenever the RH front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.**

Normal Operation

Under normal operation, the LH and RH front power window control switches receive power from the delay accessory relay through circuit CBP02 (GN). The RH window motor receives battery power through circuit SBB35 (BU/RD) at all times and ground through circuit GD139 (BK/YE). When the LH or RH front window control switch is operated in the UP position, the RH front window motor receives a voltage signal through circuit CPW13 (BN/YE). When the LH or RH front window control switch is operated in the DOWN position, the RH front window motor receives a voltage signal through circuit CPW12 (GN/OG). When the RH front window motor receives a ground signal on circuit CPW31 (GN/WH), the RH front window motor will enter one-touch up/down mode.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- RH front window motor
- LH or RH front window control switch
- RH front window motor not initialized

PINPOINT TEST E: A SINGLE POWER WINDOW IS INOPERATIVE - MKZ, RH FRONT

E1 CHECK THE LH FRONT WINDOW CONTROL SWITCH OPERATION

- Attempt to operate the RH window using the LH front power window control switch.
- **Does the RH window operate when using the LH front power window control switch?**

  YES : Go to E6.

  NO : Go to E2.

E2 CHECK THE POWER TO THE WINDOW MOTOR

- Key in OFF position.
- Disconnect: RH Front Window Motor C623

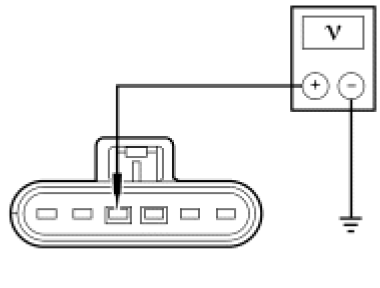


Fig. 14: Checking Power To Window Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between RH front window motor C623-4, circuit SBB35 (BU/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to E3.

  NO : VERIFY BJB fuse 35 (30A) is OK. If OK, REPAIR the circuit. DE-INITIALIZE then INITIALIZE the RH front window motor. If not OK, REFER to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ to identify the possible causes of the circuit short. REFER to **Window Motor Initialization**. TEST the system for normal operation.

E3 CHECK THE RH FRONT WINDOW MOTOR GROUND

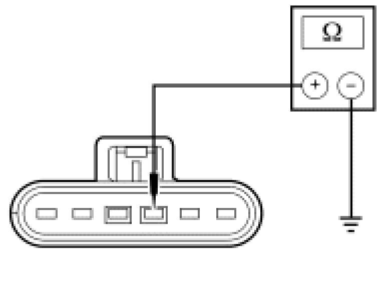


Fig. 15: Checking LH Front Window Motor Ground
Courtesy of FORD MOTOR CO.

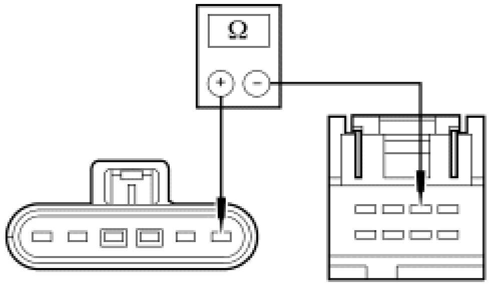
- Measure the resistance between RH front window motor C623-3, circuit GD139 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to E4.

  NO : REPAIR the circuit. DE-INITIALIZE then INITIALIZE the RH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

E4 CHECK THE LH FRONT WINDOW CONTROL SWITCH-TO-RH FRONT WINDOW MOTOR FEEDS

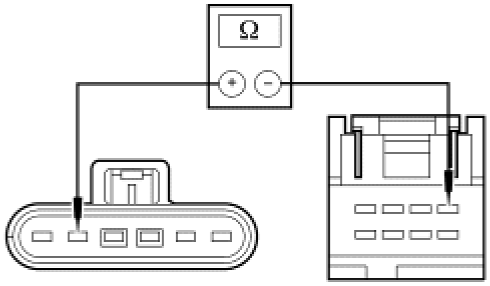
- Disconnect: LH Front Window Control Switch C535A



N0043631

Fig. 16: Checking LH Front Window Control Switch-To-RH Front Window Motor Feeds (1 Of 3)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH front window motor C623-1, circuit CPW12 (GN/OG), harness side and LH front window control switch C535A-2, circuit CPW12 (GN/OG), harness side.



N0043632

Fig. 17: Checking LH Front Window Control Switch-To-RH Front Window Motor Feeds (2 Of 3)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH front window motor C623-5, circuit CPW31 (GN/WH), harness side and LH front window control switch C535A-1, circuit CPW31 (GN/WH), harness side.

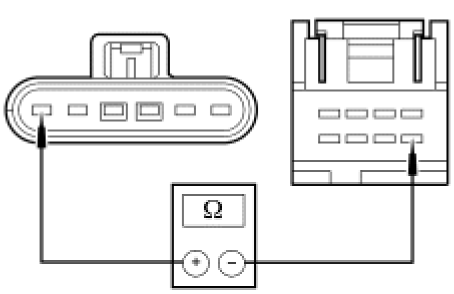


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Fig. 18: Checking LH Front Window Control Switch-To-RH Front Window Motor Feeds (3

Of 3)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH front window motor C623-6, circuit CPW13 (BN/YE), harness side and LH front window control switch C535A-5, circuit CPW13 (BN/YE), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to E5.

  NO : REPAIR the circuit. DE-INITIALIZE then INITIALIZE the RH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

E5 CHECK THE LH FRONT WINDOW CONTROL SWITCH

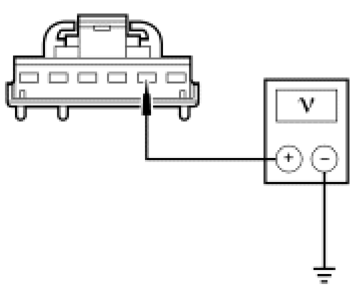
- Carry out the Master Window Adjust Switch Component Test. Refer to COMPONENT TESTING.
- **Did the window control switch pass the component test?**

  YES : INSTALL a new RH front window motor. REFER to **Glass, Frames and Mechanisms - Exploded View, Front Door** and **Window Regulator and Motor - Front Door**. INITIALIZE the RH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

  NO : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. INITIALIZE the RH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

E6 CHECK CIRCUIT CBP02 (GN) FOR VOLTAGE

- Disconnect: RH Front Window Control Switch C604
- Key in ON position.



N0043634

Fig. 19: Checking Circuit CBP02 (GN) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between RH front window control switch C604-2, circuit CBP02 (GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to E7.

  NO : REPAIR the circuit. TEST the system for normal operation.

E7 CHECK THE LH FRONT WINDOW CONTROL SWITCH-TO-RH FRONT WINDOW CONTROL SWITCH CIRCUITS

- Key in OFF position.

- Disconnect: LH Front Window Control Switch C535A

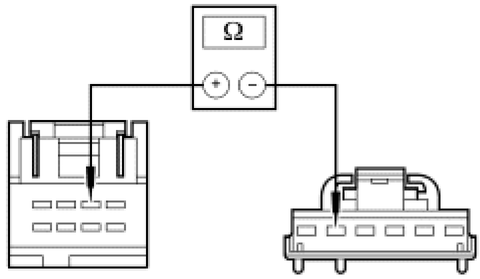


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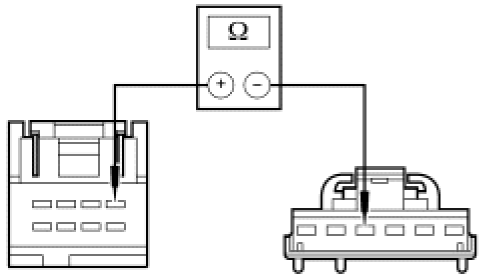
Fig. 20: Checking LH Front Window Control Switch-To-RH Front Window Control Switch Circuits
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH front window control switch C604-5, circuit CPW12 (GN/OG), harness side and LH front window control switch C535A-2, circuit CPW12 (GN/OG), harness side.



N0043636

Fig. 21: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH front window control switch C604-4, circuit CPW31 (GN/WH), harness side and LH front window control switch C535A-1, circuit CPW31 (GN/WH), harness side.

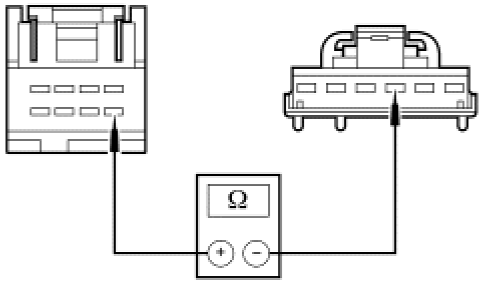


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Fig. 22: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RH front window control switch C604-3, circuit CPW13 (BN/YE), harness side and LH front window control switch C535A-5, circuit CPW13 (BN/YE), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new RH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test F: A Single Power Window is Inoperative - MKZ, LH or RH Rear

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Windows for schematic and connector information.

Normal Operation

The LH rear window control switch receives delayed accessory power from the LH front window control switch through circuit CPW14 (VT/WH) when the window lock switch is set to the unlock position, and the delayed accessory feature is active. When the LH rear window is operated in the up direction from the LH rear window control switch, power is sent to the LH rear window motor through circuit CPW21 (BN) and ground through circuit CPW22 (GN/VT). When the LH rear window is operated in the down direction from the LH rear window control switch, power is sent to the LH rear window motor through circuit CPW22 (GN/VT) and ground through circuit CPW21 (BN).

The RH rear window control switch receives delayed accessory power from the LH front window control switch through circuit CPW14 (VT/WH) when the window lock switch is set to the unlock position, and the delayed accessory feature is active. When the RH rear window is operated in the up direction from the RH rear window control switch, power is sent to the RH rear window motor through circuit CPW24 (WH/VT) and ground through circuit CPW23 (GY). When the RH rear window is operated in the down direction from the RH rear window control switch, power is sent to the RH rear window motor through circuit CPW23 (GY) and ground through circuit CPW24 (WH/VT).

Rear Window Operation From LH Front Switch

When the LH rear power window is operated in the up direction from the LH front window control switch, power is sent to the LH rear window control switch through circuit CPW16 (BU/OG), which transfers power to the LH rear window motor through circuit CPW21 (BN). Ground is provided to the LH rear window switch through circuit CPW15 (YE), which transfers ground to the LH rear window motor through circuit CPW22 (GN/VT).

During LH rear power window down operation from the LH front window control switch, power is sent to the LH rear window control switch through circuit CPW15 (YE), which transfers power to the LH rear window motor through circuit CPW22 (GN/VT). Ground is provided to the LH rear window switch through circuit CPW16 (BU/OG), which transfers ground to the LH rear window motor through circuit CPW21 (BN).

When the RH rear power window is operated in the up direction from the LH front window control switch, power is sent to the RH rear window control switch through circuit CPW18 (GY/VT), which transfers power to the RH rear window motor through circuit CPW24 (WH/VT). Ground is sent to the RH rear window switch

through circuit CPW17 (BN/GN), which transfers ground to the RH rear window motor through circuit CPW23 (GY).

During RH rear power window down operation from the LH front window control switch, power is sent to the RH rear window control switch through circuit CPW17 (BN/GN), which transfers power to the RH rear window motor through circuit CPW23 (GY). Ground is sent to the RH rear window switch through circuit CPW18 (GY/VT), which transfers ground to the RH rear window motor through circuit CPW24 (WH/VT).

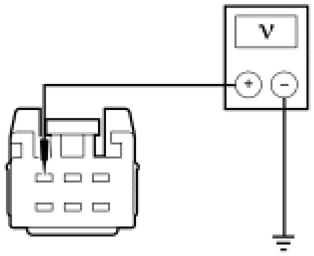
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- LH front window switch
- Rear window motor
- Rear window switch

PINPOINT TEST F: A SINGLE POWER WINDOW IS INOPERATIVE - MKZ, LH OR RH REAR

F1 CHECK THE VOLTAGE TO THE LH REAR OR RH REAR WINDOW CONTROL SWITCH

- Disconnect: Inoperative Rear Window Control Switch C701 (LH) or C819 (RH)
- Key in ON position.



N0043638

Fig. 23: Checking Voltage To LH Rear Or RH Rear Window Control Switch
Courtesy of FORD MOTOR CO.

NOTE: Set the LH front window lock switch to the UNLOCK position.

- Measure the voltage between the inoperative rear window connector and ground:
  - for the RH rear window control switch, measure the voltage between RH rear window control switch C819-3, circuit CPW14 (VT/WH), harness side and ground.
  - for the LH rear window control switch, measure the voltage between C701-3, circuit CPW14 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to F4.

  NO : Go to F2.

F2 CHECK THE VOLTAGE TO THE LH FRONT WINDOW CONTROL SWITCH

- Disconnect: LH Front Window Control Switch C535B

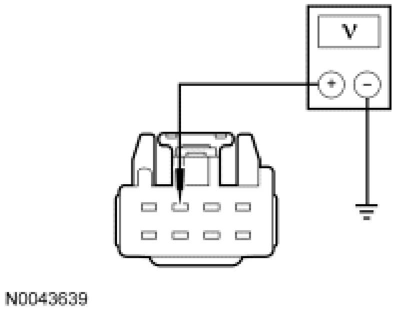


Fig. 24: Checking Voltage To LH Front Window Control Switch
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH front window control switch C535B-3, circuit CPW30 (GY/YE), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to F3.

  NO : REPAIR the circuit. TEST the system for normal operation.

F3 CHECK FOR OPEN IN CIRCUIT CPW14 (VT/WH)

- Key in OFF position.

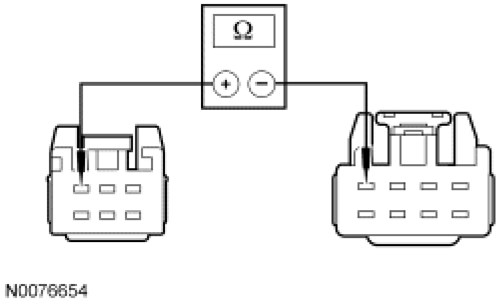


Fig. 25: Check For Open In Circuit CPW14 (VT/WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative rear window connector and the LH front window control switch connector.
  - for the RH rear window control switch, measure the resistance between RH window control switch C819-3, circuit CPW14 (VT/WH), harness side and LH front window control switch C535B-4, circuit CPW14 (VT/WH), harness side.
  - for the LH rear window control switch, measure the resistance between LH window control switch C701-3, circuit CPW14 (VT/WH), harness side and LH front window control switch C535B-4, circuit CPW14 (VT/WH), harness side.

- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

F4 CHECK THE GROUNDS TO THE INOPERATIVE REAR WINDOW CONTROL SWITCH

- Key in OFF position.

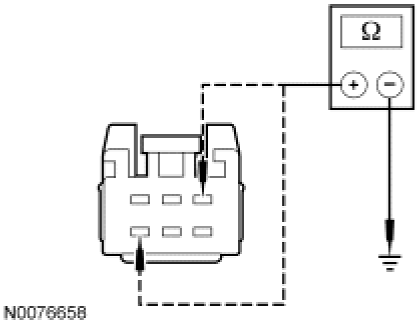


Fig. 26: Checking Grounds To Inoperative Rear Window Control Switch
Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative window control switch and ground:
  - for the RH rear window control switch, measure the resistance between RH rear window control switch C819-1, circuit CPW17 (BN/GN), harness side and ground; and between RH rear window control switch C819-6, circuit CPW18 (GY/VT), harness side and ground.
  - for the LH rear window control switch, measure the resistance between LH rear window control switch C701-1, circuit CPW15 (YE), harness side and ground; and between LH rear window control switch C701-6, circuit CPW16 (BU/OG), harness side and ground.
- **Are the resistances less than 5 ohms?**

  YES : Go to F7.

  NO : Go to F5.

F5 CHECK THE CIRCUITS TO THE INOPERATIVE REAR WINDOW CONTROL SWITCH FOR AN OPEN

- Key in OFF position.
- Disconnect: LH Front Window Control Switch C535B

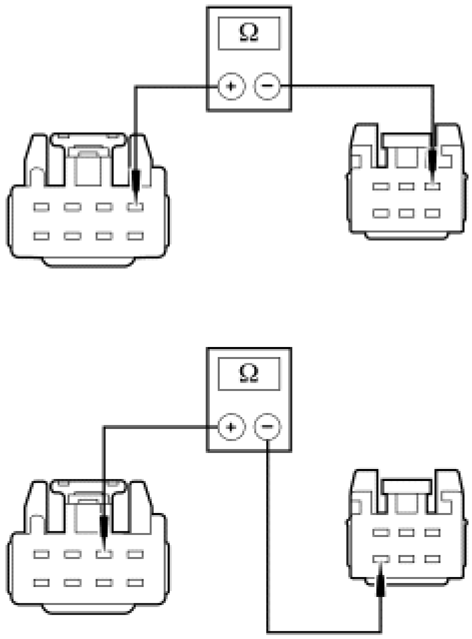


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Fig. 27: Checking Circuits To Inoperative Rear Window Control Switch For An Open - Inoperative LH Rear Power Window
Courtesy of FORD MOTOR CO.

- For an inoperative LH rear power window, measure the resistance between LH front window control switch C535B-1, circuit CPW15 (YE) and LH rear window control switch C701-1, circuit CPW15 (YE), harness side; and between LH front window control switch C535B-2, circuit CPW16 (BU/OG) and LH rear window control switch C701-6, circuit CPW16 (BU/OG), harness side.

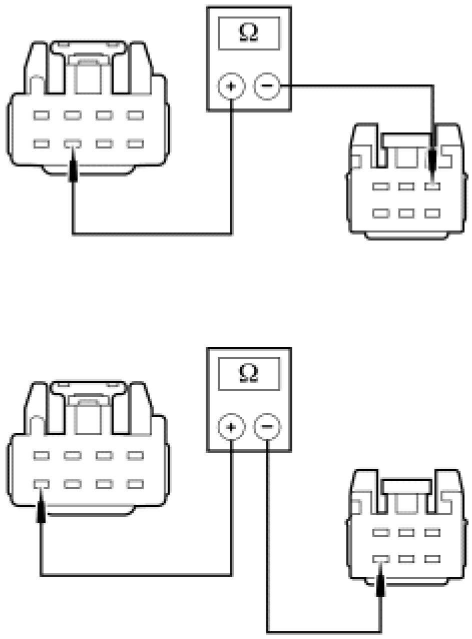

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Fig. 28: Checking Circuits To Inoperative Rear Window Control Switch For An Open - Inoperative RH Rear Power Window
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear power window, measure the resistance between LH front window control switch C535B-7, circuit CPW17 (BN/GN) and RH window control switch C819-1, circuit CPW17 (BN/GN), harness side; and between LH front window control switch C535B-8, circuit CPW18 (GY/VT) and RH rear window control switch C819-6, circuit CPW18 (GY/VT), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to F6.

  NO : REPAIR the circuit(s) for an open. TEST the system for normal operation.

F6 CHECK THE GROUND TO THE LH FRONT WINDOW CONTROL SWITCH

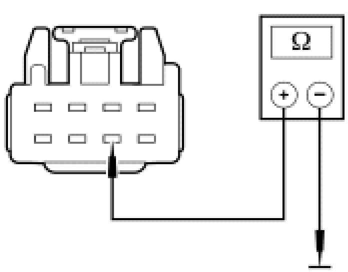

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Fig. 29: Checking Ground To LH Front Window Control Switch
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window control switch C535B-6, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

F7 CHECK THE INOPERATIVE WINDOW CONTROL SWITCH

- Connect: LH Front Window Control Switch C504B
- Key in ON position.
- For an inoperative LH rear window, connect a fused jumper wire between LH rear window control switch C701-2, circuit CPW22 (GN/VT), harness side and LH rear window control switch C701-3, circuit CPW14 (VT/WH), harness side; and between LH rear window control switch C701-5, circuit CPW21 (BN), harness side and LH rear window control switch C701-6, circuit CPW16 (BU/OG), harness side. The LH rear window should operate in the downward direction.

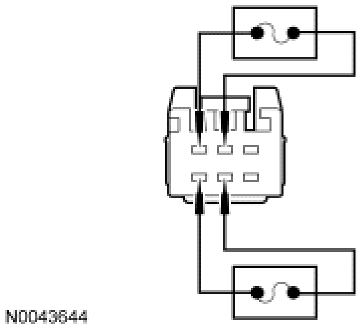

Fig. 30: Checking Inoperative Window Control Switch (1 Of 2)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, connect a fused jumper wire between RH rear window control switch C819-2, circuit CPW23 (GY), harness side and RH rear window control switch C819-3, circuit CPW14 (VT/WH), harness side; and between RH rear window control switch C819-5, circuit CPW24 (WH/VT), harness side and RH rear window control switch C819-6, circuit CPW18 (GY/VT), harness side. The RH rear window should operate in the downward direction.
- For an inoperative LH rear window, connect a fused jumper wire between LH rear window control switch C701-2, circuit CPW22 (GN/VT), harness side and LH rear window control switch C701-1, circuit CPW15 (YE), harness side; and between LH rear window control switch C701-5, circuit CPW21 (BN), harness side and LH rear window control switch C701-3, circuit CPW14 (VT/WH), harness side. The LH rear window should operate in the upward direction.

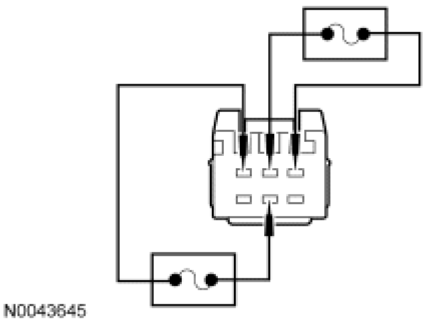

Fig. 31: Checking Inoperative Window Control Switch (2 Of 2)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, connect a fused jumper wire between RH rear window control switch C819-2, circuit CPW22 (GN/VT), harness side and RH rear window control switch C819-1, circuit CPW17 (BN/GN), harness side; and between RH rear window control switch C819-5, circuit CPW24 (WH/VT), harness side and RH rear window control switch C819-3, circuit CPW14 (VT/WH), harness side. The RH rear window should operate in the upward direction.
- **Did the inoperative window operate correctly?**

  YES : INSTALL a new LH or RH rear window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : Go to F8.

F8 CHECK THE POWER WINDOW MOTOR CIRCUITS

- Key in OFF position.
- Disconnect: Inoperative Rear Window Motor C726 (LH) or C828 (RH)
- For an inoperative LH rear window, measure the resistance between LH rear window control switch C701-2, circuit CPW22 (GN/VT), harness side and LH rear window motor C726-2, circuit CPW22 (GN/VT), harness side.

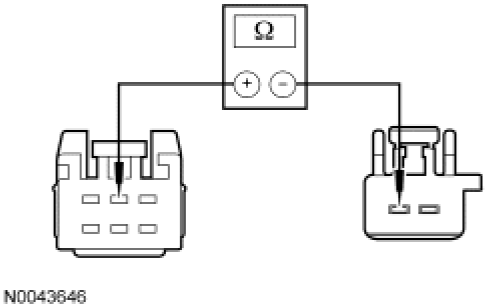

Fig. 32: Checking Power Window Motor Circuits (1 Of 2)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, measure the resistance between RH rear window control switch C819-2, circuit CPW23 (GY), harness side and RH rear window motor C828-2, circuit CPW23 (GY), harness side.
- For an inoperative LH rear window, measure the resistance between LH rear window control

switch C701-5, circuit CPW21 (BN), harness side and LH rear window motor C726-1, circuit CPW21 (BN), harness side.

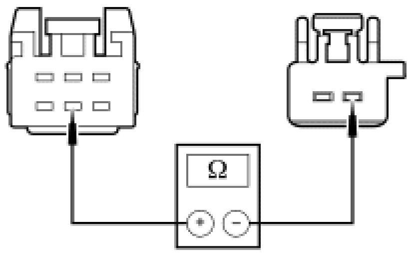

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Fig. 33: Checking Power Window Motor Circuits (2 Of 2)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, measure the resistance between RH rear window control switch C819-5, circuit CPW24 (WH/VT), harness side and RH rear window motor C726-1, circuit CPW24 (WH/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new LH or RH rear window motor. REFER to **Window Regulator Motor**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test G: A Single Power Window is Inoperative- Fusion, Milan, RH Front, LH or RH Rear

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Windows for schematic and connector information.

Normal Operation

The RH front window control switch receives delayed accessory power from the LH front window control switch through circuit CPW14 (VT/WH) when the window lock switch is set to the UNLOCK position, and the delayed accessory feature is active. When the RH front window is operated in the up direction from the RH front window control switch, power is sent to the RH front window motor through circuit CPW20 (YE/BK) and ground through circuit CPW19 (VT). When the RH front window is operated in the down direction from the RH front window control switch, power is sent to the RH front window motor through circuit CPW19 (VT) and ground through circuit CPW20 (YE/BK).

The LH rear window control switch receives delayed accessory power from the LH front window control switch through circuit CPW14 (VT/WH) when the window lock switch is set to the UNLOCK position, and the delayed accessory feature is active. When the LH rear window is operated in the up direction from the LH rear window control switch, power is sent to the LH rear window motor through circuit CPW21 (BN) and ground through circuit CPW22 (GN/VT). When the LH rear window is operated in the down direction from the LH rear window control switch, power is sent to the LH rear window motor through circuit CPW22 (GN/VT) and ground through circuit CPW21 (BN).

The RH rear window control switch receives delayed accessory power from the LH front window control switch through circuit CPW14 (VT/WH) when the window lock switch is set to the UNLOCK position, and the delayed accessory feature is active. When the RH rear window is operated in the up direction from the RH rear window control switch, power is sent to the RH rear window motor through circuit CPW24 (WH/VT) and ground through circuit CPW23 (GY). When the RH rear window is operated in the down direction from the RH rear window control switch, power is sent to the RH rear window motor through circuit CPW23 (GY) and ground through circuit CPW24 (WH/VT).

Window Operation From LH Front Switch

When the RH front power window is operated in the up direction from the LH front window control switch, power is sent to the RH front window control switch through circuit CPW13 (GY/RD), which transfers power to the RH front window motor through circuit CPW20 (YE/BK). Ground is provided to the RH front window switch through circuit CPW12 (GN/OG), which transfers ground to the RH front window motor through circuit CPW19 (VT).

During RH front power window down operation from the LH front window control switch, power is sent to the RH front window control switch through circuit CPW12 (GN/OG), which transfers power to the RH front window motor through circuit CPW19 (VT). Ground is provided to the RH front window switch through circuit CPW13 (GY/RD), which transfers ground to the RH front window motor through circuit CPW20 (YE/BK).

When the LH rear power window is operated in the up direction from the LH front window control switch, power is sent to the LH rear window control switch through circuit CPW16 (BU/OG), which transfers power to the LH rear window motor through circuit CPW21 (BN). Ground is provided to the LH rear window switch through circuit CPW15 (YE), which transfers ground to the LH rear window motor through circuit CPW22 (GN/VT).

During LH rear power window down operation from the LH front window control switch, power is sent to the LH rear window control switch through circuit CPW15 (YE), which transfers power to the LH rear window motor through circuit CPW22 (GN/VT). Ground is provided to the LH rear window switch through circuit CPW16 (BU/OG), which transfers ground to the LH rear window motor through circuit CPW21 (BN).

When the RH rear power window is operated in the up direction from the LH front window control switch, power is sent to the RH rear window control switch through circuit CPW18 (GY/VT), which transfers power to the RH rear window motor through circuit CPW24 (WH/VT). Ground is sent to the RH rear window switch through circuit CPW17 (BN/GN), which transfers ground to the RH rear window motor through circuit CPW23 (GY).

During RH rear power window down operation from the LH front window control switch, power is sent to the RH rear window control switch through circuit CPW17 (BN/GN), which transfers power to the RH rear window motor through circuit CPW23 (GY). Ground is sent to the RH rear window switch through circuit CPW18 (GY/VT), which transfers ground to the RH rear window motor through circuit CPW24 (WH/VT).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- LH front window switch

- RH front window switch
- Rear window motor
- Front window motor
- Rear window switch

PINPOINT TEST G: A SINGLE POWER WINDOW IS INOPERATIVE - FUSION, MILAN, RH FRONT, LH OR RH REAR

G1 CHECK THE VOLTAGE TO THE RH FRONT, LH REAR OR RH REAR WINDOW CONTROL SWITCH

- Disconnect: Inoperative Rear Window Control Switch C604 (RH front), C701 (LH rear) or C819 (RH rear)
- Key in ON position.

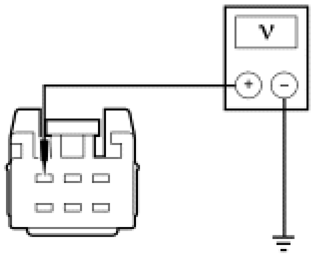

Fig. 34: Checking Voltage To RH Front, LH Rear Or RH Rear Window Control Switch
Courtesy of FORD MOTOR CO.

NOTE: Set the LH front window lock switch to the UNLOCK position.

- Measure the voltage between the inoperative rear window connector and ground:
  - for the RH front window control switch, measure the voltage between RH front window control switch C604-3, circuit CPW14 (VT/WH), harness side and ground.
  - for the RH rear window control switch, measure the voltage between RH rear window control switch C819-3, circuit CPW14 (VT/WH), harness side and ground.
  - for the LH rear window control switch, measure the voltage between C701-3, circuit CPW14 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to G3.

  NO : Go to G2.

G2 CHECK FOR OPEN IN CIRCUIT CPW14 (VT/WH)

- Disconnect: LH Front Window Control Switch C504B
- Key in OFF position.

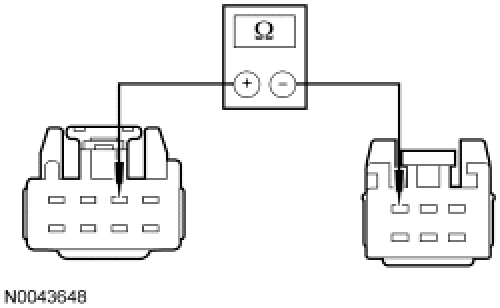

Fig. 35: Checking For Open In Circuit CPW14 (VT/WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative rear window connector and the LH front window control switch connector:
  - for the RH front window control switch, measure the resistance between RH front window control switch C604-3, circuit CPW14 (VT/WH), harness side and LH front window control switch C504B-2, circuit CPW14 (VT/WH), harness side.
  - for the RH rear window control switch, measure the resistance between RH rear window control switch C819-3, circuit CPW14 (VT/WH), harness side and LH front window control switch C504B-2, circuit CPW14 (VT/WH), harness side.
  - for the LH rear window control switch, measure the resistance between LH rear window control switch C701-3, circuit CPW14 (VT/WH), harness side and LH front window control switch C504B-2, circuit CPW14 (VT/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

G3 CHECK THE GROUNDS TO THE INOPERATIVE REAR WINDOW CONTROL SWITCH

- Key in OFF position.

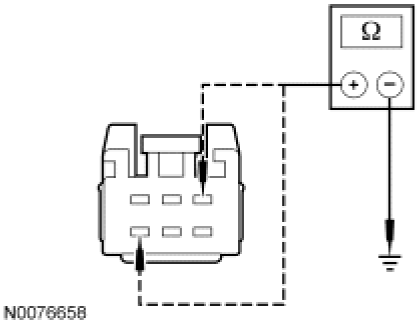

Fig. 36: Checking Grounds To Inoperative Rear Window Control Switch
Courtesy of FORD MOTOR CO.

- Measure the resistance between the inoperative window control switch and ground:

  - for the RH front window control switch, measure the resistance between RH front window control switch C604-1, circuit CPW12 (GN/OG), harness side and ground; and between RH front window control switch C604-6, circuit CPW13 (GY/RD), harness side and ground.
  - for the RH rear window control switch, measure the resistance between RH rear window control switch C819-1, circuit CPW17 (BN/GN), harness side and ground; and between RH rear window control switch C819-6, circuit CPW18 (GY/VT), harness side and ground.
  - for the LH rear window control switch, measure the resistance between LH rear window control switch C701-1, circuit CPW15 (YE), harness side and ground; and between LH rear window control switch C701-6, circuit CPW16 (BU/OG), harness side and ground.
- **Are the resistances less than 5 ohms?**

  YES : Go to G5.

  NO : Go to G4.

G4 CHECK THE CIRCUITS TO THE INOPERATIVE REAR WINDOW CONTROL SWITCH FOR AN OPEN

- Key in OFF position.
- Disconnect: LH Front Window Control Switch C504A and C504B

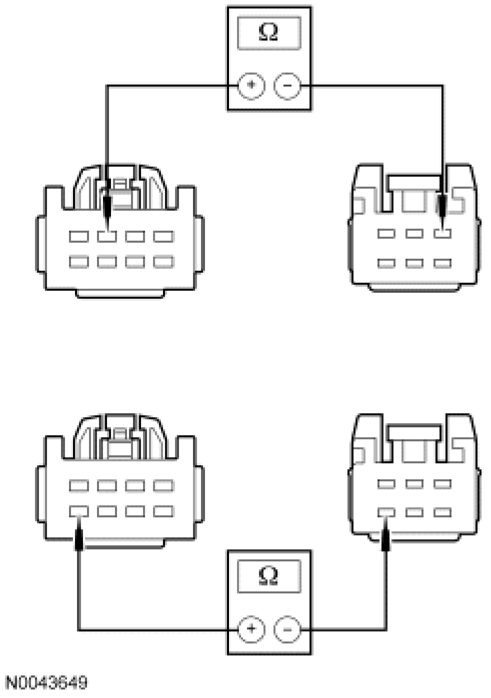

Fig. 37: Checking Circuits To Inoperative Rear Window Control Switch For An Open
Courtesy of FORD MOTOR CO.

- For an inoperative RH front power window, measure the resistance between LH front window control switch C504A-3, circuit CPW12 (GN/OG) and RH front window control switch C604-1, circuit CPW12 (GN/OG), harness side; and between LH front window control switch C504A-8, circuit CPW13 (GY/RD) and RH front window control switch C604-6, circuit CPW13 (GY/RD), harness side.

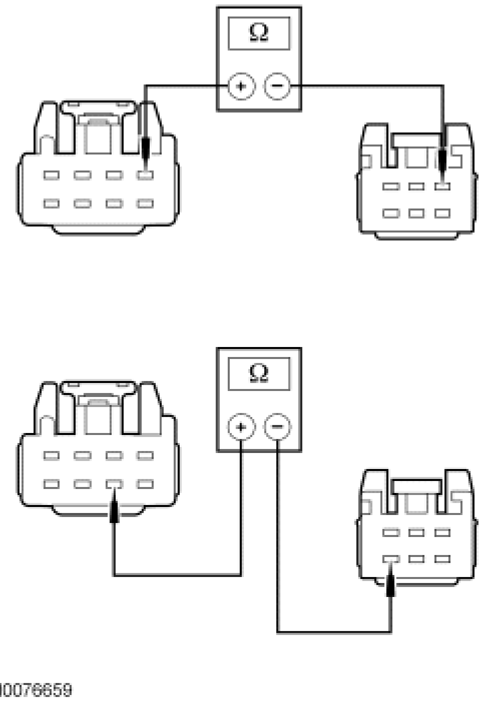

Fig. 38: Checking Circuits To Inoperative Rear Window Control Switch For An Open (2 Of 3)
Courtesy of FORD MOTOR CO.

- For an inoperative LH rear power window, measure the resistance between LH front window control switch C504B-1, circuit CPW15 (YE) and LH rear window control switch C701-1, circuit CPW15 (YE), harness side; and between LH front window control switch C504B-6, circuit CPW16 (BU/OG) and LH rear window control switch C701-6, circuit CPW16 (BU/OG), harness side.

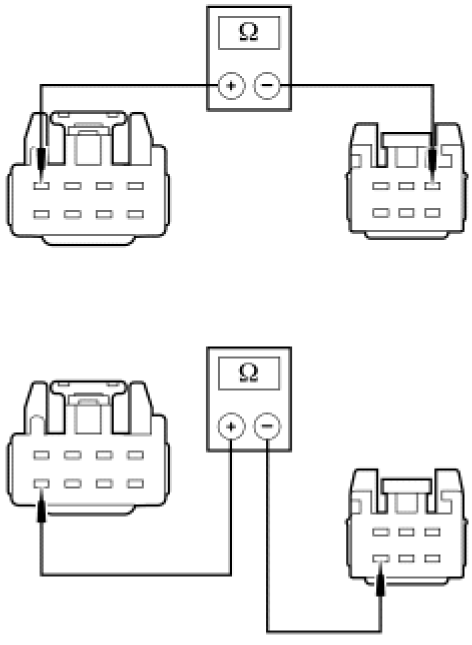

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Fig. 39: Checking Circuits To Inoperative Rear Window Control Switch For An Open (3 Of 3)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear power window, measure the resistance between LH front window control switch C504B-4, circuit CPW17 (BN/GN) and RH window control switch C819-1, circuit CPW17 (BN/GN), harness side; and between LH front window control switch C504B-8, circuit CPW18 (GY/VT) and RH rear window control switch C819-6, circuit CPW18 (GY/VT), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit(s) for an open. TEST the system for normal operation.

G5 CHECK THE INOPERATIVE WINDOW CONTROL SWITCH

- Key in ON position.
- For an inoperative RH front window, connect a fused jumper wire between RH front window control switch C604-2, circuit CPW19 (VT), harness side and RH front window control switch C604-3, circuit CPW14 (VT/WH), harness side; and between RH front window control switch C604-5, circuit CPW20 (YE/BK), harness side and RH front window control switch C604-6, circuit CPW13 (GY/RD), harness side. The RH front window should operate in the downward direction.
- For an inoperative LH rear window, connect a fused jumper wire between LH rear window control switch C701-2, circuit CPW22 (GN/VT), harness side and LH rear window control switch C701-3, circuit CPW14 (VT/WH), harness side; and between LH rear window control switch C701-5, circuit CPW21 (BN), harness side and LH rear window control switch C701-6, circuit CPW16 (BU/OG), harness side. The LH rear window should operate in the downward direction.

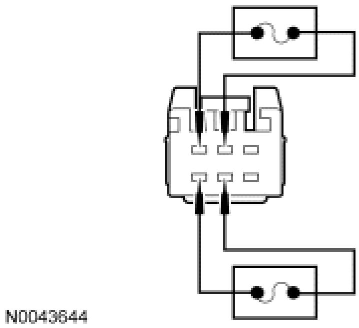


Fig. 40: Checking Inoperative Window Control Switch (1 Of 2)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, connect a fused jumper wire between RH rear window control switch C819-2, circuit CPW23 (GY), harness side and RH rear window control switch C819-3, circuit CPW14 (VT/WH), harness side; and between RH rear window control switch C819-5, circuit CPW24 (WH/VT), harness side and RH rear window control switch C819-6, circuit CPW18 (GY/VT), harness side. The RH rear window should operate in the downward direction.
- For an inoperative RH front window, connect a fused jumper wire between RH front window control switch C604-2, circuit CPW19 (VT), harness side and RH front window control switch C604-1, circuit CPW12 (GN/OG), harness side; and between RH front window control switch C604-5, circuit CPW20 (YE/BK), harness side and RH front window control switch C604-3, circuit CPW14 (VT/WH), harness side. The RH front window should operate in the upward direction.
- For an inoperative LH rear window, connect a fused jumper wire between LH rear window control switch C701-2, circuit CPW22 (GN/VT), harness side and LH rear window control switch C701-1, circuit CPW15 (YE), harness side; and between LH rear window control switch C701-5, circuit CPW21 (BN), harness side and LH rear window control switch C701-3, circuit CPW14 (VT/WH), harness side. The LH rear window should operate in the upward direction.

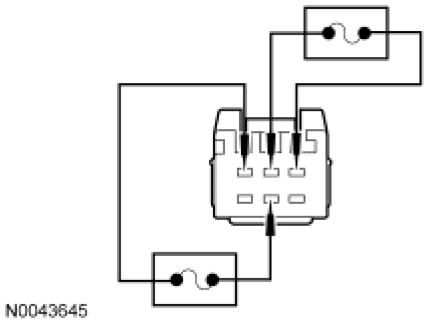


Fig. 41: Checking Inoperative Window Control Switch (2 Of 2)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, connect a fused jumper wire between RH rear window control switch C819-2, circuit CPW22 (GN/VT), harness side and RH rear window control switch C819-1, circuit CPW17 (BN/GN), harness side; and between RH rear window control switch C819-5, circuit CPW24 (WH/VT), harness side and RH rear window control switch C819-3, circuit CPW14 (VT/WH), harness side. The RH rear window should operate in the upward direction.

- **Did the inoperative window operate correctly?**

  YES : INSTALL a new LH or RH rear window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

  NO : Go to G6.

G6 CHECK THE POWER WINDOW MOTOR CIRCUITS

- Key in OFF position.
- Disconnect: Inoperative Window Motor C608 (RH front), C726 (LH rear) or C828 (RH rear)
- For an inoperative RH front window, measure the resistance between RH front window control switch C604-2, circuit CPW19 (VT), harness side and RH front window motor C608-2, circuit CPW19 (VT), harness side.
- For an inoperative LH rear window, measure the resistance between LH rear window control switch C701-2, circuit CPW22 (GN/VT), harness side and LH rear window motor C726-2, circuit CPW22 (GN/VT), harness side.

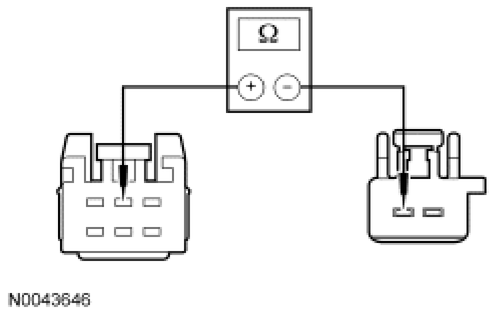


Fig. 42: Checking Power Window Motor Circuits (1 Of 2)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, measure the resistance between RH rear window control switch C819-2, circuit CPW23 (GY), harness side and RH rear window motor C828-2, circuit CPW23 (GY), harness side.
- For an inoperative RH front window, measure the resistance between RH front window control switch C604-5, circuit CPW20 (YE/BK), harness side and RH front window motor C608-1, circuit CPW20 (YE/BK), harness side.
- For an inoperative LH rear window, measure the resistance between LH rear window control switch C701-5, circuit CPW21 (BN), harness side and LH rear window motor C726-1, circuit CPW21 (BN), harness side.

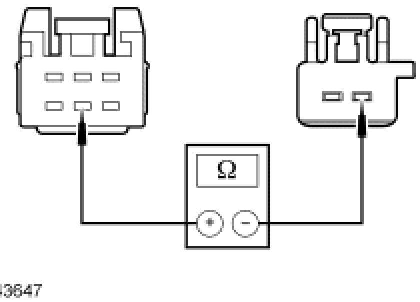


Fig. 43: Checking Power Window Motor Circuits (2 Of 2)
Courtesy of FORD MOTOR CO.

- For an inoperative RH rear window, measure the resistance between RH rear window control switch C819-5, circuit CPW24 (WH/VT), harness side and RH rear window motor C726-1, circuit CPW24 (WH/VT), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new RH front, LH or RH rear window motor. REFER to **Window Regulator Motor**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test H: The One-Touch Up/Down Feature is Inoperative - MKZ, LH or RH Front

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Windows for schematic and connector information.

NOTE: **A new LH or RH front power window motor will not operate in one-touch up or one-touch down mode until initialized. Refer to Window Motor Initialization.**

NOTE: **The LH or RH front power window motor must be initialized whenever a new motor is installed.**

NOTE: **The LH or RH front power window motor must be de-initialized, then initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.**

Normal Operation

The LH front power window control switch receives power from the accessory delay relay through circuit CPB02 (GN) and is grounded through circuit GD126 (BK/WH). When the LH front window control switch is pressed to the UP position, the LH front motor receives power through circuit CPW11 (BU/GY). When the LH front window control switch is pressed to the DOWN position, the LH front motor receives power through circuit CPW10 (YE/VT). When the LF window motor receives a ground signal on circuit CPW29 (VT/GY), the

LF window motor will enter one-touch up or one-touch down.

The RH front power window control switch receives power from the accessory delay relay through circuit CPB02 (GN) and is grounded through circuit GD126 (BK/WH). When the RH front window control switch is pressed to the UP position, the RH front motor receives power through circuit CPW13 (BN/YE). When the RH front window control switch is pressed to the DOWN position, the RH front motor receives power through circuit CPW12 (GN/OG). When the RH window motor receives a ground signal on circuit CPW31 (GN/WH), the RH window motor will enter one-touch up or one-touch down.

This pinpoint test is intended to diagnose the following:

- B(+) power lost during LH or RH front window operation
- LH or RH front window motor
- LH or RH front window control switch
- LH or RH front motor not initialized
- Wiring, terminals or connectors

PINPOINT TEST H: THE ONE-TOUCH UP/DOWN FEATURE IS INOPERATIVE - MKZ, LH OR RH FRONT

H1 CHECK FOR POWER (B+) LOSS DURING LH OR RH FRONT WINDOW OPERATION

- Verify if power (B+) was lost during LH or RH front window operation.
- **Was power (B+) lost while LH or RH front window was in operation?**

  YES : RAISE the LH or RH front window to the fully closed position. VERIFY the window glass stalls into the upper header seal. The front window should function normally. TEST the system for normal operation.

  NO : Go to H2.

H2 DE-INITIALIZE, THEN INITIALIZE THE FRONT MOTOR

- De-initialize the front window motor, then carry out the front window motor initialization procedure. Refer to **Window Motor Initialization**.
- **Is the one-touch down feature operating correctly?**

  YES : The system is operating normally at this time. The front window motor lost initialization.

  NO : For LH window, go to H3 .

  For RH window, go to H5 .

H3 CHECK THE LH FRONT WINDOW CONTROL SWITCH

- Key in OFF position.
- Disconnect: LH Front Window Control Switch C535A and C535B
- Carry out the Master Window Adjust Switch Component Test. Refer to COMPONENT TESTING.
- **Did the LH front window switch pass the component test?**

  YES : Go to H4.

  NO : INSTALL a new LH front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

H4 CHECK CIRCUIT CPW29 (VT/GY) FOR AN OPEN

- Disconnect: LH Front Window Motor C540

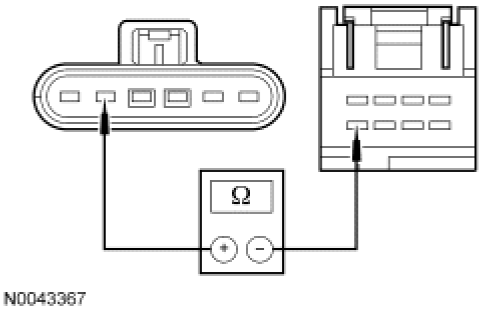


Fig. 44: Checking Circuit CPW29 (VT/GY) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window control switch C535A-8, circuit CPW29 (VT/GY), harness side and LH front window motor connector C540-5, circuit CPW29 (VT/GY).
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new LH front window motor. REFER to **Window Regulator Motor**. TEST the system for normal operation.

  NO : REPAIR the circuit. DE-INITIALIZE then INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

H5 CHECK THE LH and RH FRONT WINDOW CONTROL SWITCH

- Key in OFF position.
- Disconnect: LH Front Window Control Switch C535A, C535B and RH Front Window Control Switch C604
- Carry out the Master Window Adjust Switch Component Test and Window Adjust Switch, Passenger Side Component Test. Refer to COMPONENT TESTING.
- **Did the LH and RH front window switches pass the component tests?**

  YES : Go to H6.

  NO : INSTALL a new front window control switch. REFER to **Window Control Switch**. TEST the system for normal operation.

H6 CHECK CIRCUIT CPW31 (GN/WH) FOR AN OPEN

- Disconnect: RH Front Window Motor C623

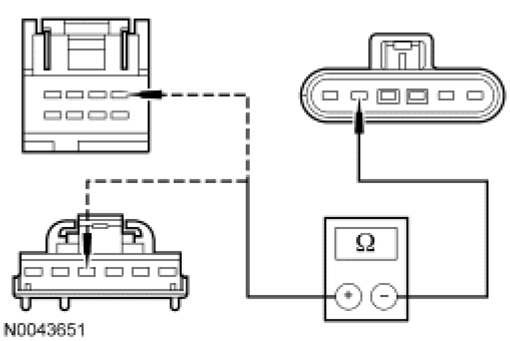


Fig. 45: Checking Circuit CPW31 (GN/WH) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH front window control switch C535A-1, circuit CPW31 (GN/WH), harness side and RH front window motor connector C623-5, circuit CPW31 (GN/WH); and between RH front window control switch C604-4, circuit CPW31 (GN/WH), harness side and RH front window motor connector C623-5, circuit CPW31 (GN/WH).
- **Are the resistances less than 5 ohms for both measurements?**

  YES : INSTALL a new RH front window motor. REFER to **Window Regulator Motor**. TEST the system for normal operation.

  NO : REPAIR the circuit. DE-INITIALIZE, then INITIALIZE the RH front window motor. REFER to **Window Motor Initialization**. TEST the system for normal operation.

Pinpoint Test I: The Global Open Function is Inoperative/Does Not Operate Correctly - MKZ

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Windows for schematic and connector information.

Normal Operation

When the unlock button of the remote keyless entry (RKE) transmitter is held for 2 seconds the global open activates. The smart junction box (SJB) sends a signal on circuit CPW01 (BN/BU) to activate the one-touch down operation of both front windows.

The global open feature does not operate if the accessory delay relay is active.

- DTC B2947 Global Opening/Closing Circuit Open - Output is open or shorted to ground
- DTC B2949 Global Opening/Closing Circuit Short to Battery - Output is shorted to battery

This pinpoint test is intended to diagnose the following:

- RKE transmitters
- Wiring, terminals or connectors
- SJB
- Window motors not initialized

PINPOINT TEST I: THE GLOBAL OPEN FUNCTION IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - MKZ

NOTE: **One-touch up/down must be operational for the global open function to operate correctly. Make sure one-touch up/down is operational before proceeding with this diagnostic.**

I1 CHECK THE DTCs

- Refer to the results from the previous SJB self-test.

- **Was DTC B2947 or B2949 retrieved?**

  YES : For B2949, go to I2 .

  For B2947, go to I5 .

  NO : Go to I7.

I2 CHECK CIRCUIT CPW01 (BN/BU) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280C
- Key in ON position.

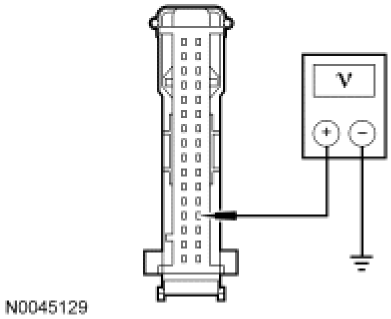


Fig. 46: Checking Circuit CPW01 (BN/BU) For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280C-29, circuit CPW01 (BN/BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to I3.

  NO : Go to I9.

I3 CHECK CIRCUIT CPW01 (BN/BU) FOR A SHORT TO VOLTAGE

- Disconnect: LH Front Window Motor C540

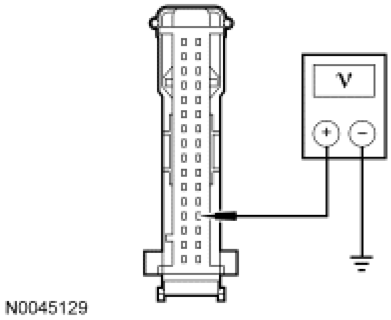


Fig. 47: Checking Circuit CPW01 (BN/BU) For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280C-29, circuit CPW01 (BN/BU), harness side and ground.

- **Is the voltage greater than 10 volts?**

  YES : Go to I4.

  NO : INSTALL a new LH front window motor. REFER to **Glass, Frames and Mechanisms - Exploded View, Front Door** and **Window Regulator and Motor - Front Door**. INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

I4 CHECK CIRCUIT CPW01 (BN/BU) FOR A SHORT TO VOLTAGE

- Disconnect: RH Front Window Motor C623

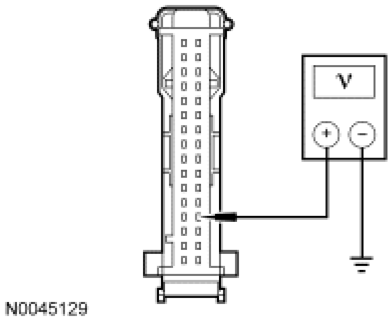


Fig. 48: Checking Circuit CPW01 (BN/BU) For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280C-29, circuit CPW01 (BN/BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : REPAIR the circuit. DE-INITIALIZE then INITIALIZE the LH and RH front window motors. REFER to **Window Motor Initialization**. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : INSTALL a new RH front window motor. REFER to **Glass, Frames and Mechanisms - Exploded View, Front Door** and **Window Regulator and Motor - Front Door**. INITIALIZE the LH front window motor. REFER to **Window Motor Initialization**. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

I5 CHECK CIRCUIT CPW01 (BN/BU) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280C
- Disconnect: LH Front Window Motor C540
- Disconnect: RH Front Window Motor C623

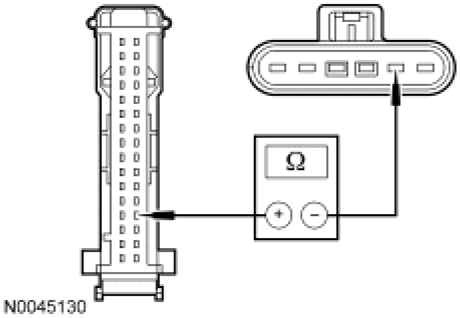


Fig. 49: Checking Circuit CPW01 (BN/BU) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280C-29, circuit CPW01 (BN/BU), harness side and LH front window motor C540-2, circuit CPW01 (BN/BU), harness side; and between SJB C2280C-29, circuit CPW01 (BN/BU), harness side and RH front window motor C604-2, circuit CPW01 (BN/BU), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to I6.

  NO : REPAIR the circuit. DE-INITIALIZE then INITIALIZE the LH and RH front window motors. REFER to **Window Motor Initialization**. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

I6 CHECK CIRCUIT CPW01 (BN/BU) FOR A SHORT TO GROUND

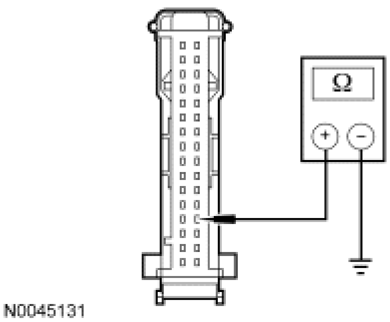


Fig. 50: Checking Circuit CPW01 (BN/BU) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280C-29, circuit CPW01 (BN/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to I9.

  NO : REPAIR the circuit. DE-INITIALIZE then INITIALIZE the LH and RH front window motors. REFER to **Window Motor Initialization**. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

I7 CHECK THE RKE TRANSMITTER OPERATION

- Operate the RKE lock/unlock function using all of the RKE transmitters.
- **Does the RKE lock/unlock function operate correctly with at least one of the RKE transmitters?**

  YES : Go to I8.

  NO : REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article to continue diagnosis of the RKE system. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

I8 CHECK THE RKE TRANSMITTERS GLOBAL OPEN OPERATION

- Operate the global open function using all of the RKE transmitters.
- **Does the global open function operate correctly with at least one of the RKE transmitters?**

  YES : PROVIDE new RKE transmitters. REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article. TEST the system for normal operation.

  NO : Go to I9.

I9 CHECK THE SJB FOR CORRECT OPERATION

- Disconnect all of the SJB connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all of the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test J: The Defrost System is Inoperative - MKZ

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Heated Window for schematic and connector information.

Normal Operation

The heated backlight relay, which is integral to the smart junction box (SJB), receives power from circuit SBB06 (BN/RD). When the rear window defrost switch is pressed on the HVAC, a message is sent to the SJB through circuit CH122 (WH/OG). Once the SJB receives the message to turn on the rear window defrost, the SJB grounds the heated backlight relay coil, which sends power through the antenna module to the rear window defrost grid through circuit CLS38 (VT/WH).

- DTC B1345 Heated Backlite Input Circuit Short To Ground - Switch input shorted to ground

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Inoperative SJB
- Antenna module
- HVAC

PINPOINT TEST J: THE DEFROST SYSTEM IS INOPERATIVE - MKZ

J1 CHECK THE DTCs

- Refer to the results from the previous SJB self-test.
- **Was DTC B1345 retrieved?**

  YES : Go to J2.

  NO : Go to J3.

J2 CHECK CIRCUIT CH122 (WH/OG) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280D
- Disconnect: HVAC C2356A

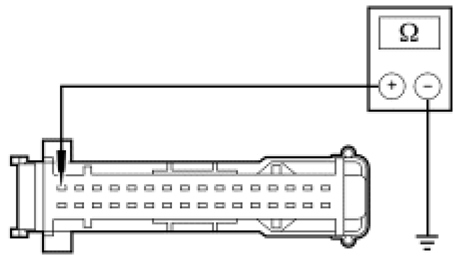


Fig. 51: Checking Circuit CH122 (WH/OG) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280D-16, circuit CH122 (WH/OG), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new HVAC. REFER to **CLIMATE CONTROL** article. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

J3 CHECK THE SJB REAR DEFROST SWITCH REQUEST PID (RDEF_SW)

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - SJB

- Monitor the SJB PID RDEF_SW while pressing the rear defrost switch.
- **Does the PID value agree with the rear defrost switch when pressed?**

  YES : Go to J5.

  NO : Go to J4.

J4 CHECK CIRCUIT CH122 (WH/OG) FOR AN OPEN CIRCUIT

- Key in OFF position.
- Disconnect: SJB C2280D
- Disconnect: HVAC C2356A

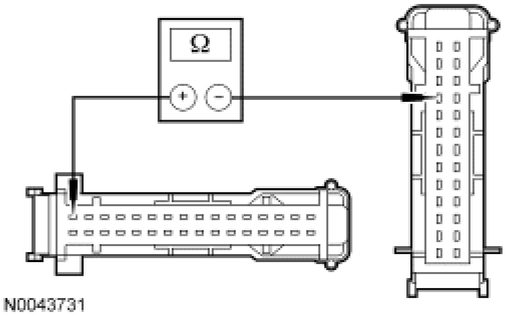


Fig. 52: Checking Circuit CH122 (WH/OG) For Open Circuit
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280D-16, circuit CH122 (WH/OG), harness side and HVAC C2356A-10, circuit CH122 (WH/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new HVAC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

J5 CHECK THE SJB OUTPUT

- Turn the rear defroster ON. Measure the voltage across the rear window defrost grid terminals.
- **Is the voltage greater than 10 volts?**

  YES : REPAIR the rear window defrost grid or INSTALL a new rear window glass. REFER to **Window Grid Wire Repair**, **Window Glass - Rear**. TEST the system for normal operation.

  NO : Go to J6.

J6 CHECK CIRCUIT CLS38 (VT/WH) VOLTAGE

- Key in OFF position.
- Connect: SJB C2280A
- Disconnect: Antenna module C4194B
- Key in ON position.
- Turn the rear defroster ON.

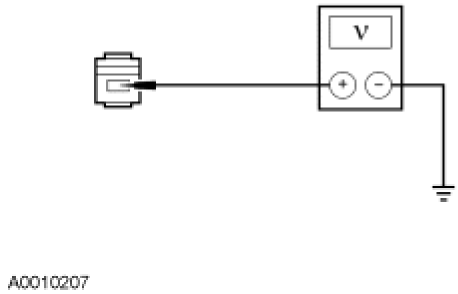


Fig. 53: Checking Circuit CLS38 (VT/WH) Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between antenna module C4194B-1, circuit CLS38 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSPECT antenna module jumper harness and rear window defrost grid ground circuit for damage and repair as necessary. If jumper harness and defrost grid ground wire are OK, INSTALL a new antenna module.

  NO : VERIFY SJB fuse 8 (30A) is OK. If OK, go to J7. If not OK, REFER to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ to identify the possible causes of the circuit short. TEST the system for normal operation.

J7 CHECK FOR POWER TO THE SJB HEATED BACKLIGHT CIRCUIT

- Key in OFF position.
- Disconnect: SJB C2280A

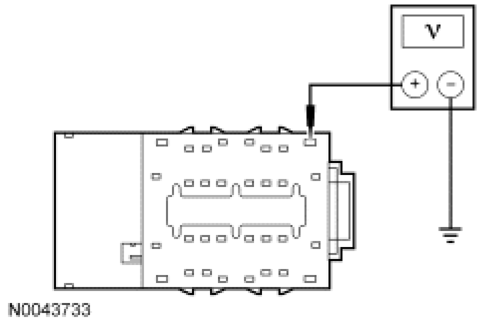


Fig. 54: Checking For Power To SJB Heated Backlight Circuit
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280A-29, circuit SBB06 (BN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to J8.

  NO : VERIFY battery junction box (BJB) fuse 6 (40A) is OK. If OK, REPAIR the circuit. If not OK, REFER to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING**

DIAGRAMS article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ to identify the possible causes of the circuit short. TEST the system for normal operation.

J8 CHECK CIRCUIT CLS38 (VT/WH) FOR AN OPEN

- Disconnect: SJB C2280E
- Key in OFF position.

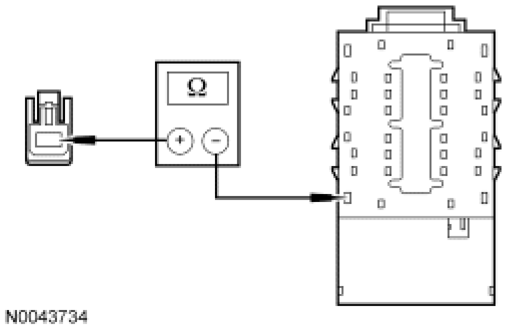


Fig. 55: Checking Circuit CLS38 (VT/WH) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280E-1, circuit CLS38 (VT/WH), harness side and antenna module C4194B-1, circuit CLS38 (VT/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to J9.

  NO : REPAIR the circuit(s). TEST the system for normal operation.

J9 CHECK FOR CORRECT SJB OPERATION

- Disconnect all SJB connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article for the removal and installation procedure. TEST the system for normal operation.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test K: The Defrost System Will Not Shut Off Automatically - MKZ

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Heated Window for schematic and connector information.

Normal Operation

The heated backlight relay, which is integral to the smart junction box (SJB), receives power from circuit SBB06 (BN/RD). When the rear window defrost switch is pressed on the HVAC, a message is sent to the SJB through circuit CH122 (WH/OG). Once the SJB receives the message to turn on the rear window defrost, the SJB grounds the heated backlight relay coil, which sends power through the antenna module to the rear window defrost grid through circuit CLS38 (VT/WH).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Antenna module
- SJB

PINPOINT TEST K: THE DEFROST SYSTEM WILL NOT SHUT OFF AUTOMATICALLY - MKZ

K1 CHECK CIRCUIT CLS38 (VT/WH) FOR SHORT TO VOLTAGE

- Disconnect: SJB C2280E
- Key in ON position.
- Measure the voltage across the rear window defrost grid terminals.
- **Is the voltage greater than 10 volts?**

  YES : Go to K2.

  NO : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article for the removal and installation procedure. TEST the system for normal operation.

K2 CHECK CIRCUIT CLS38 (VT/WH) FOR SHORT TO VOLTAGE

- Disconnect: Antenna module C4194B
- Key in ON position.

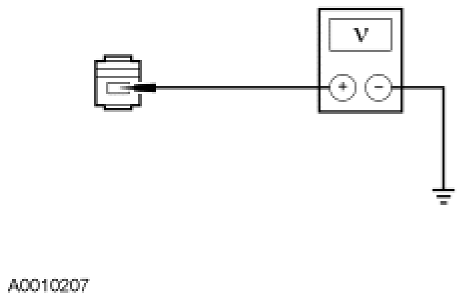


Fig. 56: Checking Circuit CLS38 (VT/WH) For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between antenna module C4194B-1, circuit CLS38 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSPECT antenna module jumper harness for damage and repair as necessary. If jumper

harness is OK, INSTALL a new antenna module. TEST the system for normal operation.

NO : REPAIR the short to voltage in circuit CLS38 (VT/WH). TEST the system for normal operation.

Pinpoint Test L: The Delayed Accessory is Inoperative/Does Not Operate Correctly

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Windows for schematic and connector information.

Normal Operation

The accessory delay relay, which is integral to the smart junction box (SJB), receives power from the battery junction box (BJB) through circuit SBB01 (RD). When the ignition key is turned ON, the SJB activates the accessory delay relay, which provides power to the LH front window control switch through circuit CPW30 (GY/YE). The delayed accessory feature remains active for 10 minutes after the ignition key is turned OFF or until either front door is opened.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- SJB
- Door ajar switch(es)

PINPOINT TEST L: THE DELAYED ACCESSORY IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

L1 CHECK FOR CORRECT OPERATION OF THE DOOR AJAR SWITCHES

- Open and close the front doors. Verify the interior lights turn on when the doors are open, and off when the doors are closed.
- **Do the interior lights operate normally?**

  YES : Go to L2.

  NO : VERIFY SJB fuse 3 (15A) and fuse 12 (7.5A) (MKZ only) are OK. If OK, REFER to **INTERIOR LIGHTING** article to diagnose the interior lighting and door ajar switches. If not OK, REFER to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ to identify the possible causes of the circuit short. TEST the system for normal operation.

L2 CHECK CIRCUIT SBB01 (RD) FOR VOLTAGE

- Disconnect: SJB C2280F
- Key in ON position.

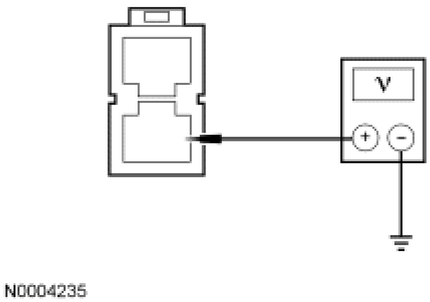


Fig. 57: Checking Circuit SBB01 (RD) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280F-2, circuit SBB01 (RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to L3.

  NO : VERIFY BJB fuse 1 (60A) is OK. If OK, REPAIR the circuit. If not OK, REFER to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ to identify the possible causes of the circuit short. TEST the system for normal operation.

L3 CHECK CIRCUIT CPW30 (GY/YE) FOR AN OPEN

- Disconnect: LH Front Window Control Switch C504A (Fusion, Milan) or C504B (MKZ)

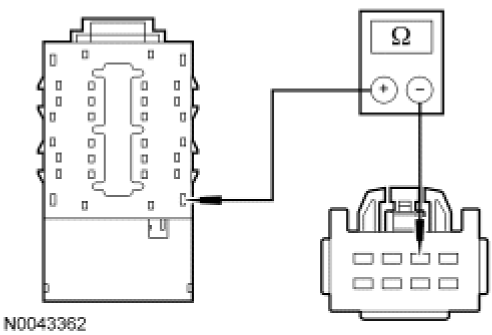


Fig. 58: Checking Circuit CPW30 (GY/YE) For An Open (Fusion Or Milan)
Courtesy of FORD MOTOR CO.

- For Fusion or Milan, measure the resistance between LH front window control switch C504A-2, circuit CPW30 (GY/YE), harness side and SJB C2280E-4, circuit CPW30 (GY/YE), harness side.

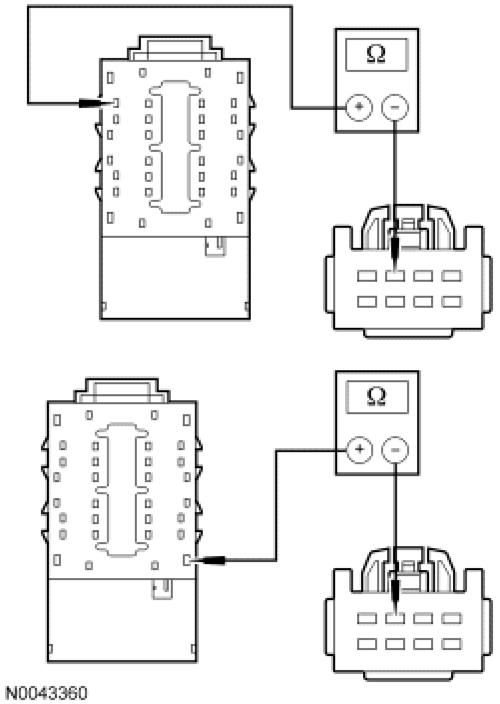


Fig. 59: Checking Circuit CPW30 (GY/YE) For An Open (MKZ)
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between LH front window control switch C504B-3, circuit CPW30 (GY/YE), harness side and SJB C2280E-4, circuit CPW30 (GY/YE), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to L4.

  NO : REPAIR the circuit. TEST the system for normal operation.

L4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all SJB connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article for the removal and installation procedure. TEST the system for normal operation.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test M: The Defrost System is Inoperative - Fusion, Milan

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Heated Window for schematic and connector information.

Normal Operation

The heated backlight relay, which is integral to the smart junction box (SJB), receives power from circuit SBB06 (BN/RD). When the rear window defrost switch is pressed on the HVAC module - electronic automatic temperature control (EATC) or HVAC module- electronic manual temperature control module (EMTC), a message is sent to the SJB through circuit CH122 (WH/OG). Once the SJB receives the message to turn on the rear window defrost, the SJB grounds the heated backlight relay coil, which sends power to the rear window defrost grid through circuit CLS38 (VT/WH).

- DTC B1345 Heated Backlite Input Circuit Short To Ground - Switch input shorted to ground

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- SJB
- HVAC module - EATC or HVAC module - EMTC

PINPOINT TEST M: THE DEFROST SYSTEM IS INOPERATIVE - FUSION, MILAN

M1 CHECK THE DTCs

- Refer to the results from the previous SJB self-test.
- **Was DTC B1345 retrieved?**

  YES : Go to M2.

  NO : Go to M3.

M2 CHECK CIRCUIT CH122 (WH/OG) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280D
- Disconnect: HVAC module - EATC C228A or HVAC module - EMTC C2357A

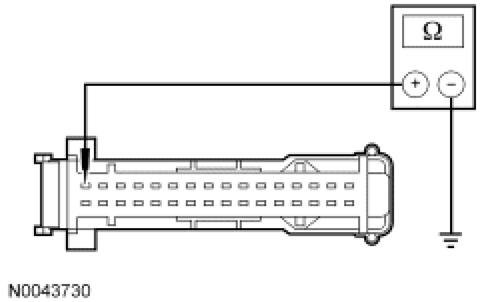


Fig. 60: Checking Circuit CH122 (WH/OG) For Short To Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280D-16, circuit CH122 (WH/OG), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new HVAC module - EATC or HVAC module - EMTC. REFER to **CLIMATE CONTROL** article. REPEAT the self-test. TEST the system for normal operation.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

M3 CHECK THE SJB REAR DEFROST SWITCH REQUEST PID (RDEF_SW)

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - SJB
- Monitor the SJB PID RDEF_SW while pressing the rear defrost switch.
- **Does the PID value agree with the rear defrost switch when pressed?**

  YES : Go to M5.

  NO : Go to M4.

M4 CHECK CIRCUIT CH122 (WH/OG) FOR AN OPEN CIRCUIT

- Key in OFF position.
- Disconnect: SJB C2280D
- Disconnect: HVAC module - EATC C228A or HVAC module - EMTC C2357A

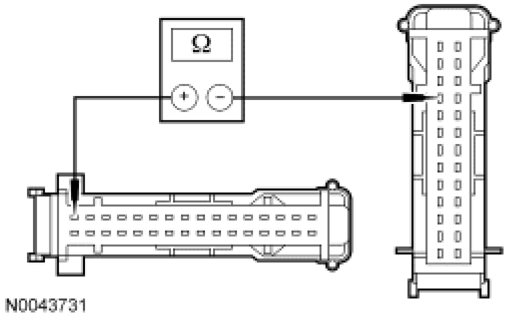


Fig. 61: Checking Circuit CH122 (WH/OG) For Open Circuit
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280D-16, circuit CH122 (WH/OG), harness side and HVAC module - EATC C228A-10 or HVAC module - EMTC C2357A-10, circuit CH122 (WH/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new HVAC module - EATC or HVAC module - EMTC. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

M5 CHECK THE SJB OUTPUT

- Disconnect: Rear Window Defrost Grid Power C402A

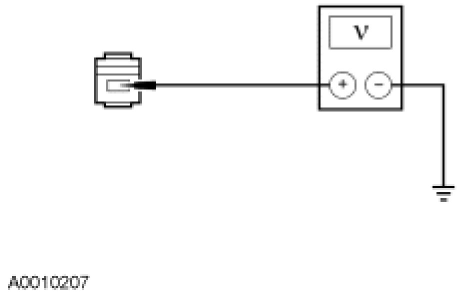


Fig. 62: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Turn the rear defroster ON. Measure the voltage between rear window defrost grid power C402A-1, circuit CLS38 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to M6.

  NO : Go to M7.

M6 CHECK THE REAR WINDOW DEFROST GROUND

- Key in OFF position.
- Disconnect: Rear Window Defrost Grid Ground C402B

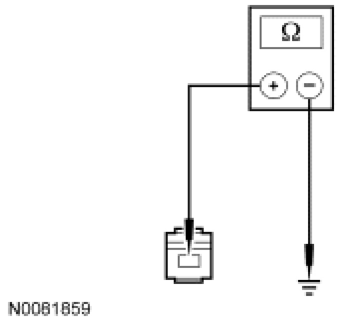


Fig. 63: Checking Rear Window Defrost Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between rear window defrost grid ground C402B-1, circuit GD147 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : REPAIR the rear window defrost grid or INSTALL a new rear window glass. REFER to **Window Grid Wire Repair**, **Window Glass - Rear**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

M7 CHECK FOR POWER TO THE SJB HEATED BACKLIGHT CIRCUIT

- Key in OFF position.
- Disconnect: SJB C2280A

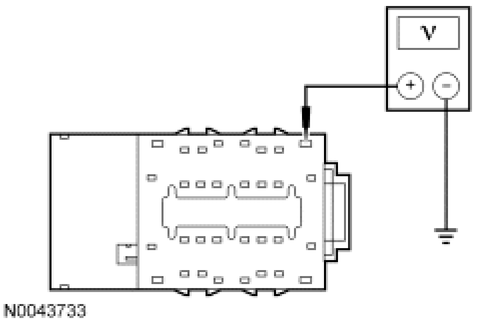


Fig. 64: Checking For Power To SJB Heated Backlight Circuit
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280A-29, circuit SBB06 (BN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to M8.

  NO : VERIFY battery junction box (BJB) fuse 6 (40A) is OK. If OK, REPAIR the circuit. If not OK, REFER to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ to identify the possible causes of the circuit short. TEST the system for normal operation.

M8 CHECK CIRCUIT CLS38 (VT/WH) FOR AN OPEN

- Disconnect: SJB C2280E
- Key in OFF position.

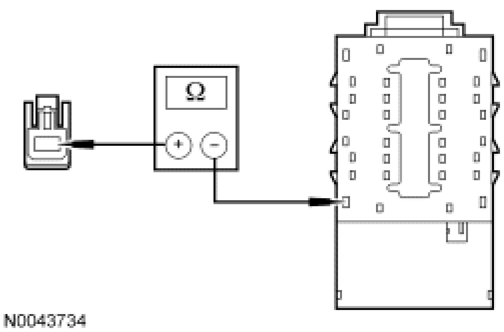


Fig. 65: Checking Circuit CLS38 (VT/WH) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280E-1, circuit CLS38 (VT/WH), harness side and rear window defrost grid power C402A-1, circuit CLS38 (VT/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to M9.

  NO : REPAIR the circuit(s). TEST the system for normal operation.

M9 CHECK FOR CORRECT SJB OPERATION

- Disconnect all SJB connectors.
- Check for:

    - corrosion.
    - pushed-out pins.
  - Connect all SJB connectors and make sure they seat correctly.
  - Operate the system and verify the concern is still present.
  - **Is the concern still present?**

    YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article for the removal and installation procedure. TEST the system for normal operation.

    NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

Pinpoint Test N: The Defrost System Will Not Shut Off Automatically - Fusion, Milan

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Heated Window for schematic and connector information.

Normal Operation

The heated backlight relay, which is integral to the smart junction box (SJB), receives power from circuit SBB06 (BN/RD). When the rear window defrost switch is pressed on the HVAC module - electronic automatic temperature control (EATC) or HVAC module - electronic manual temperature control (EMTC), a message is sent to the SJB through circuit CH122 (WH/OG). Once the SJB receives the message to turn on the rear window defrost, the SJB grounds the heated backlight relay coil, which sends power to the rear window defrost grid through circuit CLS38 (VT/WH).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB

PINPOINT TEST N: THE DEFROST SYSTEM WILL NOT SHUT OFF AUTOMATICALLY - FUSION, MILAN

N1 CHECK CIRCUIT CLS38 (VT/WH) FOR SHORT TO VOLTAGE

  - Disconnect: SJB C2280E
  - Disconnect: Rear Window Defrost Grid Power C402A
  - Key in ON position.

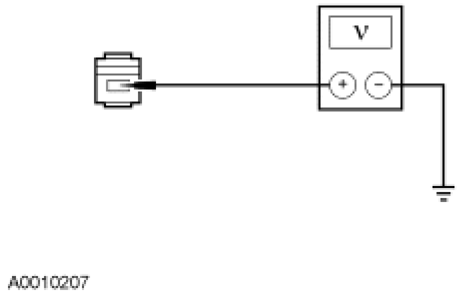


Fig. 66: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between rear window defrost grid power C402A-1, circuit CLS38 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article for the removal and installation procedure. TEST the system for normal operation.

Component Test

Grid Wire Test

1. Using a bright lamp in the vehicle, inspect the wire grid from the exterior. A broken grid wire will appear as a brown spot.
2. Run the engine at idle. Set the heated rear window switch to ON. The indicator light should come on.
3. Working in the vehicle with a voltmeter, contact the broad red-brown stripes of the rear glass window positive lead to battery side and the negative lead to ground side. The meter should read 10-13 volts. A lower voltage reading indicates a loose ground connection.
4. Contact a good ground point with the negative lead of the meter. The voltage reading should not change.
5. With the negative lead of the meter grounded, touch each grid line of the heated rear window glass at its midpoint with the positive lead. A reading of approximately 6 volts indicates the line is good. A reading of 0 volt indicates the line is broken between the midpoint and the B+ side of the grid line. A reading of 12 volts indicates the circuit is broken between the midpoint of the grid line and ground.
6. Pinpointing the exact position of the break can be accomplished (if the voltmeter reads 0 volt when the midpoint of the grid line is touched with the positive lead of the voltmeter) by moving the positive lead of the voltmeter toward the B+ side of the grid line and touching the grid line until the voltmeter reads 12 volts. If the voltmeter reads 12 volts when the midpoint of the grid line is touched with the positive lead of the voltmeter, simply move the positive lead of the voltmeter toward the ground connection of the grid line and touch the grid line until the voltmeter reads 0 volt.

GENERAL PROCEDURES

WINDOW GRID WIRE REPAIR

General Equipment

Polypropylene Film Fine Line Tape (Commercially available)

Material

Item	Specification
Lacquer Touch-Up Paint (match color to exterior grid wire) PM-19500-XXXX	ESR-M2P100-C
Rear Window Defroster Repair PM-11 (US); CPM-11 (Canada)	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

NOTE: **The grid line material is not embedded into the glass, but is baked to the glass surface and consequently can be scraped off. An undamaged grid line will have small ridges that project above the surface of the glass and can easily be felt when running a fingernail across them. Grid lines that have been "razor bladed" will feel smooth when a fingernail is dragged across the affected area. Inoperative lines may appear to the eye to be undamaged due to residue remaining on the glass and will require diagnosis with a voltmeter or 12V test lamp. For additional information, refer to DIAGNOSTIC TESTS.**

1. Bring the vehicle up to a room temperature of at least 16°C (60°F) or above.

   NOTE: **Do not use scrapers, sharp instruments or abrasive window cleaners on the interior surface of the rear window glass as this may cause damage to the grid lines.**

2. Clean the entire grid line repair area with window cleaner and 0000 steel wool to remove all dirt, wax, grease, oil or other foreign material.
3. Mark the location of the grid break on the exterior of the rear window glass.

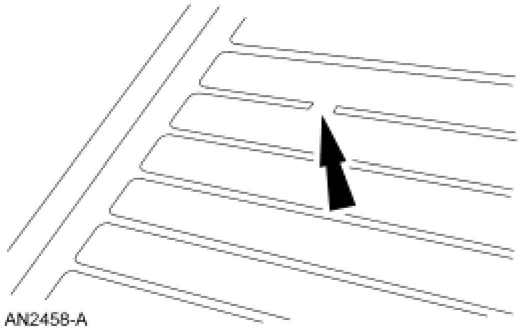


Fig. 67: Locating Grid Break
Courtesy of FORD MOTOR CO.

4. Using a polypropylene film fine line tape, mask the area directly above and below the grid break

extending the tape 26 mm (1.02 in) beyond the concern area in both directions. The break area should be at the center of the mask.

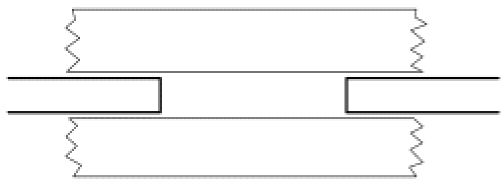


Fig. 68: Masking Grid Break Area
Courtesy of FORD MOTOR CO.

NOTE:	**If the brown layer is not broken or missing, apply only the silver grid repair compound to the break. If both the brown and silver layers of the grid are broken or missing, apply a coating of the lacquer touch up paint across the break in the grid line prior to applying the rear window defroster repair compound. Do not overlap the silver grid line with the paint. Several applications may be necessary to achieve a color match.**

NOTE:	**Allow at least 5 minutes of drying time between applications for the touch up paint or the silver repair coating. Applying fewer coats or not allowing adequate drying time between coats will produce repaired resistance that is greater than OEM resistance, resulting in poor defrost performance and excessive localized heating.**

5. Apply the repair coating to the grid break area in several smooth, continuous strokes. Extend the silver repair coating at least 6.35 mm (0.25 in) on both sides of the break area.

   Apply a minimum of 6 applications of the grid repair compound.

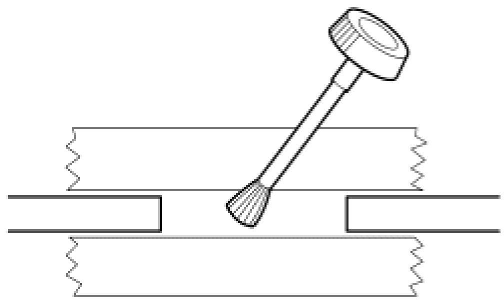


Fig. 69: Applying Repair Coating To Grid Break Area
Courtesy of FORD MOTOR CO.

NOTE: **The repair coating air-dries in approximately one minute and can be energized after 5 minutes. Optimum adhesion occurs after approximately 24 hours.**

6. Allow the repair area to dry completely and remove the mask.

NOTE: **Be careful not to damage the grid line with the razor blade. If this occurs, additional repair may be necessary.**

7. Remove any excess repair compound above or below the grid line with a razor blade.

NOTE: **The interior side of the grid lines are not painted, but due to the silver tarnishing will tend to change the grid to a gold or brown color. The repair area will be bright silver and will also tarnish over time to match the rest of the grid.**

8. Test the system for normal operation.

LEAD TERMINAL REPAIR

General Equipment

Terminal Kit - Back Glass 4F1Z-14421-AA

Material

Item	Specification
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

1. Bring the vehicle up to room temperature of at least 16°C (60°F) or above.

NOTE: **The new terminal will cover the original terminal location, but it must be placed so that the terminal conductive areas will be placed on a good conductive base.**

2. Clean the bus bar in the area to be repaired with steel wool (000 to 0000 grade), and then with window cleaner to remove all dirt, wax, grease, oil or other foreign material.

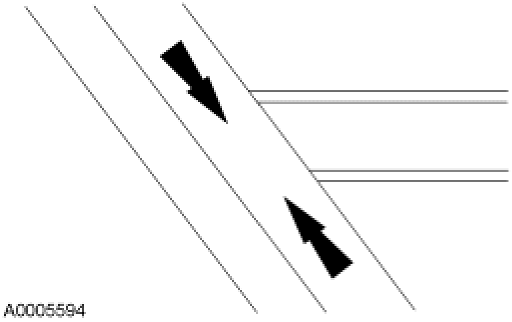


Fig. 70: Identifying Bus Bar Area To Be Repaired
Courtesy of FORD MOTOR CO.

NOTE: **Do not use any type of flame torch or flame-heated soldering gun for this procedure. Use of these tools provide inadequate heat generation at the tip and the exhaust heat can cause damage to plastic trim parts in the area. Use only an electric soldering gun with 100 watts or more of power. Before using the soldering gun, be sure to melt a small amount of rosin core solder to the tip. The solder will assist in achieving better heat transfer from the soldering gun tip to the new terminal.**

NOTE: **Depending on the original terminal location, and whether the terminal is covered by pillar trim, will determine where to locate the new terminal. Some grid line bus bars may only allow the placement of the terminal above or below the original tab location due to space limitations. For most vehicle applications, the replacement tab location will cover the original tab location, but still allow the replacement tab to attach to the bus bar on good conductive material.**

3. Place the replacement terminal type A over the original tab location, making sure the conductive areas of the terminal will be on a good conductive area. Do not place the terminal tab foot on the original location, which does not have conductive material.
4. Hold the terminal in place with an item such as a regular lead pencil at a 90 degree angle from the terminal. (Holding at other than a 90 degree angle may allow the terminal to slip when the solder liquefies.)

NOTE: **The new terminal has pre-applied solder, flux and temperature-sensitive paint. The paint provides a visual indication when the terminal has reached the correct temperature to melt solder on the terminal. When the correct temperature is achieved, the temperature paint will liquefy and change color.**

5. Place the soldering gun tip on the top of the terminal, but not on the painted areas of the tab. Energize the soldering gun and watch for the painted area of the terminal to liquefy and change color. The paint should liquefy in approximately 25-45 seconds after heating. As soon as the paint color completely changes on either side of the terminal, de-energize the soldering gun and continue to hold the terminal in place with

the soldering gun and pencil for an additional 30 seconds.

6. Remove the soldering gun and pencil from the terminal. The terminal should be allowed to cool for another 2 minutes before the wiring lead is attached to the terminal.
7. Attach the electrical lead connection to this terminal, turn on the heated rear window and verify the operation.

WINDOW MOTOR INITIALIZATION

NOTE: Initialization is required to learn both the full up and full down positions of the glass as it travels through the glass channel. Once initialized, obstacle detection is enabled.

NOTE: For MKZ only, the front window motor must be de-initialized, then initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

NOTE: A new (original factory setting) or de-initialized LH or RH front window motor will not operate in one-touch up mode until initialized. If a new LH or RH front window motor has been installed, proceed to the initialization procedure.

NOTE: If diagnosing a LH or RH front window switch problem, perform the window initialization procedure before replacing the window switch.

NOTE: All LH or RH front window components (window glass, window regulator, window motor, seals and glass top run) must be installed and tightened to specification before carrying out the initialization procedure.

NOTE: Excessive bounce-back (window reverses direction with no obstructions present) may indicate that a de-initialization procedure may need to be performed.

De-Initialization procedure

NOTE: The LH or RH front window motor must be reset to it's original factory settings first, then perform the following de-initialization procedure.

1. Turn the ignition key ON.
2. Operate the window control switch in one-touch mode and remove power from the window motor **while the window is moving** by one of the following methods:
    1. Disconnect the vehicle battery cable **while the window is moving** .
    2. Disconnect the window motor connector **while the window is moving** .

3. Remove the LH or RH front window motor fuse **while the window is moving** .

3. This will de-initialize the window motor and reset the window motor to its original factory settings.
4. Perform the initialization procedure to turn the one-touch up feature on.

Initialization procedure

NOTE: The LH or RH front window must be in the full OPEN position for this procedure to operate correctly.

NOTE: If the initialization procedure is only partially completed, the LH or RH front window motor will remain un-initialized and will operate only in proportional up/down and one-touch down modes.

5. Turn the ignition key ON.
6. Activate and hold the window control switch in the UP position at the second detent until the window glass stalls for 2 seconds into the glass top run and release the switch.
7. Activate and hold the window control switch in the DOWN position at the second detent until the window glass stalls for 2 seconds at the bottom of its travel and release the switch.
8. Test for correct window operation by carrying out the one-touch up and one-touch down features.

GLASS RESEAL - WINDSHIELD

Material

Item	Specification
Dow Urethane Adhesive Betaseal® Express	-
Sika Urethane Adhesive Sika Tack ASAP	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

1. Remove the cowl panel grille. For additional information, refer to **FRONT END BODY PANELS** article.
2. Remove the LH and RH A-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
3. Remove the LH and RH sun visors.
4. If equipped, remove the overhead console.
5. Remove the LH and RH assist handles.
6. Lower the front portion of the headliner and block with a suitable material.
7. Clean the edge formed by the existing urethane and the glass on the inside at the top and sides and outside on the bottom of the windshield with glass cleaner.
8. Cut the urethane applicator tip to specification.

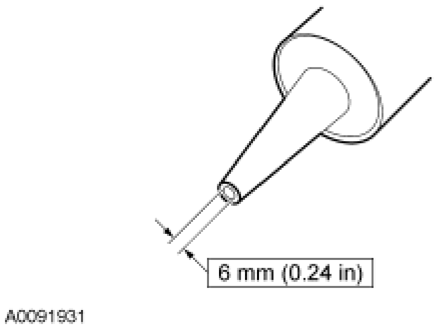


Fig. 71: Identifying Urethane Applicator Tip Specification
Courtesy of FORD MOTOR CO.

NOTE: Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane with less effort and a continuous bead.

NOTE: Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead.

9. Apply urethane adhesive over top of the existing urethane adhesive.
   - Apply the urethane to the top and sides of the windshield from the interior of the vehicle.
   - Apply the urethane to the bottom of the windshield from the exterior of the vehicle.

NOTE: The urethane adhesive must cure for a minimum of one hour before testing for air or water leaks.

10. After the urethane has cured, check the windshield seal for air or water leaks through the urethane bead and add urethane adhesive as necessary.
11. Position the front portion of the headliner.
12. Install the LH and RH assist handles.
13. If equipped, install the overhead console.
14. Install the LH and RH sun visors.
15. Install the LH and RH A-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
16. Install the cowl panel grille. For additional information, refer to **FRONT END BODY PANELS** article.
17. Clean the interior and exterior windshield glass with glass cleaner.

GLASS RESEAL - REAR

Material

Item	Specification
Dow Urethane Adhesive Betaseal® Express	-
Sika Urethane Adhesive	

Sika Tack ASAP	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

1. Remove the C-pillar trim panel and parcel shelf, and lower the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Disconnect the rear window glass electrical connectors.
3. Clean the interior and exterior of the windshield glass surface with glass cleaner.
4. Cut the urethane adhesive applicator tip to specification.

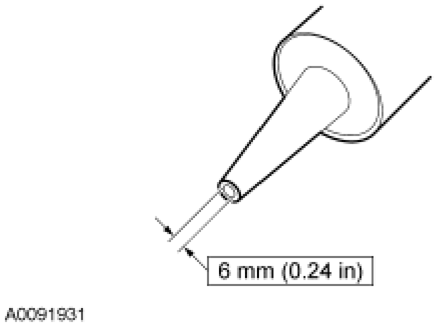


Fig. 72: Identifying Urethane Applicator Tip Specification
Courtesy of FORD MOTOR CO.

NOTE: **Use either a high ratio, electric or battery-operated caulk gun that applies the urethane with less effort and continuous bead.**

NOTE: **Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead.**

5. Apply the urethane adhesive over the top of the existing urethane adhesive.
   - Apply the urethane adhesive to the top and sides of the rear glass from the interior of the vehicle.
   - Apply the urethane adhesive to the bottom of the rear glass from the exterior of the vehicle.

NOTE: **The urethane adhesive must cure for a minimum of one hour before testing for air or water leaks.**

6. After the urethane cures, check the rear glass seal for air or water leaks through the urethane adhesive bead and add urethane adhesive as necessary.
7. Connect the rear window glass electrical connectors.
8. Install the headliner, parcel shelf and C-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

REMOVAL AND INSTALLATION

GLASS, FRAMES AND MECHANISMS - EXPLODED VIEW, FRONT DOOR

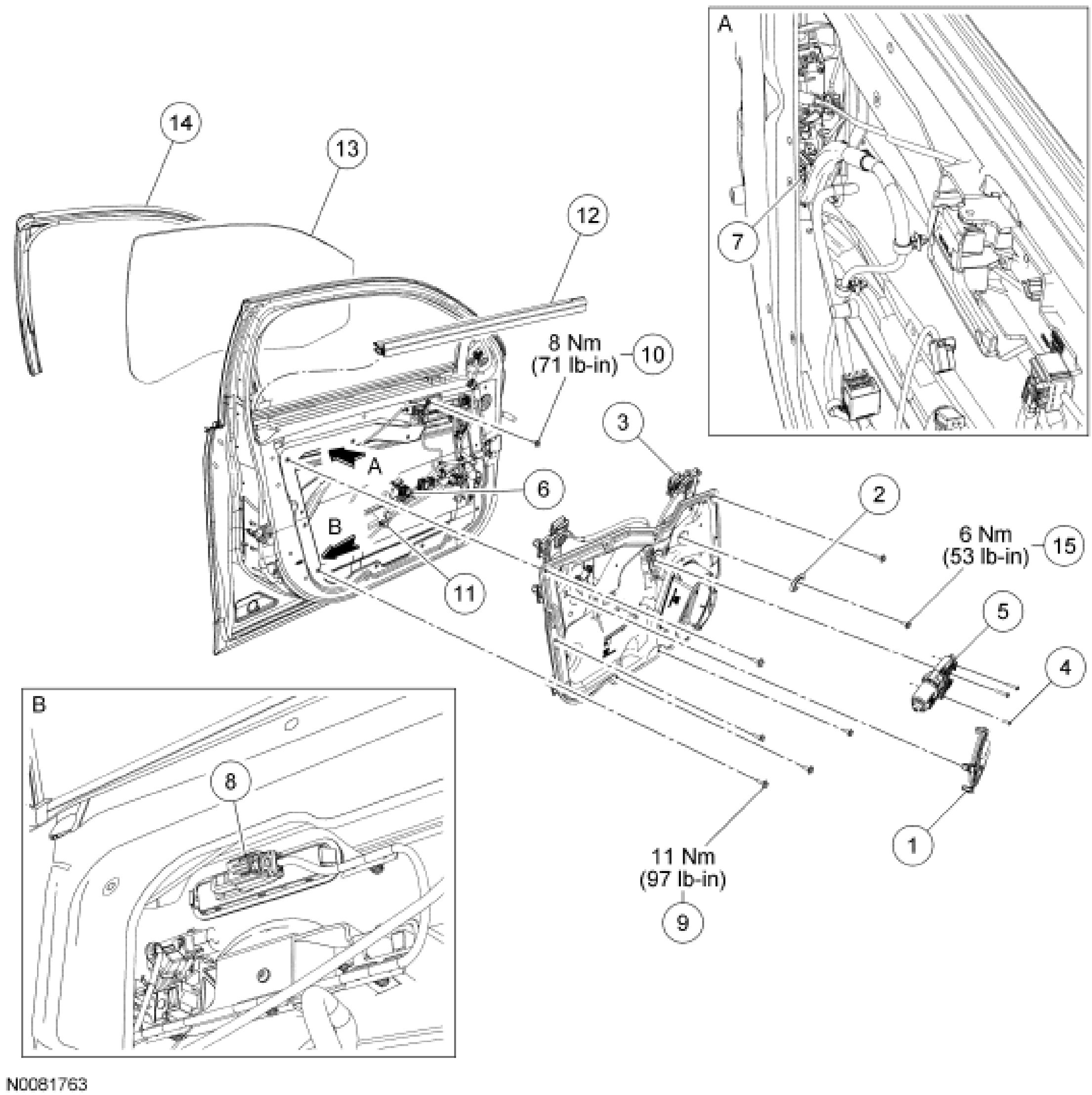


Fig. 73: Exploded View Of Front Door Glass, Frames & Mechanisms With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5402010	Wiring harness cover plate
2	378377-S	Access hole plug
3	5423201 LH/ 5423200 RH	Window regulator
4	W505966-S	Window motor screw (3 required)
5	5423395 LH/ 5423394 RH	Window motor
6	14489	Window motor electrical connector
7	14A464	Door latch electrical connector
8	14A464	Keypad latch electrical connector

9	W505421-S	Door module bolt (10 required)
10	-	Interior door handle bolt
11	-	Wiring harness retainer
12	5421457 LH/ 5421456 RH	Interior door window glass belt moulding
13	5421411 LH/ 5425712 RH	Front door window glass
14	5421597 LH/ 5421596 RH	Door window glass top run
15	378377-S	Window glass clamp bolt (2 required)

1. For additional information, refer to the procedures.

WINDOW GLASS - FRONT DOOR

REMOVAL AND INSTALLATION

NOTE: For MKZ only, if installing a new LH or RH front window motor, it must be initialized.

NOTE: For MKZ only, the LH or RH front window motor must be de-initialized, then initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.

1. Remove the front door trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the wiring harness cover plate and the access hole plug.

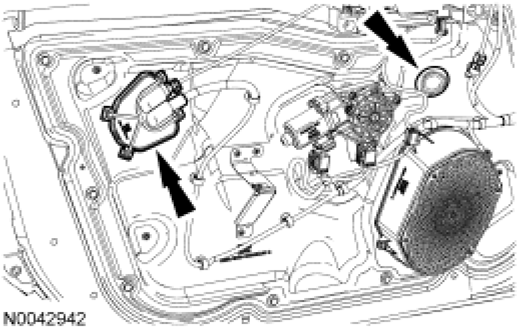


Fig. 74: Locating Wiring Harness Cover Plate And Access Hole Plug
Courtesy of FORD MOTOR CO.

NOTE: If the window regulator motor is inoperative, remove it. For additional information, refer to Window Regulator Motor.

3. Lower the window until the glass clamp bolts can be accessed through the access holes.
4. Loosen the B-pillar front door window glass clamp bolt.

- To install, tighten to 6 Nm (53 lb-in).

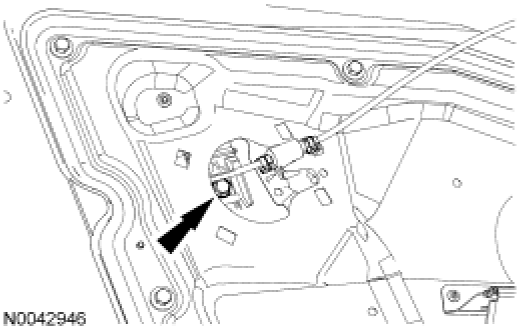


Fig. 75: Locating B-Pillar Front Door Window Glass Clamp Bolt
Courtesy of FORD MOTOR CO.

5. Loosen the A-pillar front door window glass clamp bolt.
    - To install, tighten to 6 Nm (53 lb-in).

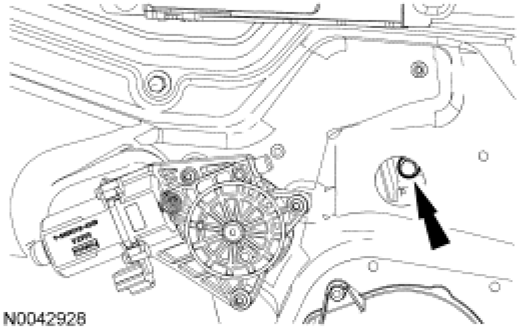


Fig. 76: Locating A-Pillar Front Door Window Glass Clamp Bolt
Courtesy of FORD MOTOR CO.

6. Tape the window in position, then lower the window regulator downward until it reaches the stops at the bottom of the regulator tracks.
7. Lift the window glass out of the door.
8. To install, reverse the removal procedure.
    - For MKZ only, if installing a new LH or RH front window motor, it must be initialized. For additional information, refer to **Window Motor Initialization**. If installing the original front window motor, it must be de-initialized, then initialized. For additional information, refer to **Window Motor Initialization**.

WINDOW REGULATOR MOTOR

REMOVAL AND INSTALLATION

NOTE:	**For MKZ only, if installing a new LH or RH front window motor, it must be initialized.**

NOTE: **For MKZ only, the LH or RH front window motor must be de-initialized, then initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.**

1. Remove the door trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Disconnect the window motor electrical connector.
3. Secure the glass in position with tape.
4. Remove the 3 window motor screws.

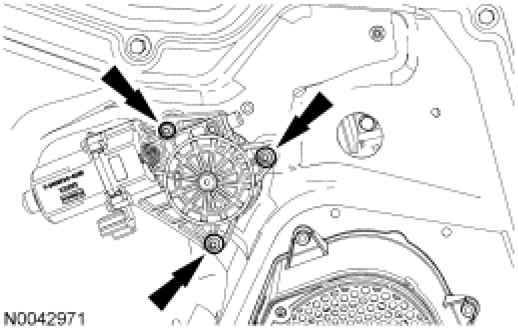


Fig. 77: Locating Window Motor Screws
Courtesy of FORD MOTOR CO.

5. Remove the window motor.
6. To install, reverse the removal procedure.
   - For MKZ only, if installing a new LH or RH front window motor, it must be initialized. For additional information, refer to **Window Motor Initialization**. If installing the original front window motor, it must be de-initialized, then initialized. For additional information, refer to **Window Motor Initialization**.

WINDOW REGULATOR AND MOTOR - FRONT DOOR

REMOVAL AND INSTALLATION

NOTE: **For MKZ only, if installing a new LH or RH front window motor, it must be initialized.**

NOTE: **For MKZ only, the LH and RH front window motor must be de-initialized, then initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.**

1. Remove the door trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the wiring harness cover plate and the access hole plug.

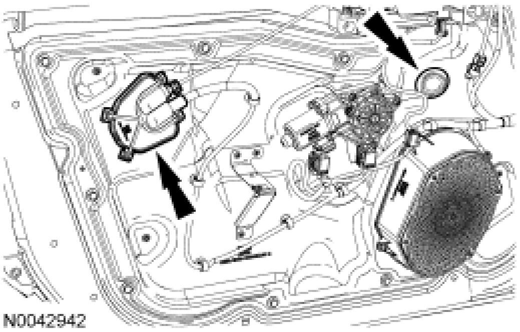


Fig. 78: Locating Wiring Harness Cover Plate And Access Hole Plug
Courtesy of FORD MOTOR CO.

NOTE: If the window regulator motor is inoperative, remove it. For additional information, refer to Window Regulator Motor.

3. Lower the window enough to access the window glass clamp bolts through the access holes.
4. Loosen the B-pillar window glass clamp bolt and disconnect the door latch cable retainers.
   - To install, tighten to 6 N.m (53 lb-in).

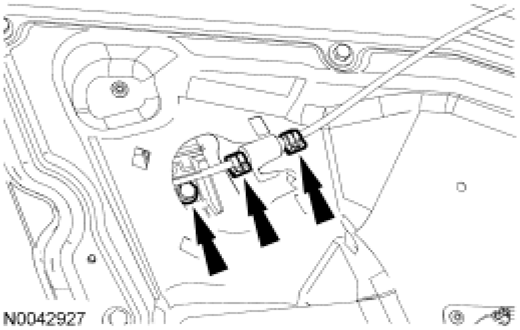


Fig. 79: Locating B-Pillar Window Glass Clamp Bolt And Door Latch Cable Retainers
Courtesy of FORD MOTOR CO.

5. Loosen the A-pillar window glass clamp bolt.
   - To install, tighten to 6 N.m (53 lb-in).

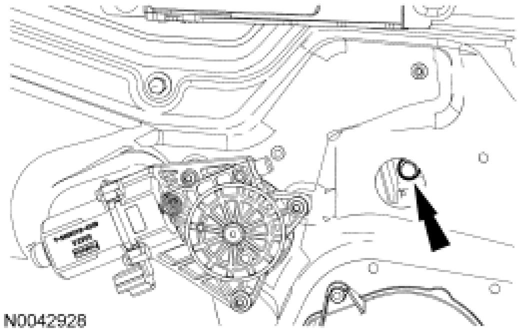


Fig. 80: Locating A-Pillar Front Door Window Glass Clamp Bolt
Courtesy of FORD MOTOR CO.

6. Tape the window in position, then lower the window regulator downward until it reaches the stops at the bottom of the regulator tracks.
7. Remove the front door speaker. For additional information, refer to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
8. Remove the interior door handle bolt and position the door handle aside.

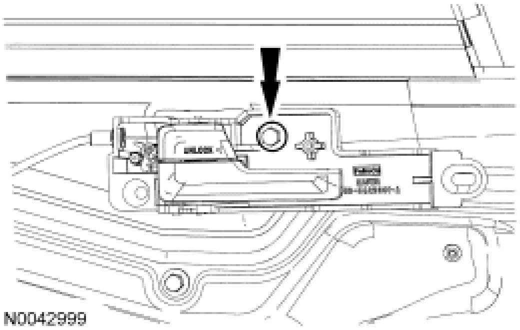


Fig. 81: Locating Interior Door Handle Bolt
Courtesy of FORD MOTOR CO.

9. Disconnect the wiring harness retainers.

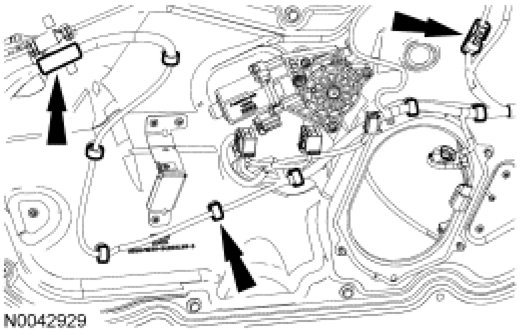


Fig. 82: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

10. Disconnect the door latch electrical connector.

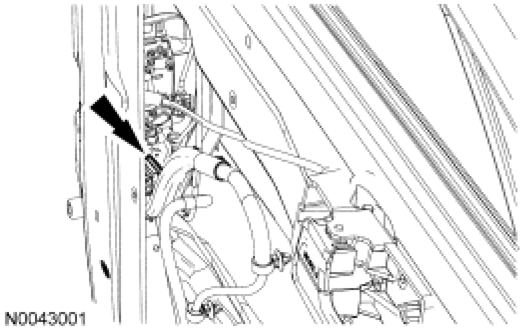


Fig. 83: Locating Door Latch Electrical Connector
Courtesy of FORD MOTOR CO.

11. If equipped, disconnect the keyless entry keypad and door lock electrical connector and release from the bracket.

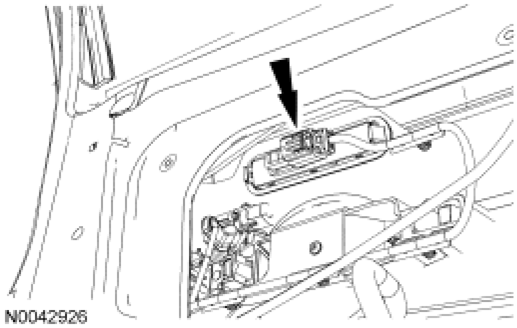


Fig. 84: Locating Door Lock Electrical Connector
Courtesy of FORD MOTOR CO.

12. If equipped, disconnect the power mirror electrical connector.

Fig. 85: Locating Power Mirror Electrical Connector
Courtesy of FORD MOTOR CO.

13. Remove the 10 door module bolts and the window regulator motor electrical connector.

- To install, tighten to 11 N.m (97 lb-in).

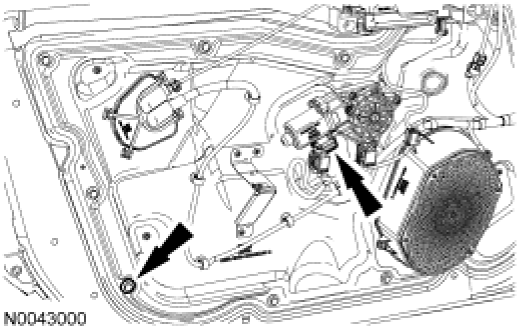


Fig. 86: Locating Window Regulator Motor Electrical Connector And Door Module Bolts
Courtesy of FORD MOTOR CO.

14. Remove the front door module. If installing a new door module, transfer parts as necessary.
15. To install, reverse the removal procedure.
    - For MKZ only, if installing a new LH or RH front window motor, it must be initialized. For additional information, refer to **Window Motor Initialization**. If installing the original front window motor, it must be de-initialized, then initialized. For additional information, refer to **Window Motor Initialization**.

DOOR GLASS TOP RUN - FRONT

REMOVAL AND INSTALLATION

NOTE: **For MKZ only, the front window motor must be de-initialized, then initialized whenever the front window motor is removed from the window regulator drum housing, a new window regulator is installed, a new window glass is installed, a new top run is installed or for any operation in which grease or lubricants are applied to the window regulator or glass run.**

1. Remove the front door window glass. For additional information, refer to **Window Glass - Front Door**.
2. Remove the front door window glass inner weatherstrip.

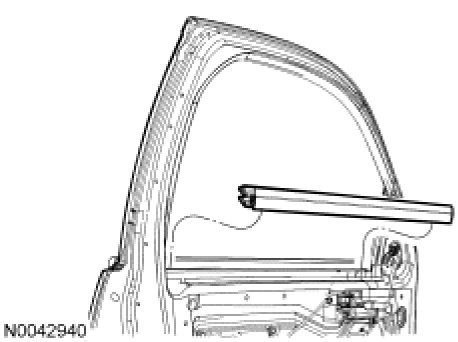


Fig. 87: Identifying Front Door Window Glass Inner Weatherstrip

Courtesy of FORD MOTOR CO.

3. Remove the front door glass top run.

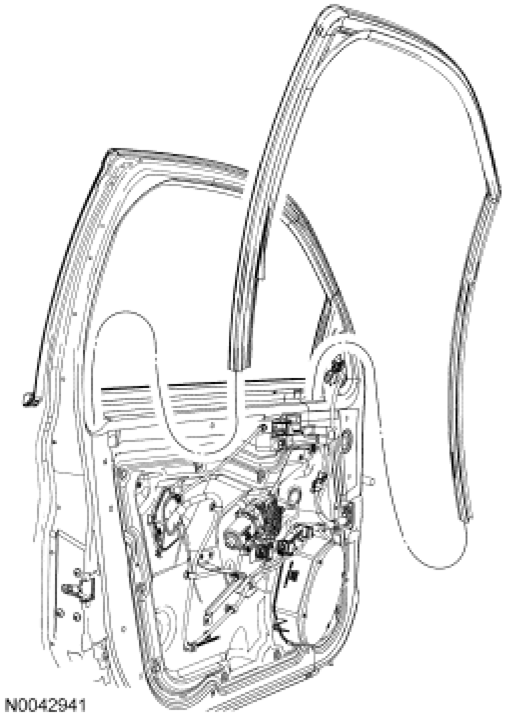


Fig. 88: Identifying Front Door Glass Top Run
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

GLASS, FRAMES AND MECHANISMS - EXPLODED VIEW, REAR DOOR

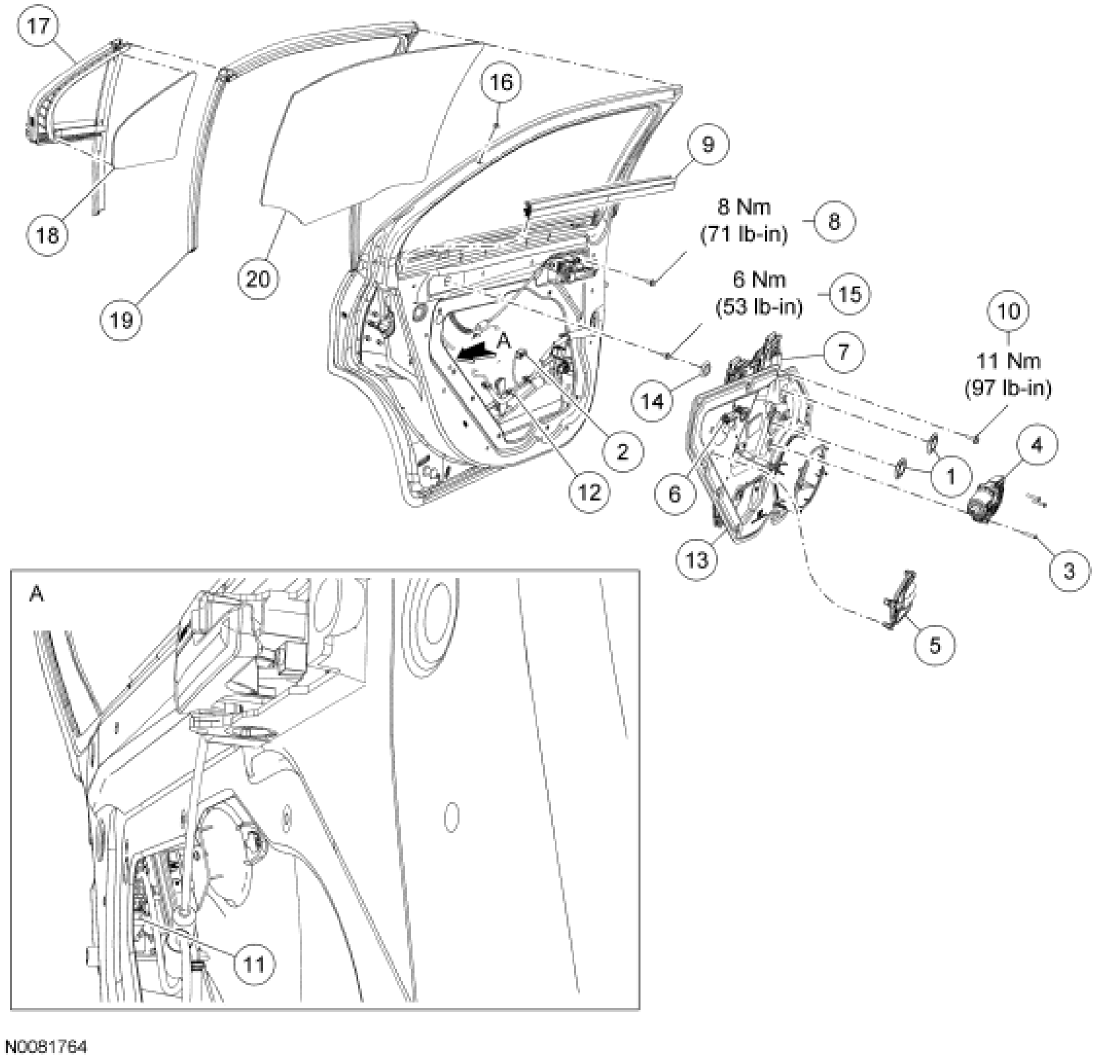


Fig. 89: Exploded View Of Rear Door Glass, Frames & Mechanisms With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	378377	Access hole plugs
2	14489	Electrical connector
3	W505966-S	Screw (3 required)
4	5423395 LH/ 5423394 RH	Window regulator motor
5	5402010	Wiring harness cover plate
6	-	Clip
7	5427001 LH/ 5427000 RH	Window regulator
8	-	Interior door handle bolt
9	5425861 LH/ 5425860 RH	Interior door window glass belt moulding
10	W505421-S	Door module bolt (10 required)

11	14A464	Rear door latch electrical connector
12	-	Wiring harness retainer
13	54235A89 LH/ 54235A88 RH	Rear door module
14	W651013-S	Access hole plug
15	W506410-S	Window regulator glass clamp bolt (2 required)
16	N811106-S	Upper C-pillar rear glass run bolt
17	5429905 LH/ 5429904 RH	Rear door fixed glass weatherstrip
18	5426871 LH/ 5426870 RH	Rear door fixed glass
19	5425767 LH/ 5425766 RH	Rear door glass top run
20	5425713 LH/ 5425712 RH	Rear door window glass

1. For additional information, refer to the procedures.

WINDOW GLASS - REAR DOOR

REMOVAL AND INSTALLATION

1. Remove the rear door fixed window glass. For additional information, refer to **Window Glass - Rear Door, Fixed**.
2. Remove the top run.
3. Remove the rear window glass.
4. To install, reverse the removal procedure.

WINDOW REGULATOR AND MOTOR - REAR DOOR

REMOVAL AND INSTALLATION

1. Remove the rear door trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the access hole plugs.

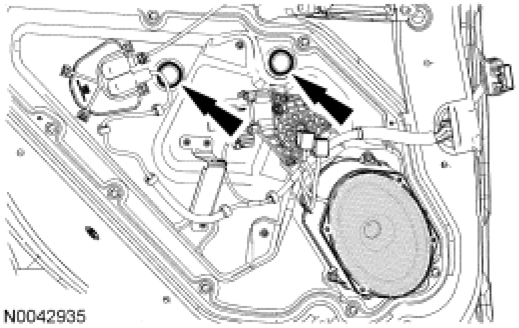


Fig. 90: Locating Access Hole Plugs
Courtesy of FORD MOTOR CO.

NOTE: **If the door window regulator motor is inoperative, remove it. For additional information, refer to Window Regulator Motor.**

3. Lower the window until the glass clamp bolts are accessible through the access hole plugs, then loosen the glass clamp bolts.
    - To install, tighten to 6 N.m (53 lb-in).

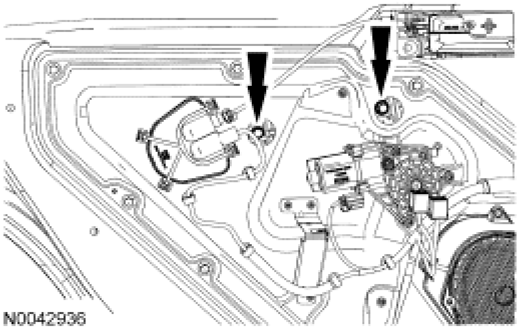


Fig. 91: Locating Glass Clamp Bolts
Courtesy of FORD MOTOR CO.

4. Tape the window in position, then lower the window regulator downward until it reaches the stops at the bottom of the regulator tracks.
5. Remove the door speaker. For additional information, refer to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
6. Remove the interior door handle screw and position the door handle aside.

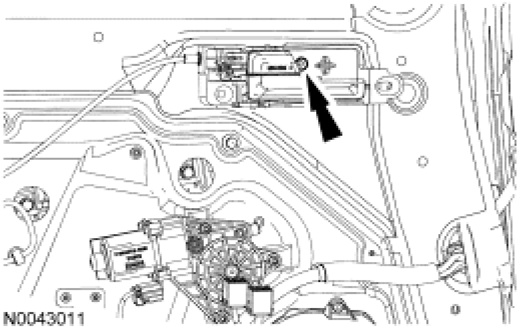


Fig. 92: Locating Interior Door Handle Screw
Courtesy of FORD MOTOR CO.

7. Disconnect the wiring harness retainers.

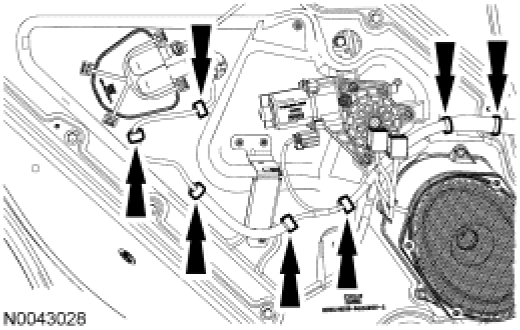


Fig. 93: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

8. Remove the wiring harness cover plate and disconnect the 2 door latch cable retainers.

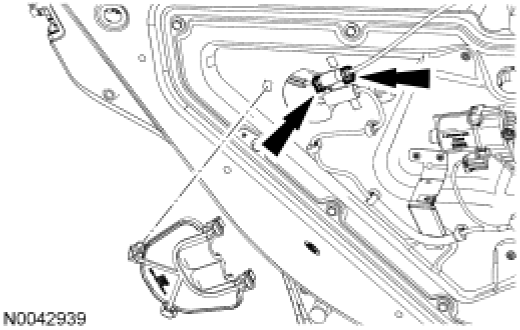


Fig. 94: Locating Wiring Harness Cover Plate & Door Latch Cable Retainers
Courtesy of FORD MOTOR CO.

9. Remove the 10 door module bolts.
   - To install, tighten to 11 N.m (97 lb-in).

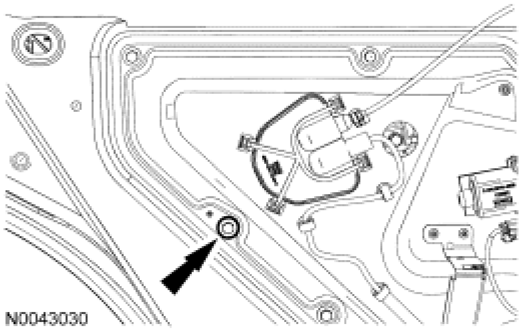


Fig. 95: Locating Door Module Bolts
Courtesy of FORD MOTOR CO.

10. Disconnect the door latch electrical connector.

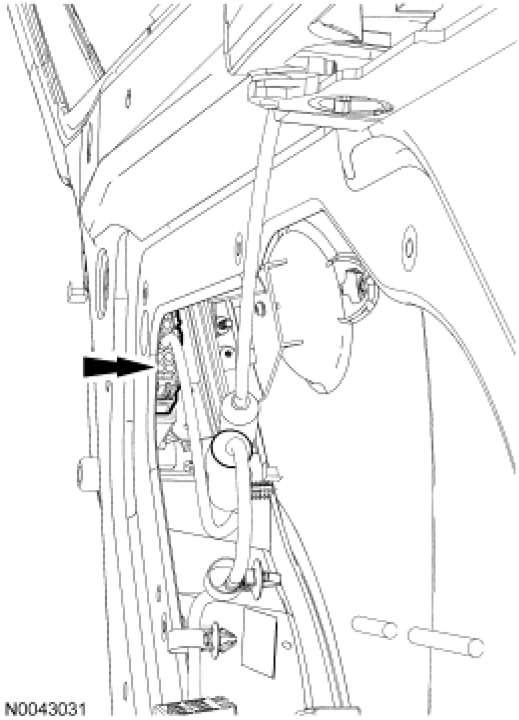


Fig. 96: Locating Door Latch Electrical Connector
Courtesy of FORD MOTOR CO.

11. Remove the rear door module assembly. If installing a new door module, transfer parts as necessary.
12. To install, reverse the removal procedure.

DOOR GLASS RUN AND BRACKET - REAR

REMOVAL AND INSTALLATION

1. Remove the rear door fixed window glass. For additional information, refer to **Window Glass - Rear Door, Fixed**.
2. Carefully position the glass aside, then remove the rear door glass top run.
3. To install, reverse the removal procedure.

WINDOW CONTROL SWITCH

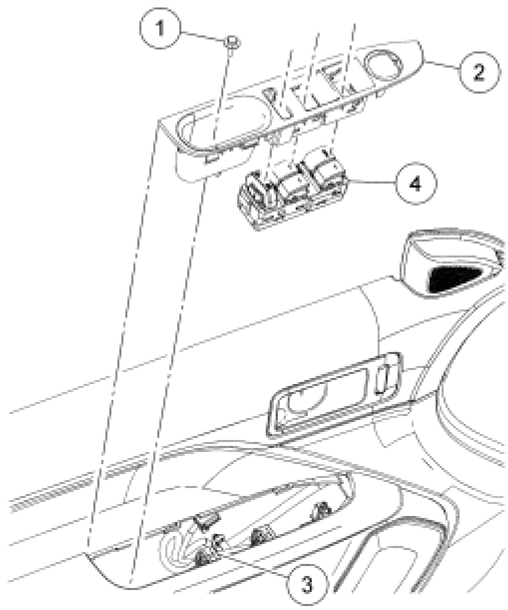


Fig. 97: Exploded View Of Window Control Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W703268	Screw
2	54266	Window control switch bezel
3	-	Electrical connector (3 required)
4	14529	Window control switch

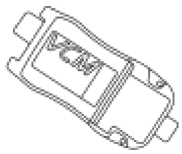
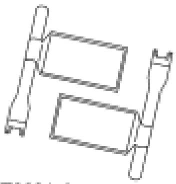
REMOVAL AND INSTALLATION

1. Remove the window regulator control switch bezel.
   - Remove the screw.
   - Disconnect the electrical connectors.
2. Remove the window control switch.
3. To install, reverse the removal procedure.

WINDOW GLASS - REAR

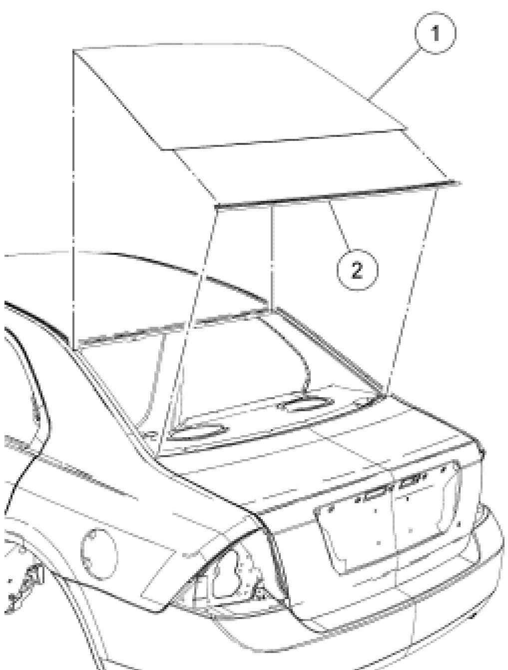
Special Tools

Illustration	Tool Name	Tool Number
	Interior Auto Glass Cut-Out Knife Kit (Electric)	164-R2450 or equivalent

 ST2834-A		
 ST2621-A	The Pumper	164-R2459 or equivalent

Material

Item	Specification
Dow Urethane Adhesive Betaseal® Express	-
Dow Urethane One Step Glass Primer Betaprime® 5500 / 5500A / 5500SA	-
Sika Urethane Adhesive Sika Tack ASAP	-
Sika Urethane Metal and Glass Primer Sika 206 G+P	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A



N0042938

Fig. 98: Exploded View Of Rear Window Glass
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5442006	Rear window glass
2	-	Moulding

REMOVAL

NOTE: If the rear window glass is being removed to repair a dust/water leak, remove and reinstall the existing rear window glass.

1. Remove the C-pillar trim panel and parcel shelf, and lower the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Disconnect the 2 rear window defrost electrical connectors.
3. Before cutting the urethane adhesive, remove dirt and other foreign material from the rear window pinchweld area.
   - Use a clean shop towel or oil-free, compressed air.

   NOTE: Refer to manufacturer's instructions before using the special tool.

4. Lubricate the urethane adhesive with water to aid the Interior Auto Glass Cut-Out Knife Kit (Electric) when cutting.

   WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

   WARNING: Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.

   CAUTION: To avoid rust formation, use extreme care not to scratch the paint or primer or otherwise damage the pinchweld during glass removal.

   NOTE: Insert the blade into the Interior Auto Glass Cut-Out Knife Kit (Electric) so that the flat side is against the glass. This will leave the entire urethane adhesive bead on the pinchweld and allow a dry fit of the replacement rear window glass.

   NOTE: Support the rear window glass to prevent the glass from dropping while cutting the urethane adhesive.

5. Insert the Interior Auto Glass Cut-Out Knife Kit (Electric) at the upper center of the rear window glass

and work toward the bottom corners.

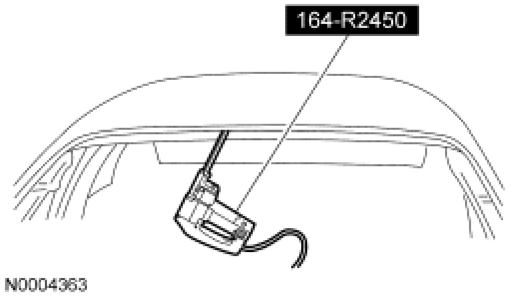


Fig. 99: Cutting Urethane Adhesive From Glass
Courtesy of FORD MOTOR CO.

6. Using The Pumper, distance the rear window glass from the body.

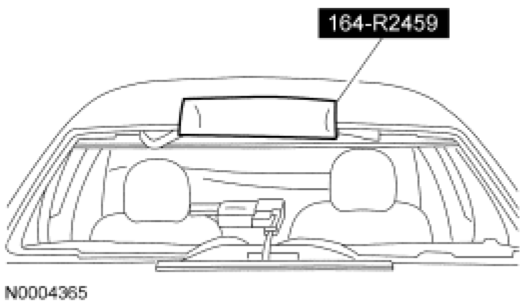


Fig. 100: Identifying Special Tool (164-R2459)
Courtesy of FORD MOTOR CO.

7. Insert the Interior Auto Glass Cut-Out Knife Kit (Electric) into the bottom of the urethane adhesive and cut from corner to corner.
8. Carefully remove the rear window glass from the vehicle and place on a stable work surface.

INSTALLATION

1. Dry-fit the rear window glass on the existing urethane adhesive bead on the pinch weld.
   - Position the glass on the pinch weld.
   - Center the glass in the opening.
   - Make alignment marks with tape or non-staining grease pencil on the rear window glass and the body.
2. After the dry-fit alignment, remove the glass from the body opening and place on a stable work surface with the interior side of the glass facing upward.

WARNING: **Repair any corrosion found on the pinch weld. The pinch weld is a structural component of the vehicle. Corrosion left unrepaired may**

reduce the structural integrity of the vehicle. Failure to follow this instruction may result in serious injury to vehicle occupant(s).

NOTE: **Avoid scratching the pinch weld. Repair all minor scratches or exposed metal on the pinch weld following glass primer manufacturer's recommendations before installation of the glass. Be sure to use the same brand and cure-rate products for the adhesive and primer.**

3. Using an appropriate tool, trim the urethane adhesive leaving a 1-2 mm (0.04-0.08 in) base of original equipment urethane on the pinchweld.

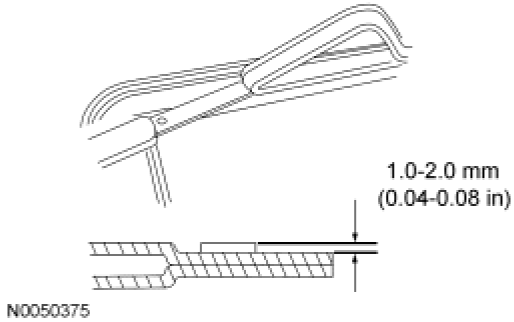


Fig. 101: Trimming Remaining Urethane Adhesive To Specification
Courtesy of FORD MOTOR CO.

4. Using a clean shop towel, brush or oil-free, compressed air, clean the pinch weld area around the existing urethane. Remove any foreign material or water that may have entered during glass removal.
5. If reinstalling the same rear window glass, remove the remaining urethane adhesive from the glass leaving a thin layer to bond with the new urethane bead.
6. Clean the inside of the new rear window glass surface with glass cleaner.

NOTE: **Be sure to use the same brand and cure-rate products for the adhesive and primer. Do not mix different brands of urethane and primer. Refer to the Material Chart in this procedure.**

NOTE: **Sika uses the same black primer for the glass and pinch weld area.**

7. If installing a new rear window glass, apply urethane glass primer according to manufacturer's instructions. Allow at least 6 minutes to dry.
8. Cut the urethane adhesive applicator tip to specification.

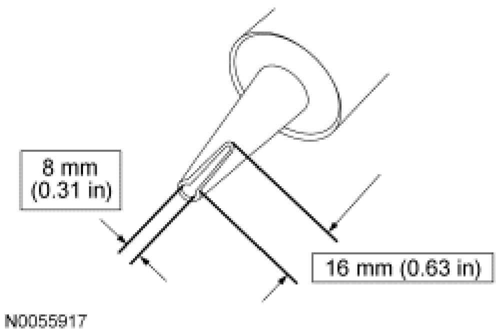


Fig. 102: Cutting Urethane Adhesive Applicator Tip With Specifications
Courtesy of FORD MOTOR CO.

NOTE: Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane with less effort and continuous bead.

NOTE: The rear window glass must be positioned within 10 minutes of applying the urethane adhesive.

9. Apply a uniform bead of urethane adhesive on top of the existing trimmed urethane adhesive bead on the pinch weld.
    - Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead starting and ending at the bottom of the rear window glass near the center.

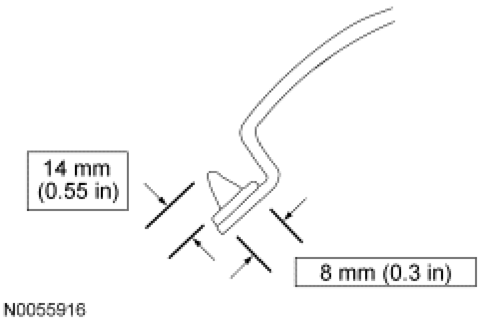


Fig. 103: Identifying Adhesive Application With Specifications
Courtesy of FORD MOTOR CO.

WARNING: **Do not drive vehicle until the urethane adhesive seal has cured. Follow urethane adhesive manufacturer's curing directions. Inadequate or incorrect curing of the urethane adhesive seal will adversely affect glass retention. Failure to follow these instructions may result in serious injury to vehicle occupant(s).**

CAUTION: Before positioning the rear window glass, open vehicle windows to prevent the air pressure of closing doors from affecting the adhesive bond.

10. Using the alignment marks made previously, position the rear window glass on the pinch weld.

NOTE: The urethane adhesive must cure for a minimum of one hour before testing for air or water leaks.

11. After the urethane has cured, check the rear window glass seal for air or water leaks through the urethane adhesive bead and add urethane adhesive as necessary.
12. Install the headliner, parcel shelf and C-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
13. Connect the LH and RH heated rear window electrical connector.

WINDOW GLASS - REAR DOOR, FIXED

REMOVAL AND INSTALLATION

1. Remove the rear door module. For additional information, refer to **Window Regulator and Motor - Rear Door**.
2. Remove the access hole plug.

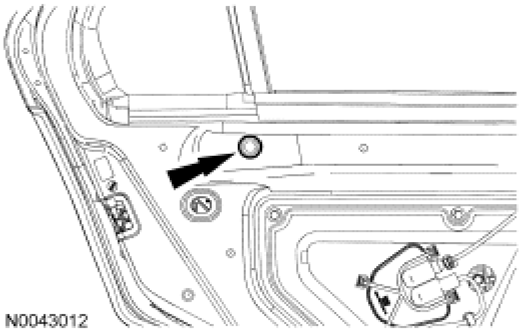


Fig. 104: Locating Access Hole Plug
Courtesy of FORD MOTOR CO.

3. Remove the bolt and the screw.

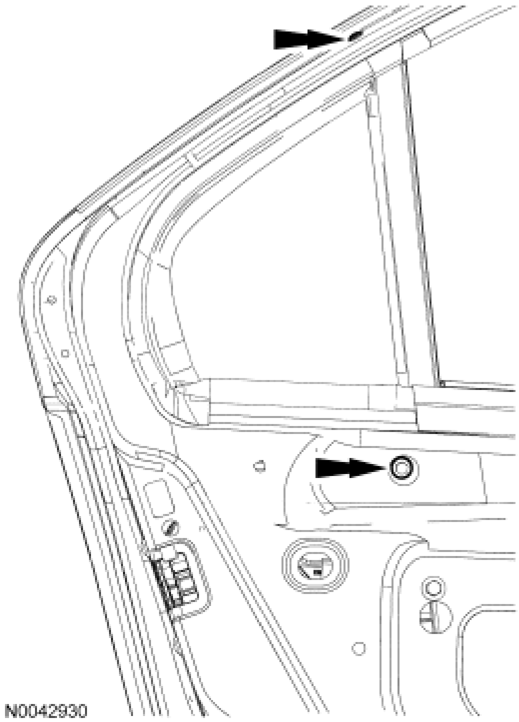


Fig. 105: Locating Bolt And Screw
Courtesy of FORD MOTOR CO.

4. Remove the inner beltline weatherstrip.

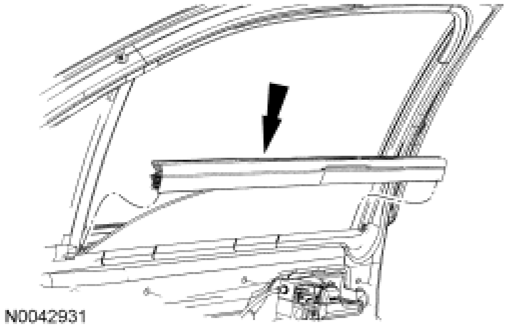


Fig. 106: Locating Inner Belt Line Weatherstrip
Courtesy of FORD MOTOR CO.

5. Remove the screw and the outer beltline weatherstrip.

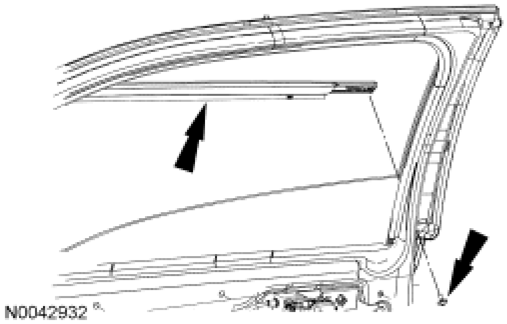


Fig. 107: Locating Outer Belt Line Weatherstrip
Courtesy of FORD MOTOR CO.

6. Position the rear window glass run aside.

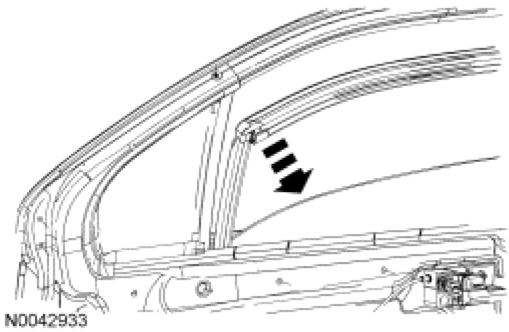


Fig. 108: Identifying Rear Window Glass Position
Courtesy of FORD MOTOR CO.

7. Remove the rear door fixed window glass assembly.

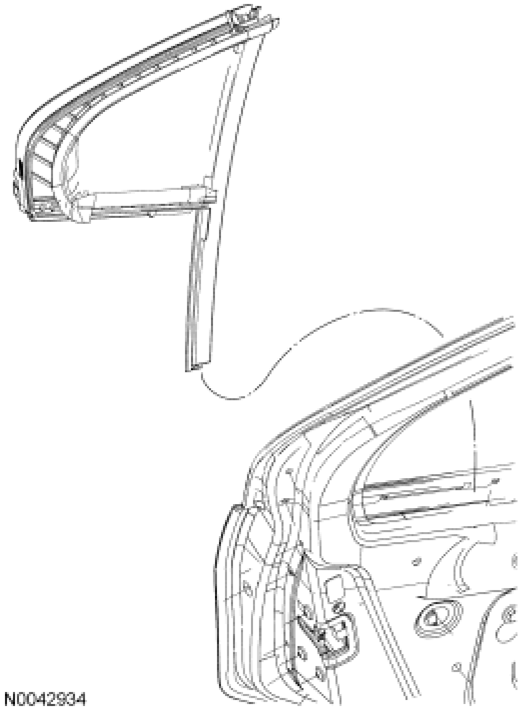
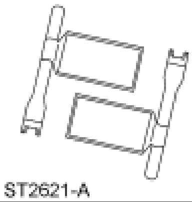


Fig. 109: Identifying Rear Quarter Window Glass
Courtesy of FORD MOTOR CO.

8. To install, reverse the removal procedure.

WINDSHIELD GLASS

Special Tools

Illustration	Tool Name	Tool Number
	Interior Auto Glass Cut-Out Knife Kit (Electric)	164-R2450 or equivalent
	The Pumper	164-R2459 or equivalent

Material

Item	Specification
Dow Urethane Adhesive Betaseal® Express	-

Dow Urethane One Step Glass Primer Betaprime® 5500 / 5500A / 5500SA	-
Sika Urethane Adhesive Sika Tack ASAP	-
Sika Urethane Metal and Glass Primer Sika 206 G+P	-
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

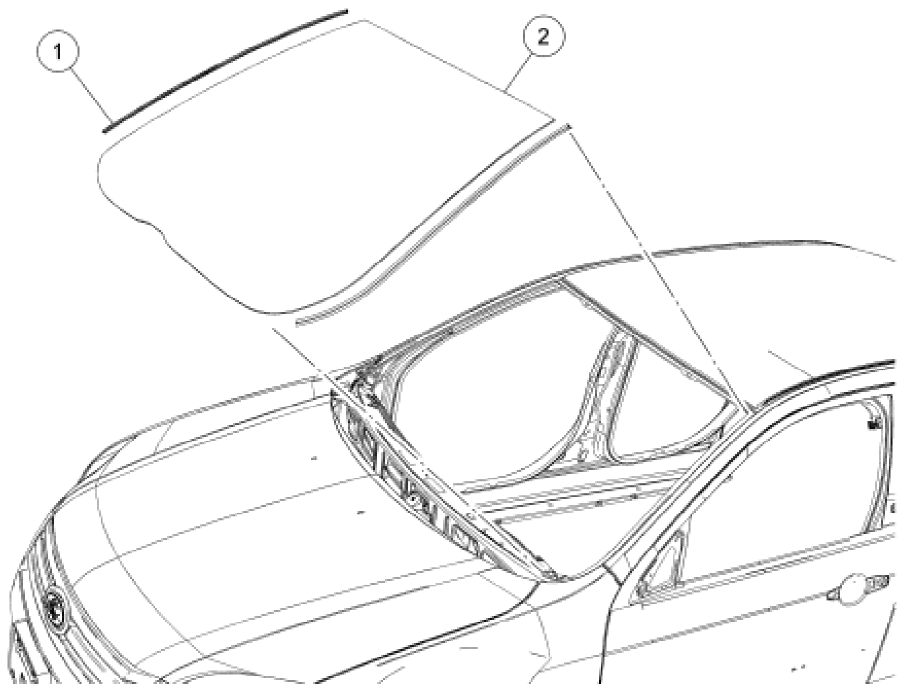


Fig. 110: Exploded View Of Windshield Glass
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Moulding
2	5403100	Windshield

REMOVAL

NOTE: If the windshield glass is being removed to repair a dust/water leak, remove and reinstall the existing windshield glass.

1. Remove the A-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the sun visors.
3. Remove the interior mirror. For additional information, refer to **REAR VIEW MIRRORS** article.

4. Partially lower the front portion of the headliner near the windshield header and block with suitable material. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
5. Remove the cowl panel grille. For additional information, refer to **FRONT END BODY PANELS** article.
6. Before cutting the urethane adhesive, remove dirt and other foreign material from the windshield pinchweld area.
   - Use a clean shop towel or oil-free, compressed air.

NOTE: Refer to manufacturer's instructions before using the Interior Auto Glass Cut-Out Knife Kit (Electric).

7. Lubricate the urethane adhesive with water to aid the Interior Auto Glass Cut-Out Knife Kit (Electric) when cutting.

WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

WARNING: Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.

CAUTION: To avoid rust formation, use extreme care not to scratch the paint or primer or otherwise damage the pinchweld during glass removal.

NOTE: Insert the blade into the Interior Auto Glass Cut-Out Knife Kit (Electric) so that the flat side is against the glass. This will leave the entire urethane adhesive bead on the pinchweld and allow a dry fit of the replacement windshield glass.

NOTE: Support the windshield glass to prevent the glass from dropping while cutting the urethane adhesive.

8. Insert the Interior Auto Glass Cut-Out Knife Kit (Electric) at the upper center of the windshield glass and work toward the bottom corners.

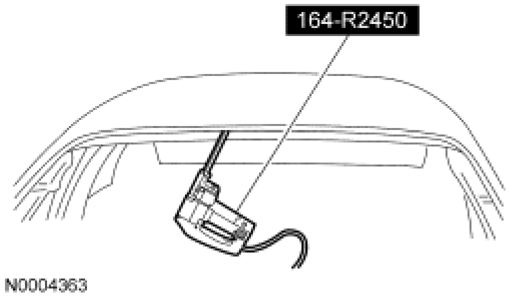


Fig. 111: Cutting Urethane Adhesive From Glass
Courtesy of FORD MOTOR CO.

9. Using The Pumper, distance the windshield glass from the body.

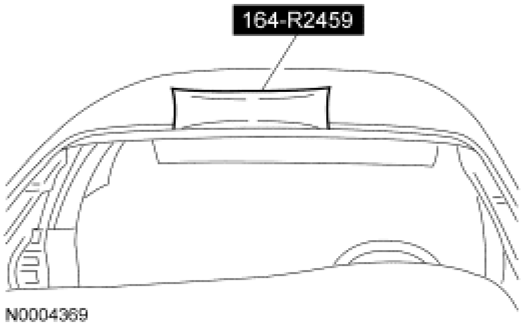


Fig. 112: Distancing Windshield Glass From The Body
Courtesy of FORD MOTOR CO.

10. Insert the Interior Auto Glass Cut-Out Knife Kit (Electric) into the bottom of the urethane adhesive and cut from corner to corner.
11. Carefully remove the windshield glass from the vehicle and place on a stable work surface.

INSTALLATION

1. Dry-fit the windshield glass on the existing urethane adhesive bead on the pinch weld.
    - Position the windshield glass on the pinch weld.
    - Center the glass in the opening.
    - Adjust the windshield glass stop blocks (if equipped) as needed for best fit.
    - Make alignment marks with tape or non-staining grease pencil (preferably at the windshield glass stop blocks) on the windshield glass and the body.
2. After the dry-fit alignment, remove the glass from the body opening and place on a stable work surface with the interior side of the glass facing upward.

WARNING: **Repair any corrosion found on the pinch weld. The pinch weld is a structural component of the vehicle. Corrosion left unrepaired may reduce the structural integrity of the vehicle. Failure to follow this**

instruction may result in serious injury to vehicle occupant(s).

NOTE: **Avoid scratching the pinch weld. Repair all minor scratches or exposed metal on the pinch weld following glass primer manufacturer's recommendations before installation of the glass. Be sure to use the same brand and cure-rate products for the adhesive and primer.**

3. Using an appropriate tool, trim the urethane adhesive leaving a 1-2 mm (0.04-0.08 in) base of original equipment urethane on the pinchweld.

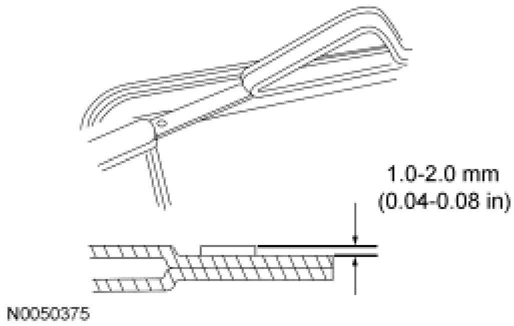


Fig. 113: Trimming Remaining Urethane Adhesive To Specification
Courtesy of FORD MOTOR CO.

4. Using a clean shop towel, brush or oil-free, compressed air, clean the pinch weld area around the existing urethane. Remove any foreign material or water that may have entered during glass removal.
5. If reinstalling the same windshield glass, remove the remaining urethane adhesive from the glass leaving a thin layer to bond with the new urethane bead.
6. Clean the inside of the windshield glass surface with glass cleaner.
   - Make sure to thoroughly clean the surface of the blackened border area where the urethane adhesive will be applied.

NOTE: **Be sure to use the same brand and cure-rate products for the adhesive and primer. Do not mix different brands of urethane and primer. Refer to the Material Chart in this procedure.**

NOTE: **Sika uses the same black primer for the glass and pinch weld area.**

7. If installing a new windshield glass, apply urethane glass primer according to manufacturer's instructions. Allow at least 6 minutes to dry.
8. Cut the urethane adhesive applicator tip to specification.

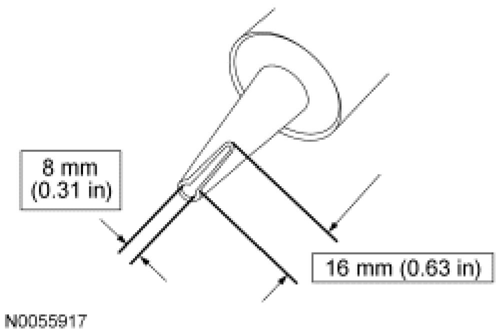


Fig. 114: Cutting Urethane Adhesive Applicator Tip With Specifications
Courtesy of FORD MOTOR CO.

NOTE: **Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane with less effort and continuous bead.**

NOTE: **The windshield glass must be positioned within 10 minutes of applying the urethane adhesive.**

9. Apply a uniform bead of urethane adhesive on top of the existing trimmed urethane adhesive bead on the pinch weld.
   - Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead starting and ending at the bottom of the windshield glass near the center.

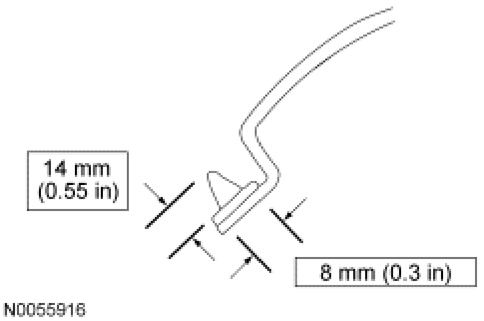


Fig. 115: Identifying Adhesive Application With Specifications
Courtesy of FORD MOTOR CO.

WARNING: **Do not drive vehicle until the urethane adhesive seal has cured. Follow urethane adhesive manufacturer's curing directions. Inadequate or incorrect curing of the urethane adhesive seal will adversely affect glass retention. Failure to follow these instructions may result in serious injury to vehicle occupant(s).**

CAUTION: **Before positioning the windshield glass, open vehicle windows to prevent the air pressure of closing doors from affecting the adhesive bond.**

10. Using the alignment marks made previously, position the windshield glass on the pinch weld.

NOTE: The urethane adhesive must cure for a minimum of one hour before testing for air or water leaks.

11. After the urethane has cured, check the windshield glass seal for air or water leaks through the urethane adhesive bead and add urethane adhesive as necessary.
12. Install the cowl panel grille. For additional information, refer to **FRONT END BODY PANELS** article.
13. Install the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
14. Install the interior mirror. For additional information, refer to **REAR VIEW MIRRORS** article.
15. Install the sun visors.
16. Install the A-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

2008 ACCESSORIES & BODY, CAB

Handles, Locks, Latches & Entry Systems - Fusion, Milan & MKZ

SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Lock Repair/Replacement Specifications	
Ignition Cylinder Lock Kit	5S4Z-11582-BB
Door Lock Kit	8E5Z-5421991-B
Lubricants	
Multi-Purpose Grease Spray XG-4 and/or XL-5	ESB-M1C93-B
Penetrating and Lock Lubricant (US) XL-1; Penetrating Fluid (Canada) CXC-51-A	-

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Door latch bolts	8	-	71
Hood latch bolts	12	9	-
Hood latch striker bolts	12	9	-
Luggage compartment lid latch nuts	9	-	80
Luggage compartment lid striker bolts	9	-	80

DESCRIPTION AND OPERATION

HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Hood Latch

The hood latch consists of the following components:

- Hood latch release handle and cable
- Hood latch

Front Door

The front door consists of the following components:

- Door ajar switch (part of the front door latch)
- Door lock cylinder (if equipped)
- Exterior front door handle
- Exterior front door handle reinforcement
- Front door latch
- Front door lock actuator (part of the front door latch)
- Interior door handle actuating cable
- Interior door handle
- Keyless entry keypad (if equipped)

Rear Door

The rear door consists of the following components:

- Door ajar switch (part of the rear door latch)
- Exterior rear door handle
- Exterior rear door handle reinforcement
- Interior door handle actuating cable (part of the rear door latch)
- Interior door handle
- Rear door latch
- Rear door lock actuator (part of the rear door latch)

Luggage Compartment Lid

The luggage compartment lid consists of the following components:

- Luggage compartment lid latch
- Luggage compartment lid lock cylinder
- Luggage compartment lid release switch (next to headlamp switch)
- Lock cylinder actuating cable (part of the luggage compartment lid latch)
- Mechanical emergency release cable and handle (part of the luggage compartment lid latch)

Power Lock/Unlock

The power lock/unlock feature requests all of the vehicle doors locked or unlocked upon a customer request from either door lock control switch in the vehicle. The power door locking system functions independently of ignition status or vehicle speed.

Autolock

NOTE: The autolock feature is not available on vehicles equipped with a manual

transmission.

The autolock feature locks all the doors when all the doors are closed, the key is in the ON position, the transmission is in either a forward or reverse gear, and the vehicle speed is greater than 20 km/h (12 mph).

The autolock feature repeats when any door is opened then closed while the ignition is still in the ON position, the vehicle speed is 15 km/h (9 mph) or slower, and the vehicle then attains a speed greater than 20 km/h (12 mph).

Auto-Unlock

NOTE:	**The doors will not auto-unlock if the vehicle has been electronically locked before the driver door is opened.**

NOTE:	**The auto-unlock feature is disabled on vehicles equipped with a manual transmission.**

The auto-unlock feature unlocks all the doors when the ignition is in the ON position, all the doors are closed, and the vehicle has been in motion at a speed greater than 20 km/h (12 mph), the vehicle then comes to a stop and the ignition is switched to LOCK or ACC, and the driver door is opened within 10 minutes of the ignition being switched to LOCK or ACC.

Smart Unlock

The smart unlock feature prevents the doors from locking with the key in the ignition lock cylinder. When the SJB receives a lock command from a door lock control switch (only), and the key is in the ignition lock cylinder with one of the front doors open, the SJB commands the doors to unlock.

The vehicle can still be locked with the ignition key in the ignition cylinder by locking the doors with the push button rods, the door lock cylinder or an RKE command from an integrated key or the keyless entry keypad.

Remote Keyless Entry (RKE)

The remote keyless entry (RKE) system uses an integrated key head transmitter (IKT). The IKT incorporates both the passive anti-theft system (PATS) functions and the RKE transmitter functions in a single device.

The RKE transmitter is programmed automatically during PATS programming. During PATS programming, the instrument cluster (IC) obtains the transmitter identification code (TIC) from the IKT and sends the TIC data over the medium speed controller area network (MS-CAN) to the SJB.

The SJB accepts programming of up to 4 IKTs. In addition to the IKTs, 6 conventional keyfobs can also be programmed to the vehicle if requested by the customer. For information on programming the IKTs, refer to Key Programming Using Two Programmed Keys or Integrated Keyhead Transmitter (IKT) Key Programming Using Diagnostic Equipment in **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. For information on programming the conventional keyfobs, refer to **Remote Keyless Entry Transmitter Programming**.

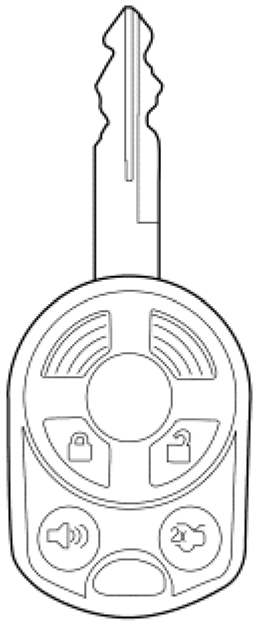


Fig. 1: Remote Keyless Entry (RKE)
Courtesy of FORD MOTOR CO.

The IKT performs the following functions:

- Unlock the driver door
- Unlock all doors
- Lock all doors
- Release the luggage compartment lid latch
- Arm/disarm the perimeter alarm (if equipped)
- Activate/deactivate the panic alarm
- Command the interior lamps on (when unlocking) and off (when locking)
- Recall the memory seat position associated with a particular remote entry device (when enabled)
- Sound the horn once when LOCK is pressed twice within 3 seconds, and the doors are closed
- Sound the horn twice when LOCK is pressed twice within 3 seconds, and any door is ajar

The IKT has a normal operating range of 10 m (33 ft).

Remote Keyless Entry (RKE) Lock/Unlock Control - Unlock

The RKE feature provides lock/unlock functions independently of key position, vehicle speed, or transmission position. The RKE feature provides a stepped (if enabled) process for unlocking the doors. Upon receipt of the first request for unlocking the doors, the RKE control feature requests the SJB to unlock the driver door only. If another unlock request is received within 3 seconds of the first, the RKE feature requests the SJB to unlock all

the doors. This feature can be configured to global unlock, so that all the doors unlock on the first press of the unlock button. Refer to **Stepped Unlock Programming** for programming information.

Remote Keyless Entry (RKE) Lock/Unlock Control - Lock

The RKE feature requests that all the doors be locked when the lock button is pressed. On any press of the lock button with all doors closed, the SJB provides one flash of the turn signals. If any door is ajar, no flash occurs. As soon as the last door is closed, the SJB provides the flash of the turn signals. If 2 presses of the lock button are received within 3 seconds, the horn chirps once and the turn signals flash twice to indicate that all the doors are closed and locked. If any door is ajar when the second lock request is received within 3 seconds of the first, the RKE transmitter feature requests the SJB chirp the horn twice without flashing the turn signals to indicate it locked all the doors but one or more doors are ajar. When the key is in the ON or START position, the turn signal flashes and horn chirp confirmations do not occur.

Remote Keyless Entry (RKE) Luggage Compartment Lid Release

The RKE feature provides luggage compartment lid release function independently of key position. The luggage compartment lid release button must be pressed twice within 3 seconds for the luggage compartment lid to release.

Panic Alarm

NOTE: The panic alarm activation can be configured using a scan tool from a single button press to press and hold. Refer to MODULE CONFIGURATION article.

The panic alarm feature provides audible and visual alarms which are evident from the exterior of the vehicle. The panic alarm feature requests that the turn signals are flashed and the horn sounds until deactivation. The flashing of the outputs occurs simultaneously. Activation of the panic alarm is accomplished by pressing the panic button on an integrated key head transmitter (IKT) whenever the key is in the OFF position. At all other times this feature is disabled. Deactivation of an active PANIC alarm is accomplished by any of the following actions:

- a second press of the IKT panic button
- the key is switched out of the OFF position
- a period of 2 minutes and 45 seconds has elapsed since the initial activation

Keyless Entry Keypad

The keyless entry keypad performs the following functions:

- Unlock the driver door
- Unlock all the doors
- Lock all doors
- Enables/disables auto-unlocking
- Enables/disables auto locking
- Arm/disarm the perimeter alarm (if equipped)

- Recall the memory seat position associated with a particular customer key code (when enabled)
- Release the luggage compartment lid latch
- Programs/erases the customer key code
- Illuminates the keyless entry keypad lamp and issues illuminated entry on/off requests

The keypad feature operates independently of key position status, vehicle speed, or transmission position. When a keypad button is pressed, the keypad buttons illuminate to provide better visibility. If the lock all doors command is entered or 5 seconds have elapsed since the last button press, the illumination is turned off.

Each vehicle equipped with a keypad is programmed with a 5-digit factory set entry code. This code is provided to the customer through a wallet card in the Owner's Literature. In addition, this code is available through a scan tool and is also printed on the SJB label. When entering codes each digit must be entered within 5 seconds of the previous button press.

Locking the Doors with the Keyless Entry Keypad System

It is not necessary to enter the factory set or personal code prior to locking all doors. To lock all doors, press the 7/8 and 9/0 controls at the same time.

Unlocking the Doors with the Keyless Entry Keypad System

To unlock the driver door, enter either the factory set code or a personal code; each digit must be pressed within 5 seconds of the prior digit. The interior lamps illuminate.

To unlock all doors, enter either the factory set code or a personal code (driver door unlocks) and press the 3/4 button within 5 seconds.

To open the luggage compartment, enter the factory set code or a personal code (driver door unlocks) and press the 5/6 button within 5 seconds.

Anti-Scan Feature

To provide added security, the keypad is disabled for 1 minute after 35 button presses without a valid entry code being entered. The keypad flashes during this 1-minute mode with all functionality disabled except for 7/8 and 9/0 still being allowed to lock the vehicle.

Anti-Scan is turned off after 1 minute of keypad inactivity.

Perimeter Lighting Feature

NOTE: **On vehicles with AUTOLAMPS, the perimeter lighting feature does not activate in daylight conditions.**

Vehicles equipped with perimeter lighting can have this feature activated or deactivated. For information on programming the perimeter lighting feature, refer to **Perimeter Lighting Feature Programming**.

The headlamps (Fusion, Milan), fog lamps (MKZ), park lamps, and tail lamps illuminate when the unlock control on the IKT is pressed. The perimeter lighting feature will turn off the interior lamps if:

- The ignition switch is turned to the ON position
- The IKT lock control is pressed
- The vehicle is locked using the keyless entry keypad (if equipped)
- After 25 seconds have elapsed since the perimeter lighting was activated

Door Lock Control Switch Inhibit

As a theft deterrent, the door lock control switches and the luggage compartment lid release switch can be disabled 20 seconds after the key is turned to the OFF position and the vehicle is locked using the RKE transmitter, the keyless entry keypad, or when the driver door is opened, and the power locks are locked with the door lock control switch, then the driver door is closed.

The door lock control switch is enabled when the vehicle is unlocked by one of the following methods:

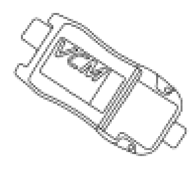
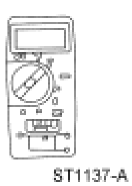
- The keyless entry keypad
- The RKE transmitter
- Any door is opened from the vehicle's interior
- The key is turned to the ON position

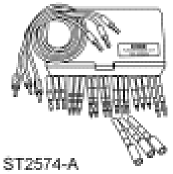
The door lock control switch inhibit feature is configured off by default. To enable this feature, refer to the Owner's Literature.

DIAGNOSTIC TESTS

LOCKS, LATCHES AND ENTRY SYSTEMS

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
	Flex Probe Kit	105-R025C or equivalent

 ST2574-A		

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB receives inputs and delivers outputs to many of the electronically controlled features of the vehicle. The SJB constantly monitors the system under its control and reports a concern in the form of a DTC.

Power Door Locks - Without Memory

Regardless of the key position, the SJB is supplied voltage at all times. When the SJB receives a signal from the remote keyless entry (RKE) transmitter, the keyless entry keypad, or the door lock control switches, the SJB supplies a ground signal to the appropriate lock or unlock relay. The ground signal closes the relay which supplies voltage to the door lock actuators. The door lock actuators then actuate to a lock or unlock position.

Power Door Locks - With Memory

Regardless of the key position, the SJB and the driver door module (DDM) are supplied voltage at all times. When the SJB receives a signal from the RKE transmitter, the keyless entry keypad, or either door lock control switch, the SJB sends a command to the DDM, through the controller area network (CAN), and a ground signal to the lock and unlock relays. When the LH door lock control switch is pressed, the DDM receives the lock or unlock signal. The DDM will send a request through the CAN network to the SJB to lock or unlock the passenger doors. The SJB then responds to the DDM request, authorizing a lock or unlock of the driver door by the DDM. The DDM then supplies voltage and ground to the driver door lock actuator based on the lock or unlock request. The ground signal in the SJB closes the relay which supplies voltage to the remaining door lock actuators. The remaining door lock actuators then actuate to a lock or unlock position determined by the relay.

Luggage Compartment Lid Release

NOTE: When using the integrated key head transmitter (IKT), 2 presses of the luggage compartment lid release button (within 3 seconds) are required to release the luggage compartment lid.

The luggage compartment lid release system is inhibited when the vehicle speed exceeds 8 km/h (5 mph). The luggage compartment lid latch releases the luggage compartment lid when the customer requests it be opened using either the IKT, the keyless entry keypad, or the luggage compartment lid release switch. When the SJB receives a signal to release the luggage compartment lid, the SJB supplies voltage to the luggage compartment lid latch. The luggage compartment lid latch then actuates to release the luggage compartment lid.

Remote Keyless Entry (RKE)

The keyless entry keypad is hardwired to the SJB. The SJB interprets the inputs from the keyless entry keypad and then controls the associated operation. The keyless entry keypad is illuminated for 5 seconds when any button is pressed. The SJB requests the illuminated entry feature to turn the interior lamps on when a valid entry code is received. If a lock all doors code is entered, the illuminated entry feature turns off. If enabled, the perimeter lighting turns on when the RKE transmitter unlock command is activated. When an RKE transmitter or keyless entry keypad lock command is activated, the perimeter lighting is turned off.

NOTE: The keyless entry keypad does not lock the doors if the driver door is ajar.

Either the RKE transmitter or the keyless entry keypad supplies a signal to the SJB when pressed. The SJB then supplies voltage to the appropriate door lock actuator(s) to lock or unlock the doors. The keyless entry keypad or the RKE transmitter can also be used to release the luggage compartment lid. The RKE transmitter can also be used to activate the panic alarm. The panic alarm activation can be configured using a scan tool. It can be changed from a single button press, to press and hold. Refer to **MODULE CONFIGURATION** article. A single press will de-activate the panic alarm. On vehicles equipped with memory, the RKE transmitter also causes the SJB to send a CAN message to the driver seat module (DSM) to activate all memory features to the positions associated with the RKE transmitter being used.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Binding linkage • Misaligned door	• Smart junction box (SJB) fuse 16 (15A) • Door lock control switch • Door latch(es) • Luggage compartment lid latch • Luggage compartment lid release switch • Keyless entry keypad • Remote keyless entry (RKE) transmitter • Wiring, terminals or connectors • Driver door module (DDM) (if equipped) • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB, DDM and the instrument cluster (IC).
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

DRIVER DOOR MODULE (DDM) DTC CHART

DTC	Description	Action
B2574	Drivers Door LOCK Switch Short to Ground	Go to **Pinpoint Test H**.
B2575	Drivers Door UNLOCK Switch Short to Ground	Go to **Pinpoint Test H**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

INSTRUMENT CLUSTER (IC) DTC CHART

DTC	Description	Action
B1137	Data Not Programmed	Go to **Pinpoint Test R**.
		The SJB limit of 4 integrated keys is exceeded.

B1138	Memory Full	PROGRAM a maximum of 4 integrated keys. REFER to programming keys using diagnostic equipment in **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. CLEAR the DTCs. REPEAT the self-test.
B1139	Invalid Transmitter Identification Code	Go to **Pinpoint Test L**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1138	Memory Full	The SJB limit of 4 integrated keys is exceeded. PROGRAM a maximum of 4 integrated keys. REFER to programming keys using diagnostic equipment in **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. CLEAR the DTCs. REPEAT the self-test.
B1139	Invalid Transmitter Identification Code	Go to **Pinpoint Test L**.
B1309	Power Door Lock Circuit Short to Ground	Go to **Pinpoint Test H**.
B1341	Power Door Unlock Circuit Short to Ground	Go to **Pinpoint Test H**.
B1554	Decklid Release Circuit Short to Ground	Go to **Pinpoint Test I**.
B1623	Lamp Keypad Output Circuit Failure	Go to **Pinpoint Test K**.
B2276	Less Than 2 Transmitters Programmed	PROGRAM all of the customers IKTs (minimum of 2). REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. TEST the system for normal operation.
B2425	Remote Keyless Entry Out of Synchronization	Go to **Pinpoint Test L**.
B2695	Keypad_A Switch Circuit Failure	Go to **Pinpoint Test J**.
B2696	Keypad_B Switch Circuit Failure	Go to **Pinpoint Test J**.
B2697	Keypad_C Switch Circuit Failure	Go to **Pinpoint Test J**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Fuse(s) • Wiring, terminals or connectors	• REFER to **MODULE COMMUNICATIONS NETWORK** article.

	• SJB	
• No communication with the driver door module (DDM)	• Fuse(s) • Wiring, terminals or connectors • DDM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• No communication with the instrument cluster (IC)	• Fuse • Wiring, terminals or connectors • IC	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• All door locks are inoperative	• Fuse • Wiring, terminals or connectors • Luggage compartment lid release solenoid (part of the luggage compartment latch) • SJB	• Go to **Pinpoint Test A**.
• A single/more than one door lock is inoperative - without memory	• Wiring, terminals or connectors • Door lock actuator (part of the door latch) • SJB	• Go to **Pinpoint Test B**.
• A single/more than one door lock is inoperative - with memory	• Fuse • Wiring, terminals or connectors • Door lock actuator (part of the door latch) • Luggage compartment lid release solenoid (part of the luggage compartment latch) • DDM • SJB	• Go to **Pinpoint Test C**.
• All door locks are inoperative from one switch - without memory	• Wiring, terminals or connectors • Door lock control switch	• Go to **Pinpoint Test D**.

• All door locks are inoperative from one switch - with memory	• Wiring, terminals or connectors • Door lock control switch • DDM • SJB	• Go to **Pinpoint Test E**.
• The door lock switches operate only one way - without memory	• Wiring, terminals or connectors • Door lock control switch • SJB	• Go to **Pinpoint Test F**.
• The door lock switches operate only one way - with memory	• Wiring, terminals or connectors • Door lock control switch • DDM • SJB	• Go to **Pinpoint Test G**.
• The luggage compartment lid is inoperative/does not operate correctly	• Wiring, terminals or connectors • Luggage compartment lid release switch • Luggage compartment lid latch • SJB	• Go to **Pinpoint Test I**.
• The doors do not lock/unlock using the keyless entry keypad	• Wiring, terminals or connectors • Keyless entry keypad • SJB	• Go to **Pinpoint Test J**.
• The keyless entry keypad illumination is inoperative/does not operate correctly	• Wiring, terminals or connectors • Keyless entry keypad • SJB	• Go to **Pinpoint Test K**.
• The remote keyless entry (RKE) transmitter is inoperative	• Integrated key head transmitter (IKT) • IKT battery • IKT button pressed a substantial amount of times while outside the range of the	• Go to **Pinpoint Test L**.

	vehicle • IKT programming • SJB	
• An individual button/feature is inoperative from the remote keyless entry (RKE) transmitter	• Door locks • Horn system • Luggage compartment lid release • Turn signal system • IKT	• Go to **Pinpoint Test M**.
• The remote keyless entry (RKE) transmitter has poor range performance	• IKT • IKT battery • Aftermarket systems • High power devices • TV/radio transmission towers • SJB	• Go to **Pinpoint Test N**.
• The autolock does not operate correctly	• Ignition switch • Door ajar switches • Vehicle speed signal • Transmission range (TR) sensor • SJB	• Go to **Pinpoint Test O**.
• The auto-unlock does not operate correctly	• Door ajar switches • Ignition switch • Vehicle speed signal • SJB	• Go to **Pinpoint Test P**.
• The smart unlock does not operate correctly	• RH front door ajar switch • LH front door ajar switch • Key-in-ignition switch • SJB	• Go to **Pinpoint Test Q**.
• The memory seat does not operate correctly using the remote keyless entry (RKE) transmitter	• DDM • SJB	• ACTIVATE the remote memory. REFER to **Remote Memory Activation**. TEST the system for normal operation. If the remote memory is still inoperative, REFER

		to **SEATING** article to diagnose the memory seat.
• The remote keyless entry (RKE) two step door unlocking does not operate correctly	• Two step door unlocking is disabled	• PROGRAM the two step door unlocking. REFER to **Stepped Unlock Programming**. TEST the system for normal operation.

Pinpoint Tests

Pinpoint Test A: All Door Locks Are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Door Locks for schematic and connector information.

Normal Operation - With Memory

The smart junction box (SJB) supplies voltage and ground to all the passenger door lock actuators by controlling the lock all and unlock all relays. The driver door module (DDM) supplies voltage and ground only to the driver door lock actuator. The SJB receives inputs from the RH door lock control switch, keyless entry keypad, and the remote keyless entry (RKE) transmitter. The DDM only receives input from the LH door lock control switch. Both modules share the information obtained from the inputs over the medium speed controller area network (MS-CAN). Upon a lock request, the SJB supplies voltage on circuit CPL11 (GY/BN) and ground on CPL52 (VT/GY), and the DDM supplies voltage on CPL02 (VT/GN) and ground on CPL51 (BU/GN). Upon an unlock request, the voltage and ground are reversed on the previously listed circuits.

Without Memory

The SJB supplies voltage to the lock all relay, the unlock driver door relay or unlock all relay based upon input from the door lock control switches, the RKE transmitter, or the keyless entry keypad. Upon a lock request, the SJB supplies voltage on circuit CPL11 (GY/BN) and ground on circuits CPL52 (VT/GY) and CPL51 (BU/GN). Upon an unlock request, the voltage and ground are reversed on the previously listed circuits.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals, or connectors
- Luggage compartment lid release solenoid (part of the luggage compartment latch)
- SJB

PINPOINT TEST A: ALL DOOR LOCKS ARE INOPERATIVE

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

A1 VERIFY THE OPERATION OF BOTH DOOR LOCK CONTROL SWITCHES

- Press the lock and unlock button on both door lock control switches while observing the door lock operation.
- **Are the door locks inoperative from both switches?**

  YES : For vehicles equipped with memory, multiple failures exist if all locks are inoperative. CHECK the symptom and Go to **Symptom Chart**.

  For vehicles equipped without memory, go to A2.

  NO : Go to **Pinpoint Test D**.

A2 VERIFY ALL DOOR LOCKS ARE INOPERATIVE

- Press the lock and unlock buttons from a door lock control switch while observing the door locks.
- **Are all the door locks inoperative from both switch positions (lock and unlock)?**

  YES : VERIFY the SJB fuse 16 (15A) is OK. If OK, go to A3.

  If not OK, go to A4.

  NO : Go to **Symptom Chart**.

A3 CHECK CIRCUIT CPL11 (GY/BN) FOR AN OPEN

- Disconnect: LH Front Door Latch C525
- Disconnect: SJB C2280e

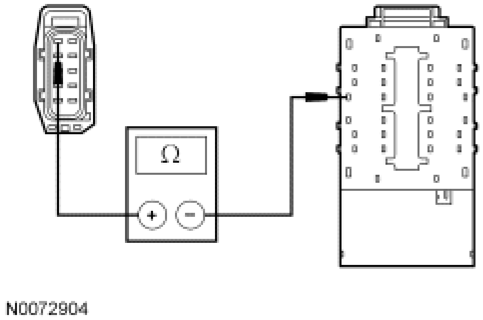


Fig. 2: Checking Circuit CPL11 (GY/BN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280e-17, circuit CPL11 (GY/BN), harness side and the LH front door latch C525-2, circuit CPL11 (GY/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A7.

  NO : REPAIR the circuit. TEST the system for normal operation.

A4 CHECK CIRCUIT CPL10 (GN/WH) FOR A SHORT TO GROUND

- Install a new SJB fuse 16 (15A).
- Operate the luggage compartment lid release by pressing the luggage compartment lid release switch.

- **Is the SJB fuse 16 (15A) OK?**

  YES : Go to A6.

  NO : Go to A5.

A5 CHECK THE LUGGAGE COMPARTMENT LID RELEASE SOLENOID

- Install a new SJB fuse 16 (15A).
- Disconnect: Luggage Compartment Lid Release Solenoid C429
- Operate the luggage compartment lid release by pressing the luggage compartment lid release switch.
- **Is the SJB fuse 16 (15A) OK?**

  YES : INSTALL a new luggage compartment lid latch. REFER to **Luggage Compartment Lid Latch**.

  NO : REPAIR circuit CPL10 (GN/WH) for a short to ground. TEST the system for normal operation.

A6 CHECK CIRCUIT CPL11 (GY/BN) FOR A SHORT TO GROUND

- Operate the door lock actuators by pressing LOCK on the door lock control switch.
- **Is the SJB fuse 16 (15A) OK?**

  YES : REPAIR circuit CPL51 (BU/GN) or CPL52 (VT/GY) for a short to ground. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

A7 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: A Single/More Than One Door Lock Is Inoperative - Without Memory

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Door Locks for schematic and connector information.

Normal Operation

The smart junction box (SJB) supplies voltage to the lock all relay, the unlock driver door relay or unlock all relay based upon input from the door lock control switches, the remote keyless entry (RKE) transmitter, or the keyless entry keypad. Upon a lock request, the SJB supplies voltage on circuit CPL11 (GY/BN) and ground on circuits CPL52 (VT/GY) and CPL51 (BU/GN). Upon an unlock request, the voltage and ground are reversed on the previously listed circuits.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door lock actuator (part of the door latch)
- SJB

PINPOINT TEST B: A SINGLE/MORE THAN ONE DOOR LOCK IS INOPERATIVE - WITHOUT MEMORY

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 CHECK CIRCUIT CPL11 (GY/BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Inoperative Door Lock Actuator

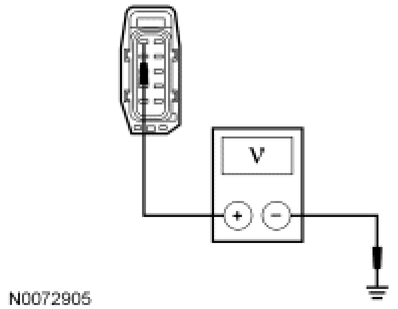


Fig. 3: Checking Circuit CPL11 (GY/BN) For An Open
Courtesy of FORD MOTOR CO.

NOTE: The SJB only supplies voltage to the actuator momentarily. It is important to monitor the meter while pressing the door lock control switch.

- While pressing the door lock control switch in the LOCK position, measure the voltage between the inoperative door lock actuator, harness side and ground as follows:

Inoperative Door Lock Actuator	Connector-Pin	Circuit
LH front	C525-2	CPL11 (GY/BN)

RH front	C603-2	CPL11 (GY/BN)
LH rear	C704-2	CPL11 (GY/BN)
RH rear	C804-2	CPL11 (GY/BN)

- **Is the voltage greater than 10 volts?**

  YES : Go to B2.

  NO : REPAIR the circuit. TEST the system for normal operation.

B2 CHECK CIRCUIT CPL52 (VT/GY) OR CIRCUIT CPL51 (BU/GN) FOR VOLTAGE

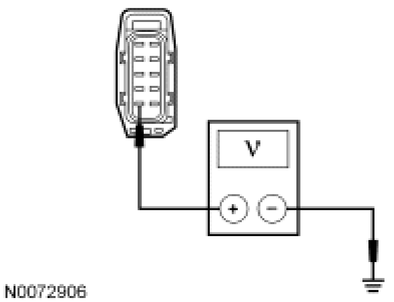


Fig. 4: Checking Circuit CPL52 (VT/GY) Or Circuit CPL51 (BU/GN) For Voltage
Courtesy of FORD MOTOR CO.

NOTE:	**The SJB only supplies voltage to the actuator momentarily. It is important to monitor the meter while pressing the door lock control switch.**

- While pressing the door lock control switch in the UNLOCK position, measure the voltage between the inoperative door lock actuator, harness side and ground as follows:

Inoperative Door Lock Actuator	Connector-Pin	Circuit
LH front	C525-10	CPL51 (BU/GN)
RH front	C603-10	CPL52 (VT/GY)
LH rear	C704-10	CPL52 (VT/GY)
RH rear	C804-10	CPL52 (VT/GY)

- **Is the voltage greater than 10 volts?**

YES : INSTALL a new door latch for the door lock actuator in question. REFER to **Front Door Latch** or **Rear Door Latch**. TEST the system for normal operation.

NO : Go to B3.

B3 CHECK CIRCUIT CPL51 (BU/GN) OR CIRCUIT CPL52 (VT/GY) FOR AN OPEN

- Disconnect: SJB C2280e
- Measure the resistance between the inoperative door lock actuator, harness side and the SJB, harness side as follows:

Inoperative Door Lock Actuator Connector-Pin	SJB Connector-Pin	Circuit
LH front C525-10	C2280e-27	CPL51 (BU/GN)
RH front C603-10	C2280e-31	CPL52 (VT/GY)
LH rear C704-10	C2280e-31	CPL52 (VT/GY)
RH rear C804-10	C2280e-31	CPL52 (VT/GY)

- **Is the resistance less than 5 ohms?**

  YES : Go to B4.

  NO : REPAIR the circuit. TEST the system for normal operation.

B4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: A Single/More Than One Door Lock Is Inoperative - With Memory

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Door Locks for schematic and connector information.

Normal Operation

The smart junction box (SJB) supplies voltage and ground to all the passenger door lock actuators by controlling the lock all and unlock all relays. The driver door module (DDM) supplies voltage and ground only to the driver door lock actuator. The SJB receives inputs from the RH door lock control switch, keyless entry keypad, and the remote keyless entry (RKE) transmitter. The DDM only receives input from the LH door lock control switch. Both modules share the information obtained from the inputs over the medium speed controller area network (MS-CAN). Upon a lock request, the SJB supplies voltage on circuit CPL11 (GY/BN) and ground on CPL52 (VT/GY), and the DDM supplies voltage on CPL02 (VT/GN) and ground on CPL51 (BU/GN). Upon an unlock request, the voltage and ground are reversed on the previously listed circuits.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Door lock actuator (part of the door latch)
- Luggage compartment lid release solenoid (part of the luggage compartment latch)
- DDM
- SJB

PINPOINT TEST C: A SINGLE/MORE THAN ONE DOOR LOCK IS INOPERATIVE - WITH MEMORY

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CHECK FOR COMMUNICATION WITH THE DDM AND SJB

- Enter the following diagnostic mode on the diagnostic tool: Network Test
- **Does the SJB or DDM fail the network test?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article.

  NO : Go to C2.

C2 CHECK THE PASSENGER DOOR LOCKS

- Key in OFF position.
- Operate the door locks from a door lock control switch.
- **Are all of the passenger door locks inoperative?**

  YES : VERIFY the SJB fuse 16 (15A) is OK. If OK, go to C3.

  If not OK, go to C5.

  NO : Go to C8.

C3 CHECK CIRCUIT CPL11 (GY/BN) FOR AN OPEN

- Disconnect: RH Front Door Latch C603
- Disconnect: SJB C2280e

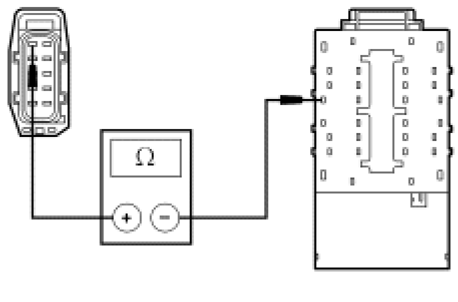


Fig. 5: Checking Circuit CPL11 (GY/BN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the RH front door latch C603-2, circuit CPL11 (GY/BN), harness side and the SJB C2280e-17, circuit CPL11 (GY/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to C4.

  NO : REPAIR the circuit. TEST the system for normal operation.

C4 CHECK CIRCUIT CPL52 (VT/GY) FOR AN OPEN

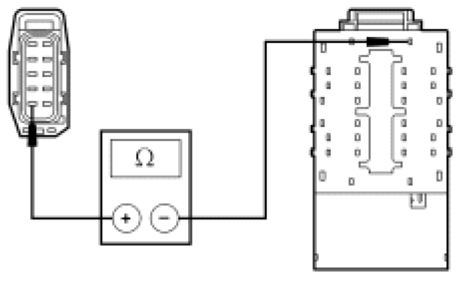


Fig. 6: Checking Circuit CPL52 (VT/GY) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the RH front door latch C603-10, circuit CPL52 (VT/GY), harness side and the SJB C2280e-31, circuit CPL52 (VT/GY), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to C16.

  NO : REPAIR the circuit. TEST the system for normal operation.

C5 CHECK CIRCUIT CPL10 (GN/WH) FOR A SHORT TO GROUND

- Install a new SJB fuse 16 (15A).
- Operate the luggage compartment lid release by pressing the luggage compartment lid release switch.

- **Is the SJB fuse 16 (15A) OK?**

  YES : Go to C7.

  NO : Go to C6.

C6 CHECK THE LUGGAGE COMPARTMENT LID RELEASE SOLENOID

- Install a new SJB fuse 16 (15A).
- Disconnect: Luggage Compartment Lid Release Solenoid C429
- Operate the luggage compartment lid release by pressing the luggage compartment lid release switch.
- **Is the SJB fuse 16 (15A) OK?**

  YES : INSTALL a new luggage compartment lid latch. REFER to **Luggage Compartment Lid Latch**.

  NO : REPAIR circuit CPL10 (GN/WH) for a short to ground. TEST the system for normal operation.

C7 CHECK CIRCUIT CPL11 (GY/BN) FOR A SHORT TO GROUND

- Operate the door lock actuators by pressing LOCK on the door lock control switch.
- **Is the SJB fuse 16 (15A) OK?**

  YES : REPAIR circuit CPL52 (VT/GY) for a short to ground. TEST the system for normal operation.

  NO : REPAIR circuit CPL11 (GY/BN) for a short to ground. TEST the system for normal operation.

C8 CHECK THE DRIVER DOOR LOCK

- Check to see if the driver door lock is the inoperative lock.
- **Is the driver door lock inoperative?**

  YES : Go to C9.

  NO : Go to C13.

C9 CHECK CIRCUIT CPL02 (VT/GN) FOR VOLTAGE

- Disconnect: LH Front Door Latch C525

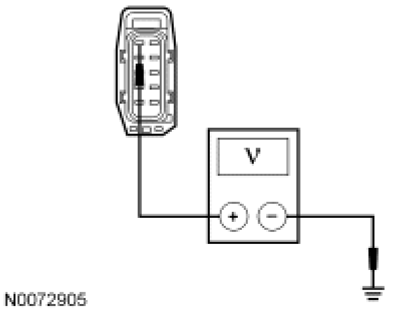


Fig. 7: Checking Circuit CPL02 (VT/GN) For Voltage
Courtesy of FORD MOTOR CO.

NOTE: **The SJB only supplies voltage to the actuator momentarily. It is**

important to monitor the meter while pressing the door lock control switch.

- While pressing the door lock control switch in the LOCK position, measure the voltage between the LH front door latch C525-2, circuit CPL02 (VT/GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to C10.

  NO : Go to C11.

C10 CHECK CIRCUIT CPL51 (BU/GN) FOR VOLTAGE

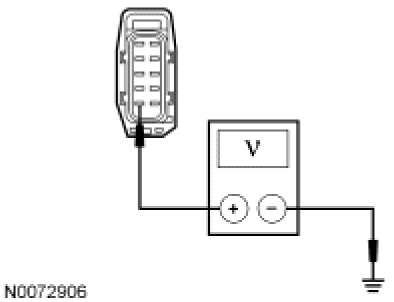


Fig. 8: Checking Circuit CPL51 (BU/GN) For Voltage
Courtesy of FORD MOTOR CO.

NOTE:	**The SJB only supplies voltage to the actuator momentarily. It is important to monitor the meter while pressing the door lock control switch.**

- While pressing the door lock control switch in the UNLOCK position, measure the voltage between the LH front door latch C525-10, circuit CPL51 (BU/GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new driver door latch. REFER to **Front Door Latch**. TEST the system for normal operation.

  NO : Go to C12.

C11 CHECK CIRCUIT CPL02 (VT/GN) FOR AN OPEN OR A SHORT TO GROUND

- Disconnect: DDM C568b

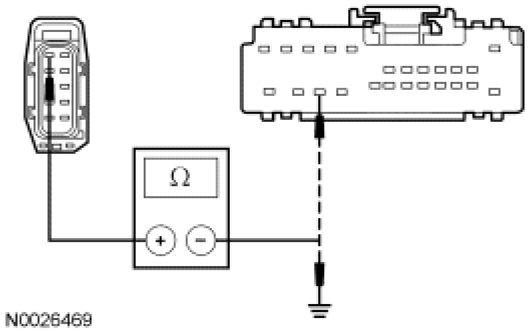


Fig. 9: Checking Circuit CPL02 (VT/GN) For Open Or Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the LH front door latch C525-2, circuit CPL02 (VT/GN), harness side and the DDM C568b-22, circuit CPL02 (VT/GN), harness side; and between the LH front door latch C525-2, circuit CPL02 (VT/GN), harness side and ground.
- **Is the resistance less than 5 ohms between the LH front door latch and the DDM, and greater than 10,000 ohms between the LH front door latch and ground?**

  YES : Go to C12.

  NO : REPAIR the circuit. TEST the system for normal operation.

C12 CHECK CIRCUIT CPL51 (BU/GN) FOR AN OPEN OR A SHORT TO GROUND

- Disconnect: DDM C568b

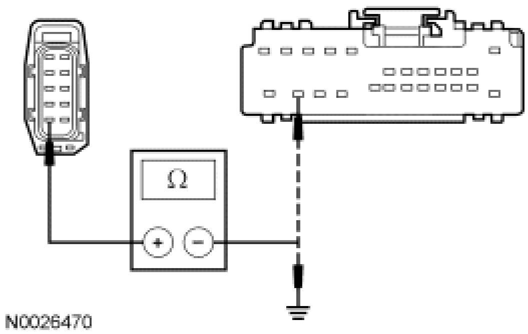


Fig. 10: Checking Circuit CPL51 (BU/GN) For Open Or Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the LH front door latch C525-10, circuit CPL51 (BU/GN), harness side and the DDM C568b-23, circuit CPL51 (BU/GN), harness side; and between the LH front door latch C525-10, circuit CPL51 (BU/GN), harness side and ground.
- **Is the resistance less than 5 ohms between the LH front door latch and the DDM, and greater than 10,000 ohms between the LH front door latch and ground?**

  YES : Go to C15.

  NO : REPAIR the circuit. TEST the system for normal operation.

C13 CHECK CIRCUIT CPL11 (GY/BN) FOR VOLTAGE

- Disconnect: Suspect Door Latch

NOTE: The SJB only supplies voltage to the actuator momentarily. It is important to monitor the meter while pressing the door lock control switch.

- While pressing the door lock control switch in the LOCK position, measure the voltage between the suspect door latch and ground as follows:

Door Latch Connector-Pin	Circuit
C603-2 (RH front)	CPL11 (GY/BN)
C704-2 (LH rear)	CPL11 (GY/BN)
C804-2 (RH rear)	CPL11 (GY/BN)

- **Is the voltage greater than 10 volts?**

  YES : Go to C14.

  NO : REPAIR the circuit for an open. TEST the system for normal operation.

C14 CHECK CIRCUIT CPL52 (VT/GY) FOR VOLTAGE

NOTE: The SJB only supplies voltage to the actuator momentarily. It is important to monitor the meter while pressing the door lock control switch.

- While pressing the door lock control switch in the UNLOCK position, measure the voltage between the suspect door latch and ground as follows:

Door Latch Connector-Pin	Circuit
C603-10 (RH front)	CPL52 (VT/GY)
C704-10 (LH rear)	CPL52 (VT/GY)
C804-10 (RH rear)	CPL52 (VT/GY)

- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new door latch for the door lock actuator in question. REFER to **Front Door Latch** or **Rear Door Latch**. TEST the system for normal operation.

NO : REPAIR the circuit for an open. TEST the system for normal operation.

C15 CHECK FOR CORRECT DDM OPERATION

- Disconnect all the DDM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the DDM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DDM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

C16 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test D: All Door Locks Are Inoperative From One Switch - Without Memory

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Door Locks for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends voltage signals to the door lock control switches through circuits CPL42 (GY/YE) and CPL43 (VT/GY) for the lock and unlock requests, respectively. When the lock or unlock switch is pressed, the voltage signal is routed to ground. The driver door lock control switch is grounded through circuit GD126 (BK/WH) and the passenger switch is grounded through circuit GD139 (BK/YE).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door lock control switch

PINPOINT TEST D: ALL DOOR LOCKS ARE INOPERATIVE FROM ONE SWITCH - WITHOUT MEMORY

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

D1 CHECK CIRCUIT GD126 (BK/WH) OR GD139 (BK/YE) FOR AN OPEN

- Disconnect: Inoperative Door Lock Control Switch

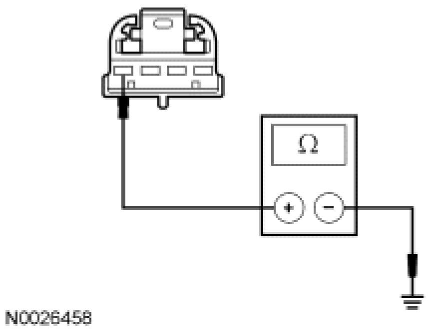


Fig. 11: Checking Circuit GD126 (BK/WH) OR GD139 (BK/YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the driver door lock control switch C505-4, circuit GD126 (BK/WH), harness side and ground; or between the passenger door lock control switch C605-4, circuit GD139 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new door lock control switch. REFER to **Door Lock Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

Pinpoint Test E: All Door Locks Are Inoperative From One Switch - With Memory

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Door Locks for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends voltage signals to the passenger door lock control switch through circuits CPL42 (GY/YE) and CPL43 (VT/GY) for the lock and unlock requests, respectively. When the lock or unlock switch is pressed, the voltage signal is routed to ground.

The driver door module (DDM) sends voltage signals to the driver door lock control switch through circuits

CPL42 (GY/YE) and CPL43 (VT/GY) for the lock and unlock requests, respectively. When the lock or unlock switch is pressed, the voltage signal is routed to ground.

The driver door lock control switch is grounded through circuit GD126 (BK/WH) and the passenger switch is grounded through circuit GD139 (BK/YE).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door lock control switch
- DDM
- SJB

PINPOINT TEST E: ALL DOOR LOCKS ARE INOPERATIVE FROM ONE SWITCH - WITH MEMORY

NOTE:	**Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

E1 CHECK THE RECORDED SJB AND DDM DTCs FROM ON-DEMAND SELF-TEST

- Check the recorded results from the SJB and DDM self-test.
- **Are any DTCs present?**

  YES : REFER to **DTC Charts**.

  NO : Go to E2.

E2 CHECK THE DRIVER DOOR LOCK CONTROL SWITCH

- Check to see if the driver door lock control switch is the inoperative switch.
- **Is the driver door lock control switch inoperative?**

  YES : Go to E3.

  NO : Go to E4.

E3 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

- Disconnect: Driver Door Lock Control Switch C505

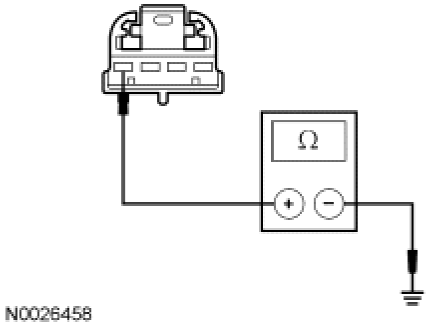


Fig. 12: Checking Circuit GD126 (BK/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the driver door lock control switch C505-4, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to E5.

  NO : REPAIR the circuit. TEST the system for normal operation.

E4 CHECK CIRCUIT GD139 (BK/YE) FOR AN OPEN

- Disconnect: Passenger Door Lock Control Switch C605

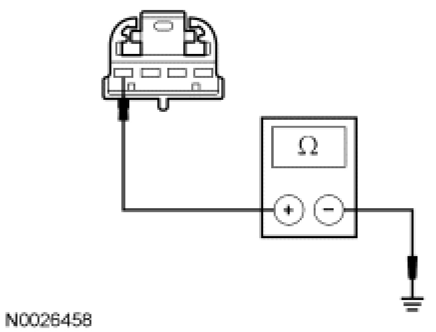


Fig. 13: Checking Circuit GD139 (BK/YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the passenger door lock control switch C605-4, circuit GD139 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to E5.

  NO : REPAIR the circuit. TEST the system for normal operation.

E5 CHECK THE SUSPECT DOOR LOCK CONTROL SWITCH FOR CORRECT OPERATION

- Carry out the door lock control switch component test. Refer to COMPONENT TESTING.
- **Is the door lock control switch OK?**

  YES : For an inoperative driver door lock control switch, go to E6.

  For an inoperative passenger door lock control switch, go to E7.

  NO : INSTALL a new door lock control switch. REFER to **Door Lock Control Switch**. TEST the system for normal operation.

E6 CHECK THE DDM FOR CORRECT OPERATION

- Disconnect all the DDM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the DDM connectors and make sure they seat correctly.

- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DDM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

E7 CHECK THE SJB FOR CORRECT OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test F: The Door Lock Switches Operate Only One Way - Without Memory

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Door Locks for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends voltage signals to the door lock control switches through circuits CPL42 (GY/YE) and CPL43 (VT/GY) for the lock and unlock requests, respectively. When the lock or unlock switch is pressed, the voltage signal is routed to ground. The driver door lock control switch is grounded through circuit GD126 (BK/WH) and the passenger switch is grounded through circuit GD139 (BK/YE).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door lock control switch
- SJB

PINPOINT TEST F: THE DOOR LOCK SWITCHES OPERATE ONLY ONE WAY - WITHOUT MEMORY

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use

the correct probe adapter(s) may damage the connector.

F1 RETRIEVE THE RECORDED SJB DTCs FROM THE ON-DEMAND SELF-TEST

- Check for recorded SJB DTCs from the on-demand self-test.
- **Are any DTCs recorded?**

  YES : For DTC B1309 or B1341, go to **Pinpoint Test H**.

  For all other SJB DTCs, REFER to **DTC Charts**.

  NO : Go to F2.

F2 VERIFY THE OPERATION OF BOTH DOOR LOCK CONTROL SWITCHES

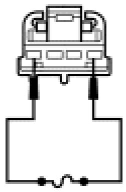
- Key in OFF position.
- Press the lock and unlock button of both door lock control switches while observing the door lock operation.
- **Do the door locks operate only one way from both switches?**

  YES : Go to F4.

  NO : Go to F3.

F3 CHECK CIRCUIT CPL42 (GY/YE) (LOCK INPUT) OR CIRCUIT CPL43 (VT/GY) (UNLOCK INPUT) FOR AN OPEN (SINGLE SWITCH INOPERATIVE)

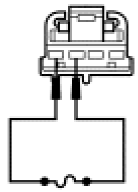
- Disconnect: Suspect Door Lock Control Switch
- Unlock the doors from the working door lock control switch.



N0062349

Fig. 14: Connecting Fused (5A) Jumper Wire Between LH Door Lock Control Switch C505-1, Circuit CPL42 (GY/YE)
Courtesy of FORD MOTOR CO.

- Observe the door locks while connecting a fused (5A) jumper wire between the LH door lock control switch C505-1, circuit CPL42 (GY/YE), harness side and the LH door lock control switch C505-4, circuit GD126 (BK/WH), harness side; or between the RH door lock control switch C605-1, circuit CPL42 (GY/YE), harness side and the RH door lock control switch C605-4, circuit GD139 (BK/YE), harness side.
- Remove the jumper wire.



N0072908

Fig. 15: Connecting Fused (5A) Jumper Wire Between LH Door Lock Control Switch C505-3, Circuit CPL43 (VT/GY)
Courtesy of FORD MOTOR CO.

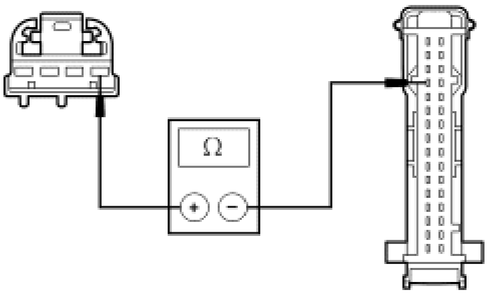
- Observe the door locks while connecting a fused (5A) jumper wire between the LH door lock control switch C505-3, circuit CPL43 (VT/GY), harness side and the LH door lock control switch C505-4, circuit GD126 (BK/WH), harness side; or between the RH door lock control switch C605-3, circuit CPL43 (VT/GY), harness side and the RH door lock control switch C605-4, circuit GD139 (BK/YE), harness side.
- **Do the doors lock and unlock with the jumper wire?**

  YES : INSTALL a new door lock control switch. REFER to **Door Lock Control Switch**. TEST the system for normal operation.

  NO : REPAIR the input circuit in question. TEST the system for normal operation.

F4 CHECK CIRCUIT CPL42 (GY/YE) (LOCK INPUT) OR CIRCUIT CPL43 (VT/GY) (UNLOCK INPUT) FOR AN OPEN (BOTH SWITCHES INOPERATIVE)

- Disconnect: LH Door Lock Control Switch C505
- Disconnect: SJB C2280c



N0072909

Fig. 16: Measuring Resistance Between SJB C2280C-4, Circuit CPL42 (GY/YE) & LH Door Lock Control Switch C505-1
Courtesy of FORD MOTOR CO.

- If the doors do not lock, measure the resistance between the SJB C2280c-4, circuit CPL42 (GY/YE), harness side and the LH door lock control switch C505-1, circuit CPL42 (GY/YE), harness side.

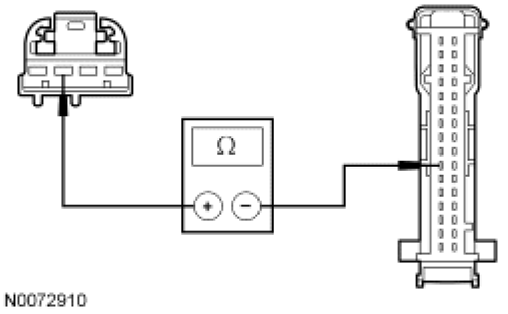


Fig. 17: Measuring Resistance Between SJB C2280C-10, Circuit CPL43 (VT/GY) & LH Door Lock Control Switch C505-3
Courtesy of FORD MOTOR CO.

- If the doors do not unlock, measure the resistance between the SJB C2280c-10, circuit CPL43 (VT/GY), harness side and the LH door lock control switch C505-3, circuit CPL43 (VT/GY), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to F5.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

F5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test G: The Door Lock Switches Operate Only One Way - With Memory

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Door Locks for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends voltage signals to the passenger door lock control switch through circuits

CPL42 (GY/YE) and CPL43 (VT/GY) for the lock and unlock requests, respectively. When the lock or unlock switch is pressed, the voltage signal is routed to ground.

The driver door module (DDM) sends voltage signals to the driver door lock control switch through circuits CPL42 (GY/YE) and CPL43 (VT/GY) for the lock and unlock requests, respectively. When the lock or unlock switch is pressed, the voltage signal is routed to ground.

The driver door lock control switch is grounded through circuit GD126 (BK/WH) and the passenger switch is grounded through circuit GD139 (BK/YE).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door lock control switch
- DDM
- SJB

PINPOINT TEST G: THE DOOR LOCK SWITCHES OPERATE ONLY ONE WAY - WITH MEMORY

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

G1 RETRIEVE THE RECORDED DDM AND SJB DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS

- Check for recorded DDM and SJB DTCs from the continuous and on-demand self-tests.
- **Are any DTCs recorded?**

  YES : For DDM DTC B2574 or B2575 and SJB DTC B1309 or B1341, go to **Pinpoint Test H**.

  For all other DTCs, REFER to **DTC Charts**.

  NO : Go to G2.

G2 CHECK THE SUSPECT DOOR LOCK CONTROL SWITCH FOR CORRECT OPERATION

- Disconnect: Inoperative Door Lock Control Switch
- Carry out the door lock control switch component test. Refer to COMPONENT TESTING.
- **Is the door lock control switch OK?**

  YES : If the driver door lock control switch was the switch tested, go to G3.

  If the passenger door lock control switch was the switch tested, go to G4.

  NO : INSTALL a new door lock control switch. REFER to **Door Lock Control Switch**. TEST the system for normal operation.

G3 CHECK CIRCUITS CPL42 (GY/YE) AND CPL43 (VT/GY) FOR AN OPEN AT THE DDM

- Key in OFF position.
- Disconnect: DDM C568b

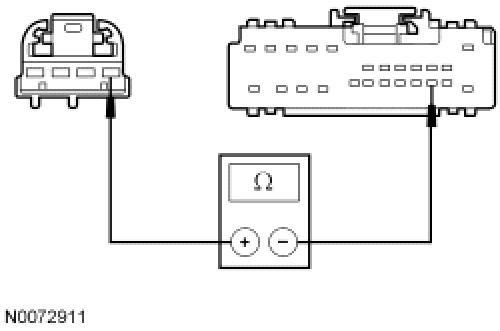


Fig. 18: Measuring Resistance Between DDM C568B-15, Circuit CPL42 (GY/YE) & LH Door Lock Control Switch C505-1
Courtesy of FORD MOTOR CO.

- If the doors do not lock, measure the resistance between the DDM C568b-15, circuit CPL42 (GY/YE), harness side and the LH door lock control switch C505-1, circuit CPL42 (GY/YE), harness side.

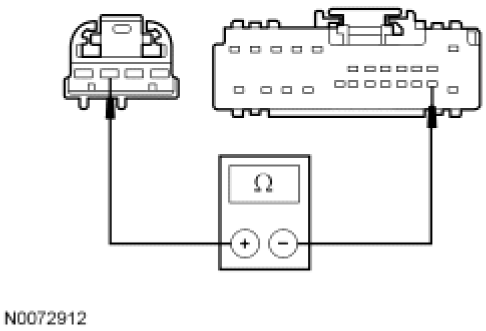


Fig. 19: Measuring Resistance Between DDM C568B-14, Circuit CPL43 (VT/GY) & LH Door Lock Control Switch C505-3
Courtesy of FORD MOTOR CO.

- If the doors do not unlock, measure the resistance between the DDM C568b-14, circuit CPL43 (VT/GY), harness side and the LH door lock control switch C505-3, circuit CPL43 (VT/GY), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to G5.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

G4 CHECK CIRCUITS CPL42 (GY/YE) AND CPL43 (VT/GY) FOR AN OPEN AT THE SJB

- Key in OFF position.
- Disconnect: SJB C2280c

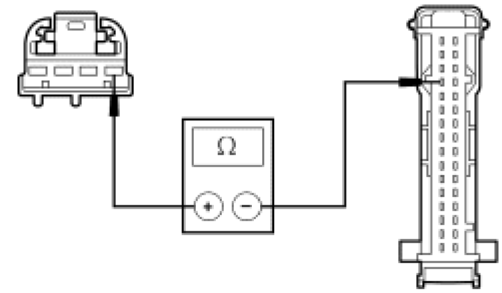


Fig. 20: Measuring Resistance Between SJB C2280C-4, Circuit CPL42 (GY/YE) & LH Door Lock Control Switch C505-1
Courtesy of FORD MOTOR CO.

- If the doors do not lock, measure the resistance between the SJB C2280c-4, circuit CPL42 (GY/YE), harness side and the LH door lock control switch C505-1, circuit CPL42 (GY/YE), harness side.

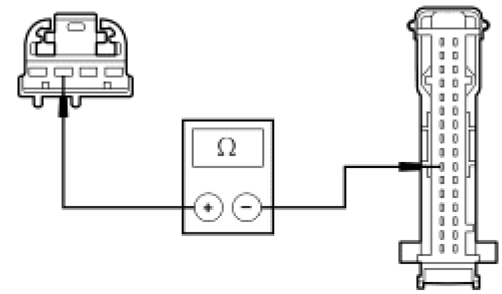


Fig. 21: Measuring Resistance Between SJB C2280C-10, Circuit CPL43 (VT/GY) & LH Door Lock Control Switch C505-3
Courtesy of FORD MOTOR CO.

- If the doors do not unlock, measure the resistance between the SJB C2280c-10, circuit CPL43 (VT/GY), harness side and the LH door lock control switch C505-3, circuit CPL43 (VT/GY), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to G6.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

G5 CHECK FOR CORRECT DDM OPERATION

- Disconnect all the DDM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the DDM connectors and make sure they seat correctly.

- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DDM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

G6 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test H: DTC B1309, B1341, B2574, or B2575: Lock/Unlock Circuit Short To Ground

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Door Locks for schematic and connector information.

Normal Operation - With Memory

The smart junction box (SJB) supplies voltage and ground to all the passenger door lock actuators by controlling the lock all and unlock all relays. The driver door module (DDM) supplies voltage and ground only to the driver door lock actuator. The SJB receives inputs from the RH door lock control switch, keyless entry keypad, and the remote keyless entry (RKE) transmitter. The DDM only receives input from the LH door lock control switch. Both modules share the information obtained from the inputs over the medium speed controller area network (MS-CAN). Upon a lock request, the SJB supplies voltage on circuit CPL11 (GY/BN) and ground on CPL52 (VT/GY), and the DDM supplies voltage on CPL02 (VT/GN) and ground on CPL51 (BU/GN). Upon an unlock request, the voltage and ground are reversed on the previously listed circuits.

Without Memory

The SJB supplies voltage to the lock all relay, the unlock driver door relay or unlock all relay based upon input from the door lock control switches, the RKE transmitter, or the keyless entry keypad. Upon a lock request, the SJB supplies voltage on circuit CPL11 (GY/BN) and ground on circuits CPL52 (VT/GY) and CPL51 (BU/GN). Upon an unlock request, the voltage and ground are reversed on the previously listed circuits.

DTC Description	Fault Trigger Conditions
B1309 - Power Door Lock Circuit Short to Ground	An on-demand DTC that sets when the SJB detects a short to ground on circuit CPL42 (GY/YE).
B1341 - Power Door Unlock Circuit Short to Ground	An on-demand DTC that sets when the SJB detects a short to ground on circuit CPL43 (VT/GY).
B2574 - Drivers Door LOCK Switch Short to Ground	A continuous and on-demand DTC that sets when the DDM detects a short to ground on circuit CPL42 (GY/YE). This code will also set if the driver door lock control switch is pressed for longer than 2 minutes.
B2575 - Drivers Door UNLOCK Switch Short to Ground	A continuous and on-demand DTC that sets when the DDM detects a short to ground on circuit CPL43 (VT/GY). This code will also set if the driver door unlock control switch is pressed for longer than 2 minutes.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door lock control switch
- DDM
- SJB

PINPOINT TEST H: DTC B1309, B1341, B2574, OR B2575: LOCK/UNLOCK CIRCUIT SHORT TO GROUND

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

H1 CHECK THE RECORDED SJB DTCs FROM ON-DEMAND SELF-TEST

- Check the recorded results from the SJB self-test.
- **Is DTC B1309 or B1341 present?**

  YES : Go to H2.

  NO : Go to H5.

H2 CHECK THE RH DOOR LOCK CONTROL SWITCH - WITHOUT MEMORY

- Disconnect: RH Door Lock Control Switch C605
- Repeat the SJB on-demand self-test.
- **Is DTC B1309 or B1341 retrieved again?**

  YES : For vehicles without memory, LEAVE the switch disconnected. Go to H3.

  For vehicles with memory, LEAVE the switch disconnected. Go to H4.

  NO : INSTALL a new RH door lock control switch. REFER to **Door Lock Control Switch**. TEST the system for normal operation.

H3 CHECK THE LH DOOR LOCK CONTROL SWITCH - WITHOUT MEMORY

- Disconnect: LH Door Lock Control Switch C505
- Repeat the SJB on-demand self-test.
- **Is DTC B1309 or B1341 retrieved again?**

  YES : LEAVE the switch disconnected. Go to H4.

  NO : INSTALL a new LH door lock control switch. REFER to **Door Lock Control Switch**. TEST the system for normal operation.

H4 CHECK THE LOCK INPUT CIRCUIT OR THE UNLOCK INPUT CIRCUIT FOR A SHORT TO GROUND - WITHOUT MEMORY

- Key in OFF position.
- Disconnect: SJB C2280c

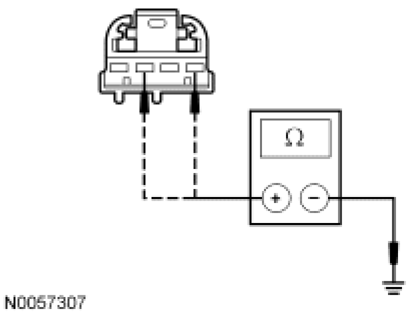


Fig. 22: Checking Lock Input Circuit Or Unlock Input Circuit For A Short To Ground - Without Memory
Courtesy of FORD MOTOR CO.

- Measure the resistance between the RH door lock control switch C605-1, circuit CPL42 (GY/YE), harness side and ground; and between the RH door lock control switch C605-3, circuit CPL43 (VT/GY), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to H8.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

H5 CHECK THE LH DOOR LOCK CONTROL SWITCH - WITH MEMORY

- Disconnect: LH Door Lock Control Switch C505
- Repeat the DDM on-demand self-test.
- **Is DTC B2574 or B2575 retrieved again?**

  YES : LEAVE the switch disconnected. Go to H6.

  NO : INSTALL a new LH door lock control switch. REFER to **Door Lock Control Switch**. TEST the system for normal operation.

H6 CHECK THE LOCK INPUT CIRCUIT OR THE UNLOCK INPUT CIRCUIT FOR A SHORT TO GROUND - WITH MEMORY

- Key in OFF position.

- Disconnect: DDM C568B

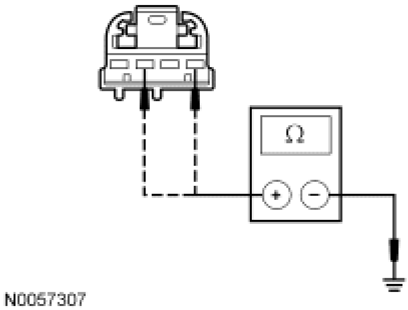


Fig. 23: Checking Lock Input Circuit Or Unlock Input Circuit For A Short To Ground - With Memory
Courtesy of FORD MOTOR CO.

- Measure the resistance between the LH door lock control switch C505-1, circuit CPL42 (GY/YE), harness side and ground; and between the LH door lock control switch C505-3, circuit CPL43 (VT/GY), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to H7.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

H7 CHECK FOR CORRECT DDM OPERATION

- Disconnect all the DDM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the DDM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DDM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

H8 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.

- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: The Luggage Compartment Lid Release Is Inoperative/Does Not Operate Correctly

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Luggage Compartment Lid Release for schematic and connector information.

Normal Operation

When the smart junction box (SJB) receives an open request from the luggage compartment lid switch on circuit CPL45 (BN), the SJB supplies voltage on circuit CPL10 (GN/WH) to the luggage compartment lid latch. The luggage compartment lid latch is grounded on circuit GD171 (BK/GY).

- DTC B1554 (Decklid Release Circuit Short to Ground) - is an on-demand DTC that sets if the SJB detects a short to ground on the luggage compartment lid release switch circuit CPL45 (BN).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Luggage compartment lid release switch
- Luggage compartment lid latch
- SJB

PINPOINT TEST I: THE LUGGAGE COMPARTMENT LID RELEASE IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

I1 CHECK THE DOOR LOCK OPERATION

- Lock and unlock the doors using a door lock control switch.
- **Do the door locks operate correctly?**

  YES : Go to I2.

  NO : Go to **Symptom Chart**.

I2 RETRIEVE THE RECORDED SJB DTCs FROM THE ON-DEMAND SELF-TEST

- Check for recorded SJB DTCs from the on-demand self-test.
- **Is DTC B1554 present?**

YES : Go to I3.

NO : Go to I5.

I3 REPEAT THE SJB ON-DEMAND SELF-TEST

- Disconnect: Luggage Compartment Lid Release Switch C2269
- Erase the DTCs, then repeat the SJB on-demand self-test.
- **Is DTC B1554 recorded?**

YES : Go to I4.

NO : INSTALL a new luggage compartment lid switch. CLEAR the DTCs. REPEAT the self-test.

I4 CHECK CIRCUIT CPL45 (BN) FOR A SHORT TO GROUND

- Disconnect: SJB C2280d

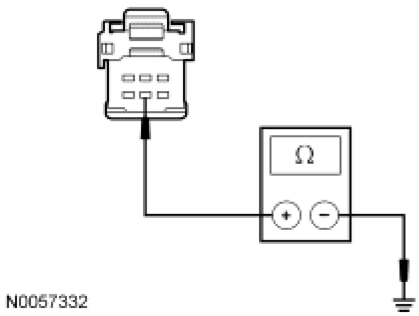


Fig. 24: Checking Circuit CPL45 (BN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the luggage compartment lid release switch C2269-5, circuit CPL45 (BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to I14.

NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

I5 CARRY OUT THE SJB LUGGAGE COMPARTMENT LID RELEASE ACTIVE COMMAND USING THE SCAN TOOL

- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Select the SJB PID (DLIDOUT) and active command the luggage compartment lid to release.
- **Does the luggage compartment lid release?**

YES : Go to I6.

NO : Go to I9.

I6 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

- Disconnect: Luggage Compartment Lid Release Switch C2269

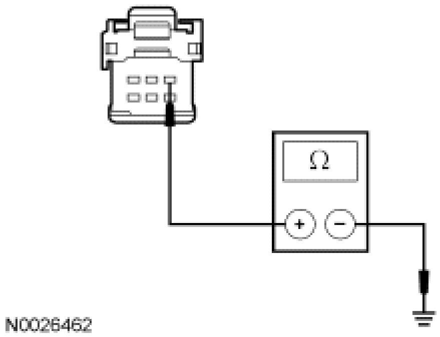


Fig. 25: Checking Circuit GD116 (BK/VT) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the luggage compartment lid release switch C2269-1, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to I7.

  NO : REPAIR the circuit. TEST the system for normal operation.

I7 CHECK THE LUGGAGE COMPARTMENT LID SWITCH

- Key in OFF position.
- Disconnect: Luggage Compartment Lid Release Switch C2269

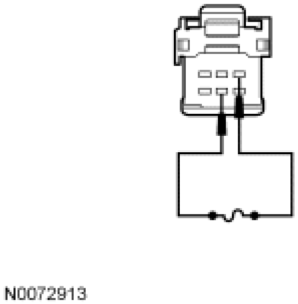


Fig. 26: Checking Luggage Compartment Lid Switch
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the luggage compartment lid release switch C2269-5, circuit CPL45 (BN), harness side and the luggage compartment lid release switch C2269-1, circuit GD116 (BK/VT), harness side.
- **Does the luggage compartment lid release?**

  YES : INSTALL a new luggage compartment lid switch. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to I8.

I8 CHECK CIRCUIT CPL45 (BN) FOR AN OPEN

- Disconnect: SJB C2280d

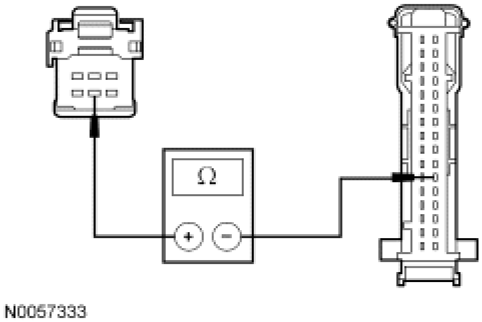


Fig. 27: Checking Circuit CPL45 (BN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the luggage compartment lid switch C2269-5, circuit CPL45 (BN), harness side and the SJB C2280d-27, circuit CPL45 (BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to I14.

  NO : REPAIR the circuit. TEST the system for normal operation.

I9 CHECK CIRCUIT GD171 (BK/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: Luggage Compartment Lid Latch C429

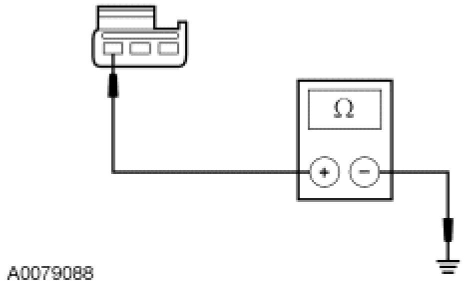


Fig. 28: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the luggage compartment lid latch C429-3, circuit GD171 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to I10.

  NO : REPAIR the circuit. TEST the system for normal operation.

I10 CHECK CIRCUIT CPL10 (GN/WH) FOR VOLTAGE

- Key in ON position.

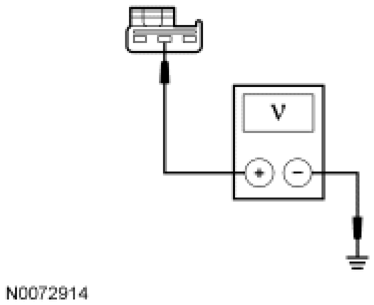


Fig. 29: Checking Circuit CPL10 (GN/WH) For Voltage
Courtesy of FORD MOTOR CO.

NOTE: Do not operate the luggage compartment lid release while performing this test.

- Measure the voltage between the luggage compartment lid latch C429-2, circuit CPL10 (GN/WH), harness side and ground.
- **Is any voltage present?**

  YES : Go to I11.

  NO : Go to I12.

I11 CHECK CIRCUIT CPL10 (GN/WH) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280e

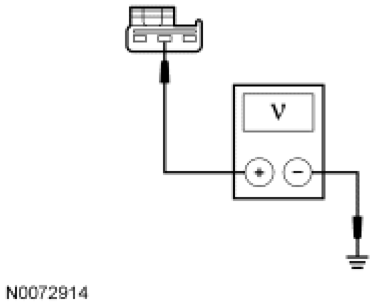


Fig. 30: Checking Circuit CPL10 (GN/WH) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the luggage compartment lid latch C429-2, circuit CPL10 (GN/WH), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to I14.

I12 CHECK FOR VOLTAGE TO THE LUGGAGE COMPARTMENT LID RELEASE SOLENOID

- Unlock the doors with a door lock control switch.

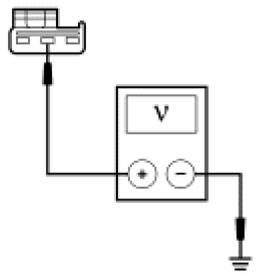


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Fig. 31: Checking For Voltage To Luggage Compartment Lid Release Solenoid
Courtesy of FORD MOTOR CO.

NOTE: **The SJB only supplies voltage to the luggage compartment lid release solenoid momentarily. It is important to watch the meter while pressing the luggage compartment lid release switch.**

- While pressing the luggage compartment lid release switch, measure the voltage between the luggage compartment lid latch C429-2, circuit CPL10 (GN/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new luggage compartment lid latch. REFER to **Luggage Compartment Lid Latch**. TEST the system for normal operation.

  NO : Go to I13.

I13 CHECK CIRCUIT CPL10 (GN/WH) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280e

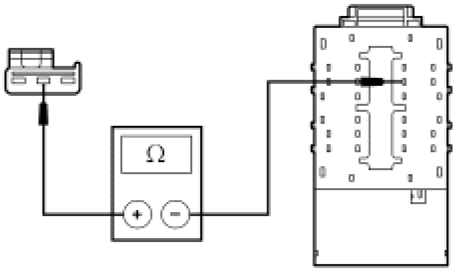

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Fig. 32: Checking Circuit CPL10 (GN/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the luggage compartment lid latch C429-2, circuit CPL10 (GN/WH), harness side and the SJB C2280e-23, circuit CPL10 (GN/WH), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to I14.

NO : REPAIR the circuit. TEST the system for normal operation.

I14 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test J: The Doors Do Not Lock/Unlock Using The Keyless Entry Keypad

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

The smart junction box (SJB) monitors for a ground signal on the reference circuits CPK29 (GY/BU), CPK30 (VT/GN), and CPK31 (YE/GN) for the keyless entry keypad. When an individual keypad button is pressed, an individual or combination of the reference circuits is routed to ground. The SJB then determines which button was pressed based on which circuit(s) are grounded. The keypad is grounded through circuit GD126 (BK/WH). Once the SJB determines that the 5-digit personal entry code, or the factory set 5-digit entry code has been entered on the keypad, the SJB then energizes the driver door unlock relay to unlock the driver door.

To unlock all the doors, the 3/4 button must be pressed within 5 seconds of the 5-digit code being entered.

To release the luggage compartment lid, the 5/6 button must be pressed within 5 seconds of the 5-digit code being entered.

To lock all the doors, the 5-digit code does not need to be entered. Press the 7/8 and 9/0 buttons at the same time.

- DTC B2695 (Keypad_A Switch Circuit Failure) - is an on-demand DTC that sets when the SJB detects a short to ground on the keyless entry keypad switch A circuit CPK29 (GY/BU).
- DTC B2696 (Keypad_B Switch Circuit Failure) - is an on-demand DTC that sets when the SJB detects a short to ground on the keyless entry keypad switch B circuit CPK30 (VT/GN).

- DTC B2697 (Keypad_C Switch Circuit Failure) - is an on-demand DTC that sets when the SJB detects a short to ground on the keyless entry keypad switch C circuit CPK31 (YE/GN).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Keyless entry keypad
- SJB

PINPOINT TEST J: THE DOORS DO NOT LOCK/UNLOCK USING THE KEYLESS ENTRY KEYPAD

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

J1 CHECK THE SJB KEYCODE PID

- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Observe the SJB PID (KEYCODE). Read and record the 5-digit factory set entry code.
- Enter the 5-digit factory set entry code on the keyless entry keypad, then press the 3/4 button.
- **Do the doors unlock?**

  YES : The system is operating as designed. INFORM the customer of the correct system operation.

  NO : Go to J2.

J2 RETRIEVE THE RECORDED SJB DTCs FROM THE ON-DEMAND SELF-TEST

- Check for recorded SJB DTCs from the on-demand self-test.
- **Is DTC B2695, B2696, or B2697 recorded?**

  YES : Go to J3.

  NO : Go to J5.

J3 REPEAT THE SJB ON-DEMAND SELF-TEST

- Disconnect: Keyless Entry Keypad C530
- Clear the DTCs, then repeat the SJB on-demand self-test.
- **Is DTC B26956, B2696, or B2697 recorded?**

  YES : Go to J4.

  NO : INSTALL a new keyless entry keypad. REFER to **Keyless Entry Keypad**. CLEAR the DTCs. REPEAT the self-test.

J4 CHECK CIRCUITS CPK29 (GY/BU), CPK30 (VT/GN) AND CPK31 (YE/GN) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280c
- Measure the resistance between the keypad, harness side and ground as follows:

Keypad Connector-	Circuit

Pin	
C530-7	CPK29 (GY/BU)
C530-5	CPK30 (VT/GN)
C530-1	CPK31 (YE/GN)

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to J10.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

J5 CHECK THE SJB KEY_PAD PID

- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Press each keyless entry keypad button while observing the SJB PID (KEY_PAD).
- **Does the PID display the correct values?**

  YES : Go to J10.

  NO : Go to J6.

J6 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

- Key in OFF position.
- Disconnect: Keyless Entry Keypad C530

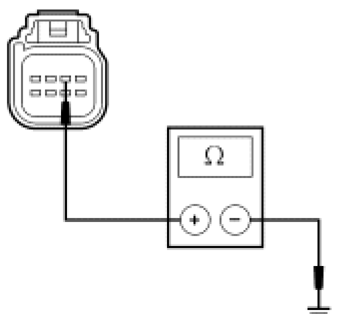

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Fig. 33: Checking Circuit GD126 (BK/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the keyless entry keypad C530-2, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to J7.

  NO : REPAIR the circuit. TEST the system for normal operation.

J7 CHECK THE KEYLESS ENTRY KEYPAD

- Connect a fused (5A) jumper wire between the keyless entry keypad harness side, while monitoring the SJB PID (KEY_PAD) as follows:

Keyless Entry Keypad Connector-Pin/ Circuit	Keyless Entry Keypad Connector-Pin/ Circuit	SJB PID (KEY_PAD) Value
C530-7 CPK29 (GY/BU)	C530-2 GD126 (BK/WH)	1/2
C530-5 CPK30 (VT/GN)	C530-2 GD126 (BK/WH)	7/8
C530-1 CPK31 (YE/GN)	C530-2 GD126 (BK/WH)	9/0

- **Does the PID display the correct values?**

  YES : INSTALL a new keyless entry keypad. REFER to **Keyless Entry Keypad**.

  NO : Go to J8.

J8 CHECK CIRCUITS CPK29 (GY/BU), CPK30 (VT/GN) AND CPK31 (YE/GN) FOR AN OPEN

- Disconnect: SJB C2280c
- Measure the resistance between the SJB, harness side and the keyless entry keypad, harness side as follows:

SJB Connector-Pin	Circuit	Keyless Entry Keypad Connector-Pin
C2280c-15	CPK29 (GY/BU)	C530-7
C2280c-16	CPK30 (VT/GN)	C530-5
C2280c-21	CPK31 (YE/GN)	C530-1

- **Are the resistances less than 5 ohms?**

  YES : Go to J9.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

J9 CHECK CIRCUITS CPK29 (GY/BU), CPK30 (VT/GN) AND CPK31 (YE/GN) FOR A SHORT TO EACH OTHER

- Measure the resistance between the keypad, harness side as follows:

Keypad Connector-Pin	Circuits	Keypad Connector-Pin
C530-7	CPK29 (GY/BU) and CPK30 (VT/GN)	C530-5
C530-7	CPK29 (GY/BU) and CPK31 (YE/GN)	C530-1
C530-5	CPK30 (VT/GN) and CPK31 (YE/GN)	C530-1

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to J10.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

J10 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test K: The Keyless Entry Keypad Illumination Is Inoperative/Does Not Operate Correctly

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Remote Keyless Entry and Alarm for schematic and connector information.

Normal Operation

When any keypad button is pressed the smart junction box (SJB) sends power to the keyless entry keypad lamps on circuit CPK28 (WH) to assist the driver in entering an access code at night. The keyless entry keypad is grounded on circuit GD126 (BK/WH).

- DTC B1623 (Lamp Keypad Output Circuit Failure) - is a continuous DTC that sets if the SJB detects a short to ground on the keyless entry keypad illumination circuit CPK28 (WH).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Keyless entry keypad
- SJB

PINPOINT TEST K: THE KEYLESS ENTRY KEYPAD ILLUMINATION IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

K1 CHECK THE KEYLESS ENTRY KEYPAD OPERATION

- Enter the security code to unlock the driver door.
- **Does the driver door unlock using the keyless entry keypad?**

  YES : Go to K2.

  NO : Go to **Pinpoint Test J**.

K2 CHECK THE RECORDED SJB DTCs FROM THE ON-DEMAND SELF-TEST

- Check the recorded results from the SJB self-test.
- **Is DTC B1623 present?**

  YES : Go to K3.

  NO : Go to K5.

K3 CHECK THE KEYLESS ENTRY KEYPAD FOR A SHORT TO GROUND

- Disconnect: Keyless Entry Keypad C530
- Clear the DTCs, then repeat the SJB on-demand self-test.
- **Is DTC B1623 recorded?**

  YES : Go to K4.

  NO : INSTALL a new keyless entry keypad. REFER to **Keyless Entry Keypad**. TEST the system for normal operation.

K4 CHECK CIRCUIT CPK28 (WH/GN) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280c

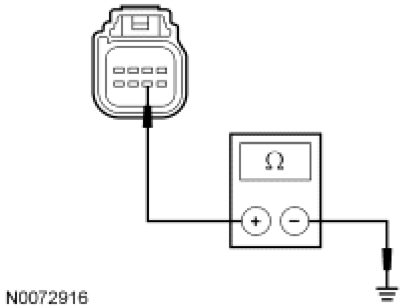


Fig. 34: Checking Circuit CPK28 (WH/GN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the keyless entry keypad C530-6, circuit CPK28 (WH/GN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to K9.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

K5 CHECK THE KEYLESS ENTRY KEYPAD ILLUMINATION

- Key in OFF position.
- Check the keyless entry keypad illumination.
- **Is the keyless entry keypad illumination always on?**

  YES : Go to K6.

  NO : Go to K7.

K6 CHECK CIRCUIT CPK28 (WH/GN) FOR A SHORT TO VOLTAGE

- Disconnect: SJB C2280c
- Key in ON position.
- Observe the keypad illumination.
- **Is the keypad still illuminated?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to K9.

K7 CHECK FOR SJB OUTPUT

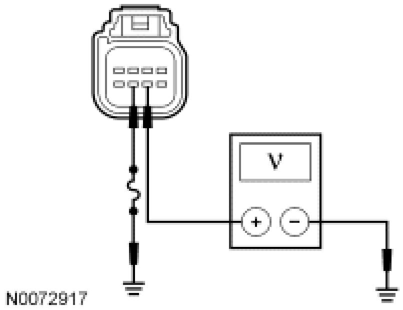


Fig. 35: Checking For SJB Output
Courtesy of FORD MOTOR CO.

- Measure the voltage between the keyless entry keypad C530-6, circuit CPK28 (WH/GN), harness side and ground while connecting a fused (5A) jumper wire between the keyless entry keypad C530-7, circuit CPK29 (GY/BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new keyless entry keypad. REFER to **Keyless Entry Keypad**. TEST the system for normal operation.

  NO : Go to K8.

K8 CHECK CIRCUIT CPK28 (WH/GN) FOR AN OPEN

- Disconnect: SJB C2280c

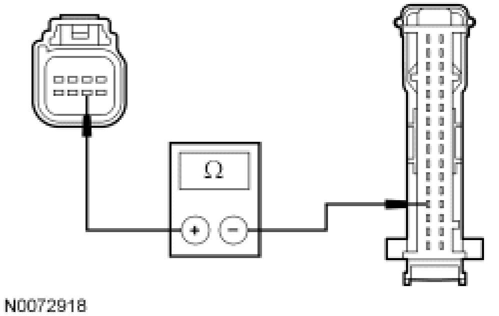


Fig. 36: Checking Circuit CPK28 (WH/GN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the keyless entry keypad C530-6, circuit CPK28 (WH/GN), harness side and the SJB C2280c-13, circuit CPK28 (WH/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to K9.

  NO : REPAIR the circuit. TEST the system for normal operation.

K9 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test L: The Remote Keyless Entry (RKE) Transmitter Is Inoperative

Normal Operation

Remote locking and unlocking of the doors, releasing the luggage compartment lid, and activating the panic alarm is accomplished by the smart junction box (SJB) receiving a command message from the RKE integrated key head transmitter (IKT). The IKTs and SJB also utilize a rolling code to prevent the code from being "captured" by a code grabber. The system advances the counter in the RKE transmitter and SJB every time an IKT button is pressed.

- DTC B1139 (Invalid Transmitter Identification Code) - is a continuous DTC that sets when the SJB detects an invalid TIC from an IKT.
- DTC B2425 (Remote Keyless Entry Out of Synchronization) - is a continuous DTC that sets when the SJB detects the rolling counter received from an RKE transmitter is 1,024 times greater than the rolling counter stored in the module.

This pinpoint test is intended to diagnose the following:

- IKT
- IKT battery
- IKT button pressed a substantial amount of times while outside the range of the vehicle
- IKT programming
- SJB

PINPOINT TEST L: THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER IS INOPERATIVE

NOTE: All IKT transmitters must be present to begin diagnosis of the RKE system.

NOTE: Aftermarket or dealer-installed systems may adversely affect the RKE system operation. These systems should be disconnected before diagnosing any RKE concerns.

L1 CHECK FOR THE CORRECT RKE TRANSMITTERS

NOTE: Make sure the IKTs are those provided with the original equipment manufacturer (OEM) system and not from an aftermarket system, or a dealer-installed system that may have been installed on the vehicle.

- Check that the correct IKTs are used with the vehicle.
- **Are all the correct IKTs present?**

  YES : Go to L2.

  NO : The system cannot be tested without the correct IKTs. INFORM the customer that all the

correct IKTs must be present to proceed with diagnosis of the system.

L2 CHECK THE RECORDED SJB AND INSTRUMENT CLUSTER (IC) DTCs FROM THE ON-DEMAND SELF-TEST

- Check the recorded results from the SJB and IC self-test.
- **Is DTC B2425 or B1137 recorded?**

  YES : For DTC B2425, go to L3.

  For DTC B1137, go to **Pinpoint Test R**.

  NO : Go to L4.

L3 RE-SYNCHRONIZE THE INOPERATIVE IKT

- Key in OFF position.
- Key in ON position.
- Leave the IKT key in the ON position for a minimum of 6 seconds.
- Key in OFF position.
- Press any button on the IKT.
- **Does the IKT operate?**

  YES : The system is OK. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to L4.

L4 MAKE SURE THE RKE TRANSMITTER SIGNAL IS BEING RECEIVED

- Enter the following diagnostic mode on the diagnostic tool: Remote Keyless Entry

NOTE: The remote keyless entry test is accessed through the scan tool by selecting Toolbox, Body, Security.

- Monitor the RKE transmitter identification code (TIC) through the scan tool menus.
- Verify the RKE transmitter signal is being received. Using a scan tool, press a button on the RKE transmitter while observing the scan tool.
- **Does the TIC show up on the scan tool screen when a button is pressed?**

  YES : Go to L5.

  NO : Go to L6.

L5 CHECK IF THE RKE TRANSMITTERS ARE PROGRAMMED

- Enter the following diagnostic mode on the diagnostic tool: Remote Keyless Entry
- Monitor the RKE TIC through the scan tool menus.
- Compare the TIC received from the RKE transmitter with the TICs stored in memory.
- **Does the TIC displayed match any of the TICs stored in memory?**

  YES : Go to L7.

  NO : PROGRAM all of the IKTs. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. INFORM the customer that any IKTs not present need to be programmed. TEST the system for normal operation.

L6 CHECK THE IKT BATTERY

- Using a thin coin, open the IKT.
- Do not clean off any grease from the battery terminals on the back surface of the circuit board.
- Verify the correct battery is used (CR2032).
- Remove the IKT battery and measure the voltage.
- **Is the voltage greater than 2.5 volts?**

  YES : Go to L7.

  NO : INSTALL a new battery (make sure the battery is seated correctly). DO NOT reprogram the IKT (weak or dead batteries do not erase TICs from memory). TEST the system for normal operation.

L7 CHECK FOR NORMAL OPERATION WITH A KNOWN GOOD IKT

- Enter the following diagnostic mode on the diagnostic tool: Remote Keyless Entry
- Monitor the RKE TIC through the scan tool menus.
- Using the customer's second RKE transmitter, or a known good RKE transmitter that is correct for the vehicle, verify the RKE transmitter signal is being received by the SJB.
- **Does the TIC show up on the scan tool when a button is pressed?**

  YES : REPLACE the inoperative IKT. PROGRAM the new IKT. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. TEST the system for normal operation.

  NO : Go to L8.

L8 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test M: An Individual Button/Feature Is Inoperative From The Remote Keyless Entry (RKE) Transmitter

Normal Operation

When any integrated key head transmitter (IKT) button is pressed, the SJB receives and processes the command to provide the appropriate output.

This pinpoint test is intended to diagnose the following:

- Door locks
- Horn system
- Luggage compartment lid release
- Turn signal system
- IKT

PINPOINT TEST M: AN INDIVIDUAL BUTTON/FEATURE IS INOPERATIVE FROM THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER

NOTE: **The panic feature will only operate when the key is in the OFF or LOCK positions.**

M1 VERIFY THE DOOR LOCK OPERATION

- Press the lock and unlock button on the driver door lock control switch while observing the door lock operation.
- **Do the door locks operate correctly?**

  YES : Go to M2.

  NO : Go to **Symptom Chart**.

M2 VERIFY THE HORN OPERATION

- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Select the SJB PID (HORNRLY) and active command the horn on.
- **Does the horn sound when commanded on?**

  YES : Go to M3.

  NO : REFER to **HORN** article.

M3 VERIFY THE HAZARD LAMP OPERATION

- Place the hazard switch in the ON position.
- **Do the hazard lamps operate correctly?**

  YES : Go to M4.

  NO : REFER to **EXTERIOR LIGHTING** article.

M4 VERIFY THE LUGGAGE COMPARTMENT LID RELEASE OPERATION

- Press the luggage compartment lid release button, located next to the headlamp switch.
- **Does the luggage compartment lid release?**

  YES : REPLACE the inoperative IKT and PROGRAM all of the IKTs. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. INFORM the customer that any IKTs not present need to be programmed. TEST the system for normal operation.

  NO : Go to **Symptom Chart**.

Pinpoint Test N: The Remote Keyless Entry (RKE) Transmitter Has Poor Range Performance

Normal Operation

The RKE transmitter sends a radio signal to the smart junction box (SJB) based on the user selected RKE transmitter button. The SJB then carries out the selected action.

This pinpoint test is intended to diagnose the following:

- IKT
- IKT battery
- Aftermarket systems
- High power devices
- TV/radio transmission towers
- SJB

PINPOINT TEST N: THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER HAS POOR RANGE PERFORMANCE

NOTE: All RKE transmitters must be present to begin diagnosis of the RKE system.

NOTE: Aftermarket or dealer-installed systems may adversely affect RKE system operation. These systems should be disconnected before diagnosing any RKE concerns.

N1 CHECK FOR THE CORRECT RKE TRANSMITTERS

NOTE: Make sure the RKE transmitters are those provided with the original equipment manufacturer (OEM) system and not from an aftermarket system or a dealer-installed system.

- Check that the correct RKE transmitters are used with the vehicle.
- **Are all the correct RKE transmitters present?**

YES : Go to N2.

NO : The system cannot be tested without the correct RKE transmitters. INFORM the customer that all the correct RKE transmitters must be present to proceed with diagnosis of the system.

N2 CHECK ALL THE RKE TRANSMITTERS FOR POOR RANGE PERFORMANCE

NOTE: The 10 m (33 ft) measurement of range is not the standard but is a guideline that clearly indicates a vehicle is experiencing poor range performance.

- Check all the RKE transmitters for poor range performance (less than 10 m [33 ft]).
- **Do all RKE transmitters experience poor range?**

YES : Go to N4.

NO : Go to N3.

N3 CHECK THE IKT BATTERY

- Using a thin coin, open the IKT.

- Do not clean off any grease from the battery terminals on the back surface of the circuit board.
- Verify the correct battery is used (CR2032).
- Remove the IKT battery and measure the voltage.
- **Is the voltage greater than 2.5 volts?**

  YES : REPLACE the inoperative integrated key and PROGRAM all the integrated keys. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article. INFORM the customer that any RKE transmitters not present need to be programmed. TEST the system for normal operation.

  NO : INSTALL a new battery (make sure the battery is seated correctly). DO NOT reprogram the IKT (weak or dead batteries do not erase TICs from memory). TEST the system for normal operation.

N4 CHECK THE LOCATION OF THE VEHICLE AND THE APPROACH ANGLES AROUND THE VEHICLE

- Make sure the poor performance is consistent in nature and is not from one approaching angle.
- The RKE transmitter range performance may be degraded in certain locations. For example, if the vehicle is within 0.8 km (0.5 miles) of high-power devices or radio/TV towers, the operating distance of the RKE transmitters may be reduced.
- **Is the poor range performance consistent around the vehicle?**

  YES : Go to N5.

  NO : The system is operating correctly at this time. TEST the system for normal operation.

N5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test O: The Autolock Does Not Operate Correctly

Normal Operation

The smart junction box (SJB) energizes the lock relay based upon input from the ajar switches, the transmission range (TR) sensor, and the vehicle speed signal. The SJB locks the doors when the following conditions are met:

- All the doors are closed
- The ignition switch is in the ON position
- The vehicle is shifted into any gear putting the vehicle in motion
- The vehicle attains a speed greater than 20 km/h (12 mph) for longer than 2 seconds

NOTE: The autolock feature is not available on vehicles equipped with a manual transmission.

This pinpoint test is intended to diagnose the following:

- Ignition switch
- Door ajar switches
- Vehicle speed signal
- TR sensor
- SJB

PINPOINT TEST O: THE AUTOLOCK DOES NOT OPERATE CORRECTLY

O1 CHECK THE AUTO LOCKS CONFIGURATION

- Check to see if the auto locks are enabled. REFER to **Autolock and Horn Chirp Programming**.
- **Are the auto locks enabled?**

  YES : Go to O2.

  NO : ENABLE the auto locks. REFER to **Autolock and Horn Chirp Programming**. TEST the system for normal operation.

O2 CHECK THE COURTESY LAMP OPERATION

- Open and close each door while observing the courtesy lamp operation.
- **Do the courtesy lamps operate correctly?**

  YES : Go to O3.

  NO : REFER to **INTERIOR LIGHTING** article.

O3 CHECK THE SJB IGNITION STATUS PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB PID (IGN_SW).
- **Does the ignition status PID indicate ON?**

  YES : Go to O4.

  NO : REFER to **STEERING COLUMN SWITCHES** article to continue diagnosis of the ignition switch.

O4 CHECK THE VEHICLE SPEED OPERATION

- Check the operation of the speedometer.
- **Does the speedometer operate correctly?**

YES : Go to O5.

NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

O5 CHECK THE TRANSMISSION RANGE SENSOR PID

- Select DRIVE.
- Enter the following diagnostic mode on the diagnostic tool: TCM DataLogger
- Monitor the transmission control module (TCM) transmission range (TR) sensor PID.
- **Does the TCM TR sensor PID display the correct value?**

  YES : Go to O6.

  NO : REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article or **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article to continue diagnosis of the TR sensor.

O6 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test P: The Auto-Unlock Does Not Operate Correctly

Normal Operation

The smart junction box (SJB) energizes the unlock relay based upon input from the ajar switches and the vehicle speed signal. The SJB unlocks the doors when the following conditions are met:

- The vehicle speed has exceeded 20 km/h (12 mph) then dropped to 0 km/h (0 mph) (vehicle stopped).
- The key is turned to the OFF or ACCY position.
- The LH front door is opened within 10 minutes of the key being turned to the OFF or ACCY position.

This pinpoint test is intended to diagnose the following:

- Door ajar switches
- Ignition switch

- Vehicle speed signal
- SJB

PINPOINT TEST P: THE AUTO-UNLOCK DOES NOT OPERATE CORRECTLY

P1 CHECK THE AUTO-UNLOCK CONFIGURATION

- Check to see if the auto-unlock is enabled. REFER to **Autolock and Horn Chirp Programming**.
- **Is auto-unlock enabled?**

  YES : Go to P2.

  NO : ENABLE auto-unlock. REFER to **Autolock and Horn Chirp Programming**. TEST the system for normal operation.

P2 CHECK THE COURTESY LAMP OPERATION

- Open and close each door while observing the courtesy lamp operation.
- **Do the courtesy lamps operate correctly?**

  YES : Go to P3.

  NO : REFER to **INTERIOR LIGHTING** article.

P3 CHECK THE SJB IGNITION STATUS PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB PID (IGN_SW).
- **Does the ignition status PID indicate ON?**

  YES : Go to P4.

  NO : REFER to **STEERING COLUMN SWITCHES** article to continue diagnosis of the ignition switch.

P4 CHECK THE VEHICLE SPEED OPERATION

- Check the operation of the speedometer.
- **Does the speedometer operate correctly?**

  YES : Go to P5.

  NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

P5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test Q: The Smart Unlock Does Not Operate Correctly

Normal Operation

The smart junction box (SJB) commands all doors to unlock based on input from the key-in-ignition switch and door ajar signal. The feature helps prevent the keys from being locked in the vehicle by unlocking the doors if the key is in the ignition and either front door is ajar.

The vehicle can still be locked with the key in the ignition, by using the manual lock rod, a key in the door lock cylinder, keyless entry keypad, or the LOCK button on a integrated key head transmitter (IKT).

This pinpoint test is intended to diagnose the following:

- LH front door ajar switch
- RH front door ajar switch
- Key-in-ignition switch
- SJB

PINPOINT TEST Q: THE SMART UNLOCK DOES NOT OPERATE CORRECTLY

Q1 CHECK THE COURTESY LAMP OPERATION

- Open and close each door while checking the courtesy lamp operation.
- **Do the courtesy lamps operate correctly?**

YES : Go to Q2.

NO : REFER to **INTERIOR LIGHTING** article.

Q2 CHECK THE KEY-IN-IGNITION CHIME

- Insert the key in the ignition switch.
- Open the driver door.
- **Does the key-in-ignition chime operate correctly?**

YES : Go to Q3.

NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

Q3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins

    - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test R: DTC B1137 - Data Not Programmed

Normal Operation

When an integrated key head transmitter (IKT) key is programmed, the remote keyless entry (RKE) transmitter identification code (TIC) data from the key is received by the instrument cluster (IC). The IC then sends the TIC data to the smart junction box (SJB) over the medium speed controller area network (MS-CAN). The SJB stores the TIC data in memory and sends an acknowledgment back to the IC that the TIC data was successfully programmed.

- DTC B1137 (Data Not Programmed) - is a continuous DTC that sets when the IC sends the RKE TIC data to the SJB over the MS-CAN network, and it does not receive a response from the SJB that the TIC data has been stored.

This pinpoint test is intended to diagnose the following:

- IKT programming
- MS-CAN network
- SJB

PINPOINT TEST R: DTC B1137 - DATA NOT PROGRAMMED

R1 CHECK FOR THE CORRECT RKE TRANSMITTERS

NOTE: **Make sure the IKTs are those provided with the original equipment manufacturer (OEM) system and not from an aftermarket system, or a dealer-installed system that may have been installed on the vehicle.**

- Check that the correct IKTs are used with the vehicle.
- **Are all the correct IKTs present?**

  YES : Go to R2.

  NO : The system cannot be tested without the correct IKTs. INFORM the customer that all the correct IKTs must be present to proceed with diagnosis of the system.

R2 CHECK FOR COMMUNICATION WITH THE IC AND SJB

- Enter the following diagnostic mode on the diagnostic tool: Network Test
- **Does the IC or SJB fail the network test?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article.

  NO : Go to R3.

R3 REPROGRAM THE IKT KEYS

- Erase and program all of the IKT keys using the scan tool method. Refer to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
- Erase all IC DTCs.
- Enter the following diagnostic mode on the diagnostic tool: IC Self-Test
- **Is DTC B1137 retrieved again?**

  YES : Go to R5.

  NO : Go to R4.

R4 CHECK THE OPERATION OF THE RKE TRANSMITTER

- Press any button on the suspect IKT key.
- **Does the RKE transmitter operate?**

  YES : The system is operating normally. The concern may have been caused by an improperly programmed IKT key.

  NO : Go to **Pinpoint Test L**.

R5 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CYCLE each IKT key to the ON position for a minimum of 6 seconds to program the RKE function of the integrated keys. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

GENERAL PROCEDURES

REMOTE KEYLESS ENTRY TRANSMITTER PROGRAMMING

NOTE:	**This procedure is for programming conventional keyfobs only. The Remote Keyless Entry (RKE) transmitter of the Integrated Keyhead Transmitter (IKT) is programmed automatically during Passive Anti-Theft System (PATS)**

programming. For additional information, refer to Key Programming Using Two Programmed Keys or Integrated Keyhead Transmitter (IKT) Key Programming Using Diagnostic Equipment in ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS) article to program the IKT.

NOTE: All RKE transmitters must be programmed at the same time.

NOTE: Do not apply the brake pedal during this sequencing, as doing so ends the sequence and the transmitters will not be programmed.

1. Electronically unlock the door locks using the door lock control switch.
2. Cycle the ignition switch from the OFF to the ON position 8 times in rapid succession (within 10 seconds), with the eighth turn ending in ON. If the module successfully enters program mode, it locks and then unlocks all the doors.

   NOTE: If no action is taken within 20 seconds after a transmitter has been programmed, the programming sequence ends (the doors lock and unlock to confirm that programming is complete).

3. Within 20 seconds, press any button on the RKE transmitter to be programmed. The doors lock and then unlock to confirm that each RKE transmitter is programmed. Repeat this step for each RKE transmitter.
4. Exiting the programming mode is accomplished if one of the following occurs:
   - The key transitions to the OFF position.
   - 20 seconds have passed since entering programming mode or since the last RKE transmitter was programmed.
   - The maximum number (6) of RKE transmitters have been programmed.
5. Check the operation of the transmitter. If the door locks do not respond for the programmed RKE transmitter(s), wait several seconds and press the button again. If the door locks still fail to respond, check the operation of the door locks using an IKT. If the door locks fail to respond with an IKT, refer to **Locks, Latches and Entry Systems**. (Make sure that no more than the maximum number of RKE transmitters (6) are attempted to be programmed.)

KEYLESS ENTRY KEYPAD CODE PROGRAMMING

NOTE: To associate a memory configuration to a personal entry code, refer to the Owner's Literature.

1. Enter the permanent factory keyless entry keypad code.

   NOTE: Holding the 1/2 button for more than 2 seconds after activation erases all the customer codes. The existing code does not need to be erased to program a new code.

2. Press the 1/2 button within 5 seconds to activate the programming mode.

3. Within 5 seconds, enter the new 5-digit keyless entry keypad code. The doors lock and unlock to confirm the new code is programmed.

REMOTE MEMORY ACTIVATION

1. Position the driver seat and mirrors to the desired position.
2. Press the set button on the driver door panel.
3. Within 5 seconds press the 1 or 2 button on the driver door panel. This stores the configuration for driver 1 or driver 2.
4. Press the set button.
5. Within 5 seconds, press any button on the Integrated Keyhead Transmitter (IKT) and then press the 1 or 2 button on the driver door panel to associate the IKT with that position.
6. If a second memory setting is desired, repeat the procedure with the second integrated key.

REMOTE MEMORY DEACTIVATION

1. Press the set button on the driver door panel.
2. Within 5 seconds press any button on the integrated key that you wish to deactivate and then press the set button on the driver door panel.
3. If a second memory setting desired to be deactivated, repeat the procedure with the second integrated key.

AUTOLOCK AND HORN CHIRP PROGRAMMING

Programming the Autolock Feature Using the Door Lock Control Switch

NOTE: The horn chirp is not programmable, but is used to verify the programming mode is entered and if the feature has been enabled or disabled.

NOTE: The autolock and auto-unlock features can also be enabled or disabled with the scan tool. For additional information on module configuration, refer to MODULE CONFIGURATION article.

NOTE: The autolock feature is not available on vehicles equipped with a manual transaxle.

NOTE: The autolock feature can be enabled or disabled independently of the auto-unlock feature.

NOTE: Make sure that the vehicle's perimeter alarm is not armed, the key is in the OFF position and the doors are closed.

NOTE: The following steps must be carried out within 30 seconds or the procedure will need to be repeated. If the procedure needs to be repeated, wait 30 seconds

between programming sessions.

1. Turn the ignition key from the OFF to the RUN position.
2. Press the unlock button on the door lock control 3 times.
3. Turn the ignition key from the RUN to the OFF position.
4. Press the unlock button on the door lock control switch 3 times.
5. Turn the ignition key to the RUN position. The horn chirps one time to indicate that programming mode is entered.
6. To enable/disable the autolock feature, press the unlock button on the door lock control switch then the lock button. The horn chirps once if the auto locks are disabled or twice (one short chirp followed by a long chirp) if the auto locks are enabled.
7. Turn the ignition key to the OFF position. The horn chirps once to signal that the programming is complete.

Programming the Autolock Feature Using the Keyless Entry Keypad

NOTE: **The horn chirp is not programmable, but is used to verify the programming mode is entered and if the feature has been enabled or disabled.**

NOTE: **The autolock and auto-unlock features can also be enabled or disabled with the scan tool. For additional information on module configuration, refer to MODULE CONFIGURATION article.**

NOTE: **The autolock feature is not available on vehicles equipped with a manual transaxle.**

NOTE: **The autolock feature can be enabled or disabled independently of the auto-unlock feature.**

NOTE: **Make sure that the vehicle's perimeter alarm is not armed, the key is in the OFF position and the doors are closed.**

NOTE: **The following steps must be carried out within 30 seconds or the procedure will need to be repeated. If the procedure needs to be repeated, wait 30 seconds between programming sessions.**

1. Turn the ignition key to the OFF position.
2. Close all of the doors.
3. Enter the factory set 5 digit entry code.
4. Press and hold the 3/4 button. While holding the 3/4 button, press the 7/8 button.
5. Release the 7/8 button.
6. Release the 3/4 button. The horn chirps once if the auto locks are disabled, or chirps once followed by a

honk if the auto locks are enabled.

Programming the Auto-Unlock Feature Using the Door Lock Control Switch

NOTE: The horn chirp is not programmable, but is used to verify the programming mode is entered and if the feature has been enabled or disabled.

NOTE: The autolock and auto-unlock features can also be enabled or disabled with the scan tool. For additional information on module configuration, refer to MODULE CONFIGURATION article.

NOTE: The auto-unlock feature is disabled on vehicles equipped with a manual transaxle.

NOTE: The auto-unlock feature can be enabled or disabled independently of the autolock feature.

NOTE: Make sure that the vehicles perimeter alarm is not armed, the key is in the OFF position and the doors are closed.

NOTE: The following steps must be carried out within 30 seconds or the procedure will need to be repeated. If the procedure needs to be repeated, wait 30 seconds between programming sessions.

1. Turn the ignition key from the OFF to the RUN position.
2. Press the unlock button on the door unlock control 3 times.
3. Turn the ignition key from the RUN to the OFF position.
4. Press the unlock button on the door lock control switch 3 times.
5. Turn the ignition key to the RUN position. The horn chirps one time to indicate that programming mode is entered.
6. To enable/disable the auto-unlock feature, press the lock button on the door lock control switch then the unlock button. The horn chirps once if auto-unlock is disabled or twice (one short chirp followed by a long chirp) if auto-unlock is enabled.
7. Turn the ignition key to the OFF position. The horn chirps once to signal that the programming is complete.

Programming the Auto-Unlock Feature Using the Keyless Entry Keypad

NOTE: The horn chirp is not programmable, but is used to verify the programming mode is entered and if the feature has been enabled or disabled.

NOTE: The autolock and auto-unlock features can also be enabled or disabled with the scan tool. For additional information on module configuration, refer to MODULE

CONFIGURATION article.

NOTE: The auto-unlock feature is disabled on vehicles equipped with a manual transaxle.

NOTE: The auto-unlock feature can be enabled or disabled independently of the autolock feature.

NOTE: Make sure that the vehicle's perimeter alarm is not armed, the key is in the OFF position and the doors are closed.

NOTE: The following steps must be carried out within 30 seconds or the procedure will need to be repeated. If the procedure needs to be repeated, wait 30 seconds between programming sessions.

1. Turn the ignition key to the OFF position.
2. Close all of the doors.
3. Enter the factory set 5 digit entry code.
4. Press and hold the 3/4 button. While holding the 3/4 button, press and release the 7/8 button. While still holding the 3/4 button, press and release the 7/8 button a second time.
5. Release the 3/4 button. The horn chirps once if auto-unlock is disabled, or chirps once followed by a honk if auto-unlock is enabled.

STEPPED UNLOCK PROGRAMMING

1. With the ignition switch in the OFF position, press the LOCK and UNLOCK buttons on the Remote Keyless Entry (RKE) transmitter simultaneously for 4 seconds.
   - The turn signals flash twice to indicate the mode change.
2. Repeat Step 1 to enable/disable the stepped unlocking feature.

PERIMETER LIGHTING FEATURE PROGRAMMING

Programming the Perimeter Lighting Feature Using the Door Lock Control Switch

NOTE: The following steps must be carried out within 30 seconds or the procedure will need to be repeated. If the procedure needs to be repeated, wait 30 seconds between programming sessions.

1. Turn the ignition switch from the OFF to the ON position.
2. Press the unlock button on the door lock control switch 3 times.
3. Turn the ignition switch from the ON to the OFF position.
4. Press the unlock button on the door lock control switch 3 times.
5. Turn the ignition switch to the ON position. The horn chirps one time to indicate that programming mode

is entered.

NOTE: The unlock button must be pressed twice within 5 seconds.

6. Within 30 seconds of entering the programming mode, press the unlock button on the door lock control switch twice to enable/disable the perimeter lighting feature. The horn chirps once if the perimeter lighting is disabled or a chirp followed by a honk if the perimeter lighting is enabled.
7. Programming ends when the ignition switch state changes or times out after 2 minutes.

REMOVAL AND INSTALLATION

HOOD LATCH AND COMPONENTS - EXPLODED VIEW

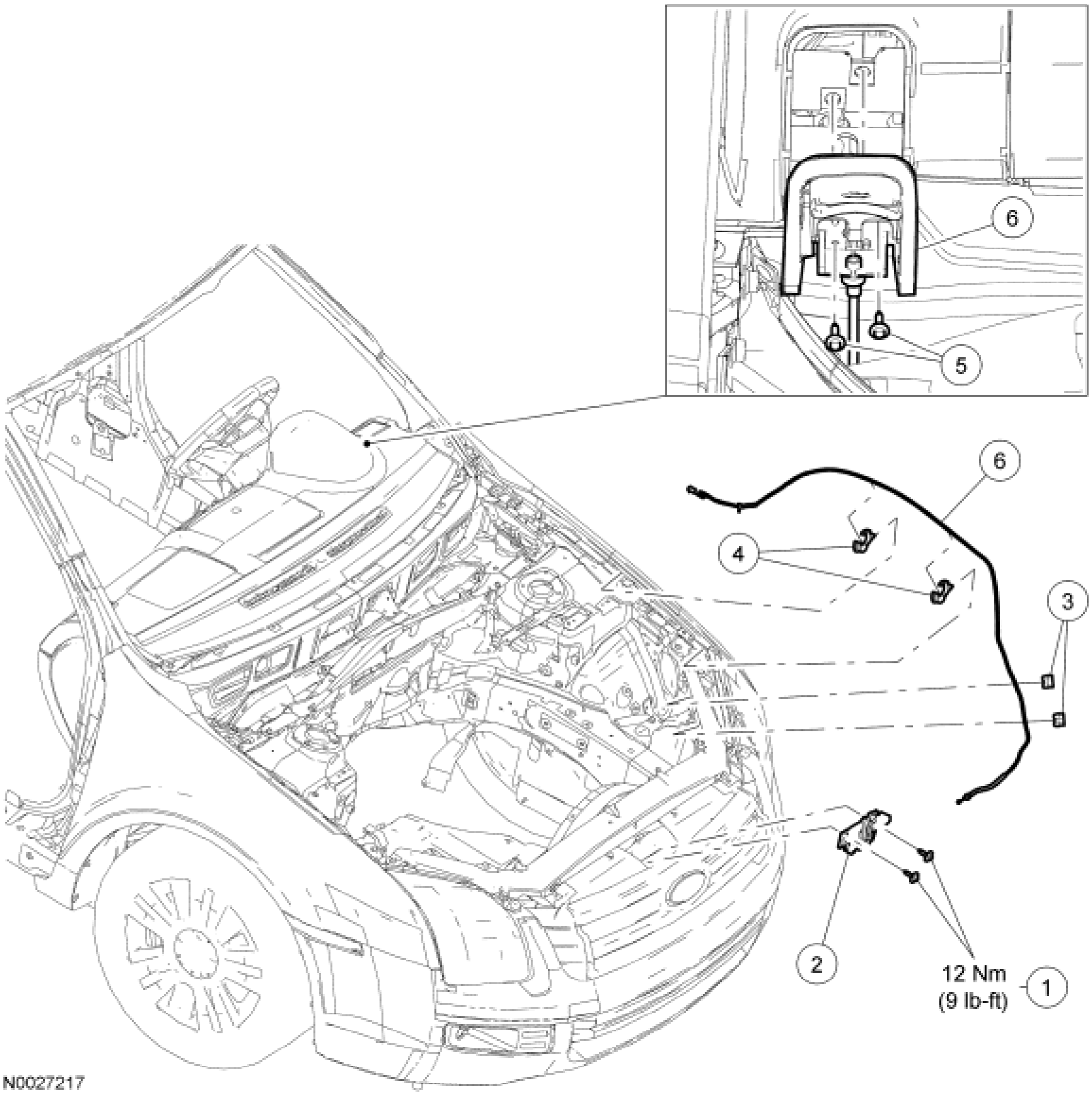


Fig. 37: Exploded View Of Hood Latch & Components With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N808727	Hood latch bolts (2 required)
2	16700	Hood latch
3	W70678	Hood latch release cable locators (2 required)
4	14A163	Hood latch release cable locators (2 required)
5	N807122	Hood latch release handle screws (2 required)
6	16916	Hood latch release handle and cable

1. For additional information, refer to the procedures.

HOOD LATCH

Material

Item	Specification
Multi-Purpose Grease Spray XL-5	ESB-M1C93-B

REMOVAL AND INSTALLATION

NOTE: Mark the hood latch position prior to removal of the hood latch bolts.

1. Remove the 2 hood latch bolts and position the hood latch aside.
   - To install, tighten to 12 Nm (9 lb-ft).
2. Disconnect the hood latch release cable and remove the hood latch.

NOTE: When the hood latch is installed, the latch adjustment must be checked to make sure the latch is installed and aligned correctly.

3. To install, reverse the removal procedure.
   - Lubricate the hood latch after installation.

HOOD LATCH RELEASE HANDLE

REMOVAL AND INSTALLATION

1. Remove the hood latch. For additional information, refer to **Hood Latch**.
2. Remove the LH fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article.
3. Release the 2 hood latch release cable locators from the radiator grille opening panel reinforcement.
4. Disconnect the hood latch release cable from the LH fender opening, open the 2 hood latch release cable locators and position the cable aside.

5. Release the hood latch release cable locator from the wiring harness.
6. Remove the 2 hood latch release handle screws.

NOTE: The hood latch release handle and cable assembly must be pulled through the dash panel into the passenger compartment.

7. Remove the hood latch release handle and cable assembly.
8. To install, reverse the removal procedure.

FRONT DOOR HANDLES, LOCKS AND LATCHES - EXPLODED VIEW

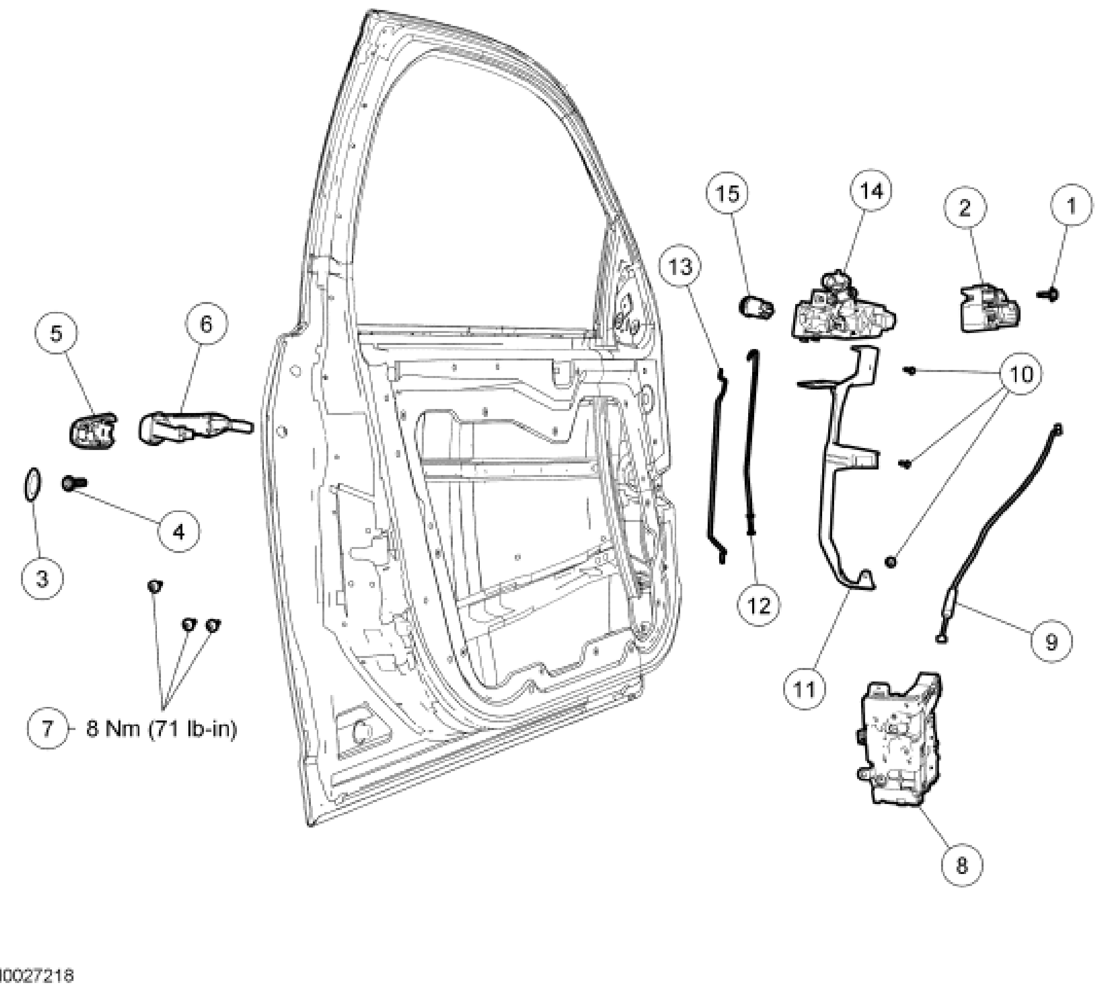


Fig. 38: Exploded View Of Front Door Handles, Locks & Latches With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Interior door handle screw
2	5422600/ 5422601	Interior door handle (RH/LH)
3	-	Grommet
4	-	Exterior front door handle cover screw
5	5422088/ 54218A14	Exterior front door handle cover (RH/LH)
6	5422404	Exterior front door handle
7	W705830-S900	Front door latch bolts (3 required)
8	5421812/ 5421813	Front door latch RH/LH)
9	-	Interior door handle actuating cable
10	-	Anti-theft guard screw (3 required) (part of 5421812/5421813)
11	-	Anti-theft guard (part of 542181254/21813)
12	5422152/ 5422153	Exterior door handle actuating rod (RH/LH)
13	5422135	Front door lock cylinder actuating rod (if equipped)
14	5426684/ 5426685	Exterior front door handle reinforcement (RH/LH)
15	-	Front door lock cylinder

1. For additional information, refer to the procedures.

INTERIOR DOOR HANDLE - FRONT

REMOVAL AND INSTALLATION

1. Remove the front door trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the interior front door handle screw.
3. Disconnect the front door interior door handle actuating cable and remove the interior door handle.
4. To install, reverse the removal procedure.

EXTERIOR FRONT DOOR HANDLE

REMOVAL AND INSTALLATION

1. Remove the grommet from the rear of the front door.
2. Remove the screw and the exterior front door handle cover.

NOTE: Pull the exterior front door handle outward and to the rear to release it from the front door handle reinforcement.

3. Remove the exterior front door handle.

4. If required, remove the 2 exterior front door handle seals.

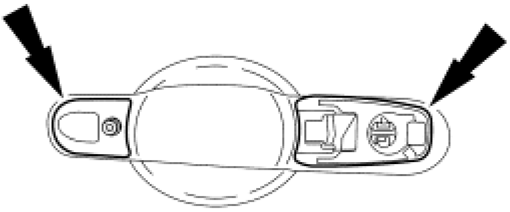


Fig. 39: Locating Exterior Front Door Handle
Courtesy of FORD MOTOR CO.

5. To install, reverse the removal procedure.

FRONT DOOR LATCH

Material

Item	Specification
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B

REMOVAL AND INSTALLATION

1. Remove the exterior front door handle. For additional information, refer to **Exterior Front Door Handle**.
2. Remove the front door window regulator and motor. For additional information, refer to **GLASS, FRAMES AND MECHANISMS** article.
3. Remove the 3 front door latch bolts.
   - To install, tighten to 8 Nm (71 lb-in)
4. Loosen the exterior front door handle reinforcement screw until the exterior door handle reinforcement slides free.
5. Remove the front door latch.
   - Slide the front door latch and exterior door handle reinforcement towards the front of the vehicle.
6. If required, remove the 3 screws and the anti-theft guard.
7. If required, disconnect the exterior front door handle actuating rod and the front door lock cylinder actuating rod.
8. If required, disconnect the interior front door handle actuating cable from the front door latch
9. To install, reverse the removal procedure.
   - Lubricate the front door latch to striker surfaces after installation.

DOOR LOCK CYLINDER - FRONT

REMOVAL AND INSTALLATION

NOTE: Individual lock cylinders are repaired by discarding the inoperative cylinder and building a new lock cylinder using the appropriate lock repair package. The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

1. Remove the front door latch. For additional information, refer to **Front Door Latch**.
2. Using a suitable tool press the release button and remove the front door lock cylinder.

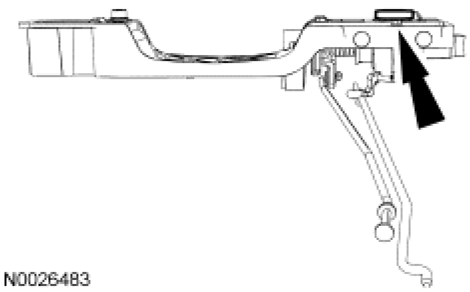


Fig. 40: Locating Front Door Lock Cylinder Release Button
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.

REAR DOOR HANDLES, LOCKS AND LATCHES - EXPLODED VIEW

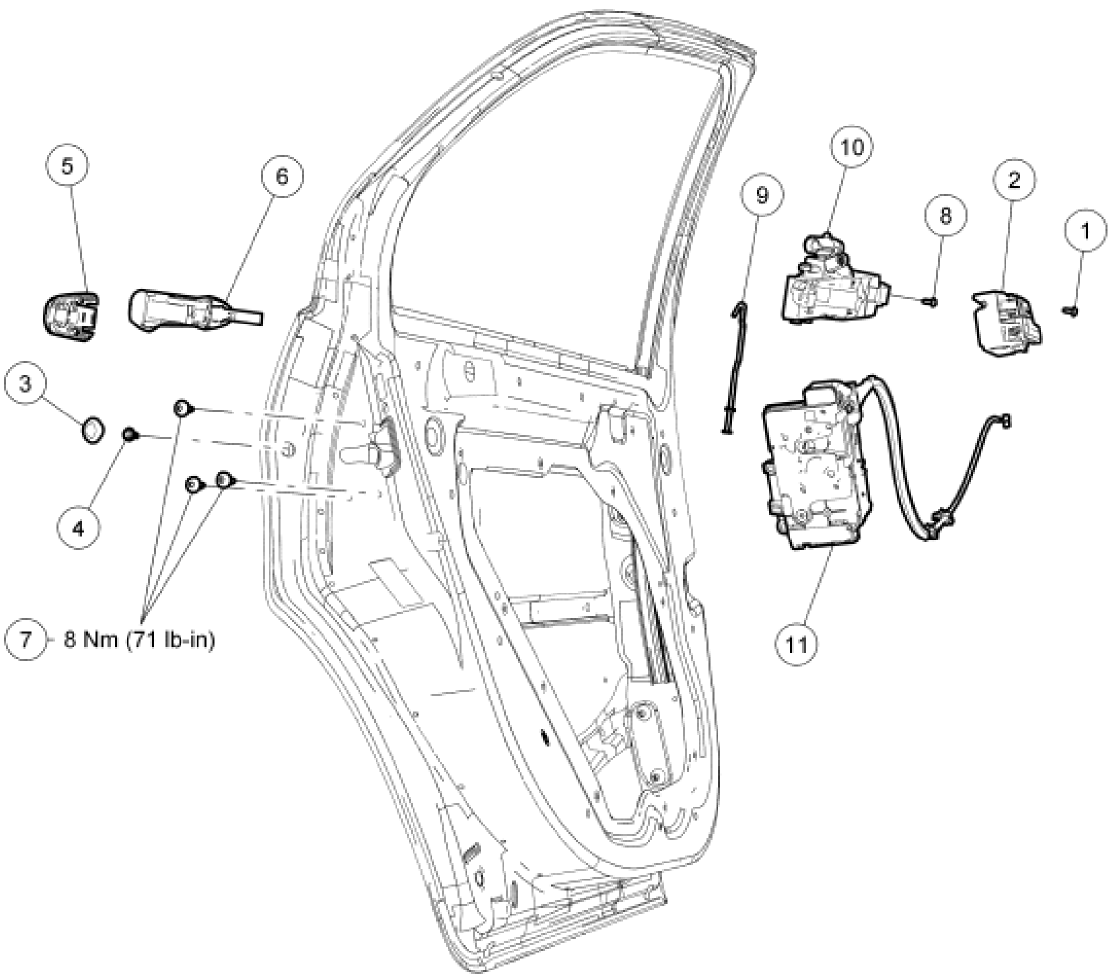


Fig. 41: Exploded View Of Rear Door Handles, Locks & Latches With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Interior rear door handle screw
2	5422600/ 5422601	Interior rear door handle (RH/LH)
3	-	Grommet
4	-	Exterior rear door handle cover screw
5	5422088	Exterior rear door handle cover
6	5422404	Exterior rear door handle
7	W705830-S900	Rear door latch bolts (3 required)
8	-	Rear door latch bracket screws (3 required) (part of 5426412/ 5426413)
9	5426596/ 5426597	Exterior door handle actuating rod

		(RH/LH)
10	5426684/ 5426685	Exterior rear door handle reinforcement (RH/LH
11	5426412/ 5426413	Rear door latch (RH/LH)

1. For additional information, refer to the procedures.

INTERIOR DOOR HANDLE - REAR

REMOVAL AND INSTALLATION

1. Remove the rear door trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the interior rear door handle screw.
3. Disconnect the rear door interior door handle actuating cable and remove the interior door handle.
4. To install, reverse the removal procedure.

EXTERIOR REAR DOOR HANDLE

REMOVAL AND INSTALLATION

1. Remove the grommet from the rear of the rear door.
2. Remove the screw and the exterior rear door handle cover.

NOTE: Pull the exterior rear door handle outward and to the rear to release it from the rear door handle reinforcement.

3. Remove the exterior rear door handle.
4. If required, remove the 2 exterior rear door handle seals.

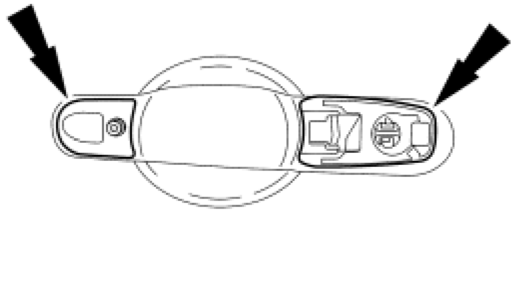


Fig. 42: Locating Exterior Front Door Handle
Courtesy of FORD MOTOR CO.

5. To install, reverse the removal procedure.

REAR DOOR LATCH

Material

Item	Specification
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B

REMOVAL AND INSTALLATION

1. Remove the exterior rear door handle. For additional information, refer to **Interior Door Handle - Rear**.
2. Remove the rear door window regulator and motor. For additional information, refer to **GLASS, FRAMES AND MECHANISMS** article.
3. Remove the rear door window glass. For additional information, refer to **GLASS, FRAMES AND MECHANISMS** article.
4. Remove the 3 rear door latch bolts.
    - To install, tighten to 8 Nm (71 lb-in).
5. Loosen the exterior rear door handle reinforcement screw until the exterior rear door handle reinforcement slides free.
6. Remove the rear door latch.
    - Slide the rear door latch and exterior rear door handle reinforcement towards the front of the vehicle.
7. If required, remove the 3 screws and the rear door latch bracket.
8. If required, disconnect the exterior rear door handle actuating rod.
9. To install, reverse the removal procedure.
    - Lubricate the rear door latch to striker surfaces after installation.

LUGGAGE COMPARTMENT LID LATCH

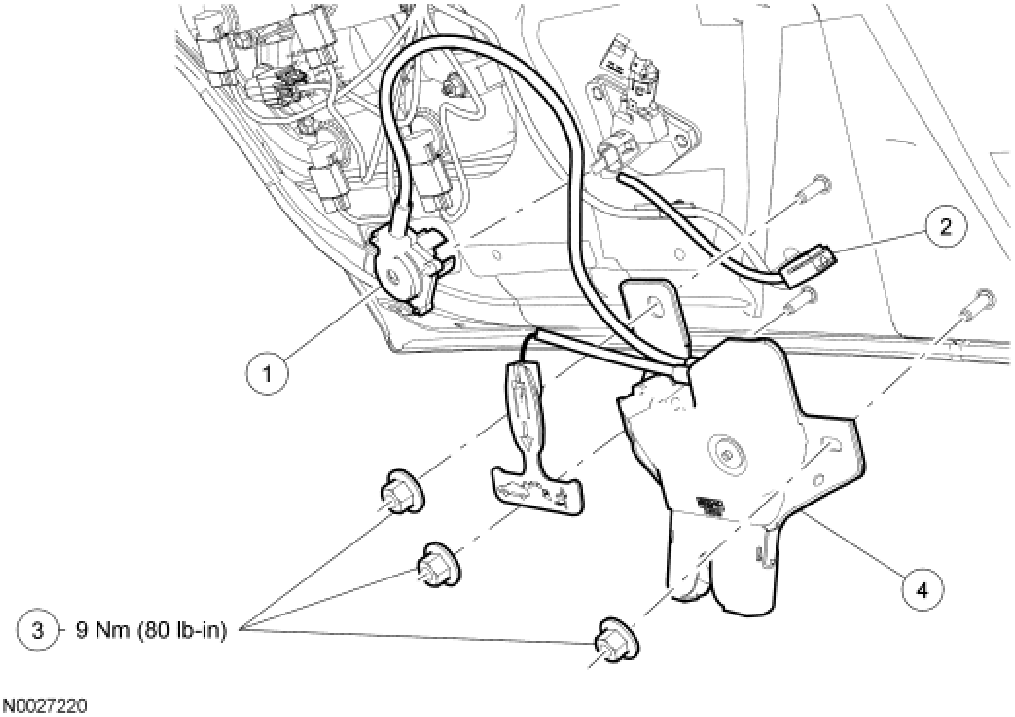


Fig. 43: Exploded View Of Luggage Compartment Lid Latch With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Luggage compartment lid lock cylinder actuating cable (part of 5443200)
2	-	Luggage compartment lid latch electrical connector (part of 14A005)
3	W705760	Luggage compartment lid latch nuts (3 required)
4	5443200	Luggage compartment lid latch

REMOVAL AND INSTALLATION

1. Remove the 12 pin-type retainers and the luggage compartment lid trim panel.
2. Disconnect the luggage compartment lid lock cylinder actuating cable from the luggage compartment lid lock cylinder.
3. Disconnect the electrical connector from the luggage compartment lid latch.
4. Remove the 3 nuts and the luggage compartment lid latch.
    - To install, tighten to 9 Nm (80 lb-in).
5. To install, reverse the removal procedure.

IGNITION LOCK CYLINDER

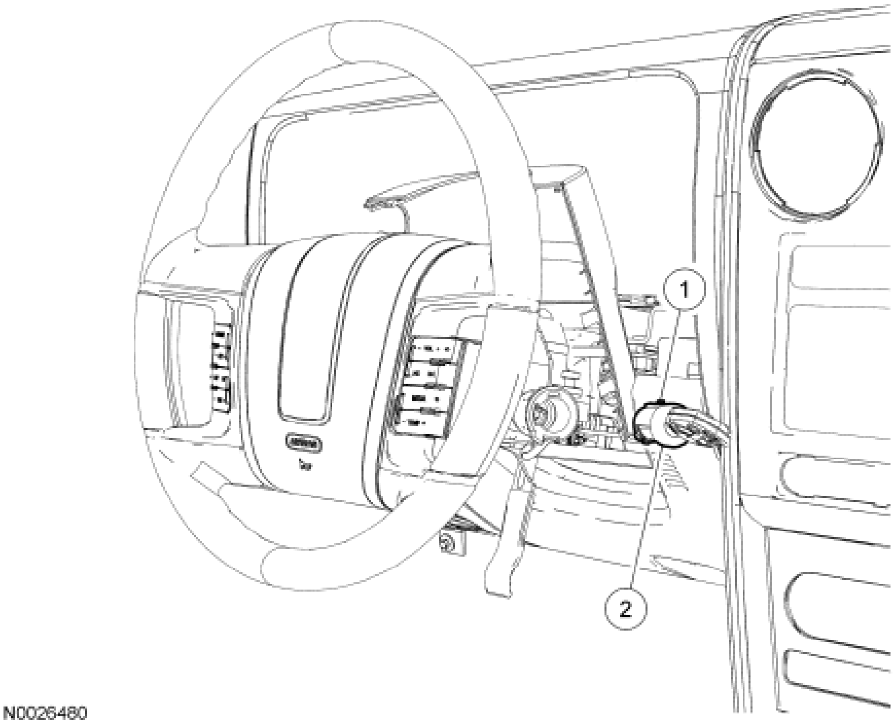


Fig. 44: Exploded View Of Ignition Lock Cylinder
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Ignition lock cylinder release button (part of 11582)
2	11582	Ignition lock cylinder

REMOVAL AND INSTALLATION

1. Remove the Passive Anti-Theft System (PATS) transceiver. For additional information, refer to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
2. Turn the ignition key to the ON position.
3. Using a suitable tool, press the ignition lock cylinder release button and remove the ignition lock cylinder.
4. To install, reverse the removal procedure.

LUGGAGE COMPARTMENT LID LOCK CYLINDER

Special Tools

Illustration	Tool Name	Tool Number
	Heavy Duty Riveter	501-D011 (D80L-23200-A) or equivalent

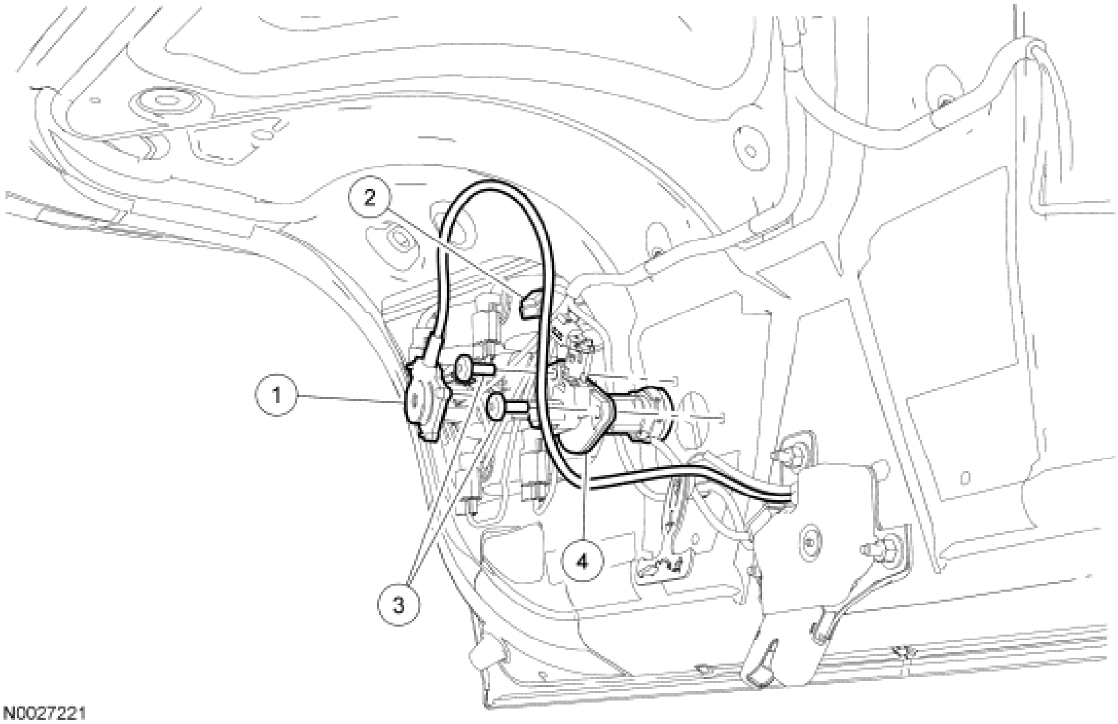


Fig. 45: Exploded View Of Luggage Compartment Lid Lock Cylinder
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Luggage compartment lid lock cylinder actuating cable (part of 5443200)
2	-	Luggage compartment lid lock cylinder electrical connector (part of 14A005) (if equipped)
3	-	Luggage compartment lid lock cylinder rivets (2 required)
4	544362	Luggage compartment lid lock cylinder

REMOVAL AND INSTALLATION

1. Remove the 12 pin-type retainers and the luggage compartment lid trim panel.
2. Disconnect the luggage compartment lid lock cylinder actuating cable from the luggage compartment lid lock cylinder.
3. If equipped, disconnect the electrical connector from the luggage compartment anti-theft inhibit switch.
4. Remove the 2 rivets and the luggage compartment lid lock cylinder.
   - Use the special tool to install new rivets.
5. To install, reverse the removal procedure.

DOOR LOCK CONTROL SWITCH

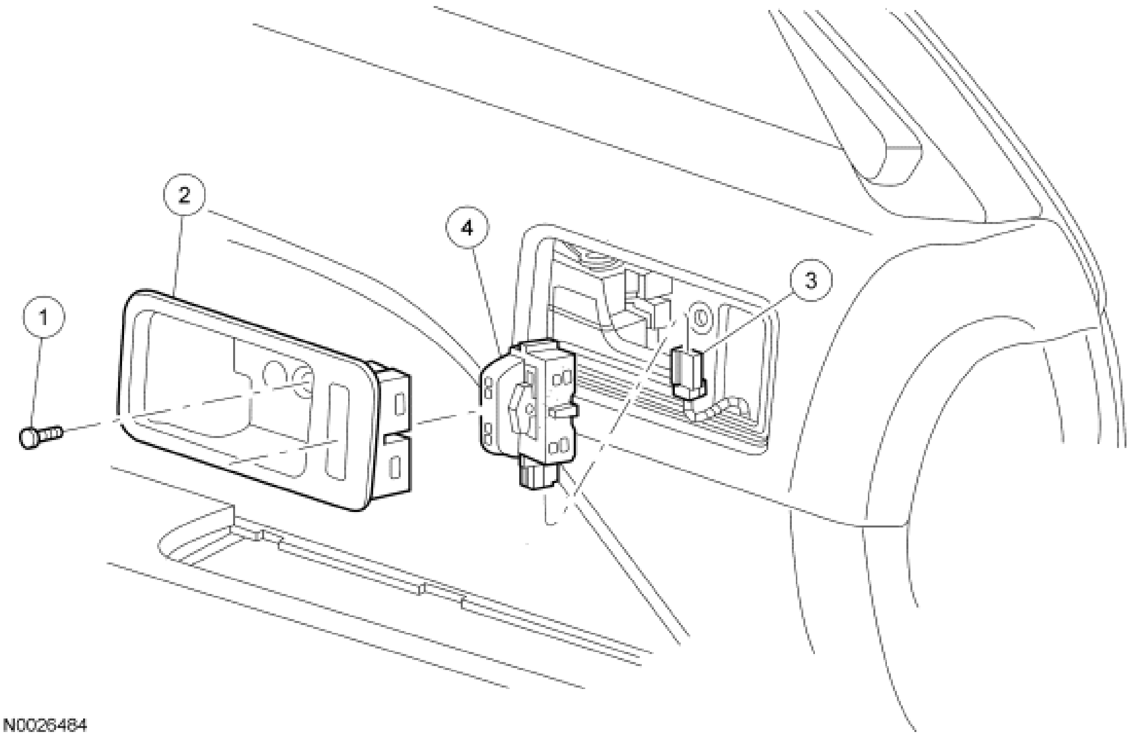


Fig. 46: Exploded View Of Door Lock Control Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Interior front door handle finish panel screw
2	5422620/ 5422621	Interior front door handle finish panel (RH/LH)
3	-	Door lock control switch electrical connector (part of 14630/14631)
4	14028	Door lock control switch

REMOVAL AND INSTALLATION

1. Open the cover, remove the screw and position the interior front door handle finish panel aside.
2. Disconnect the door lock control switch electrical connector.
3. Release the locking clips and remove the door lock control switch.
4. To install, reverse the removal procedure.

KEYLESS ENTRY KEYPAD

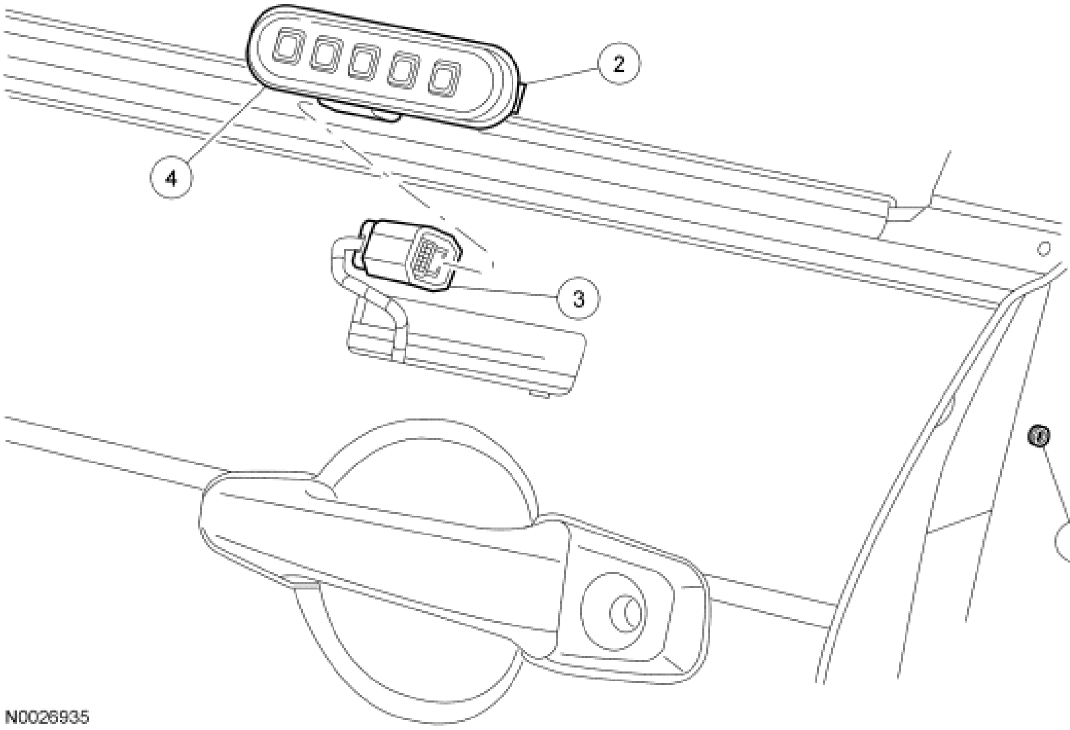


Fig. 47: Exploded View Of Keyless Entry Keypad
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Grommet
2	-	Keyless entry keypad retaining clip (2 required) (part of 14A626)
3	-	Keyless entry keypad electrical connector (part of 14631)
4	14A626	Keyless entry keypad

REMOVAL AND INSTALLATION

1. Remove the grommet.
2. Using a suitable tool, release the rear keyless entry keypad retaining clip and position the keyless entry keypad aside.
3. Remove the keyless entry keypad.
   - Disconnect the electrical connector.
4. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Horn - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Horn bolt	10	89

DESCRIPTION AND OPERATION

HORN

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The horn system consists of the following components:

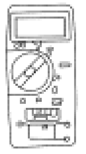
- Horn switches (part of the steering wheel)
- Clockspring
- Horn relay (part of the SJB)
- Horn (located forward of the RF wheelwell)

The horn can be operated by pressing the switch on the steering wheel. It is also controlled by the SJB when it is utilized for the panic function, or during a perimeter anti-theft alarm event.

DIAGNOSTIC TESTS

HORN

Special Tools

Illustration	Tool Name	Tool Number
	73III Automotive Meter	105-R0057 or equivalent
	Flex Probe Kit	105-R025C or equivalent

 ST2574-A		

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The battery junction box (BJB) supplies the control and switched voltage to the horn relay (part of the SJB). When the horn switches are pressed, ground is supplied through the clockspring to the horn relay. The horn relay is then energized, directing voltage to the horn. When the perimeter anti-theft system is armed, the SJB provides a momentary ground to the horn relay control side to indicate the system is armed, and an on and off ground when an intrusion is detected or the panic feature is activated.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Horn • Horn switches (part of the steering wheel)	• Battery junction box (BJB) fuse 2 (60A) • Smart junction box (SJB) fuse 2 (20A) • Wiring, terminals or connectors • Clockspring • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom. Go to **Symptom Chart**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
	• Fuse • Wiring, terminals or	

• The horn is inoperative	connectors • Horn • Clockspring • Horn switches (part of the steering wheel) • Smart junction box (SJB)	• Go to **Pinpoint Test A**.
• The horn is always on	• Wiring, terminals or connectors • Clockspring • Horn switches (part of the steering wheel) • SJB	• Go to **Pinpoint Test B**.

Pinpoint Tests

Pinpoint Test A: The Horn Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Horn/Cigar Lighter for schematic and connector information.

Normal Operation

The battery junction box (BJB) supplies the switched and control voltage to the horn relay (part of the smart junction box [SJB]) through circuit SBB02 (YE/RD). When the horn switches (part of the steering wheel) are pressed, the horn relay is grounded through the horn switch circuitry, energizing the horn relay. The horn relay then sends voltage to the horn through circuit CBP05 (YE), sounding the horn. Ground for the horn is supplied through circuit GD123 (BK/GY).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Horn
- Clockspring
- Horn switches (part of the steering wheel)
- SJB

PINPOINT TEST A: THE HORN IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 CHECK THE HORN OPERATION USING THE PANIC BUTTON

- Press the PANIC button on the integrated key head transmitter (IKT).
- **Does the horn sound when the PANIC button is pressed?**

  YES : Go to A2.

  NO : Go to A7.

A2 CHECK CIRCUIT GD165 (BK) FOR AN OPEN

- Key in OFF position.
- Remove the driver air bag module. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Clockspring C218b

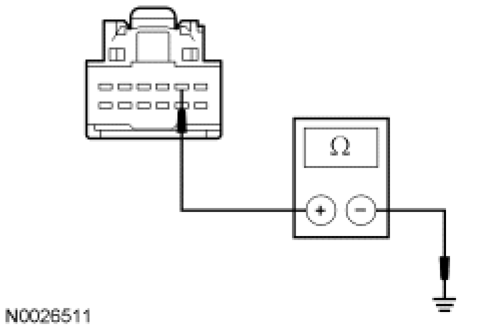


Fig. 1: Checking Circuit GD165 (BK) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218b-2, circuit GD165 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to A3.

  NO : REPAIR the circuit. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

A3 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

- Disconnect: Clockspring C218a

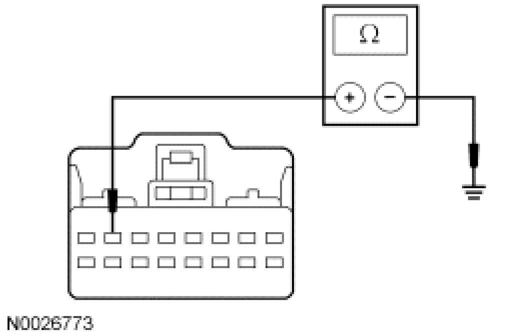


Fig. 2: Checking Circuit GD116 (BK/VT) For Open
Courtesy of FORD MOTOR CO.

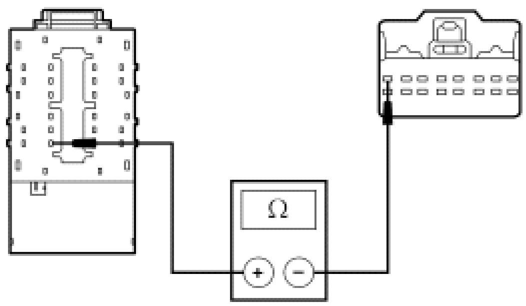
- Measure the resistance between the clockspring C218a-7, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to A4.

  NO : REPAIR the circuit. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

A4 CHECK CIRCUIT CRH02 (BU/WH) FOR AN OPEN

- Disconnect: SJB C2280b



N0026512

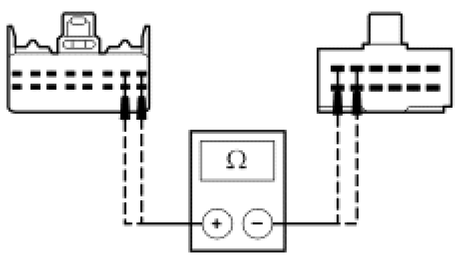
Fig. 3: Checking Circuit CRH02 (BU/WH) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280b-6, circuit CRH02 (BU/WH), harness side and the clockspring C218a-8, circuit CRH02 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A5.

  NO : REPAIR the circuit. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

A5 CHECK THE CLOCKSPRING FOR AN OPEN



N0026513

Fig. 4: Checking Clockspring For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218a pin 7, component side and the clockspring C218b pin 2, component side; and between the clockspring C218a pin 8, component side and the clockspring C218b pin 1, component side.

- **Are the resistances less than 5 ohms?**

  YES : Go to A6.

  NO : INSTALL a new clockspring. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

A6 CHECK THE STEERING WHEEL SWITCH HARNESS FOR AN OPEN

- Disconnect: Horn Switch C2296 and C2297

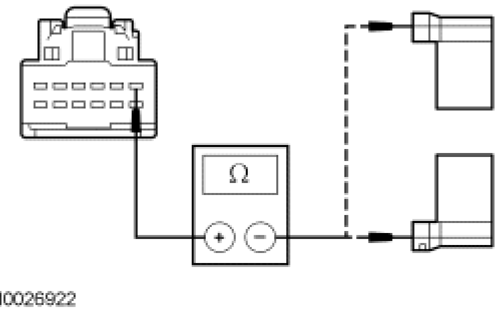


Fig. 5: Checking Steering Wheel Switch Harness For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218b-1, circuit CRH02 (BU/WH), harness side and the horn switch C2296-1, circuit CRH02 (BU/WH), harness side; and between the clockspring C218b-1, circuit CRH02 (BU/WH), harness side and the horn switch C2297-1, circuit CRH02 (BU/WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new steering wheel. REFER to **STEERING COLUMN** article. TEST the system for normal operation.

  NO : REPAIR the circuit in question. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

A7 CHECK CIRCUIT GD123 (BK/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: Horn C131

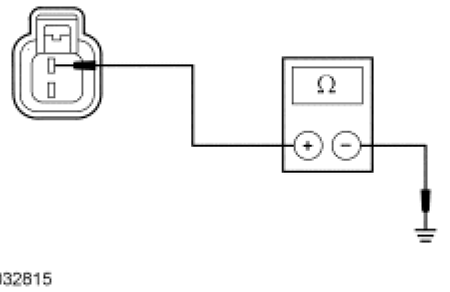


Fig. 6: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the horn C131-1, circuit GD123 (BK/GY), harness side and ground.
- **Is the resistance less than 0.1 ohm?**

  YES : Go to A8.

  NO : REPAIR the circuit. TEST the system for normal operation.

A8 CHECK CIRCUIT CBP05 (YE) FOR VOLTAGE

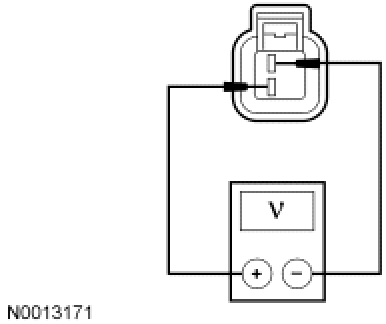


Fig. 7: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the horn C131-2, circuit CBP05 (YE), harness side, and the horn C131-1, circuit GD123 (BK/GY), harness side, while pressing the horn switch.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new horn. REFER to **Horn**. TEST the system for normal operation.

  NO : VERIFY the SJB fuse 2 (20A) is OK. If OK, go to A9. If not OK, refer to the Wiring Diagrams Manual to identify the possible causes of the circuit short.

A9 CHECK CIRCUIT CBP05 (YE) FOR AN OPEN

- Disconnect: SJB C2280a

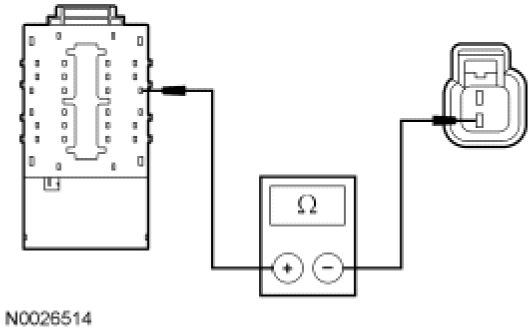


Fig. 8: Checking Circuit CBP05 (YE) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280a-20, circuit CBP05 (YE), harness side, and the horn C131-2, circuit CBP05 (YE), harness side.
- **Is the resistance less than 0.1 ohm?**

YES : Go to A10.

NO : REPAIR the circuit. TEST the system for normal operation.

A10 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: The Horn Is Always On

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Horn/Cigar Lighter for schematic and connector information.

Normal Operation

The battery junction box (BJB) supplies the switched and control voltage to the horn relay (part of the smart junction box [SJB]) through circuit SBB02 (YE/RD). When the horn switches (part of the steering wheel) are pressed, the horn relay is grounded through the horn switch circuitry, energizing the horn relay. The horn relay then sends voltage to the horn through circuit CBP05 (YE), sounding the horn. Ground for the horn is supplied through circuit GD123 (BK/GY).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Clockspring
- Horn switches (part of the steering wheel)
- SJB

PINPOINT TEST B: THE HORN IS ALWAYS ON

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 CHECK CIRCUIT CBP05 (YE) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280a
- **Does the horn continue to sound?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to B2.

B2 CHECK THE HORN SWITCH INPUT

- Connect: SJB C2280a
- Disconnect: SJB C2280b
- **Does the horn continue to sound?**

  YES : Go to B6.

  NO : Go to B3.

B3 CHECK CIRCUIT CRH02 (BU/WH) FOR A SHORT TO GROUND

- Depower the supplemental restraint system (SRS). Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Clockspring C218a

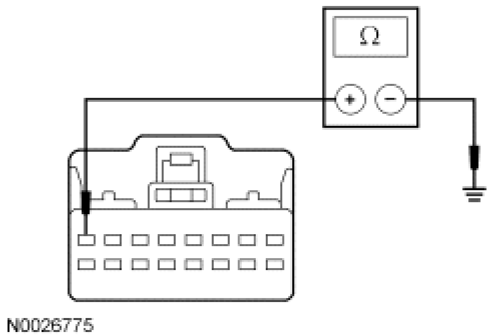


Fig. 9: Checking Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218a-8, circuit CRH02 (BU/WH), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B4.

  NO : REPAIR the circuit. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

B4 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND

- Remove the driver air bag module. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Connect: Clockspring C218a
- Disconnect: Clockspring C218b

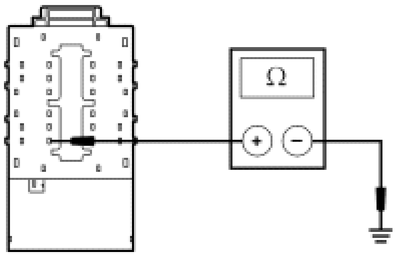


Fig. 10: Checking Clockspring For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280b-6, circuit CRH02 (BU/WH), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B5.

  NO : INSTALL a new clockspring. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

B5 CHECK THE STEERING WHEEL SWITCH HARNESS FOR A SHORT TO GROUND

- Disconnect: Horn Switch C2296 and C2297

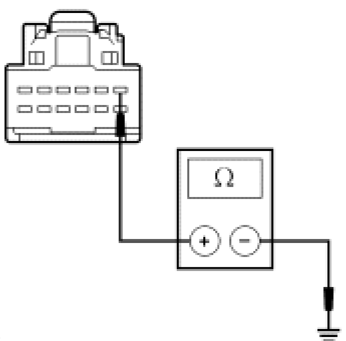


Fig. 11: Checking Steering Wheel Switch Harness For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring 218b-1, circuit CRH02 (BU/WH), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL a new steering wheel. REFER to **STEERING COLUMN** article. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

  NO : REPAIR the circuit. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

B6 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.

- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

REMOVAL AND INSTALLATION

HORN

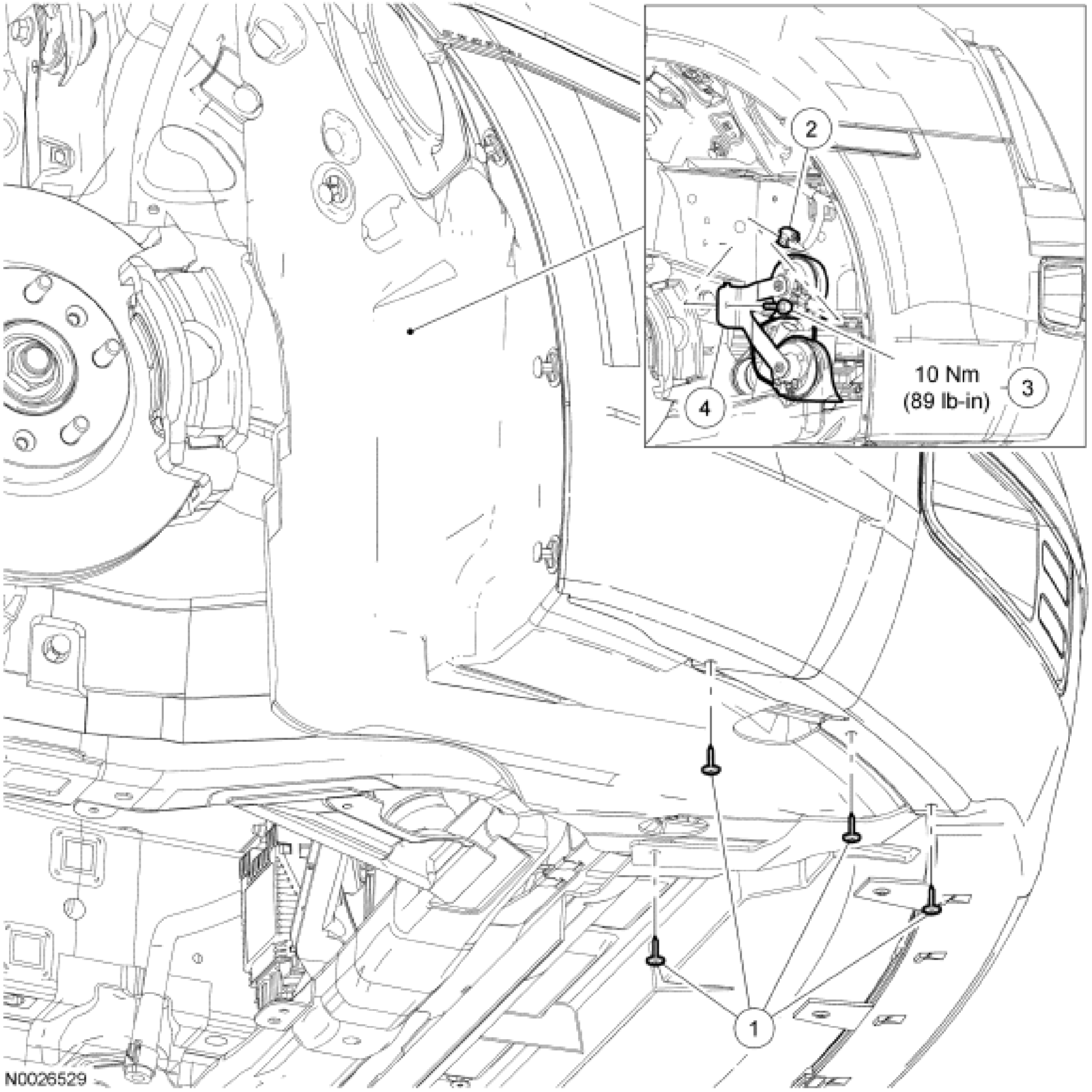


Fig. 12: Exploded View Of Horn Components With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W706805	RH front fender splash shield screws (4 required)
2	-	Horn electrical connector (part of 14290)
3	W605784	Horn bolt
4	13832	Horn

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the 4 RH front fender splash shield screws.

- Pull the RH front fender splash shield downward to access the horn.

3. Disconnect the electrical connector.
4. Remove the bolt and the horn.
   - To install, tighten to 10 Nm (89 lb-in).
5. To install, reverse the removal procedure.

2008 BRAKES

Hydraulic Brake Actuation - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	227.5 ml (0.48 pt)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Brake fluid remote reservoir nuts	7	-	62
Brake fluid reservoir pin bolt	6	-	53
Brake master cylinder nuts	25	18	-
Brake pedal bracket bolts	23	17	-
Brake pedal bracket nuts	23	17	-
Brake pressure control valve bolts	11	-	97
Brake tube fittings	17	-	150

DESCRIPTION AND OPERATION

HYDRAULIC BRAKE ACTUATION

The hydraulic brake actuation system consists of the following components:

- ABS components
- Brake master cylinder
- Brake pedal (fixed or adjustable)
- Brake tubes and hoses
- Front disc brake calipers
- Rear disc brake calipers

The brake pedal is connected to the power brake booster, which is connected to the brake master cylinder. When the brake pedal is pressed, brake fluid is pushed through the double-walled steel tube and flexible hoses to the front and rear disc brake calipers. The brake fluid enters the disc brake calipers, forcing the caliper pistons and brake pads outward against the brake disc friction surface, slowing or stopping rotation. When the brake pedal is released, brake fluid pressure is relieved, returning the front and rear disc brake caliper pistons

and brake pads to the unapplied position.

DIAGNOSTIC TESTS

HYDRAULIC BRAKE ACTUATION

Refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

BRAKE PEDAL AND BRACKET

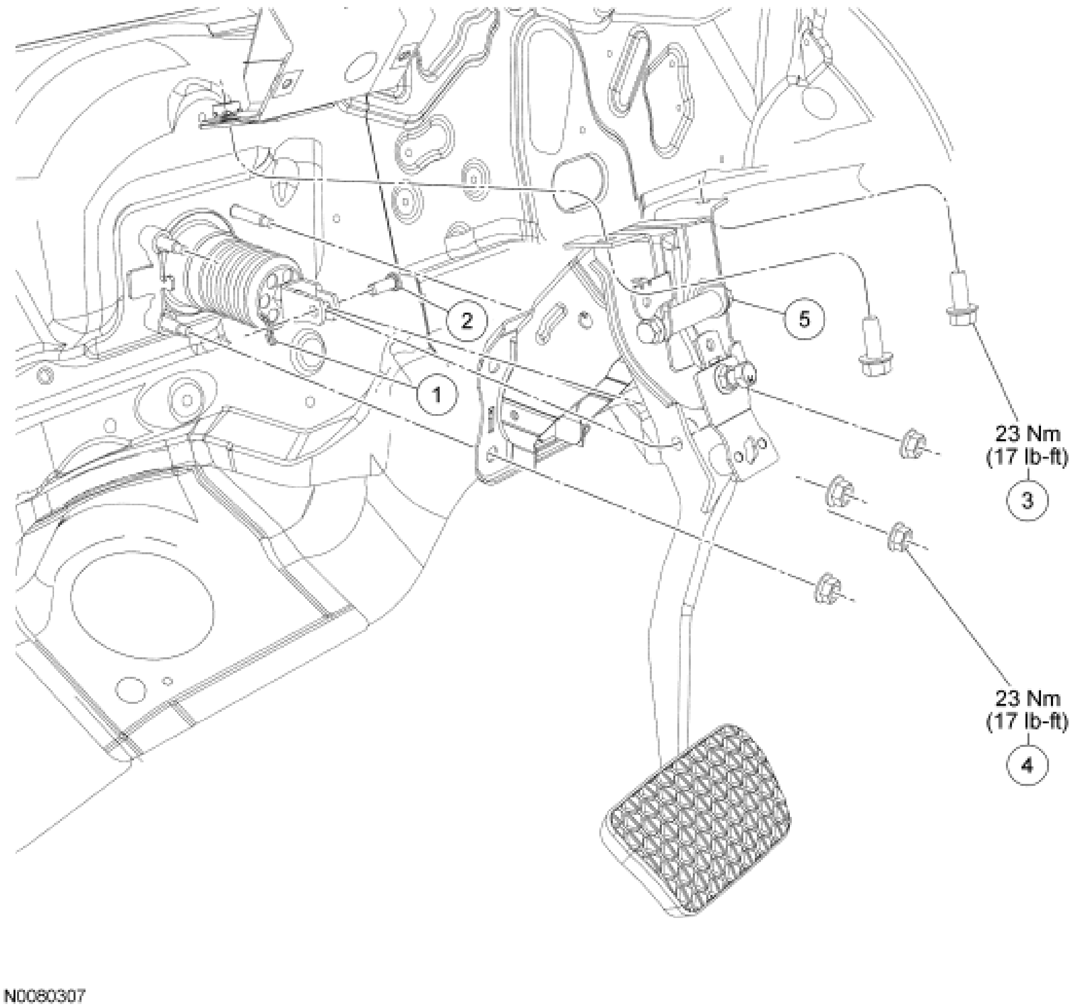


Fig. 1: Exploded View Of Brake Pedal & Bracket With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7B096	Brake booster push rod pin clip
2	2N513	Brake booster push rod pin
3	W707142	Brake pedal bracket bolt (2 required)
4	W520212	Brake pedal bracket nut (4 required)
5	2455	Brake pedal and bracket

REMOVAL AND INSTALLATION

CAUTION: Do not service the brake pedal or brake booster without first removing the stoplamp switch and speed control deactivator switch. These switches must be removed with the brake pedal in the at-rest position. Switch plungers must be compressed for the switch to rotate in the bracket. Attempting to remove the switch when the plunger is extended (during pedal apply) will result in damage to the switch.

1. Remove the stoplamp switch. For additional information, refer to **EXTERIOR LIGHTING** article.
2. Remove the brake booster push rod pin clip.
3. Remove the brake booster push rod pin.
4. Remove the 2 brake pedal bracket bolts.
   - To install, tighten to 23 Nm (17 lb-ft).
5. Remove the 4 brake pedal bracket nuts and the brake pedal and bracket assembly.
   - To install, tighten to 23 Nm (17 lb-ft).

CAUTION: Do not press, pull or otherwise move the brake pedal while installing the stoplamp switch or the speed control deactivator switch. These switches must be installed with the booster push rod attached to the brake pedal and with the brake pedal in the at-rest position. Installing these switches with the brake pedal in any other position will result in incorrect adjustment and may damage the switches.

6. To install, reverse the removal procedure.

BRAKE MASTER CYLINDER - 2.3L AND 3.0L

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

NOTE: Automatic transmission shown, manual transmission similar.

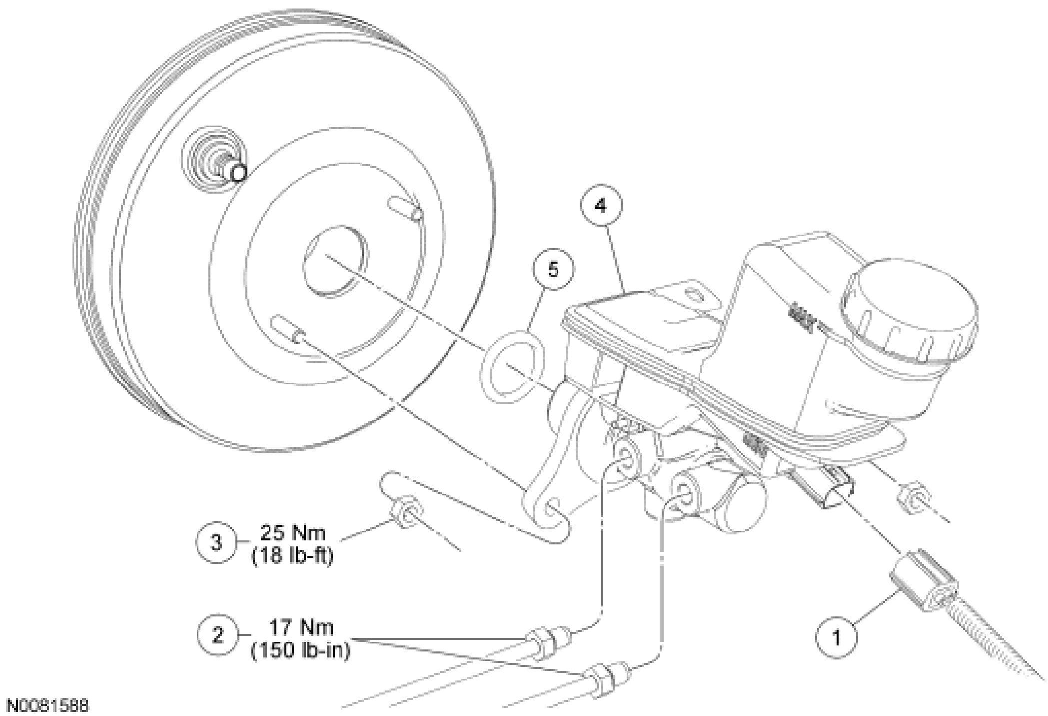


Fig. 2: Exploded View Of Brake Master Cylinder With Torque Specifications - 2.3L & 3.0L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Brake fluid level warning switch electrical connector (part of 14290)
2	-	Brake tube fittings (part of 2C360)
3	2152	Brake master cylinder nut kit
4	2140	Brake master cylinder assembly
5	-	Brake master cylinder-to-brake booster seal (part of 2152)

REMOVAL AND INSTALLATION

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Disconnect the brake fluid level warning switch electrical connector.
2. Using a suitable suction device, remove the brake fluid from the brake master cylinder reservoir.
3. If equipped with a manual transmission, disconnect the clutch master cylinder feed hose.
   - Plug the clutch master cylinder feed hose.
4. Disconnect the brake tube fittings, plug the brake tubes and the brake master cylinder ports.
   - To install, tighten to 17 Nm (150 lb-in).
5. Remove the 2 brake master cylinder nuts.
   - To install, tighten to 25 Nm (18 lb-ft).
6. Remove the brake master cylinder.
7. To install, reverse the removal procedure.
   - Bleed the master cylinder. For additional information, refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.
   - If equipped with a manual transmission, bleed the clutch master cylinder. For additional information, refer to **MANUAL TRANSAXLE/TRANSMISSION AND CLUTCH - GENERAL INFORMATION** article.

BRAKE MASTER CYLINDER - 3.5L

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

NOTE: Automatic transmission shown, manual transmission similar.

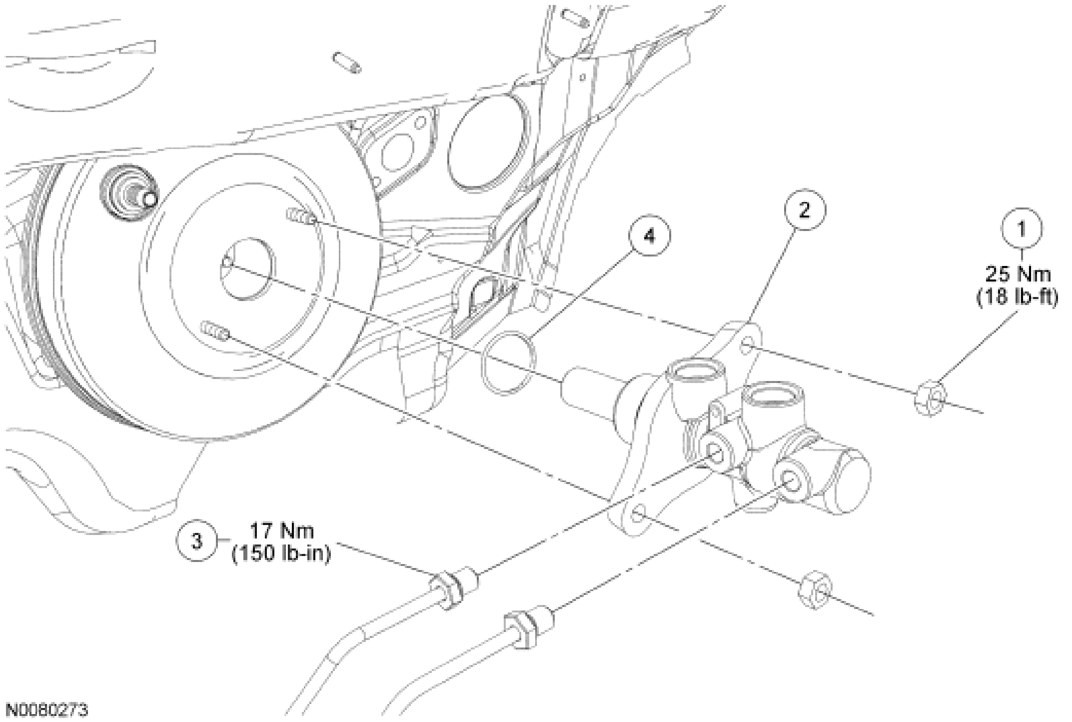


Fig. 3: Exploded View Of Brake Master Cylinder With Torque Specifications - 3.5L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2152	Brake master cylinder nut kit
2	2140	Brake master cylinder assembly
3	-	Brake tube fitting (part of 2C360)
4	-	Brake master cylinder-to-brake booster seal (part of 2152)

REMOVAL AND INSTALLATION

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is

spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the brake fluid reservoir. For additional information, refer to **Brake Fluid Reservoir - 3.5L**.
2. If equipped with a manual transmission, disconnect the clutch master cylinder feed hose.
   - Plug the clutch master cylinder feed hose.
3. Disconnect the brake tube fittings, plug the brake tubes and the brake master cylinder ports.
   - To install, tighten to 17 Nm (150 lb-in).
4. Remove the 2 brake master cylinder nuts.
   - To install, tighten to 25 Nm (18 lb-ft).
5. Remove the brake master cylinder.
6. To install, reverse the removal procedure.
   - Bleed the master cylinder. For additional information, refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.
   - If equipped with a manual transmission, bleed the clutch master cylinder. For additional information, refer to **MANUAL TRANSAXLE/TRANSMISSION AND CLUTCH - GENERAL INFORMATION** article.

BRAKE FLUID RESERVOIR - 2.3L AND 3.0L

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

NOTE: Automatic transmission shown, manual transmission similar.

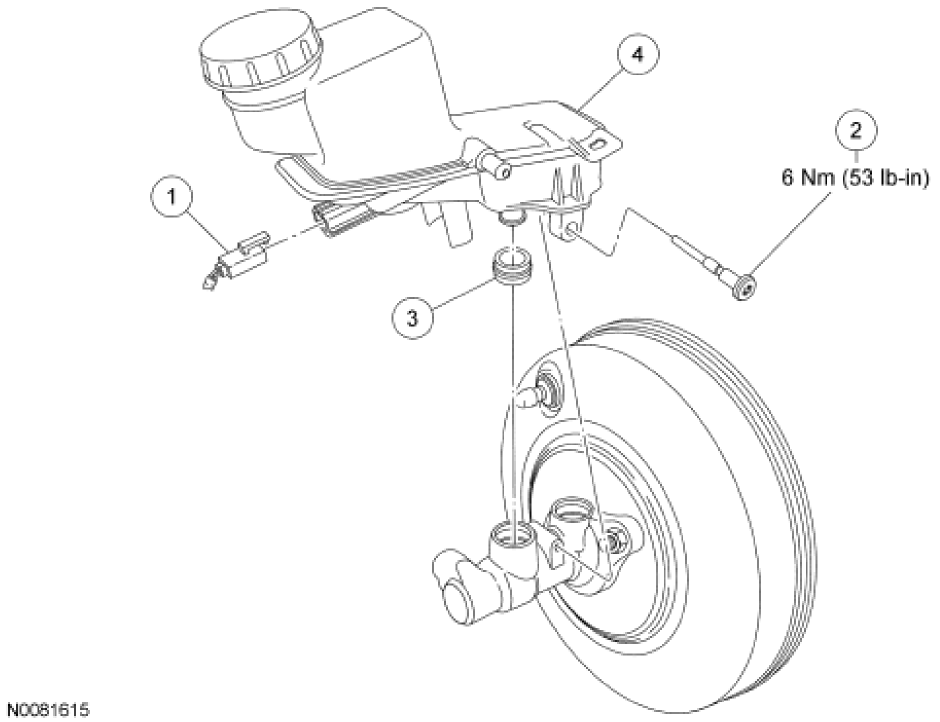


Fig. 4: Exploded View Of Brake Fluid Reservoir With Torque Specification - 2.3L and 3.0L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Brake fluid level warning switch electrical connector (part of 14290)
2	2B176	Brake fluid reservoir pin bolt
3	2L074	Brake fluid reservoir seal (2 required)
4	2C246	Brake fluid reservoir

REMOVAL AND INSTALLATION

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is

spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the brake master cylinder. For additional information, refer to **Brake Master Cylinder - 2.3L and 3.0L**.
2. Remove the reservoir pin bolt and the brake fluid reservoir.
    - To install, tighten to 6 Nm (53 lb-in).
3. Remove and discard the 2 seals.

NOTE: Install new seals. Lubricate the seals with clean specified brake fluid.

4. To install, reverse the removal procedure.

BRAKE FLUID RESERVOIR - 3.5L

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

NOTE: Automatic transmission shown, manual transmission similar.

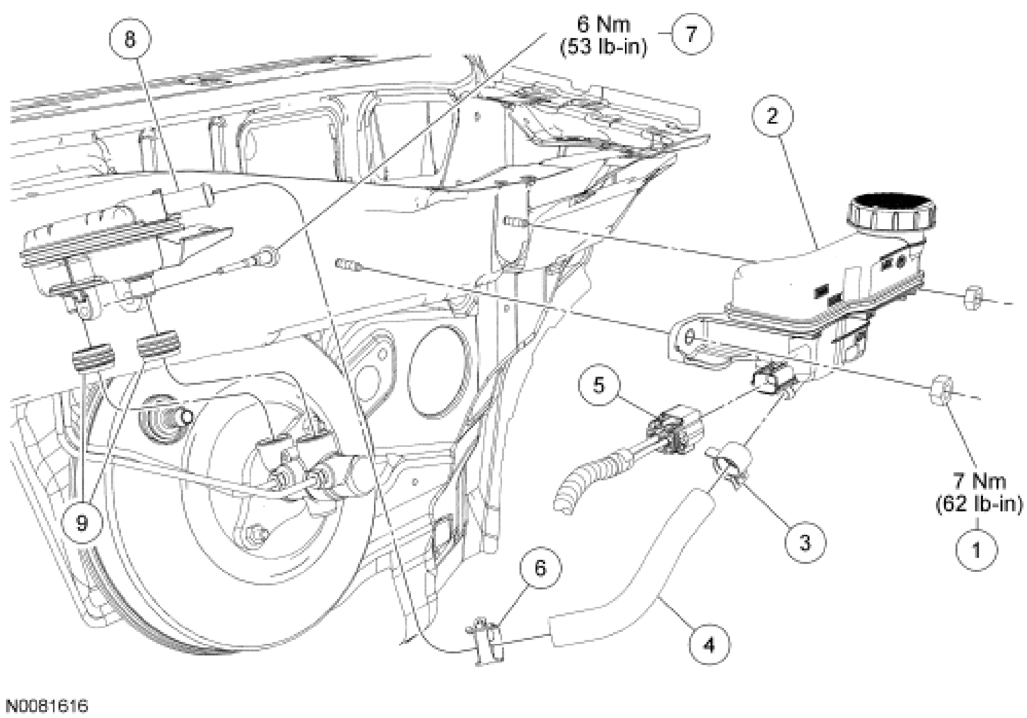


Fig. 5: Exploded View Of Brake Fluid Reservoir With Torque Specifications - 3.5L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W520111	Brake fluid remote reservoir nut (2 required)
2	2K478	Brake fluid remote reservoir
3	-	Spring clamp (part of 2K478)
4	-	Brake fluid reservoir hose (part of 2K478)
5	-	Brake fluid level warning switch electrical connector (part of 14290)
6	-	Spring clamp (part of 2K478)
7	2B176	Brake fluid reservoir pin bolt
8	2C246	Brake fluid reservoir
9	2L074	Brake fluid reservoir seals (2 required)

REMOVAL AND INSTALLATION

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the battery. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
2. Using a suitable suction device, remove the brake fluid from the remote reservoir.
3. Disconnect the brake fluid level switch electrical connector.
4. Disconnect the hose from the remote reservoir.
5. Remove the 2 nuts and the remote reservoir.
    - To install, tighten to 7 Nm (62 lb-in).
6. Disconnect the brake fluid level switch harness from the brake fluid reservoir.

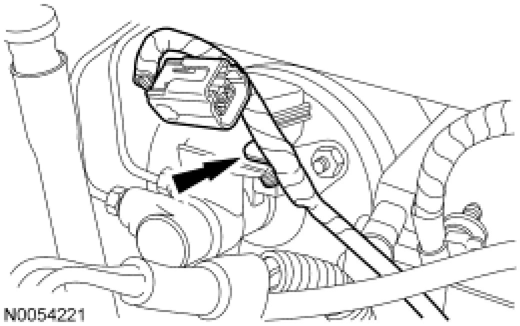


Fig. 6: Locating Brake Fluid Level Switch Harness From Brake Fluid Reservoir
Courtesy of FORD MOTOR CO.

7. Remove the reservoir pin bolt and the brake fluid reservoir.
   - To install, tighten to 6 Nm (53 lb-in).
8. Remove and discard the 2 seals.

NOTE: **Install new seals. Lubricate the seals with clean, specified motor vehicle brake fluid.**

9. To install, reverse the removal procedure.
   - Bleed the brake system. For additional information, refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.
   - If equipped with a manual transmission, bleed the clutch master cylinder. For additional information, refer to **MANUAL TRANSAXLE/TRANSMISSION AND CLUTCH - GENERAL INFORMATION** article.

BRAKE PRESSURE CONTROL VALVE

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

NOTE: **Non-ABS shown, ABS similar.**

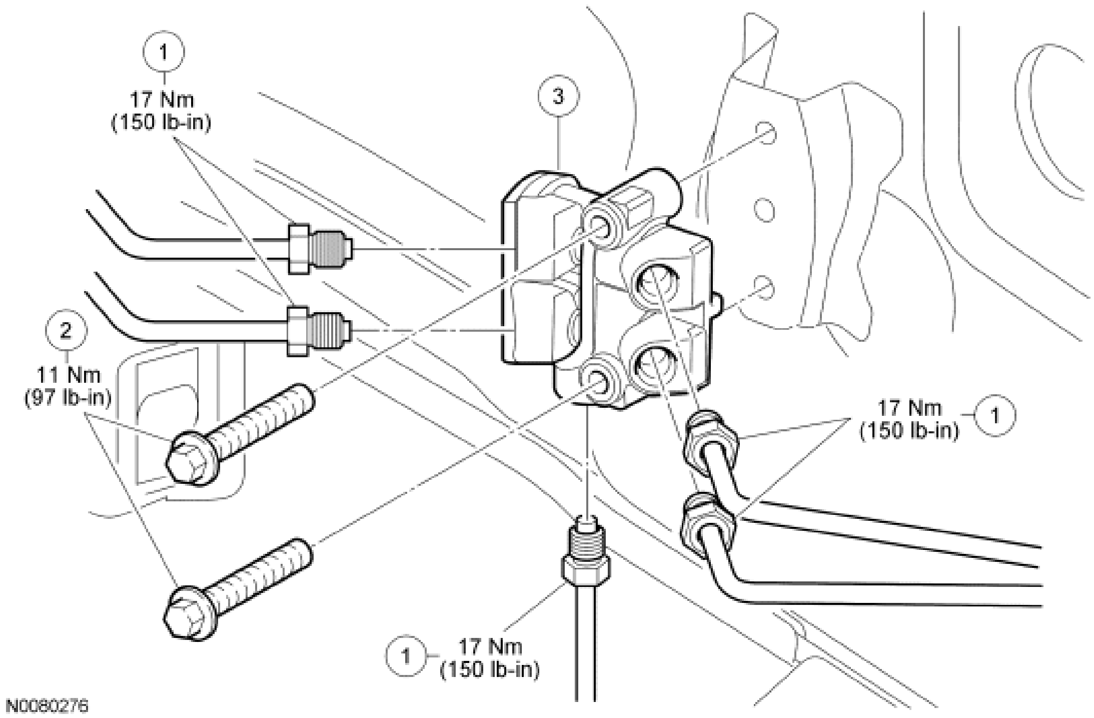


Fig. 7: Exploded View Of Brake Pressure Control Valve With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Brake tube fittings (part of 9J279)
2	W711239	Brake pressure control valve bolts (2 required)
3	43900	Brake pressure control valve

REMOVAL AND INSTALLATION

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the nut and the brake tube heat shield.
3. Disconnect the brake tube fittings, plug the tubes and the ports on the brake pressure control valve.
    - To install, tighten to 17 Nm (150 lb-in).
4. Remove the 2 brake pressure control valve bolts and the brake pressure control valve.
    - To install, tighten to 11 Nm (97 lb-in).
5. To install, reverse the removal procedure.
    - Bleed the brake system. For additional information, refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

2008 ACCESSORIES & BODY, CAB

Information & Entertainment Systems - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Antenna cable bolt	8	-	71
Antenna mast	3	-	27
Antenna module bolt	12	9	-
Engine ground strap	9	-	80
Radio interference capacitor (body)	7	-	62
Satellite Digital Audio Receiver System (SDARS) module nuts	5	-	44
Speaker enclosure mounting bolts	8	-	71
Subwoofer amplifier screws	5	-	44
Audio Digital Signal Processing (DSP) module bolts	9	-	80

DESCRIPTION AND OPERATION

INFORMATION AND ENTERTAINMENT SYSTEM

Audio Line-Up

The following audio systems are available:

- Base
  - AM/FM single CD with MP3
  - 4 speakers
- Mid-Level
  - AM/FM single CD with MP3
  - 6 speakers
- Premium
  - AM/FM 6-CD changer with MP3
  - 6 speakers
- Audiophile
  - AM/FM 6-CD changer with MP3
  - 8 speakers (includes subwoofers)
- THX® Audio
  - AM/FM 6-CD changer with MP3

    - 12 speakers (includes subwoofers and center front/rear speakers)
    - Audio digital signal processing (DSP) module (located on the RH side of the luggage compartment)
- Navigation
    - Navigation audio control module (ACM)
    - Available with Audiophile or THX® audio system

All audio systems include the following features:

- Speed sensitive volume
- Accessory delay
- MP3 capability
- Audio input jack

The following options are also available:

- Steering wheel controls
    - Available with certain audio systems
    - Standard with the SYNC system
- Satellite audio
    - Available as an option with all audio systems
    - Provides satellite-broadcast reception
- SYNC System
    - Provides mobile phone and media device functionality with the vehicle audio system

Antenna

Antenna - Fusion, Milan

The antenna is located at the top-rear of the roof panel. The antenna can be either an AM/FM antenna, or a combination AM/FM/satellite antenna if the vehicle is equipped with satellite audio.

Antenna - MKZ

The AM/FM antenna is located in the rear glass. It cannot be replaced separate from the rear glass.

Satellite Antenna

The satellite antenna (if equipped) is located at the top-rear of the roof panel. The satellite antenna is a stand-alone antenna on the MKZ, and is a combination AM/FM/satellite antenna on the Fusion/Milan.

Antenna Cable

The antenna lead-in cable is connected to the ACM and has an in-line connector (located at the right end of the instrument panel below the glove compartment) to the antenna cable. The antenna cable runs along the

passenger side rocker panel within the body main wiring harness, and runs up the passenger side C-pillar to the antenna module (MKZ) or to the antenna (Fusion, Milan).

The antenna and lead-in cables are not removable from the wiring harnesses. If either antenna cable needs to be replaced, cut the ends and leave the cable in the wiring harness. Route the new cable on top of the wiring harness and secure it with wire ties. Do not cut into the wiring harness to remove the existing antenna cable.

Satellite Antenna Cable

The satellite antenna cable is part of the harness. If it is necessary to install a new satellite antenna cable, the new cable should be overlaid on the harness and secured as necessary.

Satellite Audio

The satellite audio system is comprised of the following:

- Satellite digital audio receiver system (SDARS) module, located behind the RH C-pillar trim panel
- Combination AM/FM/satellite radio antenna (Fusion, Milan)
- Stand-alone satellite radio antenna (MKZ)
- Satellite radio antenna cable

Navigation System

The navigation system is integral to the ACM. The ACM controls the operation of the navigation system and the audio system. The system uses a global positioning system (GPS) antenna, a vehicle speed input, and other sensor information to accurately establish the vehicle position. The ACM provides the visual and audible instructions of the maneuvers required to arrive at the pre-entered destination. An audible switch feedback is provided to confirm if an ACM button or a screen button is pressed. The audible switch feedback can be set to ALL, TOUCH SCREEN, or NONE depending on user preference.

SYNC System

The SYNC system is comprised of the following:

- Accessory protocol interface module (APIM), located under the floor console
- SYNC-specific steering wheel controls
- Microphone located in the rear view mirror
- Universal serial bus (USB) port, located in the center console
- Audio input jack, located in the center console

SYNC is a hands-free communications and entertainment system that allows the following interactions:

- Send and receive phone calls via a Bluetooth®-enabled phone
- Send and receive text messages via a Bluetooth®-enabled phone
- Connect media devices (such as an iPod® or USB flash device) in order to play audio files

- Play media files via a Bluetooth®-enabled audio device

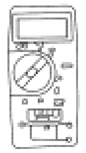
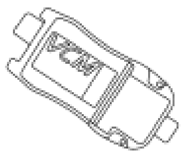
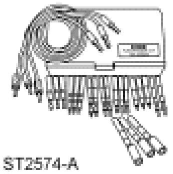
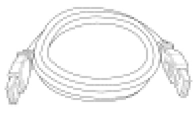
Not all features will be available with every phone.

For additional information on audio system operation, including the SYNC system, refer to the Owner's Literature.

DIAGNOSTIC TESTS

INFORMATION AND ENTERTAINMENT SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent
 ST3051-A	Universal Serial Bus (USB) Male-A To Male-A Cable	CCMUSB2-AM-AM-10

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Audio Control Module (ACM)

The audio control module (ACM) can be operated while the key is in RUN or ACC. The accessory delay feature allows the audio system to be operated for a preset period of time after the key is turned to OFF and a

front door has not been opened. The ACM sends AC voltage audio signals to the speakers or to the amplifiers, depending on vehicle configuration. The ACM can produce its own DTCs, which can be communicated to the scan tool through the medium speed controller area network (MS-CAN), or can be retrieved through the ACM self-test by simultaneously pressing presets 3 and 6.

Satellite Audio

The satellite audio system consists of a satellite digital audio receiver system (SDARS) module, a satellite radio antenna, and a satellite radio antenna cable. The satellite radio antenna receives digital audio signals and sends them to the SDARS module, where the signals are converted and sent to the ACM or the accessory protocol interface module (APIM) (if equipped). The SDARS module communicates via the MS-CAN.

Antenna - Fusion, Milan

The antenna receives AM/FM radio waves, and satellite audio signals (if equipped with satellite audio). The AM/FM antenna sends audio signals to the ACM. The satellite radio antenna receives digital audio signals and sends them to the SDARS module.

Antenna - MKZ

The antenna receives both AM and FM radio waves. The antenna is built into the rear window glass and has a module to interpret the audio signals. The audio signals are then sent to the ACM through the antenna cable. If equipped with satellite audio, the satellite radio antenna is mounted to the roof. It receives digital audio signals and sends them to the SDARS module.

Subwoofer

The subwoofer speakers are powered by the subwoofer amplifier (Audiophile) or by the audio digital signal processing (DSP) module (THX® only). The enable/clip detection circuit carries out 2 functions: to turn the amplifier on, and to indicate to the ACM when the subwoofer output distortion signal reaches a damaging level. The ACM then clips the audio output signal to prevent damage to the subwoofer.

Audio Digital Signal Processing (DSP) Module

The DSP module provides theatre quality sound in the vehicle. Audio signals are sent to the DSP module, which processes the audio signals and sends them to the 12 speakers: 4 door speakers, 2 tweeter speakers, 3 front/center speakers, 1 rear/center speaker, and 2 subwoofer speakers.

Navigation System

The navigation module is integrated in the ACM and controls the operation and the interface between the user, the vehicle subsystems, and the external components. The ACM communicates with other vehicle systems via the MS-CAN and can be diagnosed with a scan tool.

The vehicle navigation system guides the user to a pre-entered destination. A navigation map DVD stored in the navigation module sends route calculation data to the ACM. The ACM audibly and visually instructs the user of the maneuvers required to arrive at the destination entered.

In order to calculate initial vehicle position, the global positioning system (GPS) antenna is used to track several

available satellites simultaneously. Vehicle speed and transmission gear selected signals received through the MS-CAN are also used to detect vehicle speed and direction changes.

A voice recognition system allows the user to interface with the system without using the touch screen. A microphone located in the rear view mirror provides a direct input to the ACM.

SYNC System

The SYNC system allows interaction with several types of customer devices, including mobile phones and media devices. The system is comprised of the APIM, a microphone (located in the interior rear view mirror), the universal serial bus (USB) cable and port, and the audio input jack. The APIM contains an on-board Bluetooth® chipset, which enables certain wireless devices to interact with the system.

The APIM consists of 2 internal modules: the consumer interface processor (CIP) and the vehicle interface processor (VIP). The modules are not replaceable individually, but can be flashed independently, if required.

The CIP interfaces with all of the inputs to the APIM. The CIP contains an analog-to-digital-to-analog converter, as well as the Bluetooth® chipset. Any consumer-available application upgrades that are available are loaded directly to the CIP through the USB port.

The VIP provides an interface between the CIP and the vehicle. The main functions of the VIP are controlling the APIM power management and translating both inbound and outbound signals over the controller area network (CAN).

The APIM can receive inputs from the following audio sources:

- USB port
- Audio input jack
- SDARS module
- Bluetooth®

The USB port can be used for connecting a media device (such as an iPod®) with the device's available cable, or for directly plugging in a portable mass storage device (such as a "thumb drive"). When playing media files stored on a mass storage device, the SYNC system will only play files that do not have digital rights management (DRM) protection. The USB port can also be used for uploading vehicle application upgrades.

The USB port is powered by the APIM, so no external power source is needed to power a device plugged into the USB port if the device supports this feature.

The audio input jack can be used for connecting a media device (such as an iPod®) utilizing a 1/8-inch audio jack. When a device is connected through the audio input jack, only the speaker volume can be controlled by the ACM. All other functions (such as seek, fast forward, pause, etc.) must be carried out on the device itself.

If the vehicle is equipped with satellite audio, the audio signals from the SDARS module are sent to the APIM, rather than directly to the ACM. The APIM then relays the satellite audio signals to the ACM.

The Bluetooth® interface can accommodate both Bluetooth®-enabled mobile phones and Bluetooth®-enabled

media devices. Any Bluetooth® device used with the SYNC system must first be paired with the system before it is operational.

Bluetooth® is a secure, short-range radio frequency that allows devices to communicate wireless through radio waves. The operating range of a Bluetooth® signal is a maximum of 32 feet.

Only one Bluetooth® phone and one Bluetooth® device can be connected to the system at any one time. If an additional device of either type is paired with the system and made active, the APIM will disconnect any active connection and establish a connection with the new device.

It is important to understand that not all mobile phones will have the same level of features when interacting with the SYNC system. For a list of compatible phones, .

In addition to audio information, metadata may also be sent to the APIM from a device plugged into the USB port. Metadata consists of such information as artist, album title, song title, and genre. The metadata is used by the APIM to create indexes that can be used to sort for particular music, based on customer preference. Not all USB devices will send metadata to the APIM; also, no metadata is transferred when a device is connected through the audio input jack. When a new media device is connected to the SYNC system, the APIM will automatically index the information. This may take up to several minutes (depending on the amount of data on the device), and is considered normal operation. When a device that was previously connected to the SYNC system is reconnected, the APIM will update the index (rather than creating a new one), which reduces the amount of time needed to create the index.

The APIM receives both stereo and mono sound inputs, and can also transmit both stereo and mono sound. The mono function is used to receive the microphone input, and to send sound to the ACM for voice prompts, the text-to-speech (TTS) feature, ring tones, and any audio received through a connected mobile phone. The TTS feature speaks information so that it does not have to be read from the display.

The APIM communicates via the MS-CAN.

Voice Recognition For Vehicles With Navigation And The SYNC System

When a vehicle is equipped with both the navigation system and SYNC system, the interaction between the audio system components is unique for voice recognition.

Both the navigation ACM and the APIM utilize voice-recognition, but in order for the modules to determine which one should be acknowledging the voice command, the voice command set is different. This allows the modules to identify the intended source when the VOICE button is pressed. The VOICE (an icon of someone speaking) and PHONE (an icon of a phone and an up-and-down arrow) buttons are wired to the navigation ACM, rather than to the APIM (as they are in non-navigation audio systems).

When the audio system enters voice recognition mode, the ACM sends a CAN message to the APIM to enter voice recognition mode. The microphone is wired directly to the APIM, which relays the microphone input to the ACM through dedicated wiring. Control of the voice functions is given to whichever module is indicated by the first voice command.

Steering Wheel Controls

The steering wheel controls consist of a series of resistors. Each steering wheel control switch function corresponds with a specific resistance value within the switch. When a switch is pressed, the ACM (or the APIM) monitors the change in reference voltage to determine the requested function.

Audio Input Jack - Vehicles Without The SYNC System

The audio input jack allows for a portable MP3 player to be connected to the vehicle audio system. When a portable MP3 player is connected, audio from the MP3 player can be played through the vehicle speakers.

Noise Suppression Equipment

The radio frequency suppression equipment reduces interference transmitted through the speakers by the engine ignition and electrical systems. When installing any new radio suppression equipment components, make sure that a good contact is made at all connections.

Audio Signals

Audio signal flow varies greatly depending on vehicle content.

Stereo signals contain left and right channel information, and are used for most audio signals.

A mono signal is used for the microphone input to the APIM. The mono signal is also used for the voice prompts, the TTS feature, ring tones, and any audio received through a connected mobile phone. These audio signals are output from the APIM to the ACM. The mono and stereo outputs from the APIM utilize separate circuits.

A digital signal is used to transmit data from a media device connected through the USB port to the APIM. The APIM then converts the signal to analog and relays the signal to the ACM.

A wireless signal is used to broadcast audio signals from a Bluetooth® device to the APIM. As with a digital signal sent through the USB port, the APIM converts the wireless audio signal to analog and relays it to the ACM.

Network Communication

The following audio system components communicate via the MS-CAN:

- Audio control module (ACM)
- Navigation ACM
- Satellite digital audio receiver system (SDARS) module
- Audio digital signal processing (DSP) module
- Accessory protocol interface module (APIM)

The following messages are utilized by the audio system:

AUDIO SYSTEM

		Receiving Module	

Message	Transmitting Module	(s)	Audio System Function
Ignition Switch Position	Instrument cluster (IC)	ACM DSP module	Indicates ignition switch position for power-up/shut-down.
Illumination Dimmer Level	Smart junction box (SJB)	ACM	Controls the backlight intensity, based on the position of the dimmer switch.
Transmission Selector (PRNDL) Range	IC	ACM	For the navigation system, this signal is used for more accurate navigation tracking.
Volume Cutback	Parking aid module (PAM)	ACM	When this signal is active, the speaker output is reduced to allow the parking aid tone to be more easily heard.
Accessory Delay Status	SJB	ACM	When active, this signal allows the audio component to be operated after the vehicle is shut off.
Vehicle Speed	IC	ACM DSP module	Used by the ACM (or DSP module) for the speed-compensated volume function.
Navigation Radio Rolling Wheel Count	IC	ACM	For the navigation system, this signal is used to more accurately track vehicle position when the GPS signal is temporarily unavailable.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
	• Smart junction box (SJB) fuse(s): ◦ 12 (7.5A) (accessory delay feed)

• Audio control module (ACM) • Antenna • Audio input jack • Speaker(s) • Steering wheel controls • Universal serial bus (USB) port • Navigation map DVD • Noise suppression equipment	○ 13 (10A) (accessory protocol interface module [APIM]) ○ 17 (20A) (subwoofer amplifier) (Audiophile) ○ 18 (20A) (ACM hot at all times) ○ 20 (7.5A) (satellite digital audio receiver system [SDARS] module hot at all times) ○ 22 (7.5A) (ACM hot in START) • Battery junction box (BJB) fuse(s): ○ 20 (20A) (audio digital signal processing [DSP] module) ○ 21 (20A) (DSP module) • Wiring, terminals or connectors

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
    - Check the VCM connection to the vehicle.
    - Check the scan tool connection to the VCM.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
    - Verify the ignition key is in the ON position.
    - Verify the scan tool operation with a known good vehicle.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.

NOTE: Do not press any buttons on the ACM while the ACM is carrying out the self-test.

7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the ACM.
9. If the DTCs retrieved are related to the concern, go to DTC Charts.
10. If no DTCs related to the concern are retrieved, go to the Speaker Walk-Around Test (All Audio Systems Except Navigation), the Audio Control Module (ACM) Self-Diagnostic Mode (All Audio Systems Except Navigation), the Audio Control Module (ACM) Self-Diagnostic Mode - Navigation, or the Satellite Audio Bezel Diagnostic Test.

Speaker Walk-Around Test (All Audio Systems Except Navigation)

NOTE: To enter the speaker walk-around test or ACM self-diagnostic mode, the audio system must be on and in radio tuner (AM/FM) mode.

1. To enter the speaker walk-around test, simultaneously press the ACM preset buttons 3 and 6.
2. The speaker walk-around test stops at each speaker and applies sound to each speaker for about 1 to 2 seconds. Each speaker is tested and displayed on the ACM in the following sequence: RF, LF, LR, RR, SUBWOOFER, and CENTER IMAGE (THX® audio system only).
3. To exit the speaker walk-around test, turn the key OFF, turn the audio system off, or press preset button 1 for diagnostics.

Audio Control Module (ACM) Self-Diagnostic Mode - All ACMs Without Navigation

NOTE: To enter the ACM self-diagnostic mode, the ACM must be turned on and in radio tuner (AM/FM) mode.

1. To enter the following tests, press the desired preset button while in the speaker walk-around test or while in the ACM self-diagnostic mode.
2. The self-diagnostic mode has the following functions available:
    - Preset button 1 = On-Demand Self-Test. This button runs the on-demand self-test.
        - Pressing the MENU DOWN button allows scrolling of any DTCs found during the test while in this menu.

- Preset button 2 = Display Continuous DTCs. This button enables viewing of any continuous DTCs that have been logged.
  - Pressing the MENU UP button allows scrolling of any DTCs while in this menu.
  - While continuous DTCs are being displayed, pressing the EJECT button will clear all present DTCs.
- Preset button 3 = Signal Strength Test. This button displays the signal strength.
- Preset button 4 = Software Version Display. This button displays the ACM software version.
  - Pressing the MENU UP button allows scrolling of all audio subsystem software versions while in this menu.
- Preset button 5 = Display Test. This test illuminates all the display segments for 5 seconds, then turns all segments off.
- Preset button 6 = Configuration Status. This button enables ACM configuration status.
  - Pressing the MENU button displays the ACM part number while in this menu.

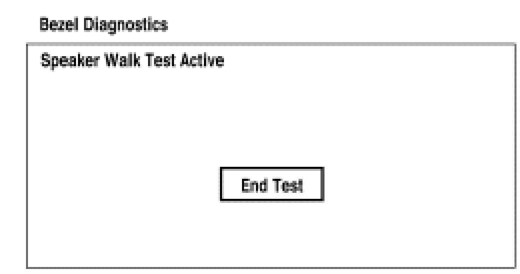
3. To exit the self-diagnostic mode, turn the audio system off or turn the key to OFF.
4. If the concern remains and the fault is not detected, go to **Symptom Chart - Audio System** to continue diagnostics.

Audio Control Module (ACM) Self-Diagnostic Mode - Navigation ACM

The navigation system provides internal self diagnostics to assist with diagnosing vehicle concerns.

Press and hold the 3 and 6 memory preset buttons for 3 seconds.

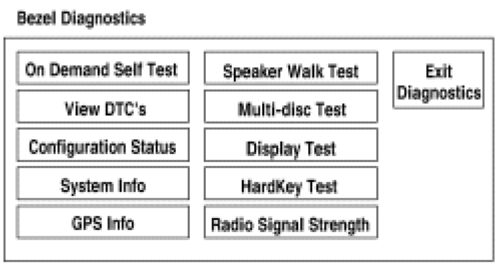
Press the End Test button on the screen to exit the speaker walk test.



N0026636

Fig. 1: Bezel Diagnostics Screen Display - Speaker Walk Test Active
Courtesy of FORD MOTOR CO.

The following diagnostics are available using the on-screen buttons as follows:



N0026635

Fig. 2: Bezel Diagnostics Screen Display - On-Screen Buttons
Courtesy of FORD MOTOR CO.

- On Demand Self Test: provides internal self-test diagnostics and displays all the DTCs resulting from the self-test.
- View DTCs: provides a list of all the DTCs currently stored in memory.
- Configuration Status: displays the current navigation ACM configuration.
- System Info: displays the navigation ACM part number and software information.
- GPS Info: provides satellite and current vehicle information.
- Speaker Walk Test: performs the speaker walk-around test.
- Multi-disc Test: checks the status of the CD player mechanism.
- Display Test: allows the screen colors to be checked, and allows testing of individual display screen touch sectors.
- Hardkey Test: provides the status (active/not active) of the ACM buttons and the touch screen.
- Radio Signal Strength: tests the antenna signal.
- Exit Diagnostics: exists diagnostics and returns to the previously selected function.

1. If the concern remains and the fault is not detected, go to **Symptom Chart - Navigation** to continue diagnostics.

Satellite Audio Bezel Diagnostic Test

NOTE: **To enter the satellite audio bezel diagnostic test, the audio system must be on and in SAT mode.**

1. To enter the satellite audio bezel diagnostic test, simultaneously press and hold the AUX button and preset button 2 (except navigation), or SOUND and preset button 1 (navigation).
2. Upon entering the self-test, the audio system produces 2 continuously alternating tones of different pitch, one for the right channel, then one for the left.
3. The test continues by displaying any DTCs currently present. If no DTCs are present, NO DTCS will be displayed. If there are DTCs present, the ACM will auto-scroll through the list of active DTCs.
4. Historical DTCs can be viewed by pressing the AUX button and preset button 2 (except navigation), or SOUND and preset button 1 (navigation) simultaneously while in the active DTC mode.
    - If any DTCs are present, simultaneously pressing the AUX button and preset button 2 (except

navigation), or SOUND and preset button 1 (navigation) will prompt CLEAR DTCS? on the display.

- To clear historical DTCs, press preset buttons 1, 2, and 3 consecutively within 4 seconds.
- To exit historical DTCs (with or without clearing DTCs), press the AUX button and preset button 2 (except navigation), or SOUND and preset button 1 (navigation) simultaneously.

5. If no historical DTCs are present, pressing the AUX button and preset button 2 (except navigation), or SOUND and preset button 1 (navigation) simultaneously while in active DTC mode will display the DLP software version.
6. To exit the satellite audio bezel diagnostic test, press the AUX button and preset button 2 (except navigation), or SOUND and preset button 1 (navigation) simultaneously while the DLP (SDARS module) software version is displayed, or turn the ACM off.
7. If the concern remains and the fault is not detected, go to **Symptom Chart - Audio System**.

DTC Charts

NOTE: For all U-codes listed in this chart, if no related symptoms are observed, disregard the DTC.

NOTE: For all U-codes listed in this chart, if DTC B1318 is present, diagnose it before diagnosing the U-code DTC.

AUDIO CONTROL MODULE (ACM) DTC CHART

DTC	Description	Action
B1117	Audio Steering Wheel Button Stuck	VERIFY that no steering wheel control switches are stuck and that no steering wheel control button was pressed during the self-test. If no concern is found, go to **Pinpoint Test G**.
B1119 (Navigation only)	Audio Disc DVD Player Thermal Shutdown	**NOTE: This DTC refers to the navigation DVD mechanism, not the DVD entertainment system.** The audio control module (ACM) was over-temperature. Navigation operation will resume after the ACM cools. This is normal operation. CLEAR the DTCs.
B1136 (Navigation only)	Audio Steering Wheel Switch #2 Circuit Failure	Go to **Pinpoint Test G**.
B1140 (Navigation only)	Map Disk Invalid	REMOVE the map DVD and CLEAN it. INSPECT for scratches, fingerprints, or damage, and REPAIR as necessary. VERIFY a valid map DVD is being used. If no concern is found, INSERT a known good map DVD. REPEAT the self-test. ○ If the system operates correctly, the concern was

		caused by a damaged or invalid map DVD. ◦ If DTC B1140 is retrieved again, INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.
B1318	Battery Voltage Low	CLEAR the DTCs. TEST the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. ◦ If the charging system is OK, the DTC was set by a previous low voltage condition. No concern is found at this time. ◦ If the charging system is not OK, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnose the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.
B2103	Antenna Not Connected	Go to **Pinpoint Test A**.
B2204 (Navigation only)	GPS Antenna Connection Open or Short	Go to **Pinpoint Test K**.
B2274	Phone Transceiver Active Circuit Failure	DISREGARD the DTC. CLEAR the DTCs.
B2384	Audio Reverse Aid Mute Input CKT Failure	DISREGARD the DTC. CLEAR the DTCs.
B2404	Audio Steering Wheel Switch Circuit Fault	Go to **Pinpoint Test G**.
B2405	Audio Disc CD Player Thermal Shutdown Fault	The ACM was over-temperature. Audio operation will resume after the ACM cools. This is normal operation. CLEAR the DTCs.
B2406	Audio Disc CD Player Internal Fault	**NOTE:** **DTC B1342 will also be set.** CLEAR the DTCs. REPEAT the self-test. If DTC B2406 or B1342 is retrieved again, INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.
B2477	Module Configuration Failure	REFER to **MODULE CONFIGURATION** article.
B2633	Driver-Front Microphone	Go to **Pinpoint Test P**.

(Navigation only)	Circuit Failure	
B2656 (Navigation only)	DVD (Digital Versatile Disk) Error	**NOTE:** **DTC B1342 will also be set.** **NOTE:** **This DTC refers to the navigation DVD mechanism, not the DVD entertainment system.** CLEAR the DTCs. REPEAT the self-test. If DTC B2656 or B1342 is retrieved again, INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.
B2924	Audio Button Stuck	**NOTE:** **For the navigation system, the hard key test should be used to isolate a stuck button.** VERIFY no ACM buttons are stuck and that no ACM button is pressed during the self-test. CLEAR the DTCs. REPEAT the self-test. If DTC B2924 is retrieved again, INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.
B2965	Audio System Speaker Circuit Fault	For the THX® audio system, go to **Pinpoint Test C**. For all others, go to **Pinpoint Test B**.
C1992	Vehicle Speed Circuit Failure	DISREGARD the DTC. CLEAR the DTCs.
P0812	Reverse Input Circuit	DISREGARD the DTC. CLEAR the DTCs.
U0140	Lost Communication With Body Control Module (GEM)	If a back lighting concern is present, REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article. If the accessory delay does not function correctly, REFER to **WIPERS AND WASHERS** article.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	If the speed sensitive volume does not operate correctly, go to **Pinpoint Test Q**. If the navigation is inaccurate, go to **Pinpoint Test O**.
U0159	Lost Communication With Parking Assist Control Module (PAM)	Go to **Pinpoint Test N**.
U0193	Lost Communication With Digital Audio Control Module (SDARS)	Go to **Pinpoint Test H**.
U0196	Lost Communication With Entertainment Control Module	DISREGARD the DTC. CLEAR the DTCs.

	- Rear (AUX)	
U0197	Lost Communication With Telephone Control Module	Go to **Pinpoint Test R**.
U0238	Lost Communication With Digital Audio Control Module "D" (DSP)	Go to **Pinpoint Test D**.
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	DISREGARD the DTC. CLEAR the DTCs.
U2050	No Application Present	REFER to **MODULE CONFIGURATION** article.
U2051	One or More Calibration Files Missing/Corrupt	REFER to **MODULE CONFIGURATION** article.
U2473	Unexpected Vehicle Speed (VSS)	Go to **Pinpoint Test O**.

NOTE: For all U-codes listed in this chart, if no related symptoms are observed, disregard the DTC.

NOTE: For all U-codes listed in this chart, if DTC B1318 is present, diagnose it before diagnosing the U-code DTC.

AUDIO DIGITAL SIGNAL PROCESSING (DSP) MODULE DTC CHART

DTC	Description	Action
B1158	Subwoofer #2 Open	Go to **Pinpoint Test C**.
B1317	Battery Voltage High	CLEAR the DTCs. TEST the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. ◦ If the charging system is OK, the DTC was set by a previous high voltage condition. No concern is found at this time. ◦ If the charging system is not OK, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnose the over-charging condition.
B1318	Battery Voltage Low	CLEAR the DTCs. TEST the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. ◦ If the charging system is OK, the DTC was set by a previous low voltage condition. No concern is found at this time. ◦ If the charging system is not OK, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnose the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new DSP module. REFER to **Audio Digital Signal Processing (DSP) Module**. TEST the system for normal operation.

B2477	Module Configuration Failure	REFER to **MODULE CONFIGURATION** article.
B2913	Audio Subwoofer Not Connected	Go to **Pinpoint Test C**.
B2925	Subwoofer Speaker Short Circuit	Go to **Pinpoint Test C**.
B292A	Subwoofer #2 Speaker Short Circuit	**NOTE:** **Despite the DTC description, this DTC applies to the DSP module clip/enable circuit, not the subwoofer.** Go to **Pinpoint Test C**.
B2965	Audio System Speaker Circuit Fault	If the symptom is no audio from all speakers, go to **Pinpoint Test D**. If the symptom is no audio from one or more (but not all) speakers, go to **Pinpoint Test C**.
C1992	Vehicle Speed Circuit Failure	DISREGARD the DTC. CLEAR the DTCs.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	CARRY OUT the network test using the scan tool. ○ If the scan tool communicates with the IC, go to **Symptom Chart - Audio System** to diagnose the observed symptom. ○ If the scan tool does not communicate with the IC, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0184	Lost Communication With Radio (ACM)	CARRY OUT the network test using the scan tool. ○ If the scan tool communicates with the ACM, go to **Symptom Chart - Audio System** to diagnose the observed symptom. ○ If the scan tool does not communicate with the ACM, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	DISREGARD the DTC. CLEAR the DTCs.
U2050	No Application Present	REFER to **MODULE CONFIGURATION** article.
U2051	One or More Calibration Files Missing/Corrupt	REFER to **MODULE CONFIGURATION** article.

NOTE: **For all U-codes listed in this chart, if no related symptoms are observed, disregard the DTC.**

NOTE: **For all U-codes listed in this chart, if DTC B1318 is present, diagnose it before diagnosing the U-code DTC.**

SATELLITE DIGITAL AUDIO RECEIVER SYSTEM (SDARS) MODULE DTC CHART

DTC	Description	Action
B1031	SDARS Satellite Antenna Open	Go to **Pinpoint Test I**.
B1032	SDARS Satellite Antenna Short	Go to **Pinpoint Test I**.
B1318	Battery Voltage Low	CLEAR the DTCs. TEST the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. ○ If the charging system is OK, the DTC was set by a previous low voltage condition. No concern is found at this time. ○ If the charging system is not OK, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnose the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new satellite digital audio receiver system (SDARS) module. REFER to **Satellite Digital Audio Receiver System (SDARS) Module**. TEST the system for normal operation.
B2477	Module Configuration Failure	REFER to **MODULE CONFIGURATION** article.
U0184	Lost Communication With Radio (ACM)	Go to **Pinpoint Test H**.
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	DISREGARD the DTC. CLEAR the DTCs.
U0197	Lost Communication With Telephone Control Module	Go to **Pinpoint Test H**.
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	DISREGARD the DTC. CLEAR the DTCs.
U2050	No Application Present	REFER to **MODULE CONFIGURATION** article.

NOTE: For all U-codes listed in this chart, if no related symptoms are observed, disregard the DTC.

NOTE: For all U-codes listed in this chart, if DTC B1318 is present, diagnose it before diagnosing the U-code DTC.

ACCESSORY PROTOCOL INTERFACE MODULE (APIM) DTC CHART

DTC	Description	Action
B1038	Microphone Input Circuit Failure	Go to **Pinpoint Test V**.

B1117	Audio Steering Wheel Button Stuck	Go to **Pinpoint Test G**.
B1136	Audio Steering Wheel Switch #2 Circuit Failure	Go to **Pinpoint Test G**.
B1317	Battery Voltage High	CLEAR the DTCs. TEST the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. o If the charging system is OK, the DTC was set by a previous high voltage condition. No concern is found at this time. o If the charging system is not OK, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnosis the over-charging condition.
B1318	Battery Voltage Low	CLEAR the DTCs. TEST the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article. o If the charging system is OK, the DTC was set by a previous low voltage condition. No concern is found at this time. o If the charging system is not OK, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnosis the low battery voltage condition.
B1342	ECU is Faulted	CLEAR the DTCs. CARRY OUT the self-test. If DTC B1342 is retrieved again, INSTALL a new accessory protocol interface module (APIM). REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.
B2477	Module Configuration Failure	REFER to **MODULE CONFIGURATION** article.
U0184	Lost Communication With Radio (ACM)	Go to **Pinpoint Test R**.
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	DISREGARD the DTC. CLEAR the DTCs.
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	DISREGARD the DTC. CLEAR the DTCs.
U0255	Lost Communication With Front Controls Interface Module	DISREGARD the DTC. CLEAR the DTCs.
U0256	Lost Communication With Front Display Interface Module	DISREGARD the DTC. CLEAR the DTCs.
U2050	No Application Present	REFER to **MODULE CONFIGURATION** article.

U261C	USB #1 Device Error	Go to **Pinpoint Test T**.
U261D	USB #2 Device Error	DISREGARD the DTC. CLEAR the DTCs.

Symptom Chart

Symptom Chart - Audio System

Condition	Possible Sources	Action
• No communication with the audio control module (ACM)	• Fuse • Wiring, terminals or connectors • ACM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• No communication with the satellite digital audio receiver system (SDARS) module	• Fuse • Wiring, terminals or connectors • SDARS module	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• No communication with the accessory protocol interface module (APIM)	• Fuse • Wiring, terminals or connectors • APIM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• No communication with the audio digital signal processing (DSP) module	• Fuse • Wiring, terminals or connectors • DSP module	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The satellite audio is inoperative/does not operate correctly	• Subscription status • Wiring, terminals or connectors • APIM (if equipped) • SDARS module • ACM	• Go to **Pinpoint Test H**.
• The ACM display is blank, but the ACM operates	• ACM	• INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.
• The ACM back lighting does not operate correctly	• Back lighting system concern • Wiring, terminals or connectors • ACM	• REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article to continue diagnosis of a single illumination source inoperative.
		• INSPECT the CD for scratches,

• The CD player is inoperative/does not operate correctly	• CD • ACM	fingerprints, a loose paper label, incorrect format, or damage. INSERT a known good CD and TEST the system. • If the system operates correctly, the concern was caused by a damaged CD. • If the system does not operate correctly, INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.
• Poor reception - AM/FM	• Wiring, terminals or connectors (MKZ only) • Antenna • Antenna cable • Charging system • Ignition system • Noise suppression equipment • Antenna module (MKZ only) • ACM	• Go to **Pinpoint Test A**.
• Poor reception - satellite audio	• Obstructions to the line of sight • Satellite antenna • Satellite antenna cable • SDARS module	• Go to **Pinpoint Test I**.
• No sound while in satellite radio mode	• Satellite radio antenna • Satellite radio antenna cable • SDARS module	• Go to **Pinpoint Test I**.
• Continuous seek/scan in	• RDS/PTY function setting • Antenna • Antenna cable	• Go to **Pinpoint Test A**.

AM/FM	• Noise suppression equipment • ACM	
• Poor quality/distorted/no sound from one or more speakers (not all speakers) - except THX® audio system	• Wiring, terminals or connectors • Speaker • ACM	• Go to **Pinpoint Test B**.
• Poor quality/distorted/no sound from one or more speakers (not all speakers) - THX® audio system	• Fuse • Wiring, terminals or connectors • Speaker • Subwoofer speaker • Audio digital signal processing (DSP) module • ACM	• Go to **Pinpoint Test C**.

• Poor quality/distorted/no sound from all speakers - except THX® audio system	• Wiring, terminals or connectors
	• ACM
		NOTE:
		If DTC B2965 is set in the ACM, the cause of the concern is a short to ground or short to voltage in the circuitry to an individual speaker. Go to Pinpoint Test B.
		• With the key in any position except START, MEASURE the voltage between the ACM C290a-15, circuit CBP13 (GY/BN), harness side and ground.
		  • If any voltage is present, REPAIR the circuit. TEST the system for normal operation.
		  • If no voltage is present, INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

• Poor quality/distorted/no	• Fuse • Wiring, terminals or	

sound from all speakers - THX® audio system	connectors • DSP module • ACM	• Go to **Pinpoint Test D**.
• Poor quality/distorted/no sound while in SYNC mode	• Wiring, terminals or connectors • APIM • ACM	• Go to **Pinpoint Test U**.
• The subwoofer is inoperative/does not operate correctly - Audiophile	• Fuse • Wiring, terminals or connectors • Subwoofer speaker • Subwoofer amplifier • ACM	• Go to **Pinpoint Test E**.
• The subwoofer is inoperative/does not operate correctly - THX® audio system	• Fuse • Wiring, terminals or connectors • Speaker • Subwoofer speaker • DSP module • ACM	• Go to **Pinpoint Test C**.
• Loud popping sound when cycling the ignition switch	• Fuse • Wiring, terminals or connectors • Subwoofer amplifier (Audiophile) • DSP module (THX® audio system) • ACM	• Go to **Pinpoint Test F**.
• The steering wheel controls are inoperative/do not operate correctly	• Wiring, terminals or connectors • Clockspring • Steering wheel controls • ACM • APIM (if equipped)	• Go to **Pinpoint Test G**.
	• Speed sensitive	

• The speed sensitive volume does not operate correctly	volume setting • Vehicle speed sensor (VSS) signal concern • ACM	• Go to **Pinpoint Test Q**.
• The audio input jack is inoperative/does not operate correctly	• Wiring, terminals or connectors • Audio input jack • ACM • APIM (if equipped)	• Go to **Pinpoint Test J**.
• The audio does not reduce when the parking aid tone sounds	• Parking aid system concern • ACM	• Go to **Pinpoint Test N**.
• Voice recognition is inoperative/does not operate correctly - vehicles without the SYNC system	• Fuse • Wiring, terminals or connectors • Microphone (part of interior rear view mirror) • Steering wheel controls • ACM	• Go to **Pinpoint Test P**.
• Voice recognition is inoperative/does not operate correctly - vehicles with the SYNC system	• Fuse • Wiring, terminals or connectors • Microphone (part of interior rear view mirror) • Steering wheel controls • ACM (if equipped with navigation) • APIM	• Go to **Pinpoint Test V**.

Symptom Chart - Navigation

Condition	Possible Sources	Action
• No global positioning system (GPS) antenna signal	• GPS antenna • ACM	• Go to **Pinpoint Test K**.
• Navigation screen only displays Dearborn, Michigan	• GPS antenna	• Go to **Pinpoint Test K**.

• The position cursor is inaccurate	• GPS antenna • Vehicle speed sensor (VSS) signal concern • ACM	• Go to **Pinpoint Test O**.
• The audible switch feedback is inoperative	• Audible switch feedback setting • ACM	• Go to **Pinpoint Test L**.
• The voice guidance is inoperative/does not operate correctly	• Incorrect system setting • Wiring, terminals or connectors (THX® only) • DSP module (if equipped) • ACM	• Go to **Pinpoint Test M**.

• The display screen is inoperative	• ACM	• VERIFY the operation of the AM/FM audio.
		  • If the AM/FM audio system does not operate correctly, go to **Symptom Chart - Audio System**.
		  • If the AM/FM audio system operates correctly, INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

• Unable to insert or eject map disc	• Map DVD • ACM	• REMOVE the map DVD and CLEAN it. INSPECT for scratches, fingerprints, or damage. If the map DVD is damaged, REPLACE the map DVD. If no damage is found, INSERT a known good map DVD. TEST the system. • If the system operates correctly, the concern was caused by a damaged or inoperable

		map DVD. • If the system does not operate correctly, INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.
• The screen does not open/close	• Trim panel interference • ACM	• INSPECT the instrument panel center trim panel for interference with the navigation screen, and REPAIR as necessary. If no interference is found, INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.
• Voice recognition is inoperative/does not operate correctly - vehicles without the SYNC system	• Fuse • Wiring, terminals or connectors • Microphone (part of interior rear view mirror) • Steering wheel controls • ACM	• Go to **Pinpoint Test P**.
• Voice recognition is inoperative/does not operate correctly - vehicles with the SYNC system	• Fuse • Wiring, terminals or connectors • Microphone (part of interior rear view mirror) • Steering wheel controls • ACM (if equipped with navigation) • APIM	• Go to **Pinpoint Test V**.

Symptom Chart - SYNC System

Condition	Possible Sources	Action
• The SYNC system is completely inoperative	• Audio system concern • Communication network concern • Customer error • Customer device • APIM	• Go to **Pinpoint Test R**.
• Unable to pair Bluetooth® device	• Incompatible Bluetooth® device • Customer error • Customer Bluetooth® device • APIM	• Go to **Pinpoint Test S**.
• An individual Bluetooth® device feature is inoperative	• Customer device compatibility	**NOTE:** **If a Bluetooth® device is able to pair with the SYNC system, there are no concerns with the APIM.** • INSTRUCT the customer to review the device compatibility list on the . Not all phone features are available through the SYNC system. This is normal operation.
• The universal serial bus (USB) port is inoperative/does not operate correctly	• Customer USB device • USB cable and port • APIM	• Go to **Pinpoint Test T**.
• The steering wheel controls are inoperative/do not operate correctly	• Wiring, terminals or connectors • Clockspring • Steering wheel controls • ACM • APIM	• Go to **Pinpoint Test G**.
• The audio input jack is inoperative/does not operate correctly	• Wiring, terminals or connectors • Audio input jack • ACM • APIM	• Go to **Pinpoint Test J**.

• The SYNC system audible prompts are inoperative/do not operate correctly	• Wiring, terminals or connectors • Customer setting • ACM • APIM	**NOTE:** **The audible prompts include the text-to-speech (TTS) feature, voice prompts, and ring tones.** • Go to **Pinpoint Test W**.
• During a phone call, no incoming audio is heard in the vehicle	• Wiring, terminals or connectors • Customer setting • ACM • APIM	• Go to **Pinpoint Test W**.
• Voice recognition is inoperative/does not operate correctly	• Fuse • Wiring, terminals or connectors • Microphone (part of interior rear view mirror) • Steering wheel controls • ACM (if equipped with navigation) • APIM	• Go to **Pinpoint Test V**.
• During a phone call, no outgoing audio is heard on the outside device	• Fuse • Wiring, terminals or connectors • Microphone (part of interior rear view mirror) • APIM	• Go to **Pinpoint Test V**.

Pinpoint Tests

Pinpoint Test A: Poor Reception - AM/FM

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation

For MKZ, the radio antenna, integral to the rear window, receives AM and FM radio waves. The antenna module sends the radio waves to the audio control module (ACM) through the antenna cable.

For Fusion and Milan, the antenna receives AM and FM radio waves and transmits them to the ACM through the antenna cable.

For all vehicles, the noise suppression equipment reduces engine ignition and electrical systems interference transmitted through the speakers.

- DTC B2103 (Antenna Not Connected) - sets during the antenna connected test (part of the ACM self-test) when the signal strength is less than the pre-configured threshold value. In order for this DTC to set, the ACM must be tuned to AM, and the self-test must be run with the scan tool.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors (MKZ only)
- Antenna
- Antenna cable
- Charging system
- Ignition system
- Antenna module (MKZ only)
- Noise suppression equipment
- ACM

PINPOINT TEST A: POOR RECEPTION - AM/FM

NOTE:	**Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

A1 CHECK THE AUDIO SYSTEM RECEPTION

- Check the audio system reception with the engine running, and with the engine off.
- **Does the poor reception only occur with the engine running?**

  YES : Go to A2.

  NO : For Fusion and Milan, go to A7 .

  For MKZ, go to A10 .

A2 CHECK THE NOISE SUPPRESSION EQUIPMENT

- Check all required noise suppression equipment and the radio frequency interference suppression bond for security, cleanliness, and metal-to-metal contact.
- **Are the connections clean, secure, and in metal-to-metal contact?**

  YES : Go to A3.

  NO : CLEAN and SECURE the antenna connections, or INSTALL new noise suppression equipment as needed. TEST the system for normal operation.

A3 CHECK THE CAPACITOR MOUNTING AND CONNECTING CIRCUITS

NOTE:	**The capacitor mounting points are used to complete the electrical circuit and must be mounted securely to clean surfaces.**

- Check the mounting and connecting circuits of the radio ignition interference capacitor for security, cleanliness, and metal-to-metal contact.
- **Are the contacts clean, secure, and in metal-to-metal contact?**

  YES : Go to A4.

  NO : CLEAN and SECURE the connections, or INSTALL a new radio ignition interference capacitor as necessary. TEST the system for normal operation.

A4 CHECK THE RADIO INTERFERENCE CAPACITOR

- Check the operation of the radio interference capacitor by installing a known good component.
- Start the vehicle.
- Operate the audio system in radio tuner (AM/FM) mode.
- **Is the reception OK?**

  YES : INSTALL a new radio interference capacitor. TEST the system for normal operation.

  NO : INSTALL the original radio interference capacitor. Go to A5 .

A5 CHECK THE GENERATOR

- Key in OFF position.
- Check the generator by disconnecting the wiring harness from the voltage regulator.
- Start the engine.
- Operate the audio system in radio tuner (AM/FM) mode.
- **Is the reception OK?**

  YES : INSTALL a new generator. REFER to **GENERATOR AND REGULATOR** article. TEST the system for normal operation.

  NO : Go to A6.

A6 CHECK THE IGNITION CIRCUITS

- Key in OFF position.
- Connect the wiring harness to the voltage regulator.
- Check the ignition circuits for correct routing, grounding, and integrity of the connections.
- **Are the ignition components OK?**

  YES : USE a jumper cable to ground various parts of the vehicle to the frame (for example: engine, fenders, quarter panels, stone deflectors, air cleaner, body sheet metal). When the noise is eliminated, PROVIDE a permanent ground where necessary. TEST the system for normal operation.

  NO : REPAIR the ignition system as necessary. TEST the system for normal operation.

A7 CHECK THE ANTENNA GROUND

- Key in OFF position.
- Measure the resistance between the antenna base and the battery ground cable.
- **Is the resistance less than 5 ohms?**

  YES : Go to A9.

  NO : Go to A8.

A8 CHECK THE ANTENNA CABLE CONNECTIONS

- Check the antenna connections, including the extension cable.
- Check to make sure the antenna is securely mounted to the vehicle body at ground points.
- **Are the connections clean, secure, and in metal-to-metal contact?**

  YES : Go to A9.

  NO : CLEAN and SECURE the antenna connections as necessary. CLEAR the DTCs. REPEAT the self-test.

A9 SUBSTITUTE THE ANTENNA

- Substitute a known good antenna.
- Operate the audio system in radio tuner (AM/FM) mode.
- **Is the reception OK?**

  YES : INSTALL a new antenna. CLEAR the DTCs. REPEAT the self-test.

  NO : TURN the key to OFF. INSTALL the original antenna. Go to A14 .

A10 CHECK THE ANTENNA MODULE POWER CIRCUIT

- Key in OFF position.
- Disconnect: Antenna Module C4194a (MKZ)
- Operate the audio system in radio tuner (AM/FM) mode.

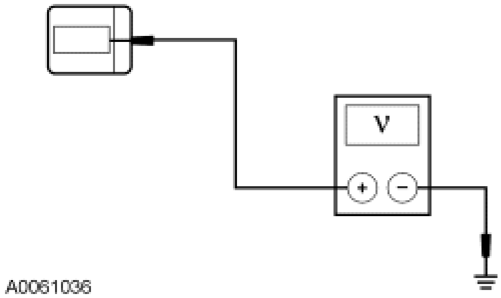


Fig. 3: Checking Antenna Module Power Circuit
Courtesy of FORD MOTOR CO.

- Measure the voltage between the antenna module C4194a-1, circuit CME44 (YE/GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A12.

  NO : Go to A11.

A11 CHECK CIRCUIT CME44 (YE/GN) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Disconnect: ACM C290a or C240a

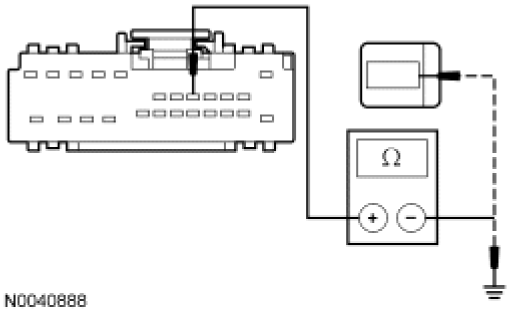


Fig. 4: Checking Circuit CME44 (YE/GN) For An Open Or Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the ACM C290a-5 or C240a-5, circuit CME44 (YE/GN), harness side and the antenna module C4194a-1, circuit CME44 (YE/GN), harness side; and between the ACM C290a-5 or C240a-5, circuit CME44 (YE/GN), harness side and ground.
- **Is the resistance less than 5 ohms between the antenna module and the ACM, and greater than 10,000 ohms between the ACM and ground?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

A12 CHECK THE ANTENNA GRID

- Key in OFF position.
- Inspect the antenna grid closely for signs of damage.
- **Is the antenna grid OK?**

  YES : Go to A13.

  NO : REPAIR the antenna grid as necessary. REFER to **GLASS, FRAMES AND MECHANISMS** article. TEST the system for normal operation.

A13 ISOLATE THE ANTENNA MODULE

- Key in OFF position.
- Substitute the antenna module for a known good antenna module.
- Operate the audio system in radio tuner (AM/FM) mode.
- **Is the reception OK?**

  YES : INSTALL a new antenna module. REFER to **Antenna Module**. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL the original antenna module. Go to A14 .

A14 SUBSTITUTE THE ANTENNA LEAD-IN CABLE

- Key in OFF position.
- Substitute a known good antenna lead-in cable.
- Operate the audio system in radio tuner (AM/FM) mode.
- **Is the reception OK?**

  YES : INSTALL a new antenna lead-in cable. CLEAR the DTCs. REPEAT the self-test.

NO : Go to A15.

A15 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the ACM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: Poor Quality/Distorted/No Sound From One Or More Speakers (Not All Speakers) - Except THX® Audio System

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation

The audio control module (ACM) directs the audio signals to the speakers through separate positive and negative circuits for each of the 4 audio channels: LH front, RH front, LH rear, and RH rear. The ACM provides internal circuit protection for shorts to ground or shorts to voltage. For vehicles with door tweeter speakers, the speakers are wired in series with the door speakers.

- DTC B2965 (Audio System Speaker Circuit Fault) - sets when a short to ground is detected on any of the speaker circuits. For all audio systems except single CD, DTC B2965 also sets when an open circuit or short to voltage is detected.

For some audio systems, a short to ground or short to voltage in the circuitry to one of the speakers will cause all speakers to lose sound due to the built-in overload protection feature of the ACM. In this case, DTC B2965 will set in the ACM, and this pinpoint test should be followed to isolate the damaged circuit.

For the navigation system, if the voice guidance setting is set to zero rather than to off, it may appear that the front speakers intermittently produce no sound. Make sure the voice guidance setting is not set to zero before addressing a concern with the front speakers.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

- Speaker
- ACM

PINPOINT TEST B: POOR QUALITY/DISTORTED/NO SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS) - EXCEPT THX® AUDIO SYSTEM

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 ISOLATE THE SUSPECT SPEAKER

- Carry out the speaker walk-around test.
- **Is the concern with a tweeter speaker?**

YES : Go to B5.

NO : Go to B2.

B2 CHECK THE SPEAKER CIRCUITS FOR VOLTAGE

- Key in OFF position.
- Disconnect: Suspect Speaker
- Operate the audio system in radio tuner (AM/FM) mode.
- Measure the AC voltage between the suspect speaker pin 1 and pin 2, harness side as follows:

Suspect Speaker	Connector-Pin/ Circuit	Connector-Pin/ Circuit
LH front	C523-1 VME07 (WH or GN/BK)	C523-2 RME07 (WH/BN)
RH front	C612-1 VME10 (WH/VT or VT/BK)	C612-2 RME10 (WH/OG)
LH rear	C702-1 VME09 (BN/GN)	C702-2 RME09 (BN/YE)
RH rear	C802-1 VME12 (BN/WH)	C802-2 RME12 (BN/BU)

- **Is a fluctuating AC voltage present?**

YES : INSTALL a new speaker for the suspect speaker. REFER to **Door Speaker** or **Parcel Shelf Speaker**. CLEAR the DTCs. REPEAT the self-test.

NO : Go to B3.

B3 CHECK THE SPEAKER CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C290a or C240a
- Key in ON position.
- Measure the voltage between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Connector-Pin/ Circuit	Connector-Pin/ Circuit
LH front	C523-1 VME07 (WH or GN/BK)	C523-2 RME07 (WH/BN)
RH front	C612-1 VME10 (WH/VT or VT/BK)	C612-2 RME10 (WH/OG)
LH rear	C702-1 VME09 (BN/GN)	C702-2 RME09 (BN/YE)
RH rear	C802-1 VME12 (BN/WH)	C802-2 RME12 (BN/BU)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to B4.

B4 CHECK THE SPEAKER CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the ACM, harness side and the suspect speaker, harness side; and between the ACM, harness side and ground as follows:

Suspect Speaker	ACM Connector-Pin	Speaker Connector-Pin	Circuit
LH front	C290a-8 or C240a-8	C523-1	VME07 (WH)
LH front	C290a-21 or C240a-21	C523-2	RME07 (WH/BN)
RH front	C290a-11 or C240a-11	C612-1	VME10 (WH/VT)
RH	C290a-12 or C240a-	C612-2	RME10

front	12		(WH/OG)
LH rear	C290a-9 or C240a-9	C702-1	VME09 (BN/GN)
LH rear	C290a-22 or C240a-22	C702-2	RME09 (BN/YE)
RH rear	C290a-10 or C240a-10	C802-1	VME12 (BN/WH)
RH rear	C290a-23 or C240a-23	C802-2	RME12 (BN/BU)

- **Are the resistances less than 5 ohms between the ACM and the speaker, and greater than 10,000 ohms between the ACM and ground?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

B5 CHECK FOR VOLTAGE TO THE SUSPECT TWEETER SPEAKER

- Key in OFF position.
- Disconnect: Suspect Tweeter Speaker
- Operate the audio system in radio tuner (AM/FM) mode.
- Measure the AC voltage between the suspect tweeter speaker pin 1 and pin 2, harness side as follows:

Suspect Speaker	Connector-Pin/ Circuit	Connector-Pin/ Circuit
LH tweeter	C569-1 VME08 (GN/OG)	C569-2 RME08 (GY/OG)
RH tweeter	C645-1 VME11 (VT/OG)	C645-2 RME11 (YE/OG)

- **Is a fluctuating AC voltage present?**

  YES : INSTALL a new speaker for the suspect tweeter speaker. REFER to **Door Speaker**. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to B6.

B6 CHECK THE TWEETER SPEAKER CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: LF Speaker C513 or RF Speaker C613
- Key in ON position.

- Measure the voltage between the suspect tweeter speaker, harness side and ground as follows:

Suspect Tweeter Speaker	Tweeter Speaker Connector-Pin	Circuit
LH tweeter	C569-1	VME08 (GN/OG)
LH tweeter	C569-2	RME08 (GY/OG)
RH tweeter	C645-1	VME11 (VT/OG)
RH tweeter	C645-2	RME11 (YE/OG)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to B7.

B7 CHECK THE TWEETER SPEAKER CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the suspect tweeter speaker, harness side and the respective door speaker, harness side; and between the suspect tweeter speaker, harness side and ground as follows:

Suspect Tweeter Speaker	Tweeter Speaker Connector-Pin	Door Speaker Connector-Pin	Circuit
LH tweeter	C569-1	C513-1	VME08 (GN/OG)
LH tweeter	C569-2	C513-2	RME08 (GY/OG)
RH tweeter	C645-1	C613-1	VME11 (VT/OG)
RH tweeter	C645-2	C613-2	RME11 (YE/OG)

- **Is the resistance less than 5 ohms between the suspect tweeter speaker and the door speaker, and greater than 10,000 ohms between the suspect tweeter speaker and ground?**

  YES : Go to B8.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

B8 ISOLATE THE DOOR SPEAKER

- Connect: Suspect Tweeter Speaker
- Install a known good door speaker for the door with the suspect tweeter speaker.

- Operate the audio system in radio tuner (AM/FM) mode.
- **Does the tweeter speaker operate correctly?**

  YES : INSTALL a new door speaker. REFER to **Door Speaker**. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL a new tweeter speaker. REFER to **Door Speaker**. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: Poor Quality/Distorted/No Sound From One Or More Speakers (Not All Speakers) - THX® Audio System

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation

The audio control module (ACM) directs the audio signals to the audio digital signal processing (DSP) module, which processes the audio signals and sends them to the speakers. Each speaker has a signal and return circuit.

DTC Description	Fault Trigger Conditions
B1158 - Subwoofer #2 Open	Sets when an open is detected on either of the RH subwoofer circuit.
B2913 - Audio Subwoofer Not Connected	Sets when an open is detected on either of the LH subwoofer circuit.
B2925 - Subwoofer Speaker Short Circuit	Sets when a short to ground is detected in the LH subwoofer circuit.
B292A - Subwoofer #2 Speaker Short Circuit	Sets when a short to ground is detected in the RH subwoofer circuit.
B2965 - Audio System Speaker Circuit Failure.	Sets when an open or a short to ground is detected on any of the speaker circuits. It should also be noted that the ACM will not set B2965 when the vehicle is equipped with the THX® audio system

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Speaker
- Subwoofer speaker
- DSP module
- ACM

PINPOINT TEST C: POOR QUALITY/DISTORTED/NO SOUND FROM ONE OR MORE SPEAKERS (NOT ALL SPEAKERS) - THX® AUDIO SYSTEM

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CHECK THE AUDIO SIGNALS TO THE SUSPECT SPEAKER

- Key in OFF position.
- Disconnect: Suspect Speaker
- Operate the audio system in radio tuner (AM/FM) mode.
- Measure the AC voltage between the suspect speaker pins, harness side as follows:

Suspect Speaker	Speaker Connector-Pin/ Circuit	Speaker Connector-Pin/ Circuit
LH subwoofer	C3307-1 VME01 (GN/VT)	C3307-2 RME01 (GY)
LR door	C702-1 VME09 (BN/GN)	C702-2 RME09 (BN/YE)
LF door	C523-1 VME07 (WH)	C523-2 RME07 (WH/BN)
LH tweeter	C569-1 VME08 (GN/OG)	C569-2 RME08 (GY/OG)
LH front imaging	C2358-1 VME28 (BN/VT)	C2358-4 RME28 (BN/GN)
Center front imaging	C2358-2 VME06 (GN)	C2358-5 RME06 (GY/YE)
RH front imaging	C2358-3 VME29 (GN/WH)	C2358-6 RME29 (BU/WH)
RH tweeter	C645-1 VME11 (VT/OG)	C645-2 RME11 (YE/OG)
RF door	C612-1 VME10 (WH/VT)	C612-2 RME10 (WH/OG)
RR door	C802-1 VME12 (BN/WH)	C802-2 RME12 (BN/BU)
RH	C3308-1	C3308-2

subwoofer	VME02 (VT)	RME02 (YE)
Rear center imaging	C3306-1 VME30 (GN/BN)	C3306-2 RME30 (VT/BN)

- **Is a fluctuating AC voltage present?**

  YES : INSTALL a new speaker for the suspect speaker. REFER to **Door Speaker**, **Instrument Panel Speaker**, or **Parcel Shelf Speaker** . CLEAR the DTCs. REPEAT the self-test.

  NO : Go to C2.

C2 CHECK THE CIRCUITS TO THE SUSPECT SPEAKER FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSP Module C4326a or C4326b
- Key in ON position.
- Measure the voltage between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Speaker Connector-Pin	Speaker Connector-Pin
LH subwoofer	C3307-1	VME01 (GN/VT)
	C3307-2	RME01 (GY)
LR door	C702-1	VME09 (BN/GN)
	C702-2	RME09 (BN/YE)
LF door	C523-1	VME07 (WH)
	C523-2	RME07 (WH/BN)
LH tweeter	C567-1	VME08 (GN/OG)
	C567-2	RME08 (GY/OG)
LH front imaging	C2358-1	VME28 (BN/VT)
	C2358-4	RME28 (BN/GN)
Center front imaging	C2358-2	VME06 (GN)
	C2358-5	RME06 (GY/YE)

RH front imaging	C2358-3	VME29 (GN/WH)
	C2358-6	RME29 (BU/WH)
RH tweeter	C645-1	VME11 (VT/OG)
	C645-2	RME11 (YE/OG)
RF door	C612-1	VME10 (WH/VT)
	C612-2	RME10 (WH/OG)
RR door	C802-1	VME12 (BN/WH)
	C802-2	RME12 (BN/BU)
RH subwoofer	C3306-1	VME30 (GN/BN)
	C3306-2	RME30 (VT/BN)
Rear center imaging	C3308-1	VME02 (VT)
	C3308-2	RME02 (YE)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to C3.

C3 CHECK THE CIRCUITS TO THE SUSPECT SPEAKER FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the suspect speaker, harness side and the DSP module, harness side; and between the suspect speaker, harness side and ground as follows:

Suspect Speaker	Speaker Connector-Pin	DSP Module Connector-Pin	Circuit
LH subwoofer	C3307-1 C3307-2	C4326b-16 C4326b-17	VME01 (GN/VT) RME01 (GY)
			VME09

LR door	C702-1 C702-2	C4326b-7 C4326-6	(BN/GN) RME09 (BN/YE)
LF door	C523-1 C523-2	C4326b-3 C4326b-2	VME07 (WH) RME07 (WH/BN)
LH tweeter	C567-1 C567-2	C4326a-9 C4326a-10	VME08 (GN/OG) RME08 (GY/OG)
LH front imaging	C2358-1 C2358-4	C4326a-2 C4326a-1	VME28 (BN/VT) RME28 (BN/GN)
Center front imaging	C2358-2 C2358-5	C4326a-4 C4326a-3	VME06 (GN) RME06 (GY/YE)
RH front imaging	C2358-3 C2358-6	C4326a-6 C4326a-5	VME29 (GN/WH) RME29 (BU/WH)
RH tweeter	C645-1 C645-2	C4326a-11 C4326a-12	VME11 (VT/OG) RME11 (YE/OG)
RF door	C612-1 C612-2	C4326b-5 C4326b-4	VME10 (WH/VT) RME10 (WH/OG)
RR door	C802-1 C802-2	C4326b-18 C4326b-19	VME12 (BN/WH) RME12 (BN/BU)
RH subwoofer	C3306-1 C3306-2	C4326a-13 C4326a-14	VME30 (GN/BN) RME30 (VT/BN)
Rear center imaging	C3308-1 C3308-2	C4326b-14 C4326b-15	VME02 (VT) RME02 (YE)

- **Is the resistance less than 5 ohms between the suspect speaker and the DSP module, and greater than 10,000 ohms between the suspect speaker and ground?**

YES : Go to C4.

NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C4 ISOLATE THE SUSPECT SPEAKER

- Key in OFF position.
- Connect: DSP Module C4326a and C4326b
- Substitute a known good speaker for the suspect speaker.
- Operate the audio system in radio tuner (AM/FM) mode.
- **Is the concern still present?**

  YES : INSTALL the original speaker. Go to C5 .

  NO : INSTALL a new speaker for the suspect speaker. REFER to **Door Speaker**, **Instrument Panel Speaker**, or **Parcel Shelf Speaker** . CLEAR the DTCs. REPEAT the self-test.

C5 CHECK FOR CORRECT DSP MODULE OPERATION

- Key in OFF position.
- Disconnect all the DSP module connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the DSP module connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DSP module. REFER to **Audio Digital Signal Processing (DSP) Module**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: Poor Quality/Distorted/No Sound From All Speakers - THX® Audio System

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation

The audio control module (ACM) enables the audio digital signal processing (DSP) module through circuit CME27 (YE/VT). The DSP module receives voltage through circuits SBB20 (GN/RD) and SBB21 (GY/RD), and ground through circuit GD148 (BK/YE).

Left and right channel audio signals are sent from the ACM to the DSP module through circuits VME17 (GN), RME17 (GY), VME18 (VT), and RME18 (YE). If there is a fault on one of these circuits, the audio quality will be reduced approximately 25% for all speakers.

The enable/clip circuit CME27 (YE/VT) carries out 2 functions: to turn the DSP module on, and to monitor an overload condition to the DSP module. In the event of an overload, the ACM clips the audio output signal to the DSP module (heard as distortion).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- DSP module
- ACM

PINPOINT TEST D: NO SOUND FROM ALL SPEAKERS - THX® AUDIO SYSTEM

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

D1 CHECK CIRCUITS SBB20 (GN/RD) AND CIRCUIT SBB21 (GY/RD) FOR VOLTAGE

- Key in OFF position.
- Disconnect: DSP Module C4326b
- Measure the voltage between the DSP module, harness side and ground as follows:

Connector-Pin	Circuit
C4326b-9	SBB21 (GY/RD)
C4326b-10	SBB21 (GY/RD)
C4326b-11	SBB20 (GN/RD)
C4326b-12	SBB20 (GN/RD)

- **Are the voltages greater than 10 volts?**

  YES : Go to D2.

  NO : VERIFY the battery junction box (BJB) fuse 20 (20A) or fuse 21 (20A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D2 CHECK CIRCUIT GD148 (BK/YE) FOR AN OPEN

- Measure the resistance between the DSP module, harness side and ground as follows:

Connector-Pin	Circuit
C4326b-22	GD148 (BK/YE)

C4326b-23	GD148 (BK/YE)
C4326b-24	GD148 (BK/YE)

- **Are the resistances less than 5 ohms?**

  YES : Go to D3.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D3 CHECK CIRCUIT CME27 (YE/VT) FOR VOLTAGE

- Operate the audio system in radio tuner (AM/FM) mode.

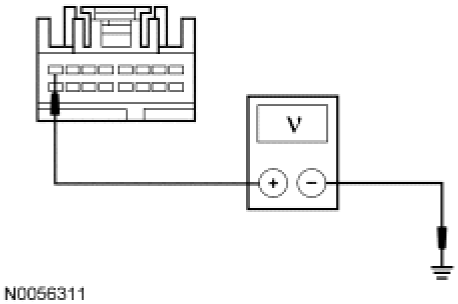


Fig. 5: Checking Circuit CME27 (YE/VT) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the DSP module C4326c-8, circuit CME27 (YE/VT), harness side and ground.
- **Is the voltage between 3.8 and 6.7 volts?**

  YES : Go to D5.

  NO : Go to D4.

D4 CHECK CIRCUIT CME27 (YE/VT) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Disconnect: ACM C240d

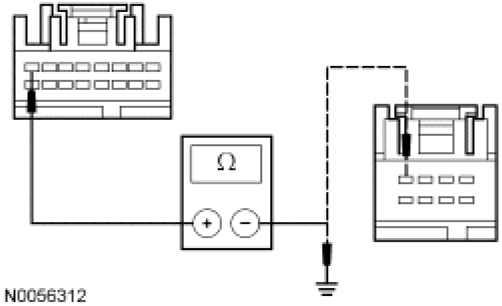


Fig. 6: Checking Circuit CME27 (YE/VT) For An Open Or Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DSP module C4326c-8, circuit CME27 (YE/VT), harness side and the ACM C240d-4, circuit CME27 (YE/VT), harness side; and between the DSP module C4326c-8, circuit CME27 (YE/VT), harness side and ground.
- **Is the resistance less than 5 ohms between the DSP module and the ACM, and greater than 10,000 ohms between the DSP module and ground?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

D5 CHECK THE AUDIO SIGNALS TO THE DSP MODULE

- Operate the audio system in radio tuner (AM/FM) mode.
- Measure the AC voltage between the audio circuits at the DSP module as follows:

Suspect Speaker Bank	DSP Module Connector-Pin	Circuit
LH	C4326c-1	VME17 (GN)
	C4326c-2	RME17 (GY)
RH	C4326c-3	VME18 (VT)
	C4326c-4	RME18 (YE)

- **Is a fluctuating AC voltage present?**

  YES : Go to D8.

  NO : Go to D6.

D6 CHECK THE AUDIO CIRCUITS TO THE DSP MODULE FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C240a
- Key in ON position.
- Measure the voltage between the DSP module, harness side and ground as follows:

Connector-Pin	Circuit
C4326c-1	VME17 (GN)
C4326c-2	RME17 (GY)
C4326c-3	VME18 (VT)

C4326c-4	RME18 (YE)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to D7.

D7 CHECK THE AUDIO CIRCUITS TO THE DSP MODULE FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the DSP module, harness side and the ACM, harness side; and between the DSP module, harness side and ground as follows:

DSP Module Connector-Pin	ACM Connector-Pin	Circuit
C4326c-1	C240a-8	VME17 (GN)
C4326c-2	C240a-21	RME17 (GY)
C4326c-3	C240a-11	VME18 (VT)
C4326c-4	C240a-12	RME18 (YE)

- **Is the resistance less than 5 ohms between the DSP module and the ACM, and greater than 10,000 ohms between the DSP module and ground?**

  YES : Go to D9.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D8 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the ACM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

D9 CHECK FOR CORRECT DSP MODULE OPERATION

- Key in OFF position.
- Disconnect all the DSP module connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the DSP module connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DSP module. REFER to **Audio Digital Signal Processing (DSP) Module**. CLEAR the ACM DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: The Subwoofer is Inoperative/Does Not Operate Correctly - Audiophile

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation

The subwoofer speakers are powered by a separate subwoofer amplifier. The subwoofer amplifier receives voltage through circuit CBP06 (WH/BU), and ground through circuit GD148 (BK/YE).

To enable the subwoofer amplifier, the audio control module (ACM) sends voltage through the enable/clip circuit SME23 (VT/RD). The circuit acts as both an output (to enable the amplifier) and an input (to detect an amplifier overload condition). A variable resistor in the subwoofer amplifier modifies the voltage signal from the ACM. In the event of an overload, the ACM clips the audio output signal to the amplifier (heard as distortion), in order to prevent damage to the amplifier and the subwoofer speaker.

The clip/enable status is based on the following voltages, as detected by the ACM:

- Less then 0.4 volts: amplifier disabled
- Between 3.8 and 6.7 volts: amplifier enabled
- Greater than 8.5 volts: amplifier clipped

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors

- Subwoofer speaker
- Subwoofer amplifier
- ACM

PINPOINT TEST E: THE SUBWOOFER IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - AUDIOPHILE

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

E1 DETERMINE THE INOPERATIVE SUBWOOFER

- Key in ON position.
- Operate the audio system in radio tuner (AM/FM) mode and observe the subwoofer operation.
- **Do both of the subwoofers have a concern?**

  YES : Go to E2.

  NO : Go to E10.

E2 CHECK CIRCUIT CBP06 (WH/BU) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Subwoofer Amplifier C466a

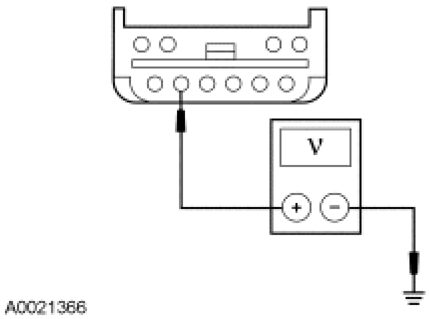


Fig. 7: Checking Circuit CBP06 (WH/BU) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the subwoofer amplifier C466a-5, circuit CBP06 (WH/BU), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to E3.

  NO : VERIFY the smart junction box (SJB) fuse 17 (20A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

E3 CHECK CIRCUIT GD148 (BK/YE) FOR AN OPEN

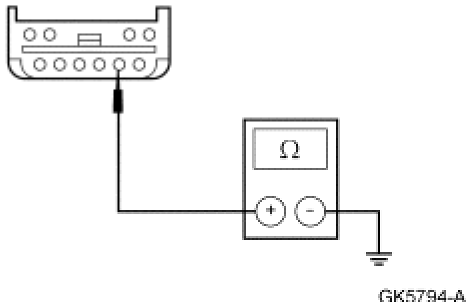


Fig. 8: Checking Circuit GD148 (BK/YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the subwoofer amplifier C466a-2, circuit GD148 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to E4.

  NO : REPAIR the circuit. TEST the system for normal operation.

E4 CHECK CIRCUIT SME23 (VT/RD) FOR VOLTAGE

- Key in ON position.
- Operate the audio system in radio tuner (AM/FM) mode.

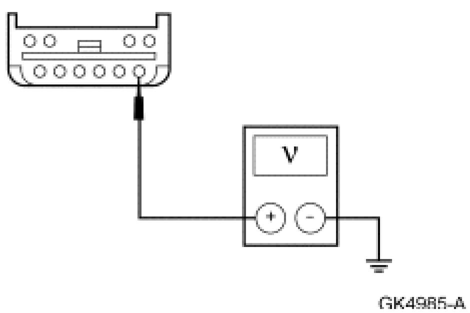


Fig. 9: Checking Circuit SME23 (VT/RD) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the subwoofer amplifier C466a-1, circuit SME23 (VT/RD), harness side and ground.
- **Is the voltage between 3.8-6.7 volts?**

  YES : If the subwoofers have poor quality/distorted sound, go to E7 .

  If the subwoofers have no sound, INSTALL a new subwoofer amplifier. REFER to **Subwoofer Amplifier**. TEST the system for normal operation.

  NO : Go to E5.

E5 CHECK CIRCUIT SME23 (VT/RD) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.

- Disconnect: ACM C290d

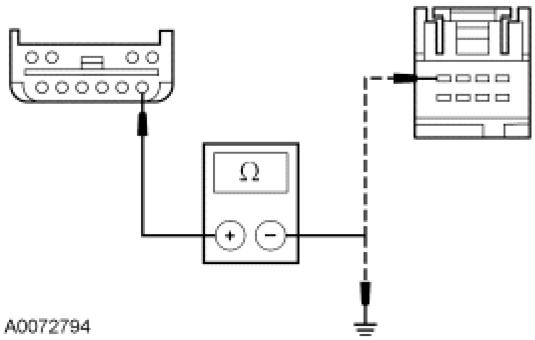


Fig. 10: Checking Circuit SME23 (VT/RD) For An Open Or Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the subwoofer amplifier C466a-1, circuit SME23 (VT/RD), harness side and the ACM C290d-4, circuit SME23 (VT/RD), harness side; and between the subwoofer amplifier C466a-1, circuit SME23 (VT/RD), harness side and ground.
- **Is the resistance less than 5 ohms between the subwoofer amplifier and the ACM, and greater than 10,000 ohms between the subwoofer amplifier and ground?**

  YES : Go to E6.

  NO : REPAIR the circuit. TEST the system for normal operation.

E6 CHECK CIRCUIT SME23 (VT/RD) FOR A SHORT TO VOLTAGE

- Key in ON position.

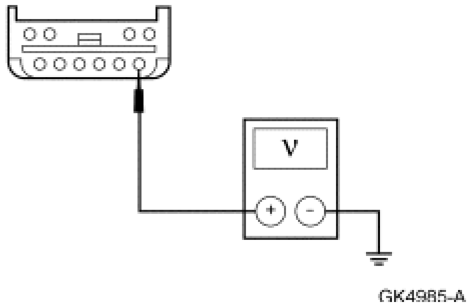


Fig. 11: Checking Circuit SME23 (VT/RD) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the subwoofer amplifier C466a-1, circuit SME23 (VT/RD), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

E7 CHECK THE AUDIO SIGNAL TO THE SUBWOOFER AMPLIFIER

- Key in OFF position.

- Key in ON position.
- Operate the audio system in radio tuner (AM/FM) mode.

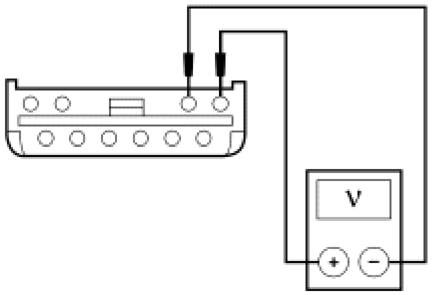


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Fig. 12: Checking Audio Signal To Subwoofer Amplifier
Courtesy of FORD MOTOR CO.

- Measure the AC voltage between the subwoofer amplifier C466a-7, circuit VME22 (VT/GN), harness side and the subwoofer amplifier C466a-8, circuit RME22 (GN/WH), harness side.
- **Is a fluctuating AC voltage present?**

  YES : INSTALL a new subwoofer amplifier. REFER to **Subwoofer Amplifier**. TEST the system for normal operation.

  NO : Go to E8.

E8 CHECK THE AUDIO CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C290d
- Key in ON position.

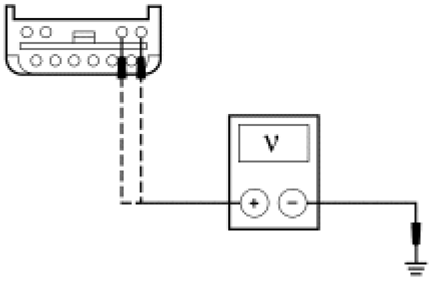

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Fig. 13: Checking Audio Circuits For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the subwoofer amplifier C466a-7, circuit VME22 (VT/GN), harness side and ground; and between the subwoofer amplifier C466a-8, circuit RME22 (GN/WH), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

NO : Go to E9.

E9 CHECK THE AUDIO CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the subwoofer amplifier, harness side and the ACM, harness side; and between the subwoofer amplifier, harness side and ground as follows:

Subwoofer Amplifier Connector-Pin	ACM Connector-Pin	Circuit
C466a-7	C290d-1	VME22 (VT/GN)
C466a-8	C290d-2	RME22 (GN/WH)

- **Is the resistance less than 5 ohms between the subwoofer amplifier and the ACM, and greater than 10,000 ohms between the subwoofer amplifier and ground?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

E10 CHECK THE AUDIO CIRCUITS TO THE SUSPECT SUBWOOFER SPEAKER FOR VOLTAGE

- Key in OFF position.
- Disconnect: Suspect Subwoofer Speaker
- Key in ON position.
- Operate the audio system in radio tuner (AM/FM) mode.

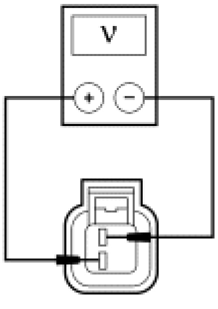


Fig. 14: Checking Audio Circuits To Suspect Subwoofer Speaker For Voltage
Courtesy of FORD MOTOR CO.

- Measure the AC voltage between the LH subwoofer speaker C3120-1, circuit VME01 (GN/VT), harness side and the LH subwoofer speaker C3120-2, circuit RME01 (GY), harness side; or between the RH subwoofer speaker C3121-1, circuit VME02 (VT), harness side and the RH subwoofer speaker C3121-2, circuit RME02 (YE), harness side.

- **Is a fluctuating AC voltage present?**

  YES : INSTALL a new subwoofer speaker for the suspect speaker. REFER to **Subwoofer Speaker**. TEST the system for normal operation.

  NO : Go to E11.

E11 CHECK THE AUDIO CIRCUITS TO THE SUSPECT SUBWOOFER SPEAKER FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Subwoofer Amplifier C466b
- Key in ON position.
- Measure the voltage between the suspect subwoofer speaker, harness side and ground as follows:

Suspect Subwoofer Speaker	Connector-Pin/ Circuit	Connector-Pin/ Circuit
LH	C3120-1 VME01 (GN/VT)	C3120-2 RME01 (GY)
RH	C3121-1 VME02 (VT)	C3121-2 RME02 (YE)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to E12.

E12 CHECK THE AUDIO CIRCUITS TO THE SUSPECT SUBWOOFER SPEAKER FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the suspect subwoofer speaker, harness side and the subwoofer amplifier, harness side; and between the suspect subwoofer speaker, harness side and ground as follows:

Suspect Subwoofer Speaker	Subwoofer Speaker Connector-Pin	Subwoofer Amplifier Connector-Pin	Circuit
LH	C3120-1	C466b-1	VME01 (GN/VT)
LH	C3120-2	C466b-2	RME01 (GY)
RH	C3121-1	C466b-3	VME02 (VT)
RH	C3121-2	C466b-4	RME02 (YE)

- **Is the resistance less than 5 ohms between the suspect subwoofer speaker and the subwoofer amplifier, and greater than 10,000 ohms between the suspect subwoofer speaker and ground?**

  YES : INSTALL a new subwoofer amplifier. REFER to **Subwoofer Amplifier**. TEST the system for normal operation.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

Pinpoint Test F: Loud Popping Sound When Cycling The Ignition Switch

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation

Voltage is sent through the start input circuit CBP13 (GY/BN) to the audio control module (ACM) with the key in START. Upon receiving this signal, the ACM mutes all speaker outputs to eliminate the possibility of speaker pops during engine cranking.

For the Audiophile audio system, the ACM disables the subwoofer while the key is in START by keeping the enable signal below 0.4 volts on circuit SME23 (VT/RD).

For the THX® audio system, the ACM disables the audio digital signal processing (DSP) module while the key is in START by keeping the enable signal below 0.4 volts on circuit SME23 (VT/RD).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Subwoofer amplifier (Audiophile)
- DSP module (THX® audio system)
- ACM

PINPOINT TEST F: LOUD POPPING SOUND WHEN CYCLING THE IGNITION SWITCH

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

F1 CHECK CIRCUIT CBP13 (GY/BN) FOR VOLTAGE

- Key in OFF position.
- Disconnect: ACM C290a or C240a
- Disconnect: Starter Relay
- Key in START position.

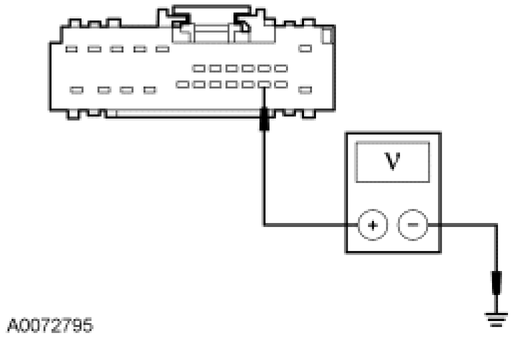


Fig. 15: Checking Circuit CBP13 (GY/BN) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the ACM C290a-15 or C240a-15, circuit CBP13 (GY/BN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : For the Audiophile audio system, go to F2 .

  For the THX® audio system, go to F3 .

  For all others, INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : VERIFY the smart junction box (SJB) fuse 22 (7.5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

F2 ISOLATE THE SUBWOOFER AMPLIFIER

- Key in OFF position.
- Connect: ACM C290a
- Connect: Starter Relay
- Disconnect: Subwoofer Amplifier C466a
- Cycle the key through all of the ignition switch positions.
- **Is a loud popping sound present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : INSTALL a new subwoofer amplifier. REFER to **Subwoofer Amplifier**. TEST the system for normal operation.

F3 ISOLATE THE DSP MODULE

- Key in OFF position.
- Connect: ACM C240a
- Connect: Starter Relay
- Disconnect: DSP Module C4326b
- Cycle the key through all of the ignition switch positions.
- **Is a loud popping sound present?**

YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

NO : Go to F4.

F4 CHECK FOR CORRECT DSP MODULE OPERATION

- Key in OFF position.
- Disconnect all the DSP module connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the DSP module connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DSP module. REFER to **Audio Digital Signal Processing (DSP) Module**. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test G: The Steering Wheel Controls Are Inoperative/Do Not Operate Correctly

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation

There are 4 different steering wheel controls configurations:

- Non-navigation, without SYNC
- Non-navigation, with SYNC
- Navigation, without SYNC
- Navigation, with SYNC

The VOL-, VOL+, SEEK-, SEEK+, and MEDIA buttons are always wired to the audio control module (ACM). Voltage is sent from the ACM to the steering wheel controls through circuit VME14 (GY/YE), and the ACM ground the reference voltage through circuit RME24 (BU/WH).

For vehicles equipped with navigation, but not the SYNC system, the VOICE button is wired to the ACM.

For vehicles equipped with the SYNC system, the VOICE (an icon of someone speaking), PHONE (an icon of a phone with an up and down arrow), and OK buttons are wired directly to the accessory protocol interface module (APIM) unless the vehicle is equipped with navigation, in which case there is no OK button, and the VOICE and PHONE buttons are wired to the ACM. Voltage is sent from the APIM (or ACM if equipped with

navigation) to the steering wheel controls through circuit VME54 (BU/OG), and the APIM (or ACM if equipped with navigation) grounds the reference voltage through circuit RME24 (BU/WH) (which is circuit RME54 [WH/VT] at the steering wheel controls).

For all configurations, when a switch is pressed, the voltage is routed through a specific resistor value for each function. The ACM (or APIM) then uses the reference voltage to determine which control input function has been selected.

- DTC B1117 (Audio Steering Wheel Button Stuck) - set by the ACM or the APIM (depending on vehicle configuration) when a steering wheel control switch is detected as active for more than 120 seconds during normal operation, or for any duration during the self-test. A short to ground on VME14 (GY/YE) should not set this DTC, as the reference voltage would fall out-of-range, resulting in DTC B1136 or B2404 being set.
- DTC B1136 (Audio Steering Wheel Switch #2 Circuit Failure) - set by the ACM or the APIM (depending on vehicle configuration) when the reference voltage to the steering wheel controls is out-of-range. This can be caused by a number of different failures on the steering wheel controls circuit except for a stuck button or a short to ground in circuit RME24 (BU/WH). This DTC only applies to the VOICE, PHONE, and OK buttons.
- DTC B2404 (Audio Steering Wheel Switch Circuit Fault) - set by the ACM when the reference voltage to the steering wheel controls is out-of-range. This can be caused by a number of different failures on the steering wheel controls circuit except for a stuck button a short to ground in circuit RME24 (BU/WH). This DTC only applies to the VOL-, VOL+, SEEK-, SEEK+, and MEDIA buttons.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Clockspring
- Steering wheel controls
- ACM
- APIM (if equipped)

PINPOINT TEST G: THE STEERING WHEEL CONTROLS ARE INOPERATIVE/DO NOT OPERATE CORRECTLY

NOTE:	**Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

G1 DETERMINE THE INOPERATIVE STEERING WHEEL CONTROLS

- Determine which steering wheel controls are inoperative by pressing each steering wheel control button individually while operating the audio system in various modes (AM/FM, SYNC, etc.).
- **Is the concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA button?**

  YES : Go to G2.

  NO : Go to G3.

G2 MONITOR THE STEERING WHEEL CONTROL PIDs (EXCEPT NAVIGATION/SYNC SWITCHES)

- Enter the following diagnostic mode on the diagnostic tool: ACM DataLogger
- Monitor the steering wheel controls PIDs while pressing each steering wheel controls button as follows:

Steering Wheel Controls Button	PID
VOL-	VOL_DN
VOL+	VOL_UP
SEEK-	SEEK_DN
SEEK+	SEEK_UP
MEDIA	MODE_SW

- **Do the PID values agree with the switch positions?**

  YES : Go to G8.

  NO : If only one PID value is incorrect or the PID value always reads one particular switch position, INSTALL new steering wheel controls. REFER to **Steering Wheel Controls**. CLEAR any DTCs present. TEST the system for normal operation.

  Otherwise, go to G4.

G3 MONITOR THE STEERING WHEEL CONTROL PIDs (NAVIGATION/SYNC SWITCHES)

- Enter the following diagnostic mode on the diagnostic tool: ACM DataLogger (With Navigation) or APIM DataLogger (Without Navigation)
- Monitor the steering wheel controls PIDs while pressing each steering wheel controls button as follows:

Steering Wheel Controls Button	APIM PID
VOICE	VOICE_SW
PHONE	PHONE_SW
OK (without navigation only)	OK_SW

- **Do the PID values agree with the switch positions?**

  YES : For vehicle with navigation, go to G8.

  For vehicles without navigation, go to G9.

NO : If only one PID value is incorrect or the PID value always reads one particular switch position, INSTALL new steering wheel controls. REFER to **Steering Wheel Controls**. CLEAR any DTCs present. TEST the system for normal operation.

Otherwise, go to G4.

G4 CHECK THE REFERENCE VOLTAGE CIRCUIT TO THE CLOCKSPRING FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Clockspring C218a
- Disconnect: ACM C290a or C240a, or APIM C3338
- Key in ON position.

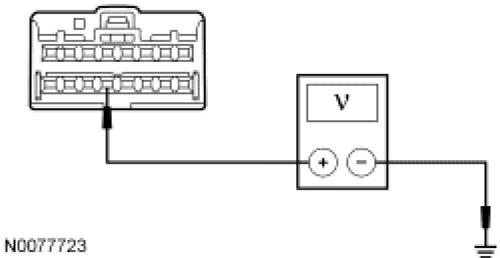


Fig. 16: Measuring Voltage Between Clockspring C218A-13, Circuit VME14 (GY/YE)
Courtesy of FORD MOTOR CO.

- For a concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA buttons, measure the voltage between the clockspring C218a-13, circuit VME14 (GY/YE), harness side and ground.

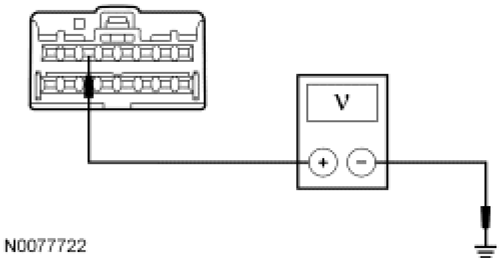


Fig. 17: Measuring Voltage Between Clockspring C218A-6, Circuit VME54 (BU/OG)
Courtesy of FORD MOTOR CO.

- For a concern with the VOICE, PHONE, or OK buttons, measure the voltage between the clockspring C218a-6, circuit VME54 (BU/OG), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal

operation.

NO : Go to G5.

G5 CHECK THE CIRCUITS TO THE CLOCKSPRING FOR AN OPEN OR SHORT TO GROUND

NOTE: Circuit RME24 (BU/WH) does not need to be checked for a short to ground.

- Key in OFF position.
- For a concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA buttons, measure the resistance between the ACM, harness side and the clockspring, harness side; and between the ACM, harness side and ground as follows:

ACM Connector-Pin	Clockspring Connector-Pin	Circuit
C290a-18 or C240a-18	C218a-13	VME14 (GY/YE)
C290a-19 or C240a-19	C218a-12	RME24 (BU/WH)

- For a concern with the VOICE, PHONE, or OK buttons, measure the voltage between ACM (with navigation) or APIM (without navigation), harness side and the clockspring, harness side; and between the ACM (with navigation) or APIM (without navigation), harness side and ground as follows:

ACM or APIM Connector-Pin	Clockspring Connector-Pin	Circuit
C290a-17, C240a-17, or C3338-14	C218a-6	VME54 (BU/OG)
C290a-16, C240a-16, or C3338-15	C218a-4	RME24 (BU/WH)

- **Is the resistance less than 5 ohms between the ACM (or APIM) and the clockspring, and greater than 10,000 ohms between the ACM (or APIM) and ground?**

  YES : Go to G6.

  NO : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

G6 CHECK THE REFERENCE VOLTAGE CIRCUIT TO THE STEERING WHEEL CONTROLS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Clockspring C218b
- Disconnect: Steering Wheel Controls C2999
- Key in ON position.
- For a concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA buttons, measure the voltage between the clockspring C218b-10, circuit VME14 (GY/YE), harness side and ground.
- For a concern with the VOICE, PHONE, or OK buttons, measure the voltage between the clockspring C218b-3, circuit VME54 (BU/OG), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. CLEAR any DTCs present. TEST the system for normal operation.

  NO : Go to G7.

G7 CHECK THE CIRCUITS TO THE STEERING WHEEL CONTROLS FOR AN OPEN OR SHORT TO GROUND

NOTE: **Circuits RME24 (BU/WH) and RME54 (WH/VT) do not need to be checked for a short to ground.**

- Key in OFF position.
- For a concern with the VOL-, VOL+, SEEK-, SEEK+, or MEDIA buttons, measure the resistance between the clockspring, harness side and the steering wheel controls, harness side; and between the clockspring, harness side and ground as follows:

Clockspring Connector-Pin	Steering Wheel Controls Connector-Pin	Circuit
C218b-10	C2999-2	VME14 (GY/YE)
C218b-11	C2999-4	RME24 (BU/WH)

- For a concern with the VOICE, PHONE, or OK buttons, measure the voltage between clockspring, harness side and the steering wheel controls, harness side; and between the clockspring, harness side and ground as follows:

Clockspring Connector-Pin	Steering Wheel Controls Connector-Pin	Circuit

C218b-3	C2999-6	VME54 (BU/OG)
C218b-5	C2999-7	RME54 (WH/VT)

- **Is the resistance less than 5 ohms between the clockspring and the steering wheel controls, and greater than 10,000 ohms between the clockspring and ground?**

  YES : INSTALL a new clockspring. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR any DTCs present. TEST the system for normal operation.

  NO : REPAIR the circuit in question. CLEAR any DTCs present. TEST the system for normal operation.

G8 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Connect: Any Disconnected Connectors
- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR any DTCs present. REPEAT the self-test.

G9 CHECK FOR CORRECT APIM OPERATION

- Connect: All Disconnected Connectors
- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initalize.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose

or corroded connector. CLEAR any DTCs present. REPEAT the self-test.

Pinpoint Test H: The Satellite Audio Is Inoperative/Does Not Operate Correctly

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation

The satellite digital audio receiver system (SDARS) module receives voltage through circuit SBP15 (WH/RD) and ground through circuit GD148 (BK/YE). Digital signals are received by the satellite radio antenna and sent to the SDARS module, which converts the signals to analog and sends them to either the audio control module (ACM) or to the accessory protocol interface module (APIM) (if equipped).

If there is an open in the satellite antenna circuit, there will be no satellite audio. The ACM display will indicate a satellite antenna concern (the method varies according to the type of ACM) when the audio system is operated in satellite radio mode. To diagnose an open in the satellite antenna circuit, go to **Pinpoint Test I**.

The SDARS module transmits left and right channel audio signals. When there is a fault in any of the audio signal circuits, the audio quality is reduced. If the circuits for a specific channel are shorted together, loss of audio on the entire channel will occur. This can be detected by using the SDARS module tones test.

- DTC U0184 (Lost Communication With Radio [ACM]) - set by the SDARS module when certain medium speed controller area network (MS-CAN) messages are missing from the ACM for greater than 5 seconds.
- DTC U0193 (Lost Communication With Digital Audio Control Module [SDARS]) - set by the ACM when certain MS-CAN messages are missing from the SDARS module for greater than 5 seconds.
- DTC U0197 (Lost Communication With Telephone Control Module) - set by the SDARS module when certain MS-CAN messages are missing from the APIM for greater than 5 seconds.

This pinpoint test is intended to diagnose the following:

- Subscription status
- Wiring, terminals or connectors
- SDARS module
- APIM (if equipped)
- ACM

PINPOINT TEST H: THE SATELLITE AUDIO IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

H1 VERIFY AN ACTIVE SUBSCRIPTION

- Operate the audio system in satellite radio mode and observe the display.

- **Does the display read CALL SIRIUS?**

  YES : The subscription has expired. INFORM the customer to contact Sirius to re-activate the subscription.

  NO : If the display indicates a satellite antenna fault, go to **Pinpoint Test I**.

  Otherwise, go to H2.

H2 CHECK FOR NON-NETWORK DTCs

- Carry out the SDARS module self-test using the scan tool.
- **Are any non-network DTCs present?**

  YES : For DTC B1031 or DTC B1032, go to **Pinpoint Test I**.

  For all other DTCs, REFER to **DTC Charts**.

  NO : Go to H3.

H3 CHECK FOR COMMUNICATION WITH THE ACM AND APIM

- Carry out the network test using the scan tool.
- **Does the scan tool communicate with the ACM and the APIM (if equipped)?**

  YES : Go to H4.

  NO : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose no communication with the ACM or APIM.

H4 CHECK FOR LOST COMMUNICATION DTCs

- Key in ON position.
- Using the scan tool, clear any ACM and SDARS module continuous DTCs.
- Key in OFF position.
- Key in ON position.
- Wait at least 10 seconds.
- Retrieve the ACM and SDARS module continuous DTCs.
- **Is DTC U0184 (SDARS module), U0193 (ACM), or U0197 (SDARS module, if equipped with the SYNC system) present?**

  YES : For DTC U0184, go to H13.

  For DTC U0193, go to H11.

  For DTC U0197, go to H12.

  NO : Go to H5.

H5 CHECK THE SATELLITE AUDIO OUTPUT

- Enter the following diagnostic mode on the diagnostic tool: Electrical -> Audio -> Tones Test -> Satellite Digital Audio Receiver System
- Carry out the SDARS module tones test using the scan tool.

- **Are alternating LH/RH tones audible?**

  YES : Go to H11.

  NO : If the vehicle is equipped with the SYNC system, go to H6.

  Otherwise, go to H9.

H6 CHECK THE OPERATION OF THE SYNC SYSTEM AUDIO

- Operate the audio system in radio tuner (AM/FM) mode.
- Connect: Known Good MP3 Device (To Audio Input Jack)
- Using the ACM buttons, press AUX until "SYNC LINE IN" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "LINE IN" appears (navigation).
- Using the known good MP3 device, attempt to play a file through the audio input jack.
- **Does the SYNC system audio operate correctly?**

  YES : Go to H7.

  NO : Go to **Pinpoint Test U**.

H7 CHECK THE AUDIO CIRCUITS TO THE APIM FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: APIM C3338
- Disconnect: SDARS Module C4300
- Key in ON position.
- Measure the voltage between the SDARS module, harness side and ground as follows:

Connector-Pin	Circuit
C4300-5	VME52 (BU)
C4300-6	VME53 (VT/GN)
C4300-11	RME52 (GY/OG)
C4300-12	RME53 (BN/WH)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to H8.

H8 CHECK THE AUDIO CIRCUITS TO THE APIM FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the APIM, harness side and the SDARS module, harness side; and between the APIM, harness side and ground as follows:

APIM Connector-Pin	SDARS Module Connector-Pin	Circuit
C3338-10	C4300-5	VME52 (BN)
C3338-7	C4300-6	VME53 (VT/GN)
C3338-11	C4300-11	RME52 (GY/OG)
C3338-8	C4300-12	RME53 (BN/WH)

- **Is the resistance less than 5 ohms between the APIM and the SDARS module, and greater than 10,000 ohms between the APIM and ground?**

  YES : Go to H11.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

H9 CHECK THE AUDIO CIRCUITS TO THE ACM FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C240c or C290c
- Disconnect: SDARS Module C4300
- Key in ON position.
- Measure the voltage between the SDARS module, harness side and ground as follows:

Connector-Pin	Circuit
C4300-5	VME41 (GN/OG)
C4300-6	VME42 (VT/BN)
C4300-11	RME41 (BU/BN)
C4300-12	RME42 (YE/BU)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to H10.

H10 CHECK THE AUDIO CIRCUITS FROM THE SDARS MODULE FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the SDARS module, harness side and the ACM, harness side; and

between the SDARS module, harness side and ground as follows:

SDARS Module Connector-Pin	ACM Connector-Pin	Circuit
C4300-5	C240c-1 or C290c-1	VME41 (GN/OG)
C4300-6	C240c-9 or C290c-9	VME42 (VT/BN)
C4300-11	C240c-2 or C290c-2	RME41 (BU/BN)
C4300-12	C240c-10 or C290c-10	RME42 (YE/BU)

- **Is the resistance less than 5 ohms between the SDARS module and the ACM, and greater than 10,000 ohms between the SDARS module and ground?**

  YES : Go to H11.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

H11 ISOLATE THE SDARS MODULE

- Key in OFF position.
- Connect: APIM C3338 (If Equipped)
- Install a new SDARS module. Refer to **Satellite Digital Audio Receiver System (SDARS) Module**.
- Operate the audio system in satellite radio mode.
- **Does the system operate correctly?**

  YES : The concern was caused by an inoperative SDARS module. The system is operating correctly at this time.

  NO : If equipped with the SYNC system, go to H12.

  Otherwise, go to H13.

H12 CHECK FOR CORRECT APIM OPERATION

- Connect: All Disconnected Connectors
- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initalize.

- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation. If the concern is still present, go to H13.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

H13 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: Poor Reception/No Sound - Satellite Audio

Normal Operation

Digital signals are received by the satellite antenna and sent to the satellite digital audio receiver system (SDARS) module, which then converts the signals and provides audio signals to the audio control module (ACM).

A short to ground typically has no effect on the antenna signal. However, an open in the antenna circuit will result in no sound from the satellite radio system. A short to voltage in the antenna circuit can have varying effects on the system.

- DTC B1031 (SDARS Satellite Antenna Open) - sets when an open or high resistance is detected in the satellite antenna circuit. This DTC can be either continuous or on-demand.
- DTC B1032 (SDARS Satellite Antenna Short) - sets when a short to ground is detected in the satellite antenna circuit. This DTC can be either continuous or on-demand.

This pinpoint test is intended to diagnose the following:

- Obstructions to the line of sight
- Satellite antenna cable
- Satellite antenna

- SDARS module

PINPOINT TEST I: POOR RECEPTION/NO SOUND - SATELLITE AUDIO

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

I1 CHECK THE OPERATION OF THE SATELLITE AUDIO

- Drive the vehicle to an open location, free of obstacles.
- Operate the audio system in satellite audio mode.
- **Is the reception OK?**

  YES : The system is OK at this time. ADVISE the customer that the satellite signal can be affected by obstructions to the satellite antenna line of sight.

  NO : Go to I2.

I2 CHECK FOR A SATELLITE ANTENNA FAULT MESSAGE

- Operate the audio system in satellite audio mode and observe the ACM display.
- **Does the ACM display indicate a satellite radio antenna fault?**

  YES : Go to I3.

  NO : Go to **Pinpoint Test H**.

I3 CHECK THE SATELLITE ANTENNA CABLE

- Key in OFF position.
- Disconnect: Satellite Antenna Connection (At Satellite Radio Receiver)
- Disconnect: Satellite Antenna Connection (At Satellite Radio Antenna)
- Measure the resistance of the satellite radio antenna cable between the SDARS module and the satellite antenna connection.
- **Is the resistance less than 1 ohm?**

  YES : Go to I4.

  NO : INSTALL a new satellite antenna cable. CLEAR the DTCs. REPEAT the self-test.

I4 SUBSTITUTE THE SATELLITE ANTENNA

- Install a known good satellite antenna.
- Operate the audio system in satellite audio mode.
- **Is the reception OK?**

  YES : INSTALL a new satellite antenna. REFER to **Antenna**. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to I5.

I5 CHECK FOR CORRECT SDARS MODULE OPERATION

- Key in OFF position.
- Disconnect the SDARS module connector.
- Check for:

  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the SDARS module connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SDARS module. REFER to **Satellite Digital Audio Receiver System (SDARS) Module**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test J: The Audio Input Jack Is Inoperative/Does Not Operate Correctly

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation - Vehicles Without the SYNC System

Audio signals are sent from the audio input jack to the audio control module (ACM). There are no external power or ground circuits to the audio input jack.

Vehicles With the SYNC System

Audio signals are sent from the audio input jack to the accessory protocol interface module (APIM). The signals are then sent to the ACM. There are no external power or ground circuits to the audio input jack.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Audio input jack
- ACM
- APIM (if equipped)

PINPOINT TEST J: THE AUDIO INPUT JACK IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Before carrying out this pinpoint test, make sure the MP3 device is operating correctly.**

J1 CHECK THE AUDIO INPUT JACK AUDIO

- Connect: Known Good MP3 Device (to Audio Input Jack)

- Using the known good MP3 device, attempt to play a file using the audio input jack.
- **Does the file play correctly?**

  YES : The system is operating correctly at this time. The concern may be with the customer device.

  NO : Go to J2.

J2 DETERMINE THE VEHICLE CONTENT

- Disconnect: Known Good MP3 Device (From Audio Input Jack)
- Determine if the vehicle is equipped with the SYNC system.
- **Is the vehicle equipped with the SYNC system?**

  YES : Go to J3.

  NO : Go to J4.

J3 CHECK THE APIM AUDIO OUTPUT

- Attempt to play an audio file using either the universal serial bus (USB) port or a Bluetooth® device.
- **Is the audio output OK for devices connected through the USB port or Bluetooth®?**

  YES : Go to J4.

  NO : Go to **Pinpoint Test P**.

J4 CHECK THE AUDIO INPUT JACK CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Audio Input Jack C3337
- Disconnect: ACM C290c or C240c, or APIM C3338 (If Equipped)
- Key in ON position.
- Measure the voltage between the audio input jack, harness side and ground as follows:

Connector-Pin	Circuit
C3337-1	VME46 (BU/GN)
C3337-2	RME46 (WH/GN)
C3337-3	RME45 (YE/GN)
C3337-4	VME45 (BU)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to J5.

J5 CHECK THE AUDIO INPUT JACK CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- For vehicles without the SYNC system, measure the resistance between the audio input jack,

harness side and the ACM, harness side; and between the audio input jack, harness side and ground as follows:

Audio Input Jack Connector-Pin	ACM Connector-Pin	Circuit
C3337-1	C240c-6 or C290c-6	VME46 (BU/GN)
C3337-2	C240c-14 or C290c-14	RME46 (WH/GN)
C3337-3	C240c-8 or C290c-8	RME45 (YE/GN)
C3337-4	C240c-7 or C290c-7	VME45 (BU)

- For vehicles with the SYNC system, measure the resistance between the audio input jack, harness side and the APIM, harness side; and between the audio input jack, harness side and ground as follows:

Audio Input Jack Connector-Pin	APIM Connector-Pin	Circuit
C3337-1	C3338-47	VME46 (BU/GN)
C3337-2	C3338-48	RME46 (WH/GN)
C3337-3	C3338-46	RME45 (YE/GN)
C3337-4	C3338-45	VME45 (BU)

- **Is the resistance less than 5 ohms between the audio input jack and the ACM (or APIM), and greater than 10,000 ohms between the audio input jack and ground?**

  YES : Go to J6.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

J6 SUBSTITUTE THE AUDIO INPUT JACK

- Connect: ACM C290c or C240c, or APIM C3338 (If equipped)
- Install a known good audio input jack.
- Operate the audio system using a device plugged into the audio input jack.
- **Does the system operate correctly?**

  YES : INSTALL a new audio input jack. REFER to **Audio Input Jack**. TEST the system for

normal operation.

NO : INSTALL the original audio input jack. Go to J7.

J7 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test K: No Global Positioning System (GPS) Antenna Signal

Normal Operation

The global position system (GPS) antenna provides information from the GPS satellite system to the GPS receiver in the navigation module. This information is used to calculate vehicle position and direction of travel.

- DTC 2204 (GPS Antenna Connection Open or Short) - sets when an open, short to ground, or short to voltage is detected in the GPS antenna circuit.

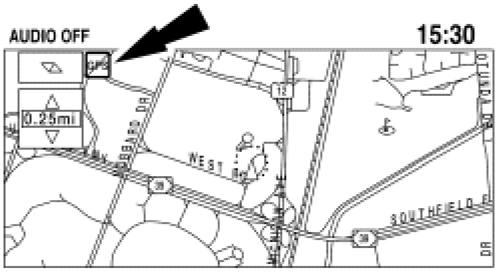
This pinpoint test is intended to diagnose the following:

- GPS antenna
- Audio control module (ACM)

PINPOINT TEST K: NO GLOBAL POSITIONING SYSTEM (GPS) ANTENNA SIGNAL

K1 CHECK THE OPERATION OF THE NAVIGATION SYSTEM

- Move the vehicle outside of any enclosed structure to an area that is unobstructed by trees, tall buildings, and bridges.



N0026638

Fig. 18: Checking Operation Of Navigation System
Courtesy of FORD MOTOR CO.

- Operate the audio system in navigation mode.
- **Does the GPS icon appear, then disappear?**

  YES : The system is operating correctly at this time. NOTIFY the customer that obstructions to the line of sight may affect the GPS antenna.

  NO : Go to K2.

K2 CHECK THE ACM RECORDED DTCs

- Check the recorded DTCs from the ACM self-test.
- **Is DTC B2204 recorded?**

  YES : Go to K4 .

  NO : Go to K3.

K3 CHECK THE GPS ANTENNA MOUNTING

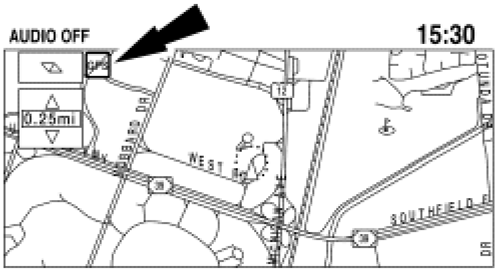
- Verify the GPS antenna is installed correctly and no aftermarket equipment is obstructing the antenna.
- **Is the GPS antenna mounted correctly?**

  YES : Go to K4.

  NO : Correctly INSTALL the GPS antenna. REFER to **Global Positioning System (GPS) Antenna**. TEST the system for normal operation.

K4 SUBSTITUTE THE GPS ANTENNA

- Install a good known GPS antenna.
- Move the vehicle outside of any enclosed structure to an area that is unobstructed by trees, tall buildings, and bridges.



N0026638

Fig. 19: Checking Operation Of Navigation System
Courtesy of FORD MOTOR CO.

- Operate the audio system in navigation mode.
- **Does the GPS icon appear, then disappear?**

  YES : INSTALL a new GPS antenna. REFER to **Global Positioning System (GPS) Antenna**. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL the original GPS antenna. Go to K5 .

K5 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test L: The Audible Switch Feedback Is Inoperative

Normal Operation

The audible switch feedback settings are controlled by the audio control module (ACM). The audible switch feedback can be set to ALL, TOUCH SCREEN, or NONE depending on user preference.

This pinpoint test is intended to diagnose the following:

- Audible switch feedback setting
- Audio control module (ACM)

PINPOINT TEST L: THE AUDIBLE SWITCH FEEDBACK IS INOPERATIVE

L1 CHECK THE SWITCH DISPLAY

- Key in ON position.
- Turn the audio system on.
- Press the MENU button.

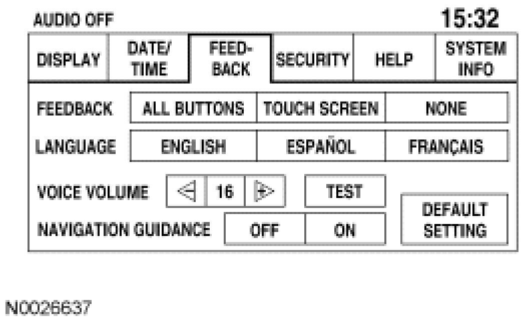


Fig. 20: Checking Switch Display
Courtesy of FORD MOTOR CO.

- Select the FEEDBACK tab.
- **Is NONE highlighted on the audible feedback settings?**

  YES : SELECT "ALL BUTTONS". TEST the system for normal operation.

  NO : Go to L2.

L2 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test M: The Voice Guidance Is Inoperative/Does Not Operate Correctly

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation

For the Audiophile navigation system, the audio control module (ACM) provides voice-assisted route guidance through the front speakers.

For the THX® navigation system, the ACM sends voice guidance audio signals to the audio digital signal processing (DSP) module through circuits RMN07 (VT) and VMN07 (GY). The voice-assisted route guidance is broadcast through the instrument panel speaker.

For all navigation audio systems, the volume of the voice guidance is controlled by the ACM.

This pinpoint test is intended to diagnose the following:

- Incorrect system setting
- Wiring, terminals or connectors (THX® only)
- DSP module (if equipped)
- ACM

PINPOINT TEST M: THE VOICE GUIDANCE IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

M1 CHECK THE VOICE GUIDANCE SETTING

- Operate the audio system in navigation mode.
- Press the MENU button.

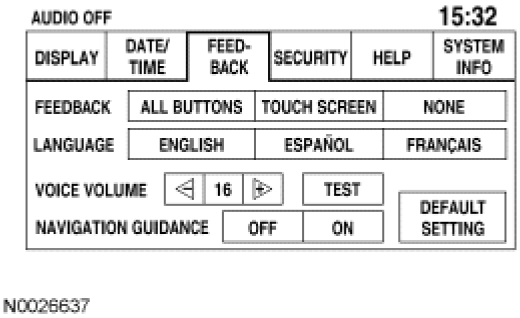


Fig. 21: Checking Voice Guidance Setting
Courtesy of FORD MOTOR CO.

- Select the FEEDBACK tab.
- Select DEFAULT SETTING.
- Verify the operation of the voice guidance.
- **Does the voice guidance operate correctly?**

  YES : The system is operating correctly at this time. The concern was caused by a customer-

selected setting.

NO : If the vehicle is equipped with THX® audio, go to M2.

Otherwise, go to M6.

M2 CHECK THE INSTRUMENT PANEL SPEAKER

- Carry out the speaker walk-around test.
- **Does the instrument panel speaker operate correctly?**

  YES : Go to M3.

  NO : Go to **Pinpoint Test C**.

M3 CHECK THE NAVIGATION AUDIO SIGNAL TO THE DSP MODULE

- Key in OFF position.
- Disconnect: DSP Module 4326c
- Operate the audio system in navigation mode.

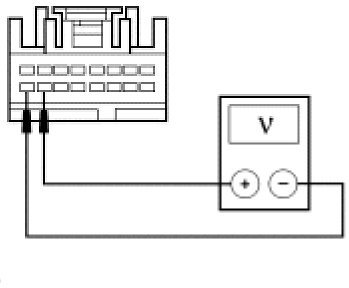


Fig. 22: Checking Navigation Audio Signal To DSP Module
Courtesy of FORD MOTOR CO.

- While pressing the REPEAT button on the ACM, measure the AC voltage between the DSP module 4326c-15, circuit VMN07 (GY), harness side and the DSP module 4326c-16, circuit RMN07 (VT), harness side.
- **Is a fluctuating AC voltage present?**

  YES : Go to M7.

  NO : Go to M4.

M4 CHECK CIRCUITS RMN07 (VT) AND VMN07 (GY) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C240d
- Key in ON position.

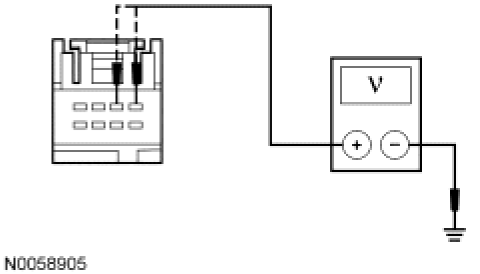


Fig. 23: Checking Circuits RMN07 (VT) & VMN07 (GY) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the ACM C240d-1, circuit VMN07 (GY), harness side and ground; and between the ACM C240d-2, circuit RMN07 (VT), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to M5.

M5 CHECK CIRCUITS RMN07 (VT) AND VMN07 (GY) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the ACM, harness side and the DSP module, harness side; and between the ACM, harness side and ground as follows:

ACM Connector-Pin	DSP Module Connector-Pin	Circuit
C240d-1	4326c-15	VMN07 (GY)
C240d-2	4326c-16	RMN07 (VT)

- **Is the resistance less than 5 ohms between the ACM and the DSP module, and greater than 10,000 ohms between the ACM and ground?**

  YES : Go to M6.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

M6 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins

- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation after the repair.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

M7 CHECK FOR CORRECT DSP MODULE OPERATION

- Disconnect all the DSP module connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the DSP module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DSP module. REFER to **Audio Digital Signal Processing (DSP) Module**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test N: The Audio Does Not Reduce When The Parking Aid Tone Sounds

Normal Operation

The parking aid module (PAM) sends the volume cutback message to the audio control module (ACM) via the medium speed controller area network (MS-CAN). When the PAM sounds the parking aid tone, it sends an "Enabled" message to the ACM. When the ACM receives this message, it reduces the speaker output so that the parking aid tone can be heard more clearly.

- DTC U0159 (Lost Communication With Parking Assist Control Module [PAM]) - sets when the volume cutback message is missing for greater than 5 seconds. When the message is missing, the ACM defaults to no volume cutback when the parking aid tone is sounding.

This pinpoint test is intended to diagnose the following:

- Parking aid system concern
- ACM

PINPOINT TEST N: THE AUDIO DOES NOT REDUCE WHEN THE PARKING AID TONE SOUNDS

N1 CHECK THE PARKING AID SIGNAL

- Apply the parking brake.

- Place an object behind the vehicle within the range of the parking aid sensors. Refer to **PARKING AID** article.
- Key in ON position.
- Place the transmission in REVERSE (R).
- Enter the following diagnostic mode on the diagnostic tool: ACM DataLogger
- Monitor the RPA_STAT (Parking Aid Input Status) PID while the parking aid tone is sounding.
- **Does the RPA_STAT PID read "Enabled" while the parking aid tone is sounding?**

  YES : Go to N2.

  NO : REFER to **PARKING AID** article to continue diagnosis of the parking aid system.

N2 CHECK FOR COMMUNICATION WITH THE PAM

- Carry out the network test using the scan tool.
- **Does the scan tool communicate with the PAM?**

  YES : Go to N3.

  NO : REFER to **MODULE COMMUNICATIONS NETWORK** article.

N3 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test O: The Position Cursor Is Inaccurate

Normal Operation

The primary source of vehicle location for the navigation system is the audio control module (ACM) receiving the position signal through the global positioning system (GPS) antenna.

In addition, the ACM receives the wheel pulse signal from the instrument cluster (IC) (which gateways the signal from the ABS module). This secondary signal is used to calculate vehicle position when the GPS signal is lost. It also supports the adaptive learning function of the ACM, whereby the ACM can compensate for long-term differences between the GPS signal location, and the actual distance traveled by the vehicle.

- DTC B2204 (GPS Antenna Connection Open or Short) - sets when an open, short to ground, or short to voltage is detected in the GPS antenna circuit. If DTC B2204 is present, go to **Pinpoint Test K**.

- DTC U0155 (Lost Communication With Instrument Panel Cluster [IC] Control Module) - sets when the ACM is missing messages from the IC for greater than 5 seconds.
- DTC U2473 (Unexpected Vehicle Speed [VSS]) - sets when the calculated vehicle distance traveled based on the wheel pulse signal does not agree with the GPS antenna location. To do this, the ACM compares the wheel pulse signal during a 4-second range, and compares it with the change in GPS antenna location. If the ACM finds that the variation is greater than 0.5% after performing this check 4 times, it sets DTC U2473. When DTC U2473 is set, the adaptive learn function is disabled. This DTC is also set when the navigation rolling wheel count signal is missing for greater than 2 seconds with the key in RUN.

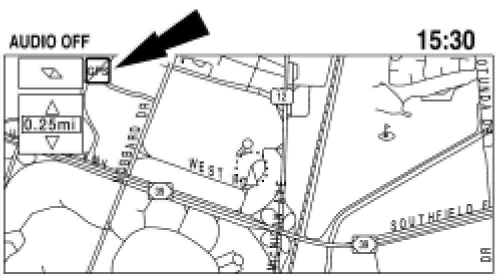
This pinpoint test is intended to diagnose the following:

- GPS antenna
- VSS signal concern
- ACM

PINPOINT TEST O: THE POSITION CURSOR IS INACCURATE

O1 CHECK THE OPERATION OF THE NAVIGATION SYSTEM

- Move the vehicle outside of any enclosed structure to an area that is unobstructed by trees, tall buildings, and bridges.



N0026638

Fig. 24: Checking Operation Of Navigation System
Courtesy of FORD MOTOR CO.

- Operate the audio system in navigation mode.
- **Does the GPS icon appear, then disappear?**

YES : Go to O2.

NO : Go to **Pinpoint Test K**.

O2 CHECK THE ACM DTCs

- Review the DTCs from the ACM self-test.
- **Is DTC U2473 or U0155 present?**

YES : Go to O3.

NO : Go to **Pinpoint Test K**.

O3 CHECK FOR COMMUNICATION WITH THE IC

- Carry out the network test using the scan tool.
- **Does the scan tool communicate with the IC?**

  YES : Go to O4.

  NO : REFER to **MODULE COMMUNICATIONS NETWORK** article.

O4 CHECK THE IC AND ABS MODULE DTCs

- Carry out the self-test for the IC and the ABS module.
- **Are any DTCs recorded?**

  YES : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article (IC) or **VEHICLE DYNAMIC SYSTEMS** article (ABS module) to diagnose a fault in the wheel pulse signal.

  NO : Go to O5.

O5 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test P: Voice Recognition Is Inoperative/Does Not Operate Correctly - Vehicles Without SYNC

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation

When the VOICE switch is pressed, a signal is sent to the audio control module (ACM) through circuit VME54 (BU/OG), and the ACM enters voice recognition mode. A microphone located in the interior rear view mirror receives the voice command and sends a signal to the ACM through circuits VMM13 (YE/GN) and RMM13 (BU). Power to the interior rear view mirror is provided through circuit CBP02 (GN), and ground through circuit GD139 (BK/YE).

The microphone test is available through the integrated diagnostic system (IDS). Running this test causes the ACM to produce a test tone. If the system is operating correctly, the microphone detects the tone and produces a

signal to the ACM indicating the tone was heard.

- DTC B2633 (Driver-Front Microphone Circuit Failure) - set by the ACM during the microphone test when the ACM does not receive an adequate signal from the microphone when the test tone is sounded.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Steering wheel controls
- Microphone (part of the interior rear view mirror)
- ACM

PINPOINT TEST P: VOICE RECOGNITION IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - VEHICLES WITHOUT SYNC

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

P1 CHECK THE ACM DTCs

- Carry out the microphone test using the scan tool.
- **Is DTC B2633 retrieved?**

  YES : Go to P9.

  NO : Go to P2.

P2 CHECK THE OPERATION OF THE STEERING WHEEL CONTROL SWITCHES

- Operate the audio system in radio tuner (AM/FM) mode.
- Press the VOL+ and VOL- steering wheel control switches.
- **Do the VOL+ and VOL- steering wheel control switches operate correctly?**

  YES : Go to P3.

  NO : Go to **Pinpoint Test G**.

P3 CHECK THE VOICE SWITCH PID (VOICE_SW)

- Disconnect: ACM DataLogger
- Monitor the ACM PID (VOICE_SW) while pressing and releasing the VOICE switch on the steering wheel controls.
- **Does the PID indicate the correct VOICE switch state?**

  YES : Go to P9.

  NO : Go to P4.

P4 CHECK THE VOICE SWITCH

- Key in OFF position.
- Disconnect: Steering Wheel Controls C2999
- Measure the resistance between the steering wheel controls pins component side while pressing and

releasing the VOICE switch as follows:

Steering Wheel Controls Connector-Pin	Steering Wheel Controls Connector-Pin	VOICE Switch Position	Resistance Value (Ohms)
C2999-6	C2999-4	Pressed Released	50.6-51.6 179.3-182.9

- **Are all the resistance values within specification?**

  YES : Go to P5.

  NO : INSTALL new steering wheel controls. REFER to **Steering Wheel Controls**. TEST the system for normal operation.

P5 CHECK CIRCUIT VME45 (BU/OG) FOR A SHORT TO VOLTAGE

- Disconnect: ACM C240a or C290a
- Key in ON position.

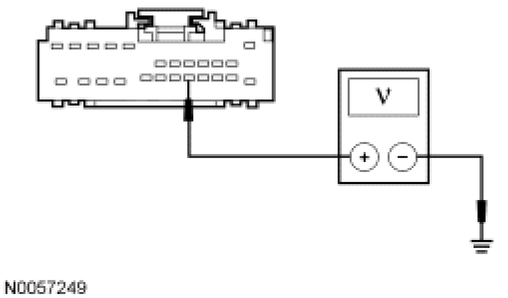


Fig. 25: Checking Circuit VME45 (BU/OG) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the ACM C240a-17 or C290a-17, circuit VME45 (BU/OG), harness side and ground.
- **Is any voltage present?**

  YES : Go to P6.

  NO : Go to P7.

P6 CHECK THE CLOCKSPRING FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Clockspring C218a
- Key in ON position.

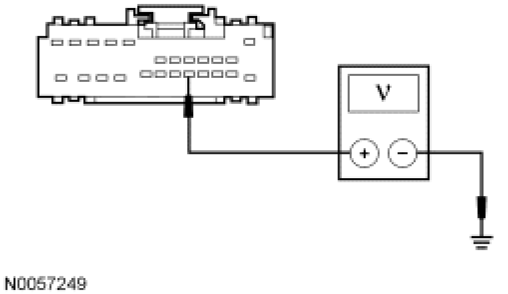


Fig. 26: Checking Clockspring For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the ACM C240a-17 or C290a-17, circuit VME45 (BU/OG), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : INSTALL a new clockspring. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

P7 CHECK CIRCUIT VME54 (BU/OG) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the ACM, harness side and the steering wheel controls, harness side; and between the ACM, harness side and ground as follows.

ACM Connector-Pin	Steering Wheel Controls Connector-Pin	Circuit
C240a or C290a-17	C2999-6	VME54 (BU/OG)

- **Is the resistance less than 5 ohms between the ACM and the steering wheel controls, and greater than 10,000 ohms between the ACM and ground?**

  YES : Go to P14.

  NO : Go to P8.

P8 CHECK THE CLOCKSPRING FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Disconnect: Clockspring C218a

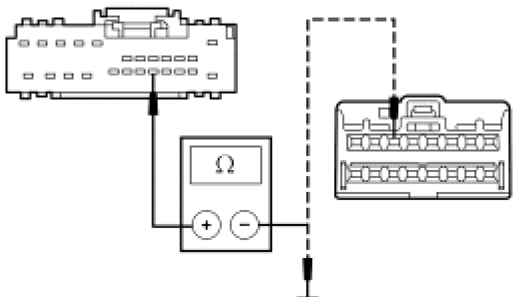


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Fig. 27: Checking Clockspring For An Open Or Short To Ground
Courtesy of FORD MOTOR CO.

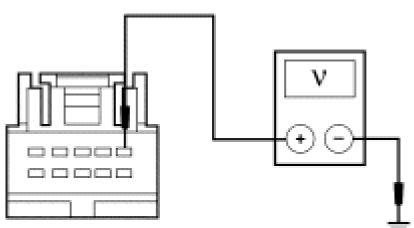
- Measure the resistance between the ACM C240a-17 or C290a-17, circuit VME54 (BU/OG), harness side and the clockspring C218a-6, circuit VME54 (BU/OG), harness side; and between the ACM C240a-17 or C290a-17, circuit VME54 (BU/OG), harness side and ground.
- **Is the resistance less than 5 ohms between the ACM and the clockspring, and greater than 10,000 ohms between the ACM and ground?**

  YES : INSTALL a new clockspring. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

P9 CHECK CIRCUIT CBP02 (GN) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Interior Rear View Mirror C9030
- Key in ON position.



N0057331

Fig. 28: Checking Circuit CBP02 (GN) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the interior rear view mirror C9030-1, circuit CBP02 (GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to P10.

  NO : VERIFY the smart junction box (SJB) fuse 12 (7.5A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

P10 CHECK CIRCUIT GD139 (BK/YE) FOR AN OPEN

- Key in OFF position.

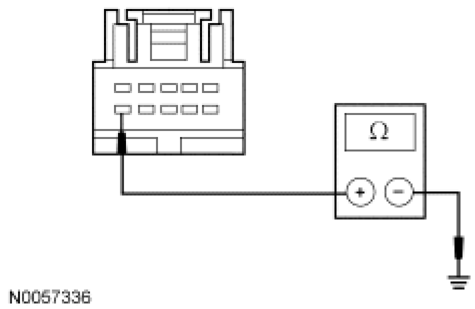


Fig. 29: Checking Circuit GD139 (BK/YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the interior rear view mirror C9030-10, circuit GD139 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to P11.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

P11 CHECK THE MICROPHONE CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect: ACM C240c
- Key in ON position.

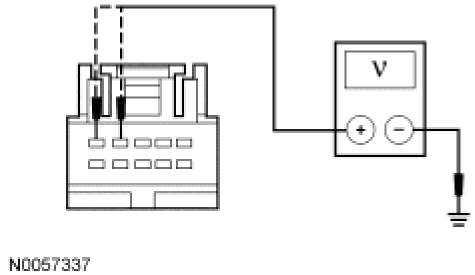


Fig. 30: Checking Microphone Circuits For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the interior rear view mirror C9030-4, circuit VMM13 (YE/GN), harness side and ground; and between the interior rear view mirror C9030-5, circuit RMM13 (BU), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to P12.

P12 CHECK THE MICROPHONE CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the inside rear view mirror, harness side and the ACM, harness side; and between the rear view mirror, harness side and ground as follows:

Interior Rear View Mirror Connector-Pin	ACM Connector-Pin	Circuit
C9030-4	C240c-11 or C290c-11	VMM13 (YE/GN)
C9030-5	C240c-12 or C290c-12	RMM13 (BU)

- **Is the resistance less than 5 ohms between the interior rear view mirror and the ACM, and greater than 10,000 ohms between the interior rear view mirror and ground?**

  YES : Go to P13.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

P13 ISOLATE THE INTERIOR REAR VIEW MIRROR

- Connect: ACM C240c or C290c
- Substitute a known good interior rear view mirror.
- Operate the audio system in navigation mode.
- Attempt several voice commands. Refer to the Owner's Literature.
- **Does the voice recognition operate correctly?**

  YES : INSTALL a new interior rear view mirror. REFER to **REAR VIEW MIRRORS** article. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to P14.

P14 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose

or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test Q: The Speed Sensitive Volume Does Not Operate Correctly

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio/Navigation for schematic and connector information.

Normal Operation

The speed sensitive volume function adjusts the volume based on the vehicle speed sensor (VSS) signal from the instrument cluster (IC). The IC does not generate the VSS signal; it gateways the signal from the PCM.

- DTC U0155 (Lost Communication With Instrument Panel Cluster Control [IC] Module) - sets when the VSS signal is lost for greater than 5 seconds. When the signal is lost, the audio control module (ACM) turns the speed sensitive volume feature off. The smart junction box (SJB) also receives this signal, and should demonstrate symptoms if the VSS signal is lost. If no symptoms are present, this DTC can be ignored, as it may have been set by a low battery voltage condition.

This pinpoint test is intended to diagnose the following:

- Speed sensitive volume setting
- VSS signal concern
- ACM

PINPOINT TEST Q: THE SPEED SENSITIVE VOLUME DOES NOT OPERATE CORRECTLY

Q1 CHECK THE SPEEDOMETER OPERATION

- Drive the vehicle and observe the speedometer.
- **Does the speedometer operate correctly?**

  YES : Go to Q2.

  NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

Q2 CHECK THE SPEED SENSITIVE VOLUME SETTING

- Turn the speed sensitive volume off. Refer to the Owner's Literature.
- Operate the audio system in radio tuner (AM/FM) mode.
- Drive the vehicle at various speeds and observe the speaker volume.
- Set the speed sensitive volume to maximum compensation. Refer to the Owner's Literature.
- Operate the audio system in radio tuner (AM/FM) mode.
- Drive the vehicle at various speeds and observe the speaker volume.
- **Does the volume remain constant with the speed sensitive volume turned off, and increase and decrease with vehicle speed with the speed sensitive volume set to maximum?**

  YES : The system is operating correctly at this time. INFORM the customer of proper operation.

  NO : Go to Q3.

Q3 CHECK FOR DTC U0155

- Key in OFF position.
- Clear any ACM DTCs.
- Key in ON position.
- Wait 10 seconds, and re-run the ACM self-test.
- Run the SJB self-test.
- **Is DTC U0155 present in both the ACM and the SJB?**

  YES : Go to Q5.

  NO : Go to Q4.

Q4 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Q5 CHECK FOR CORRECT IC OPERATION

- Disconnect the IC connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect IC connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. CLEAR the ACM DTCs. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test R: The SYNC System Is Completely Inoperative

Normal Operation

The accessory protocol interface module (APIM) receives voltage at all times from circuit SBB13 (GY/RD), and ground through circuit GD148 (BK/YE). The wake-up signal is sent to the APIM by the audio control module (ACM) via the medium speed controller area network (MS-CAN).

- DTC U0184 (Lost Communication With Radio [ACM]) - set by the APIM when it is missing messages from the ACM over the MS-CAN for greater than 5 seconds.
- DTC U0197 (Lost Communication With Telephone Control Module) - set by the ACM when it is missing messages from the APIM over the MS-CAN for greater than 5 seconds.

This pinpoint test is intended to diagnose the following:

- Audio system concern
- Communication network concern
- Customer error
- Customer device
- APIM
- ACM

PINPOINT TEST R: THE SYNC SYSTEM IS COMPLETELY INOPERATIVE

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

R1 CHECK THE AUDIO SYSTEM OPERATION

- Press the AUX button repeatedly until "SYNC LINE IN" appears on the display (except navigation), or look for the presence of the "USER DEVICE" tab (navigation).
- **Is "SYNC LINE IN" available when pressing the AUX button (except navigation), or is the "USER DEVICE" tab present (navigation)?**

  YES : Go to R2.

  NO : Go to R3.

R2 CHECK THE SYNC SYSTEM OPERATION

NOTE: **Carrying out a Master Reset will return all preference settings to the factory defaults, erase all the phone book and call histories and delete any devices paired with the SYNC system.**

- Connect: Known Good MP3 Device (To Audio Input Jack)

NOTE: **Make sure no universal serial bus (USB) device is plugged-in, and no Bluetooth® device is active for this step.**

- Using the ACM buttons, press AUX until "SYNC LINE IN" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "LINE IN" appears (navigation).

- Using the known good MP3 device, attempt to play a file using the audio input jack.
- Disconnect: Known Good MP3 Device (From Audio Input Jack)
- Connect: Known Good USB Device (To USB Port)
- Using the ACM buttons, press AUX until "SYNC USB" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "USB" appears (navigation).

NOTE: If a USB mass storage device is used to play the audio file, the SYNC system will only play audio files that do not have digital rights management (DRM) protection.

- Using a known good MP3 device or mass storage device, attempt to play a file using the USB port.
- Disconnect: Known Good USB Device (From USB Port)
- Using a known good Bluetooth® device, attempt to pair to the APIM using Bluetooth®, and attempt to play an audio file using the Bluetooth® connection. Refer to the Owner's Literature.
- **Do all of the SYNC inputs function correctly?**

  YES : The SYNC system is operating correctly at this time. CARRY OUT a SYNC system Master Reset.

  For vehicles without navigation, PRESS the "PHONE" button on the steering wheel controls, SCROLL until "SYSTEM SETTINGS" displays on the screen, PRESS "OK", SCROLL until "ADVANCED" displays on the screen, PRESS "OK", SCROLL until "MASTER RESET" displays on the screen, and PRESS "OK" twice.

  For vehicles with navigation, PRESS "PHONE" on the ACM display, SELECT the "SETTINGS" tab, PRESS "ADVANCED", SELECT "Master Reset", and PRESS "YES".

  REVIEW the pairing process with the customer. If the customer device still does not pair, the fault is with the customer device.

  NO : If only some of the inputs are inoperative, go to **Symptom Chart - SYNC System** to diagnose the observed symptom.

  If all inputs are inoperative, go to **Pinpoint Test U**.

R3 CHECK FOR SCAN TOOL COMMUNICATION

- Carry out the network test using the scan tool.
- **Does the APIM pass the network test?**

  YES : Go to R4.

  NO : REFER to **MODULE COMMUNICATIONS NETWORK** article.

R4 CHECK FOR CORRECT APIM OPERATION

- Connect: All Disconnected Connectors
- Disconnect the APIM connector.

- Check for:
    - corrosion
    - damaged pins
    - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initalize.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test S: Unable To Pair Bluetooth® Device

Normal Operation

When a new Bluetooth® device is added, the accessory protocol interface module (APIM) and the Bluetooth® device must be paired together. Most Bluetooth® devices will pair with the SYNC system, although functionality will vary. To determine if a Bluetooth® device is supported, retrieve the consumer interface processor (CIP) software level using the **Accessory Protocol Interface Module (APIM) Software Level Check** and verify the customer device is on the compatibility list for the current CIP software level.

Pairing a Bluetooth® device is accomplished through the "Add Device" selection of the phone menu. When pairing a device, the SYNC system generates a unique personal identification number (PIN) that must be entered on the Bluetooth® device in order for the pairing process to be successful. There are also some device-specific actions that must take place. For additional information on the pairing process, refer to the Owner's Literature.

This pinpoint test is intended to diagnose the following:

- Incompatible Bluetooth® device
- Customer error
- Customer Bluetooth® device
- APIM

PINPOINT TEST S: UNABLE TO PAIR BLUETOOTH® DEVICE

S1 CHECK THE BLUETOOTH® CONNECTION

NOTE:	**Carrying out a Master Reset will return all preference settings to the factory defaults, erase all the phone book and call histories and delete any devices paired with the SYNC system.**

NOTE: Refer to the for a list of compatible devices.

- Using a known good Bluetooth® device, attempt to pair to the SYNC system using Bluetooth®. Refer to the Owner's Literature.
- Enter the following diagnostic mode on the diagnostic tool: APIM DataLogger
- Monitor the BT_PAIR (Bluetooth® device paired) and BT_CONN (Bluetooth® device connected) PIDs.
- **Do the BT_PAIR and BT_CONN PIDs both read "Yes"?**

  YES : The SYNC system is operating correctly at this time. CARRY OUT a SYNC system Master Reset.

  For vehicles without navigation, PRESS the "PHONE" button on the steering wheel controls, SCROLL until "SYSTEM SETTINGS" displays on the screen, PRESS "OK", SCROLL until "ADVANCED" displays on the screen, PRESS "OK", SCROLL until "MASTER RESET" displays on the screen, and PRESS "OK" twice.

  For vehicles with navigation, PRESS "PHONE" on the ACM display, SELECT the "SETTINGS" tab, PRESS "ADVANCED", SELECT "Master Reset", and PRESS "YES".

  REVIEW the pairing process with the customer. If the customer device still does not pair, the fault is with the customer device.

  NO : Go to S2.

S2 CHECK FOR CORRECT APIM OPERATION

- Connect: All Disconnected Connectors
- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initalize.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test T: The Universal Serial Bus (USB) Port Is Inoperative/Does Not Operate Correctly

Normal Operation

The universal serial bus (USB) port is connected to the accessory protocol interface module (APIM) through the USB cable. The USB port can be used to play audio files or upload software from mass storage devices, or for connecting a media device.

If supported by the user device, the USB can provide charging. Because of this feature, when a USB device is plugged into the USB port, the SYNC system does not automatically switch to the device.

The USB cable and port are not serviceable separately.

- DTC U261C (USB #1 Device Error) - sets when the APIM detect an over-current or over-temperature condition in the USB circuit. This can be caused by a fault in the USB cable or port, or by the customer USB device.

This pinpoint test is intended to diagnose the following:

- Customer USB device
- USB cable and port
- APIM

PINPOINT TEST T: THE UNIVERSAL SERIAL BUS (USB) PORT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

T1 CHECK THE USB CONNECTION

- Connect: Known Good USB Device (To USB Port)
- Using the ACM buttons, press AUX until "SYNC USB" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "USB" appears (navigation).

NOTE: If a USB mass storage device is used to play the audio file, SYNC will only play audio files that do not have digital rights management (DRM) protection.

- Using a known good MP3 or mass storage device, attempt to play an audio file using the USB port.
- **Does the known good device successfully play an audio file using the USB connection?**

  YES : The SYNC system is operating correctly. REVIEW the operation of the USB port with the customer. If the customer device still does not operate correctly, the fault is with the customer device.

  NO : Go to T2.

T2 INSPECT THE USB CABLE

- Key in OFF position.
- Disconnect: USB Cable (At APIM)
- Inspect the USB cable for damage.
- Connect: USB Cable (AT APIM)
- Key in ON position.
- Using the ACM buttons, press AUX until "SYNC USB" appears on the display (except navigation),

or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "USB" appears (navigation).

- Using a known good MP3 or mass storage device, attempt to play an audio file using the USB port.
- **Does the known good device successfully play the audio file using the USB connection?**

  YES : The concern was caused by the USB connection not being seated correctly. The system is now operating correctly.

  NO : Go to T3.

T3 ISOLATE THE USB CABLE AND PORT

- Disconnect: Known Good USB Device (From USB Port)
- Install a new USB cable and port. Refer to **Universal Serial Bus (USB) Cable and Port**.
- Connect: Known Good USB Device (To USB Port)
- Using the ACM buttons, press AUX until "SYNC USB" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "USB" appears (navigation).
- Using a known good MP3 or mass storage device, attempt to play an audio file using the USB port.
- **Does the known good device successfully play an audio file using the USB connection?**

  YES : The concern was caused by an inoperative USB cable. The system is now operating correctly.

  NO : Go to T4.

T4 CHECK FOR CORRECT APIM OPERATION

- Connect: All Disconnected Connectors
- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initalize.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test U: Poor Quality/Distorted/No Sound While In SYNC Mode

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation

The accessory protocol interface module (APIM) sends left and right channel analog audio signals through circuits VME52 (BU), RME52 (GY/OG), VME53 (VT/GN), and RME53 (BN/WH). These audio signals are sent to the audio control module (ACM).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- ACM
- APIM

PINPOINT TEST U: POOR QUALITY/DISTORTED/NO SOUND WHILE IN SYNC MODE

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

U1 VERIFY THE OPERATION OF THE SYNC SYSTEM AUDIO SOURCES

- Connect: Known Good MP3 Device (To Audio Input Jack)

NOTE: Make sure no universal serial bus (USB) device is plugged-in, and no Bluetooth®device is active for this step.

- Using the ACM buttons, press AUX until "SYNC LINE IN" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "LINE IN" appears (navigation).
- Using the known good MP3 device, attempt to play an audio file using the audio input jack, and listen to the audio output.
- Disconnect: Known Good MP3 Device (From Audio Input Jack)
- Connect: Known Good USB Device (To USB Port)
- Using the ACM buttons, press AUX until "SYNC USB" appears on the display (except navigation), or press MEDIA, select "USER DEVICE", and press "SOURCE" repeatedly until "USB" appears (navigation).

NOTE: If a USB mass storage device is used to play the audio file, the SYNC system will only play audio files that do not have digital rights management (DRM) protection.

- Using a known good MP3 device or a mass storage device, attempt to play a file using the USB port, and listen to the audio output.
- Disconnect: Known Good USB Device (From USB Port)
- Using a known good Bluetooth® device, attempt to pair to the APIM using Bluetooth®, and attempt to play an audio file using the Bluetooth® connection while listening to the audio output. Refer to the Owner's Literature.

- **Is there poor quality/distorted sound from each SYNC audio source?**

  YES : Go to U2.

  NO : If the concern is only with some (but not all) of the audio sources, go to **Symptom Chart - SYNC System** to diagnose the observed symptom.

  If all audio sources operate correctly, the concern is with the customer device.

U2 CHECK THE CIRCUITS FROM THE APIM FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C290c or C240c
- Disconnect: APIM C3338
- Measure the voltage between the APIM, harness side and ground as follows:

Connector-Pin	Circuit
C3338-23	VME42 (VT/BN)
C3338-24	RME42 (YE/BU)
C3338-25	VME41 (GN/OG)
C3338-26	RME41 (BU/BN)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to U3.

U3 CHECK THE CIRCUITS FROM THE APIM FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the APIM, harness side, and the ACM, harness side; and between the APIM, harness side and ground as follows:

APIM Connector-Pin	ACM Connector-Pin	Circuit
C3338-23	C290c-9 or C240c-9	VME42 (VT/BN)
C3338-24	C290c-10 or C240c-10	RME42 (YE/BU)
C3338-25	C290c-1 or C240c-1	VME41 (GN/OG)
	C290c-2 or	RME41

C3338-26	C240c-2	(BU/BN)

- **Is the resistance less than 5 ohms between the APIM and the ACM, and greater than 10,000 ohms between the APIM and ground?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to U4.

U4 CHECK FOR CORRECT APIM OPERATION

- Connect: All Disconnected Connectors
- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initalize.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation. If the concern is still present, go to U5.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

U5 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test V: Voice Recognition Is Inoperative/Does Not Operate Correctly - Vehicles With The SYNC System

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation

When the VOICE switch is pressed, it changes the reference voltage on circuit VME54 (BU/OG), and the audio system enters voice recognition mode. If the vehicle is equipped with navigation, the VOICE switch is wired to the audio control module (ACM). If the vehicle is not equipped with navigation, the VOICE switch is wired to the accessory protocol interface module (APIM). A microphone located in the interior rear view mirror receives the voice command and sends a signal to the APIM through circuits VMM13 (YE/GN) and RMM13 (BU). The microphone is also used to detect outgoing audio during a phone call.

If the vehicle is equipped with navigation, the APIM receives the microphone input, and also broadcasts it to the ACM through circuits VMM13 (YE/GN) and RMM13 (BU). This is to allow voice commands specific to the navigation system to be handled directly by the ACM. The first voice commands spoken determine which system handles the voice commands.

- DTC B1038 (Microphone Input Circuit Failure) - set by the APIM during the on-demand self-test if the APIM does not detect the microphone.
- DTC B2633 (Driver-Front Microphone Circuit Failure) - set by the ACM during the microphone test when the ACM does not receive an adequate signal from the microphone when the test tone is sounded.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Steering wheel controls
- Microphone (part of the interior rear view mirror)
- ACM (if equipped with navigation)
- APIM

PINPOINT TEST V: VOICE RECOGNITION IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - VEHICLES WITH THE SYNC SYSTEM

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

V1 CHECK THE OPERATION OF THE STEERING WHEEL CONTROLS

- Operate the audio system in radio tuner (AM/FM) mode.
- Press the VOICE button on the steering wheel controls.
- **Does the audio system enter voice recognition mode?**

  YES : Go to V2.

  NO : Go to **Pinpoint Test G** to diagnose the steering wheel controls system.

V2 CHECK THE OPERATION OF THE VOICE RECOGNITION

- Press the VOICE button on the steering wheel controls.
- Wait for the SYNC system to acknowledge the VOICE button being pressed.
- While still in voice recognition mode, speak the command "PHONE", and observe the audio

system.

- **Does the SYNC system acknowledge the command "PHONE"?**

  YES : If the vehicle is equipped with navigation, go to V3.

  Otherwise, the system is operating correctly at this time. ADVISE the customer on the correct operation of the voice recognition system.

  NO : Go to V6.

V3 CHECK THE MICROPHONE SIGNAL TO THE ACM

- Key in OFF position.
- Disconnect: ACM C290c or C240c

NOTE: **ACM C290a (or C240a) must remain connected for this step to produce accurate results.**

- Operate the audio system in radio tuner (AM/FM) mode.
- Press the VOICE button on the steering wheel controls.

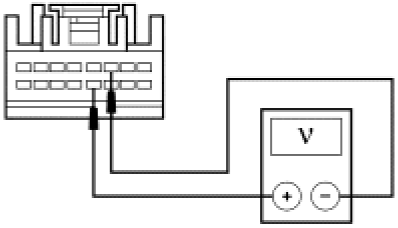


Fig. 31: Checking Microphone Signal To ACM
Courtesy of FORD MOTOR CO.

- While speaking a command, measure the AC voltage between the ACM C290c-11 or C240c-11, circuit VMM02 (YE/GN), harness side and the ACM C290c-12 or C240c-12, circuit RMM02 (BU/WH), harness side.
- **Is a fluctuating AC voltage present?**

  YES : Go to V12.

  NO : Go to V4.

V4 CHECK THE MICROPHONE CIRCUITS TO THE ACM FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: APIM C3338
- Key in ON position.

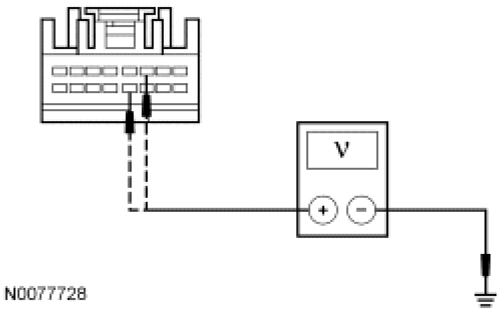


Fig. 32: Checking Microphone Circuits To ACM For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the ACM C290c-11 or C240c-11, circuit VMM02 (YE/GN), harness side and ground; and between the ACM C290c-12 or C240c-12, circuit RMM02 (BU/WH), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to V5.

V5 CHECK THE MICROPHONE CIRCUITS TO THE ACM FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the ACM, harness side and the APIM, harness side; and between the ACM, harness side and ground as follows:

ACM Connector-Pin	APIM Connector-Pin	Circuit
C290c-11 or C240c-11	C3338-12	VMM02 (YE/GN)
C290c-12 or C240c-12	C3338-13	RMM02 (BU/WH)

- **Is the resistance less than 5 ohms between the ACM and the APIM, and greater than 10,000 ohms between the ACM and ground?**

  YES : Go to V11.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

V6 CHECK CIRCUIT CBP02 (GN) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Interior Rear View Mirror C9030
- Key in ON position.

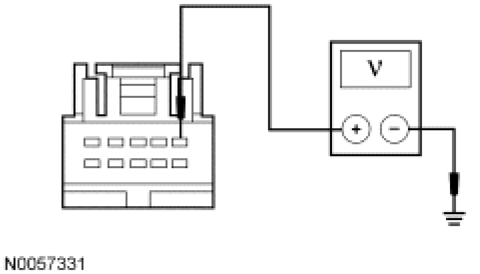


Fig. 33: Checking Circuit CBP02 (GN) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the interior rear view mirror C9030-1, circuit CBP02 (GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to V7.

  NO : VERIFY the smart junction box (SJB) fuse 12 (7.5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation. If not OK, REFER to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ to identify the possible sources of the circuit short.

V7 CHECK CIRCUIT GD139 (BK/YE) FOR AN OPEN

- Key in OFF position.

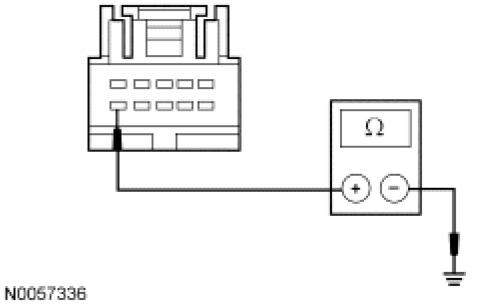


Fig. 34: Checking Circuit GD139 (BK/YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the interior rear view mirror C9030-10, circuit GD139 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to V8.

  NO : REPAIR the circuit. TEST the system for normal operation.

V8 CHECK THE MICROPHONE CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect: APIM C3338
- Key in ON position.

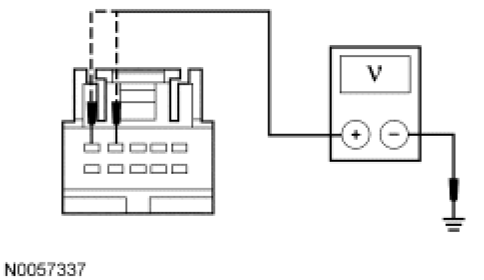


Fig. 35: Checking Microphone Circuits For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the interior rear view mirror C9030-4, circuit VMM13 (YE/GN), harness side and ground; and between the interior rear view mirror C9030-5, circuit RMM13 (BU), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to V9.

V9 CHECK THE MICROPHONE CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the inside rear view mirror, harness side and the APIM, harness side; and between the interior rear view mirror, harness side and ground as follows:

Interior Rear View Mirror Connector-Pin	APIM Connector-Pin	Circuit
C9030-4	C3338-5	VMM13 (YE/GN)
C9030-5	C3338-6	RMM13 (BU)

- **Is the resistance less than 5 ohms between the interior rear view mirror and the APIM, and greater than 10,000 ohms between the interior rear view mirror and ground?**

  YES : Go to V10.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

V10 ISOLATE THE INTERIOR REAR VIEW MIRROR

- Connect: APIM C3338
- Install a new interior rear view mirror. Refer to **REAR VIEW MIRRORS** article.
- Operate the audio system in radio tuner (AM/FM) mode.
- Press the VOICE button on the steering wheel controls, and attempt several voice commands.

- **Does the voice recognition operate correctly?**

  YES : The fault was caused by an inoperative interior rear view mirror. The system is now operating correctly.

  NO : Go to V11.

V11 CHECK FOR CORRECT APIM OPERATION

- Connect: All Disconnected Connectors
- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initalize.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

V12 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test W: The SYNC System Audible Prompts Are Inoperative/Do Not Operate Correctly

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation

The text-to-speech (TTS) and voice prompt features speak certain text information and interaction requests in

order to minimize driver distraction by having to look at the audio control module (ACM) while driving. The ring tone alerts the driver to an incoming call.

Audible prompts can range from a simple tone to more elaborate spoken text, based on the customer setting. When interaction mode is set to standard, detailed guidance is provided. When interaction mode is set to advanced, most prompts are tones only and minimal audible guidance is provided. Refer to the Owner's Literature for further information on voice interaction.

The audio signals for the TTS and voice prompt features, the ring tones, and audio from the outside device during a phone call, are sent from the accessory protocol interface module (APIM) to the ACM through circuits VMN14 (WH/VT) and RMN14 (GY/BN).

This pinpoint test is intended to diagnose the following:

- Customer setting
- Wiring, terminals or connectors
- ACM
- APIM

PINPOINT TEST W: THE SYNC SYSTEM AUDIBLE PROMPTS ARE INOPERATIVE/DO NOT OPERATE CORRECTLY

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

W1 CHECK THE AUDIBLE PROMPT SETTING

- Operate the audio system in SYNC mode.
- Verify the audible prompts are enabled. Refer to "SYNC Voice Recognition Feature" in the Owner's Literature.
- Press the VOICE button on the steering wheel controls and observe the SYNC audible prompt.
- **Does the SYNC system produce an audible prompt correctly?**

  YES : The concern was caused by a customer setting. ADVISE the customer on the operation of the audible prompt feature.

  NO : Go to W2.

W2 CHECK THE AUDIBLE PROMPT CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ACM C290c or C240c
- Disconnect: APIM C3338
- Key in ON position.

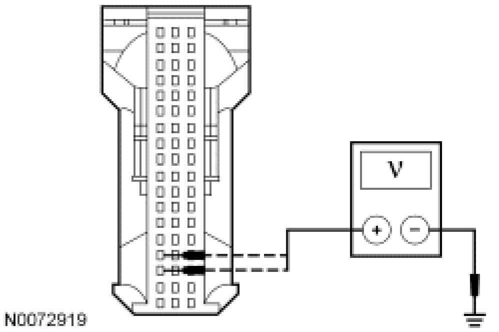


Fig. 36: Checking Audible Prompt Circuits For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the APIM C3338-3, circuit VMN14 (WH/VT), harness side and ground; and between the APIM C3338-4, circuit RMN14 (GY/BN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to W3.

W3 CHECK THE AUDIBLE PROMPT CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between the APIM, harness side and the ACM, harness side; and between the APIM, harness side and ground as follows:

APIM Connector-Pin	ACM Connector-Pin	Circuit
C3338-3	C290c-4 or C240c-4	VMN14 (WH/VT)
C3338-4	C290c-5 or C240c-5	RMN14 (GY/BN)

- **Is the resistance less than 5 ohms between the APIM and the ACM, and greater than 10,000 ohms between the APIM and ground?**

  YES : Go to W4.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

W4 CHECK FOR A VOLTAGE SIGNAL FROM THE APIM

- Connect: ACM C290c or C240c
- Connect: APIM C3338
- Wait 2 minutes for the APIM to re-initialize.
- Operate the audio system in SYNC mode, and verify the audible prompts are enabled. Refer to "SYNC Voice Recognition Feature" in the Owner's Literature.
- While pressing the VOICE button repeatedly, measure the AC voltage by backprobing between the ACM C290c-4 (or C240c-4), circuit VMN14 (WH/VT), harness side and the ACM C290c-5 (or

C240c-5), circuit RMN14 (GY/BN), harness side.

- **Is an AC voltage produced each time the VOICE button is pressed?**

  YES : Go to W5.

  NO : Go to W6.

W5 CHECK FOR CORRECT ACM OPERATION

- Key in OFF position.
- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

W6 CHECK FOR CORRECT APIM OPERATION

- Connect: All Disconnected Connectors
- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Wait 2 minutes for the APIM to re-initalize.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **Accessory Protocol Interface Module (APIM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

GENERAL PROCEDURES

AUDIO UNIT PART NUMBER RETRIEVAL

Audio Systems Without Navigation

NOTE: **The terms "Audio Control Module (ACM)" and "audio unit" refer to the same**

component.

1. Turn the ACM on.
2. Press and hold preset buttons 3 and 6 for 3 seconds. The speaker walk-around test will begin.
3. Before the speaker walk-around test is complete, press preset button 6.

NOTE: This step will cause the ACM to auto-scroll through configuration 1, configuration 2, EEPROM number, and ACM part number.

4. Press the TUNE UP button.

NOTE: Step 4 may need to be repeated until the ACM part number can be recorded.

5. Record the ACM part number.
6. Turn the ACM off.

Navigation Audio System

1. Turn the ACM on.
2. Press and hold preset buttons 3 and 6 for 3 seconds. The speaker walk-around test will begin.
3. Before the speaker walk-around test is complete, press END TEST on the display screen.
4. Select SYSTEM INFO from the menu.
5. Record the ACM part number.
6. Turn the ACM off.

SATELLITE RADIO RECEIVER ELECTRONIC SERIAL NUMBER (ESN) RETRIEVAL

Audio Systems Without Navigation

1. Operate the audio system in satellite radio mode.
2. Press and hold the AUX button and preset button 1, simultaneously.
   - The satellite radio receiver Electronic Serial Number (ESN) will be displayed on the screen.
3. Record the satellite radio receiver ESN.
4. Turn the audio system off.

Audio Systems With Navigation

1. Turn the audio system on.
2. Press the MENU button.
3. Select the SYSTEM INFO tab.

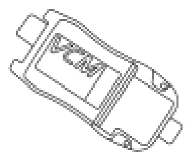
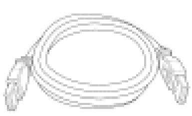
NOTE: The satellite radio receiver ESN is shown on the lower left corner of the

screen with the text "SR ESN:".

4. Record the satellite radio receiver ESN.
5. Turn the audio system off.

ACCESSORY PROTOCOL INTERFACE MODULE (APIM) SOFTWARE LEVEL CHECK

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST3051-A	Universal Serial Bus (USB) Male-A to Male-A Cable	CCMUSB2-AM-AM-10 or equivalent

1. Turn the Audio Control Module (ACM) on.
2. Connect the scan tool to the Data Link Connector (DLC).
3. Connect one end of the Universal Serial Bus (USB) male-A to male-A cable to the scan tool.
4. Connect the other end of the USB male-A to male-A cable to the vehicle USB port.
5. From the technician service publication website, run On-Line Automotive Service Information System (OASIS) using Quick Start or by manually entering the Vehicle Identification Number (VIN).
6. From the OASIS tab, select the "Sync/APIM" bullet.
7. Select the "Read APIM" button to verify the current Accessory Protocol Interface Module (APIM) software level.
    - The display shows both the Vehicle Interface Processor (VIP) and Consumer Interface Processor (CIP) software levels.
8. The scan tool displays the following information:
    - Last Recorded State - Hardware
        - VIN: vehicle identification number associated with the current APIM
        - Installed date: date the APIM was installed
        - Radio: currently identified ACM in the vehicle
        - HW Part No.: APIM hardware part number
        - Un-installed date: date (if any) the APIM was uninstalled
        - S/N: APIM serial number
    - Last Recorded State - Software

  - Date/Time: date and time of last recorded software installation
  - VIP: VIP software that was installed at that time
  - CIP: CIP software that was installed at that time
  - Description: a description of the content of the software revision
- History - Software
  - Date/Time: date and time of any recorded software installation
  - VIP: VIP software that was installed at that time
  - CIP: CIP software that was installed at that time
  - Description: a description of the content of the software revision
- Available Software for Programming
  - Select: allows the software package to be selected
  - Lineage: the original software release, if the software available is a revision
  - VIP: VIP software level that is available with the selection
  - CIP: CIP software level that is available with the selection
  - Description: a description of the content of the software revision

9. Click a CIP software level to view the device compatibility list associated with the CIP software level, if desired.
10. To exit the APIM software level check, disconnect the scan tool from the DLC and the USB port, or exit the OASIS screen.

REMOVAL AND INSTALLATION

ANTENNA

NOTE: Combination AM/FM/satellite antenna shown, others similar.

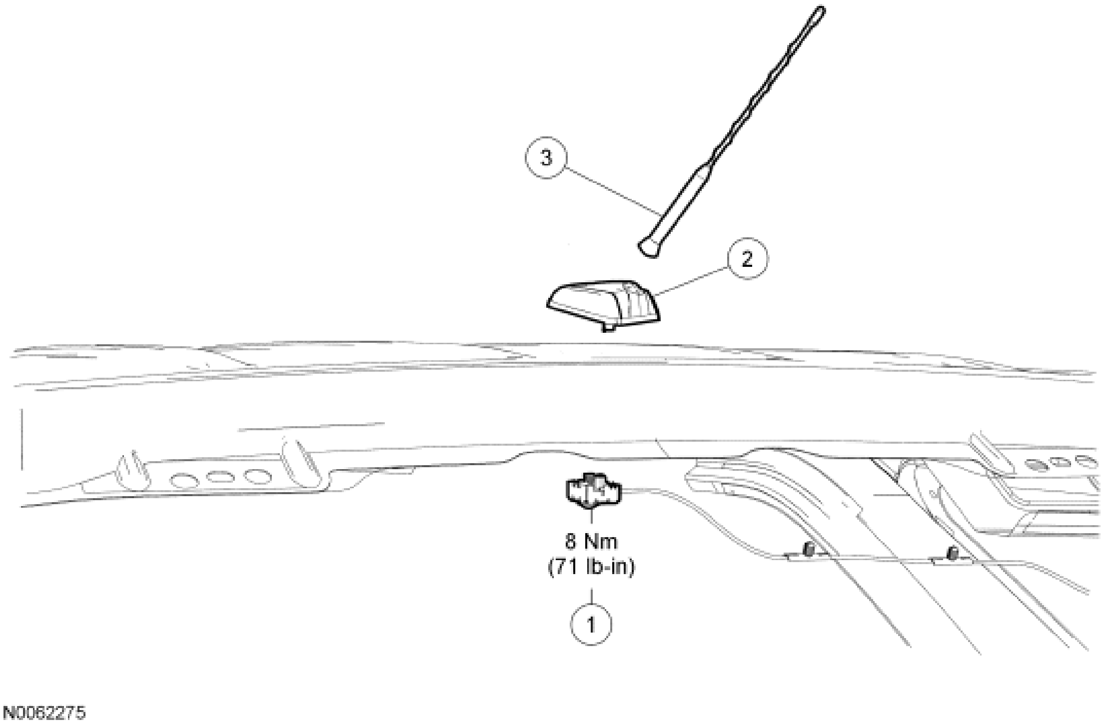


Fig. 37: Exploded View Of Antenna With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Antenna cable bolt (part of 18812)
2	18936	Antenna
3	18813	Antenna mast

REMOVAL AND INSTALLATION

1. Remove the LH and RH assist handles. For additional information, refer to Headliner in **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the LH and RH C-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
3. Carefully lower the rear of the headliner to gain access to the antenna.
4. Loosen the antenna cable bolt and disconnect the cable from the antenna.
   - To install, tighten to 8 Nm (71 lb-in).
5. Remove the antenna.
   - Remove the antenna mast, if equipped.
   - Press the 2 tabs and remove the antenna.
6. To install, reverse the removal procedure.

ANTENNA MODULE

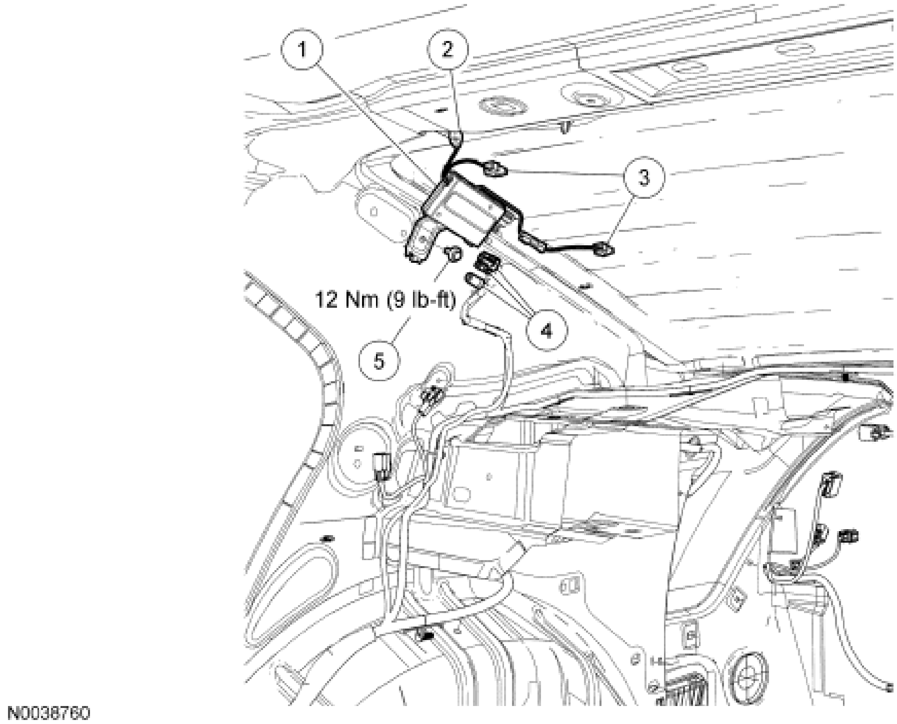


Fig. 38: Exploded View Of Antenna Module With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	19C029	Antenna module
2	-	Antenna module-to-antenna connector (part of 19C029)
3	-	Heated rear window connectors (part of 19C029)
4	-	Antenna module electrical connectors (part of 14A005)
5	-	Antenna module bolt

REMOVAL AND INSTALLATION

1. Remove the RH C-pillar trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Disconnect the antenna module connectors.
   - Disconnect the antenna cable-to-antenna module connector.
   - Disconnect the antenna module electrical connectors.
   - Disconnect the antenna module-to-antenna connector.
3. Remove the bolt and the antenna module.
   - To install, tighten to 12 Nm (9 lb-ft).
4. To install, reverse the removal procedure.

AUDIO DIGITAL SIGNAL PROCESSING (DSP) MODULE

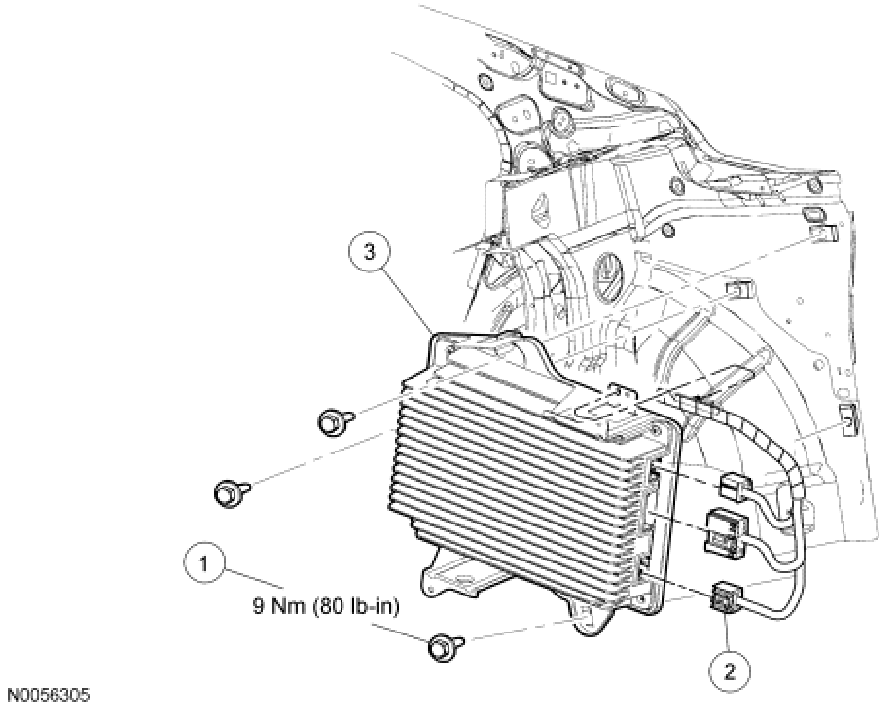


Fig. 39: Exploded View Of Audio Amplifier With Torque Specification - THX(R)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505423-S	Audio Digital Signal Processing (DSP) module bolts (3 required)
2	-	Audio DSP module electrical connectors (part of 14A005)
3	18B849	Audio DSP module

REMOVAL AND INSTALLATION

NOTE: Module configuration is only required if a new audio Digital Signal Processing (DSP) module is being installed.

1. Upload the audio DSP module configuration information to the scan tool. For additional information, refer to Programmable Module Installation (PMI) in **MODULE CONFIGURATION** article.
2. Remove the 4 pushpins and the RH luggage compartment trim panel.
3. Disconnect the audio DSP module electrical connectors.
4. Remove the 3 bolts and the audio DSP module.
    - To install, tighten to 9 Nm (80 lb-in).
5. To install, reverse the removal procedure.

- Download the configuration information to the audio DSP module. For additional information, refer to PMI in **MODULE CONFIGURATION** article.

AUDIO INPUT JACK

NOTE: Stowage bin door shown removed for clarity.

NOTE: Vehicle with the SYNC system shown, others similar.

NOTE: Fusion, Milan shown, MKZ similar.

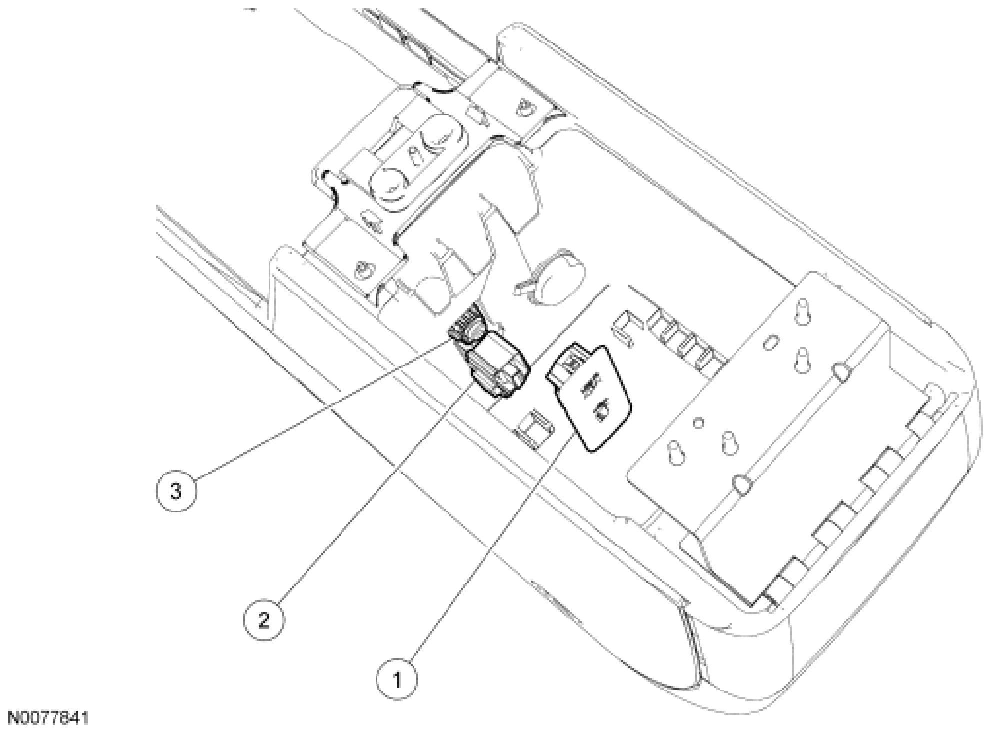


Fig. 40: Exploded View Of Audio Input Jack
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Audio input jack bezel
2	-	Universal Serial Bus (USB) cable and port (if equipped) (part of 14D202)
3	19A164	Audio input jack

REMOVAL AND INSTALLATION

1. Open the floor console stowage bin door.
2. Using a suitable tool, remove the audio input jack bezel by prying straight back (Fusion, Milan) or

straight up (MKZ).

- Disconnect the Universal Serial Bus (USB) cable and port, if equipped.

3. Release the tabs and remove the audio input jack.

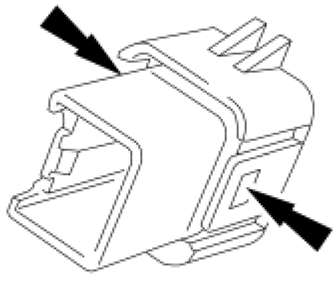


Fig. 41: Identifying Tabs On Audio Input Jack
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

AUDIO CONTROL MODULE (ACM) - FUSION, MILAN

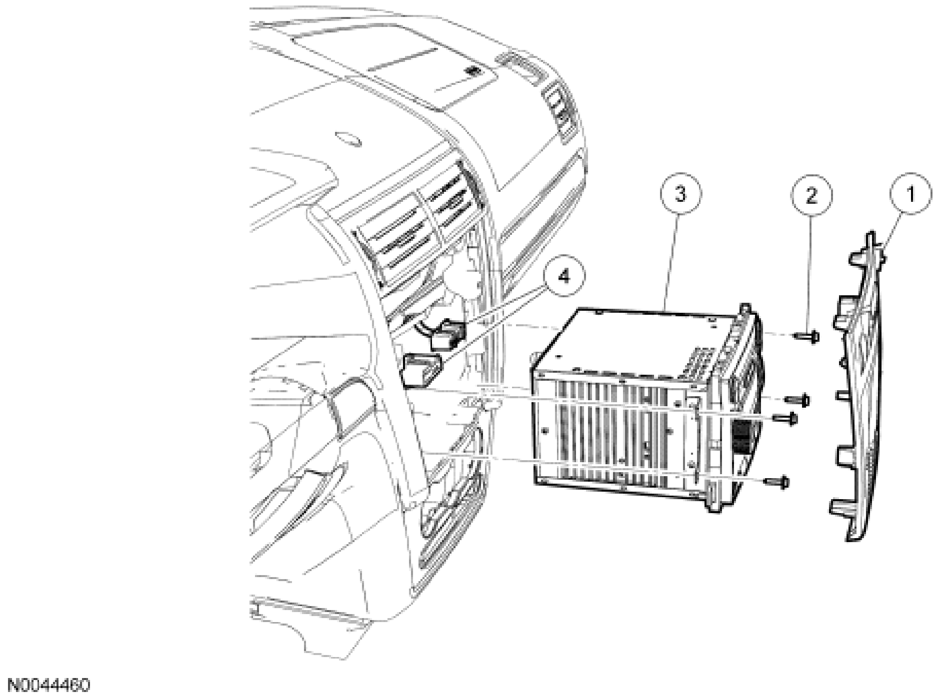


Fig. 42: Exploded View Of Audio Unit - Fusion, Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Instrument panel center finish panel

2	W707628	Audio Control Module (ACM) screws (4 required)
3	18806	ACM
4	-	ACM electrical connectors (part of 14401)

REMOVAL AND INSTALLATION

NOTE: **It is not necessary to remove the Audio Control Module (ACM) to retrieve the part number. For additional information, refer to Audio Unit Part Number Retrieval.**

NOTE: **Module configuration is only required if a new ACM is being installed.**

1. Upload the ACM configuration information to the scan tool. For additional information, refer to **MODULE CONFIGURATION** article.
2. Remove the instrument panel center finish panel.
   - Disengage the clips.
3. Remove the 4 screws and the ACM.
   - Disconnect the electrical connectors and the antenna lead-in cable.
4. To install, reverse the removal procedure.
   - Download the configuration information to the ACM. For additional information, refer to **MODULE CONFIGURATION** article.

AUDIO CONTROL MODULE (ACM) - MKZ

NOTE: **Navigation Audio Control Module (ACM) shown; others similar.**

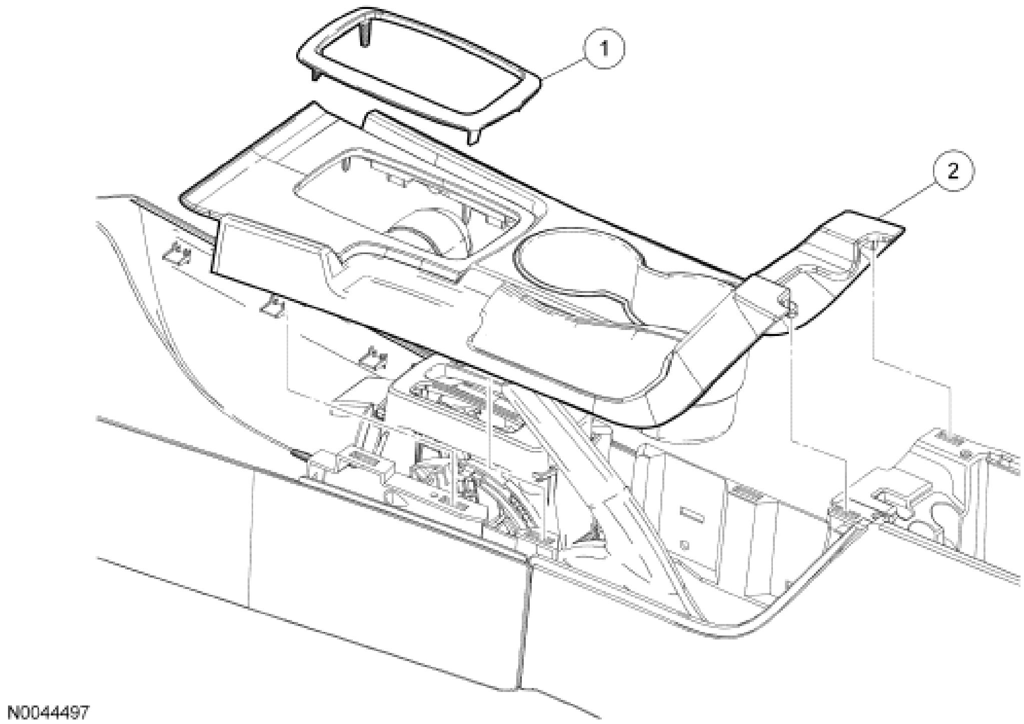


Fig. 43: Exploded View Of Floor Console Finish Panel
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Floor console finish panel trim ring
2	-	Floor console finish panel

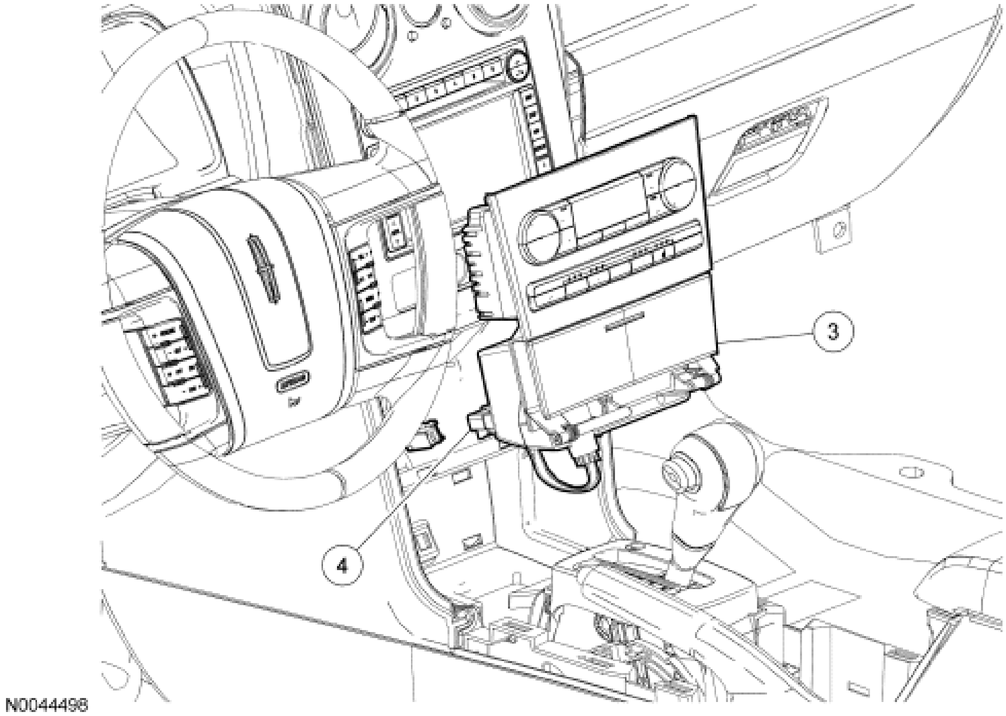


Fig. 44: Exploded View Of Climate Control & Bezel Assembly
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
3	-	Climate control and bezel assembly
4	-	Climate control and bezel assembly electrical connectors (part of 14401)

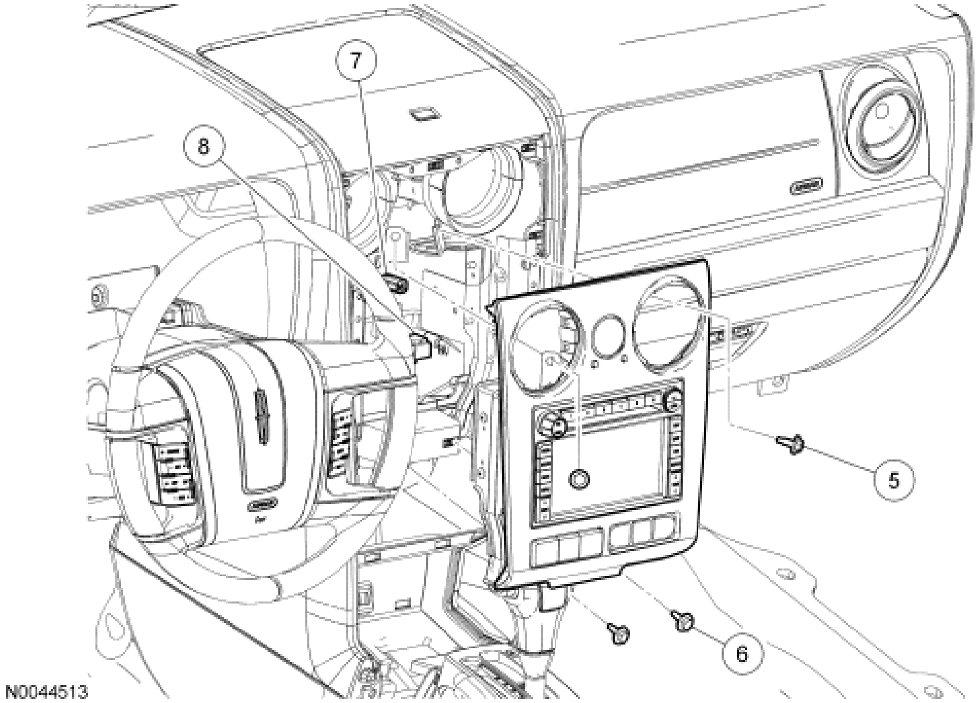


Fig. 45: Exploded View Of ACM & Bezel Assembly
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
5	-	Audio Control Module (ACM) bracket upper bolts (2 required)
6	-	ACM bracket lower bolts (2 required)
7	-	Navigation antenna connector (part of 14401)
8	-	ACM electrical connectors (part of 14401)

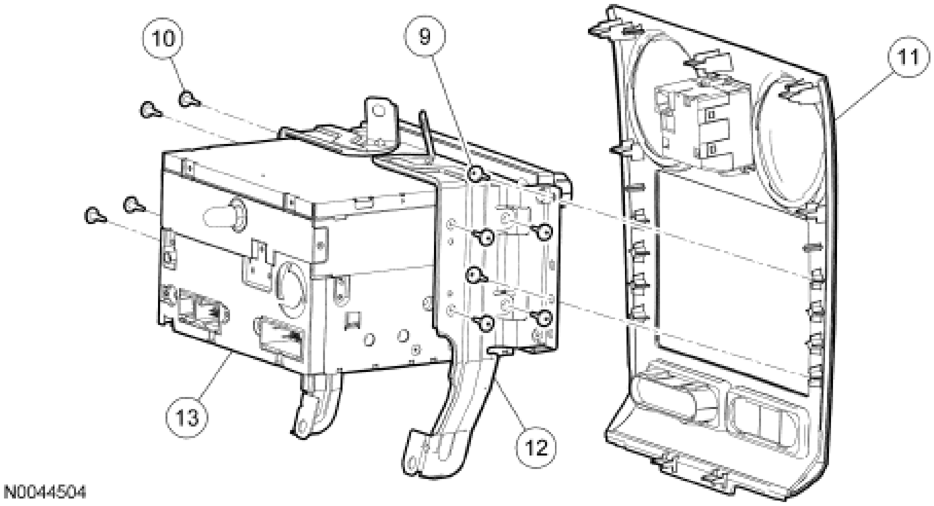


Fig. 46: Exploded View Of ACM

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
9	-	Audio Control Module (ACM) bracket-to-bezel screws (4 required)
10	-	ACM bracket-to-ACM screws (8 required)
11	-	Instrument panel center finish panel
12	-	ACM bracket (2 required)
13	18801	ACM

REMOVAL AND INSTALLATION

NOTE: It is not necessary to remove the ACM to retrieve the part number. For additional information, refer to <u>Audio Unit Part Number Retrieval</u>.

NOTE: For the navigation ACM, remove the navigation DVD before installing a new ACM, if possible.

NOTE: Module configuration is only required if a new ACM is being installed.

1. Upload the ACM configuration information to the scan tool. For additional information, refer to **MODULE CONFIGURATION** article.
2. Remove the floor console finish panel trim ring.
    - Disengage the clips.

NOTE: Apply the parking brake and pull the shift lever all the way back to ease removal.

3. Open the floor console storage compartment and remove the floor console finish panel.
    - Disengage the clips.
4. Remove the climate control and bezel assembly screw.
    - Open the ash receptacle door and remove the ash receptacle to access the screw.

NOTE: Close the ash receptacle door and pull gently, starting at the bottom of the bezel, in order to disengage the clips. Failure to follow this instruction may result in damage to the climate control and bezel assembly.

5. Remove the climate control and bezel assembly.
    - Disengage the clips.
    - Disconnect the electrical connectors.
6. Remove the center A/C ducts by opening the vents and pulling them straight out.
7. Remove the center A/C duct retainers.

- Using an appropriate tool, release the tabs and pull the retainers out.

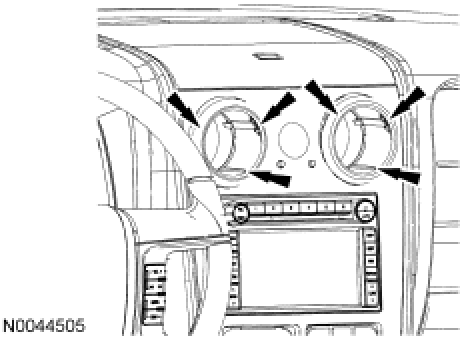


Fig. 47: Locating Center A/C Duct Retainers
Courtesy of FORD MOTOR CO.

8. Remove the ACM and bezel assembly.
   - Remove the 2 upper and 2 lower bolts.
   - Disengage the clips.
   - Disconnect the antenna and electrical connectors.
9. Remove the ACM.
   - Remove the 4 ACM bracket-to-bezel screws.
   - Remove the 8 ACM bracket-to-ACM screws.
   - Remove the ACM brackets from the ACM.
10. To install, reverse the removal procedure.
    - Download the configuration information to the ACM. For additional information, refer to **MODULE CONFIGURATION** article.

DOOR SPEAKER

NOTE: **Fusion and Milan shown.**

NOTE: **Front door shown, rear door similar.**

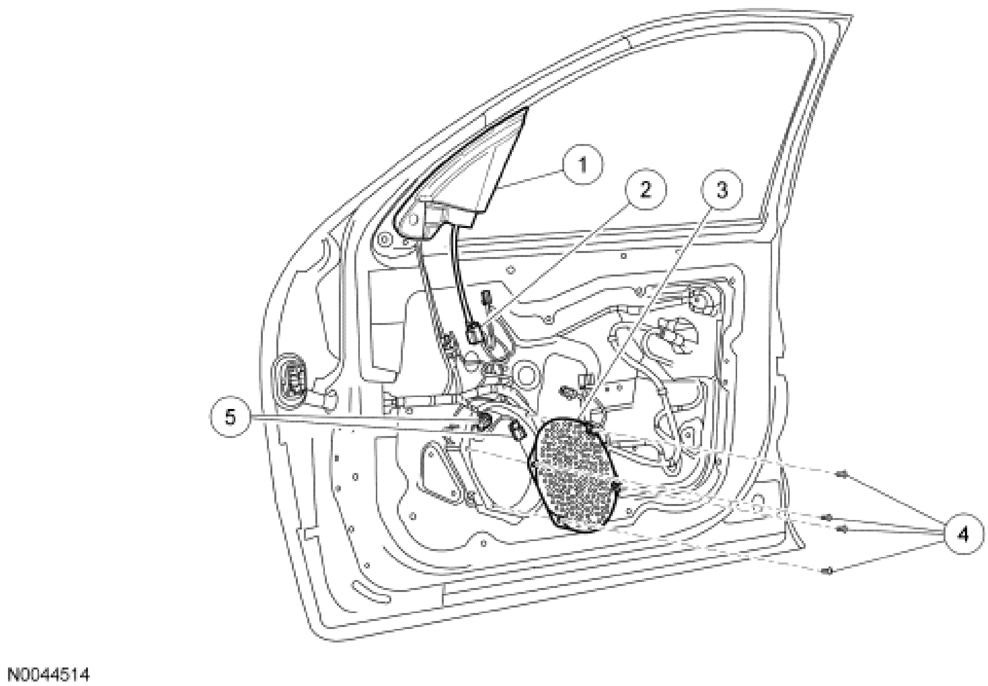


Fig. 48: Exploded View Of Door Speaker
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Sail panel
2	-	Front door tweeter speaker electrical connector (part of 18808)
3	18808	Door speaker
4	-	Door speaker screws (4 required)
5	-	Door speaker electrical connectors (part of 14630/14631)

REMOVAL AND INSTALLATION

All speakers

1. Remove the door trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

   Front door tweeter speaker (Fusion and Milan)

2. Remove the sail panel.
   - Disconnect the electrical connector.
3. Remove the 2 screws and the front door tweeter speaker from the sail panel.

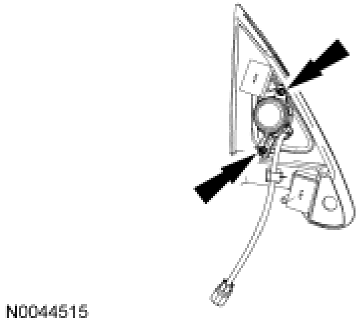


Fig. 49: Locating Front Door Tweeter Speaker Screws
Courtesy of FORD MOTOR CO.

Front door tweeter speaker (MKZ)

4. Remove the 2 nuts and the front door tweeter speaker from the door trim panel.

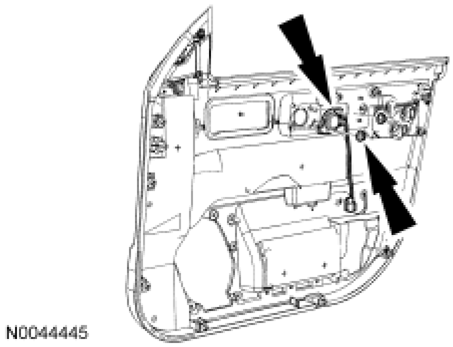


Fig. 50: Locating Front Door Tweeter Speaker Nuts
Courtesy of FORD MOTOR CO.

Front or rear door speaker

5. Remove the 4 screws and the door speaker.
   - Disconnect the electrical connectors.

All speakers

6. To install, reverse the removal procedure.

GLOBAL POSITIONING SYSTEM (GPS) ANTENNA

NOTE:	**Steering wheel shown removed for clarity.**

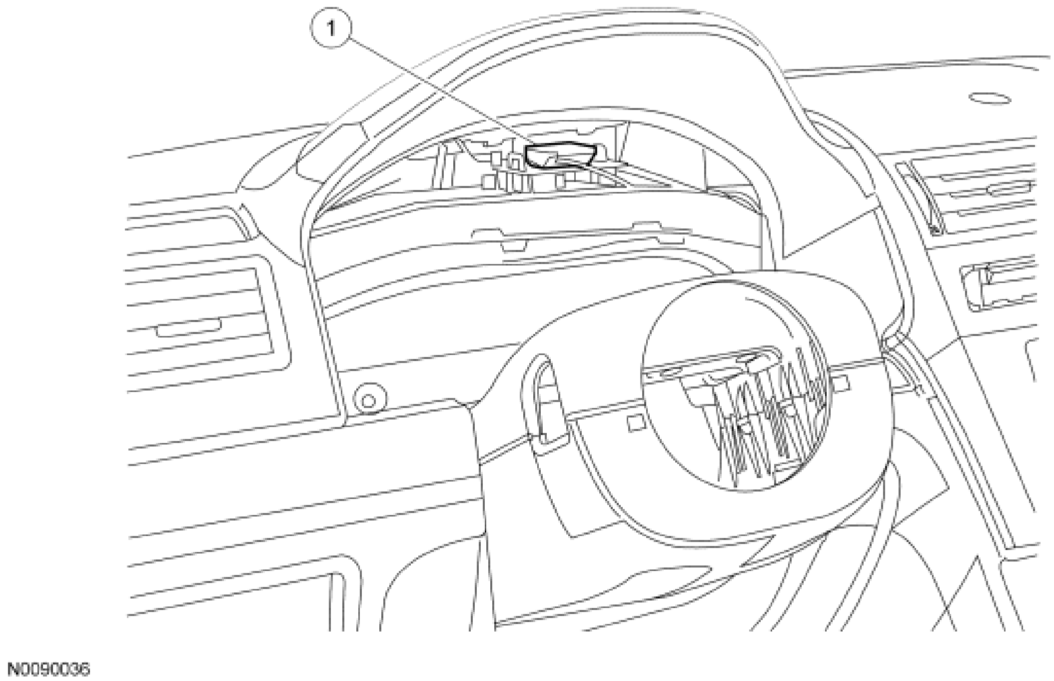


Fig. 51: Exploded View Of Global Positioning System (GPS) Antenna
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	10E893	Global Positioning System (GPS) antenna

REMOVAL AND INSTALLATION

1. Remove the Audio Control Module (ACM). For additional information, refer to **Audio Control Module (ACM) - Fusion, Milan** or **Audio Control Module (ACM) - MKZ**.
2. Remove the Instrument Cluster (IC). For additional information, refer to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
3. Release the clip and remove the GPS antenna.
4. To install, reverse the removal procedure.

INSTRUMENT PANEL SPEAKER

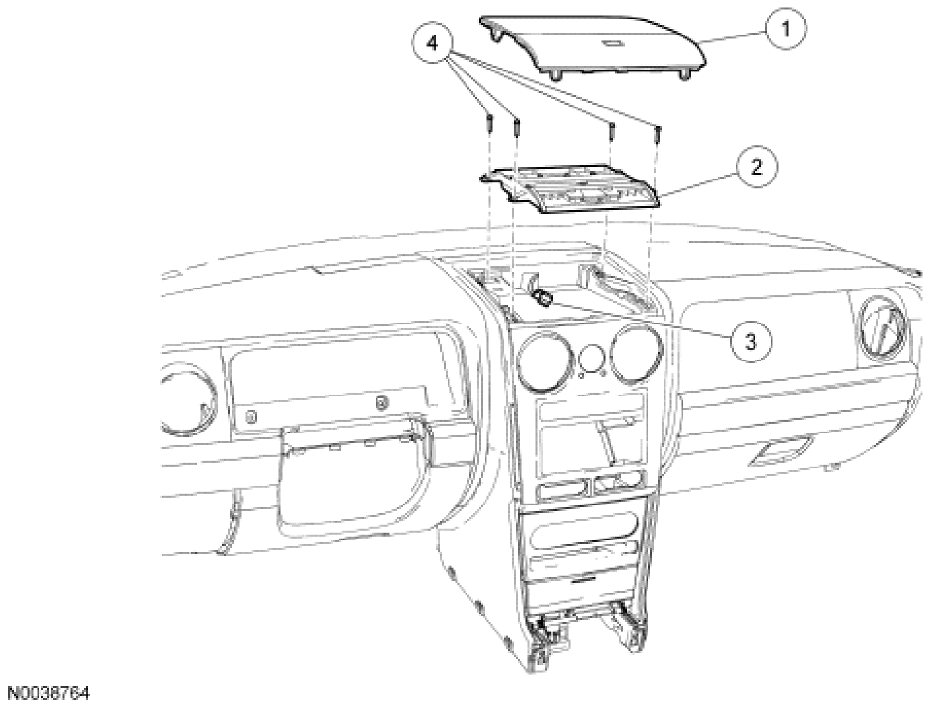


Fig. 52: Exploded View Of Instrument Panel Speaker
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	54044A92	Instrument panel speaker cover
2	18808	Instrument panel speaker
3	-	Instrument panel speaker electrical connector (part of 14401)
4	-	Instrument panel speaker screws (4 required)

REMOVAL AND INSTALLATION

1. Remove the instrument panel speaker cover.
2. Remove the 4 screws and the instrument panel speaker.
   - Disconnect the electrical connector.
3. To install, reverse the removal procedure.

PARCEL SHELF SPEAKER

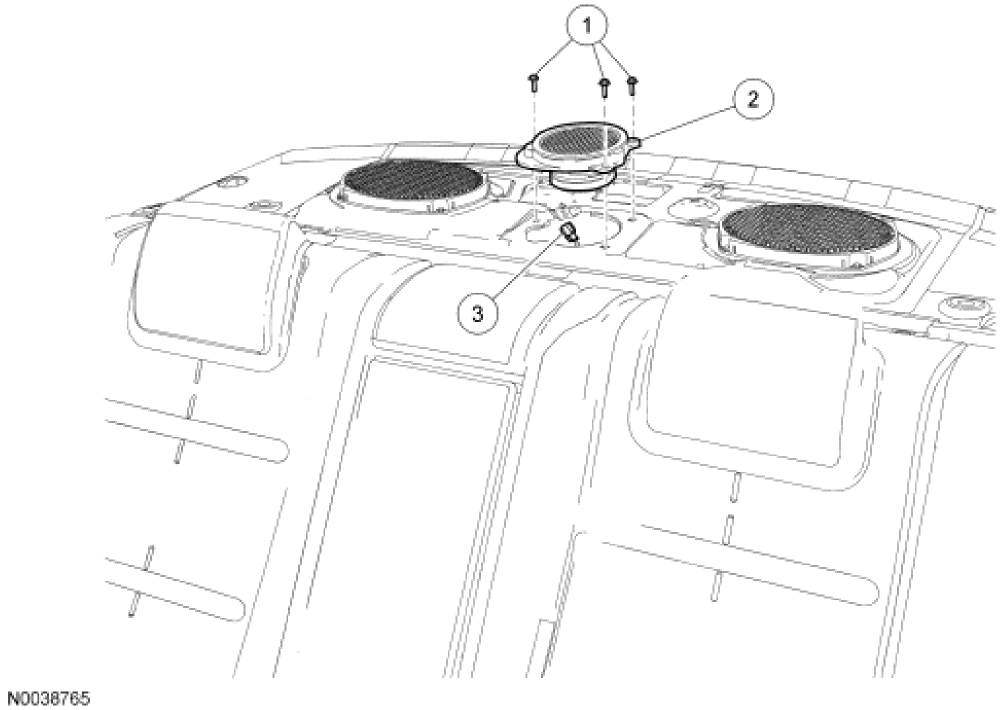


Fig. 53: Exploded View Of Parcel Shelf Speaker
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Parcel shelf speaker screws (3 required)
2	18808	Parcel shelf speaker
3	-	Parcel shelf speaker electrical connector (part of 14A005)

REMOVAL AND INSTALLATION

1. Remove the parcel shelf. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the 3 screws and the parcel shelf speaker.
   - Disconnect the electrical connector.
3. To install, reverse the removal procedure.

SATELLITE DIGITAL AUDIO RECEIVER SYSTEM (SDARS) MODULE

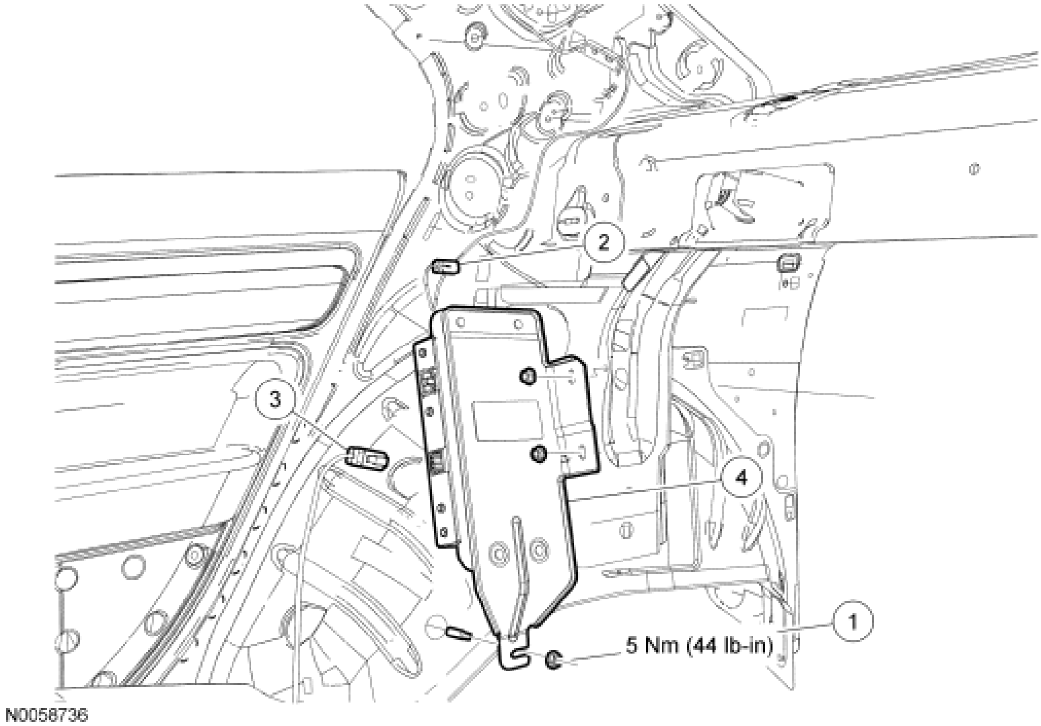


Fig. 54: Exploded View Of Satellite Radio Receiver With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W706131-S437	Satellite Digital Audio Receiver System (SDARS) module nuts (3 required)
2	18812	Satellite radio antenna cable electrical connector
3	-	SDARS module electrical connector (part of 14A005)
4	18C851	SDARS module

REMOVAL AND INSTALLATION

NOTE: Module configuration is only required if a new Satellite Digital Audio Receiver System (SDARS) module is being installed.

1. Upload the SDARS module configuration information to the scan tool. For additional information, refer to Programmable Module Installation (PMI) in **MODULE CONFIGURATION** article.
2. Remove the rear seat backrest. For additional information, refer to **SEATING** article.
3. Disconnect the satellite radio antenna cable and the SDARS module electrical connectors.
4. Remove the 3 nuts and the SDARS module.
   - To install, tighten to 5 Nm (44 lb-in).
5. To install, reverse the removal procedure.
   - Download the configuration information to the SDARS module. For additional information, refer to PMI in **MODULE CONFIGURATION** article.

STEERING WHEEL CONTROLS

NOTE: Fusion shown, Milan similar.

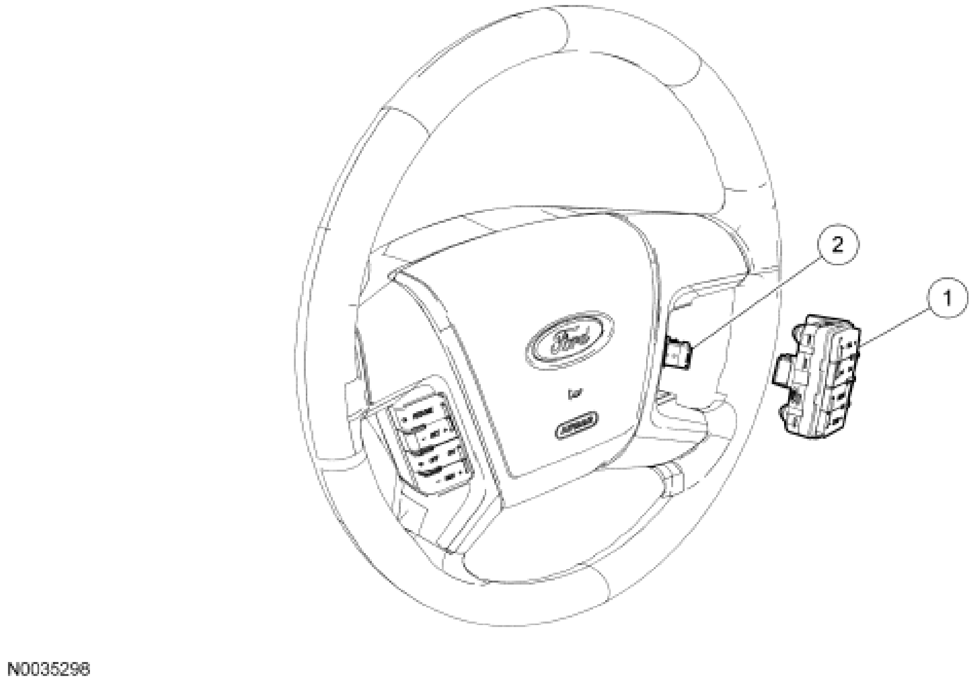


Fig. 55: Exploded View Of Steering Wheel Controls - Fusion, Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9C888	Steering wheel controls
2	-	Steering wheel controls electrical connector (part of 14A411)

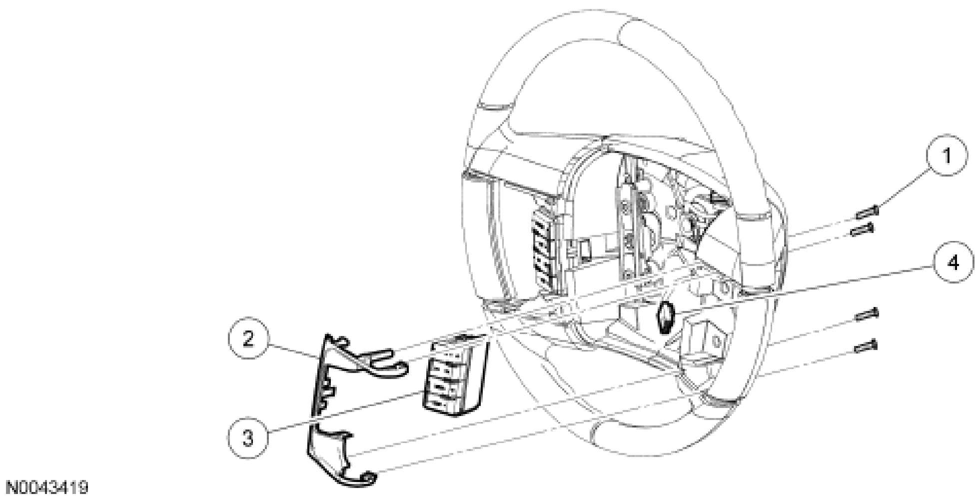


Fig. 56: Exploded View Of Steering Wheel Controls - MKZ
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Steering wheel controls bezel screws (4 required)
2	-	Steering wheel controls bezel
3	9C888	Steering wheel controls
4	-	Steering wheel controls electrical connector (part of 14A411)

REMOVAL AND INSTALLATION

MKZ

1. Remove the driver air bag module. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
2. Remove the 4 screws and the steering wheel controls bezel.

   All vehicles

3. Remove the steering wheel controls by pulling the switch toward the rear of the vehicle.
   - Disconnect the electrical connector.
4. Remove the steering wheel controls bezel, if equipped.
5. To install, reverse the removal procedure.

SUBWOOFER AMPLIFIER

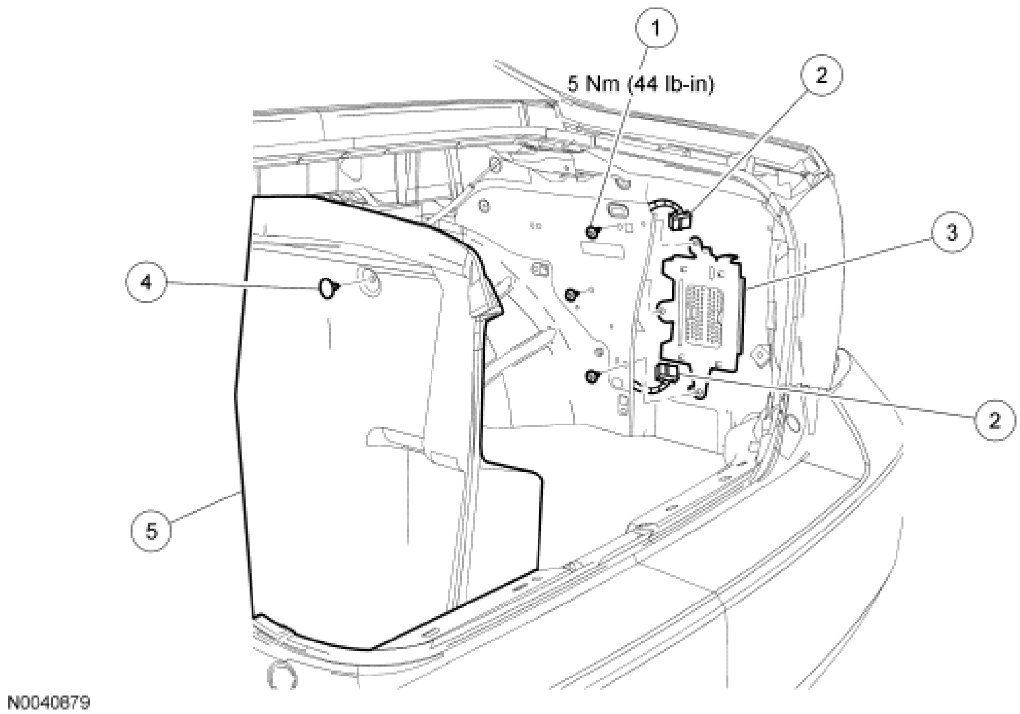


Fig. 57: Exploded View Of Subwoofer Amplifier With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W503924	Subwoofer amplifier screws (3 required)
2	-	Subwoofer amplifier electrical connectors (part of 14A005)
3	18B849	Subwoofer amplifier
4	N802734	RH luggage compartment trim panel pushpins (4 required)
5	5445422	RH luggage compartment trim panel

REMOVAL AND INSTALLATION

NOTE: Make sure the key is in the OFF position.

1. Remove the 4 pushpins and the RH luggage compartment trim panel.
2. Disconnect the subwoofer amplifier electrical connectors.
3. Remove the 3 screws and the subwoofer amplifier.
    - To install, tighten to 5 Nm (44 lb-in).
4. To install, reverse the removal procedure.

SUBWOOFER SPEAKER

NOTE: **RH side shown, LH side similar.**

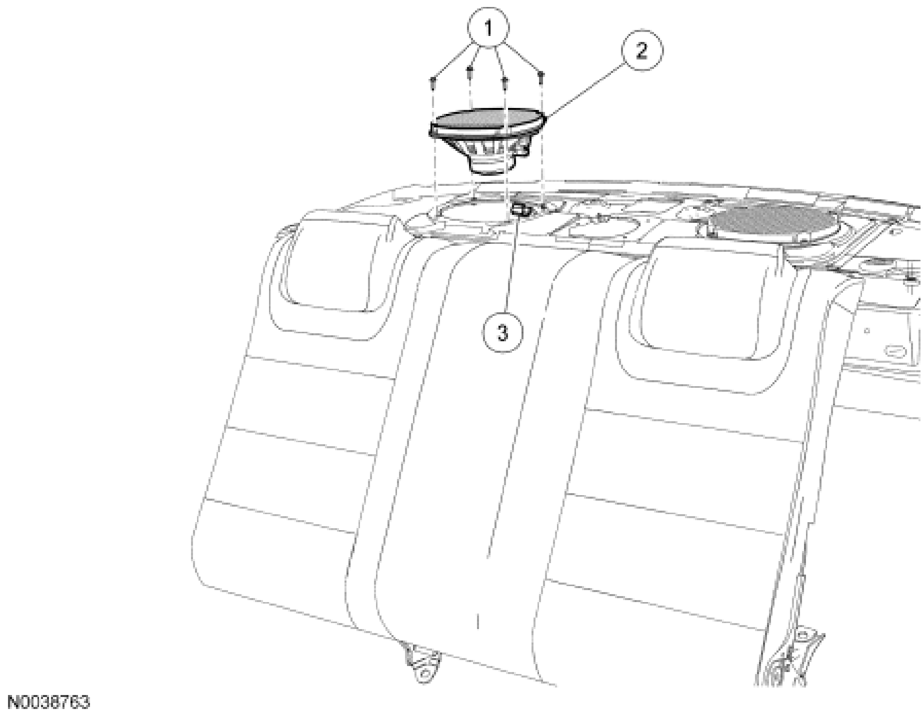


Fig. 58: Exploded View Of Subwoofer Speaker
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Subwoofer speaker screws (4 required)
2	18808	Subwoofer speaker
3	-	Subwoofer speaker electrical connector (part of 14A005)

REMOVAL AND INSTALLATION

1. Remove the parcel shelf. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the 4 screws and the subwoofer speaker.
    - Disconnect the electrical connector.
3. To install, reverse the removal procedure.

ACCESSORY PROTOCOL INTERFACE MODULE (APIM)

NOTE: **Fusion, Milan shown, MKZ similar.**

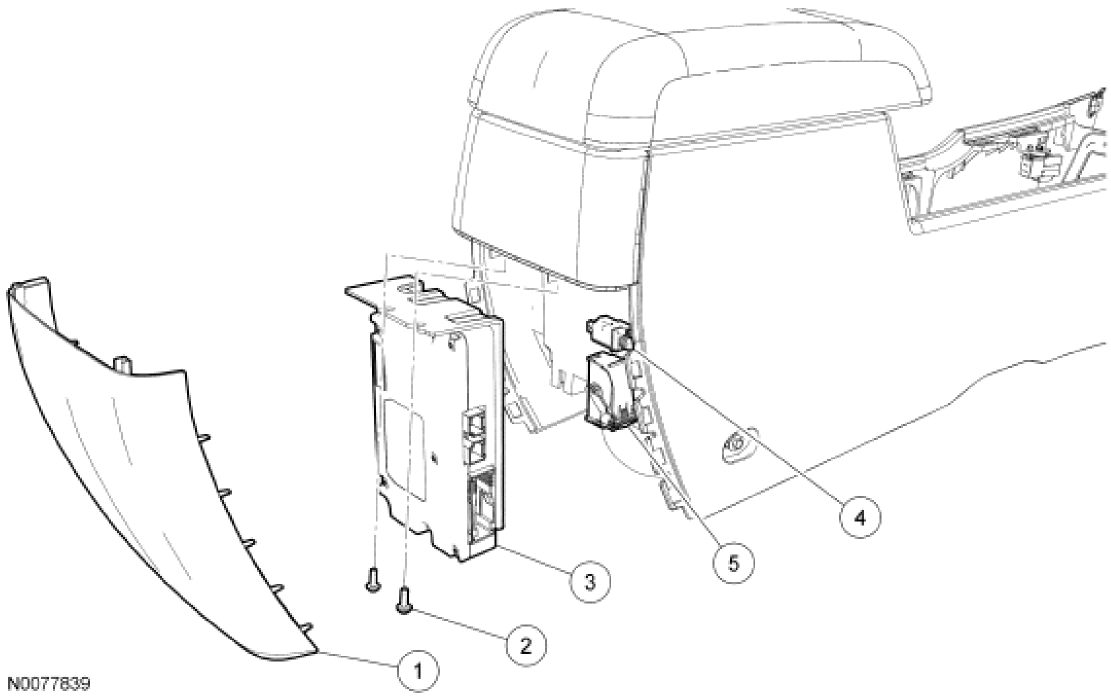


Fig. 59: Exploded View Of Accessory Protocol Interface Module (APIM)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Floor console rear trim panel (part of 045A36)
2	W505060-S	Accessory Protocol Interface Module (APIM) screws (2 required [Fusion, Milan], 4 required [MKZ])
3	14D212	APIM
4	14D202	Universal Serial Bus (USB) cable
5	-	APIM electrical connector (part of 14B079)

REMOVAL AND INSTALLATION

NOTE: Accessory Protocol Interface Module (APIM) reprogramming is only necessary if a new module is being installed.

1. Verify the current APIM software and hardware level. For additional information, refer to Accessory Protocol Interface Module (APIM) Reprogramming **MODULE CONFIGURATION** article.
2. Remove the floor console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
3. Remove the floor console rear trim panel by pulling straight back to disengage the clips.

NOTE: For Fusion, Milan, the APIM is removed as an assembly with the bracket.

4. Remove the 2 screws (Fusion, Milan) or 4 screws (MKZ) and the APIM.

- Disconnect the APIM electrical connector.
- Disconnect the Universal Serial Bus (USB) cable.

5. To install, reverse the removal procedure.
    - Reprogram the APIM. For additional information, refer to **MODULE CONFIGURATION** article.

UNIVERSAL SERIAL BUS (USB) CABLE AND PORT

NOTE: Fusion, Milan shown, MKZ similar.

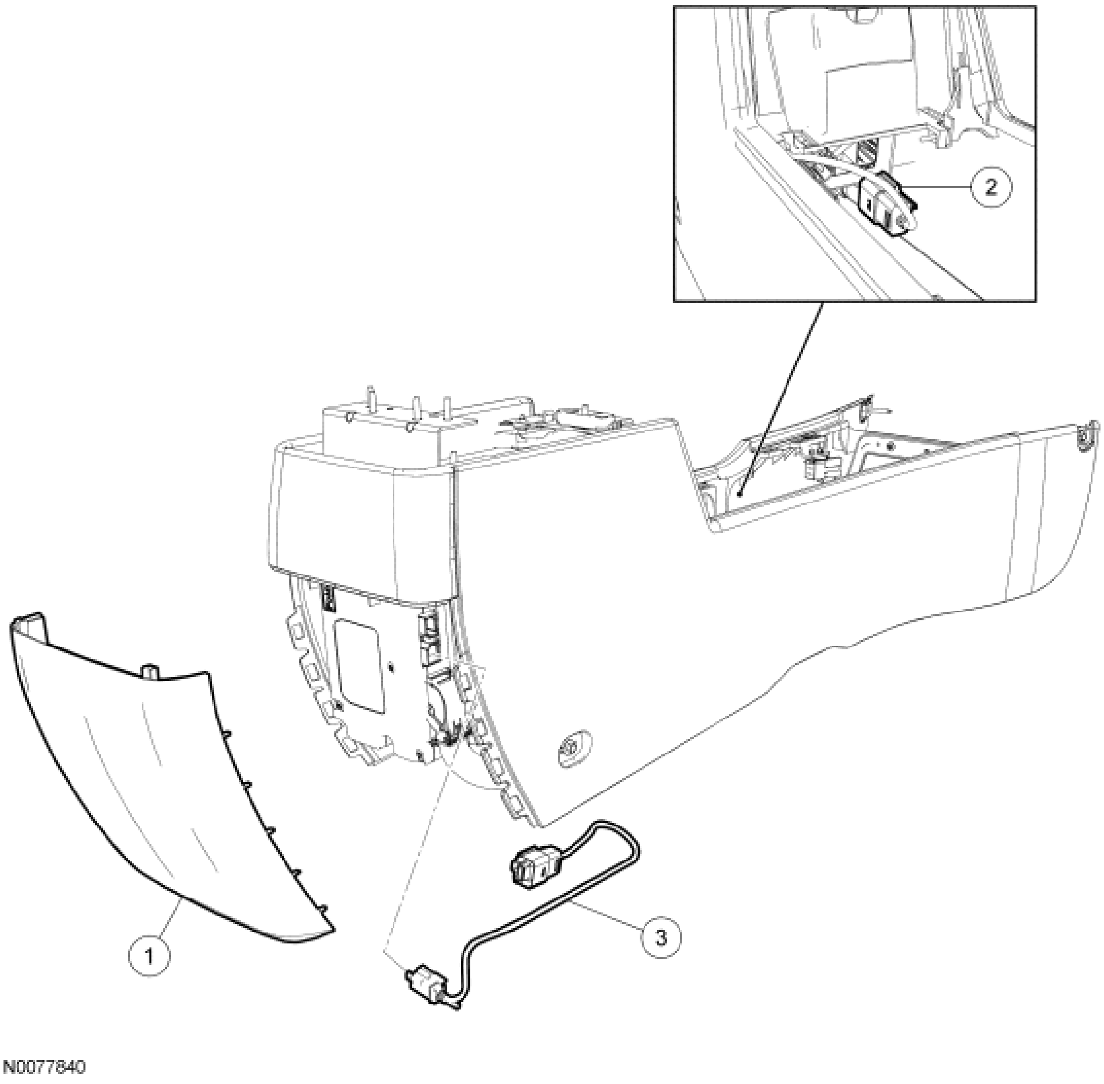


Fig. 60: Exploded View Of Universal Serial Bus (USB) Cable & Port
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Floor console rear trim panel (part of 045A36)

2	-	Universal Serial Bus (USB) cable and port-to-bezel connector (part of 14D202)
3	14D202	USB cable and port

REMOVAL AND INSTALLATION

1. Remove the floor console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Disconnect the Universal Serial Bus (USB) cable and port-to-bezel connector.
3. Remove the floor console rear trim panel by pulling straight back to disengage the clips.

NOTE: **Be careful not to flex the floor console RH side panel too much, or damage to the floor console may occur.**

4. Remove the USB cable and port.
   - Disconnect the USB cable and port-to-Accessory Protocol Interface Module (APIM) electrical connector.
   - Carefully flex the floor console RH side panel and remove the USB cable and port.
5. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Instrument Cluster & Panel Illumination - Fusion, Milan & MKZ

DESCRIPTION AND OPERATION

INSTRUMENT CLUSTER AND PANEL ILLUMINATION

The instrument cluster and panel illumination is used to provide back lighting to the dimmable and non-dimmable switches and control components.

For MKZ vehicles equipped with autolamps, if the exterior lamps are activated during daytime sunload conditions, the message center, audio control module (ACM), heating ventilation air conditioning (HVAC) module and switch illumination remain at full intensity and do not dim from the instrument panel dimmer switch during this condition. If the vehicle travels under a bridge or a tunnel, the low level of ambient light causes the illumination level of the message center, ACM, HVAC module and switch to change to the level set by the instrument panel dimmer switch. The message center, ACM, HVAC module and switch illumination change back to full intensity when the intense ambient light is restored.

Dimmable Backlighting

The dimmable switches and components are illuminated when the headlamp switch is in either the PARKING LAMPS ON or HEADLAMPS ON position. The level of intensity is adjustable by rotating the instrument panel dimmer switch either up to increase intensity or down to decrease intensity. The dimmable switches and components consist of:

- Ashtray
- Audio control module (ACM)
- Clock
- Deck lid release switch
- Door lock control switches (MKZ)
- Hazard/passenger air bag disable/traction control switch (if equipped)
- Headlamp switch
- Heating ventilation air conditioning (HVAC) module
- Instrument cluster (IC)
- Instrument panel dimmer switch
- Memory set switch (if equipped)
- Message center switch
- Speed control switches
- Steering wheel audio control switches
- Transaxle range (TR) indicator
- Window adjust switches (MKZ)

Non-Dimmable Backlighting

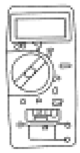
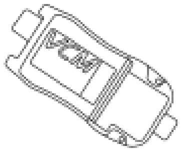
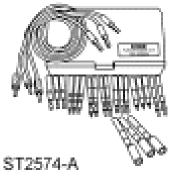
The non-dimmable lighting switches and components are illuminated when the accessory delay relay is energized. The non-dimmable switches and components are illuminated at full lamp intensity. The non-dimmable lighting switches and components consist of:

- Cigar lighter
- Door lock control switches (Fusion, Milan)
- Roof opening panel switch (if equipped)
- Window adjust switches (Fusion, Milan)

DIAGNOSTIC TESTS

INSTRUMENT CLUSTER AND PANEL ILLUMINATION

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communications Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

Hardwired Dimmable Illumination

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

When the parking lamps or the headlamps are on, the SJB monitors the input from the instrument panel dimmer switch. The SJB sends a pulse-width modulated (PWM) voltage to the dimmable switches and control components based on input received from the instrument panel dimmer switch.

Networked Controlled Dimmable Illumination

The SJB sends a message over the medium speed controller area network (MS-CAN) to the heating ventilation air conditioning (HVAC) module - electronic automatic temperature control (EATC), the audio control module (ACM), and the instrument cluster (IC) to indicate the back lighting intensity level. When any module does not receive the illumination signal, it defaults to full nighttime brightness. Full nighttime intensity is equivalent to the illumination level when the parking lamps are on, and the instrument panel dimmer switch is in the highest setting.

Non-Dimmable Illumination

When the ignition switch is in the START or RUN positions, the delayed accessory relay provides voltage from the SJB to the non-dimmable components.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical
• Bulb(s) • Wiring, terminals or connectors • Illuminated components • Ashtray

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool release software.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the

PCM.

7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record the continuous memory DTCs.
8. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
9. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1247	Panel Dim Switch Circuit Open	Go to **Pinpoint Test E**.
B2026	Incandescent Backlighting Output Circuit Failure	Go to **Pinpoint Test C**.
B2027	LED Backlighting Output Circuit Failure	Go to **Pinpoint Test C**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The control illumination is inoperative - all hardwired dimmable illumination	• Wiring, terminals or connectors • Instrument panel dimmer switch • SJB	• Go to **Pinpoint Test A**.
• The control illumination is inoperative - all non-dimmable illumination	• Fuse • Wiring, terminals or connectors • SJB	• Go to **Pinpoint Test F**.
• The control illumination is always on - all hardwired illumination	• Wiring, terminals or connectors • SJB	• Go to **Pinpoint Test D**.

• All control illumination sources do not dim	• Wiring, terminals or connectors • Instrument panel dimmer switch • SJB	• Go to **Pinpoint Test E**.

• All network-controlled illumination sources do not dim - hardwired illumination sources operate correctly	• Medium speed communication area network (MS-CAN) fault
	• SJB
		• Using the scan tool, CARRY OUT the network test.
		  ◦ If the SJB does not communicate with the scan tool, REFER to **MODULE COMMUNICATIONS NETWORK** article.
		  ◦ If the SJB does communicate with the scan tool, INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

• One or more (but not all) individual dimmable illumination sources are inoperative	• Wiring, terminals or connectors • Illumination source • Clockspring (steering wheel controls only) • SJB	• For the steering wheel controls, go to **Pinpoint Test B**. • For all others, go to **Pinpoint Test C**.
• One or more (but not all) non-dimmable illumination sources are inoperative	• Wiring, terminals or connectors • Illumination source • SJB	• Go to **Pinpoint Test G**.

• The instrument cluster (IC) illumination is inoperative	• IC
	• SJB
		• VERIFY that the IC is the only inoperative network controlled illumination source.
		  ◦ If the IC is the only inoperative network controlled illumination source, INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. TEST the system for normal operation.
		  ◦ If more than one network controlled illumination source is inoperative, INSTALL a new SJB.

		REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

• The audio control module (ACM) illumination is inoperative	• ACM
	• SJB
		• VERIFY that the ACM is the only inoperative network controlled illumination source.
		  • If the ACM is the only inoperative network controlled illumination source, INSTALL a new ACM. REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article. TEST the system for normal operation.
		  • If more than one network controlled illumination source is inoperative, INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

• The heating ventilation air conditioning (HVAC) module - electronic automatic temperature control (EATC) illumination is inoperative	• HVAC module-EATC
	• SJB
		• VERIFY that the HVAC module-EATC is the only inoperative network controlled illumination source.
		  • If the HVAC module-EATC is the only inoperative network controlled illumination source, INSTALL a new HVAC module-EATC. REFER to HVAC module in **CLIMATE CONTROL** article. TEST the system for normal operation.
		  • If more than one network controlled illumination source is inoperative, INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

Pinpoint Tests

Pinpoint Test A: The Control Illumination Is Inoperative - All Hardwired Dimmable Illumination

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Cluster and Panel Illumination for schematic and

connector information.

Normal Operation

When the parking lamps or the headlamps are on, the smart junction box (SJB) sends a reference voltage signal to the instrument panel dimmer switch on circuit VLN18 (BU/WH), which is grounded by the SJB through circuit CLN27 (WH/BN). The SJB uses the reference voltage to determine the intensity of the back lighting desired by the operator. The SJB sends a pulse-width modulated (PWM) voltage to the dimmable illumination sources on circuit VLN04 (VT/GY) based on the input received from the instrument panel dimmer switch.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Instrument panel dimmer switch
- SJB

PINPOINT TEST A: THE CONTROL ILLUMINATION IS INOPERATIVE - ALL HARDWIRED DIMMABLE ILLUMINATION

A1 CHECK THE INSTRUMENT PANEL DIMMER SWITCH INPUT

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB dimmer switch status (DSWSTAT) PID while rotating the instrument panel dimmer switch from the lowest setting to the highest setting.
- **Does the DSWSTAT PID indicate the switch is operating correctly?**

  YES : Go to A2.

  NO : INSTALL a new instrument panel dimmer switch. REFER to **Instrument Panel Dimmer Switch**. TEST the system for normal operation.

A2 CHECK CIRCUIT VLN04 (VT/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280d

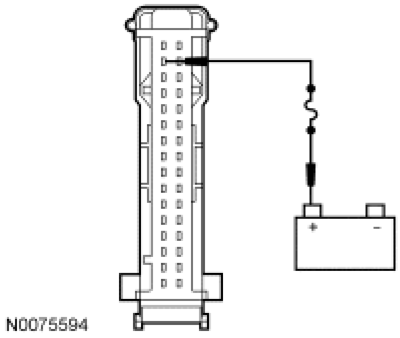


Fig. 1: Checking Circuit VLN04 (VT/GY) For An Open
Courtesy of FORD MOTOR CO.

NOTE: If the jumper wire fuse fails, repair circuit VLN04 (VT/GY) for a short to ground.

- Connect a fused jumper wire between the SJB C2280d-2, circuit VLN04 (VT/GY), harness side and battery positive.
- Observe the dimmable illumination sources.
- **Do the dimmable illumination sources illuminate?**

  YES : Go to A3.

  NO : REPAIR the circuit. TEST the system for normal operation.

A3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: The Steering Wheel Controls Illumination Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Cluster and Panel Illumination for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a pulse width modulated (PWM) voltage to the steering wheel controls through circuit VLN04 (VT/GY) to the clockspring. The PWM signal passes through the clockspring to circuit VLN04 (VT/GY) to the LH and RH control switches. Ground to the LH and RH steering wheel switch is supplied through circuit GD165 (BK).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Steering wheel control switch
- Clockspring

PINPOINT TEST B: THE STEERING WHEEL CONTROLS ILLUMINATION IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 CHECK FOR VOLTAGE TO THE STEERING WHEEL CONTROL SWITCHES

- Remove the speed control switch. Refer to **SPEED CONTROL** article.
- Remove the audio steering wheel controls. Refer to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
- With the parking lamps on, rotate the instrument panel dimmer switch to the full illumination position.

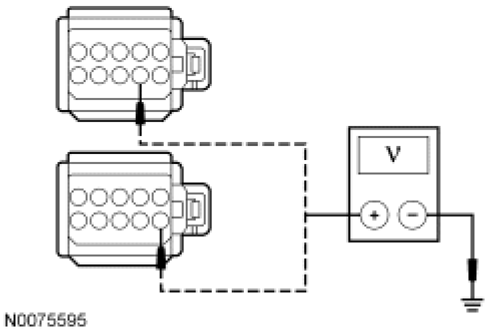


Fig. 2: Checking For Voltage To Steering Wheel Control Switches
Courtesy of FORD MOTOR CO.

- Measure the voltage between the speed control switch C2998-2, circuit VLN04 (VT/GY), harness side and ground; and between the audio steering wheel controls C2999-1, circuit VLN04 (VT/GY), harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : TURN the parking lamps off. Go to B4.

  NO : Go to B2.

B2 CHECK CIRCUIT VLN04 (VT/GY) FOR AN OPEN IN THE STEERING WHEEL CONTROLS HARNESS

- Disconnect: Clockspring C218b

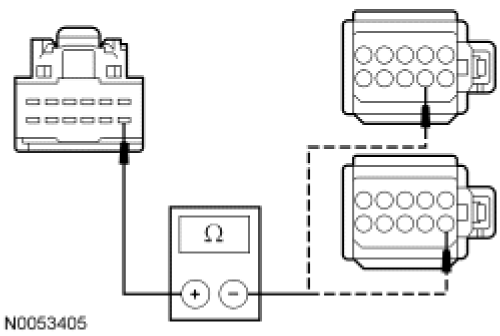


Fig. 3: Checking Steering Wheel Harness Circuit VLN04 (VT/GY) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218b-7, circuit VLN04 (VT/GY), harness side and the speed control switch C2998-2, circuit VLN04 (VT/GY), harness side; and between the clockspring C218b-7, circuit VLN04 (VT/GY), harness side and the audio steering wheel controls C2999-1, circuit VLN04 (VT/GY), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to B3.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

B3 CHECK CIRCUIT VLN04 (VT/GY) FOR AN OPEN TO THE CLOCKSPRING

- Disconnect: Clockspring C218a
- With the parking lamps on, rotate the instrument panel dimmer switch to the full illumination position.

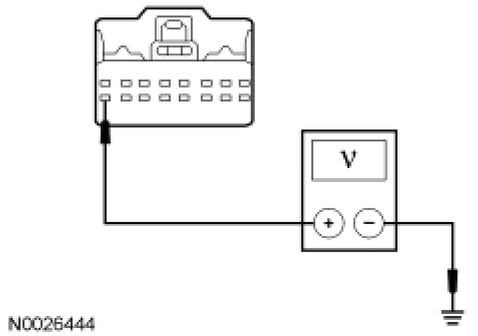


Fig. 4: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the clockspring C218a-16, circuit VLN04 (VT/GY), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new clockspring. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

B4 CHECK CIRCUIT GD165 (BK) FOR AN OPEN

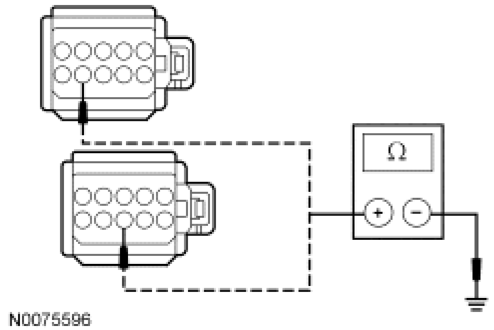


Fig. 5: Checking Circuit GD165 (BK) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the speed control switch C2998-4, circuit GD165 (BK), harness side and ground; and between the audio steering wheel controls C2999-3, circuit GD165 (BK), harness side and ground.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new speed control switch or audio steering wheel controls as necessary. REFER to **SPEED CONTROL** article (speed control switch) or **INFORMATION AND ENTERTAINMENT SYSTEMS** article (audio steering wheel controls). TEST the system for normal operation.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

Pinpoint Test C: One Or More (But Not All) Individual Dimmable Illumination Sources Are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Cluster and Panel Illumination for schematic and connector information.

Normal Operation

The smart junction box (SJB) sends a pulse-width modulated (PWM) voltage to the dimmable components through circuits VLN04 (VT/GY) and CLN04 (BU/BN) (Fusion, Milan only). Ground for the illumination sources is supplied through circuit GD116 (BK/VT), GD126 (BK/WH), or GD139 (BK/YE).

The window adjust and door lock control switches are only dimmable for MKZ. To diagnose an inoperative window adjust or door lock control switch illumination for Fusion or Milan, go to **Pinpoint Test G**.

- DTC B2026 (Incandescent Backlighting Output Circuit Failure) - sets when the SJB detects a short to ground on the floor shifter or clock circuit. Only Fusion and Milan set this DTC, as the floor shifter and clock for MKZ receive voltage through the LED illumination circuit. This DTC only sets as a continuous DTC.
- DTC B2027 (LED Backlighting Output Circuit Failure) - sets when a short to ground is detected on circuit VLN04 (VT/GY). This DTC only sets as a continuous DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Illumination source

PINPOINT TEST C: ONE OR MORE (BUT NOT ALL) INDIVIDUAL DIMMABLE ILLUMINATION SOURCES ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CHECK THE VOLTAGE TO THE INOPERATIVE ILLUMINATION SOURCE

- Key in OFF position.

- Disconnect: Inoperative Illumination Source
- With the parking lamps on, rotate the instrument panel dimmer switch to the full illumination position.
- Measure the voltage between the inoperative illumination source, harness side and ground as follows:

Component	Connector-Pin	Circuit
Floor shifter (Fusion, Milan)	C3245-3	CLN04 (BU/BN)
Floor shifter (MKZ)	C3245-3	VLN04 (VT/GY)
Heating ventilation air conditioning (HVAC) module - electronic manual temperature control (EMTC)	C2357a-2	VLN04 (VT/GY)
Memory set switch	C503-3	VLN04 (VT/GY)
Headlamp switch	C205-5	VLN04 (VT/GY)
Clock (Fusion, Milan)	C2016-2	CLN04 (BU/BN)
Clock (MKZ)	C2016-2	VLN04 (VT/GY)
Message center switch	C253-1	VLN04 (VT/GY)
Hazard/passenger air bag disable/traction switch	C2355-6	VLN04 (VT/GY)
Deck lid release switch	C2269-3	VLN04 (VT/GY)
LH front window adjust switch (MKZ)	C535a-6	VLN04 (VT/GY)
RH front window adjust switch (MKZ)	C624-1	VLN04 (VT/GY)
LH rear window adjust switch (MKZ)	C701-4	VLN04 (VT/GY)

RH rear window adjust switch (MKZ)	C819-4	VLN04 (VT/GY)
LH door lock control switch	C505-2	VLN04 (VT/GY)
RH door lock control switch	C605-2	VLN04 (VT/GY)

- **Is the voltage greater than 10 volts?**

  YES : For the LH or RH rear window adjust switch, INSTALL a new switch for the inoperative component. TEST the system for normal operation.

  For all other components, go to C2.

  NO : REPAIR the circuit for an open or short to ground. CLEAR any DTCs. TEST the system for normal operation.

C2 CHECK THE ILLUMINATION SOURCE GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.
- Measure the resistance between the inoperative illumination source, harness side and ground as follows:

Component	Connector-Pin	Circuit
Floor shifter	C3245-4	GD116 (BK/VT)
HVAC module-EMTC	C2357a-1	GD116 (BK/VT)
Memory set switch	C503-7	GD126 (BK/WH)
Headlamp switch	C205-10	GD116 (BK/VT)
Clock	C2016-5	GD116 (BK/VT)
Message center switch	C253-4	GD116 (BK/VT)
Hazard/passenger air bag disable/traction switch	C2355-1	GD116 (BK/VT)
Deck lid release switch	C2269-2	GD116 (BK/VT)
LH front window adjust switch	C535b-6	GD126 (BK/WH)
RH front window	C624-6	GD139

adjust switch		(BK/YE)
LH door lock control switch	C505- 4	GD126 (BK/WH)
RH door lock control switch	C605-4	GD139 (BK/YE)

- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new component for the inoperative component. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test D: The Control Illumination Is Always On - All Hardwired Illumination

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Cluster and Panel Illumination for schematic and connector information.

Normal Operation

With the parking lamps or headlamps on, the smart junction box (SJB) supplies a pulse width modulated (PWM) voltage signal to the dimmable illumination sources on circuit VLN04 (VT/GY) or CLN04 (BU/BN) (Fusion, Milan only).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB

PINPOINT TEST D: THE CONTROL ILLUMINATION IS ALWAYS ON - ALL HARDWIRED ILLUMINATION

D1 CHECK THE EXTERIOR LIGHTING

- Key in OFF position.
- Make sure the headlamp switch is in the OFF position.
- Observe the exterior lighting components.
- **Are any exterior lighting components illuminated?**

  YES : REFER to **EXTERIOR LIGHTING** article.

  NO : Go to D2.

D2 CHECK CIRCUIT VLN04 (VT/GY) OR CLN04 (BU/BN) FOR A SHORT TO VOLTAGE

- Disconnect: SJB C2280d
- Key in ON position.
- **Do the dimmable hardwired illumination components continue to illuminate?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to D3.

D3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test E: All Control Illumination Sources Do Not Dim

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Cluster and Panel Illumination for schematic and connector information.

Normal Operation

When the parking lamps or the headlamps are on, the smart junction box (SJB) sends a reference voltage signal to the instrument panel dimmer switch on circuit VLN18 (BU/WH), which is grounded by the SJB through circuit CLN27 (WH/BN). The SJB uses the reference voltage to determine the intensity of the back lighting desired by the operator.

For hardwired dimmable illumination sources, the SJB sends a pulse-width modulated (PWM) voltage on circuit VLN04 (VT/GY) and CLN04 (BU/BN) (Fusion, Milan only) based on the input received from the instrument panel dimmer switch.

For network controlled illumination sources, the SJB sends a message via the medium speed controller area network (MS-CAN). If the module receiving the back lighting message either does not receive the message or receives invalid data for greater than 5 seconds, the module defaults to full nighttime intensity. Full nighttime intensity is equivalent to the illumination level when the parking lamps are on, and the instrument panel dimmer switch is in the highest setting.

- DTC B1247 (Panel Dim Switch Circuit Open) - sets when the reference voltage to the instrument panel dimmer switch exceeds the maximum allowable value. This can be caused by an open or short to voltage on circuit VLN18 (BU/WH). This DTC only sets as a continuous DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Instrument panel dimmer switch

- SJB

PINPOINT TEST E: ALL CONTROL ILLUMINATION SOURCES DO NOT DIM

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

E1 CHECK THE INSTRUMENT PANEL DIMMER SWITCH INPUT

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB dimmer switch status (DSWSTAT) PID while rotating the instrument panel dimmer switch from the lowest setting to the highest setting.
- Monitor the SJB DSWSTAT PID while rotating the instrument panel dimmer switch to the COURTESY LAMPS ON position.
- **Does the DSWSTAT PID indicate the switch is operating correctly?**

  YES : Go to E5.

  NO : If the PID indicates correctly in the COURTESY LAMPS ON position only, go to E2.

  If the PID indicates incorrectly in all positions, REPAIR circuit CLN27 (WH/BN) for an open. CLEAR the DTCs. TEST the system for normal operation.

  If the system still does not operate correctly, go to E5.

E2 CHECK CIRCUIT VLN18 (BU/WH) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280d
- Disconnect: Instrument Panel Dimmer Switch C2065

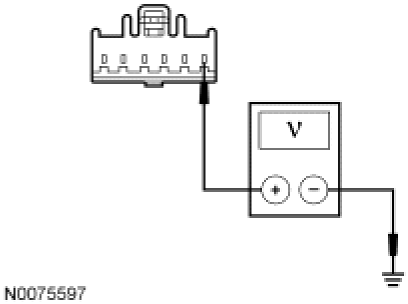


Fig. 6: Checking Circuit VLN18 (BU/WH) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument panel dimmer switch C2065-1, circuit VLN18 (BU/WH), harness side and ground.
- **Is there any voltage indicated?**

YES : REPAIR the circuit. TEST the system for normal operation.

NO : Go to E3.

E3 CHECK CIRCUIT VLN18 (BU/WH) FOR AN OPEN OR SHORT TO GROUND

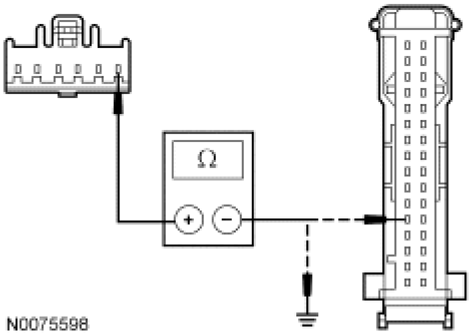


Fig. 7: Checking Circuit VLN18 (BU/WH) For An Open Or Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument panel dimmer switch C2065-1, circuit VLN18 (BU/WH), harness side and the SJB C2280d-12, circuit VLN18 (BU/WH); and between the instrument panel dimmer switch C2065-1, circuit VLN18 (BU/WH), harness side and ground.
- **Is the resistance less than 5 ohms between the instrument panel dimmer switch and the SJB, and greater than 10,000 ohms between the instrument panel dimmer switch and ground?**

  YES : Go to E4.

  NO : REPAIR the circuit. TEST the system for normal operation.

E4 CHECK THE INSTRUMENT PANEL DIMMER SWITCH

- Carry out the component test for the instrument panel dimmer switch. Refer to COMPONENT TESTING.
- **Is the instrument panel dimmer switch OK?**

  YES : Go to E5.

  NO : INSTALL a new instrument panel dimmer switch. REFER to **Instrument Panel Dimmer Switch**. TEST the system for normal operation.

E5 CHECK FOR CORRECT SJB OPERATION

- Connect: Instrument Panel Dimmer Switch C2065
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES**

article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test F: The Control Illumination Is Inoperative - All Non-Dimmable Illumination

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Cluster and Panel Illumination for schematic and connector information.

Normal Operation

When the accessory delay relay is energized, voltage is supplied from the smart junction box (SJB) to the door lock control switches (Fusion, Milan), the roof opening panel (if equipped) and the cigar lighter (MKZ) through circuit CBP02 (GN).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- SJB

PINPOINT TEST F: THE CONTROL ILLUMINATION IS INOPERATIVE - ALL NON-DIMMABLE ILLUMINATION

F1 CHECK THE ACCESSORY DELAY RELAY OPERATION

- Key in ON position.
- Close all the vehicle doors.
- Operate the audio system in radio tuner (AM/FM) mode.
- Key in OFF position.
- Observe the audio system operation.
- **Does the audio system continue to operate with the key in OFF and all the doors closed?**

  YES : REPAIR circuit CBP02 (GN) for an open. TEST the system for normal operation.

  NO : VERIFY the SJB fuse 12 (7.5A) is OK. If OK, go to F2. If not OK, REFER to the Wiring Diagrams article to identify the possible causes of the circuit short.

F2 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test G: One Or More (But Not All) Non-Dimmable Illumination Sources Are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Cluster and Panel Illumination for schematic and connector information.

Normal Operation

When the delayed accessory relay is energized, voltage is supplied from the smart junction box (SJB) to the door lock control switches (Fusion, Milan), the roof opening panel control switch (if equipped) and the cigar lighter (MKZ) through circuit CBP02 (GN). The LH door lock control switch is grounded through circuit GD126 (BK/WH). The RH door lock control switch is grounded through circuit GD139 (BK/YE). The cigar lighter is grounded through circuit GD115 (BK/GY). The roof opening panel control switch is grounded through circuit CPR39 (VT/WH) to the roof opening panel module, which is grounded through circuit GD139 (BK/YE).

All of the non-dimmable illumination source bulbs share an internal ground within their respective component. For example, the cigar lighter bulb is spliced internally to the lighter element, and they share a common ground path. Because of this characteristic, a concern in the ground circuit to any non-dimmable illumination source will cause both the illumination bulb and the component, itself, to be inoperative. Refer to the appropriate part if the entire component is inoperative.

For the passenger window switches (Fusion, Milan), the illumination power is provided through the passenger window lock-out switch in the LF window control switch on circuit CPW14 (VT/WH). The lock-out switch must be off in order for the passenger window switches to illuminate. Circuit CPW14 (VT/WH) also provides voltage to the passenger window motors. Therefore, if there is a fault in CPW14 (VT/WH), all of the passenger windows will be inoperative. If an individual passenger window switch illumination is inoperative, but the power windows themselves operate correctly, the cause of the concern is the inoperative passenger window switch. Otherwise, refer to **GLASS, FRAMES AND MECHANISMS** article to diagnose the power windows.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Illumination source
- SJB

PINPOINT TEST G: ONE OR MORE (BUT NOT ALL) NON-DIMMABLE ILLUMINATION SOURCES ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

G1 CHECK CIRCUIT CBP02 (GN) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Inoperable Illumination Source
- Key in ON position.
- Measure the voltage between the inoperative illumination source, harness side and ground as follows:

Component	Connector-Pin	Circuit
LH door lock control switch (Fusion, Milan)	C505-2	CBP02 (GN)
RH door lock control switch (Fusion, Milan)	C605-2	CBP02 (GN)
Cigar lighter	C370-B	CBP02 (GN)
Roof opening panel control switch	C912-1	CBP02 (GN)

- **Is the voltage greater than 10 volts?**

  YES : For a door lock control switch concern, INSTALL a new door lock control switch for the inoperative switch. REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article. TEST the system for normal operation.

  For a roof panel opening control switch concern, INSTALL a new roof panel opening control switch. REFER to **ROOF OPENING PANEL** article. TEST the system for normal operation.

  For a cigar lighter concern, go to G2.

  NO : Go to G3.

G2 CHECK CIRCUIT GD115 (BK/GY) FOR AN OPEN

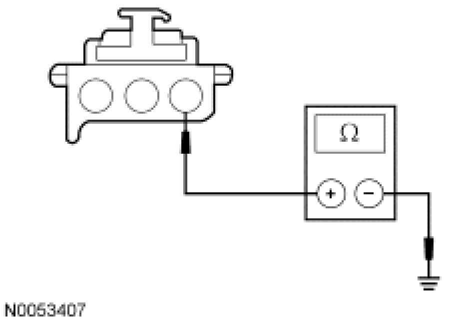


Fig. 8: Checking Circuit GD115 (BK/GY) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the cigar lighter C370-C, circuit GD115 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : INSTALL a new cigar lighter. TEST the system for normal operation.

NO : REPAIR the circuit. TEST the system for normal operation.

G3 CHECK CIRCUIT CBP02 (GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280e
- Measure the resistance between the SJB connector, circuit CBP02 (GN), harness side and the inoperative illumination source, harness side as follows:

Component	SJB Connector-Pin	Inoperative Component Connector-Pin	Circuit
LH door lock control switch (Fusion, Milan)	C2280e-25	C505-2	CBP02 (GN)
RH door lock control switch (Fusion, Milan)	C2280e-25	C605-2	CBP02 (GN)
Cigar lighter	C2280b-28	C370-B	CBP02 (GN)
Roof opening panel switch	C2280e-25	C912-1	CBP02 (GN)

- **Is the resistance less than 5 ohms?**

  YES : Go to G4.

  NO : REPAIR the circuit. TEST the system for normal operation.

G4 CHECK FOR CORRECT SJB OPERATION

- Connect: Inoperable Illumination Source
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

REMOVAL AND INSTALLATION

INSTRUMENT PANEL DIMMER SWITCH

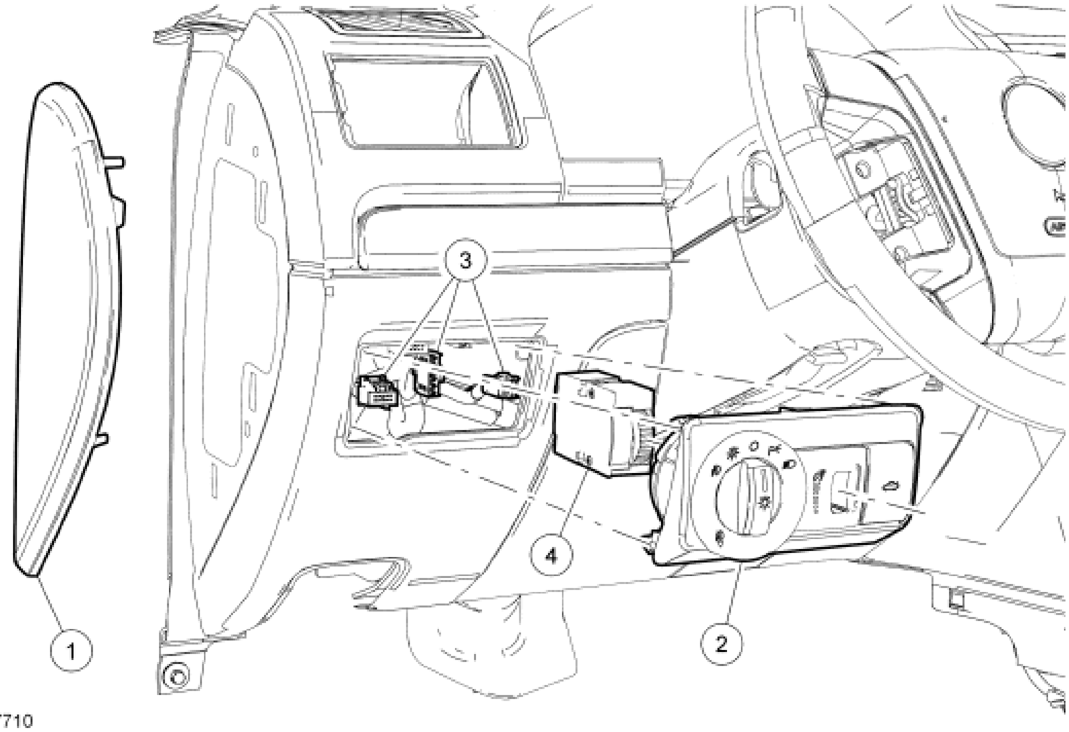


Fig. 9: Exploded View Of Instrument Panel Dimmer Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5404481	Instrument panel side finish panel
2	14K147	Headlamp switch assembly
3	-	Headlamp switch assembly electrical connectors (part of 14401)
4	11691	Instrument panel dimmer switch

REMOVAL AND INSTALLATION

1. Remove the instrument panel side finish panel.

NOTE: The switch is removed by pushing from behind.

2. Release the tabs and remove the headlamp switch assembly.
   - Disconnect the electrical connectors.
3. Release the 4 tabs and remove the instrument panel dimmer switch.

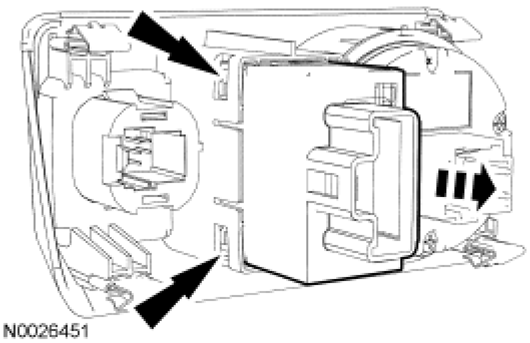


Fig. 10: Releasing Tabs & Removing Instrument Panel Dimmer Switch
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Instrument Cluster (IC), Message Center, & Warning Chimes - Fusion, Milan & MKZ

DESCRIPTION AND OPERATION

INSTRUMENT CLUSTER (IC)

The instrument cluster (IC) is available with either a vacuum florescent display (base cluster) or with a message center cluster. Both the base cluster and the message center cluster contain gauges, indicator lamps, and warning lamps that are designed to provide the driver with a system status and to alert the driver that certain conditions exist in the vehicle.

Gauges provide information to the driver indicating the status of systems. Examples of systems that use gauges include vehicle speed, fuel level, engine coolant temperature, and engine rpm. Indicator lamps provide information to the driver of conditions that exist in the vehicle. Examples of the indicator lamps include the turn signal, speed control, and high beams on. Warning indicator lamps provide information to the driver of conditions that could potentially alter vehicle performance. Examples of the warning indicators include the ABS, BRAKE, safety belt, and low oil pressure. The instrument cluster (IC) lens and mask assembly are the only parts that may be installed separately.

INFORMATION AND MESSAGE CENTER

The message center is a fixed format display, integrated into the instrument cluster (IC). The message center functions are controlled by the message center switches. The message center displays important vehicle information by constantly monitoring different vehicle systems. The message center informs the driver of vehicle operations and notifies the driver of potential vehicle problems by displaying a warning message pertaining to the system in which a fault has been detected.

The message center provides a compass display and uses directional information sent from a compass module, located on the underside of the inside rear view mirror (early build) or integrated into the interior rear view mirror (late build).

The message center provides the following features:

- Information displays
- Setup displays
- System check messages
- System warning messages

The message center information is selected through a set of 3 buttons:

- INFO
- SETUP
- RESET

Information Displays (INFO button)

The information displays are non-timed modes. The selected mode remains on until the driver presses a message center button to change the mode or it is overridden by another mode. The information display modes are:

- Odometer
- Trip odometer A or B
- Distance to empty (DTE)
- Average fuel economy
- Average speed
- Compass (if equipped)
- Trip elapsed drive time

Setup Displays (SETUP button)

The setup displays are timed modes and terminate after a finite interval. The setup display modes are:

- System check

NOTE: Pressing the message center switch SETUP button, the message center displays the current units to be displayed. Refer to the Owner's Literature for more information.

- Units (English/metric)
- Language

System Check Displays (RESET button)

By pressing the RESET button on the message center switch, the message center cycles through each of the system check displays being monitored. For each of the monitored systems, the message center indicates either an OK message or a warning message for 2-4 seconds.

The system check displays are:

- ALL DOORS CLOSED
- ENGINE TEMPERATURE
- OIL PRESSURE
- BRAKE FLUID LEVEL
- EXTERIOR LAMPS
- FUEL LEVEL
- DISTANCE TO EMPTY (DTE)

System Warning Messages

System warnings alert the operator to possible problems or malfunctions in the vehicle operating system. When multiple warnings are displayed, the message center cycles all the warnings by displaying each one for several seconds.

The message center displays the last selected feature if there are no more warning messages. This allows full functionality of the message center by pressing the message center switch RESET button to clear the warning message. Warning messages that have been reset are divided into 3 categories where the message:

- does not disappear until a condition has changed.
- will reappear 10 minutes after pressing the RESET button.
- does not reappear until the ignition switch LOCK/OFF to RUN cycle has been completed. This acts as a reminder that the warning conditions still exist on the vehicle.

The system warning messages that cannot be reset are:

- DRIVER DOOR AJAR
- PASSENGER DOOR AJAR
- REAR LEFT DOOR AJAR
- REAR RIGHT DOOR AJAR
- PARK BRAKE ENGAGED

The system warning messages that return after 10 minutes are:

- LOW FUEL LEVEL
- CHECK CHARGING SYSTEM
- CHECK BRAKE SYSTEM

The system warning messages that return after the ignition switch is turned from the LOCK/OFF to RUN position are:

- CHECK PARK AID (if equipped)
- LOW BRAKE FLUID LEVEL
- LOW TIRE PRESSURE
- TIRE PRESSURE MONITOR FAULT
- TIRE PRESSURE SENSOR FAULT
- TRUNK AJAR
- REMOVE OBJECTS NEAR PASS SEAT
- COMPASS ERROR (if equipped)
- CHECK LEFT HEADLAMP
- CHECK RIGHT HEADLAMP
- CHECK LF TURN LAMP
- CHECK RF TURN LAMP

- CHECK LR TURN LAMP
- CHECK RR TURN LAMP
- INTEGRATED KEY PROGRAMMING STATUS (displayed when an attempt is made to program a fifth integrated key to the remote keyless entry (RKE) system) - only allows 4 integrated keys.

WARNING CHIMES

The warning chime sounds to remind the driver:

- to turn the headlamps off when exiting the vehicle.
- to remove the ignition key when exiting the vehicle.
- to close the doors after starting the vehicle.
- to fasten the safety belt after starting the vehicle.
- to turn off the turn signal.
- to disengage the parking brake.
- that a fault is present in the airbag warning indicator circuit.

The instrument cluster (IC) controls the warning chime function using various inputs to determine when to sound the warning chime. The warning chime sounds if:

- the headlamps are on with the key removed from the ignition lock cylinder and the driver door ajar.
- the key is in the ignition lock cylinder in the OFF or ACC position and the driver door ajar.
- a door is ajar and the ignition key is in the ON position.
- the safety belts are not fastened and the ignition key is in the ON position.
- the turn signal is on for more than 3.2 km (2.0 miles).
- the parking brake is engaged and the vehicle is moving at a speed higher than 5 km/h (3 mph).
- the ignition switch is in the ON position, the air bag warning indicator is faulted, and an air bag warning chime request is received from the restraints control module (RCM).

Audible signals are also provided to confirm operation of the following vehicle systems:

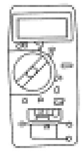
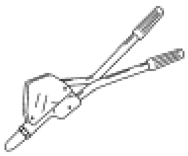
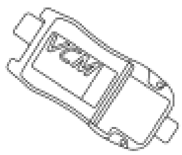
- Turn signal
- Hazard signal

DIAGNOSTIC TESTS

INSTRUMENT CLUSTER (IC), MESSAGE CENTER AND WARNING CHIMES

Special Tools

Illustration	Tool Name	Tool Number

 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST1132-A	Instrument Gauge System Tester	014-R1063 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The base and message center instrument clusters (ICs) are configurable, electronic clusters that contain a microprocessor, gauges, indicator lamps, and internal circuitry. Data is sent to the instrument cluster (IC) over the high speed controller area network (HS-CAN), the medium speed controller area network (MS-CAN) and through hardwired circuitry from individual components. The instrument cluster (IC) uses each input to output an action to the gauges or indicators. For additional information regarding the communication network, refer to **MODULE COMMUNICATIONS NETWORK** article.

The instrument cluster (IC), message center and warning chimes use input messages from other modules to control the gauges, informational indicators, and warning indicators over the communication networks. If a required message is missing or invalid for less than 5 seconds, the gauge or indicator that requires the message remains at the last commanded state based upon the last known good message. For example, if the brake system status message is missing for less than 5 seconds and the brake warning indicator was ON, the indicator remains in the ON state until the next good message is received. If the message remains missing or invalid for more than 5 seconds, the instrument cluster (IC) sets a U-code DTC and the output becomes a default action for the indicator or gauge. Each indicator or gauge utilizes a different default strategy depending on the nature of the indication. Refer to the normal operation descriptions located before each individual pinpoint test for a further description of the default action specific to each indicator or gauge. If the messaged input to the cluster returns at any time, the normal function of the gauge or indicator resumes.

NOTE: **Whenever a network message is suspected as missing and confirmed by a missing message DTC (U-code), it is important to look for other symptoms that may also be present in the instrument cluster (IC) and throughout the vehicle. Once a DTC is set in the instrument cluster (IC), it may be helpful to review the complete message list available in MODULE COMMUNICATIONS NETWORK article to see what other modules also rely on the same message and run the self-test for those modules. If the message is missing from other modules, the same DTC may also be set in those modules. Confirmation of missing messages common to multiple modules may indicate that the originating module is the source of the concern or the communication network may be experiencing some problems.**

It is very important to understand:

- where the input originates.
- all the information necessary in order for a feature to operate.
- which module(s) receive(s) the input or command message.
- does the module which received the input control the output of the feature, or does it output a message over the communication network to another module.
- which module controls the output of the feature.

Instrument Cluster

Instrument Cluster (IC) Gateway Function

The instrument cluster (IC) acts as a gateway module by receiving information in one format and transmitting it to other modules using another format. For example, the instrument cluster (IC) receives the vehicle speed data from the PCM over the HS-CAN, converts the data into a MS-CAN message and sends (gateways) the message to other network modules such as the heating ventilation air conditioning (HVAC) module, the audio control module (ACM), the parking aid module (PAM), the restraints control module (RCM) and the SJB. This enables network communication between modules that do not communicate using the same network (HS-CAN or the MS-CAN).

Instrument Cluster (IC) Configuration

The instrument cluster (IC) contains items that are configurable. While some configurable items are customer preference items, most items are configured at the end of the line production and are only available for configuration using programmable module installation (PMI) procedures. Refer to **MODULE CONFIGURATION** article for additional information on the PMI procedure.

The Belt-Minder® is the only configurable customer preference item.

Instrument Cluster (IC) Prove-Out

The instrument cluster (IC) and other vehicle modules carry out a display prove-out to verify that all module controlled warning/indicator lamps and monitored systems are functioning correctly within the instrument cluster (IC). The instrument cluster (IC) and other modules such as the restraints control module (RCM) provide

a timed prove-out while other indicators illuminate until engine start up. When the ignition switch is cycled to the ON position with the engine off, the indicators illuminate to prove-out according to the following table:

Indicator	Indicator Type	Prove-Out Duration
ABS	Warning	3 seconds
Air bag	Warning	6 seconds on/2 seconds off
Anti-theft	Indicator	Approx. 3 seconds
Brake	Warning	3 seconds
Charging system	Warning	Engine startup
Check fuel cap	Informational	3 seconds
Door ajar	Warning	None
High beam	Informational	None
Low fuel	Informational	3 seconds
Low oil pressure	Warning	Engine startup
Malfunction indicator lamp (MIL)	Warning	Engine startup
Safety belt	Warning	70 seconds or until the safety belt is fastened
Speed control	Informational	None
Tire pressure monitoring system (TPMS)	Warning	3 seconds
Traction assist	Warning	3 seconds
Powertrain malfunction (wrench)	Informational	3 seconds
RH/LH turn	Informational	None

Information And Message Center

The message center is an integral part of the instrument cluster (IC) that receives and acts upon much of the same information that is input and used to operate the instrument cluster (IC) gauges, informational indicators, and warning indicators. The message center, located in the center of the instrument cluster (IC), is a 2 line display. The message center electronic functions use both hardwired, and the controller area network (CAN) circuitry to transmit and receive information.

Whenever conditions are present that require a warning message, the message center replaces the last selected display with the new warning display. Once the message is reset or cleared, the message center returns to the last selected display. If multiple warning messages are present, the message center displays each warning for approximately 4 seconds. Warning messages are also generally associated with other observable instrument cluster (IC) indications. For example, when the LH front door is opened, the message center displays the message DRIVER DOOR AJAR along with the door ajar warning indicator. This allows the message center to be a more informative supplement to the instrument cluster (IC) gauges and indicators.

Warning Chimes

The instrument cluster (IC) uses inputs that are both hardwired to individual components and messages that are sent from the other modules over the high speed or medium speed controller area networks (HS-CAN or MS-CAN) to control the warning chime functions.

Warning Chime Characteristics

Each warning chime has unique characteristics that help to identify and differentiate each warning chime. The warning chimes use volume, chime frequency, length of time the chime sounds and the number of chime tones to identify which chime is sounding. The instrument cluster (IC) prioritizes the chimes according to a preset hierarchy programmed into the instrument cluster (IC) software. Generally, when more than one chime request is received by the instrument cluster (IC), the most important chime sounds. If a lower priority chime is currently sounding, the higher priority request takes over and replaces the lower priority chime.

There are 3 different chimes as listed below:

- Repetitive
- Single tone
- Tic-tock

The following list provides a summary of the chimes and each chimes type/characteristics.

- Safety belt warning (repetitive chime)
- Belt-Minder® warning (repetitive chime after a delay and after the safety belt chime is completed)
- Key-in-ignition warning (repetitive chime)
- Headlamps on warning (repetitive chime)
- Door ajar warning (single tone chime)
- Turn signal left on warning (repetitive chime after 3.2 km [2.0 miles])
- Turn signal tone (tic-tock chime)
- Parking brake warning (repetitive chime)
- Air bag secondary warning chime (repetitive chime)
- Low fuel level warning chime (single tone chime)

Safety Belt Warning Chime

The safety belt warning chime warns that the safety belt is not fastened. The safety belt warning chime sounds when the driver or passenger safety belt is not fastened and the ignition lock cylinder is turned from the OFF/LOCK or ACC to the ON or START position.

The safety belt warning chime stops sounding when the safety belt is fastened, when the ignition lock cylinder is turned from the ON or START position to the OFF/LOCK or ACC position, or when the chime has sounded for approximately 6 seconds.

The safety belt warning chime inputs are the:

- Ignition switch RUN/START position
- Driver or passenger safety belt switch data communicated by the restraints control module (RCM) to the instrument cluster (IC) through the controller area network (CAN)

Belt-Minder®

The Belt-Minder® is configurable. Refer to **MODULE CONFIGURATION** article. To configure without using a scan tool, refer to **Belt-Minder® Deactivating/Activating**.

NOTE: The Belt-Minder® is disabled for one ignition switch cycle if the safety belt is buckled then unbuckled during that specific cycle.

The Belt-Minder® feature supplements the current safety belt warning function. The Belt-Minder® is enabled after the current safety belt warning is complete. The Belt-Minder® reminds the driver that the driver or passenger safety belt is unbuckled by intermittently sounding a chime and illuminating the safety belt warning lamp in the instrument cluster (IC) once the vehicle speed has exceeded 5 km/h (3 mph), and remains active for 5 minutes from the time it is started. While activated, the Belt-Minder® alternates the chime and indicator from on for 6 seconds to off for 30 seconds.

Key-In-Ignition Warning Chime

The key-in-ignition warning chime warns that the key is still in the ignition lock cylinder when the driver door is ajar. The key-in-ignition warning chime sounds when the driver door is ajar, the key is in the ignition lock cylinder and in the OFF/LOCK or ACC position.

The key-in-ignition warning chime stops sounding when the driver door is closed, the key is removed from the ignition lock cylinder, or if the ignition lock cylinder is turned to the ON position.

The key-in-ignition warning chime inputs are the:

- Ignition switch RUN/START position
- Door ajar data communicated by the SJB to the instrument cluster (IC) through the CAN
- Key-in-ignition switch signal from the ignition switch

Headlamps On Warning Chime

The headlamps on warning chime warns that the headlamps are on when the driver door is ajar and the key is removed from the ignition lock cylinder. The headlamps on warning chime sounds if the driver door is ajar, the headlamp switch is in the PARKING LAMP or HEADLAMP position, and the ignition lock cylinder is in the OFF/LOCK position with the key out.

The headlamps on warning chime stops sounding when any one of the above conditions are removed.

The headlamps on warning chime inputs are the:

- Ignition switch position
- Key-in-ignition switch position
- Driver door ajar data communicated by the SJB to the instrument cluster (IC) through the CAN
- Headlamp switch data communicated by the SJB to the instrument cluster (IC) through the CAN

Door Ajar Warning Chime

The door ajar warning chime warns that a door is not fully closed. The chime sounds when any door, or the luggage compartment lid becomes ajar while the ignition lock cylinder is in the ON position.

The door ajar warning chime stops sounding when all the doors and the luggage compartment lid are closed, or the ignition lock cylinder is turned to the OFF/LOCK or ACC position.

The door ajar warning lamp/chime inputs are the:

- Ignition switch RUN/START position
- Door ajar data communicated by the SJB to the instrument cluster (IC) through the CAN

Turn Signal Left On Reminder Chime

The turn signal left on reminder chime warns that the turn signal has not been cancelled. The turn signal left on reminder chime sounds if the left or right turn signal is on and the vehicle has traveled more than 3.2 km (2.0 miles).

The turn signal left on reminder chime stops sounding if the turn signal is turned off, or if the ignition lock cylinder is turned to the OFF or ACC position.

The turn signal left on reminder chime inputs are the:

- Turn signal data communicated by the SJB to the instrument cluster (IC) through the CAN communication
- Odometer count data communicated by the PCM to the instrument cluster (IC) through the CAN

Parking Brake Warning Chime

The parking brake warning chime warns that the parking brake is engaged when the vehicle is in motion. The parking brake warning chime sounds if the ignition lock cylinder is in the ON position, the parking brake is engaged, and the vehicle speed is greater than 5 km/h (3 mph).

The parking brake warning chime stops sounding if the parking brake is released, the ignition lock cylinder is not in the ON position, if the vehicle speed is less than 5 km/h (3 mph), or after 90 seconds from the time the chime is activated.

The parking brake warning chime inputs are the:

- Ignition switch RUN/START position
- Parking brake switch data communicated by the SJB to the instrument cluster (IC) through the CAN
- Vehicle speed data communicated by the PCM to the instrument cluster (IC) through the CAN

Air Bag Secondary Warning Chime

The air bag secondary warning chime warns that the air bag warning indicator light does not work correctly. The instrument cluster (IC) monitors the air bag warning indicator status internally. When a fault is present in the air bag warning indicator and the instrument cluster (IC) receives an air bag warning indicator on request

from the restraints control module (RCM), the air bag secondary warning chime sounds.

The air bag secondary warning chime inputs are the:

- Ignition switch RUN/START position
- Air bag warning indicator request data is communicated by the RCM to the instrument cluster (IC)

Turn/Hazard On Tone

The turn/hazard on tone provides an audible signal in addition to the turn/hazard indicator lamps. The turn/hazard on tone sounds if the turn or hazard signals are on.

The turn/hazard on tone inputs are the:

- Left turn indicator signal from the SJB to the instrument cluster (IC)
- Right turn indicator signal from the SJB to the instrument cluster (IC)

Low Fuel Level Warning Chime

The low fuel level warning chime provides a supplemental alert to inform the driver that the fuel level is low. The LOW FUEL LEVEL warning message displays in the message center and the low fuel level warning chime sounds simultaneously when the fuel level reaches approximately 1/8 tank and the distance to empty is 80 km (50 miles) or below.

The low fuel level warning chime inputs are the:

- Ignition switch RUN/START position
- Fuel level input from the fuel level sensor

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Accessory drive belt • Brake fluid level • Door adjustment • Engine coolant level • Engine oil level • Fuel evaporative system	• Smart junction box (SJB) fuse(s): ○ 13 (7.5A) ○ 23 (7.5A) ○ 27 (7.5A) ○ 28 (10A) • Wiring, terminals or connectors

• Fuel tank • Tire pressure • Luggage compartment lid adjustment	• Message center switches • Key-in-ignition warning switch (part of the ignition switch) • Smart junction box (SJB) • Instrument cluster (IC)

3. If the cause is not visually evident, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs for the instrument cluster (IC), the restraints control module (RCM), the SJB, and the PCM.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the instrument cluster (IC) and the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other module DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart - Instrument Cluster (IC)**, go to **Symptom Chart - Information And Message Center** or Go to **Symptom Chart - Warning Chimes**.

DTC Charts

INSTRUMENT CLUSTER (IC) DTC CHART

DTC	Description	Action
B1137	IKT Data Not Programmed	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B1138	IKT Memory Full	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B1139	Invalid Transmitter Identification Code	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B1202	Fuel Sender Circuit Open (fuel pump module)	If equipped with front wheel drive (FWD), go to **Pinpoint Test B**. If equipped with all wheel drive (AWD), go to **Pinpoint Test C**.
B1204	Fuel Sender Circuit Short to Ground (fuel pump module)	If equipped with front wheel drive (FWD), go to **Pinpoint Test B**. If equipped with all wheel drive (AWD), go to **Pinpoint Test C**.
B1205	EIC Switch-1 Assembly Circuit Failure	Trip/Reset switch failure occurred. VERIFY the trip/reset switch is not binding on the instrument cluster (IC) bezel. If the trip/reset switch is binding on the instrument cluster (IC) bezel, REPAIR the bezel assembly as necessary. CLEAR the DTCs. REPEAT the self-test. If the trip/reset switch is not binding on the instrument cluster (IC) bezel, CLEAR the DTCs. REPEAT the self-test. If DTC B1205 is still present, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
B1209	EIC Switch-2 Assembly Circuit Failure	INSTALL a new message center switch. REFER to **Message Center Switch**. TEST the system for normal operation.
B1213	Anti-Theft Number of Programmed Keys Is Below Minimum	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1317	Battery Voltage High	CLEAR the DTCs. REPEAT the self-test. If DTC B1317 is still present, REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1318	Battery Voltage Low	Go to **Pinpoint Test AA**.
B1342	ECU is Faulted	INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
B1352	Ignition Key-In Circuit Failure	Go to **Pinpoint Test AI**.
B1360	Ignition Run/Acc Circuit Open	Go to **Pinpoint Test A**.
B1600	PATS Ignition Key Transponder Signal Is Not Received	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

B1602	PATS Received Invalid Format Of Key-Code From Ignition Key Transponder	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1681	PATS Transceiver Module Signal Is Not Received	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1868	Lamp Air Bag Warning Indicator Circuit Failure	INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
B2103	Antenna Not Connected	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2141	NVM Configuration Failure	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2143	NVM Memory Failure	CLEAR the DTCs. REPEAT the self-test. If DTC B2143 is still present, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
B2207	ECU ROM Checksum Error	CLEAR the DTCs. REPEAT the self-test. If DTC B2207 is still present, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
B2390	Master/Slave Communication Failure	CLEAR the DTCs. REPEAT the self-test. If DTC B2390 is still present, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
B2431	Transponder Programming Failed	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2477	Module Configuration Failure	REFER to **MODULE CONFIGURATION** article.
B2627	Fuel Sender Circuit Open #2 (secondary fuel sender)	Go to **Pinpoint Test C**.
B2628	Fuel Sender Circuit Short to Ground #2 (secondary fuel sender)	Go to **Pinpoint Test C**.
B2844	Ignition Fault	Go to **Pinpoint Test AB**.
B2879	Fuel Tank Jet Pump Fault	Go to **Pinpoint Test C**.
C1093	Traction Control Disable Switch Circuit Failure	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
C2784	RAM Checksum Failure	REPAIR all other DTCs first. CLEAR the DTCs. REPEAT the self-test. If DTC C2784 is still present, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
U0002	High Speed CAN Communication Bus Performance	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0020	Low Speed CAN Communication Bus	REFER to **MODULE COMMUNICATIONS NETWORK** article.

	Performance	
U1900	CAN Communication Bus Fault	REPAIR all other DTCs first. CLEAR the DTCs. CYCLE the key OFF then ON and wait 10 seconds. REPEAT the self-test. If DTC U1900 is still present, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U1901	CAN Network #2 Communication Bus Fault-Receive Error	REPAIR all other DTCs first. CLEAR the DTCs. CYCLE the key OFF then ON and wait 10 seconds. REPEAT the self-test. If DTC U1901 is still present, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U2013	Compass Module is Not Responding	Go to **Pinpoint Test AE**.
U2023	Fault Received From External Node	U2023 is set when a module receives invalid network data from another module with a faulted input. RETRIEVE and REPAIR all non-network DTCs in the other modules on the network. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article for a list of all DTCs.
U2050	No Application Present	REPROGRAM the instrument cluster (IC). If the DTC occurs after REPROGRAMMING, REPROGRAM the instrument cluster (IC) again. If the DTC reappears after each attempt to PROGRAM, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
U2051	One or More Calibration Files Missing/Corrupt	REPROGRAM the instrument cluster (IC). If the DTC occurs after REPROGRAMMING, REPROGRAM the instrument cluster (IC) again. If the DTC reappears after each attempt to PROGRAM, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
U2510	CAN - Invalid Data For Vehicle Security	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
U2511	CAN - Data Mis-Match (Receive Data Does Not Match Expected)	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B2479	Brake Park Switch Circuit Short to Ground	Go to **Pinpoint Test J**.
C1125	Brake Fluid Level Sensor Input Circuit Failure	Go to **Pinpoint Test J**.
C1284	Oil Pressure Switch Failure	Go to **Pinpoint Test S**.

All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

PCM DTC CHART

DTC	Description	Action
P0457	Evaporative Emission System Leak Detected (fuel cap loose/off)	Go to **Pinpoint Test V**.
P0460	Fuel Level Sensor A Circuit	REFER to the **Introduction - Gasoline Engines** article first. If sent here from the PC/ED manual, go to **Pinpoint Test B** for front wheel drive (FWD). If sent here from the PC/ED manual, go to **Pinpoint Test C** for wagon or all wheel drive (AWD).
P0461	Fuel Level Sensor A Circuit Range/Performance	REFER to the **Introduction - Gasoline Engines** article first. If sent here from the PC/ED manual, go to **Pinpoint Test B** for front wheel drive (FWD). If sent here from the PC/ED manual, go to **Pinpoint Test C** for wagon or all wheel drive (AWD).
P0462	Fuel Level Sensor A Circuit Low	REFER to the **Introduction - Gasoline Engines** article first. If sent here from the PC/ED manual, go to **Pinpoint Test B** for front wheel drive (FWD). If sent here from the PC/ED manual, go to **Pinpoint Test C** for wagon or all wheel drive (AWD).
P0463	Fuel Level Sensor A Circuit High	REFER to the **Introduction - Gasoline Engines** article first. If sent here from the PC/ED manual, go to **Pinpoint Test B** for front wheel drive (FWD). If sent here from the PC/ED manual, go to **Pinpoint Test C** for wagon or all wheel drive (AWD).
P2065	Fuel Level Sensor B Circuit	REFER to the **Introduction - Gasoline Engines** article first. If sent here from the PC/ED manual, go to **Pinpoint Test C**.
P2066	Fuel Level Sensor B Circuit Range/Performance	REFER to the **Introduction - Gasoline Engines** article first. If sent here from the PC/ED manual, go to **Pinpoint Test C**.
P2067	Fuel Level Sensor B Circuit Low	REFER to the **Introduction - Gasoline Engines** article first. If sent here from the PC/ED manual, go to **Pinpoint Test C**.
P2068	Fuel Level Sensor B Circuit High	REFER to the **Introduction - Gasoline Engines** article first. If sent here from the PC/ED manual, go to **Pinpoint Test C**.
All other DTCs	-	REFER to the **Introduction - Gasoline Engines** article.

Symptom Charts

Symptom Chart - Instrument Cluster (IC)

Condition	Possible Sources	Action
	• Fuse(s)	

• No communication with the instrument cluster (IC)	• Wiring, terminals or connectors • Instrument cluster (IC)	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• No communication with the smart junction box (SJB)	• Fuse(s) • Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The instrument cluster (IC) is inoperative	• Fuse(s) • Wiring, terminals or connectors • Instrument cluster (IC)	• Go to **Pinpoint Test A**.
• Incorrect fuel gauge indication - front wheel drive (FWD)	• Wiring, terminals or connectors • Fuel pump module assembly • Fuel level sensor (float and card) • Fuel tank • Instrument cluster (IC)	• Go to **Pinpoint Test B**.
• Incorrect fuel gauge indication - all wheel drive (AWD)	• Wiring, terminals or connectors • Fuel pump module assembly • Secondary fuel level sensor • Fuel level sensor (float and card) • Fuel tank • Instrument cluster (IC)	• Go to **Pinpoint Test C**.
• Incorrect temperature gauge indication	• Instrument cluster (IC)	• Go to **Pinpoint Test D**.
• The tachometer is inoperative	• Instrument cluster (IC)	• Go to **Pinpoint Test E**.
• The speedometer/odometer is inoperative	• PCM • Instrument cluster (IC)	• Go to **Pinpoint Test F**.

• Incorrect speedometer indication	• Tire size configuration • Axle ratio configuration • PCM • Instrument cluster (IC)	• Go to **Pinpoint Test G**.
• The low fuel indicator is never/always on (if equipped)	• Instrument cluster (IC)	• Go to **Pinpoint Test H**.
• The brake warning indicator is never on	• Wiring, terminals or connectors • Parking brake warning indicator switch • Brake fluid level switch (part of the brake fluid reservoir) • SJB • Instrument cluster (IC)	• Go to **Pinpoint Test I**.
• The brake warning indicator is always on	• Wiring, terminals or connectors • Parking brake warning indicator switch • Brake fluid level switch (part of the brake fluid reservoir) • Base brake system • SJB • Instrument cluster (IC)	• Go to **Pinpoint Test J**.
• The ABS warning indicator is never/always on	• ABS module • Instrument cluster (IC)	• Go to **Pinpoint Test K**.
• The safety belt warning indicator is never/always on	• Restraints control module (RCM) • Instrument cluster (IC)	• Go to **Pinpoint Test L**.

• The air bag warning indicator is never/always on	• RCM • Instrument cluster (IC)	• Go to **Pinpoint Test M**.
• The tire pressure monitoring system (TPMS) warning indicator is never/always on	• Tire pressure • TPMS concern • SJB • Instrument cluster (IC)	• Go to **Pinpoint Test N**.
• The door ajar warning indicator is never/always on	• Interior lamps concern • SJB • Instrument cluster (IC)	• Go to **Pinpoint Test O**.
• The high beam indicator is never/always on	• SJB • Instrument cluster (IC)	• Go to **Pinpoint Test P**.
• The LH/RH turn signal indicator is never/always on	• SJB • Instrument cluster (IC)	• Go to **Pinpoint Test Q**.
• The anti-theft indicator is never/always on	• Passive anti-theft system (PATS) concern • Instrument cluster (IC)	• Go to **Pinpoint Test R**.
• The anti-theft indicator is never on (does not prove-out)	• Instrument cluster (IC)	• INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
• The low oil pressure warning indicator is never/always on	• Wiring, terminals or connectors • Oil pressure switch • Base engine concern • SJB • Instrument cluster (IC)	• Go to **Pinpoint Test S**.
• The malfunction indicator lamp (MIL) is never/always on	• PCM • Instrument cluster (IC)	• Go to **Pinpoint Test T**.
	• Transmission	

• The powertrain malfunction (wrench) warning indicator is never/always on	control module (TCM) • PCM • 4X4 control module (if equipped) • Instrument cluster (IC)	• Go to **Pinpoint Test U**.
• The check fuel cap warning indicator is never/always on	• PCM • Instrument cluster (IC)	• Go to **Pinpoint Test V**.
• The speed control indicator is never/always on	• PCM • Instrument cluster (IC)	• Go to **Pinpoint Test W**.
• The traction assist indicator is never/always on	• Traction assist system • PCM • Instrument cluster (IC)	• Go to **Pinpoint Test X**.
• The charging system warning indicator is never/always on	• Charging system concern • PCM • Instrument cluster (IC)	• Go to **Pinpoint Test Y**.
• The O/D OFF indicator is never/always on	• TCM • Instrument cluster (IC)	• Go to **Pinpoint Test Z**.

Symptom Chart - Information And Message Center

Condition	Possible Sources	Action
• The message center is not operating correctly	• Message center switch concern • Instrument cluster (IC)	• Go to **Pinpoint Test AC**.
• The message center switch does not operate correctly	• Wiring, terminals or connectors • Message center switch • Instrument cluster (IC)	• Go to **Pinpoint Test AD**.

• The message center display is blank	• Instrument cluster (IC)	• INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
• The compass is inoperative	• Fuse • Wiring, terminals or connectors • Compass module	• Go to **Pinpoint Test AE**.
• The COMPASS ERROR message is inoperative	• Fuse • Wiring, terminals or connectors • Compass module (early build) • Auto-dimming interior mirror (late build)	• Go to **Pinpoint Test AE**.
• The compass is inaccurate	• Zone setting • Calibration • Vehicle magnetization • Compass module (early build) • Auto-dimming interior mirror (late build)	• Go to **Pinpoint Test AF**.
• The DRIVER DOOR, PASSENGER DOOR, REAR LEFT DOOR, REAR RIGHT DOOR or TRUNK AJAR warning message is inoperative	• Smart junction box (SJB) • Instrument cluster (IC)	• Go to **Pinpoint Test AG**.
• The LOW FUEL LEVEL warning message is inoperative	• Fuel gauge • Instrument cluster (IC)	• Go to **Pinpoint Test AH**.
		• CHECK the operation of the speedometer, the odometer, and the fuel gauge. • If the speedometer, odometer, or fuel gauge do not operate correctly, go to **Pinpoint Test B** (fuel gauge, front wheel drive [FWD]), go to **Pinpoint**

		Test C (fuel gauge, all wheel drive [AWD]) or Go to **Pinpoint Test F** (speedometer). • If the speedometer, odometer, and fuel gauge operate correctly, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
• The distance to empty (DTE)/average fuel economy is inoperative	• Instrument cluster (IC)	
• The LOW TIRE PRESSURE, TIRE PRESSURE SENSOR FAULT or TIRE PRESSURE MONITOR FAULT warning message is inoperative/always on	• SJB • Instrument cluster (IC)	• VERIFY that the tire pressure monitoring system (TPMS) warning indicator operates correctly. • If the TPMS reconfigurable telltale indicator does not operate correctly, go to **Pinpoint Test N**. • If the TPMS warning indicator operates correctly, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
• The CHECK CHARGING SYSTEM warning message is inoperative	• Instrument cluster (IC)	• OBSERVE the charging system warning indicator. • If the charging system warning indicator does not operate correctly, go to **Pinpoint Test Y**. • If the charging system warning indicator operates correctly, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
• The LOW BRAKE FLUID LEVEL warning message is	• Instrument cluster (IC)	• OBSERVE the BRAKE warning indicator. • If the BRAKE warning indicator does not operate correctly, go to **Pinpoint Test I**. • If the BRAKE warning

inoperative		indicator operates correctly, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

• The CHECK BRAKE SYSTEM warning message is inoperative	• Instrument cluster (IC)	• OBSERVE the BRAKE warning indicator.
		  • If the BRAKE warning indicator does not operate correctly, go to **Pinpoint Test I**.
		  • If the BRAKE warning indicator operates correctly, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

• The PARK BRAKE ENGAGED message is inoperative	• Instrument cluster (IC)	• OBSERVE the BRAKE warning indicator.
		  • If the BRAKE warning indicator does not operate correctly, go to **Pinpoint Test I**.
		  • If the BRAKE warning indicator operates correctly, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

• The CHECK RIGHT HEADLAMP/CHECK LEFT HEADLAMP message is inoperative	• SJB
	• Instrument cluster (IC)
		• OBSERVE the headlamps for correct operation.
		  • If the headlamps do not operate correctly, REFER to **EXTERIOR LIGHTING** article.
		  • If the headlamps operate correctly, INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

• The CHECK LF, RF, LR, and RR TURN LAMP message is inoperative	• SJB
	• Instrument cluster (IC)
		• OBSERVE the turn signals for correct operation.
		  ◦ If the turn signals do not operate correctly, REFER to **EXTERIOR LIGHTING** article.
		  ◦ If the turn signals operate correctly, INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

Symptom Chart - Warning Chimes

Condition	Possible Sources	Action
• No communication with the instrument cluster (IC)	• Fuse(s) • Wiring, terminals or connectors • Instrument cluster (IC)	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• All the chimes are inoperative	• Instrument cluster (IC)	• INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
• The key-in-ignition warning chime is inoperative	• Wiring, terminals or connectors • Key-in-ignition warning switch (part of the ignition switch) • Instrument cluster (IC)	• Go to **Pinpoint Test AI**.
• The headlamps on warning chime is inoperative	• Instrument cluster (IC)	• Go to **Pinpoint Test AJ**.
• The turn signal left on reminder chime is inoperative	• Instrument cluster (IC)	• Go to **Pinpoint Test AK**.
• The chime sounds when the driver door is ajar (no	• Wiring, terminals or connectors • Key-in-ignition warning switch (part	

key in ignition and headlamps off)	of the ignition switch) • Instrument cluster (IC)	• Go to **Pinpoint Test AL**.
• The safety belt warning chime does not operate correctly	• Instrument cluster (IC)	• Go to **Pinpoint Test AM**.
• The Belt-Minder® feature does not operate correctly	• Belt-Minder® deactivated • Safety belt warning indication concern • Speedometer concern • Instrument cluster (IC)	• Go to **Pinpoint Test AM**.

• The door ajar warning chime is inoperative	• Instrument cluster (IC)	• If not equipped with a message center, CHECK the operation of the door ajar warning indicator.
		  ◦ If the door ajar warning indicator does not operate correctly, go to **Pinpoint Test O**.
		  ◦ If the door ajar warning indicator operates correctly, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
		• If equipped with a message center, CHECK the operation of the door ajar warning messages.
		  ◦ If the door ajar warning messages do not operate correctly, go to **Pinpoint Test AG**.
		  ◦ If the door ajar warning messages operate correctly, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
		• RETRIEVE the recorded instrument cluster (IC) DTCs from the

• The air bag secondary warning chime is inoperative	• Instrument cluster (IC)	continuous and on-demand self-tests. • If instrument cluster (IC) DTC B1868 is not present, the system is operating correctly. The air bag secondary warning chime sounds only when a fault in the air bag warning indicator is present and DTC B1868 is recorded. • If instrument cluster (IC) DTC B1868 is present, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**.
• The parking brake warning chime is inoperative	• Instrument cluster (IC)	• CHECK the operation of the brake warning indicator. • If the brake warning indicator does not operate correctly, go to **Pinpoint Test I**. • If the brake warning indicator operates correctly, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.
• The low fuel level warning chime is inoperative	• Instrument cluster (IC)	• CHECK the operation of the LOW FUEL LEVEL warning message in the message center. • If the LOW FUEL LEVEL warning message is not displayed and the fuel level is at or below 80 km (50 miles), go to **Pinpoint Test AH**. • If the LOW FUEL LEVEL warning message is displayed, INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

Pinpoint Tests

Pinpoint Test A: The Instrument Cluster (IC) Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for

Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Instrument Cluster for schematic and connector information.

Normal Operation

With the ignition switch in the START or RUN position, the instrument cluster (IC) receives voltage from the smart junction box (SJB) through circuit CBP20 (YE/VT). When the ignition switch is in the RUN or ACC position, voltage is received from the SJB through circuit CBP23 (BN/YE). With the ignition switch in the OFF position, the instrument cluster (IC) receives its keep-alive voltage from the SJB through circuit SBP07 (WH/RD). The instrument cluster (IC) grounding is through circuit GD116 (BK/VT).

- DTC B1360 (Ignition Run/Acc Circuit Open) - is a continuous DTC that sets if the instrument cluster (IC) detects an open on the RUN/ACC input, circuit CBP23 (BN/YE) with voltage applied to the RUN/START input, circuit CBP20 (YE/VT) for more than 15 seconds.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Instrument cluster (IC)

PINPOINT TEST A: THE INSTRUMENT CLUSTER (IC) IS INOPERATIVE

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

A1 CHECK THE INSTRUMENT CLUSTER (IC) VOLTAGE SUPPLY

- Key in OFF position.
- Disconnect: Instrument Cluster (IC) C220
- Key in ON position.

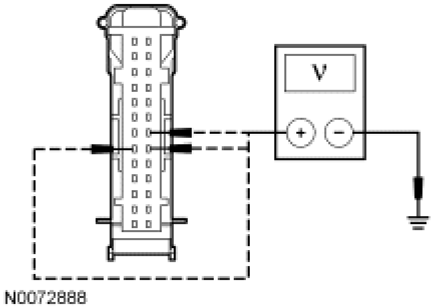


Fig. 1: Checking Instrument Cluster (IC) Voltage Supply
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC), harness side and ground as follows:

Instrument Cluster (IC) Connector-Pin	Circuit
C220-20	CBP20 (YE/VT)
C220-6	CBP23 (BN/YE)
C220-19	SBP07 (WH/RD)

- **Are the voltages greater than 10 volts?**

  YES : Go to A2.

  NO : VERIFY the SJB fuses 13 (7.5A), 23 (7.5A), and 27 (7.5A) are OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

A2 CHECK THE INSTRUMENT CLUSTER (IC) GROUND CIRCUITS

- Key in OFF position.

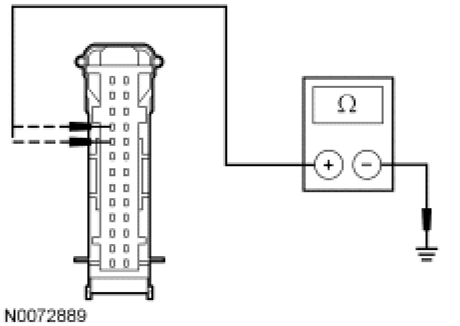


Fig. 2: Checking Instrument Cluster (IC) Ground Circuits
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC), harness side and ground as follows:

Instrument Cluster (IC) Connector-Pin	Circuit
C220-9	GD116 (BK/VT)
C220-10	GD116 (BK/VT)

- **Are the resistances less than 5 ohms?**

YES : Go to A3.

NO : REPAIR the circuit in question. TEST the system for normal operation.

A3 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: Incorrect Fuel Gauge Indication - Front Wheel Drive (FWD)

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Instrument Cluster for schematic and connector information.

Normal Operation

The fuel pump module assembly receives a reference voltage signal from the instrument cluster (IC) through circuit VMC11 (YE/VT), and returns the fuel level signal to the instrument cluster (IC) through circuit RMC32 (GN/BU). As the fuel level changes, a float actuates a variable resistor that alters the fuel level signal voltage. The instrument cluster (IC) interprets this signal and commands the fuel gauge to sweep to the correct level.

NOTE: The fuel pump module may also be called the fuel tank unit.

The instrument cluster (IC) receives the fuel level signal from the fuel level sensor, part of the fuel pump module. The fuel level sensor measures variable resistance in the fuel tank depending on the current fuel level. When the fuel level is low, the resistance in the unit is high (180 ohms ± 4 ohms). When the fuel level is high, the resistance in the unit is low (10 ohms ± 2 ohms).

The instrument cluster (IC) uses 4 different operating modes to calculate the fuel level:

- Anti-slosh (default mode)
- Key OFF fueling
- Key ON fueling
- Recovery

After a fuel fill up, the time for the fuel gauge to move from empty (E) to full (F) ranges from 2 seconds to 55 minutes depending on which operating mode the fuel gauge is in.

Anti-Slosh Mode

The default fuel gauge mode is the anti-slosh mode. To prevent fuel gauge changes from fuel slosh (gauge instability due to changes in fuel sender readings caused by fuel moving around in the tank), the fuel gauge takes approximately 55 minutes to go from empty (E) to full (F).

Key Off Fueling Mode

The key OFF fueling mode (2 seconds to read empty [E] to full [F]) requires 3 conditions be met:

- The key must be in the OFF position during the entire refueling of the vehicle.
- At least 15% of the vehicle's fuel capacity must be added to the fuel tank.
- The instrument cluster (IC) must receive a valid key ON fuel sender reading within 1 second of the key being put into the RUN position. The key ON sample readings are considered valid if the fuel sender reading is between 10 ohms ± 2 ohms and 180 ohms ± 4 ohms.

If these conditions are not met, the fuel gauge stays in the anti-slosh mode, which results in a slow to read full (F) event.

Key On Fueling Mode

The key ON fueling mode (approximately 90 seconds to read empty [E] to full [F]) requires 3 conditions be met:

- The transaxle is in PARK (P) (automatic transaxle), or the parking brake is applied (manual transaxle).
- The key is in the RUN position.
- At least 15% of the vehicle's fuel capacity must be added to the fuel tank.

In key ON fueling mode, a 30-second timer activates after the transaxle is put into the PARK (P) position (automatic transaxle) or when the parking brake is applied (manual transaxle). When the 30-second time has elapsed and at least 15% of the vehicle's fuel capacity has been added, the fuel gauge response time is 90 seconds to read from empty (E) to full (F). When the transaxle is shifted out of PARK (P) or the parking brake is released, the fuel gauge strategy reverts to the anti-slosh mode. The key ON fueling mode prevents slow to read full events from happening if the customer refuels the vehicle with the key in the RUN position.

Recovery Mode

Recovery mode is incorporated into the instrument cluster (IC) strategy to recover from a missing fuel level input during a refueling event. Missing fuel level inputs result from intermittent opens in the fuel sender or its circuits. Recovery mode (empty [E] to full [F] approximately 20 minutes) is initiated when the following 2 conditions are met:

- The instrument cluster (IC) is in the anti-slosh (default) mode.
- The actual fuel level in the tank is greater than what is being displayed by the fuel gauge.

INSTRUMENT CLUSTER (IC) DTCS

DTC Description	Fault Trigger Conditions
B1202 - Fuel Sender Circuit Open (fuel pump module)	A continuous and on-demand DTC that sets if the instrument cluster (IC) detects that the fuel sender is out of range for 33 seconds on input circuit VMC11 (YE/VT) with an open or short to voltage. The instrument cluster (IC) defaults the fuel gauge to empty (E), once the instrument cluster (IC) detects a fault and sets DTC B1202.
B1204 - Fuel Sender Circuit Short to Ground (fuel pump module)	A continuous and on-demand DTC that sets if the instrument cluster (IC) detects that the fuel sender is out of range for 33 seconds on input circuit VMC11 (YE/VT) with short to ground. The instrument cluster (IC) defaults the fuel gauge to empty (E), once the instrument cluster (IC) detects a fault and sets DTC B1204.

PCM DTCS

DTC Description	Fault Trigger Conditions
P0460 - Fuel Level Sensor A Circuit	Sets when the PCM determines the value of the fuel level input signal is stuck, that the fuel level input signal does not change or does not correspond with the calculated fuel usage.
P0461 - Fuel Level Sensor A Circuit Range/Performance	Sets when the PCM determines the fuel level input signal repeatedly moves in and out of range, exceeding the minimum or maximum allowable calibrated parameters for a specified fuel fill percentage in the fuel tank.
P0462 Fuel Level Sensor A Circuit Low	Sets in the PCM when the PCM detects a short to ground on the fuel pump module signal circuit based on the messaged input received from the instrument cluster (IC).
P0463 Fuel Level Sensor A Circuit High	Sets in the PCM when the PCM detects an open or a short to voltage on the fuel pump module signal circuit based on the messaged input received from the instrument cluster (IC).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Fuel pump module assembly

- Fuel level sensor (float and card)
- Fuel tank
- Instrument cluster (IC)

PINPOINT TEST B: INCORRECT FUEL GAUGE INDICATION - FRONT WHEEL DRIVE (FWD)

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER (IC) SELF-TESTS

- Check for recorded instrument cluster (IC) DTCs from the continuous and on-demand self-tests.
- **Are any DTCs recorded?**

YES : If DTC B1202 is retrieved, go to B3.

If DTC B1204, go to B8.

For all other DTCs, REFER to **DTC Charts**.

NO : Go to B2.

B2 CARRY OUT THE INSTRUMENT CLUSTER (IC) FUEL GAUGE ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) fuel gauge (Fuel) active command and command the fuel gauge from 0% to 20%, 50%, 70% and 100% while observing the fuel gauge.
- **Does the fuel gauge begin at (E) empty, move to approximately 1/4, 1/2, 3/4 and F (full)?**

YES : Go to B11.

NO : Go to B14.

B3 CHECK THE FUEL PUMP MODULE FOR AN OPEN

- Key in OFF position.
- Disconnect: Fuel Pump Module C433

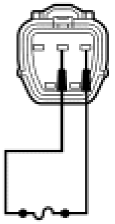


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Fig. 3: Checking Fuel Pump Module For Open
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the fuel pump module C433-1, circuit RMC32 (GN/BU), harness side and the fuel pump module C433 -2, circuit VMC11 (YE/VT), harness side.
- Key in ON position.
- Wait one minute.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) Self-Test

NOTE: DTC B1202 may also be present when carrying out this step and should be ignored.

- Repeat the instrument cluster (IC) self-test.
- Retrieve the instrument cluster (IC) continuous DTCs.
- **Is DTC B1204 retrieved?**

  YES : REMOVE the jumper wire. Go to B13.

  NO : REMOVE the jumper wire. Go to B4.

B4 CHECK CIRCUIT VMC11 (YE/VT) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Instrument Cluster (IC) C220
- Key in ON position.

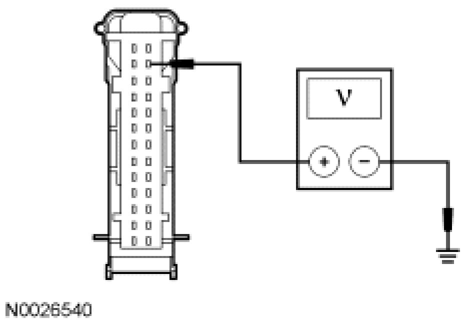

Fig. 4: Checking Circuit VMC11 (YE/VT) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC) C220-25, circuit VMC11 (YE/VT), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to B5.

B5 CHECK CIRCUIT RMC32 (GN/BU) FOR A SHORT TO VOLTAGE

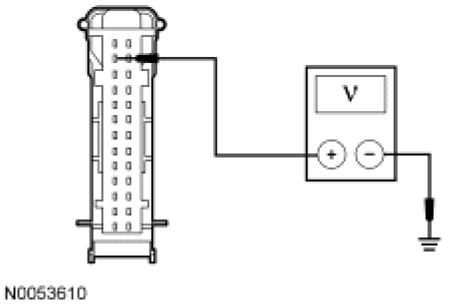

Fig. 5: Checking Circuit RMC32 (GN/BU) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC) C220-12, circuit RMC32 (GN/BU), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to B6.

B6 CHECK CIRCUIT VMC11 (YE/VT) FOR AN OPEN

- Key in OFF position.

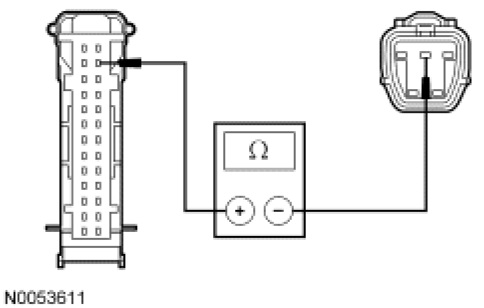

Fig. 6: Checking Circuit VMC11 (YE/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-25, circuit VMC11 (YE/VT), harness side and the fuel pump module C433-2, circuit VMC11 (YE/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to B7.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B7 CHECK CIRCUIT RMC32 (GN/BU) FOR AN OPEN

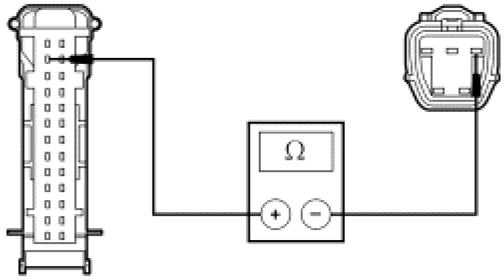

Fig. 7: Checking Circuit RMC32 (GN/BU) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-12, circuit RMC32 (GN/BU), harness side and the fuel pump module C433-1, circuit RMC32 (GN/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to B14.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B8 CHECK THE FUEL PUMP MODULE FOR A SHORT TO GROUND

- Disconnect: Fuel Pump Module C433
- Key in ON position.
- Wait one minute.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Self-Test

NOTE: DTC B1204 may also be present when carrying out this step and should be ignored.

- Repeat the instrument cluster (IC) self-test.
- Retrieve the instrument cluster (IC) continuous DTCs.
- **Is DTC B1202 retrieved?**

  YES : Go to B13.

  NO : Go to B9.

B9 CHECK CIRCUITS VMC11 (YE/VT) AND RMC32 (GN/BU) FOR A SHORT TOGETHER

- Disconnect: Instrument Cluster (IC) C220
- Key in OFF position.

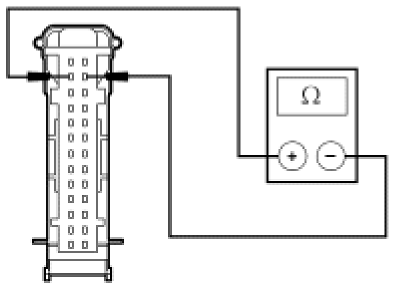

Fig. 8: Checking Circuits VMC11 (YE/VT) & RMC32 (GN/BU) For A Short Together
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-25, circuit VMC11 (YE/VT), harness side and the instrument cluster (IC) C220-12, circuit RMC32 (GN/BU), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B10.

  NO : REPAIR the circuits. CLEAR the DTCs. REPEAT the self-test.

B10 CHECK CIRCUIT VMC11 (YE/VT) FOR A SHORT TO GROUND

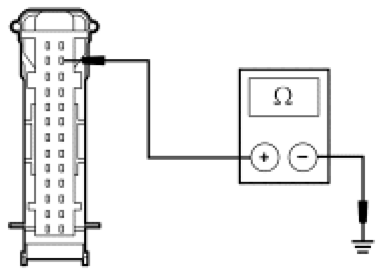

Fig. 9: Checking Circuit VMC11 (YE/VT) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-25, circuit VMC11 (YE/VT), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B14.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B11 CHECK THE FUEL LEVEL INPUT TO THE INSTRUMENT CLUSTER (IC)

NOTE:	**Since the instrument cluster (IC) may be in anti-slosh fuel indication mode, the PID values may not match the fuel gauge readings. The actual gauge indication should be disregarded during this test step.**

- Key in OFF position.

- Disconnect: Fuel Pump Module C433

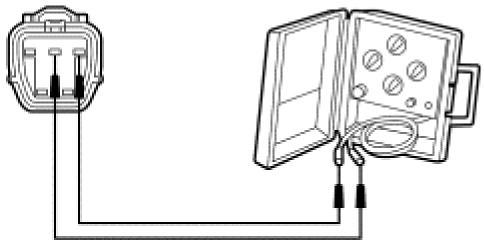

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Fig. 10: Checking Fuel Level Input To Instrument Cluster
Courtesy of FORD MOTOR CO.

- Connect one lead of the instrument gauge system tester to the fuel pump module C433-2, circuit VMC11 (YE/VT), harness side and the other lead to the fuel pump module C433-1, circuit RMC32 (GN/BU), harness side.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger

NOTE: **It is extremely important to confirm the gauge tester settings with an ohmmeter to ensure that the gauge tester is in the correct position. Failure to follow this check may result in inaccurate test results.**

- Select the instrument cluster (IC) fuel level (FUELLVL) PID.
- Monitor the fuel level PID with the gauge tester set at 180 ohms, 90 ohms, 55 ohms, 30 ohms and 10 ohms.
- **Does the PID begin at approximately 0%, move to 25%, 50%, 75% then 100%?**

  YES : DISCONNECT the instrument gauge system tester. Go to B12.

  NO : DISCONNECT the instrument gauge system tester. Go to B14.

B12 CHECK THE FUEL TANK

- Check the fuel tank for any damage or deformation.
- **Is the fuel tank OK?**

  YES : Go to B13.

  NO : VERIFY the fuel level sensor and fuel pump module are OK. INSTALL a new fuel tank. REFER to **FUEL TANK AND LINES** article. CLEAR the DTCs. REPEAT the self-test.

B13 CHECK THE FUEL LEVEL SENSOR

NOTE: **The fuel level sensor resistance measures between 10 ohms ± 2 ohms at the upper stop position and 180 ohms ± 4 ohms at the lower stop position.**

- Remove the fuel pump module. Refer to **FUEL TANK AND LINES** article.

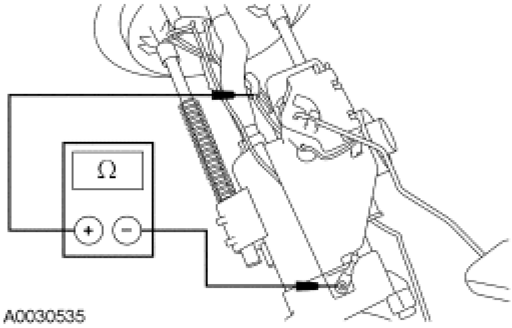


Fig. 11: Checking Fuel Level Sensor
Courtesy of FORD MOTOR CO.

NOTE: Disconnect the fuel level sensor input wire from the fuel level sensor for this measurement.

- Measure the resistance between the fuel level sensor input wire and the fuel level sensor ground while slowly moving the float arm between the upper and lower stop position.
- **Does the resistance slowly increase from approximately 10 ohms at the upper stop to 180 ohms at the lower stop?**

  YES : INSTALL a new fuel pump module. REFER to **FUEL TANK AND LINES** article. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL a new fuel level sensor. REFER to **FUEL TANK AND LINES** article. CLEAR the DTCs. REPEAT the self-test.

B14 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: Incorrect Fuel Gauge Indication - All Wheel Drive (AWD)

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Instrument Cluster for schematic and connector information.

Normal Operation

The fuel pump module and the secondary fuel level sensor receive a reference voltage signal from the instrument cluster (IC) through circuits VMC11 (YE/VT) and VMC23 (GN/OG) respectively, and returns the fuel level signal to the instrument cluster (IC) through circuits RMC32 (GN/BU) and RMC33 (WH/VT) respectively. As the fuel level changes in each side of the fuel tank, a float actuates a variable resistor that alters the fuel level signal voltage. The instrument cluster (IC) interprets these signals and commands the fuel gauge to sweep to the correct level.

NOTE: The fuel pump module may also be called the fuel tank unit.

NOTE: The secondary fuel level sensor may also be called the fuel level sensor.

The fuel tank is a saddle tank design with 2 variable resistance senders, driven by floats, that provide resistances related to fuel height, in each side, to the cluster through hardwired inputs. The fuel level is read from each fuel sender through a 2-wire input. The fuel senders provide variable resistance between 180 ohms ± 4 ohms (empty tank) and 10 ohms ± 2 ohms (full tank). If the fuel level is low, the resistance in the fuel level sensor is high, causing the gauge to indicate empty (E). When the fuel level is high, the resistance in the fuel level sensor is low, and the gauge indicates full (F).

As fuel is consumed from the fuel pump module side of the fuel tank (the side with the fuel filler hose inlet), fuel is transferred from the secondary fuel level sensor side of the tank (the side opposite the fuel filler hose inlet) to the fuel pump module side of the tank. The fuel pump module is connected to the secondary fuel level sensor by a crossover line and transfers fuel when the fuel pump module is running.

The instrument cluster (IC) uses 4 different operating modes to calculate the fuel level:

- Anti-slosh (default mode)
- Key OFF fueling
- Key ON fueling
- Recovery

After a fuel fill up, the time for the fuel gauge to move from empty (E) to full (F) ranges from 2 seconds to 55 minutes depending on which operating mode the fuel gauge is in.

Anti-Slosh Mode

The default fuel gauge mode is the anti-slosh mode. To prevent fuel gauge changes from fuel slosh (gauge instability due to changes in fuel sender readings caused by fuel moving around in the tank), the fuel gauge takes approximately 55 minutes to go from empty (E) to full (F).

Key Off Fueling Mode

The key OFF fueling mode (2 seconds to read empty [E] to full [F]) requires 3 conditions be met:

- The key must be in the OFF position during the entire refueling of the vehicle.

- At least 15% of the vehicle's fuel capacity must be added to the fuel tank.
- The instrument cluster (IC) must receive a valid key ON fuel sender reading within 1 second of the key being put into the RUN position. The key ON sample readings are considered valid if the fuel sender reading is between 10 ohms ± 2 ohms and 180 ohms ± 4 ohms.

If these conditions are not met, the fuel gauge stays in the anti-slosh mode, which results in a slow to read full (F) event.

Key On Fueling Mode

The key ON fueling mode (approximately 90 seconds to read empty [E] to full [F]) requires 3 conditions be met:

- The transaxle is in PARK (P) (automatic transaxle), or the parking brake is applied (manual transaxle).
- The key is in the RUN position.
- At least 15% of the vehicle's fuel capacity must be added to the fuel tank.

In key ON fueling mode, a 30-second timer activates after the transaxle is put into the PARK (P) position (automatic transaxle) or when the parking brake is applied (manual transaxle). When the 30-second time has elapsed and at least 15% of the vehicle's fuel capacity has been added, the fuel gauge response time is 90 seconds to read from empty (E) to full (F). When the transaxle is shifted out of PARK (P) or the parking brake is released, the fuel gauge strategy reverts to the anti-slosh mode. The key ON fueling mode prevents slow to read full events from happening if the customer refuels the vehicle with the key in the RUN position.

Recovery Mode

Recovery mode is incorporated into the instrument cluster (IC) strategy to recover from a missing fuel level input during a refueling event. Missing fuel level inputs result from intermittent opens in the fuel sender or its circuits. Recovery mode (empty [E] to full [F] approximately 20 minutes) is initiated when the following 2 conditions are met:

- The instrument cluster (IC) is in the anti-slosh (default) mode.
- The actual fuel level in the tank is greater than what is being displayed by the fuel gauge.

INSTRUMENT CLUSTER (IC) DTCS

DTC Description	Fault Trigger Conditions
B1202 - Fuel Sender Circuit Open (fuel pump module)	A continuous and on-demand DTC that sets if the instrument cluster (IC) detects that the fuel sender is out of range on input circuit VMC11 (YE/VT) with an open or short to voltage. The instrument cluster (IC) defaults the fuel gauge to empty (E), once the instrument cluster (IC) detects a fault and sets DTC B1202.
B1204 - Fuel Sender Circuit Short to Ground (fuel	A continuous and on-demand DTC that sets if the instrument cluster (IC) detects that the fuel sender is out of range on input circuit VMC11 (YE/VT) with

pump module)	short to ground. The instrument cluster (IC) defaults the fuel gauge to empty (E), once the instrument cluster (IC) detects a fault and sets DTC B1204.
B2627 - Fuel Sender Circuit Open #2 (secondary fuel level sensor)	A continuous and on-demand DTC that sets when the instrument cluster (IC) detects an open or a short to voltage on the secondary fuel level sensor signal circuit. The instrument cluster (IC) defaults the fuel gauge to empty (E), once the instrument cluster (IC) detects a fault and sets DTC B2627.
B2628 - Fuel Sender Circuit Short to Ground #2 (secondary fuel level sensor)	A continuous DTC that sets when the instrument cluster (IC) detects a short to ground on the secondary fuel level sensor signal circuit. The instrument cluster (IC) defaults the fuel gauge to empty (E), once the instrument cluster (IC) detects a fault and sets DTC B2628.
B2879 - Fuel Tank Jet Pump Fault	**NOTE:** **Normal operation of the fuel delivery system allows the secondary side of the fuel tank (the side opposite of the fuel filler hose) to have less fuel than the side with the fuel pump module (side with the fuel filler hose).** A continuous DTC that sets when the instrument cluster (IC) detects a large discrepancy in the amount of fuel (based on input from the fuel senders) between both sides of the fuel tank. The fuel level in the secondary fuel level sensor side of the fuel tank (the side opposite the fuel filler hose inlet) has significantly more fuel than the fuel pump module side (the side with the fuel filler hose inlet).

PCM DTCS

DTC Description	Fault Trigger Conditions
DTC P0460 Fuel Level Sensor A Circuit	Sets when the PCM determines the value of the fuel level input signal is stuck, that the fuel level input signal does not change or does not correspond with the calculated fuel usage.
DTC P0461 Fuel Level Sensor A Circuit Range/Performance	Sets when the PCM determines the fuel level input signal repeatedly moves in and out of range, exceeding the minimum or maximum allowable calibrated parameters for a specified fuel fill percentage in the fuel tank.
	Sets in the PCM when the PCM detects a short to ground on the fuel

DTC P0462 Fuel Level Sensor A Circuit Low	pump module signal circuit based on the messaged input received from the instrument cluster (IC).
DTC P0463 Fuel Level Sensor A Circuit High	Sets in the PCM when the PCM detects an open or a short to voltage on the fuel pump module signal circuit based on the messaged input received from the instrument cluster (IC).
DTC P2065 Fuel Level Sensor B Circuit (secondary fuel level sensor)	Sets when the PCM determines the value of the fuel level sensor input signal is stuck, that the fuel level input signal does not change or does not correspond with the calculated fuel usage.
DTC P2066 Fuel Level Sensor B Circuit Range/Performance (secondary fuel level sensor)	Sets when the PCM determines the fuel level sensor input signal repeatedly moves in and out of range, exceeding the minimum or maximum allowable calibrated parameters for a specified fuel fill percentage in the fuel tank.
DTC P2067 Fuel Level Sensor B Circuit Low (secondary fuel level sensor)	Sets in the PCM when the PCM detects a short to ground on the fuel level sensor signal circuit based on the messaged input received from the instrument cluster (IC).
DTC P2068 Fuel Level Sensor B Circuit High (secondary fuel level sensor)	Sets in the PCM when the PCM detects a open or short to voltage on the fuel level sensor signal circuit on the messaged input received from the instrument cluster (IC).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Fuel pump module assembly
- Secondary fuel level sensor
- Fuel level sensor (float and card)
- Fuel tank
- Instrument cluster (IC)

PINPOINT TEST C: INCORRECT FUEL GAUGE INDICATION - ALL WHEEL DRIVE (AWD)

NOTE:	**Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

C1 CHECK FOR INSTRUMENT CLUSTER (IC) DTCs

- Key in OFF position.
- Check for recorded instrument cluster (IC) DTCs from the continuous and on-demand self-tests.
- **Are any DTCs recorded?**

  YES : For DTC B1204 or B2628, go to C3.

  For DTC B1202, go to C7.

  For DTC B2627, go to C12.

  For DTC B2879, go to C17.

  For all other DTCs, REFER to **DTC Charts**.

  NO : Go to C2.

C2 CARRY OUT THE INSTRUMENT CLUSTER (IC) FUEL GAUGE ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) fuel gauge (Fuel) active command and command the fuel gauge from 0% to 20%, 50%, 70% and 100% while observing the fuel gauge.
- **Does the fuel gauge begin at (E) empty, move to approximately 1/4, 1/2, 3/4 and F (full)?**

  YES : Go to C17.

  NO : Go to C21.

C3 CHECK THE SECONDARY FUEL LEVEL SENSOR FOR A SHORT TO GROUND

NOTE: The fuel pump module may also be called the fuel tank unit.

NOTE: The secondary fuel level sensor may also be called the fuel level sensor.

- Disconnect: Fuel Pump Module C433 (DTC B1204) or Secondary Fuel Level Sensor C3270 (DTC B2628)
- Key in ON position.
- Wait one minute.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster Self-Test

  NOTE: DTC B1204 or B2628 may still be present.

- Repeat the instrument cluster (IC) on-demand self-test.
- **Is DTC B1202 or B2627 retrieved?**

  YES : Go to C4.

NO : INSTALL a new fuel sender for the suspect fuel sender. REFER to **FUEL TANK AND LINES** article. CLEAR the DTCs. REPEAT the self-test.

C4 CHECK CIRCUIT VMC11 (YE/VT) (DTC B1204) OR CIRCUIT VMC23 (GN/OG) (DTC B2628) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: Instrument Cluster (IC) C220

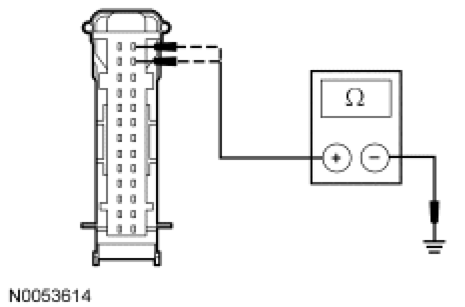


Fig. 12: Checking Circuit VMC11 (YE/VT) (DTC B1204) Or VMC23 (GN/OG) (DTC B2628) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-25 (DTC B1204), circuit VMC11 (YE/VT) harness side and ground; or between the instrument cluster (IC) C220-26 (DTC B2628), circuit VMC23 (GN/OG) harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : For DTC B1204, go to C5.

  For DTC B2628, go to C6.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C5 CHECK CIRCUITS VMC11 (YE/VT) AND RMC32 (GN/BU) FOR A SHORT TOGETHER

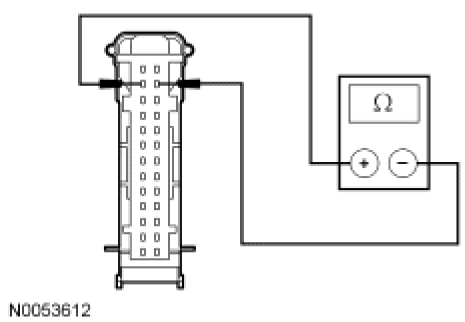


Fig. 13: Checking Circuits VMC11 (YE/VT) & RMC32 (GN/BU) For A Short Together
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-25, circuit VMC11 (YE/VT)

harness side and the instrument cluster (IC) C220-12, circuit RMC32 (WH/VT) harness side.

- **Is the resistance greater than 10,000 ohms?**

  YES : Go to C21.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C6 CHECK CIRCUITS VMC23 (GN/OG) AND RMC33 (WH/VT) FOR A SHORT TOGETHER

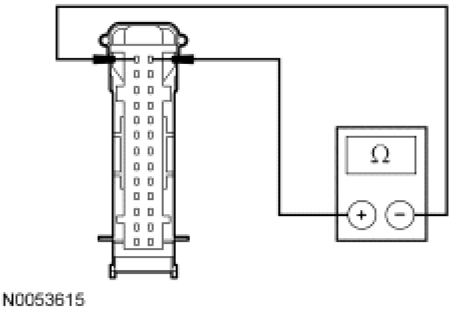


Fig. 14: Checking Circuits VMC23 (GN/OG) & RMC33 (WH/VT) For A Short Together
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-26, circuit VMC23 (GN/OG) harness side and the instrument cluster (IC) C220-13, circuit RMC33 (WH/VT) harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to C21.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C7 CHECK THE FUEL PUMP MODULE CIRCUITRY FOR A SHORT TO VOLTAGE

- Disconnect: Instrument Cluster (IC) C220
- Key in ON position.

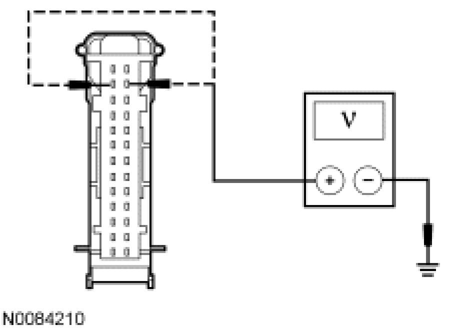


Fig. 15: Checking Fuel Pump Module Circuitry For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC) C220-25, circuit VMC11 (YE/VT), harness side and ground; and between the instrument cluster (IC) C220-12, circuit RMC32 (GN/BU), harness side and ground.
- **Is any voltage present?**

YES : Go to C8.

NO : Go to C9.

C8 CHECK THE FUEL PUMP MODULE FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Fuel Pump Module C433
- Key in ON position.

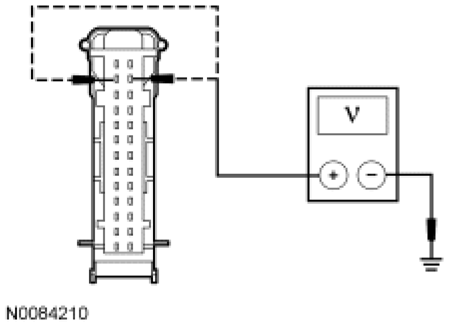


Fig. 16: Checking Fuel Pump Module For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC) C220-25, circuit VMC11 (YE/VT), harness side and ground; and between the instrument cluster (IC) C220-12, circuit RMC32 (GN/BU), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL a new fuel pump module. REFER to **FUEL TANK AND LINES** article. CLEAR the DTCs. REPEAT the self-test.

C9 CHECK THE FUEL PUMP MODULE CIRCUITRY FOR AN OPEN

- Key in OFF position.
- Disconnect: Fuel Pump Module C433

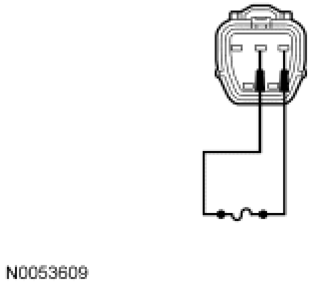


Fig. 17: Checking Fuel Pump Module For Open
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the fuel pump module C433-2, circuit VMC11

(YE/VT), harness side and the fuel pump module C433-1, circuit RMC32 (GN/BU) harness side.

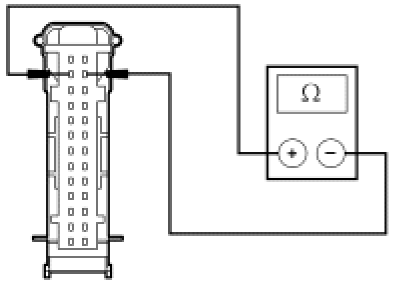


Fig. 18: Measuring Resistance Between Instrument Cluster (IC) C220-25 & C220-12, Circuit VMC11 (YE/VT) & RMC32 (GN/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-25, circuit VMC11 (YE/VT), harness side and the instrument cluster (IC) C220-12, RMC32 (GN/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : REMOVE the jumper wire. Go to C10.

  NO : REMOVE the jumper wire. Go to C11.

C10 CHECK THE FUEL PUMP MODULE FOR AN OPEN

NOTE:	**The fuel sender resistance varies from 180 ± 4 ohms when empty (E) to 10 ± 2 ohms when full (F).**

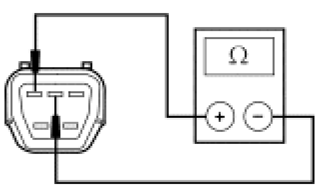


Fig. 19: Checking Fuel Pump Module For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the fuel pump module C433 pin 1, component side and the fuel pump module C433 pin 2, component side.
- **Is the resistance within specifications?**

  YES : Go to C21.

  NO : Go to C20.

C11 CHECK CIRCUIT VMC11 (YE/VT) FOR AN OPEN

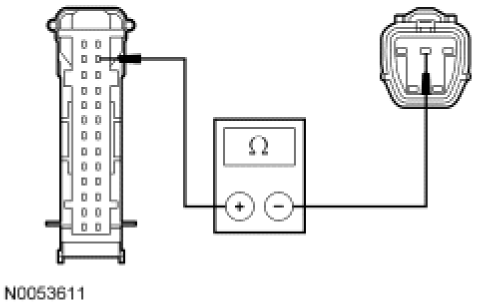


Fig. 20: Checking Circuit VMC11 (YE/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-25, circuit VMC11 (YE/VT), harness side and the fuel pump module C433-2, circuit VMC11 (YE/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : REPAIR circuit RMC32 (GN/BU) for an open. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR circuit VMC11 (YE/VT). CLEAR the DTCs. REPEAT the self-test.

C12 CHECK THE SECONDARY FUEL SENDER CIRCUITRY FOR A SHORT TO VOLTAGE

- Disconnect: Instrument Cluster (IC) C220
- Key in ON position.

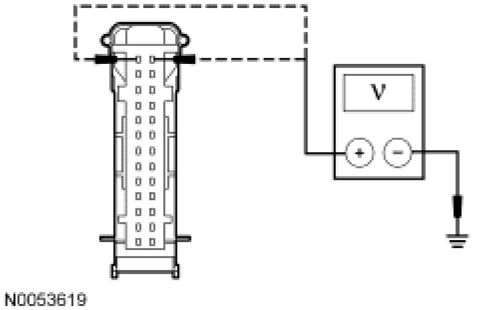


Fig. 21: Checking Secondary Fuel Sender Circuitry For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC) C220-26, circuit VMC23 (GN/OG), harness side and ground; and between the instrument cluster (IC) C220-13, circuit RMC33 (WH/VT), harness side and ground.
- **Is any voltage present?**

  YES : Go to C13.

  NO : Go to C14.

C13 CHECK CIRCUIT VMC23 (GN/BU) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Secondary Fuel Sender C3270

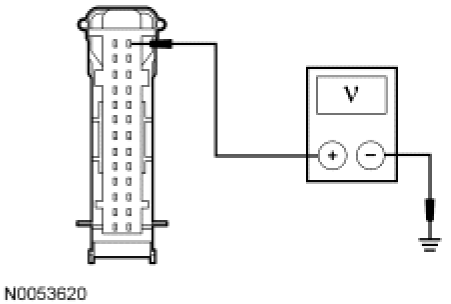


Fig. 22: Checking Circuit VMC23 (GN/BU) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC) C220-26, circuit VMC23 (GN/BU), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR circuit VMC23 (GN/BU). CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR circuit RMC33 (WH/VT) for a short to voltage. CLEAR the DTCs. REPEAT the self-test.

C14 CHECK THE SECONDARY FUEL LEVEL SENSOR FOR AN OPEN

NOTE: **The fuel sender resistance varies from 180 ± 4 ohms when empty (E) to 10 ± 2 ohms when full (F).**

- Key in OFF position.
- Disconnect: Secondary Fuel Level Sensor C3270

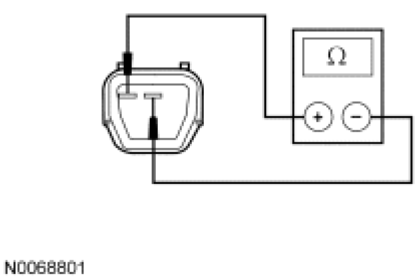


Fig. 23: Checking Secondary Fuel Level Sensor For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the secondary fuel level sensor C3095 pin 1, component side and the secondary fuel level sensor C3095 pin 2, component side.
- **Is the resistance within specifications?**

  YES : Go to C15.

  NO : INSTALL a new secondary fuel level sensor. REFER to **FUEL TANK AND LINES** article.

CLEAR the DTCs. REPEAT the self-test.

C15 CHECK THE SECONDARY FUEL LEVEL SENSOR CIRCUITRY FOR AN OPEN

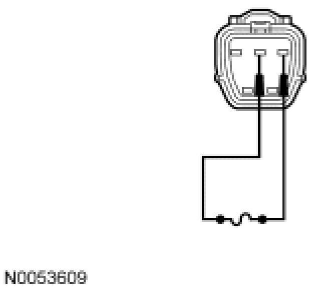


Fig. 24: Checking Fuel Pump Module For Open
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the secondary fuel level sensor C3270-1, circuit RMC33 (WH/VT), harness side and the secondary fuel level sensor C3270-2, circuit VMC23 (GN/OG), harness side.

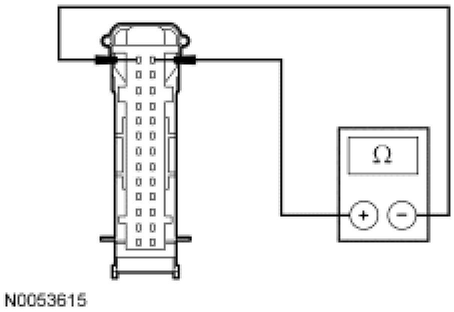


Fig. 25: Measuring Resistance Between Instrument Cluster (IC) C220-26 & C220-13, Circuit VMC23 (GN/OG) & RMC33 (WH/VT)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-26, circuit VMC23 (GN/OG), harness side and the instrument cluster (IC) C220-13, circuit RMC33 (WH/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : REMOVE the jumper wire. Go to C21.

  NO : REMOVE the jumper wire. Go to C16.

C16 CHECK CIRCUIT VMC23 (GN/OG) FOR AN OPEN

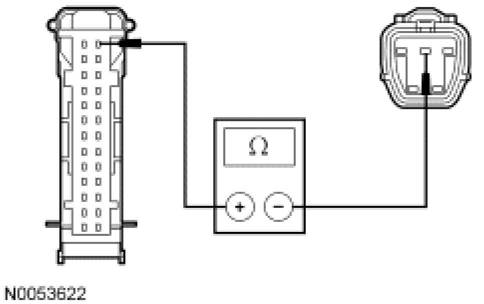


Fig. 26: Checking Circuit VMC23 (GN/OG) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-26, circuit VMC23 (GN/OG), harness side and the secondary fuel level sensor C3270-2, circuit VMC23 (GN/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : REPAIR circuit RMC33 (WH/VT) for an open. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR circuit VMC23 (GN/OG). CLEAR the DTCs. REPEAT the self-test.

C17 INSPECT THE FUEL TANK

- Visually inspect the fuel tank for any damage or deformation.
- **Is the fuel tank OK?**

  YES : Go to C18.

  NO : INSTALL a new fuel tank. REFER to **FUEL TANK AND LINES** article. CLEAR the DTCs. REPEAT the self-test.

C18 INSPECT THE FUEL TANK TRANSFER TUBE CONNECTIONS

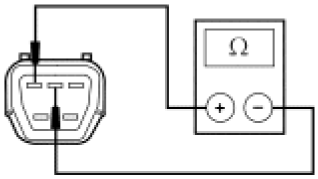
- Remove the fuel pump module and the secondary fuel level sensor. Refer to **FUEL TANK AND LINES** article.
- Inspect the fuel tank transfer tube, connections, the fuel pump module and the secondary fuel level sensor for any damage or deformation.
- **Are the fuel tank transfer tube, connections, the fuel pump module and the fuel level sensor OK?**

  YES : Go to C19.

  NO : INSTALL a new fuel tank transfer tube, fuel pump module or secondary fuel level sensor as necessary. REFER to **FUEL TANK AND LINES** article. CLEAR the DTCs. REPEAT the self-test.

C19 CHECK THE FUEL PUMP MODULE AND THE SECONDARY FUEL LEVEL SENSOR FOR CORRECT OPERATION

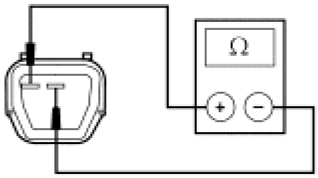
NOTE:	**The resistance varies from 180 ± 4 ohms when empty (E) to 10 ± 2 ohms when full (F).**



N0068798

Fig. 27: Checking Fuel Pump Module And Secondary Fuel Level Sensor For Correct Operation (Fuel Pump Module)
Courtesy of FORD MOTOR CO.

- For the fuel pump module, measure the resistance between the fuel pump module C433 pin 1, component side and the fuel pump module C433 pin 2, component side while slowly moving the float arm from the bottom to the top of travel.



N0068801

Fig. 28: Checking Fuel Pump Module And Secondary Fuel Level Sensor For Correct Operation (Secondary Fuel Level Sensor)
Courtesy of FORD MOTOR CO.

- For the secondary fuel level sensor, measure the resistance between the secondary fuel sender C3095 pin 1, component side and the secondary fuel level sensor C3095 pin 2, component side while slowly moving the float arm from the bottom to the top of travel.
- **Does the resistance start at approximately 180 ohms with the float at the bottom of travel and slowly increase to approximately 10 ohms at the top of travel?**

  YES : For DTC B2879, INSTALL a new fuel tank transfer tube or fuel level sender as required. REFER to **FUEL TANK AND LINES** article. CLEAR the DTCs. REPEAT the self-test.

  For no DTCs, the concern could have been caused by an intermittent input to the instrument cluster (IC), most likely created by corrosion on one of the fuel level sensors (float and card).

  NO : For the secondary fuel level sensor, INSTALL a new secondary fuel level sensor. REFER to **FUEL TANK AND LINES** article. CLEAR the DTCs. REPEAT the self-test.

  For the fuel pump module, go to C20.

C20 CHECK THE FUEL LEVEL SENSOR

NOTE:	**The fuel level sensor resistance measures between 10 ohms ± 2 ohms at the upper stop position and 180 ohms ± 4 ohms at the lower stop position.**

- Remove the fuel pump module. Refer to **FUEL TANK AND LINES** article.

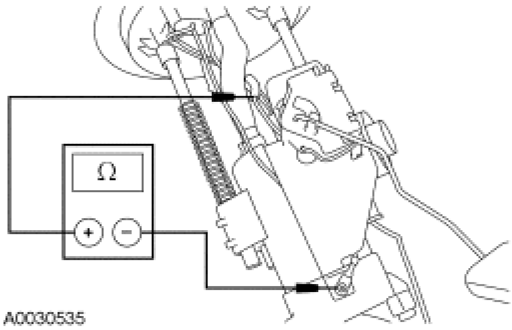


Fig. 29: Checking Fuel Level Sensor
Courtesy of FORD MOTOR CO.

NOTE:	**Disconnect the fuel level sensor input wire from the fuel level sensor for this measurement.**

- Measure the resistance between the fuel level sensor input wire and the fuel level sensor ground while slowly moving the float arm between the upper and lower stop position.
- **Does the resistance slowly increase from approximately 10 ohms at the upper stop to 180 ohms at the lower stop?**

  YES : INSTALL a new fuel pump module. REFER to **FUEL TANK AND LINES** article. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL a new fuel level sensor. REFER to **FUEL TANK AND LINES** article. CLEAR the DTCs. REPEAT the self-test.

C21 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose

or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: Incorrect Temperature Gauge Indication

Normal Operation

The PCM receives the engine coolant temperature status through hardwired circuitry to the engine coolant temperature (ECT) sensor (2.3L and 3.0L engines) or to the cylinder head temperature sensor (CHT) (3.5L engine). The instrument cluster (IC) receives the engine coolant temperature data from the PCM over the communication network. The instrument cluster (IC) monitors the engine coolant temperature data received from the PCM and commands the temperature gauge indication with a corresponding movement of the pointer.

This pinpoint test is intended to diagnose the following:

- Instrument cluster (IC)

PINPOINT TEST D: INCORRECT TEMPERATURE GAUGE INDICATION

D1 CHECK FOR CORRECT OPERATION OF THE COOLING SYSTEM

- Verify that the engine cooling system and thermostat are functioning correctly.
- **Is the engine cooling system and thermostat operating correctly?**

  YES : Go to D2.

  NO : REFER to **ENGINE COOLING** article.

D2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS

- Check for recorded PCM DTCs from the continuous and on-demand self-tests.
- **Are any DTCs recorded?**

  YES : REFER to the **Introduction - Gasoline Engines** article to continue diagnosis of the DTCs.

  NO : Go to D3.

D3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER (IC) SELF-TESTS

- Check for recorded continuous memory instrument cluster (IC) DTCs.
- **Is DTC U1900 recorded?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose communication with the PCM.

  NO : Go to D4.

D4 CARRY OUT THE INSTRUMENT CLUSTER (IC) COOLANT TEMPERATURE GAUGE ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger

NOTE: **The coolant temperature should range between 0-59°C (32-138°F) with the gauge in the cold (C) range, between 60-120°C (140-248°F)**

with the gauge in the normal or mid-range and above 123°C (253°F) with the gauge in the hot (H) range.

- Select the instrument cluster (IC) temperature gauge (ENGCOOLNT) active command. Command the temperature gauge according to the following table:

Temperature Command	Gauge Position
44°C (111°F)	Cold (C)
96°C (205°F)	Center of the gauge (mid-range)
121°C (250°F)	Beginning of the hot (H)
123°C (253°F)	Full hot (H)

- **Does the temperature gauge operate according to the above specifications?**

  YES : Go to D5.

  NO : Go to D7.

D5 CHECK THE PCM TEMPERATURE PIDs

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger
- Key in START position.
- Select the PCM engine coolant temperature (ECT) (2.3L and 3.0L engines) or cylinder head temperature (CHT) (3.5L engine) PID and monitor the PID while the engine is running.
- **Does the PID agree with the position of the temperature gauge?**

  YES : INSTALL a new ECT (2.3L and 3.0L) or CHT (3.5L) sensor. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

  NO : Go to D6.

D6 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

D7 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test E: The Tachometer Is Inoperative

Normal Operation

The PCM uses the crankshaft position sensor to measure the engine rpm, and sends the instrument cluster (IC) the data over the communication network, to command the tachometer gauge according to the data.

This pinpoint test is intended to diagnose the following:

- Instrument cluster (IC)

PINPOINT TEST E: THE TACHOMETER IS INOPERATIVE

E1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS

- Check for recorded PCM DTCs from the continuous and on-demand self-tests.
- **Are any DTCs recorded?**

YES : REFER to the **Introduction - Gasoline Engines** article to continue diagnosis of the DTCs.

NO : Go to E2.

E2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER (IC) SELF-TESTS

- Check for recorded continuous memory instrument cluster (IC) DTCs.
- **Is DTC U1900 recorded?**

YES : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose

communication with the PCM.

NO : Go to E3.

E3 CARRY OUT THE INSTRUMENT CLUSTER (IC) TACHOMETER ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) tachometer (TACH) active command. Command the tachometer on. Observe the tachometer.
- **Does the tachometer begin at 0 rpm and move to 7000 rpm when commanded on?**

  YES : Go to E4.

  NO : Go to E5.

E4 CHECK THE PCM RPM PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger
- Select the PCM engine rpm (RPM) PID and monitor the PID while the engine is running.
- Start the engine.
- **Does the PID agree with the position of the tachometer gauge?**

  YES : The system is operating correctly at this time.

  NO : Go to E5.

E5 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test F: The Speedometer/Odometer Is Inoperative

Normal Operation

The instrument cluster (IC) receives the vehicle speed sensor (VSS) signal from the PCM over the communication network. The PCM receives the VSS information from the output shaft speed (OSS) sensor. The instrument cluster (IC) monitors the VSS input from the PCM and commands the speedometer with a corresponding movement of the pointer. The odometer is tamper resistant and accumulates and registers up to 1 million kilometers in metric mode or 1 million miles in English mode, based upon rolling count data sent from

the PCM over the communication network.

This pinpoint test is intended to diagnose the following:

- PCM
- Instrument cluster (IC)

PINPOINT TEST F: THE SPEEDOMETER/ODOMETER IS INOPERATIVE

F1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS

- Check for recorded PCM DTCs from the continuous and on-demand self-tests.
- **Are any DTCs recorded?**

  YES : REFER to the **Introduction - Gasoline Engines** article to continue diagnosis of the DTCs.

  NO : Go to F2.

F2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER (IC) SELF-TESTS

- Check for recorded continuous memory instrument cluster (IC) DTCs.
- **Is DTC U1900 recorded?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article.

  NO : If the speedometer is inoperative, go to F3.

  If the odometer is inoperative, go to F5.

F3 CARRY OUT THE INSTRUMENT CLUSTER (IC) SPEEDOMETER ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) speedometer (SPDOMETER) active command. Command the speedometer on. Observe the speedometer.
- **Does the speedometer begin at 0 km/h (0 mph) and move to 193 km/h (120 mph)?**

  YES : Go to F4.

  NO : Go to F7.

F4 CHECK THE PCM VSS PIDs

NOTE:	**This step may require the use of an assistant to monitor and record the scan tool data.**

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger

NOTE:	**The speedometer should register approximately the same speed as the VSS PID ± 8 km/h (5 mph).**

- Monitor the PCM vehicle speed (VSS) PID while driving the vehicle at 32 km/h (20 mph), 64 km/h (40 mph) and 97 km/h (60 mph).
- **Does the PID indicate vehicle speed?**

  YES : Go to F7.

  NO : Go to F6.

F5 MONITOR THE DISPLAY SEGMENT CONTROL DISPLAY

- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the display segment control (SEGMENT_2) active command. Command the display segment active command on.
- **Do the display segments illuminate correctly?**

  YES : Go to F6.

  NO : Go to F7.

F6 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

F7 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test G: Incorrect Speedometer Indication

Normal Operation

The instrument cluster (IC) receives the vehicle speed sensor (VSS) signal from the PCM over the communication network. The PCM receives the VSS information from the output shaft speed (OSS) sensor. The instrument cluster (IC) monitors the VSS input from the PCM and commands the speedometer with a corresponding movement of the pointer. The odometer is tamper resistant and accumulates and registers up to 1 million kilometers in metric mode or 1 million miles in English mode, based upon rolling count data sent from the PCM over the communication network.

This pinpoint test is intended to diagnose the following:

- Tire size configuration
- Axle ratio configuration
- PCM
- Instrument cluster (IC)

PINPOINT TEST G: INCORRECT SPEEDOMETER INDICATION

G1 VERIFY THE VEHICLE TIRE SIZE AND AXLE RATIO CONFIGURATION

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Module Programming
- Select programmable parameters and confirm that the axle ratio and tire size is correctly configured.
- **Is the axle ratio and tire size correctly configured?**

  YES : Go to G2.

  NO : Configure the axle ratio or tire size as required. TEST the system for normal operation.

G2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS

- Check for recorded PCM DTCs from the continuous and on-demand self-tests.
- **Are any PCM DTCs recorded?**

  YES : REFER to the **Introduction - Gasoline Engines** article to continue diagnosis of the DTCs.

  NO : Go to G3.

G3 CARRY OUT THE INSTRUMENT CLUSTER (IC) SPEEDOMETER ACTIVE COMMAND USING THE SCAN TOOL

- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) speedometer (SPDOMETER) active command. Command the speedometer in increments of 10%. Observe the speedometer.
- **Does the speedometer begin at 0 km/h (0 mph) and increase by approximately 19 km/h (12 mph)?**

  YES : Go to G4.

  NO : Go to G6.

G4 CHECK THE PCM VSS PIDs

NOTE: This step may require the use of an assistant to monitor and record the scan tool data.

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger

  NOTE: The speedometer should register approximately the same speed as the VSS PID ± 8 km/h (5 mph).

- Monitor the PCM vehicle speed (VSS) PID while driving the vehicle at 32 km/h (20 mph), 64 km/h (40 mph) and 97 km/h (60 mph).
- **Does the speedometer indication agree with the PCM VSS PID within specification?**

  YES : Go to G5.

  NO : Go to G6.

G5 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

G6 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test H: The Low Fuel Indicator Is Never/Always On (If Equipped)

Normal Operation

The low fuel indicator is illuminated when the fuel level reaches a predetermined level of approximately 1/8 tank. The low fuel indicator and the fuel gauge are controlled by the instrument cluster (IC) based upon the fuel level data provided by the fuel sender. When the instrument cluster (IC) receives the data, the fuel gauge indicates low fuel and the instrument cluster (IC) illuminates the low fuel indicator.

This pinpoint test is intended to diagnose the following:

- Instrument cluster (IC)

PINPOINT TEST H: THE LOW FUEL INDICATOR IS NEVER/ALWAYS ON (IF EQUIPPED)

H1 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) low fuel indicator (FUEL_LOW) active command. Command the low fuel indicator on and off. Observe the low fuel indicator.
- **Does the low fuel indicator illuminate when commanded on, and turn off when commanded off?**

  YES : Go to H2.

  NO : Go to H3.

H2 CHECK THE FUEL GAUGE OPERATION

- Monitor the fuel gauge.
- **Does the fuel gauge operate correctly?**

  YES : The system is operating correctly at this time. The fuel level must be below 1/8 tank for the instrument cluster (IC) to turn on the low fuel indicator.

  NO : For front wheel drive (FWD), go to **Pinpoint Test B**.

  For all wheel drive (AWD), go to **Pinpoint Test C**.

H3 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins

- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: The Brake Warning Indicator Is Never On

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Instrument Cluster for schematic and connector information.

Normal Operation

When the parking brake is applied, the parking brake warning indicator switch grounds circuit CCB09 (GY/BU) to the smart junction box (SJB). The SJB receives the ground signal and sends the instrument cluster (IC) a message over the communication network to illuminate the brake warning indicator. When the brake fluid level is low, the brake fluid level switch closes, and the signal from the SJB on circuit CMC19 (GY/VT) is grounded on circuit GD121 (BK/YE). When a base brake system concern is detected, the ABS module sends a signal to the instrument cluster (IC) over the communication network to illuminate the brake system warning indicator.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Parking brake warning indicator switch
- Brake fluid level switch (part of the brake fluid reservoir)
- SJB
- Instrument cluster (IC)

PINPOINT TEST I: THE BRAKE WARNING INDICATOR IS NEVER ON

NOTE:	**Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

I1 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) brake warning indicator (BRK_LAMP) active command. Command the brake warning indicator on. Observe the brake warning indicator.
- **Does the brake warning indicator illuminate when commanded on?**

  YES : Go to I2.

NO : Go to I10.

I2 CHECK THE BRAKE WARNING INDICATOR WITH THE PARKING BRAKE APPLIED

- Apply the parking brake while monitoring the brake warning indicator.
- **Does the brake warning indicator illuminate?**

YES : Go to I6.

NO : Go to I3.

I3 CHECK THE PARKING BRAKE WARNING INDICATOR SWITCH PID

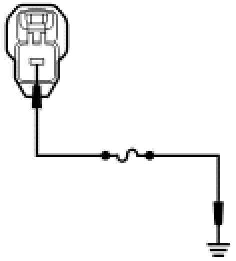
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB parking brake warning indicator switch (PRK_BRK) PID while applying the parking brake.
- **Does the PID agree with the parking brake position?**

YES : Go to I9.

NO : Go to I4.

I4 CHECK THE PARKING BRAKE WARNING INDICATOR SWITCH

- Disconnect: Parking Brake Warning Indicator Switch C306



N0026569

Fig. 30: Checking Parking Brake Warning Indicator Switch
Courtesy of FORD MOTOR CO.

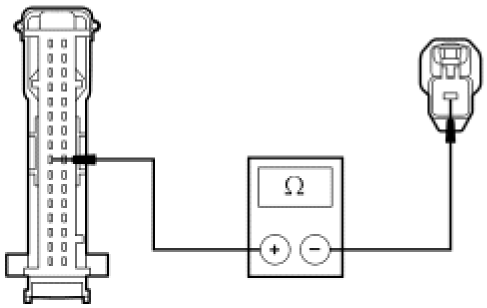
- Connect a fused (5A) jumper wire between the parking brake warning indicator switch C306-1, circuit CCB09 (GY/BU), harness side and ground.
- **Does the brake warning indicator illuminate?**

YES : REMOVE the jumper wire. INSTALL a new parking brake warning indicator switch. REFER to **PARKING BRAKE AND ACTUATION** article. TEST the system for normal operation.

NO : REMOVE the jumper wire. Go to I5.

I5 CHECK CIRCUIT CCB09 (GY/BU) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280c



N0026570

Fig. 31: Checking Circuit CCB09 (GY/BU) For Open
Courtesy of FORD MOTOR CO.

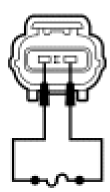
- Measure the resistance between the SJB C2280c-9, circuit CCB09 (GY/BU), harness side and the parking brake warning indicator switch C306-1, circuit CCB09 (GY/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to I9.

  NO : REPAIR the circuit. TEST the system for normal operation.

I6 CHECK THE BRAKE FLUID LEVEL WARNING INDICATOR OPERATION FROM THE BRAKE FLUID LEVEL SWITCH

- Key in OFF position.
- Disconnect: Brake Fluid Level Switch C124
- Key in ON position.



N0026571

Fig. 32: Checking Brake Fluid Level Warning Indicator Operation From Brake Fluid Level Switch
Courtesy of FORD MOTOR CO.

- Connect a fused (10A) jumper wire between the brake fluid level switch C124-1, circuit CMC19 (GY/VT), harness side and the brake fluid level switch C124-2, circuit GD121 (BK/YE), harness side.
- Monitor the brake warning indicator.
- **Does the brake warning indicator illuminate?**

  YES : REMOVE the jumper wire. INSTALL a new brake fluid reservoir. REFER to **HYDRAULIC BRAKE ACTUATION** article. TEST the system for normal operation.

NO : REMOVE the jumper wire. Go to I7.

I7 CHECK CIRCUIT GD121 (BK/YE) FOR AN OPEN

- Key in OFF position.

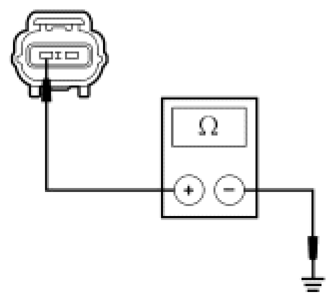


Fig. 33: Checking Circuit GD121 (BK/YE) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the brake fluid level switch C124-2, circuit GD121 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to I8.

NO : REPAIR the circuit. TEST the system for normal operation.

I8 CHECK CIRCUIT CMC19 (GY/VT) FOR AN OPEN

- Disconnect: SJB C2280a

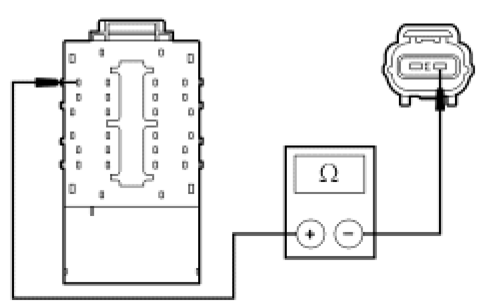


Fig. 34: Checking Circuit CMC19 (GY/VT) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280a-25, circuit CMC19 (GY/VT), harness side and the brake fluid level switch C124-1 , circuit CMC19 (GY/VT), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to I9.

NO : REPAIR the circuit. TEST the system for normal operation.

I9 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.

- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify that the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

I10 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify that the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test J: The Brake Warning Indicator Is Always On

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Instrument Cluster for schematic and connector information.

Normal Operation

When the parking brake is applied, the parking brake warning indicator switch grounds circuit CCB09 (GY/BU) to the smart junction box (SJB). The SJB receives the ground signal and sends the instrument cluster (IC) a message over the communication network to illuminate the brake warning indicator. When the brake fluid level is low, the brake fluid level switch closes, the signal from the SJB on circuit CMC19 (GY/VT) is grounded on circuit GD121 (BK/YE). When the ABS module detects a base brake system concern or other ABS related concerns that affect the electronic brake distribution (EBD) function, the ABS module sends a message to the instrument cluster (IC) to illuminate both the ABS warning indicator and the brake warning indicator.

NOTE: When the ABS module detects an electronic brake distribution (EBD) fault, the

ABS module sends a message to the instrument cluster (IC). Whenever the instrument cluster (IC) receives an EBD message from the ABS module, the instrument cluster (IC) illuminates both the brake warning indicator and the ABS warning indicator simultaneously.

- DTC B2479 (Brake Park Switch Circuit Short to Ground) - is an on-demand DTC that sets in the SJB if a short to ground is detected on the parking brake input, circuit CCB09 (GY/BU).
- DTC C1125 (Brake Fluid Level Sensor Input Circuit Failure) - is an on-demand DTC that sets in the SJB if a short to ground is detected on the brake fluid level input, circuit CMC19 (GY/VT).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Parking brake warning indicator switch
- Brake fluid level switch (part of the brake fluid reservoir)
- Base brake system
- SJB
- Instrument cluster (IC)

PINPOINT TEST J: THE BRAKE WARNING INDICATOR IS ALWAYS ON

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Verify that the parking brake is fully released and the brake fluid level is full before proceeding with diagnostics.**

J1 CHECK THE BASE BRAKE SYSTEM

- Operate the brakes and verify that the base braking system operates correctly.
- **Does the base braking system operate correctly?**

  YES : Go to J2.

  NO : REFER to **BRAKE SYSTEM - GENERAL INFORMATION** article.

J2 CHECK THE ABS WARNING INDICATOR OPERATION

- Key in ON position.
- Monitor the ABS warning indicator and the brake warning indicator following prove-out.
- **Do both the ABS and brake warning indicators illuminate after prove-out?**

  YES : Go to **Pinpoint Test K**.

  NO : Go to J3.

J3 CHECK FOR INSTRUMENT CLUSTER (IC) DTCs

- Key in OFF position.
- Check for recorded continuous memory instrument cluster (IC) DTCs.

- **Is DTC U1901 recorded?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnosis no communication with the SJB.

  NO : Go to J4.

J4 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SJB SELF-TESTS

- Check for recorded SJB DTCs from the continuous and on-demand self-tests.
- **Are any SJB DTCs recorded?**

  YES : If DTC B2479 is retrieved, go to J6.

  If DTC C1125 is retrieved, go to J9.

  For all other SJB DTCs, REFER to **DTC Charts**.

  NO : Go to J5.

J5 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) brake warning indicator (BRK_LAMP) active command. Command the brake warning indicator on then off. Observe the brake warning indicator.
- **Does the brake warning indicator illuminate when commanded on and turn off when commanded off?**

  YES : Go to J11.

  NO : Go to J12.

J6 CHECK THE PARKING BRAKE WARNING INDICATOR SWITCH PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB parking brake warning indicator switch (PRK_BRK) PID while applying and releasing the parking brake.
- **Does the PID agree with the parking brake position?**

  YES : Go to J11.

  NO : Go to J7.

J7 CHECK THE PARKING BRAKE WARNING INDICATOR SWITCH

- Key in OFF position.
- Disconnect: Parking Brake Warning Indicator Switch C306
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB parking brake warning indicator switch (PRK_BRK) PID.
- **Does the PID indicate that the parking brake is off?**

YES : INSTALL a new parking brake warning indicator switch. REFER to **PARKING BRAKE AND ACTUATION** article. CLEAR the DTCs. REPEAT the self-test.

NO : Go to J8.

J8 CHECK CIRCUIT CCB09 (GY/BU) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280c

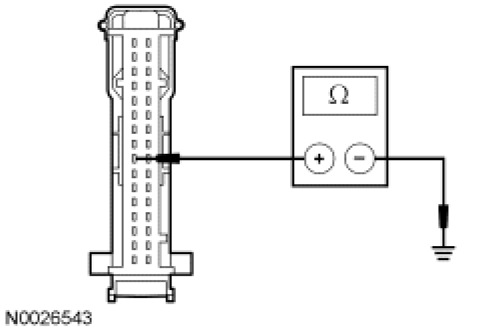


Fig. 35: Checking Circuit CCB09 (GY/BU) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280c-9, circuit CCB09 (GY/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to J11.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

J9 CHECK THE BRAKE FLUID LEVEL SWITCH OPERATION

- Key in OFF position.
- Disconnect: Brake Fluid Level Switch C124
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB Self-Test
- Clear the SJB DTCs. Repeat the SJB self-test.
- **Is DTC C1125 still present?**

  YES : Go to J10.

  NO : INSTALL a new brake fluid reservoir. REFER to **HYDRAULIC BRAKE ACTUATION** article. CLEAR the DTCs. REPEAT the self-test.

J10 CHECK CIRCUIT CMC19 (GY/VT) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280a

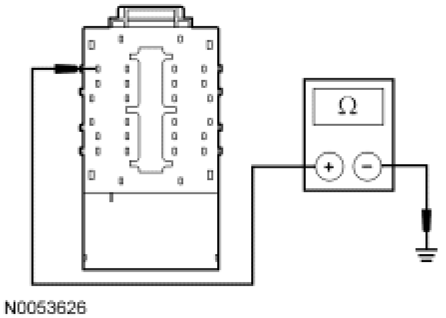


Fig. 36: Checking Circuit CMC19 (GY/VT) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280a-25, circuit CMC19 (GY/VT), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to J11.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

J11 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify that the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

J12 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify that the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the

system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test K: The ABS Warning Indicator Is Never/Always On

Normal Operation

The status of the ABS system is sent to the instrument cluster (IC) from the ABS module over the communication network. The instrument cluster (IC) monitors the ABS input and illuminates the ABS warning indicator when a concern is present.

NOTE: When the ABS module detects an electronic brake distribution (EBD) fault, the ABS module sends a message to the instrument cluster (IC). Whenever the instrument cluster (IC) receives an EBD message from the ABS module, the instrument cluster (IC) illuminates both the brake warning indicator and the ABS warning indicator simultaneously.

This pinpoint test is intended to diagnose the following:

- ABS module
- Instrument cluster (IC)

PINPOINT TEST K: THE ABS WARNING INDICATOR IS NEVER/ALWAYS ON

K1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND ABS MODULE SELF-TESTS

- Check for recorded ABS module DTCs from the continuous and on-demand self-tests.
- **Are any ABS module DTCs recorded?**

  YES : REFER to **VEHICLE DYNAMIC SYSTEMS** article.

  NO : Go to K2.

K2 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) ABS warning indicator (ABS_LAMP) active command. Command the ABS warning indicator on and off. Observe the ABS warning indicator.
- **Does the ABS warning indicator illuminate when commanded on, and turn off when commanded off?**

  YES : Go to K3.

  NO : Go to K4.

K3 CHECK FOR CORRECT ABS MODULE OPERATION

- Disconnect the ABS module connector.
- Check for:

    - corrosion
    - damaged pins
    - pushed-out pins
- Connect the ABS module connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ABS module. REFER to **VEHICLE DYNAMIC SYSTEMS** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

K4 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
    - corrosion
    - damaged pins
    - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test L: The Safety Belt Warning Indicator Is Never/Always On

Normal Operation

The safety belt warning indicator informs the driver that his or her safety belt and/or the front passenger's safety belt is unbuckled. During the first 70 seconds after the ignition switch transitions from OFF or ACC to RUN or START, the safety belt warning indicator and the associated chime are used as a reminder to the driver that the front row safety belts are not buckled. During this first 70 seconds the indicator illuminates when the driver and/or front passenger safety belt is unbuckled (with a person in the seat) and turns off whenever the safety belt (s) in the occupied front row seat(s) is buckled. The indicator illuminates again if a safety belt is unbuckled after both are buckled and the 70 seconds has not yet expired.

The safety belt switch is hardwired to the restraints control module (RCM). The instrument cluster (IC) receives the safety belt switch status from the RCM over the communication network. The RCM signals the instrument cluster (IC), when the safety belt is unfastened, to illuminate the safety belt warning indicator.

This pinpoint test is intended to diagnose the following:

- RCM

- Instrument cluster (IC)

PINPOINT TEST L: THE SAFETY BELT WARNING INDICATOR IS NEVER/ALWAYS ON

L1 RETRIEVE THE RECORDED RCM DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS

- Check for recorded RCM DTCs from the continuous and on-demand self-tests.
- **Are any RCM DTCs recorded?**

YES : REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to L2.

L2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER (IC) SELF-TESTS

- Check for recorded continuous memory instrument cluster (IC) DTCs.
- **Is DTC U1900 recorded?**

YES : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose communication with the RCM.

NO : Go to L3.

L3 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) safety belt warning indicator (SBLT_LAMP) active command. Command the safety belt warning indicator active command on and off. Observe the safety belt warning indicator.
- **Does the safety belt warning indicator illuminate when commanded on, and turn off when commanded off?**

YES : Go to L4.

NO : Go to L5.

L4 CHECK FOR CORRECT RCM OPERATION

- Disconnect all the RCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the RCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new RCM. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose

or corroded connector.

L5 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test M: The Air Bag Warning Indicator Is Never/Always On

Normal Operation

The air bag warning indicator provides an indication that there is a restraint system problem and the air bag may be inoperable or have degraded performance. If the instrument cluster (IC) does not receive the restraint control command over the communication network, the instrument cluster (IC) illuminates the air bag warning indicator. When a fault is detected in the primary air bag warning indication, the instrument cluster (IC) sets DTC B1868 and defaults to the secondary warning and the air bag warning chime sounds.

This pinpoint test is intended to diagnose the following:

- Restraints control module (RCM)
- Instrument cluster (IC)

PINPOINT TEST M: THE AIR BAG WARNING INDICATOR IS NEVER/ALWAYS ON

M1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND RCM SELF-TESTS

- Check for recorded RCM DTCs from the continuous and on-demand self-tests.
- **Are any RCM DTCs recorded?**

  YES : If the air bag warning indicator is always on, REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article to continue diagnosis of the air bag system.

  If the air bag warning indicator is never on, go to M2.

  NO : Go to M2.

M2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER (IC) SELF-TESTS

- Check for recorded continuous memory instrument cluster (IC) DTCs.
- **Are any DTCs recorded?**

  YES : For DTC U1900, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose communication with the RCM.

  For all other DTCs, REFER to **DTC Charts**.

  NO : Go to M3.

M3 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) air bag warning indicator (RESTRAINT) active command. Command the air bag warning indicator on and off. Observe the air bag warning indicator.
- **Does the air bag warning indicator illuminate when commanded on, and turn off when commanded off?**

  YES : Go to M4.

  NO : Go to M5.

M4 CHECK FOR CORRECT RCM OPERATION

- Disconnect all the RCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the RCM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new RCM. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

M5 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test N: The Tire Pressure Monitoring System (TPMS) Warning Indicator Is Never/Always On

Normal Operation

The instrument cluster (IC) receives the TPMS messages from the smart junction box (SJB) over the medium speed controller area network (MS-CAN) communication bus. If the SJB determines that the tire pressure has exceeded the low tire pressure limits, a message is sent to the instrument cluster (IC) to turn the TPMS warning indicator on. If a TPMS fault condition exists, the SJB sends a message to the instrument cluster (IC) to flash the TPMS warning indicator. If the TPMS status message is missing for less than 5 seconds, the instrument cluster (IC) defaults the TPMS warning indicator to the last setting (on or off), based upon the last known good message received. If the TPMS status message is missing for more than 5 seconds, the instrument cluster (IC) sets DTC U0140 and flashes the TPMS indicator for approximately 75 seconds then turns on the indicator steady.

NOTE: **If DTC U0140 is set in the SJB, other symptoms may also be present such as high beam indicator, RH/LH turn indicators, instrument panel backlighting, and door ajar indication.**

This pinpoint test is intended to diagnose the following:

- Tire pressure
- TPMS concern
- SJB
- Instrument cluster (IC)

PINPOINT TEST N: THE TIRE PRESSURE MONITORING SYSTEM (TPMS) WARNING INDICATOR IS NEVER/ALWAYS ON

N1 CHECK THE TIRE PRESSURE

- Verify that the tire pressure in all tires meets the recommended tire pressures on the vehicle certification label. Refer to **IDENTIFICATION CODES** article.
- **Do all the tires meet the recommended tire pressures?**

YES : Go to N2.

NO : CORRECT the tire pressures. TEST the system for normal operation.

N2 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the TPMS warning indicator (TPM_IND) active command. Command the TPMS warning indicator on and off. Observe the TPMS warning indicator.

- **Does the TPMS warning indicator illuminate when commanded on and turn off when commanded off?**

  YES : Go to N3.

  NO : Go to N6.

N3 RETRIEVE THE RECORDED DTCs FROM THE CONTINUOUS INSTRUMENT CLUSTER (IC) SELF-TEST

- Check for recorded continuous memory instrument cluster (IC) DTCs.
- **Are any DTCs recorded?**

  YES : For DTC U1901, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose communication with the SJB.

  For all other DTCs, REFER to **DTC Charts**.

  NO : Go to N4.

N4 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SJB SELF-TESTS

- Check for recorded SJB DTCs from the continuous and on-demand self-tests.
- **Are any TPMS DTCs recorded?**

  YES : REFER to **WHEELS AND TIRES** article.

  NO : Go to N5.

N5 CHECK FOR CORRECT SJB MODULE OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify that the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

N6 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect all the instrument cluster (IC) connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the instrument cluster (IC) connectors and make sure they seat correctly.

- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test O: The Door Ajar Warning Indicator Is Never/Always On

Normal Operation

The door ajar indicator informs the driver if any of the doors, or the decklid is not completely closed. The information is sent from the smart junction box (SJB) to the instrument cluster (IC) over the communication network.

This pinpoint test is intended to diagnose the following:

- Interior lamps concern
- SJB
- Instrument cluster (IC)

PINPOINT TEST O: THE DOOR AJAR WARNING INDICATOR IS NEVER/ALWAYS ON

O1 CHECK THE OPERATION OF THE INTERIOR LAMPS

- Open and close each door, and the decklid, and monitor the interior lamps.
- **Do the interior lamps operate correctly?**

  YES : Go to O2.

  NO : REFER to **INTERIOR LIGHTING** article.

O2 CARRY OUT THE INSTRUMENT CLUSTER (IC) WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) door ajar warning lamp (AJAR_LAMP) active command. Command the door ajar warning lamp on and off. Observe the door ajar warning indicator.
- **Does the door ajar warning indicator illuminate when commanded on, and turn off when commanded off?**

  YES : Go to O3.

  NO : Go to O5.

O3 RETRIEVE THE RECORDED DTCs FROM THE CONTINUOUS INSTRUMENT CLUSTER (IC) SELF-TEST

- Check for recorded continuous memory instrument cluster (IC) DTCs.
- **Are any DTCs recorded?**

  YES : For DTC U1901, REFER to **MODULE COMMUNICATIONS NETWORK** article to

diagnose communication with the SJB.

For all other DTCs, REFER to **DTC Charts**.

NO : Go to O4.

O4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

O5 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test P: The High Beam Indicator Is Never/Always On

Normal Operation

When the high beams are turned on, the smart junction box (SJB) sends a signal to the instrument cluster (IC) through the communication network to illuminate the high beam indicator.

This pinpoint test is intended to diagnose the following:

- SJB

- Instrument cluster (IC)

PINPOINT TEST P: THE HIGH BEAM INDICATOR IS NEVER/ALWAYS ON

P1 CHECK THE HIGH BEAM HEADLAMPS OPERATION

- Turn the headlamp switch to the HIGH BEAMS ON position. Observe the high beam headlamps.
- **Do the high beam headlamps operate correctly?**

  YES : Go to P2.

  NO : REFER to **EXTERIOR LIGHTING** article.

P2 RETRIEVE THE RECORDED DTCs FROM THE CONTINUOUS INSTRUMENT CLUSTER (IC) SELF-TEST

- Check for recorded continuous memory instrument cluster (IC) DTCs.
- **Is DTC U1901 recorded?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose communication with the SJB.

  NO : Go to P3.

P3 CARRY OUT THE INSTRUMENT CLUSTER (IC) WARNING LAMPS AND CHIME ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) high beam indicator (HIGH_BEAM) active command. Command the high beam indicator on and off. Observe the high beam indicator.
- **Does the high beam indicator illuminate when commanded on, and turn off when commanded off?**

  YES : Go to P4.

  NO : Go to P5.

P4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

P5 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test Q: The LH/RH Turn Signal Indicator Is Never/Always On

Normal Operation

When the multifunction switch is in the LH or RH turn signal position, a message is sent to the instrument cluster (IC) from the smart junction box (SJB) through the communication network, and the LH or RH turn signal indicator flashes on and off.

This pinpoint test is intended to diagnose the following:

- SJB
- Instrument cluster (IC)

PINPOINT TEST Q: THE LH TURN SIGNAL INDICATOR IS NEVER/ALWAYS ON

Q1 CHECK THE LH OR RH TURN SIGNAL LAMPS OPERATION

- Key in ON position.
- Operate the LH or RH turn signal. Observe the exterior LH or RH turn lamps.
- **Do the LH or RH turn lamps operate correctly?**

  YES : Go to Q2.

  NO : REFER to **EXTERIOR LIGHTING** article.

Q2 RETRIEVE THE RECORDED DTCs FROM THE CONTINUOUS INSTRUMENT CLUSTER (IC) SELF-TEST

- Check for recorded continuous memory instrument cluster (IC) DTCs.
- **Is DTC U1901 recorded?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose communication with the SJB.

  NO : Go to Q3.

Q3 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL

ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) LH turn indicator (L_TURN) or RH turn indicator (R_TURN) active command. Command the LH or RH turn signal indicator on and off. Observe the LH or RH turn signal indicator.
- **Does the LH or RH turn signal indicator illuminate when commanded on, and turn off when commanded off?**

  YES : Go to Q4.

  NO : Go to Q5.

Q4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Q5 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test R: The Anti-Theft Indicator Is Never/Always On

Normal Operation

The anti-theft indicator proves out for 3 seconds when the key is turned to the ON or START position under normal operation. If there is a passive anti-theft system (PATS) concern, the anti-theft indicator either flashes rapidly or glows steadily (for more than 3 seconds) when the key is turned to the ON or the START position. PATS also flashes the anti-theft indicator every 2 seconds at key off to act as a visual theft deterrent. The anti-theft indicator operation is controlled by the instrument cluster (IC).

This pinpoint test is intended to diagnose the following:

- PATS concern
- Instrument cluster (IC)

PINPOINT TEST R: THE ANTI-THEFT INDICATOR IS NEVER/ALWAYS ON

R1 CARRY OUT THE INSTRUMENT CLUSTER (IC) ANTI-THEFT INDICATOR ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) anti-theft indicator (ANTITHEFT) active command. Command the anti-theft indicator on and off. Observe the anti-theft indicator.
- **Does the anti-theft indicator illuminate when commanded on, and turn off when commanded off?**

  YES : Go to R2.

  NO : Go to R3.

R2 RETRIEVE THE RECORDED DTCs FROM THE CONTINUOUS INSTRUMENT CLUSTER (IC) SELF-TEST

- Check for recorded continuous memory instrument cluster (IC) DTCs.
- **Are any PATS related DTCs recorded?**

  YES : REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

  NO : Go to R3.

R3 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect all the instrument cluster (IC) connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the instrument cluster (IC) connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test S: The Low Oil Pressure Warning Indicator Is Never/Always On

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Instrument Cluster for schematic and connector information.

Normal Operation

The oil pressure switch is hardwired to the smart junction box (SJB) through circuit CMC24 (GY). When the oil pressure is within normal ranges, the oil pressure switch closes, grounding the signal to the SJB. The SJB then sends a command message to the instrument cluster (IC) over the communication network, to turn off the low oil pressure warning indicator. When engine oil pressure is low, the oil pressure switch opens, removing the ground to the SJB. The SJB sends a low oil pressure message to the instrument cluster (IC) over the communication network to illuminate the low oil pressure warning indicator.

- DTC C1284 (Oil Pressure Switch Failure) - is an on-demand DTC that sets in the SJB if the SJB detects a short to ground on the oil pressure input, circuit CMC24 (GY).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Oil pressure switch
- Base engine concern
- SJB
- Instrument cluster (IC)

PINPOINT TEST S: THE LOW OIL PRESSURE WARNING INDICATOR IS NEVER/ALWAYS ON

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

S1 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) low oil pressure indicator (OIL_P_LOW) active command. Command the low oil pressure warning indicator on and off. Observe the low oil pressure warning indicator.
- **Does the low oil pressure warning indicator illuminate when commanded on, and turn off when commanded off?**

  YES : If the oil pressure indicator is never on, go to S2.

  If the oil pressure indicator is always on, go to S4.

  NO : Go to S8.

S2 CHECK FOR A STUCK CLOSED ENGINE OIL PRESSURE SWITCH

- Key in OFF position.
- Disconnect: Engine Oil Pressure Switch C103
- Key in ON position.
- Observe the low oil pressure warning indicator.
- **Does the low oil pressure warning indicator turn on?**

  YES : INSTALL a new engine oil pressure switch. REFER to **ENGINE - 2.3L** article, **ENGINE - 3.0L (4V)** article or **ENGINE - 3.5L** article. TEST the system for normal operation.

  NO : Go to S3.

S3 CHECK CIRCUIT CMC24 (GY) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280a

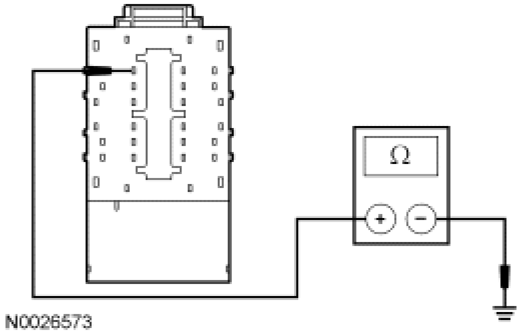


Fig. 37: Checking Circuit CMC24 (GY) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280a-26, circuit CMC24 (GY), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to S7.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

S4 MONITOR THE LOW OIL PRESSURE WARNING INDICATOR

- Key in OFF position.
- Disconnect: Oil Pressure Switch C103
- Key in ON position.

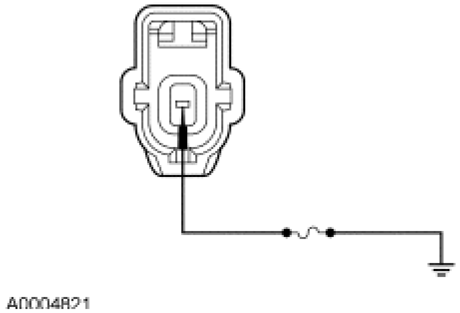


Fig. 38: Monitoring Low Oil Pressure Warning Indicator
Courtesy of FORD MOTOR CO.

- Connect a fused (5A) jumper wire between the oil pressure switch C103-1, circuit CMC24 (GY), harness side and ground.
- **Does the low oil pressure warning indicator turn off?**

  YES : REMOVE the jumper wire. Go to S5.

  NO : REMOVE the jumper wire. Go to S6.

S5 CARRY OUT THE ENGINE OIL PRESSURE TEST

- Carry out the engine oil pressure test. Refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
- **Is the engine oil pressure within specification?**

  YES : INSTALL a new oil pressure switch. REFER to **ENGINE - 2.3L** article, **ENGINE - 3.0L (4V)** article or **ENGINE - 3.5L** article. TEST the system for normal operation.

  NO : REFER to **ENGINE SYSTEM - GENERAL INFORMATION** article.

S6 CHECK CIRCUIT CMC24 (GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280a

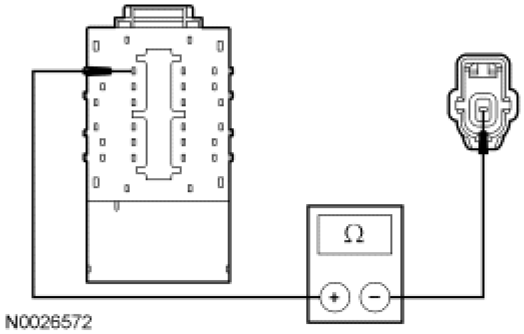


Fig. 39: Checking Circuit CMC24 (GY) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280a-26, circuit CMC24 (GY), harness side and the oil pressure switch C103-1, circuit CMC24 (GY), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to S7.

NO : REPAIR the circuit. TEST the system for normal operation.

S7 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

S8 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test T: The Malfunction Indicator Lamp (MIL) Is Never/Always On

Normal Operation

The MIL is controlled by the instrument cluster (IC) using data sent from the PCM over the communication network. When an emission system concern exists, the PCM sets a DTC and sends the instrument cluster (IC) a message to turn on the MIL.

This pinpoint test is intended to diagnose the following:

- PCM
- Instrument cluster (IC)

PINPOINT TEST T: THE MALFUNCTION INDICATOR LAMP (MIL) IS NEVER/ALWAYS ON

T1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS

- Check for recorded PCM DTCs from the continuous and on-demand self-tests.
- **Are any PCM DTCs recorded?**

  YES : REFER to the **Introduction - Gasoline Engines** article.

  NO : Go to T2.

T2 RETRIEVE THE RECORDED DTCs FROM THE CONTINUOUS INSTRUMENT CLUSTER (IC) SELF-TEST

- Check for recorded continuous memory instrument cluster (IC) DTCs.
- **Is DTC U1900 recorded?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose communication with the PCM.

  NO : Go to T3.

T3 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) MIL indicator (MIL_IC) active command. Command the MIL on and off. Observe the MIL.
- **Does the MIL illuminate when commanded on, and turn off when commanded off?**

  YES : Go to T4.

  NO : Go to T5.

T4 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

T5 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.

- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test U: The Powertrain Malfunction (Wrench) Warning Indicator is Never/Always On

Normal Operation

The PCM, the transmission control module (TCM) and the 4X4 control module (if equipped) monitor the powertrain system and provide the instrument cluster (IC) with the operating status over the communication network. When a system concern is detected, the PCM, the TCM or the 4X4 control module provide the instrument cluster (IC) with a signal commanding the instrument cluster (IC) to illuminate the powertrain malfunction (wrench) warning indicator.

This pinpoint test is intended to diagnose the following:

- TCM
- PCM
- 4X4 control module (if equipped)
- Instrument cluster (IC)

PINPOINT TEST U: THE POWERTRAIN MALFUNCTION (WRENCH) WARNING INDICATOR IS NEVER/ALWAYS ON

U1 OBSERVE THE INDICATOR

- Key in ON position.
- Start the vehicle. Observe the powertrain malfunction (wrench) warning indicator.
- **Does the powertrain malfunction (wrench) indicator illuminate during the bulb prove-out?**

  YES : Go to U2.

  NO : Go to U12.

U2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS

- Check for recorded PCM DTCs from the continuous and on-demand self-tests.
- **Are any PCM DTCs recorded?**

  YES : REFER to the **Introduction - Gasoline Engines** article to continue diagnosis of the DTCs.

NO : Go to U3.

U3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND TCM SELF-TESTS

- Check for recorded TCM DTCs from the continuous and on-demand self-tests.
- **Are any TCM DTCs recorded?**

  YES : REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article or **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.

  NO : If equipped with AWD, go to U4.

  If not equipped with AWD, go to U5.

U4 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND 4X4 CONTROL MODULE SELF-TESTS

- Check for recorded 4X4 control module DTCs from the continuous and on-demand self-tests.
- **Are any 4X4 control module DTCs recorded?**

  YES : REFER to **FOUR WHEEL DRIVE (4WD) SYSTEMS** article.

  NO : Go to U5.

U5 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) powertrain malfunction (wrench) indicator (ETC_IND) active command. Command the powertrain malfunction (wrench) warning indicator active command on and off. Observe the indicator.
- **Does the powertrain malfunction (wrench) warning indicator illuminate when commanded on, and turn off when commanded off?**

  YES : Go to U6.

  NO : Go to U12.

U6 CHECK THE INSTRUMENT CLUSTER (IC) TCM WRENCH REQUEST PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select and monitor the instrument cluster (IC) TCM wrench request (WR_LMP_TCM) PID.
- **Does the TCM wrench request PID read YES?**

  YES : Go to U9.

  NO : Go to U7.

U7 CHECK THE INSTRUMENT CLUSTER (IC) ELECTRONIC THROTTLE CONTROL WRENCH REQUEST PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select and monitor the instrument cluster (IC) electronic throttle control wrench request

(WR_LMP_ETC) PID.

- **Does the electronic throttle control wrench request PID read YES?**

  YES : Go to U10.

  NO : If equipped with four wheel drive (4WD), go to U8.

  If not equipped with 4WD, go to U12.

U8 CHECK THE INSTRUMENT CLUSTER (IC) 4X4 CONTROL MODULE WRENCH REQUEST PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select and monitor the instrument cluster (IC) 4X4 control module wrench request (WR_LMP_4X4M) PID.
- **Does the 4X4 control module control wrench request PID read YES?**

  YES : Go to U11.

  NO : Go to U12.

U9 CHECK FOR CORRECT TCM OPERATION

- Disconnect all the TCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the TCM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new TCM. REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article or **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

U10 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article,

ELECTRONIC ENGINE CONTROLS - 3.0L (4V) article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

U11 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION

- Disconnect all the 4X4 control module connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the 4X4 control module connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new 4X4 control module. REFER to **FOUR WHEEL DRIVE (4WD) SYSTEMS** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

U12 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test V: The Check Fuel Cap Warning Indicator Is Never/Always On

Normal Operation

The PCM monitors the fuel tank evaporative emission system for significant leaks that occur following refueling of the vehicle. Once the PCM detects a fuel vapor leak, the PCM sends the instrument cluster (IC) a message over the communication network to turn on the check fuel cap warning indicator. DTC P0457 sets in the PCM following a successful cruise test, which is initiated when the vehicle is driven at a steady speed above 64 km/h (40 mph) for a duration of approximately 4-5 minutes. If the PCM is unable to successfully run the cruise test, the instrument cluster (IC) does not receive the check fuel cap message and the check fuel cap indicator remains off.

- DTC P0457 (Evaporative Emission System Leak Detected [fuel cap loose/off]) - sets in the PCM if a fuel tank pressure change greater than -23.7 kPa (-7 in-Hg) of vacuum within 30 seconds after refueling occurs, or there is an excessive purge (fuel vapor) flow of greater than 454 g (1.0 lb) per minute.

This pinpoint test is intended to diagnose the following:

- PCM
- Instrument cluster (IC)

PINPOINT TEST V: THE CHECK FUEL CAP INDICATOR IS NEVER/ALWAYS ON

V1 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the check fuel cap indicator (FUEL_CAP) active command. Command the check fuel cap indicator on and off. Observe the check fuel cap indicator.
- **Does the check fuel cap indicator illuminate when commanded on, and turn off when commanded off?**

  YES : Go to V2.

  NO : Go to V5.

V2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS

- Check for recorded PCM DTCs from the continuous and on-demand self-tests.
- **Is DTC P0457 recorded?**

  YES : If the check fuel cap indicator is illuminated, REFER to the **Introduction - Gasoline Engines** article.

  If the check fuel cap indicator is not illuminated, go to V3.

  NO : If the check fuel cap indicator is always on, go to V5.

  If the check fuel cap indicator is not illuminated, the system is operating normally at this time. If the fuel cap was left off and the check fuel cap warning indicator did not turn on, driving conditions may not have allowed for the PCM to run the cruise test and message the instrument cluster (IC) to turn on the check fuel cap warning indicator.

V3 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER (IC) SELF-TESTS

- Check for recorded continuous memory instrument cluster (IC) DTCs.
- **Is DTC U1900 recorded?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose communication with the PCM.

  NO : Go to V4.

V4 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

V5 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test W: The Speed Control Indicator Is Never/Always On

Normal Operation

The speed control status information is sent to the instrument cluster (IC) from the PCM over the communication network.

This pinpoint test is intended to diagnose the following:

- PCM
- Instrument cluster (IC)

PINPOINT TEST W: THE SPEED CONTROL INDICATOR IS NEVER/ALWAYS ON

W1 CHECK THE SPEED CONTROL OPERATION

- Test drive the vehicle and operate the speed control.
- **Does the speed control operate correctly?**

  YES : Go to W2.

  NO : REFER to **SPEED CONTROL** article.

W2 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) speed control indicator (SC_SET) active command. Command the speed control indicator on and off. Observe the speed control indicator.
- **Does the speed control indicator illuminate when command on, and turn off when command off?**

  YES : Go to W3.

  NO : Go to W4.

W3 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

W4 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the

system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test X: The Traction Assist Indicator Is Never/Always On

Normal Operation

When the PCM senses a traction assist event is taking place, it sends the instrument cluster (IC) a message over the communication network to illuminate the traction assist indicator or to flash the traction assist indicator. The traction assist indicator informs the driver that a traction assist event is taking place, by flashing the indicator. It is also used to indicate a malfunction in the traction assist system, or if the traction assist control has been disabled by the operator, by illuminating the indicator constantly (not flashing).

This pinpoint test is intended to diagnose the following:

- Traction assist system
- PCM
- Instrument cluster (IC)

PINPOINT TEST X: THE TRACTION ASSIST INDICATOR IS NEVER/ALWAYS ON

X1 CHECK THE TRACTION ASSIST INDICATOR OPERATION USING THE TRACTION ASSIST DISABLE SWITCH

- Key in ON position.
- Press the traction assist disable switch to disable the traction assist system while monitoring the traction assist indicator.
- **Does the traction assist indicator illuminate?**

YES : If the traction assist indicator does not operate while in traction active mode, go to X5.

If the traction assist indicator operates in traction active mode, the system is operating normally at this time.

NO : Go to X2.

X2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER (IC) SELF-TESTS

- Check for recorded instrument cluster (IC) DTCs from the continuous and on-demand self-tests.
- **Are any instrument cluster (IC) DTCs recorded?**

YES : For DTC C1093, REFER to **VEHICLE DYNAMIC SYSTEMS** article.

For DTC U1900 or U1901, REFER to **MODULE COMMUNICATIONS NETWORK** article.

For all other DTCs, REFER to **DTC Charts**.

NO : Go to X3.

X3 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) traction control indicator (CHECK_TRACT) active command. Command the traction assist lamp on and off. Observe the traction assist indicator.
- **Does the traction assist indicator illuminate when commanded on, and turn off when commanded off?**

  YES : Go to X4.

  NO : Go to X6.

X4 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PCM SELF-TESTS

- Check for recorded PCM DTCs from the continuous and on-demand self-tests.
- **Are any PCM DTCs recorded?**

  YES : REFER to the **Introduction - Gasoline Engines** article.

  NO : Go to X5.

X5 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

X6 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test Y: The Charging System Warning Indicator Is Never/Always On

Normal Operation

The charging system warning indicator is controlled by the instrument cluster (IC) based upon data received from the PCM over the communication network.

This pinpoint test is intended to diagnose the following:

- Charging system concern
- PCM
- Instrument cluster (IC)

PINPOINT TEST Y: THE CHARGING SYSTEM WARNING INDICATOR IS NEVER/ALWAYS ON

Y1 CHECK THE CHARGING SYSTEM OPERATION

- Check the charging system operation. Refer to **CHARGING SYSTEM - GENERAL INFORMATION** article.
- **Is the charging system operating correctly?**

  YES : Go to Y2.

  NO : REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.

Y2 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) charging system warning indicator (CHARGE_LMP) active command. Command the charging system warning indicator active command on and off. Observe the charging system warning indicator.
- **Does the charging system warning indicator illuminate when commanded on, and turn off when commanded off?**

  YES : Go to Y3.

  NO : Go to Y4.

Y3 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins

- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Y4 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test Z: The O/D OFF Indicator Is Never/Always On

Normal Operation

The transmission control module (TCM) monitors the overdrive (O/D) off switch status. When the O/D function is selected off, the TCM sends a message to the instrument cluster (IC) over the communication network to turn on the O/D OFF indicator.

This pinpoint test is intended to diagnose the following:

- TCM
- Instrument cluster (IC)

PINPOINT TEST Z: THE O/D OFF INDICATOR IS NEVER/ALWAYS ON

Z1 CHECK THE OPERATION OF THE O/D OFF FUNCTION

- Test drive the vehicle while turning the O/D function on and off.
- **Does the O/D function correctly?**

  YES : Go to Z2.

  NO : REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article or **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.

Z2 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND TCM SELF-TESTS

- Check for recorded TCM DTCs from the continuous and on-demand self-tests.
- **Are any TCM DTCs recorded?**

  YES : REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article or **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.

  NO : Go to Z3.

Z3 CARRY OUT THE INSTRUMENT CLUSTER (IC) INDICATOR LAMP CONTROL ACTIVE COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) Active Command
- Select the instrument cluster (IC) indicator lamp control active command ALL_LAMP. Command all the lamps on and off. Observe the O/D OFF indicator.
- **Does the O/D OFF indicator illuminate when commanded on, and turn off when commanded off?**

  YES : Go to Z4.

  NO : Go to Z5.

Z4 CHECK FOR CORRECT TCM OPERATION

- Disconnect all the TCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the TCM connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new TCM. REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article or **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Z5 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.

- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AA: DTC B1318 - Battery Voltage Low

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Instrument Cluster for schematic and connector information.

Normal Operation

The instrument cluster (IC) sets DTC B1318 in continuous memory and on-demand if the instrument cluster (IC) detects low battery voltage on the B+ keep alive voltage input, circuit SBP26 (YE/RD).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- High circuit resistance
- Instrument cluster (IC)

PINPOINT TEST AA: DTC B1318 - BATTERY VOLTAGE LOW

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

AA1 RECHECK THE INSTRUMENT CLUSTER (IC) DTCs

- Verify that the battery is fully charged. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Clear the DTCs. Repeat the instrument cluster (IC) self-test.
- **Is DTC B1318 still present?**

  YES : Go to AA2.

  NO : The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition.

AA2 CHECK THE INSTRUMENT CLUSTER (IC) VOLTAGE SUPPLY

- Key in OFF position.
- Disconnect: Instrument Cluster C220
- Key in ON position.

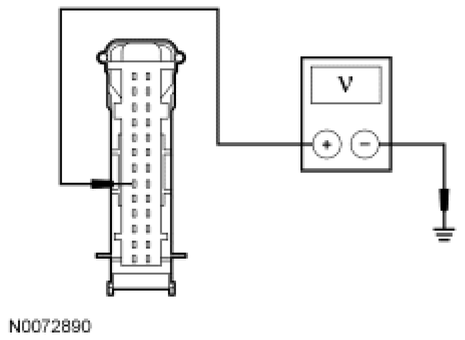


Fig. 40: Checking Instrument Cluster (IC) Voltage Supply
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC) C220-6, circuit CBP23 (BN/YE), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to AA3.

  NO : REPAIR the circuit for high resistance. CLEAR the DTC. REPEAT the self-test.

AA3 CHECK THE INSTRUMENT CLUSTER (IC) GROUND CIRCUITS

- Key in OFF position.

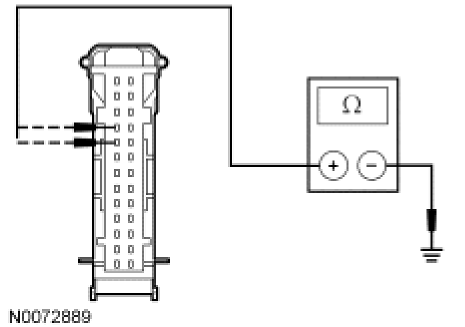


Fig. 41: Checking Instrument Cluster (IC) Ground Circuits
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-9, circuit GD116 (BK/VT), harness side and ground; and between the instrument cluster (IC) C220-10, circuit GD116 (BK/VT), harness side and ground.
- **Are the resistances less than 5 ohms?**

  YES : Go to AA4.

  NO : REPAIR the circuit for high resistance. TEST the system for normal operation.

AA4 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion

    - damaged pins
    - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AB: DTC B2844 - Ignition Fault

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Instrument Cluster for schematic and connector information.

Normal Operation

With the ignition switch in the START or RUN position, the instrument cluster (IC) receives voltage from the smart junction box (SJB) through circuit CBP20 (YE/VT). When the ignition switch is turned to the OFF or ACC position, the voltage drops to 0 volts on circuit CBP20 (YE/VT). The instrument cluster (IC) sets DTC B2844 in continuous memory if the instrument cluster (IC) detects voltage on circuit CBP20 (YE/VT) with the ignition switch in the ACC position or if no voltage is supplied by the key-in-ignition switch on circuit CDC30 (BU/GY) with the ignition in the START, RUN or ACC positions.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Ignition switch
- Instrument cluster (IC)

PINPOINT TEST AB: DTC B2844 - IGNITION FAULT

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

AB1 RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND INSTRUMENT CLUSTER (IC) SELF-TESTS

- Check for recorded instrument cluster (IC) DTCs from the continuous and on-demand self-tests.
- **Is DTC B1352 recorded?**

  YES : Go to **Pinpoint Test AI**.

  NO : Go to AB2.

AB2 CHECK CIRCUIT CBP20 (YE/VT) FOR VOLTAGE WITH THE IGNITION SWITCH IN THE ACC POSITION

- Key in OFF position.
- Disconnect: Instrument Cluster (IC) C220
- Key in ACCESSORY position.

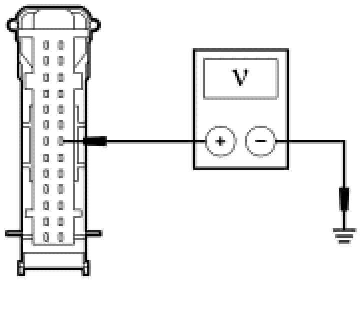


Fig. 42: Checking Circuit CBP20 (YE/VT) For Voltage With Ignition Switch In ACC Position
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC) C220-20, circuit CBP20 (YE/VT), harness side and ground.
- **Is the voltage greater than 10 volts with the ignition switch in the ACC position?**

  YES : REFER to **STEERING COLUMN SWITCHES** article. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to AB3.

AB3 CHECK CIRCUIT CBP20 (YE/VT) FOR VOLTAGE WITH THE IGNITION SWITCH IN THE RUN OR START POSITION

- Key in OFF position.
- Disconnect: PCM Power Relay
- Key in ON position.

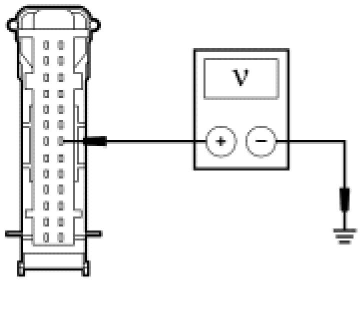


Fig. 43: Checking Circuit CBP20 (YE/VT) For Voltage With Ignition Switch In Run Or Start Position
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC) C220-20, circuit CBP20 (YE/VT), harness side and ground.

- Place the ignition switch in the START postion.

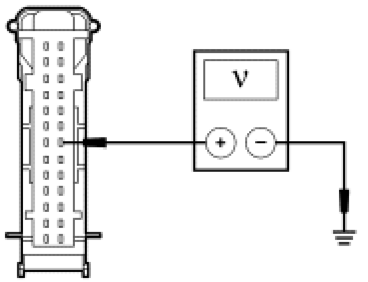


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Fig. 44: Measuring Voltage Between Instrument Cluster (IC) C220-20, Circuit CBP20 (YE/VT) (START Postion)
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC) C220-20, circuit CBP20 (YE/VT), harness side and ground.
- Key in OFF position.

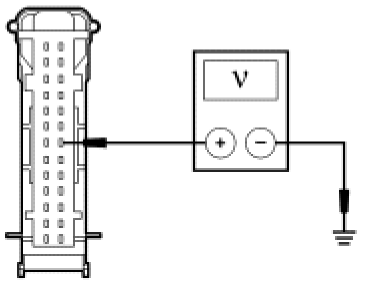

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Fig. 45: Measuring Voltage Between Instrument Cluster (IC) C220-20, Circuit CBP20 (YE/VT) (OFF Postion)
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC) C220-20, circuit CBP20 (YE/VT), harness side and ground.
- **Is the voltage greater than 10 volts with the ignition switch in the RUN and the START position, and does the voltage drop to 0 volts when the ignition switch is turned to the OFF position?**

  YES : Go to AB4.

  NO : REFER to **STEERING COLUMN SWITCHES** article to diagnose the ignition switch circuits.

AB4 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion

  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test AC: The Message Center Is Not Operating Correctly

Normal Operation

The message center displays information about total odometer, trip odometers and compass information after instrument cluster (IC) prove-out. With the ignition in the ON position, the message center displays important vehicle information through a constant monitoring of vehicle systems. Pressing the message center switch notifies the operator of potential vehicle conditions with a display of system warnings.

This pinpoint test is intended to diagnose the following:

- Message center switch concern
- Instrument cluster (IC)

PINPOINT TEST AC: THE MESSAGE CENTER IS NOT OPERATING CORRECTLY

AC1 CHECK THE MESSAGE CENTER DISPLAY OPERATION USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) display segment (SEGMENTS_2) active command. Command the display segments on. Observe the message center display.
- **Does the message center display illuminate all segments?**

  YES : The system is OK. If the SET, INFO or RESET buttons are inoperative, go to **Pinpoint Test AD**.

  NO : Go to AC2.

AC2 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.

- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AD: The Message Center Switch Does Not Operate Correctly

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Instrument Cluster for schematic and connector information.

Normal Operation

The message center switch is hardwired to the instrument cluster (IC) through circuits CMC29 (GN/VT) and RMC27 (WH/BN). To communicate the requested switch function, each message center switch button uses a different resistance value, allowing the instrument cluster (IC) to determine which switch is pressed.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Message center switch
- Instrument cluster (IC)

PINPOINT TEST AD: THE MESSAGE CENTER SWITCH DOES NOT OPERATE CORRECTLY

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

AD1 CHECK THE INSTRUMENT CLUSTER (IC) PID FOR THE MESSAGE CENTER SWITCH USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select and monitor the instrument cluster (IC) message center switch INFO (INFO), SETUP (SETUPSW) and RESET (RES_SW) PIDs while pressing each message center switch (INFO, SETUP, and RESET).
- **Do the PIDs agree with the switch position?**

  YES : Go to AD6.

  NO : Go to AD2.

AD2 CHECK CIRCUITS CMC29 (GN/VT) AND RMC27 (WH/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Instrument Cluster (IC) C220

- Disconnect: Message Center Switch C253
- Key in ON position.

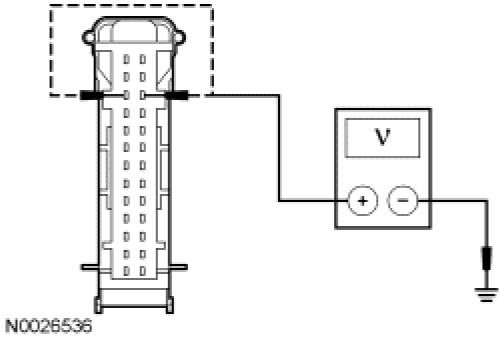

Fig. 46: Checking Circuits CMC29 (GN/VT) And RMC27 (WH/BN) For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC) C220-24, circuit CMC29 (GN/VT), harness side and ground; and between the instrument cluster (IC) C220-11, circuit RMC27 (WH/BN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. TEST the system for normal operation.

  NO : Go to AD3.

AD3 CHECK CIRCUIT CMC29 (GN/VT) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.

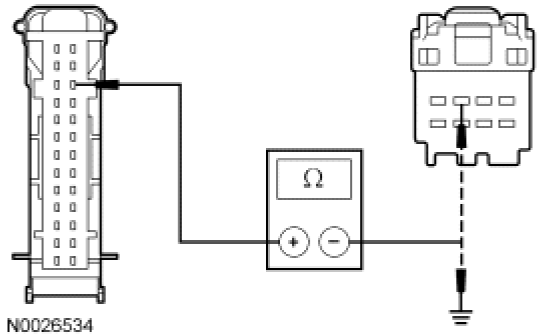

Fig. 47: Checking Circuit CMC29 (GN/VT) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-24, circuit CMC29 (GN/VT), harness side and the message center switch C253-3, circuit CMC29 (GN/VT), harness side; and between the instrument cluster (IC) C220-24, circuit CMC29 (GN/VT), harness side and ground.
- **Is the resistance less than 5 ohms between the instrument cluster (IC) and the message center switch, and greater than 10,000 ohms between the instrument cluster (IC) and ground?**

  YES : Go to AD4.

  NO : REPAIR the circuit. TEST the system for normal operation.

AD4 CHECK CIRCUIT RMC27 (WH/BN) FOR AN OPEN OR SHORT TO GROUND

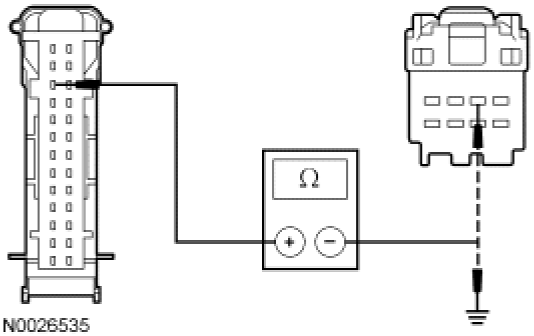

Fig. 48: Checking Circuit RMC27 (WH/BN) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-11, circuit RMC27 (WH/BN), harness side and the message center switch C253-2, circuit RMC27 (WH/BN), harness side; and between the instrument cluster (IC) C220-11, circuit RMC27 (WH/BN), harness side and ground.
- **Is the resistance less than 5 ohms between the instrument cluster (IC) and the message center switch, and greater than 10,000 ohms between the instrument cluster (IC) and ground?**

  YES : Go to AD5.

  NO : REPAIR the circuit. TEST the system for normal operation.

AD5 CHECK FOR VOLTAGE FROM THE INSTRUMENT CLUSTER (IC)

- Connect: Instrument Cluster (IC) C220
- Key in ON position.

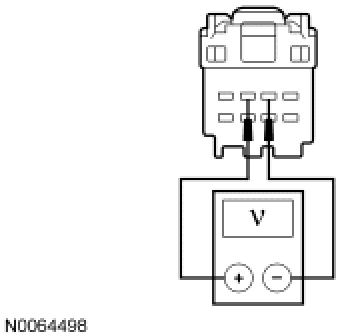

Fig. 49: Checking For Voltage From Instrument Cluster (IC)
Courtesy of FORD MOTOR CO.

- Measure the voltage between the message center switch C269-3, circuit CMC29 (GN/VT), harness side and the message center switch C269-2, circuit RMC27 (WH/BN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new message center switch. REFER to **Message Center Switch**. TEST the system for normal operation.

  NO : Go to AD6.

AD6 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AE: The Compass Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Instrument Cluster for schematic and connector information.

Normal Operation

The compass module (early build) receives voltage from the smart junction box (SJB) through circuit CBP19 (BN/WH) or the auto-dimming interior mirror (late build) receives voltage from the SJB through circuit CBP02 (GN). The compass module (early build) or the interior rear view mirror (late build) is grounded through circuit GD139 (BK/YE). The compass module (early build) or auto-dimming interior mirror (late build) communicates the vehicle direction to the instrument cluster (IC) through circuits VMC30 (BU/GY) and VMC31 (YE/GN) and the direction is displayed in the instrument cluster (IC).

- DTC U2013 (Compass Module is Not Responding) - is a continuous DTC that sets if the instrument cluster (IC) does not receive compass data on circuits VMC30 (BU/GY) and VMC31 (YE/GN).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Compass module (early build)
- Auto-dimming interior mirror (late build)

PINPOINT TEST AE: THE COMPASS IS INOPERATIVE

NOTE:	**Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

AE1 CHECK CIRCUIT CBP19 (BN/WH) (EARLY BUILD) OR CBP02 (GN) (LATE BUILD) FOR BATTERY VOLTAGE

- Key in OFF position.
- Disconnect: Compass Module (Early Build) C909
- Disconnect: Auto-Dimming Interior Mirror (Late Build) C911 or C9030
- Key in ON position.
- Measure the voltage between the compass module (early build) or auto-dimming interior mirror (late build), harness side and ground as follows:

Component	Connector-Pin	Circuit
Early Build		
Compass module	C909-3	CBP19 (BN/WH)
Late Build		
Auto-dimming interior mirror (without microphone)	C911-1	CBP02 (GN)
Auto-dimming interior mirror (with microphone)	C9030-1	CBP02 (GN)

- **Is the voltage greater than 10 volts?**

  YES : Go to AE2.

  NO : VERIFY the SJB fuse 28 (10A) (early build) or 12 (7.5A) (late build) is OK. If OK, REPAIR the circuit for an open. CLEAR the DTCs. REPEAT the self-test.

AE2 CHECK CIRCUIT GD139 (BK/YE) FOR AN OPEN

- Key in OFF position.
- Measure the resistance between the compass module (early build) or the auto-dimming interior mirror (late build), harness side and ground as follows:

Component	Connector-Pin	Circuit
Early Build		
Compass module	C909-4	GD139 (BK/YE)
Late Build		
Auto-dimming interior mirror (without microphone)	C911-3	GD139 (BK/YE)
Auto-dimming interior mirror (with microphone)	C9030-10	GD139 (BK/YE)

- **Is the resistance less than 5 ohms?**

  YES : Go to AE3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

AE3 CHECK CIRCUIT VMC30 (BU/GY) FOR AN OPEN OR SHORT TO GROUND

- Disconnect: Instrument Cluster (IC) C220

- Measure the resistance between the compass module (early build) or the interior rear view mirror (late build), harness side and the instrument cluster (IC), harness side; and between the compass module (early build) or the interior rear view mirror (late build), harness side and ground.

Component	Connector-Pin	Instrument Cluster Connector-Pin	Circuit
Early Build			
Compass module	C909-2	C220-17	VMC30 (BU/GY)
Late Build			
Auto-dimming interior mirror (without microphone)	C911-7	C220-17	VMC30 (BU/GY)
Auto-dimming interior mirror (with microphone)	C9030-2	C220-17	VMC30 (BU/GY)

- **Is the resistance less than 5 ohms between the compass module (early build) or the auto-dimming interior mirror (late build) and the instrument cluster (IC), and greater than 10,000 ohms between the compass module (early build) or the auto-dimming interior mirror (late build) and ground?**

  YES : Go to AE4.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

AE4 CHECK CIRCUIT VMC31 (YE/GN) FOR AN OPEN OR SHORT TO GROUND

- Measure the resistance between the compass module (early build) or the interior rear view mirror (late build), harness side and the instrument cluster (IC), harness side; and between the compass module (early build) or the interior rear view mirror (late build), harness side and ground.

Component	Connector-Pin	Instrument Cluster Connector-Pin	Circuit
Early Build			
Compass module	C909-1	C220-16	VMC31 (YE/GN)
Late Build			
Auto-dimming interior mirror (without microphone)	C911-6	C220-16	VMC31 (YE/GN)
Auto-dimming interior mirror (with microphone)	C9030-6	C220-16	VMC31 (YE/GN)

- **Is the resistance less than 5 ohms between the compass module (early build) or the interior rear view mirror (late build) and the instrument cluster (IC), and greater than 10,000 ohms between the compass module (early build) or the interior rear view mirror (late build) and ground?**

  YES : On early build vehicles, INSTALL a new compass module.

  On late build vehicles, INSTALL a new auto-dimming interior mirror. REFER to **REAR VIEW**

MIRRORS article.

SET the zone. REFER to **Compass Zone Adjustment**. CALIBRATE the compass. REFER to **Compass Calibration**. CLEAR the DTCs. REPEAT the self-test.

If the compass is still inoperative, go to AE5.

NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

AE5 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AF: The Compass Is Inaccurate

Normal Operation

The compass sensor module (early build) or the auto-dimming interior mirror (late build) communicates the vehicle direction to the instrument cluster (IC) through the compass communication data plus circuit VMC31 (YE/GN) and compass communication data minus circuit VMC30 (BU/GY). The magnetic fields generated by the earths north and south poles are divided into zones that differ from each other with respect to how the magnetic fields appear. The magnetic north can change by up to 4 degrees between zones and become noticeable across multiple zones. The compass zone must be set to the correct zone for the compass to read accurately. Factors within the vehicle may affect the ability of the compass module to accurately read the magnetic north. Calibrating the compass allows the compass module to compensate for vehicle factors that influence the accuracy of the compass.

This pinpoint test is intended to diagnose the following:

- Vehicle magnetization
- Zone setting
- Calibration
- Compass module (early build)
- Auto-dimming interior mirror (late build)

PINPOINT TEST AF: THE COMPASS IS INACCURATE

AF1 CHECK THE COMPASS ZONE SETTING AND CALIBRATION

- Set the zone. Refer to **Compass Zone Adjustment**.
- Calibrate the compass. Refer to **Compass Calibration**.
- **Does the compass calibrate correctly?**

  YES : Go to AF3.

  NO : Go to AF2.

AF2 DEMAGNETIZE THE VEHICLE

- Demagnetize the vehicle. Refer to **Vehicle Demagnetizing**.
- **Does the compass operate correctly?**

  YES : Go to AF3.

  NO : On early build vehicles, INSTALL a new compass module. On late build vehicles, INSTALL a new auto-dimming interior mirror. REFER to **REAR VIEW MIRRORS** article. SET the zone. REFER to **Compass Zone Adjustment**. CALIBRATE the compass. REFER to **Compass Calibration**. TEST the system for normal operation.

AF3 CHECK COMPASS ACCURACY

- Position the vehicle and observe the compass display as follows:

Vehicle Direction	Compass Display
North	N
Northeast	NE
East	E
Southeast	SE
South	S
Southwest	SW
West	W
Northwest	NW

- **Does the compass display as indicated?**

  YES : The compass is OK.

  NO : On early build vehicles, INSTALL a new compass module. On late build vehicles, INSTALL a new auto-dimming interior mirror. REFER to **REAR VIEW MIRRORS** article. SET the zone. REFER to **Compass Zone Adjustment**. CALIBRATE the compass. REFER to **Compass Calibration**. TEST the system for normal operation.

Pinpoint Test AG: The DRIVER DOOR, PASSENGER DOOR, REAR LEFT DOOR, REAR RIGHT DOOR or TRUNK AJAR Warning Message Is Inoperative

Normal Operation

The DRIVER DOOR, PASSENGER DOOR, REAR LEFT DOOR, REAR RIGHT DOOR or TRUNK AJAR

warning informs the driver if any of the vehicle doors are not completely closed. The information is sent from the smart junction box (SJB) to the instrument cluster (IC) over the communication network.

This pinpoint test is intended to diagnose the following:

- SJB
- Instrument cluster (IC)

PINPOINT TEST AG: THE DRIVER DOOR, PASSENGER DOOR, REAR LEFT DOOR, REAR RIGHT DOOR OR TRUNK AJAR WARNING MESSAGE IS INOPERATIVE

AG1 CHECK THE OPERATION OF THE INTERIOR LAMPS

- Open and close each door and the luggage compartment lid while monitoring the interior lamps.
- **Do the interior lamps operate correctly?**

  YES : Go to AG2.

  NO : REFER to **INTERIOR LIGHTING** article.

AG2 RETRIEVE THE RECORDED DTCs FROM THE CONTINUOUS INSTRUMENT CLUSTER (IC) SELF-TEST

- Check for recorded instrument cluster (IC) DTCs from the continuous self-test.
- **Is DTC U1901 recorded?**

  YES : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose communication with the SJB.

  NO : Go to AG3.

AG3 CARRY OUT THE INSTRUMENT CLUSTER (IC) DISPLAY SEGMENT COMMAND USING THE SCAN TOOL

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) display segment (SEGMENTS_2) active command. Command the display segments on.
- **Do the instrument cluster (IC) display segments illuminate?**

  YES : Go to AG4.

  NO : Go to AG5.

AG4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

AG5 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AH: The LOW FUEL LEVEL Warning Message Is Inoperative

Normal Operation

The LOW FUEL LEVEL warning is displayed when the fuel level reaches a predetermined level of approximately 1/8 tank. The LOW FUEL LEVEL warning display and the fuel gauge are controlled by the instrument cluster (IC) based upon the distance until empty (DTE) calculated internally by the instrument cluster (IC) from data received from the PCM and fuel gauge. When the instrument cluster (IC) receives the data, the fuel gauge indicates low fuel and the instrument cluster (IC) displays LOW FUEL LEVEL.

This pinpoint test is intended to diagnose the following:

- Fuel gauge
- Instrument cluster (IC)

PINPOINT TEST AH: THE LOW FUEL LEVEL WARNING MESSAGE IS INOPERATIVE

AH1 CHECK THE FUEL GAUGE OPERATION

- Key in ON position.
- Access and observe the message center distance to empty (DTE) displayed mileage.
- **Does the DTE display indicate 80 km (50 miles) or less until empty?**

  YES : Go to AH2.

  NO : The system is operating correctly at this time. The low fuel warning message does not appear until the DTE is 80 km (50 miles) or less.

AH2 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AI: The Key-In-Ignition Warning Chime Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Instrument Cluster for schematic and connector information.

Normal Operation

When the key is inserted into the ignition cylinder, the key-in-ignition warning switch (part of the ignition switch) closes providing voltage on circuit CDC30 (BU/GY) to the instrument cluster (IC). The voltage input signals the instrument cluster (IC) that the key is inserted. Door ajar status is communicated to the instrument cluster (IC) from the smart junction box (SJB) through the controller area network (CAN). If the instrument cluster (IC) detects that the ignition lock cylinder is in the OFF or ACC position, the key is inserted in the ignition cylinder, and the SJB communicates to the instrument cluster (IC) that the driver door is ajar, the key-in-ignition warning chime sounds.

- DTC B1352 (Ignition Key-In Circuit Failure) - is a continuous DTC that sets in the instrument cluster (IC) if the instrument cluster (IC) does not sense voltage applied on circuit CDC30 (BU/GY) with voltage applied to circuit CBP23 (BN/YE) or CBP20 (YE/VT).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Key-in-ignition warning switch (part of the ignition switch)
- Instrument cluster (IC)

PINPOINT TEST AI: THE KEY-IN-IGNITION WARNING CHIME IS INOPERATIVE

NOTE:	**Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

AI1 CHECK THE RECORDED INSTRUMENT CLUSTER (IC) DTCs FROM BOTH THE

CONTINUOUS AND ON-DEMAND SELF-TESTS

- Check the recorded instrument cluster (IC) DTCs from the continuous and on-demand self-tests.
- **Is DTC B1352 recorded?**

  YES : Go to AI4.

  NO : Go to AI2.

AI2 CARRY OUT THE INSTRUMENT CLUSTER (IC) WARNING LAMPS AND CHIME ACTIVE COMMAND

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Instrument Cluster (IC) DataLogger
- Select the instrument cluster (IC) chime (CHIME) active command. Command the chime on.
- **Does the chime sound?**

  YES : Go to AI3.

  NO : Go to AI6.

AI3 CHECK THE DOOR AJAR INDICATOR

- Make sure all the doors are closed.
- While observing the message center (if equipped) or the door ajar warning indicator, open the driver door.
- **Is the DRIVER DOOR AJAR message displayed on the message center (if equipped) or the door ajar warning indicator illuminated with the driver door open?**

  YES : Go to AI5.

  NO : If not equipped with a message center, go to **Pinpoint Test O**.

  If equipped with a message center, go to **Pinpoint Test AG**.

AI4 CHECK CIRCUIT CDC30 (BU/GY) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Instrument Cluster (IC) C220
- Insert the key in to the lock cylinder.
- Measure the voltage between the instrument cluster (IC) C220-7, circuit CDC30 (BU/GY), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to AI6.

  NO : Go to AI5.

AI5 CHECK CIRCUIT CDC30 (BU/GY) FOR AN OPEN OR SHORT TO GROUND

- Disconnect: Ignition Switch C250

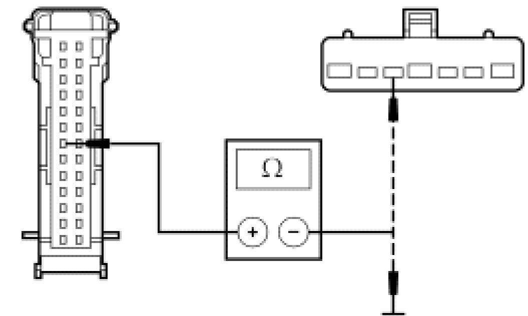

Fig. 50: Checking Circuit CDC30 (BU/GY) For Open Or Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the instrument cluster (IC) C220-7, circuit CDC30 (BU/GY), harness side and the ignition switch C250-5, circuit CDC30 (BU/GY), harness side; and between the instrument cluster (IC) C220-7, circuit CDC30 (BU/GY), harness side and ground.
- **Is the resistance less than 5 ohms between the instrument cluster (IC) and the ignition switch, and greater than 10,000 ohms between the instrument cluster (IC) and ground?**

  YES : INSTALL a new ignition switch. REFER to **STEERING COLUMN SWITCHES** article. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

AI6 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AJ: The Headlamps On Warning Chime Is Inoperative

Normal Operation

The headlamps on warning chime sounds when the driver door is opened with the ignition lock cylinder in the OFF position, the key not in the ignition lock cylinder, and the headlamp switch in the PARK or HEADLAMP positions. The smart junction box (SJB) provides the headlamps on status and the driver door ajar status to the instrument cluster (IC) over the medium speed controller area network (MS-CAN) communication bus. The autolamps feature must not be selected for the headlamps on warning chime to operate.

This pinpoint test is intended to diagnose the following:

- Instrument cluster (IC)

PINPOINT TEST AJ: THE HEADLAMPS ON WARNING CHIME IS INOPERATIVE

AJ1 CHECK THE EXTERIOR LAMPS

- Turn the headlamp switch to the PARKING LAMP position.
- **Do the parking lamps illuminate with the headlamp switch in the PARKING LAMP position?**

  YES : Go to AJ2.

  NO : REFER to **EXTERIOR LIGHTING** article to continue diagnosis of the exterior lamps.

AJ2 CHECK THE DOOR AJAR INDICATOR

- Key in OFF position.
- Make sure all the doors are closed.
- Key in ON position.
- While observing the message center (if equipped) or the door ajar warning indicator, open the driver door.
- **Is the DRIVER DOOR AJAR message displayed on the message center (if equipped) or the door ajar warning indicator illuminated with the driver door open?**

  YES : Go to AJ3.

  NO : If not equipped with a message center, go to **Pinpoint Test O**.

  If equipped with a message center, go to **Pinpoint Test AG**.

AJ3 CHECK THE INSTRUMENT CLUSTER (IC) ILLUMINATION FOR CORRECT OPERATION

- Turn the headlamp switch to the PARKING LAMP position.
- **Does the instrument cluster (IC) illumination operate correctly?**

  YES : Go to AJ4.

  NO : REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article.

AJ4 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AK: The Turn Signal Left On Reminder Chime Is Inoperative

Normal Operation

The turn signal left on reminder chime sounds when the vehicle travels more than 3.2 km (2.0 miles) with the turn signal on. The smart junction box (SJB) communicates the turn signal switch status to the instrument cluster (IC) over the controller area network (CAN). The PCM communicates the odometer count data to the instrument cluster (IC) over the CAN.

This pinpoint test is intended to diagnose the following:

- Instrument cluster (IC)

PINPOINT TEST AK: THE TURN SIGNAL LEFT ON WARNING CHIME IS INOPERATIVE

AK1 CHECK THE TURN SIGNAL INDICATORS OPERATION

- Key in ON position.
- Verify the turn signal indicators operation.
- **Do the turn signal indicators operate correctly?**

  YES : Go to AK2.

  NO : Go to **Pinpoint Test Q**.

AK2 CHECK THE ODOMETER FOR CORRECT OPERATION

- Drive the vehicle and observe the odometer for correct operation.
- **Does the odometer operate correctly?**

  YES : Go to AK3.

  NO : Go to **Pinpoint Test F**.

AK3 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AL: The Chime Sounds When The Driver Door Is Ajar (No Key In Ignition And Headlamps Off)

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Instrument Cluster for schematic and connector information.

Normal Operation

When the key is inserted into the ignition lock cylinder, the key-in-ignition warning switch (part of the ignition switch) closes providing voltage on circuit CDC30 (BU/GY) to the instrument cluster (IC). The voltage input signals the instrument cluster (IC) that the key is inserted. Door ajar status is communicated to the instrument cluster (IC) from the smart junction box (SJB) through the controller area network (CAN). If the instrument cluster (IC) detects that the ignition lock cylinder is in the OFF or ACC position, the key is inserted in the ignition lock cylinder, and the SJB communicates to the instrument cluster (IC) that the driver door is ajar, the key-in-ignition warning chime sounds. The SJB communicates to the instrument cluster (IC) that the exterior lamps are on and the driver door is opened. The headlamps on warning chime sounds when the driver door is opened with the ignition lock cylinder in the OFF position, the key not in the ignition lock cylinder, and the multifunction switch in the PARKING LAMP or HEADLAMP positions.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Key-in-ignition warning switch (part of the ignition switch)
- Instrument cluster (IC)

PINPOINT TEST AL: THE CHIME SOUNDS WHEN THE DRIVER DOOR IS AJAR (NO KEY IN IGNITION AND HEADLAMPS OFF)

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

AL1 CHECK THE EXTERIOR LAMPS

- Verify the exterior lamps operate correctly.
- **Do the exterior lamps operate correctly?**

  YES : Go to AL2.

  NO : REFER to **EXTERIOR LIGHTING** article.

AL2 CHECK THE IGNITION SWITCH

- Key in OFF position.
- Remove the key from the ignition lock cylinder.
- Disconnect: Instrument Cluster (IC) C220

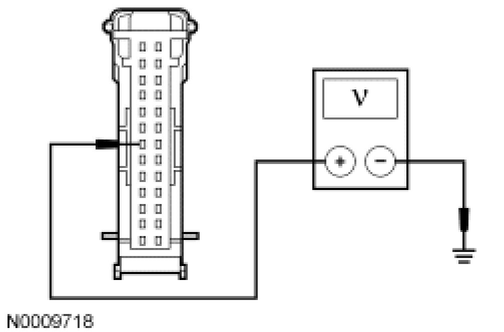

Fig. 51: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC) C220-7, circuit CDC30 (BU/GY), harness side and ground.
- **Is any voltage present?**

  YES : Go to AL3.

  NO : Go to AL4.

AL3 CHECK CIRCUIT CDC30 (BU/GY) FOR A SHORT TO VOLTAGE

- Disconnect: Ignition Switch C250

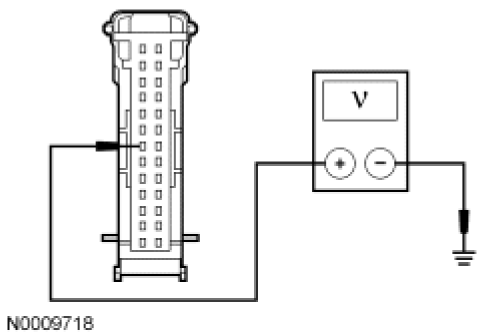

Fig. 52: Checking Circuit CDC30 (BU/GY) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the instrument cluster (IC) C220-7, circuit CDC30 (BU/GY), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : INSTALL a new ignition switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

AL4 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins

    - pushed-out pins
  - Connect the instrument cluster (IC) connector and make sure it seats correctly.
  - Operate the system and verify the concern is still present.
  - **Is the concern still present?**

    YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

    NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test AM: The Safety Belt Warning Chime Does Not Operate Correctly/The Belt-Minder® Feature Does Not Operate Correctly

Normal Operation

The instrument cluster (IC) receives the safety belt and Belt-Minder® requests from the restraints control module (RCM) over the high speed controller area network (HS-CAN). The safety belt warning chime sounds for approximately 6 seconds when the driver safety belt is not fastened and the ignition lock cylinder is turned from the OFF/LOCK or ACC to the ON or START position.

The Belt-Minder® feature supplements the safety belt warning function and is enabled after the safety belt warning is complete. The Belt-Minder® reminds the driver that the driver or passenger safety belt is unbuckled by intermittently sounding a chime and illuminating the safety belt warning lamp in the instrument cluster (IC) once the vehicle speed has exceeded 5 km/h (3 mph), and remains active for 5 minutes from the time it is started. While activated, the Belt-Minder® alternates the chime and indicator from on for 6 seconds to off for 30 seconds.

NOTE: Make sure that the safety belt/Belt-Minder® chime operation is verified with the vehicle moving at least 5 km/h (3 mph).

This pinpoint test is intended to diagnose the following:

- Safety belt warning indication concern
- Belt-Minder® deactivated
- Speedometer concern
- Instrument cluster (IC)

PINPOINT TEST AM: THE SAFETY BELT WARNING CHIME IS INOPERATIVE/THE BELT-MINDER® FEATURE DOES NOT OPERATE CORRECTLY

AM1 CHECK THE KEY-IN-IGNITION WARNING CHIME OPERATION

  - Key in OFF position.
  - With the ignition switch in the OFF position and the key in the ignition lock cylinder, open the LH front door and observe the key-in-ignition warning chime operation.
  - **Does the key-in-ignition warning chime operate correctly?**

    YES : Go to AM2.

NO : Go to AM6.

AM2 CHECK THE SAFETY BELT WARNING INDICATOR FOR CORRECT OPERATION

- Key in ON position.
- Buckle then unbuckle the LH front safety belt.
- Verify the safety belt warning indicator illuminates with the safety belt unbuckled and turns off when buckled.
- **Does the safety belt warning indicator operate correctly?**

  YES : Go to AM3.

  NO : Go to **Pinpoint Test L**.

AM3 CHECK THE SPEEDOMETER OPERATION

- Drive the vehicle and verify that the speedometer is operating correctly.
- **Does the speedometer operate correctly?**

  YES : Go to AM4.

  NO : Go to **Pinpoint Test F**.

AM4 CHECK THE BELT-MINDER® CONFIGURATION

- Verify that the Belt-Minder® is activated or configured on for the seating position in question. Refer to **Belt-Minder® Deactivating/Activating** to configure without a scan tool.
- **Is the Belt-Minder® activated for the seating position in question?**

  YES : Go to AM5.

  NO : ACTIVATE the Belt-Minder® for the seating position in question. REFER to **Belt-Minder® Deactivating/Activating**. TEST the system for normal operation.

AM5 CHECK FOR CORRECT RCM OPERATION

- Disconnect all the RCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the RCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new RCM. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

AM6 CHECK FOR CORRECT INSTRUMENT CLUSTER (IC) OPERATION

- Disconnect the instrument cluster (IC) connector.
- Check for:
  - corrosion
  - damaged pins

    - pushed-out pins
- Connect the instrument cluster (IC) connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster (IC). REFER to **Instrument Cluster (IC)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

GENERAL PROCEDURES

VEHICLE DEMAGNETIZING

NOTE:	During demagnetizing, the demagnetizer coil is pulled towards the vehicle. Place a cloth over the vehicle roof to protect the vehicle surface if contact occurs. Make sure the cloth covers the front third and the entire width of the roof.

NOTE:	The demagnetizing process requires the use of a demagnetizing coil commonly used by television repair technicians to demagnetize television tubes.

NOTE:	To demagnetize, use a constant circular motion over the vehicle roof. Do not turn off the demagnetizer while sweeping the vehicle roof to prevent remagnetizing ferrous materials contained in the vehicle.

NOTE:	During the demagnetizing process, make sure the phenolic surface of the tool (the side opposite the handle) is closest to the vehicle surface.

1. Demagnetize the front third of the vehicle roof.
    1. Turn on the demagnetizer at least 1 m (3 ft) away from the vehicle.
    2. Holding the demagnetizer no more than 2.5 cm (1 in) from the vehicle roof and starting on the passenger side, demagnetize the front third of the vehicle roof closest to the windshield using a constant circular motion. Keep the circle radius within 30 cm (12 in) while sweeping across the entire surface of the vehicle roof closest to the windshield. Continue the circular motion 4 times.
    3. After the fourth pass and without stopping, move the demagnetizer at least 1 m (3 ft) away from the vehicle.
    4. Turn the demagnetizer off.
2. Carry out the Compass Zone Adjustment procedure. For additional information, refer to **Compass Zone Adjustment**.
3. Carry out the Compass Calibration Adjustment procedure. For additional information, refer to **Compass Calibration**.

COMPASS ZONE ADJUSTMENT

1. Turn the ignition switch to the ON position.
2. Start the engine.

NOTE: The top of the message center must be blank. Do not select Trip, DTE, or AFE.

3. Press the message center switch INFO button repeatedly until the compass and the odometer are displayed in the message center.
4. Determine which magnetic zone you are in for your geographic location.

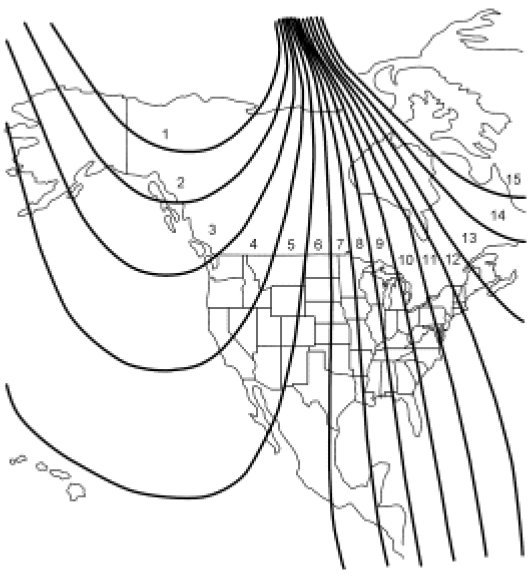

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Fig. 53: Compass Calibration Zone Map
Courtesy of FORD MOTOR CO.

5. Press and hold the RESET button until RESET FOR ZONE is displayed in the message center.
6. Release the RESET button and slowly press the RESET button down again.
7. Press the SETUP button repeatedly until the correct zone setting for your geographic location is displayed.
8. Press and release the RESET button to exit the zone setting mode and lock your individual zone.

COMPASS CALIBRATION

NOTE: For optimum calibration, drive to an open, level location away from large metallic objects or structures. Switch off all non-essential electrical accessories (rear window defrost, heater, A/C, map lamps, wipers, etc.)

and make sure all doors are closed.

1. Start the vehicle.
2. Press the RESET button until RESET FOR CAL/INFO TO EXIT is displayed in the message center display.

NOTE: This will take up to 3 circles to complete calibration.

3. Slowly drive the vehicle in a circle at no more than 5 km/h (3 mph) until SLOW CIRCLES TO CALIBRATE changes to CALIBRATION COMPLETED in the message center.
4. The compass is now calibrated.

BELT-MINDER® DEACTIVATING/ACTIVATING

Preparation

NOTE: The Belt-Minder® deactivating/activating can also be carried out using the scan tool.

1. Apply the parking brake before deactivating/activating the safety Belt-Minder®.
2. Place the gear selector lever in PARK (P) (automatic transaxle) or NEUTRAL (N) (manual transaxle).
3. Place the ignition switch in the OFF position.
4. Close all the vehicle doors.
5. Unbuckle the driver and the front passenger safety belts.

Deactivating/Activating

NOTE: The driver and front passenger Belt-Minder® are deactivated/activated independently.

1. Turn the ignition lock cylinder to the ON position (do not start the engine).
2. Wait until the safety belt warning lamp turns off (approximately 1 minute).

NOTE: Step 3 must be completed within 50 seconds after the safety belt warning indicator turns off.

3. For the seating position being disabled, at a moderate speed, buckle then unbuckle the safety belt 9 times, ending with the safety belt in the unbuckled state. After this step the safety belt warning indicator illuminates for 3 seconds.
4. Within 10 seconds of the safety belt warning indicator turning on, at a moderate speed, buckle then unbuckle the safety belt.
    - This disables the safety Belt-Minder® feature for that seating position, if it is currently enabled. As confirmation, the safety belt warning indicator flashes 4 times per second for 3 seconds.

- This enables the safety Belt-Minder® feature for that seating position, if it is currently disabled. As confirmation, the safety belt warning indicator flashes 4 times per second for 3 seconds, followed by 3 seconds with the indicator off, then the safety belt warning indicator flashes 4 times per second for 3 seconds again.

5. After confirmation, the deactivation/activation procedure is complete.

REMOVAL AND INSTALLATION

INSTRUMENT CLUSTER (IC)

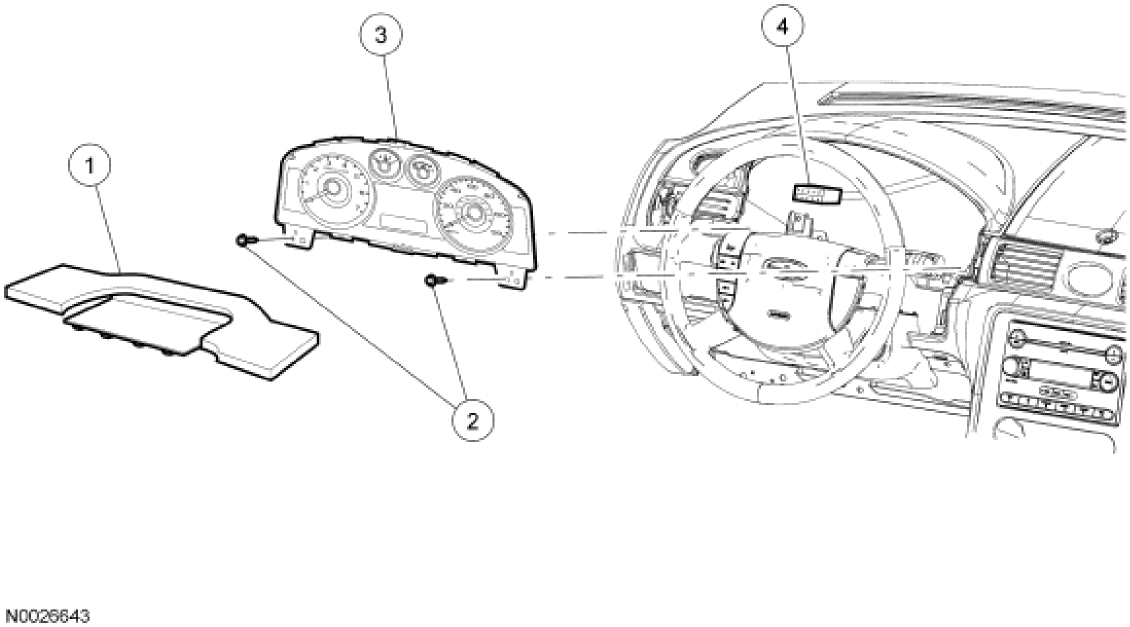


Fig. 54: Exploded View Of Instrument Cluster (IC) - Fusion, Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	54044D70	Instrument cluster (IC) finish panel
2	W705314	Instrument cluster (IC) screws (2 required)
3	10849	Instrument cluster (IC)
4	-	Instrument cluster (IC) electrical connector (part of 14401)

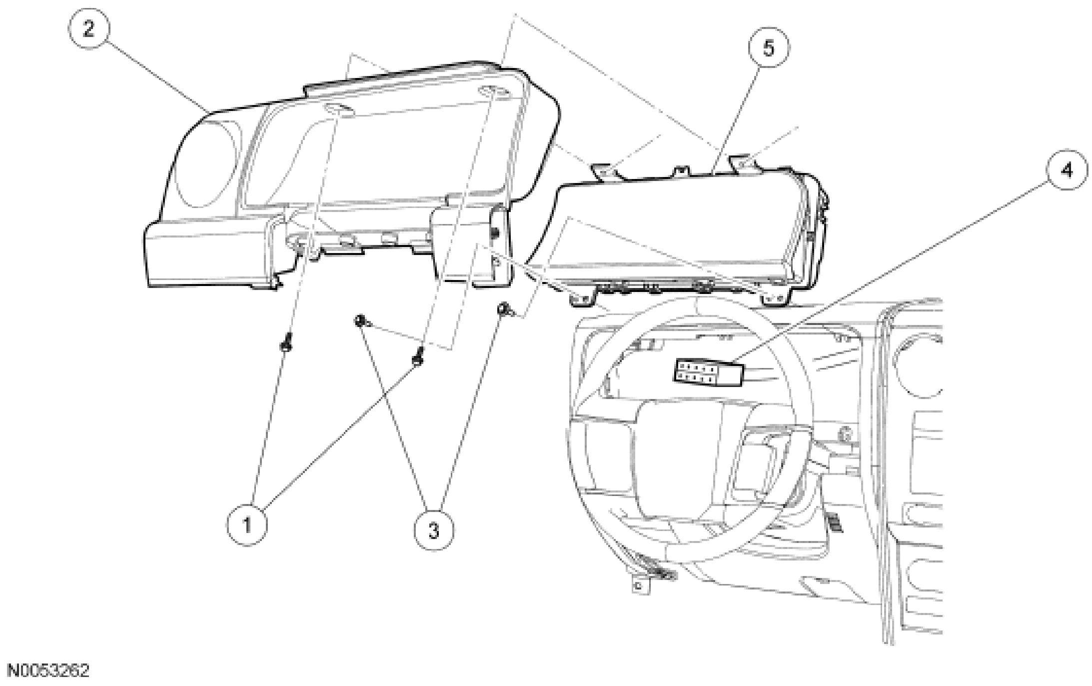


Fig. 55: Exploded View Of Instrument Cluster (IC) - MKZ
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W70534	Instrument cluster (IC) finish panel screws (2 required)
2	54044D70	Instrument cluster (IC) finish panel
3	W705314	Instrument cluster (IC) screws (2 required)
4	-	Instrument cluster (IC) electrical connector (part of 14401)
5	10849	Instrument cluster (IC)

REMOVAL

All vehicles

1. If installing a new instrument cluster (IC), upload the module configuration to the scan tool. For additional information, refer to **MODULE CONFIGURATION** article, programmable module installation (PMI).
2. Tilt the steering column to the lowest position.

   MKZ

3. Remove the 2 instrument cluster (IC) finish panel screws and the instrument cluster (IC) finish panel.
4. Remove the 2 screws and the instrument cluster (IC).

- Disconnect the electrical connector.

Fusion, Milan

NOTE: **The instrument cluster (IC) finish panel is held in place by spring clips located on the finish panel.**

5. Remove the instrument cluster (IC) finish panel.

NOTE: **The top of the instrument cluster (IC) is a snap fit to the instrument panel. To ease removal of the instrument cluster (IC) insert a suitable tool between the instrument panel and the top of the instrument cluster (IC) and use a slight outward movement until the top of the instrument cluster (IC) is released. The instrument cluster (IC) can now be rotated outwards.**

6. Remove the 2 screws and the instrument cluster (IC).
   - Disconnect the electrical connector.

INSTALLATION

MKZ

1. Position the instrument cluster (IC) in the instrument panel.
   - Connect the electrical connector.
   - Install the 2 screws.
2. Position the instrument cluster (IC) finish panel and install the 2 screws.

Fusion, Milan

NOTE: **Position the bottom portion of the instrument cluster (IC) on the instrument panel locator pins first then rotate the top of the instrument cluster (IC) into position.**

3. Position the instrument cluster (IC) in the instrument panel.
   - Connect the electrical connector.
   - Install the 2 screws.
4. Install the instrument cluster (IC) finish panel.

All vehicles

5. If a new instrument cluster (IC) was installed, download the instrument cluster (IC) configuration information from the scan tool into the new instrument cluster (IC). For additional information, refer to **MODULE CONFIGURATION** article, PMI.

NOTE: If a new instrument cluster (IC) is installed, updated, or re-configured, the instrument cluster and the powertrain control module (PCM) require a parameter reset to allow the instrument cluster (IC) and the PCM to recognize each other. Failure to carry out the parameter reset to the instrument cluster (IC) and the PCM may result in a no start condition.

6. If a new instrument cluster (IC) was installed, updated or reconfigured, carry out the parameter reset procedure. For additional information, refer to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

NOTE: The vehicles integrated keys (or standard passive anti-theft system [PATS] keys) must be programmed to the new instrument cluster.

7. If a new instrument cluster (IC) was installed, program the integrated keys. For additional information, refer to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

INSTRUMENT CLUSTER (IC) LENS

REMOVAL AND INSTALLATION

1. Remove the instrument cluster (IC). For additional information, refer to **Instrument Cluster (IC)**.
2. Remove the screw.

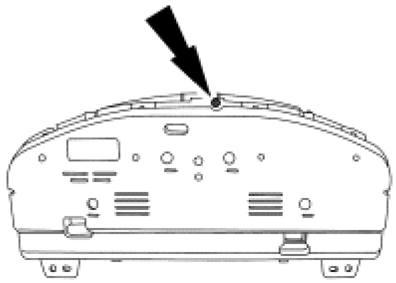


Fig. 56: Locating Instrument Cluster Lens Screw
Courtesy of FORD MOTOR CO.

3. Release the 8 tabs and remove the lens.

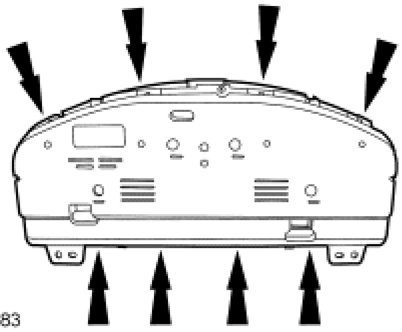


Fig. 57: Locating Instrument Cluster Lens Tabs
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

MESSAGE CENTER SWITCH

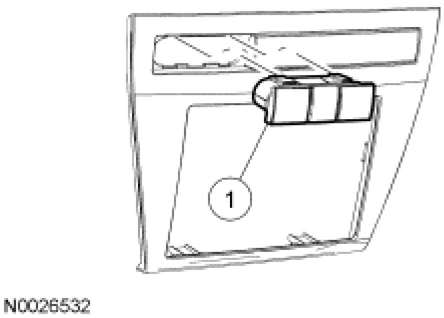


Fig. 58: Exploded View Of Message Center Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	10D889	Message center switch

REMOVAL AND INSTALLATION

1. Remove the instrument panel center finish panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Press the retaining tabs and remove the message center switch.

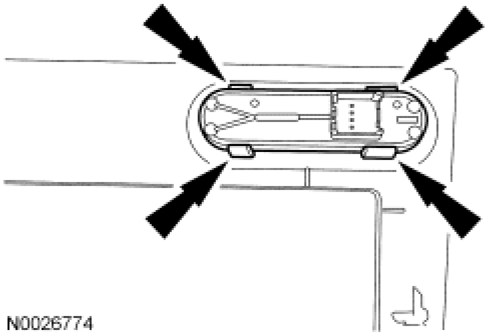


Fig. 59: Locating Message Center Switch Retaining Tabs
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Instrument Panel & Console - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Glove compartment dampener screw	2	-	18
Hood release handle bolts	3	-	27
Instrument cluster opening bolts	23	17	-
Instrument cluster screw	2	-	18
Instrument panel center brace bolts	20	-	177
Instrument panel lower bolts	8	-	71
Instrument panel side bolts	23	17	-
Lower center instrument panel finish panel screw	3	-	27
RH applique screw	2	-	18
Steering column pinch bolt	25	18	-
Steering column shaft-to-steering column bolt	25	18	-
Upper center instrument panel finish panel lower screw	9	-	80
Upper center instrument panel finish panel upper screw	9	-	80
Upper storage bin screw	3	-	27
Wire harness screw	3	-	27

REMOVAL AND INSTALLATION

INSTRUMENT PANEL - EXPLODED VIEW

NOTE: **Fusion shown, Milan similar.**

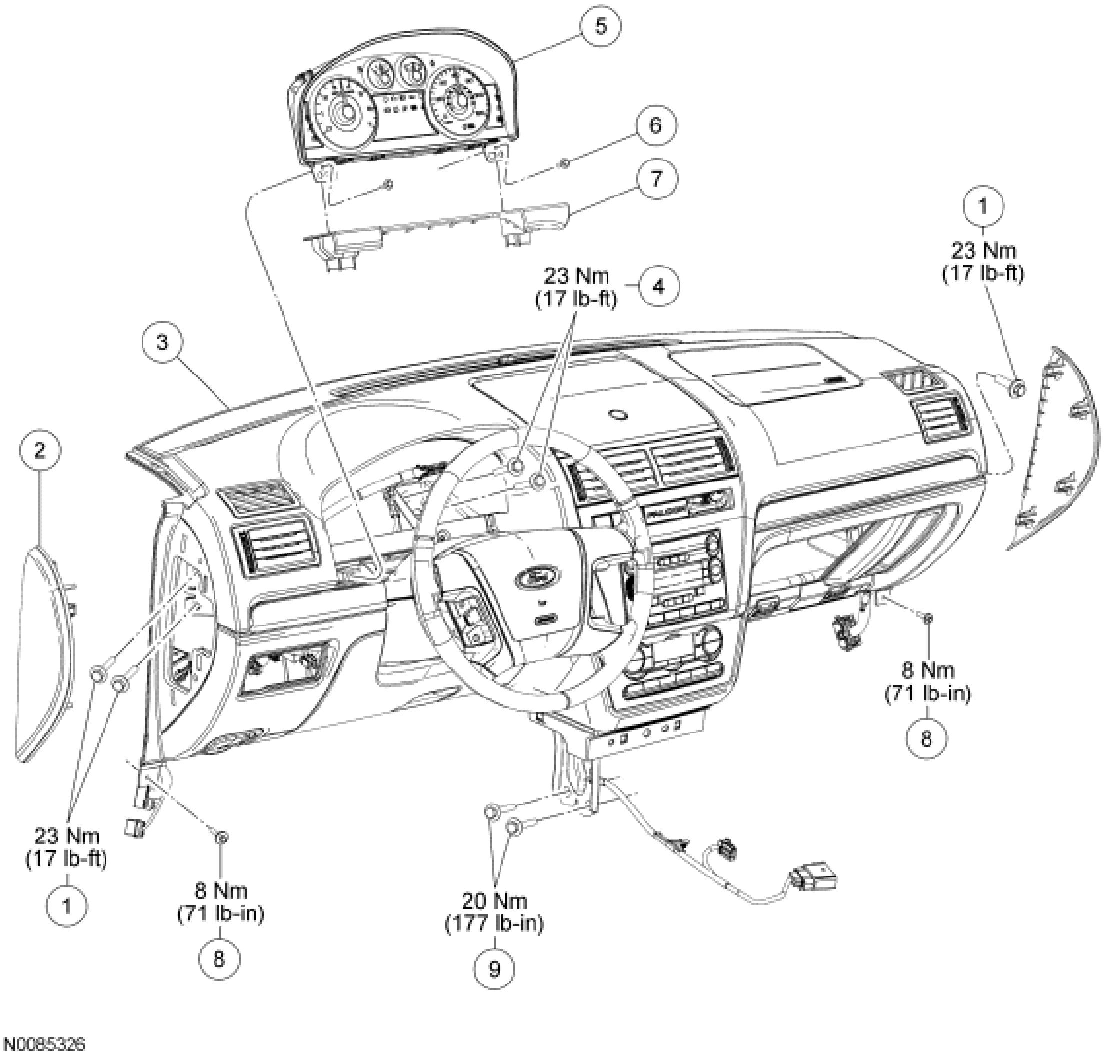


Fig. 1: Exploded View Of Instrument Panel With Torque Specifications - Fusion/Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701834	Instrument panel side bolts (3 required)
2	04480 RH/ 04481 LH	Instrument panel side finish panel
3	04320	Instrument panel upper section
4	W701834	Instrument cluster opening bolts (2 required)
5	10849	Instrument cluster
6	W705314	Instrument cluster screw (2 required)
7	044D70	Instrument cluster finish panel
8	W708268	Instrument panel lower bolts (2 required)
9	N811479	Instrument panel center support bolts (2

		required)

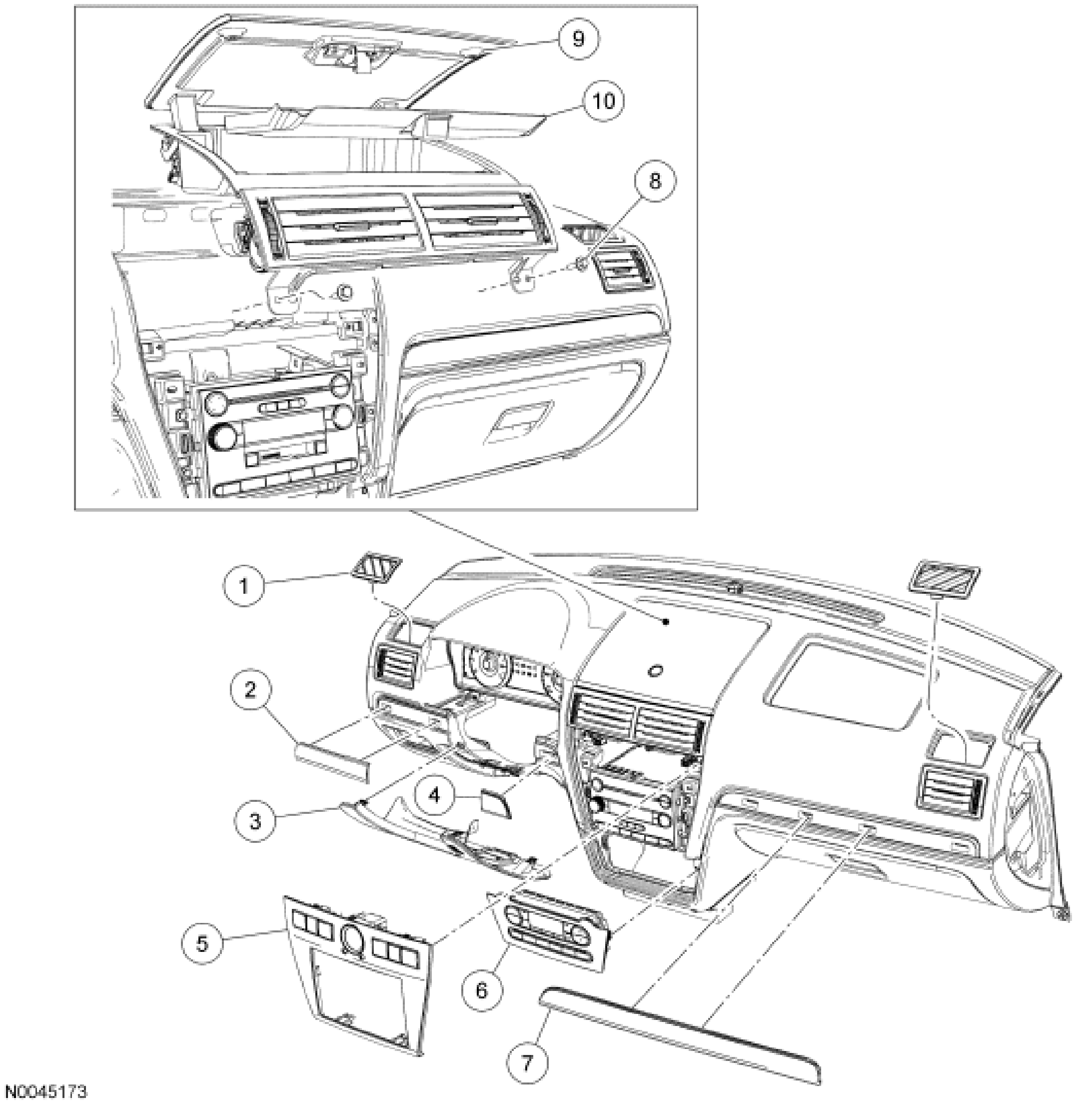


Fig. 2: Exploded View Of Instrument Panel Finish Panels - Fusion/Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	54046A77	Demister bezel (2 required)
2	04338	LH instrument panel finish molding
3	04459	Steering column opening trim cover
4	044A90A	Center instrument panel finish molding
5	04302	Upper center instrument panel finish panel
6	04608	Lower center instrument panel finish panel

7	044A90B	RH instrument panel finish molding
8	W705314	Upper storage bin screw (2 required)
9	13594	Upper storage bin
10	045G34	Upper storage bin mat

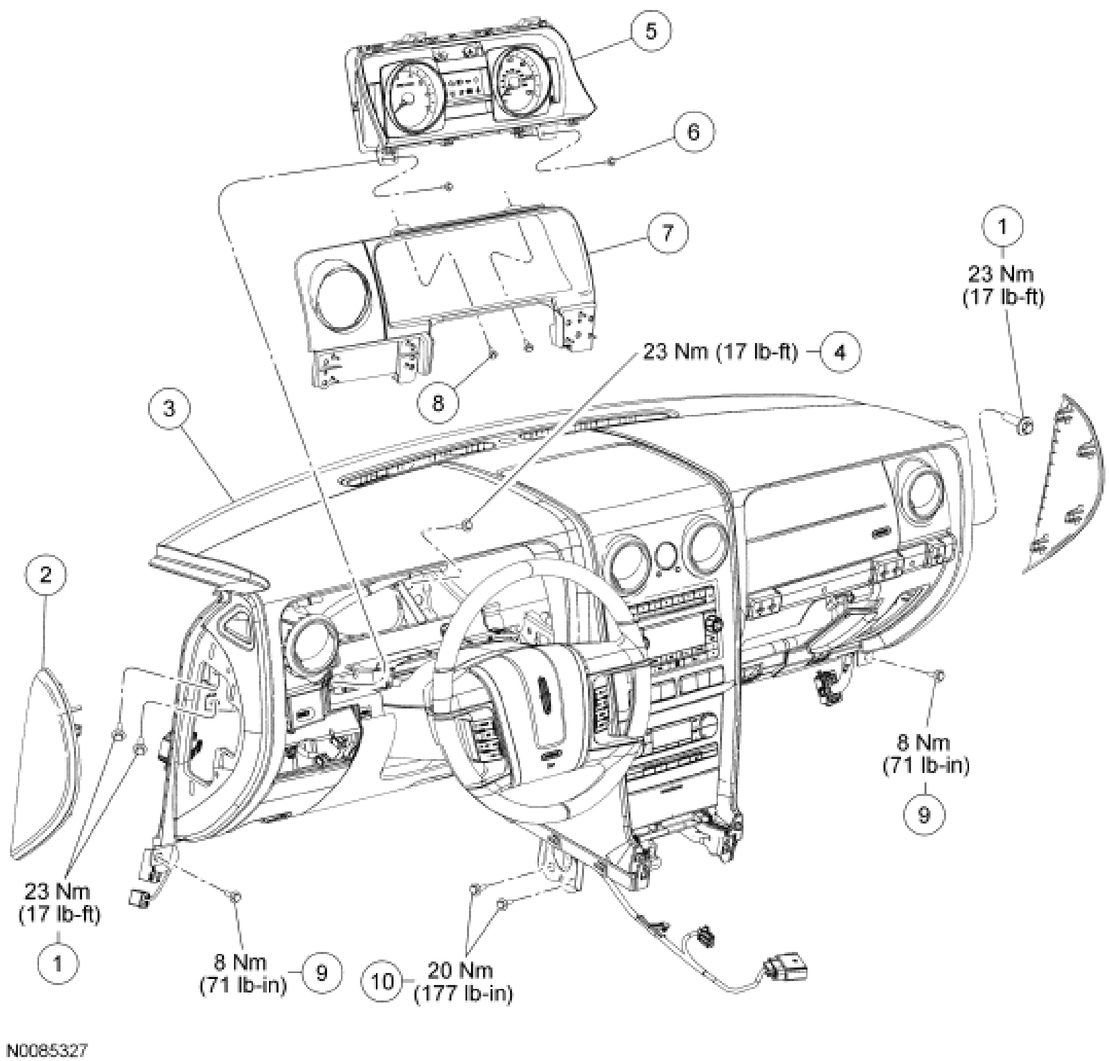


Fig. 3: Exploded View Of Instrument Panel With Torque Specifications - MKZ
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701834	Instrument panel side bolts (3 required)
2	04480 RH/ 04481 LH	Instrument panel side finish panel
3	04320	Instrument panel upper section
4	W701834	Instrument cluster opening bolt (2 required)

5	10849	Instrument cluster
6	W705314	Instrument cluster screw (2 required)
7	044D70	Instrument cluster finish panel
8	W505155	Instrument cluster finish panel screw (2 required)
9	W708268	Instrument panel lower bolts (2 required)
10	N811479	Instrument panel center support bolts (2 required)

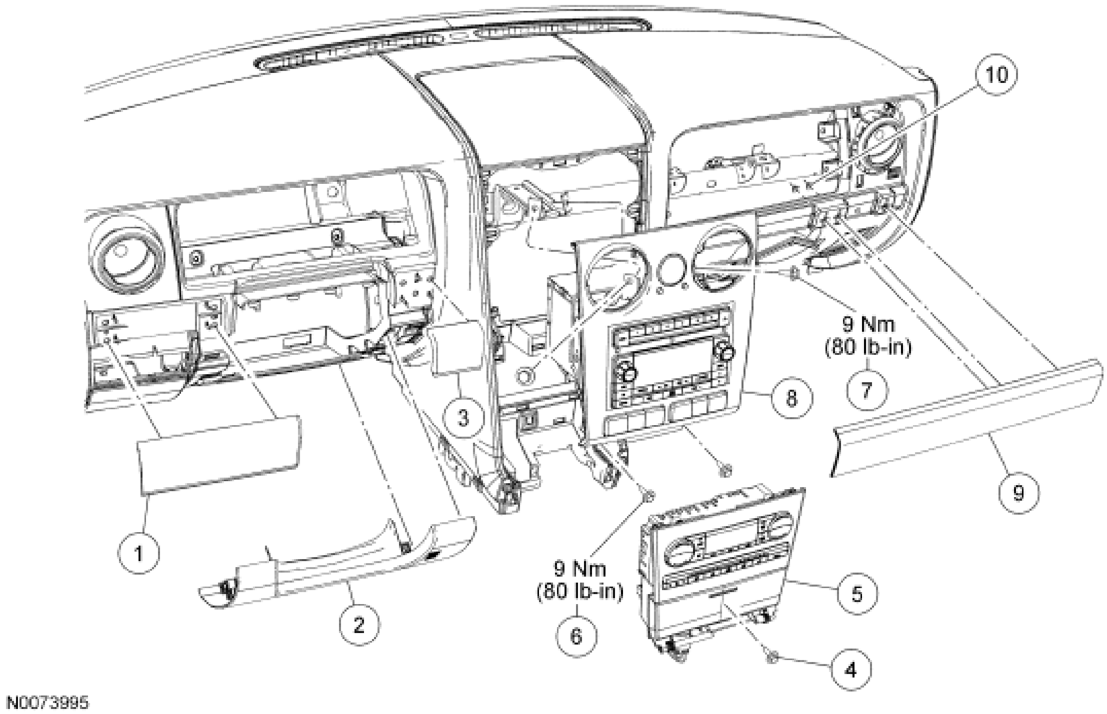


Fig. 4: Exploded View Of Instrument Panel Finish Panels With Torque Specifications - MKZ
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	044A90A	LH instrument panel finish molding
2	04459	Steering column opening trim panel
3	04388	Center instrument panel finish molding
4	W705314	Lower center instrument panel finish panel screw
5	04608	Lower center instrument panel finish panel
6	W505422	Upper center instrument panel finish panel lower screw (2 required)
7	W505422	Upper center instrument panel finish panel upper screw (2 required)
8	04302	Upper center instrument panel finish panel
9	044A90B	RH instrument panel finish molding

10	W706675	RH instrument panel finish molding nut (aluminum)
10	W704831	RH instrument panel finish molding clip (wood)

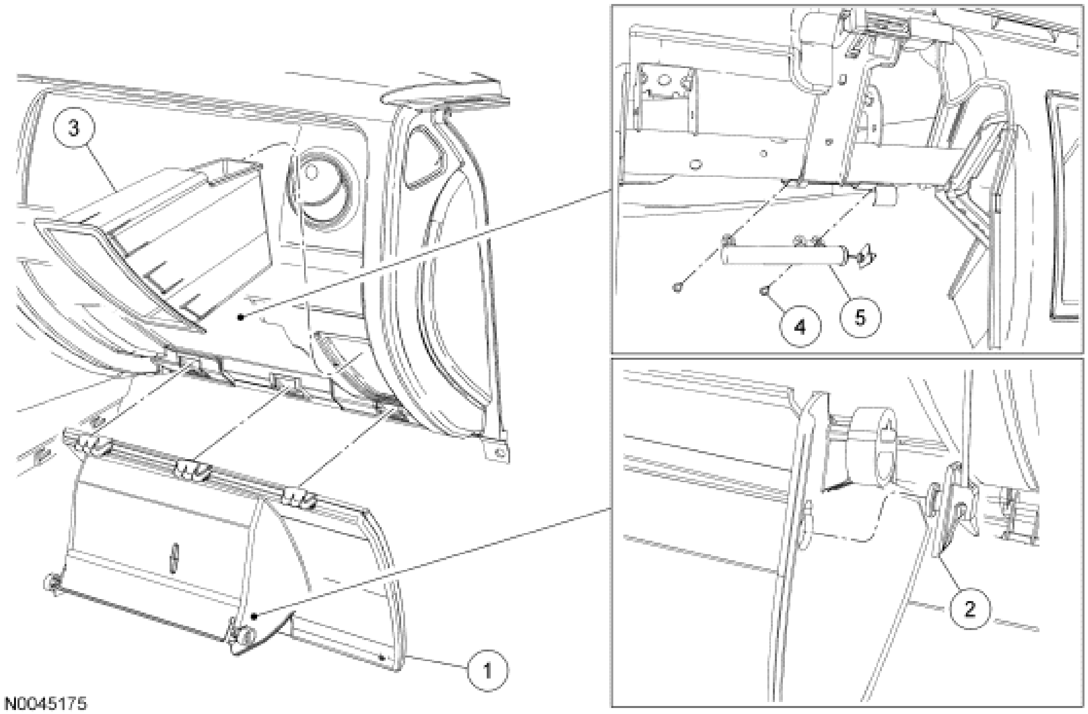


Fig. 5: Exploded View Of Glove Compartment
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	060T10	Glove compartment
2	-	Glove compartment damper clip (part of 06102)
3	06010	Glove compartment mini-bin
4	W505152	Glove compartment damper screw (2 required)
5	06102	Glove compartment damper

1. For additional information, refer to the procedures.

INSTRUMENT PANEL

REMOVAL AND INSTALLATION

1. Turn the steering wheel to the straight-ahead position and turn the ignition switch to the OFF position.
   - Remove the key.
2. Depower the supplemental restraint system (SRS). For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

3. Remove the floor console. For additional information, refer to **Console - Floor**.
4. Remove the selector lever or the gearshift lever. For additional information, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article or **MANUAL TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
5. Remove the LH and RH instrument panel side finish panels.
6. Remove the RH and LH weatherstrips from the front door openings near the instrument panel.
7. Remove the RH and LH A-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
8. Remove the RH and LH lower cowl panels.
9. If equipped, remove the RH lower instrument panel insulator.
10. Disconnect the 2 electrical connectors located at the LH lower cowl.

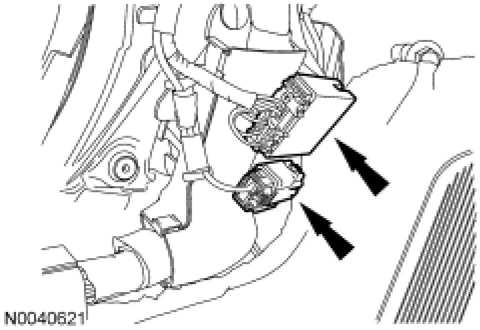


Fig. 6: Locating Electrical Connectors
Courtesy of FORD MOTOR CO.

11. Remove the small gray connector and the large black connector from the Smart Junction Box (SJB).

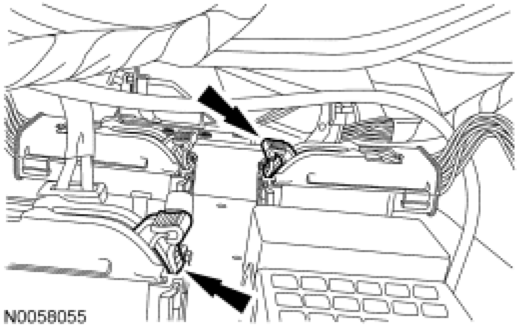


Fig. 7: Locating Black Connector
Courtesy of FORD MOTOR CO.

12. Remove the 2 screws and position the hood release handle aside.

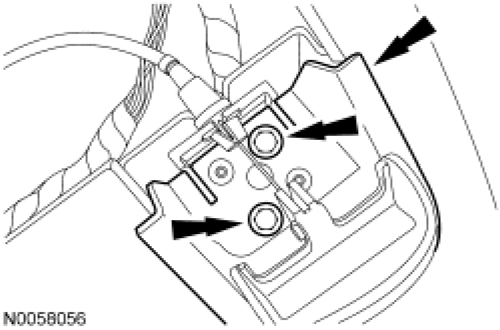


Fig. 8: Locating Hood Latch Release Handle
Courtesy of FORD MOTOR CO.

13. Disconnect the bulkhead electrical connector and the antenna cable located at the RH lower cowl.

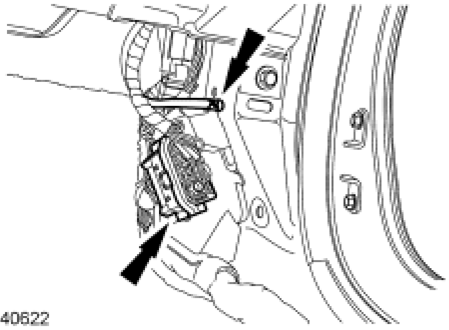


Fig. 9: Locating Bulkhead Electrical Connector And Antenna Lead-In Cable
Courtesy of FORD MOTOR CO.

14. Fully lower the glove compartment door and disconnect the 2 A/C electrical connectors.

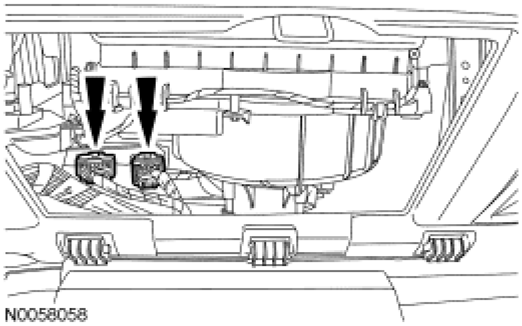


Fig. 10: Locating A/C Electrical Connectors
Courtesy of FORD MOTOR CO.

15. Disconnect the 2 electrical connectors and retainers located on the floor between the 2 front seats.

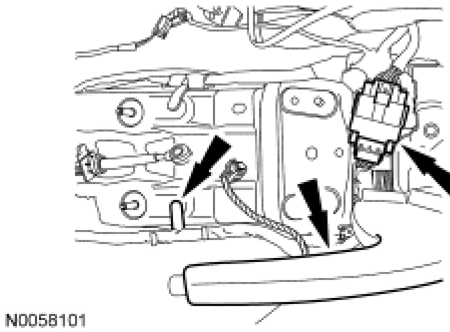


Fig. 11: Locating Electrical Connector
Courtesy of FORD MOTOR CO.

16. Remove the 2 nuts and position the steering column pinch bolt cover aside.

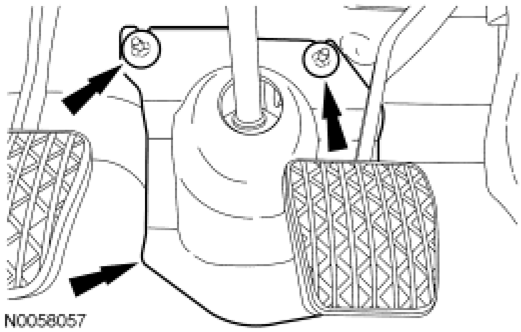


Fig. 12: Locating Steering Column Pinch Bolt Cover
Courtesy of FORD MOTOR CO.

17. Remove and discard the steering column shaft-to-steering column bolt.
    - To install, use a new steering column shaft-to-steering column bolt and tighten to 25 Nm (18 lb-ft).

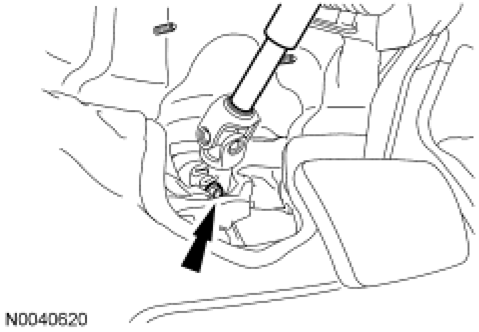


Fig. 13: Locating Steering Column Pinch Bolt
Courtesy of FORD MOTOR CO.

NOTE: **Do not allow the steering column shaft to rotate while the intermediate shaft is disconnected or damage to the clockspring may result. If there is evidence that the shaft has rotated, the clockspring must be removed and**

recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.

NOTE: Index-mark the steering column shaft position to the steering gear for reference during installation.

18. Detach the upper steering column shaft from the steering column.
19. Remove the instrument cluster finish panel.
20. Remove the instrument cluster.
    - Remove the 2 screws.
    - Remove the instrument cluster.
        - Disconnect the electrical connector.

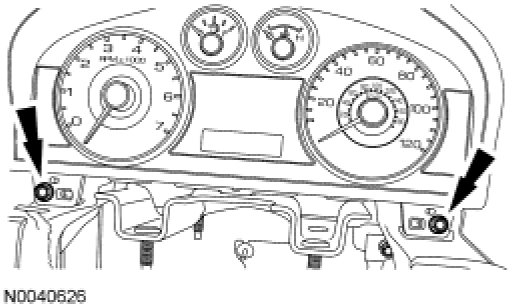


Fig. 14: Locating Instrument Cluster Screws
Courtesy of FORD MOTOR CO.

21. Through the instrument cluster opening, remove the 2 instrument cluster opening bolts.
    - To install, tighten to 18 Nm (159 lb-in).
22. Remove the 2 instrument panel lower bolts.
    - To install, tighten to 8 Nm (71 lb-in).

NOTE: To avoid damaging the instrument panel, the aid of an assistant is required to carry out this step.

23. Remove the instrument panel.
    - Remove the 3 instrument panel side bolts.
    - To install, tighten to 18 Nm (159 lb-in).
24. To install, reverse the removal procedure.

INSTRUMENT PANEL UPPER SECTION

REMOVAL AND INSTALLATION

NOTE: Fusion shown, Milan and MKZ similar.

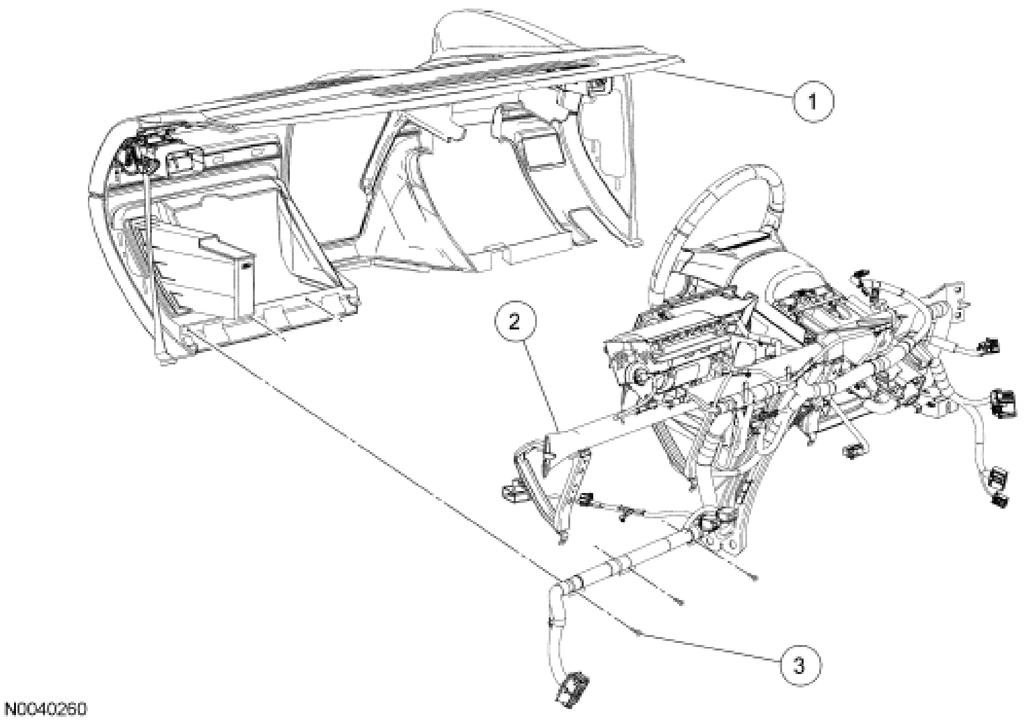


Fig. 15: Exploded View Of Instrument Panel Upper Section - All vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	04320	Instrument panel upper section
2	04545	In-vehicle cross beam
3	W707607	Wire harness screw (13 required)

1. Remove the center instrument panel finish panel. For additional information, refer to **Instrument Panel Finish Panel - Center**.

   NOTE: To avoid damaging the in-vehicle cross beam or the instrument panel upper section, spread a suitable covering over the bench on which to place the instrument panel.

   NOTE: Place the instrument panel on the bench and support it upright so that the screws are accessible from the rear.

2. Remove the instrument panel. For additional information, refer to **Instrument Panel**.
3. Remove the steering wheel. For additional information, refer to **STEERING COLUMN** article.
4. Remove the passenger air bag. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

5. Remove the audio unit. For additional information, refer to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
6. Disconnect the Data Link Connector (DLC) from the lower LH instrument panel.
7. Remove the headlamp switch. For additional information, refer to **EXTERIOR LIGHTING** article.

NOTE: **To avoid damaging the instrument panel upper section, the aid of an assistant is required to carry out this step.**

NOTE: **Do not twist or bend the instrument panel upper section when removing it from the vehicle.**

8. Remove the instrument panel upper section.
   - Remove the 13 wire harness screws and remove the instrument panel upper section.
9. To install, reverse the removal procedure.

INSTRUMENT PANEL FINISH PANEL - CENTER

REMOVAL AND INSTALLATION

Fusion, Milan

1. Using a suitable tool, gently pry out the upper center instrument panel finish panel to disengage the clips.
2. Remove the upper center instrument panel finish panel.
   - Disconnect the electrical connectors.
3. Using a suitable tool, gently pry out the lower center instrument panel finish panel to disengage the clips.
4. Remove the lower center instrument panel finish panel.
   - Disconnect the electrical connectors.

MKZ

5. Remove the floor console finish panel.
6. Remove the lower center instrument panel finish panel screw beneath the ash tray and the lower center instrument panel finish panel.
   - Disconnect the electrical connectors.
7. Remove the 2 upper center instrument panel finish panel lower screws.

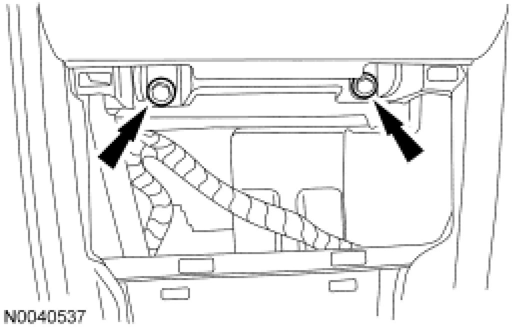


Fig. 16: Locating Upper Center Instrument Panel Finish Panel Lower Screws
Courtesy of FORD MOTOR CO.

8. Remove both center instrument panel registers. For additional information, refer to **CLIMATE CONTROL** article.
9. Working through the center instrument panel register openings, remove the 2 upper center instrument panel finish panel upper screws.
10. Remove the upper center instrument panel finish panel.
    - Disconnect the electrical connectors.

All vehicles

11. To install, reverse removal procedure.

STORAGE COMPARTMENT - UPPER

REMOVAL AND INSTALLATION

1. Remove the instrument panel finish panel.
2. Remove the 2 upper storage compartment screws and remove the upper storage compartment.
3. To install, reverse the removal procedure.

CONSOLE - FLOOR

NOTE: Fusion, Milan shown, MKZ similar.

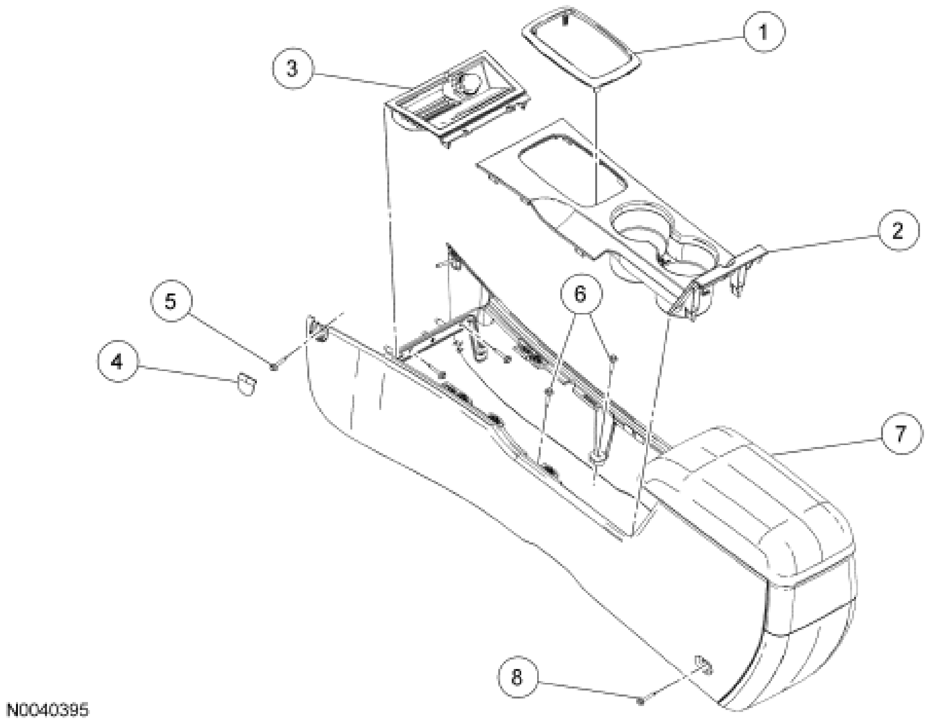


Fig. 17: Exploded View Of Floor Console
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	061A16	Selector lever trim ring
2	045A76	Floor console finish panel
3	-	Floor console utility tray
4	672A40	Floor console bolt cover (2 required)
5	W711401	Floor console bolt (2 required)
6	W709955	Floor console center bolts (2 required)
7	045A36	Floor console
8	W711401	Floor console rear bolt (2 required)

REMOVAL AND INSTALLATION

All vehicles

1. Position the front seats forward and remove the 2 floor console rear bolts.
2. Position the front seats rearward.
3. If equipped, pull the parking brake handle upward.

Fusion, Milan

4. If equipped with an automatic transmission, remove the selector lever trim ring.

All vehicles

5. If equipped with a manual transmission, remove the gearshift knob.
6. Open the storage compartment door.
7. Remove the floor console finish panel.
    - Disconnect the electrical connectors.

Fusion, Milan

8. Remove the utility tray.
    - Disconnect the electrical connector.
    - Disconnect the audio jack connector.
9. Remove the 2 floor console bolt covers.
10. Remove the 2 floor console bolts.

MKZ only

11. Remove the LH and RH floor console trim panels.

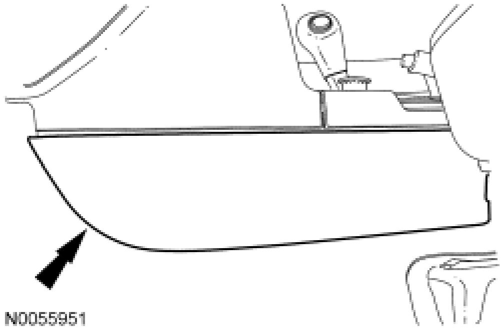


Fig. 18: Identifying Console Side Finish Panels
Courtesy of FORD MOTOR CO.

12. Remove the 2 floor console-to-instrument panel bolts (one each side).

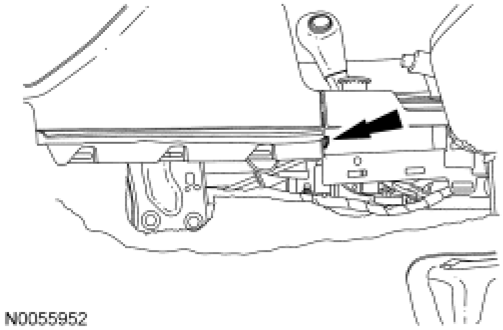


Fig. 19: Identifying Console-To-Instrument Panel Bolts
Courtesy of FORD MOTOR CO.

All vehicles

13. Remove the 4 floor console bolts and remove the floor console.
14. To install, reverse the removal procedure.

CONSOLE - OVERHEAD

REMOVAL AND INSTALLATION

NOTE: Fusion shown, Milan and MKZ similar.

1. Open the overhead console compartment door.

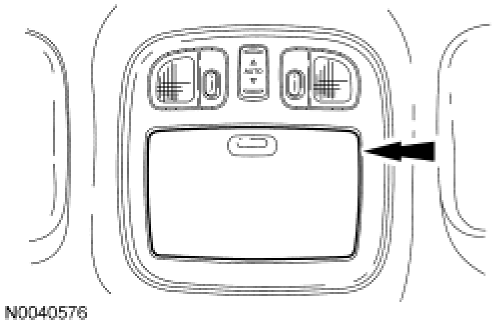
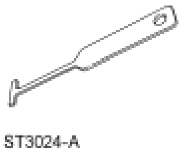


Fig. 20: Locating Overhead Console Compartment Door
Courtesy of FORD MOTOR CO.

2. From inside the compartment, remove the 2 screws.
3. Remove the overhead console.
   - Disconnect the electrical connectors.
4. To install, reverse the removal procedure.

POWER POINT

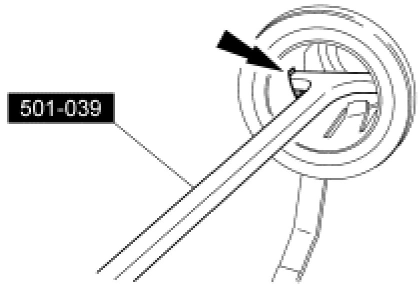
Special Tools

Illustration	Tool Name	Tool Number
	Remover, Power Point Socket	501-039 or equivalent

REMOVAL

NOTE: Power point cover may differ depending on location.

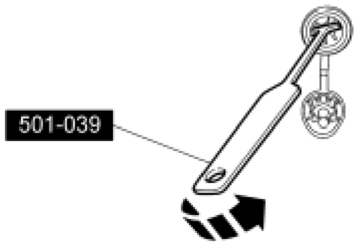
1. Open the power point cover.
2. Install the Power Point Socket Remover in one of the power point socket slots.



N0061767

Fig. 21: Installing Special Tool (501-039) In Power Point Socket Slot
Courtesy of FORD MOTOR CO.

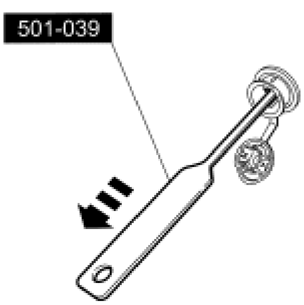
3. Position the Power Point Socket Remover so that it engages in the adjacent slot.



N0061768

Fig. 22: Positioning Special Tool (501-039) To Engage In Adjacent Slot
Courtesy of FORD MOTOR CO.

4. Using the Power Point Socket Remover, pull the power point socket out of the retainer.



N0061769

Fig. 23: Pulling Power Point Socket Out Of Retainer
Courtesy of FORD MOTOR CO.

5. Disconnect the electrical connector.

INSTALLATION

1. Connect the electrical connector.
2. Slide the power point socket into the retainer.

2008 ENGINE PERFORMANCE

Intake Air Distribution & Filtering - 3.5L - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Air cleaner assembly bolts	5	-	44
Air cleaner outlet pipe-to-air cleaner cover clamp	5	-	44
Air cleaner outlet pipe-to-throttle body clamp	5	-	44
Intake air resonator nuts	15	11	-

DESCRIPTION AND OPERATION

INTAKE AIR DISTRIBUTION AND FILTERING

The air intake system consists of the:

- air cleaner inlet.
- air cleaner element.
- mass air flow (MAF) sensor.
- air cleaner outlet and resonator assembly.

The air intake system:

- cleans intake air with a replaceable, dry-type air cleaner element.
- measures airflow and air temperature with the MAF sensor.

DIAGNOSTIC TESTS

INTAKE AIR DISTRIBUTION AND FILTERING

Refer to the **Introduction - Gasoline Engines** article.

REMOVAL AND INSTALLATION

INTAKE AIR SYSTEM COMPONENTS - EXPLODED VIEW

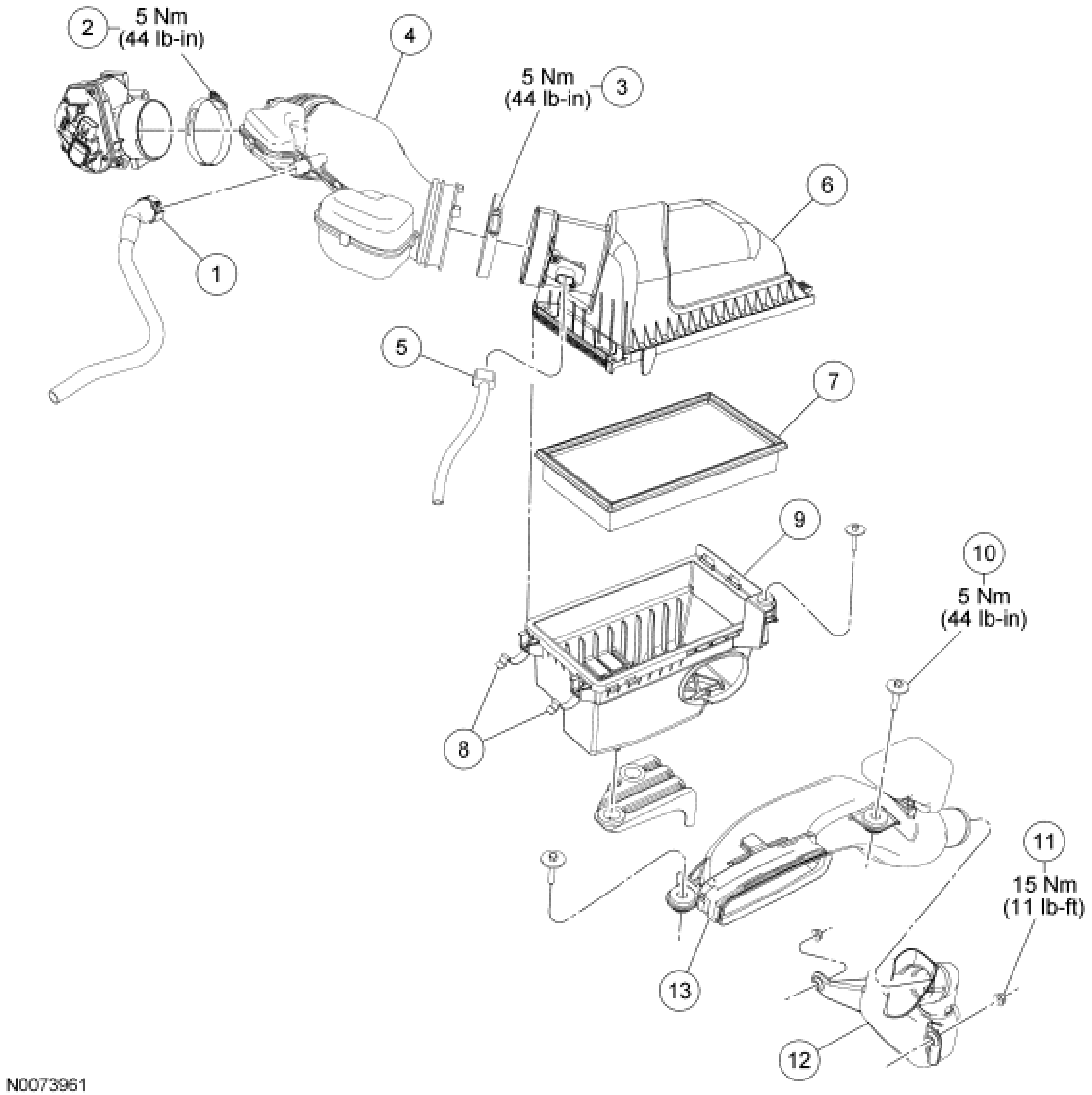


Fig. 1: Exploded View Of Intake Air System Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6758	Crankcase vent tube
2	9C632	Air cleaner outlet pipe-to-throttle body clamp
3	9C632	Air cleaner outlet pipe-to-air cleaner cover clamp
4	9B659	Air cleaner outlet pipe
5	14A464	Mass air flow (MAF) sensor electrical connector
6	-	Air cleaner housing cover (part or 9600)
7	9601	Air cleaner element

8	9628	Air cleaner housing-to-air cleaner cover clamps
9	9600	Air cleaner housing
10	W710317	Air cleaner bolt (3 required)
11	W520413	Intake air resonator nut (2 required)
12	9F763	Intake air resonator
13	9A675	Intake air pipe

1. For additional information, refer to the procedures.

AIR CLEANER

REMOVAL AND INSTALLATION

1. Disconnect the mass air flow (MAF) sensor electrical connector and wiring harness retainer.
2. Loosen the clamp and disconnect the air cleaner outlet pipe from the air cleaner.
   - To install, tighten to 5 Nm (44 lb-in).
3. Remove the 3 bolts from the air cleaner assembly.
   - To install, tighten to 5 Nm (44 lb-in).
4. Separate the 2 air cleaner feet from the rubber grommets and the air cleaner inlet pipe and remove the air cleaner assembly.

NOTE: **Make sure that the 2 air cleaner feet are seated into the rubber grommets under the air cleaner assembly.**

NOTE: **The air cleaner outlet pipe should be securely sealed to prevent unmetered air from entering the engine.**

5. To install, reverse the removal procedure.

AIR CLEANER OUTLET PIPE

REMOVAL AND INSTALLATION

1. Disconnect the crankcase vent tube from the air cleaner outlet pipe.
2. Loosen the air cleaner outlet pipe-to-air cleaner cover clamp.
   - To install, tighten to 5 Nm (44 lb-in).
3. Loosen the air cleaner outlet pipe-to-throttle body clamp.
   - Remove the air cleaner outlet pipe.
   - To install, tighten to 5 Nm (44 lb-in).

NOTE: **The air cleaner outlet pipe should be securely sealed to prevent unmetered air from entering the engine.**

4. To install, reverse the removal procedure.

INTAKE AIR RESONATOR

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the LH fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article.
3. Remove the 2 nuts and the air intake resonator.
    - To install, tighten to 15 Nm (11 lb-ft).

NOTE: **Make sure that the air cleaner inlet pipe is securely seated to the intake air resonator.**

4. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Interior Lighting - Fusion, Milan & MKZ

DESCRIPTION AND OPERATION

INTERIOR LIGHTING

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The interior lighting system consists of the following components:

- SJB
- Instrument panel dimmer switch
- Interior/map lamps
- Luggage compartment lamp
- Vanity mirror lamps
- Puddle lamps (if equipped)
- Door ajar switches
- Luggage compartment lid ajar switch
- Ambient lighting module (if equipped)
- Ambient lighting switch (if equipped)

The interior lighting system consists of up to 3 subsystems:

- Courtesy lamps
- Demand lamps
- Ambient lighting (if equipped)

The courtesy lamp subsystem consists of the interior dome lamps, luggage compartment lamp, and the puddle lamps (if equipped). The courtesy lamps illuminate as a system when requested by the SJB during such conditions as an open vehicle door.

The demand lamps subsystem consists of the front map lamps and the left and right vanity mirror lamps. The demand lamps illuminate individually when the vehicle occupant activates them.

Both the courtesy and the demand lamps are controlled by the SJB. The SJB sets DTCs if certain circuit failures exist with the interior lighting system.

The ambient lighting feature allows the vehicle occupant to lightly illuminate the interior of the vehicle in a variety of colors. The ambient lighting system consists of the following:

- Ambient lighting switch (located in the center console)

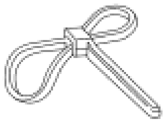
- Ambient lighting module (located in the center console)
- LEDs (hardwired in the ambient lighting electrical harness)
  - Located on the center console cupholder, the storage bin, and the front and rear footwells

The ambient lighting system is powered through the accessory delay relay.

DIAGNOSTIC TESTS

INTERIOR LIGHTING

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	73III Automotive Meter	105-R0057 or equivalent
 ST1385-A	Vehicle Communications Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST1438-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB supplies voltage to the interior lighting system. The interior lighting system illuminates the courtesy lamps to enhance visibility of the interior while a vehicle door is open or ajar, and the vehicle speed is less than 15 km/h (9 mph). The SJB controls all interior lighting functions and timing by monitoring inputs from the door ajar switches and vehicle speed.

Interior Lighting Delay

The interior lighting delay feature provides temporary illumination of the courtesy lamps after the doors are opened and then closed. The interior lighting delay feature will keep the courtesy lamps on for a period of 25 seconds. If during the 25 second delay time the SJB detects that the ignition has been turned ON, or if the vehicle is locked using the remote keyless entry (RKE) transmitter or the keyless entry keypad, the courtesy

lamp illumination will be discontinued.

Illuminated Entry

The illuminated entry feature illuminates the courtesy lamps when the ignition is off and either the RKE transmitter UNLOCK button is pressed, or the vehicle is unlocked using the keyless entry keypad. The illuminated entry feature turns the courtesy lamps off when 25 seconds have elapsed, the ignition is switched to ON, the RKE transmitter LOCK button is pressed, or the vehicle is locked using the keyless entry keypad.

Illuminated Exit

The illuminated exit feature illuminates the courtesy lamps for 25 seconds when all doors are closed and the ignition key is removed from the ignition lock cylinder. The illuminated exit feature turns the courtesy lamps off when the ignition key is inserted into the ignition lock cylinder or 25 seconds have elapsed.

Theater Lighting (MKZ Only)

The theater lighting feature ramps-up the courtesy lamps intensity over 0.7 seconds when courtesy lamp activation is requested. The theater lighting feature ramps-down the courtesy lamps intensity over 1.7 seconds when interior lighting deactivation is requested by any feature other than the panic alarm or battery saver.

Interior Lamp Arbitrator

The interior lamp arbitrator (a function of the SJB) chooses between the interior lighting, interior mode, interior lighting delay, illuminated entry, illuminated exit and battery saver to determine which feature has precedence of activating and deactivating the interior lamps. The features are prioritized as follows: battery saver, interior mode, interior lighting, interior light delay, illuminated entry, and illuminated exit.

Ambient Lighting

The ambient lighting feature provides illumination to the center console cupholder, the storage bin, and the front and rear footwells. There are a total of 7 LED locations. The ambient lighting feature is powered by the accessory delay relay, which allows the ambient lighting feature to be used independent of the parking lamps status.

The ambient lighting module provides voltage and ground to the LEDs. There are 3 different color LEDs (red, blue, and green) housed within each LED assembly. By illuminating various color combinations, the LEDs are able to produce 7 different colors of ambient light. The ambient lighting switch is an input to the ambient lighting module. With each press of the switch, the ambient lighting module cycles through a different color variation or turns the ambient lighting feature off. The module retains the last color setting between uses.

Battery Saver

The battery saver is internal to the SJB and provides automatic shutoff of the demand lamps (vanity lamps, map lamps and glove compartment lamp) and courtesy lamps after a period of 30 minutes (10 minutes if the lights are on due to a door ajar) has elapsed in order to save battery voltage. A timer in the SJB starts when the ignition is turned to the OFF position. When the time-out period for the lamps has elapsed, the voltage is automatically shutoff to the lamps by the battery saver.

To activate the battery saver feature, one of the following events must occur:

- The ignition is transition out of the OFF position
- Any door is opened
- The luggage compartment lid is opened
- The UNLOCK button of the RKE transmitter is pressed
- The keyless entry keypad is used to unlock the vehicle

Field-Effect Transistor (FET) Protection (MKZ Only)

The SJB utilizes a protective circuit strategy for many of its outputs (for example, the headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault is detected. The circuit then resets after an ignition cycle or customer demand of the function (switching the component on, battery saver being energized). When an excessive circuit load occurs several times, a continuous DTC is stored and the module shuts down the output until a repair procedure is carried out. At the same time, the continuous DTC that was stored on the first failure cannot be cleared by a command to clear the continuous DTCs. The module does not allow this code to be cleared or the circuit restored to normal until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC clears and the circuit function returns.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Courtesy lamps • Map lamps • Luggage compartment lamp • Vanity lamps • Glove compartment lamp • Ambient lighting switch (if equipped)	• Smart junction box (SJB) fuse 3 (15A) • Wiring, terminals or connectors • SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool release software.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
    - Check the VCM connection to the vehicle.
    - Check the scan tool connection to the VCM.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
    - Verify the ignition key is in the ON position.
    - Verify the scan tool operation with a known good vehicle.
    - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
    - If the scan tool responds with no communication with the SJB, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1320	Driver Door Ajar Circuit Open	Go to **Pinpoint Test C**.
B1328	Passenger Door Ajar Circuit Open	Go to **Pinpoint Test C**.
B1331	Decklid Ajar Rear Door Circuit Failure	Go to **Pinpoint Test C**.
B1336	Door Ajar RR Circuit Open	Go to **Pinpoint Test C**.
B1572	Door Ajar LR Circuit Open	Go to **Pinpoint Test C**.
B1688	Lamp Dome Input Circuit Short to Ground	Go to **Pinpoint Test C**.
B2499	Courtesy Lamp Output Failure	Go to **Pinpoint Test A**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Wiring, terminals or connectors • SJB	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The courtesy lamps are inoperative	• Fuse • Wiring, terminals or connectors • SJB	• Go to **Pinpoint Test A**.
• An individual courtesy lamp is inoperative	• Wiring, terminals or connectors • Interior lamp	• Go to **Pinpoint Test B**.
• The courtesy lamps stay on continuously	• Wiring, terminals or connectors • Door ajar switch • Luggage compartment lid ajar switch • Instrument panel dimmer switch • SJB	• Go to **Pinpoint Test C**.
• The courtesy lamps do not turn on with one door open	• Wiring, terminals or connectors • Door ajar switch • SJB	• Go to **Pinpoint Test D**.
• The courtesy lamps do not turn on with the luggage compartment lid open	• Wiring, terminals or connectors • Luggage compartment lid ajar switch • SJB	• Go to **Pinpoint Test D**.
• The demand lamps are inoperative	• Wiring, terminals or connectors • SJB	• Go to **Pinpoint Test E**.
• An individual demand lamp is inoperative	• Wiring, terminals or connectors • Interior lamp	• Go to **Pinpoint Test F**.
• The illuminated entry is inoperative when using the remote keyless entry (RKE) transmitter	• RKE system concern • SJB	• Go to **Pinpoint Test G**.

• The battery saver does not deactivate after time-out	• Wiring, terminals or connectors • SJB	• Go to **Pinpoint Test H**.
• The puddle lamps are inoperative	• Wiring, terminals or connectors • Exterior mirror	• Go to **Pinpoint Test I**.
• The courtesy lamps are inoperative from the instrument panel dimmer switch	• Dimmable back lighting illumination system concern • Wiring, terminals or connectors • Instrument panel dimmer switch • SJB	• Go to **Pinpoint Test J**.
• The ambient lighting is inoperative	• Wiring, terminals or connectors • Ambient lighting switch • Ambient lighting module	• Go to **Pinpoint Test K**.
• An individual ambient lighting LED is inoperative/does not operate correctly	• Ambient lighting harness	**NOTE:** **The LEDs are not serviceable separate from the harness.** • INSTALL a new ambient lighting harness. TEST the system for normal operation.
• The ambient lighting does not cycle through all color combinations	• Wiring, terminals or connectors • Ambient lighting switch • Ambient lighting module	• Go to **Pinpoint Test L**.

Pinpoint Tests

Pinpoint Test A: The Courtesy Lamps Are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Interior Lamps for schematic and connector information.

Normal Operation

Power is supplied to the courtesy lamps through the smart junction box (SJB) fuse 3 (15A), which supplies voltage to the courtesy lamps relay, the demand lamps relay (Fusion, Milan only), and the demand lamps field-effect transistor (FET) (MKZ only). When any door is opened, the ajar switch opens, signaling the SJB to activate the courtesy lamps. The SJB monitors the ajar circuits, and based on the ajar status, the SJB will supply voltage to the courtesy lamps on circuit CLN26 (BU). Ground for the courtesy lamps is supplied through circuit GD139 (BK/YE) or GD126 (BK/WH).

- DTC B2499 (Courtesy Lamp Output Failure) - sets when the FET output has been disabled due to an over-current fault on circuit CLN26 (BU). This continuous DTC applies to MKZ only, and it can only be cleared once the fault has been repaired and the on-demand self-test is re-run.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- SJB

PINPOINT TEST A: THE COURTESY LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 CHECK CIRCUIT CLN26 (BU) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280e

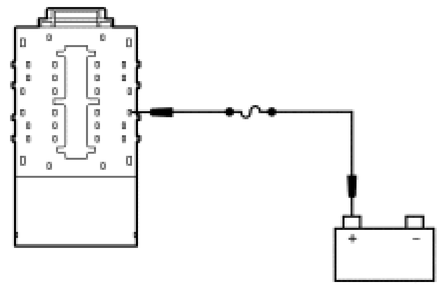


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Fig. 1: Checking Circuit CLN26 (BU) For Open
Courtesy of FORD MOTOR CO.

NOTE: If the fuse fails, repair circuit CLN26 (BU) for a short to ground. For MKZ, clear the DTCs and repeat the self-test after the repair.

- Connect a fused jumper wire between the SJB C2280e-16, circuit CLN26 (BU), harness side and battery positive.
- **Do the courtesy lamps illuminate?**

YES : REMOVE the jumper wire. VERIFY the SJB fuse 3 (15A) is OK. If OK, go to A3. If not OK, REFER to the Wiring Diagrams article to identify the possible causes of the circuit short.

NO : REMOVE the jumper wire. Go to A2.

A2 CHECK CIRCUIT CLN09 (YE/GN) FOR A SHORT TO GROUND

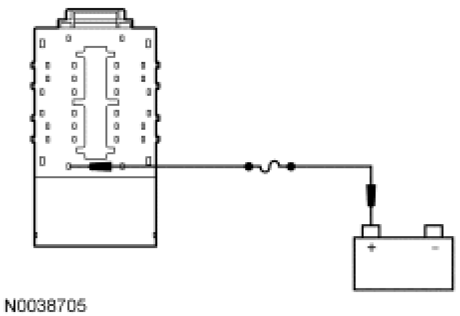

Fig. 2: Checking Circuit CLN09 (YE/GN) For A Short To Ground
Courtesy of FORD MOTOR CO.

NOTE: If the fuse fails, repair circuit CLN09 (YE/GN) for a short to ground.

- Connect a fused jumper wire between the SJB C2280e-2, circuit CLN09 (YE/GN), harness side and battery positive.
- Operate the demand lighting on one of the interior lamps.
- **Does the demand lighting operate correctly?**

  YES : REMOVE the jumper wire. VERIFY the SJB fuse 3 (15A) is OK. If OK, go to A3. If not OK, REFER to the Wiring Diagrams article to identify the possible causes of the circuit short.

  NO : REMOVE the jumper wire. Go to A4.

A3 CHECK CIRCUIT GD139 (BK/YE) FOR AN OPEN

- Key in OFF position.
- Disconnect: Front Interior Lamp C930

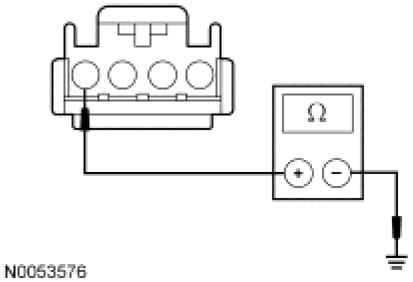

Fig. 3: Checking Circuit GD139 (BK/YE) For An Open - Vehicles With An Overhead Console
Courtesy of FORD MOTOR CO.

- Measure the resistance between the front interior lamp C930-1, circuit GD139 (BK/YE), harness

side and ground.

- **Is the resistance less than 5 ohms?**

  YES : REPAIR circuit CLN26 (BU) for an open. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

A4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: An Individual Courtesy Lamp Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Interior Lamps for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Luggage Compartment Lid Release for schematic and connector information.

Normal Operation

The smart junction box (SJB) provides voltage to the courtesy lamps on circuit CLN26 (BU). The courtesy lamps are grounded through circuit GD139 (BK/YE). The luggage compartment lamp is also on the courtesy lamp circuit. Circuit CLN26 (BU) provides voltage to the luggage compartment lamp, and the lamp is grounded through circuit GD139 (BK/YE).

For a concern with the puddle lamps, go to **Pinpoint Test I**.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Interior lamp

PINPOINT TEST B: AN INDIVIDUAL COURTESY LAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 CHECK THE COURTESY LAMP

- Key in OFF position.
- Disconnect: Suspect Interior Lamp
- Operate the courtesy lamps by opening the LF door.
- Measure the voltage between the suspect courtesy lamp, harness side as follows:

Location	Connector-Pin/ Circuit	Connector-Pin/ Circuit
Front interior lamp	C930-3 CLN26 (BU)	C930-1 GD139 (BK/YE)
Rear interior lamp	C901-1 CLN26 (BU)	C901-2 GD139 (BK/YE)
Luggage compartment lamp	C4198-1 CLN26 (BU)	C4198-2 GD139 (BK/YE)

- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new interior lamp for the suspect lamp. REFER to **Interior Lamp - Front** or **Interior Lamp - Rear**. TEST the system for normal operation.

  NO : Go to B2.

B2 CHECK CIRCUIT CLN26 (BU) FOR VOLTAGE

- Measure the voltage between the suspect courtesy lamp, harness side and ground as follows:

Location	Connector-Pin	Circuit
Front interior lamp	C930-3	CLN26 (BU)
Rear interior lamp	C901-1	CLN26 (BU)
Luggage compartment lamp	C4198-1	CLN26 (BU)

- **Is the voltage greater than 10 volts?**

  YES : REPAIR circuit GD139 (BK/YE) for the lamp in question. TEST the system for normal operation.

  NO : REPAIR circuit CLN26 (BU) for the lamp in question. TEST the system for normal

operation.

Pinpoint Test C: The Courtesy Lamps Stay On Continuously

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Interior Lamps for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Door Locks for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Luggage Compartment Lid Release for schematic and connector information.

Normal Operation

When any door or the luggage compartment lid is open, the ajar switch opens the monitored circuit to the smart junction box (SJB). The SJB monitors the ajar switches and the instrument panel dimmer switch, and based on the input, the SJB supplies voltage to the courtesy lamps on circuit CLN26 (BU).

DTC Description	Fault Trigger Conditions
B1320 - Driver Door Ajar Circuit Open	Sets during the on-demand self-test if an open is detected in the LF door ajar circuit.
B1328 - Passenger Door Ajar Circuit Open	Sets during the on-demand self-test if an open is detected in the RF door ajar circuit.
B1331 - Decklid Ajar Rear Door Circuit Failure	Sets during the on-demand self-test if an open is detected in the luggage compartment lid circuit.
B1336 - Door Ajar RR Circuit Open	Sets during the on-demand self-test if an open is detected in the RR door ajar circuit.
B1572 - Door Ajar LR Circuit Open	Sets during the on-demand self-test if an open is detected in the LR door ajar circuit.
B1688 - Lamp Dome Input Circuit Short to Ground	Sets during the on-demand self-test if circuit CLN28 (GN/BU) has continuity to ground during the self-test.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door ajar switch
- Luggage compartment lid ajar switch
- Instrument panel dimmer switch
- SJB

PINPOINT TEST C: THE COURTESY LAMPS STAY ON CONTINUOUSLY

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CHECK THE SJB DTCs

NOTE: Make sure all doors (including the luggage compartment lid) are closed and that the instrument panel dimmer switch is not in the DOME LAMPS position before running the SJB on-demand self-test, or the results may not be accurate.

- Carry out the SJB on-demand self-test.
- **Are any DTCs recorded?**

  YES : For DTC B1320, B1328, B1331, B1336 or B1572, go to C2.

  For DTC B1688, go to C6.

  For all other DTCs, REFER to **DTC Charts**.

  NO : Go to C8.

C2 CHECK THE AJAR SWITCH GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.
- Disconnect: Suspect Ajar Switch
- Measure the resistance between the suspect ajar switch, harness side and ground as follows:

Location	Connector-Pin	Circuit
LH front	C525-6	GD126 (BK/WH)
RH front	C603-6	GD139 (BK/YE)
LH rear	C704-6	GD126 (BK/WH)
RH rear	C804-6	GD139 (BK/YE)
Luggage compartment	C429-1	GD171 (BK/GY)

- **Is the resistance less than 5 ohms?**

  YES : Go to C3.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C3 CHECK THE AJAR SWITCH FOR VOLTAGE

- Measure the voltage between the suspect ajar switch, harness side and ground as follows:

Location	Suspect Ajar Switch Connector-Pin	Circuit
LH front	C525-8	CPL26 (GN/VT)
RH front	C603-8	CPL31 (WH)
LH rear	C704-8	CPL36 (GN)
RH rear	C804-8	CPL39 (YE)
Luggage compartment	C429-1	CPL44 (YE/OG)

- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new latch for the ajar switch in question. REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to C4.

C4 CHECK THE AJAR SWITCH CIRCUIT FOR AN OPEN

- Disconnect: SJB C2280c
- Measure the resistance between the suspect ajar switch, harness side and the SJB, harness side as follows:

Location	SJB Connector-Pin	Suspect Ajar Switch Connector-Pin	Circuit
LH front	C2280c-11	C525-8	CPL26 (GN/VT)
RH front	C2280c-12	C603-8	CPL31 (WH)
LH rear	C2280c-8	C704-8	CPL36 (GN)
RH rear	C2280c-7	C804-8	CPL39 (YE)
Luggage compartment	C2280c-6	C429-1	CPL44 (YE/OG)

- **Is the resistance less than 5 ohms?**

  YES : Go to C5.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C5 CHECK THE AJAR SWITCH OPERATION

- Connect: Suspect Ajar Switch
- Measure the resistance between the SJB, harness side and ground, while opening and closing the suspect door (or the luggage compartment) as follows:

Location	SJB Connector-Pin	Circuit
LH front	C2280c-11	CPL26 (GN/VT)
RH front	C2280c-12	CPL31 (WH)
LH rear	C2280c-8	CPL36 (GN)
RH rear	C2280c-7	CPL39 (YE)
Luggage compartment	C2280c-6	CPL44 (YE/OG)

- **Is the resistance less than 5 ohms when the suspect door (or the luggage compartment) is closed, and greater than 10,000 ohms when the suspect door (or the luggage compartment) is open?**

  YES : Go to C9.

  NO : INSTALL a new latch for the switch in question. REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article. CLEAR the DTCs. REPEAT the self-test.

C6 CHECK THE INSTRUMENT PANEL DIMMER SWITCH

- Key in OFF position.
- Disconnect: Instrument Panel Dimmer Switch C2065
- Observe the courtesy lamps.
- **Are the courtesy lamps still illuminated?**

  YES : Go to C7.

  NO : INSTALL a new instrument panel dimmer switch. REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article. CLEAR the DTCs. REPEAT the self-test.

C7 CHECK CIRCUIT CLN28 (GN/BU) FOR A SHORT TO GROUND

- Disconnect: SJB C2280d
- Observe the courtesy lamps.
- **Are the courtesy lamps still illuminated?**

  YES : Go to C9.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C8 CHECK CIRCUIT CLN26 (BU) FOR A SHORT TO VOLTAGE

- Key in OFF position.

- Disconnect: SJB C2280e
- Observe the courtesy lamps.
- **Are the courtesy lamps still illuminated?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to C9.

C9 CHECK FOR CORRECT SJB OPERATION

- Connect: Luggage Compartment Lid Ajar Switch C429 (if disconnected)
- Connect: Suspect Door Ajar Switch (if disconnected)
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: The Courtesy Lamps Do Not Turn On With One Door Open

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Door Locks for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Luggage Compartment Lid Release for schematic and connector information.

Normal Operation

When any door is open, including the luggage compartment lid, the ajar switch opens the circuit to the smart junction box (SJB). The SJB monitors the ajar circuits, and based on the ajar status, the SJB will supply voltage to the courtesy lamps on circuit CLN26 (BU).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Door ajar switch
- Luggage compartment lid ajar switch

- SJB

PINPOINT TEST D: THE COURTESY LAMPS DO NOT TURN ON WITH ONE DOOR OPEN

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

D1 CHECK THE AJAR SWITCH PIDs

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: SJB DataLogger
- Monitor the SJB ajar switch PIDs while opening and closing the suspect door or the luggage compartment lid as follows:

Suspect Ajar Switch	PID
LF door	D_DR_SW
RF door	P_DR_SW
LR door	LRDR_SW
RR door	RRDR_SW
Luggage compartment lid	DECKLID

- **Does the PID value agree with the ajar switch position?**

  YES : Go to D4.

  NO : Go to D2.

D2 CHECK THE DOOR AJAR SWITCH OPERATION

- Key in OFF position.
- Disconnect: Suspect Ajar Switch
- Observe the interior lamps.
- **Do the interior lamps illuminate with the suspect ajar switch disconnected?**

  YES : INSTALL a new door latch or luggage compartment lid latch for the suspect ajar switch. REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article. TEST the system for normal operation.

  NO : Go to D3.

D3 CHECK THE AJAR SWITCH CIRCUIT FOR A SHORT TO GROUND

- Disconnect: SJB C2280c
- Measure the resistance between the suspect ajar switch, harness side and ground as follows:

Location	Connector-Pin	Circuit

LF door	C525-8	CPL26 (GN/VT)
RF door	C603-8	CPL31 (WH)
LR door	C704-8	CPL36 (GN)
RR door	C804-8	CPL39 (YE)
Luggage compartment lid	C429-1	CPL44 (YE/OG)

- **Is the resistance greater than 10,000 ohms?**

  YES : Go to D4.

  NO : REPAIR the circuit. TEST the system for normal operation.

D4 CHECK FOR CORRECT SJB OPERATION

- Connect: Suspect Ajar Switch (If Disconnected)
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test E: The Demand Lamps Are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Interior Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) supplies voltage to the demand lamps on circuit CLN09 (YE/GN). The demand lamps are grounded through circuit GD139 (BK/YE). The glove compartment lamp (MKZ only) is case grounded.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB

PINPOINT TEST E: THE DEMAND LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

E1 CHECK THE OPERATION OF THE COURTESY LAMPS

- Key in ON position.
- Operate the courtesy lamps by opening the LF door.
- **Do the courtesy lamps illuminate?**

  YES : Go to E2.

  NO : Go to **Pinpoint Test A**.

E2 CHECK CIRCUIT CLN09 (YE/GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280e

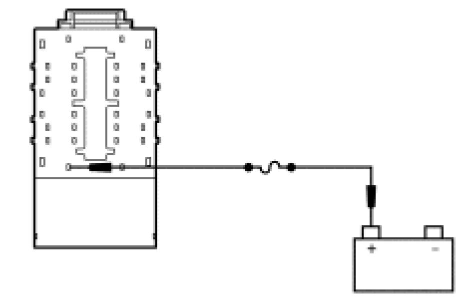

Fig. 4: Checking Circuit CLN09 (YE/GN) For An Open
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between the SJB C2280e-2, circuit CLN09 (YE/GN), harness side and battery positive.
- **Do the demand lamps illuminate?**

  YES : REMOVE the jumper wire. Go to E3.

  NO : REMOVE the jumper wire. REPAIR the circuit. TEST the system for normal operation.

E3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins

- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test F: An Individual Demand Lamp Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Interior Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) supplies voltage to the demand lamps on circuit CLN09 (YE/GN). The demand lamps are grounded through circuit GD139 (BK/YE). The glove compartment lamp (MKZ only) is case grounded.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Interior lamp

PINPOINT TEST F: AN INDIVIDUAL DEMAND LAMP IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

F1 CHECK CIRCUIT CLN09 (YE/GN) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Suspect Demand Lamp
- Key in ON position.
- Measure the voltage between the suspect demand lamp, harness side and ground as follows:

Location	Connector-Pin	Circuit
RH vanity mirror lamp	C906-1	CLN09 (YE/GN)
LH vanity mirror lamp	C907-1	CLN09 (YE/GN)
Front interior lamp	C930-2	CLN26 (BU)

Rear interior lamp	C901-3	CLN09 (YE/GN)
Glove compartment lamp	C254-1	CLN09 (YE/GN)

- **Is the voltage greater than 10 volts?**

  YES : Go to F2.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

F2 CHECK THE GROUND CIRCUIT FOR AN OPEN

- Measure the resistance between the suspect demand lamp connector, harness side and ground as follows:

Location	Connector-Pin	Circuit
RH vanity mirror lamp	C906-2	GD139 (BK/YE)
LH vanity mirror lamp	C907-2	GD139 (BK/YE)
Front interior lamp	C930-1	GD139 (BK/YE)
Rear interior lamp	C901-2	GD139 (BK/YE)
Glove compartment lamp	Case ground	-

- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new demand lamp for the suspect lamp. TEST the system for normal operation.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

Pinpoint Test G: The Illuminated Entry Is Inoperative When Using The Remote Keyless Entry (RKE) Transmitter

Normal Operation

The illuminated entry provides interior lighting whenever the smart junction box (SJB) receives a door unlock request from the RKE transmitter. The SJB provides voltage on circuit CLN26 (BU) for the courtesy lamps.

This pinpoint test is intended to diagnose the following:

- RKE system concern
- SJB

PINPOINT TEST G: THE ILLUMINATED ENTRY IS INOPERATIVE WHEN USING THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER

G1 CHECK FOR CORRECT RKE OPERATION

- Using the RKE transmitter, lock and unlock the doors.
- **Do the doors lock and unlock?**

  YES : Go to G2.

  NO : REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article to continue diagnosis of the RKE system.

G2 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test H: The Battery Saver Does Not Deactivate After Time-Out

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Interior Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) provides a battery saver function. The battery saver function provides automatic shutoff of the interior lamps (courtesy lamps and demand lamps) after a predetermined time has elapsed in order to save battery power.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB

PINPOINT TEST H: THE BATTERY SAVER DOES NOT DEACTIVATE AFTER TIME-OUT

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

H1 CHECK CIRCUIT CLN09 (YE/GN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280e
- Key in ON position.
- Operate the demand lamps.
- **Do the demand lamps illuminate?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to H2.

H2 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test I: The Puddle Lamps Are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Interior Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) provides voltage to the puddle lamps through circuit CLN26 (BU) whenever the courtesy lamps are active. The puddle lamps have separate ground circuits. The LH exterior mirror is grounded through circuit GD126 (BK/WH), and the RH exterior mirror is grounded through circuit GD139 (BK/YE).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Exterior mirror

PINPOINT TEST I: THE PUDDLE LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

I1 CHECK THE COURTESY LAMP OPERATION

- Operate the courtesy lamps by opening the LF door.
- **Do the courtesy lamps illuminate?**

  YES : Go to I2.

  NO : Go to **Pinpoint Test A**.

I2 CHECK CIRCUIT CLN26 (BU) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Suspect Exterior Mirror
- Operate the courtesy lamps by opening the LF door.
- Measure the voltage between the suspect exterior mirror, harness side and ground as follows:

Location	Connector-Pin	Circuit
RH exterior mirror (without memory)	C625-4	CLN26 (BU)
RH exterior mirror (with memory)	C626-5	CLN26 (BU)
LH exterior mirror (without memory)	C517-4	CLN26 (BU)
LH exterior mirror (with memory)	C522-5	CLN26 (BU)

- **Is the voltage greater than 10 volts?**

  YES : Go to I3.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

I3 CHECK THE GROUND CIRCUIT FOR AN OPEN

- Measure the resistance between the suspect exterior mirror, harness side and ground as follows:

Location	Connector-Pin	Circuit
RH		

exterior mirror (without memory)	C625-6	GD139 (BK/YE)
RH exterior mirror (with memory)	C626-7	GD139 (BK/YE)
LH exterior mirror (without memory)	C517-6	GD126 (BK/WH)
LH exterior mirror (with memory)	C522-7	GD126 (BK/WH)

- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new exterior mirror for the suspect exterior mirror. REFER to **REAR VIEW MIRRORS** article. TEST the system for normal operation.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

Pinpoint Test J: The Courtesy Lamps Are Inoperative From The Instrument Panel Dimmer Switch

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Interior Lamps for schematic and connector information.

Normal Operation

The smart junction box (SJB) monitors the instrument panel dimmer switch status on circuit CLN28 (GN/BU) to determine if the courtesy lamps are requested. Based on the instrument panel dimmer switch status, the SJB supplies voltage to the courtesy lamps through circuit CLN26 (BU).

This pinpoint test is intended to diagnose the following:

- Dimmable back lighting illumination system concern
- Wiring, terminals or connectors
- Instrument panel dimmer switch
- SJB

PINPOINT TEST J: THE COURTESY LAMPS ARE INOPERATIVE FROM THE INSTRUMENT PANEL DIMMER SWITCH

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

J1 CHECK THE DIMMABLE BACK LIGHTING ILLUMINATION

- Key in ON position.
- Turn the headlamps switch to the PARKING LAMPS ON position.
- Rotate the instrument panel dimmer switch and observe the instrument cluster illumination.
- **Does the instrument cluster illumination intensity agree with the instrument panel dimmer switch position?**

  YES : Go to J2.

  NO : REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article to continue diagnosis of the dimmable back lighting illumination.

J2 CHECK THE DIMMER SWITCH

- Key in OFF position.
- Disconnect: Dimmer Switch C2065

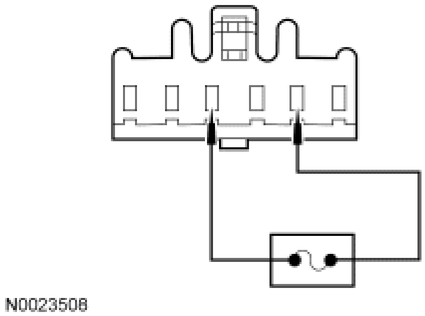

Fig. 5: Checking Dimmer Control Switch
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between the dimmer switch C2065-2, circuit CLN28 (BN/BU), harness side and the dimmer switch C2065-4, circuit CLN27 (WH/BN), harness side.
- **Do the courtesy lamps illuminate?**

  YES : INSTALL a new instrument panel dimmer switch. REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article. TEST the system for normal operation.

  NO : REMOVE the jumper wire. Go to J3.

J3 CHECK CIRCUIT CLN28 (GN/BU) FOR AN OPEN

- Key in OFF position.
- Disconnect: Instrument Panel Dimmer Switch C2065
- Disconnect: SJB C2280d

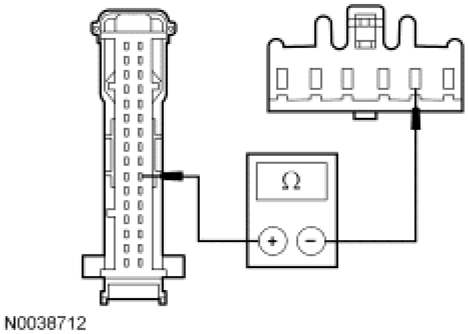

Fig. 6: Checking Circuit CLN28 (GN/BU) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280d-26, circuit CLN28 (GN/BU), harness side and the instrument panel dimmer switch C2065-2, circuit CLN28 (GN/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to J4.

  NO : REPAIR the circuit. TEST the system for normal operation.

J4 CHECK FOR CORRECT SJB OPERATION

- Connect: Instrument Panel Dimmer Switch C2065 (If Disconnected)
- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test K: The Ambient Lighting Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Interior Lamps for schematic and connector information.

Normal Operation

The ambient lighting module and switch receive voltage from the accessory delay relay on circuit CBX07 (GN/RD), which is circuit CBP02 (GN) at the smart junction box (SJB). The ambient lighting module supplies voltage and ground to the LEDs, located in the floor console. The ambient lighting switch can cycle through 7

color combinations or turn the ambient lighting off by sending a voltage signal to the ambient lighting module through circuit CLN54 (BN/YE). There are 3 different color LEDs (red, blue, and green) housed within each LED assembly. Ground is provided to the module and switch through circuit GD116 (BK/VT), which is circuit GD908 (BK) at the module and switch.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Ambient lighting switch
- Ambient lighting module

PINPOINT TEST K: THE AMBIENT LIGHTING IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

K1 CHECK CIRCUIT CBP08 (GY/YE)/CBX07 (GN/RD) FOR AN OPEN (TO AMBIENT LIGHTING MODULE)

- Key in OFF position.
- Disconnect: Ambient Lighting Module C3251
- Key in ON position.

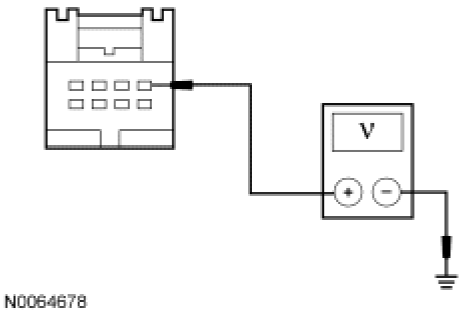

Fig. 7: Checking Circuit CBP08 (GY/YE)/CBX07 (GN/RD) For An Open (To Ambient Lighting Module)
Courtesy of FORD MOTOR CO.

- Measure the voltage between the ambient lighting module C3251-1, circuit CBX07 (GN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to K2.

  NO : REPAIR circuit CBX07 (GN/RD) or CBP08 (GY/YE). TEST the system for normal operation.

K2 CHECK THE INPUT FROM CIRCUIT CLN54 (BN/YE)

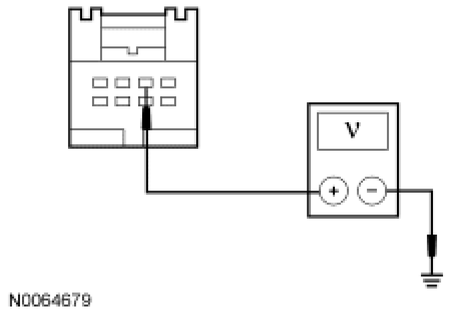

Fig. 8: Checking Input From Circuit CLN54 (BN/YE)
Courtesy of FORD MOTOR CO.

- While pressing and releasing the ambient lighting switch, measure the voltage between the ambient lighting module C3251-2, circuit CLN54 (BN/YE), harness side and ground.
- **Is the voltage greater than 10 volts with the switch pressed, and 0 volts with the switch released?**

  YES : Go to K3.

  NO : If voltage is always present, go to K4.

  If no voltage is present, go to K5.

K3 CHECK CIRCUIT GD908 (BK)/GD116 (BK/VT) FOR AN OPEN

- Key in OFF position.

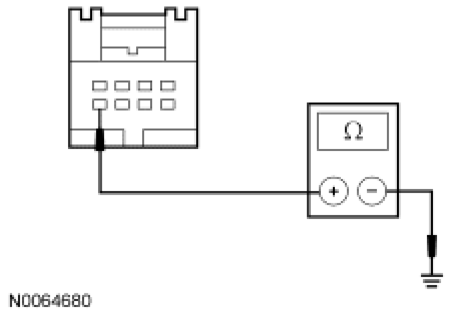

Fig. 9: Checking Circuit GD908 (BK)/GD116 (BK/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the ambient lighting module C3251-8, circuit GD908 (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to K7.

  NO : REPAIR circuit GD908 (BK) or GD116 (BK/VT). TEST the system for normal operation.

K4 CHECK CIRCUIT CLN54 (BN/YE) FOR A SHORT TO VOLTAGE

- Key in OFF position.

- Disconnect: Ambient Lighting Switch C3250
- Key in ON position.

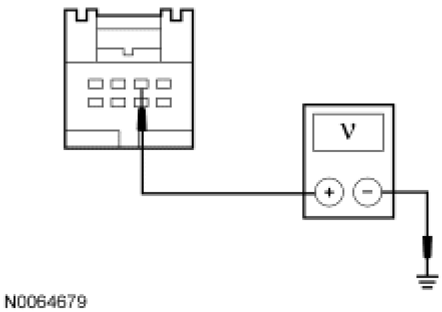

Fig. 10: Checking Circuit CLN54 (BN/YE) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the ambient lighting module C3251-2, circuit CLN54 (BN/YE), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : INSTALL a new ambient lighting switch. REFER to **Ambient Lighting Switch**. TEST the system for normal operation.

K5 CHECK CIRCUIT CBX07 (GN/RD) FOR AN OPEN (TO THE AMBIENT LIGHTING SWITCH)

- Disconnect: Ambient Lighting Switch C3250

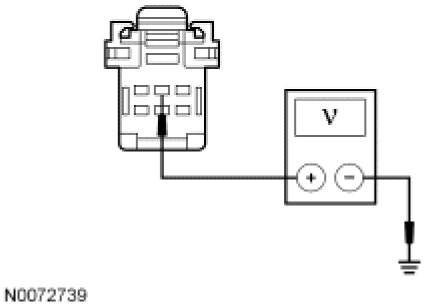

Fig. 11: Checking Circuit CBX07 (GN/RD) For An Open (To The Ambient Lighting Switch)
Courtesy of FORD MOTOR CO.

- Measure the voltage between the ambient lighting switch C3250-2, circuit CBX07 (GN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to K6.

  NO : REPAIR the circuit. TEST the system for normal operation.

K6 CHECK THE AMBIENT LIGHTING SWITCH

- Connect: Ambient Lighting Module C3251

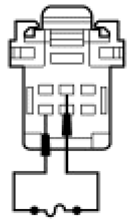

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Fig. 12: Checking Ambient Lighting Switch
Courtesy of FORD MOTOR CO.

- Connect and remove a fused jumper wire between the ambient lighting switch C3250-2, circuit CBX07 (GN/RD), harness side and the ambient lighting switch C3250-6, circuit CBX07 (GN/RD), harness side.
- **Do the ambient lighting LEDs illuminate and cycle through a color change each time the jumper wire is connected and removed?**

  YES : INSTALL a new ambient lighting switch. REFER to **Ambient Lighting Switch**. TEST the system for normal operation.

  NO : REPAIR circuit CLN54 (BN/YE) for an open. TEST the system for normal operation.

K7 CHECK THE AMBIENT LIGHTING HARNESS

- Key in OFF position.

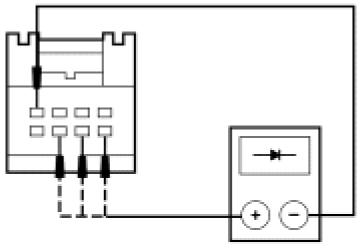

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Fig. 13: Checking Diode Circuits
Courtesy of FORD MOTOR CO.

- Check the diode circuits between the ambient lighting module, harness side as follows:

Connector-Pin/Circuit	Connector-Pin/Circuit
C3251-5 CLN45 (GN)	C3251-4 RLN44 (BN)

C3251-6 CLN45 (GN)	C3251-4 RLN44 (BN)
C3251-7 CLN44 (OG)	C3251-4 RLN44 (BN)

- **Does the meter indicate that each circuit is OK?**

  YES : Go to K8.

  NO : INSTALL a new ambient lighting harness. TEST the system for normal operation.

K8 CHECK FOR CORRECT AMBIENT LIGHTING MODULE OPERATION

- Connect: Ambient Lighting Switch C3250
- Disconnect the ambient lighting module connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the ambient lighting module connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ambient lighting module. REFER to **Ambient Lighting Module**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test L: The Ambient Lighting Does Not Cycle Through All Color Combinations

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Interior Lamps for schematic and connector information.

Normal Operation

The ambient lighting switch sends a voltage signal to the ambient lighting module on circuit CLN54 (BN/YE) when the switch is pressed. Each press of the switch either changes the color or turns the system off/on.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Ambient lighting switch
- Ambient lighting module

PINPOINT TEST L: THE AMBIENT LIGHTING DOES NOT CYCLE THROUGH ALL COLOR COMBINATIONS

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

L1 CHECK THE INPUT FROM CIRCUIT CLN54 (BN/YE)

- Key in OFF position.
- Disconnect: Ambient Lighting Module C3251
- Key in ON position.

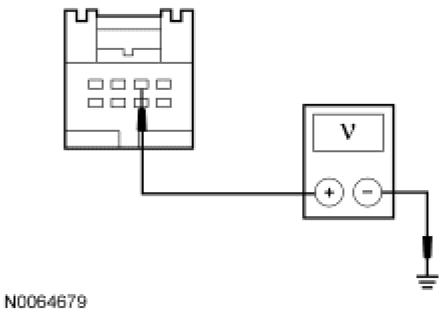

Fig. 14: Checking Input From Circuit CLN54 (BN/YE)
Courtesy of FORD MOTOR CO.

- While pressing and releasing the ambient lighting switch, measure the voltage between the ambient lighting module C3251-2, circuit CLN54 (BN/YE), harness side and ground.
- **Is the voltage greater than 10 volts with the switch pressed, and 0 volts with the switch released?**

  YES : Go to L2.

  NO : If voltage is always present, go to L3.

  If no voltage is present, go to L4.

L2 CHECK THE AMBIENT LIGHTING HARNESS

- Key in OFF position.

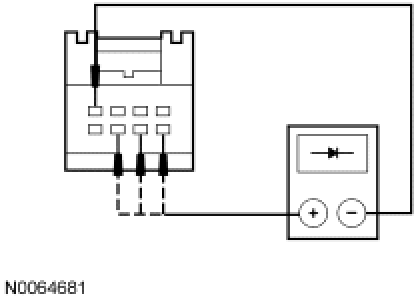

Fig. 15: Checking Diode Circuits
Courtesy of FORD MOTOR CO.

- Check the diode circuits between the ambient lighting module, harness side as follows:

Connector-Pin/Circuit	Connector-Pin/Circuit
C3251-5 CLN45 (GN)	C3251-4 RLN44 (BN)
C3251-6 CLN45 (GN)	C3251-4 RLN44 (BN)
C3251-7 CLN44 (OG)	C3251-4 RLN44 (BN)

- **Does the meter indicate that each circuit is OK?**

  YES : Go to L6.

  NO : REPAIR or INSTALL a new ambient lighting harness. TEST the system for normal operation.

L3 CHECK CIRCUIT CLN54 (BN/YE) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Ambient Lighting Switch C3250
- Key in ON position.

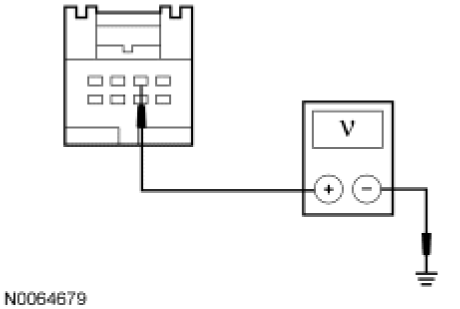

Fig. 16: Checking Circuit CLN54 (BN/YE) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the ambient lighting module C3251-2, circuit CLN54 (BN/YE), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : INSTALL a new ambient lighting switch. REFER to **Ambient Lighting Switch**. TEST the system for normal operation.

L4 CHECK CIRCUIT CPX07 (GN/RD) FOR AN OPEN (TO THE AMBIENT LIGHTING SWITCH)

- Key in OFF position.
- Disconnect: Ambient Lighting Switch C3250
- Key in ON position.

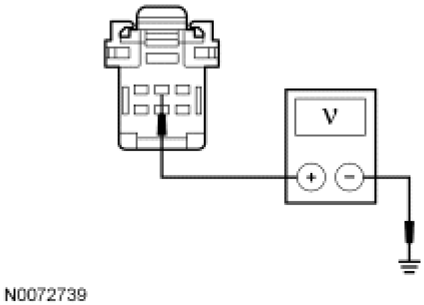

Fig. 17: Checking Circuit CPX07 (GN/RD) For An Open (To The Ambient Lighting Switch)
Courtesy of FORD MOTOR CO.

- Measure the voltage between the ambient lighting switch C3250-2, circuit CBX07 (GN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to L5.

  NO : REPAIR the circuit. TEST the system for normal operation.

L5 CHECK THE AMBIENT LIGHTING SWITCH

- Connect: Ambient Lighting Module C3251

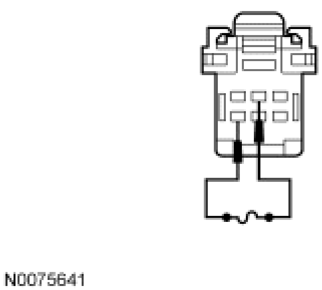

Fig. 18: Checking Ambient Lighting Switch
Courtesy of FORD MOTOR CO.

- Connect and remove a fused jumper wire between the ambient lighting switch C3250-2, circuit CBX07 (GN/RD), harness side and the ambient lighting switch C3250-6, circuit CLN54 (BN/YE), harness side.
- **Do the ambient lighting LEDs illuminate and cycle through a color change each time the jumper wire is connected and removed?**

  YES : INSTALL a new ambient lighting switch. REFER to **Ambient Lighting Switch**. TEST the system for normal operation.

NO : REPAIR circuit CLN54 (BN/YE) for an open. TEST the system for normal operation. TEST the system for normal operation.

L6 CHECK FOR CORRECT AMBIENT LIGHTING MODULE OPERATION

- Connect: Ambient Lighting Switch C3250
- Disconnect the ambient lighting module connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the ambient lighting module connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ambient lighting module. REFER to **Ambient Lighting Module**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

REMOVAL AND INSTALLATION

INTERIOR LAMP - FRONT

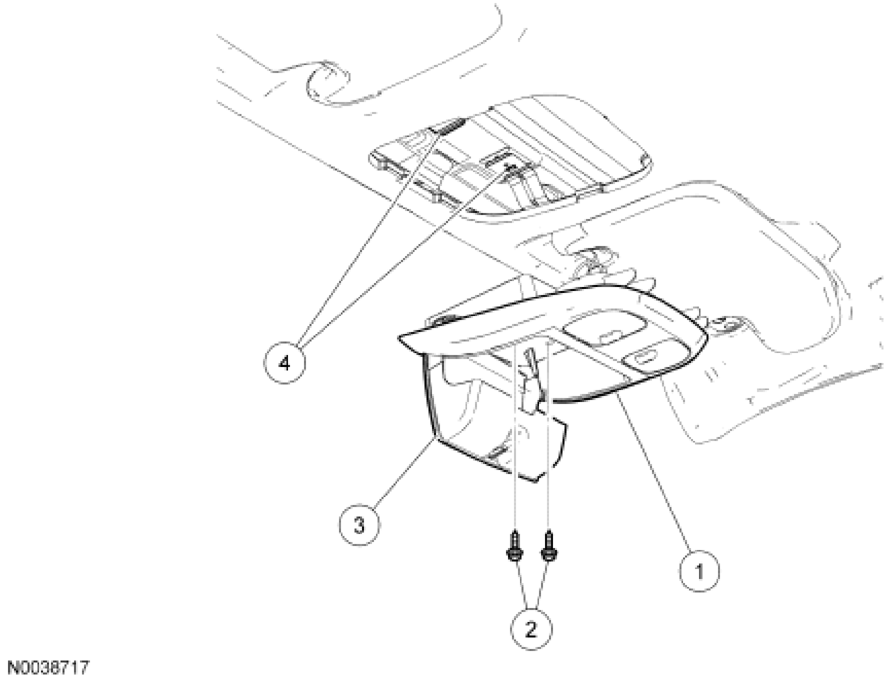

Fig. 19: Exploded View Of Front Interior Lamp
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	54519A70	Overhead console
2	-	Overhead console screws (2 required)
3	-	Overhead console storage door (part of 54519A70)
4	-	Overhead console retainer brackets

REMOVAL AND INSTALLATION

1. Open the overhead console storage door to access the screws.
   - Remove the 2 screws.
2. Pull the overhead console down and remove the console from the headliner retainer.
   - Disconnect the electrical connector.
3. To install, reverse the removal procedure.

INTERIOR LAMP - REAR

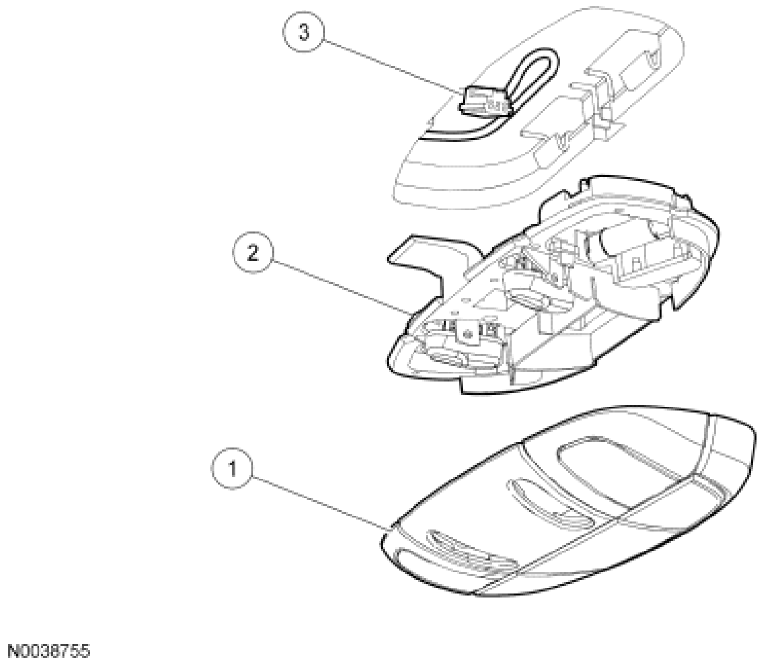

Fig. 20: Exploded View Of Rear Interior Lamp
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	13783	Rear interior lamp lens
2	13776	Rear interior lamp
3	-	Rear interior lamp electrical connector

		(part of 14334)

REMOVAL AND INSTALLATION

1. Remove the rear interior lamp lens.

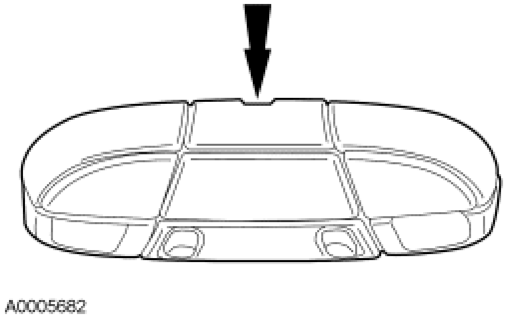

Fig. 21: Identifying Rear Interior Lamp Lens
Courtesy of FORD MOTOR CO.

2. Release the 2 retaining clips (through the access holes) and remove the rear interior lamp assembly.
   - Disconnect the electrical connector.

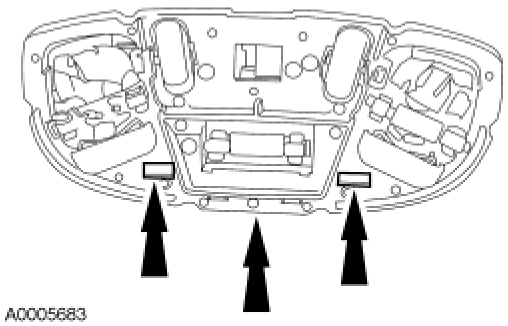

Fig. 22: Locating Electrical Connector Retaining Clips
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.

AMBIENT LIGHTING MODULE

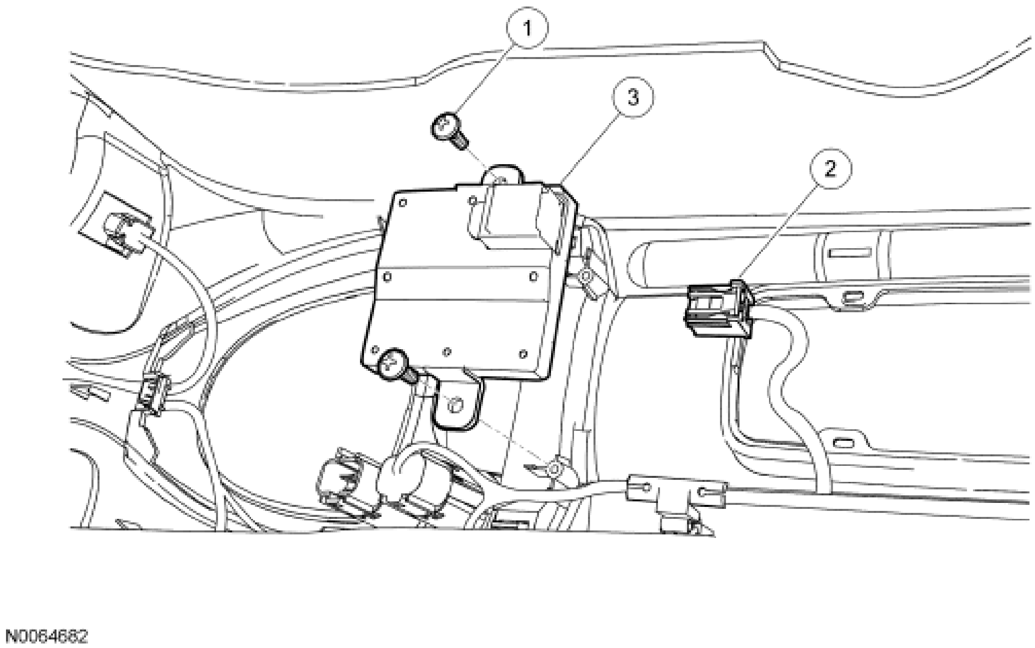

Fig. 23: Identifying Ambient Lighting Module Components
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701679	Ambient lighting module screws (2 required)
2	-	Ambient lighting module electrical connector (part of 14D375)
3	13C788	Ambient lighting module

REMOVAL AND INSTALLATION

1. Remove the floor console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Remove the 2 screws and the ambient lighting module.
   - Disconnect the electrical connector.
3. To install, reverse the removal procedure.

AMBIENT LIGHTING SWITCH

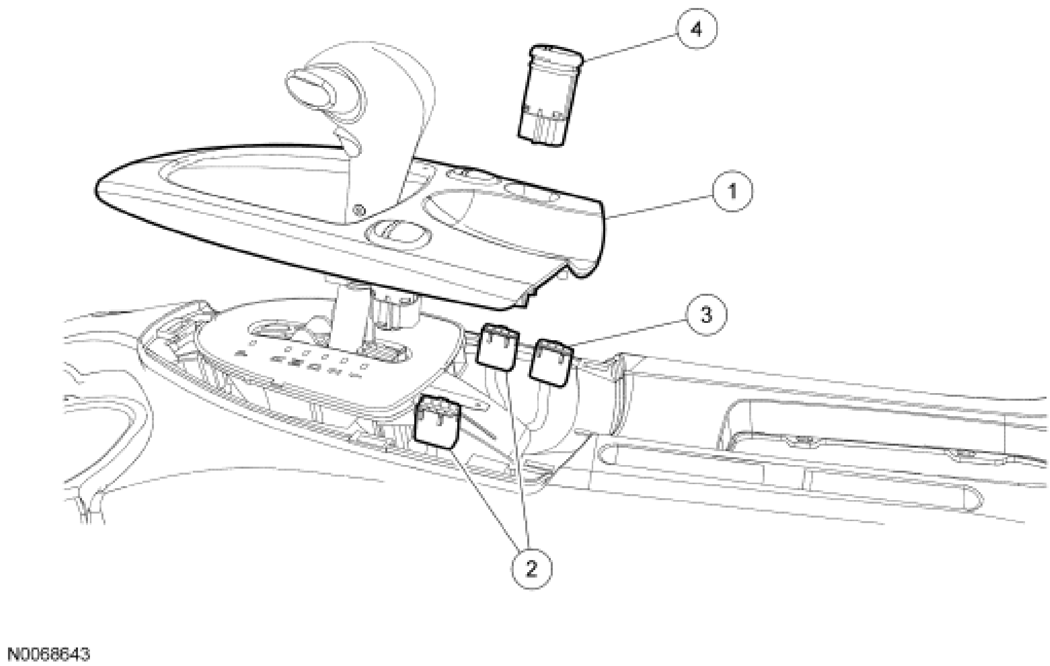

Fig. 24: Identifying Ambient Lighting Switch Components
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	044D90	Floor console trim panel
2	-	Center console electrical connectors (part of 14014)
3	-	Ambient lighting switch electrical connector (part of 14D375)
4	-	Ambient lighting switch

REMOVAL AND INSTALLATION

NOTE: The trim panel is removed by grasping the sides and pulling upward.

1. Remove the floor console trim panel.
   - Disconnect the electrical connectors.
2. Squeeze the retaining tabs and remove the ambient lighting switch.
3. To install, reverse the removal procedure.

2008 ACCESSORIES & BODY, CAB

Interior Trim & Ornamentation - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Assist handle bolts	5	-	44
Child seat tether anchor bolts	22	16	-
Safety belt bolt	54	40	-

REMOVAL AND INSTALLATION

INTERIOR TRIM - EXPLODED VIEW

NOTE: **Fusion shown, Milan and MKZ similar.**

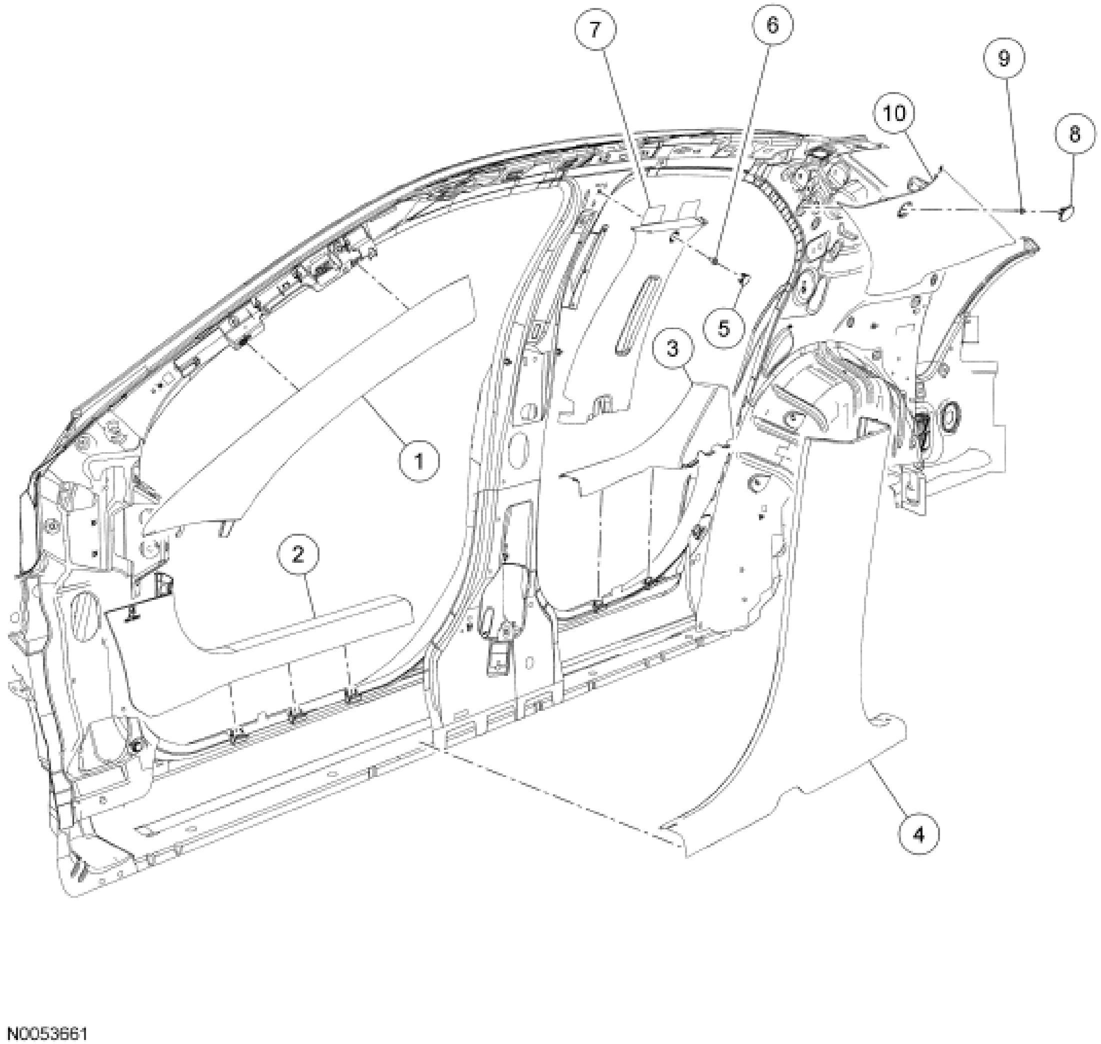

Fig. 1: Exploded View Of Interior Trim
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	03598 RH/ 03599 LH	A-pillar trim panel
2	13208 RH/ 13209 LH	Front door scuff plate
3	13228 RH/ 13229 LH	Rear door scuff plate
4	24346 RH/ 24347 LH	B-pillar lower trim panel
5	672A40A	B-pillar trim panel screw cover
6	W705604	B-pillar trim panel screw
7	24356 RH/ 24357 LH	B-pillar upper trim panel
8	672A40B	C-pillar trim panel screw cover
9	W705604	C-pillar trim panel screw
10	52018 RH/ 52019 LH	C-pillar trim panel

1. For additional information, refer to the procedures.

A-PILLAR TRIM PANEL

NOTE: This procedure is for vehicles equipped with side air curtains. On vehicles without side air curtains, the A-pillar trim panel is easier to remove and the retainers are reusable.

NOTE: The A-pillar trim panel is held in place by a clip that is snapped to the back of the panel. When installing the existing trim panel, a new clip must be installed.

NOTE: When removing the A-pillar trim panel, use a gentle side-to-side rocking motion to free the clip from the trim panel.

1. Remove the A-pillar trim panel and the clip from the sheet metal.
   - Use a new A-pillar trim panel clip when installing.
2. To install, reverse the removal procedure.
   - Align attachment clips to the holes and snap in place.

B-PILLAR TRIM PANEL

REMOVAL AND INSTALLATION

1. Position the front seats in the full forward position.

NOTE: Inspect the safety belt D-ring cover for damage. If the safety belt D-ring cover does not remain in place, install a new cover.

2. Remove the safety belt D-ring cover and remove the safety belt bolt.
   - To install, tighten to 54 Nm (40 lb-ft).
3. Position the front and rear door weatherstrips aside.
4. Remove the front door scuff plate trim panel.
5. Remove the rear door scuff plate trim panel.
6. Remove the lower B-pillar trim panel.
   - Slide the lower B-pillar trim panel down to disengage it from the upper B-pillar trim panel.
7. Remove the upper B-pillar trim panel.
   - Remove the screw cover.
   - Remove the screw.

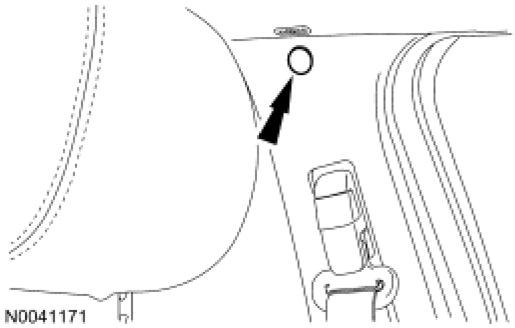

Fig. 2: Locating Screw Cover
Courtesy of FORD MOTOR CO.

8. To install, reverse the removal procedure.

C-PILLAR TRIM PANEL

REMOVAL AND INSTALLATION

1. Position the rear door weatherstrip aside.
2. Remove the screw cover.
3. Remove the screw.
4. Remove the C-pillar trim panel.
5. To install, reverse the removal procedure.

DOOR TRIM PANEL - FRONT

NOTE: Fusion shown, Milan and MKZ similar.

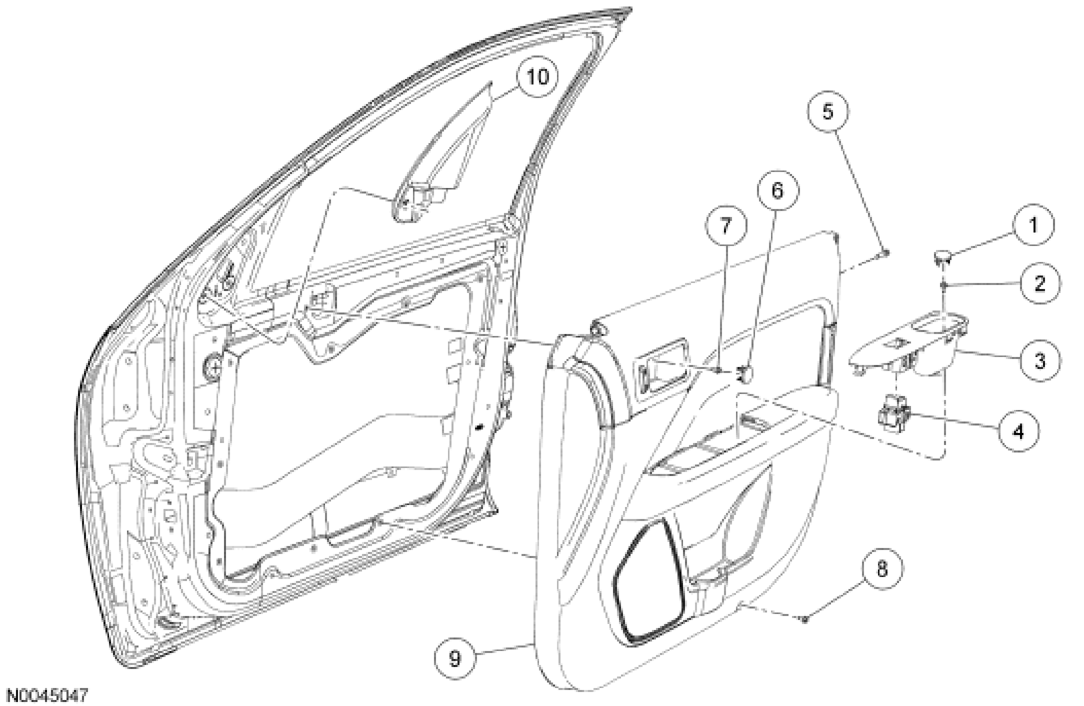

Fig. 3: Exploded View Of Front Door Trim Panel
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Front door inside handle bezel screw cover
2	W703268	Front door inside handle bezel screw
3	54266B	Front door inside handle bezel
4	14529B	Front door window switch
5	W706476	Front door trim panel upper screw
6	-	Front door handle screw cover
7	W505942	Front door handle screw
8	W706476	Front door trim panel lower screw
9	5423942	Front door trim panel
10	17K709	Front door trim sail panel

REMOVAL AND INSTALLATION

NOTE: RH side shown, LH side similar.

1. Remove the front door handle bezel screw cover.
2. Remove the front door inside handle bezel screw.
3. Remove the front door inside handle bezel.
    - Lift upward on the rear of the front door inside handle bezel.

- Disconnect the electrical connector.

4. Remove the front door handle screw cover.
5. Remove the front door handle screw.
6. Remove the front door trim panel upper screw.
7. Remove the front door trim panel lower screw.

NOTE: The back of the front door trim panel shown with the location of the front door trim panel pin-type retainers indicated.

8. Remove the front door trim panel.
   - Pull the front door trim panel outward to release the front door trim panel pin-type retainers.
   - Disconnect the electrical connector.

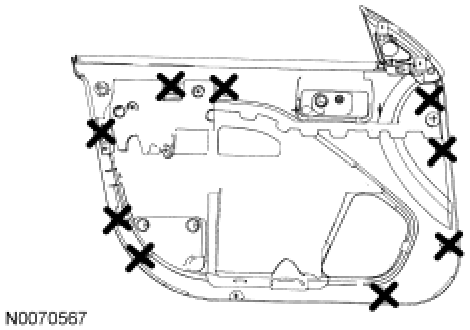

Fig. 4: Locating Front Door Trim Panel Pin-Type Retainers
Courtesy of FORD MOTOR CO.

9. To install, reverse the removal procedure.

DOOR TRIM PANEL - REAR

NOTE: Fusion shown, Milan and MKZ similar.

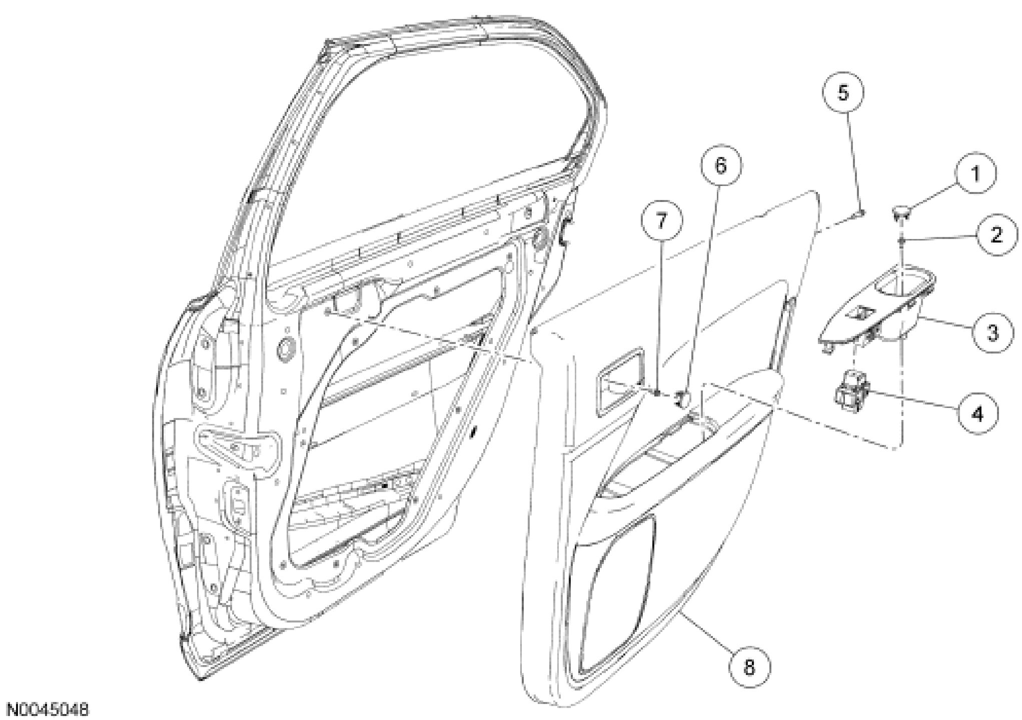

Fig. 5: Exploded View Of Rear Door Trim Panel
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Rear door inside handle bezel screw cover
2	W703268	Rear door inside handle bezel screw
3	54266	Rear door inside handle bezel
4	14529	Rear door window switch
5	W505942	Rear door trim panel upper screw
6	-	Rear door handle screw cover
7	W706476	Rear door handle screw
8	5427406	Rear door trim panel

REMOVAL AND INSTALLATION

NOTE: RH side shown, LH side similar.

1. Remove the rear door inside handle bezel screw cover.
2. Remove the upper rear door inside handle bezel screw.
3. Remove the rear door inside handle bezel.
   - Lift upward on the rear of the rear door inside handle bezel.
   - Disconnect the electrical connector.
4. Remove the rear door handle screw cover.

5. Remove the rear door handle screw.
6. Remove the rear door trim panel upper screw.

NOTE: **The back of the rear door trim panel shown with the location of the rear door trim panel pin-type retainers indicated.**

7. Remove the rear door trim panel.
   - Pull the rear door trim panel outward to release the rear door trim panel pin-type retainers.

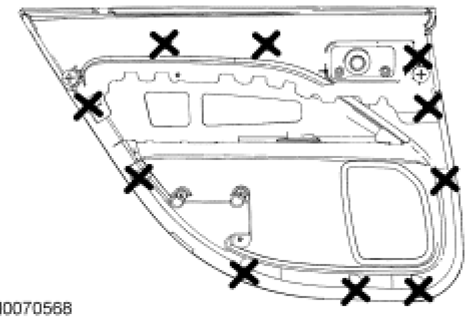

Fig. 6: Locating Rear Door Trim Panel Pin-Type Retainers
Courtesy of FORD MOTOR CO.

8. To install, reverse the removal procedure.

HEADLINER

NOTE: **Headliner with moon roof shown, headliner without moon roof similar.**

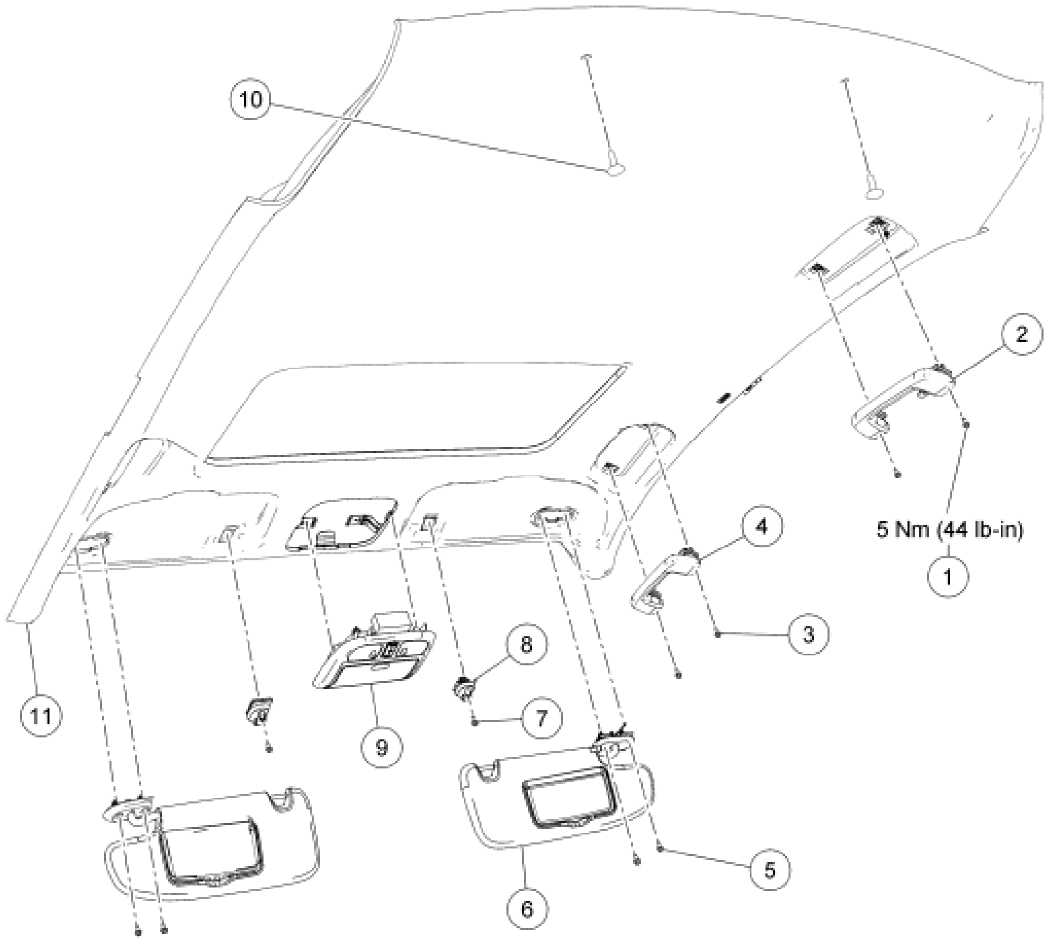

Fig. 7: Exploded View Of Headliner With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W504265	Assist handle bolt (2 required)
2	31406B RH/ 31407B LH	Rear assist handle
3	W504265	Assist handle bolt (2 required)
4	31406A RH/ 31407A LH	Front assist handle
5	W505003	Sun visor screw (2 required)
6	04104 RH/ 04105 LH	Sun visor
7	W505003	Sun visor arm clip screw
8	04132	Sun visor arm clip
9	519A70	Overhead console
10	W709571	Push pin retainer (2 required)

11	51916	Headliner

REMOVAL AND INSTALLATION

1. Remove the driver seat and rear seat cushion. For additional information, refer to **SEATING** article.
2. Position the passenger seat fully rearward and recline fully.
3. Open the 4 passenger assist handle covers.
    - Remove the bolts and remove the handles.
        - To install, tighten to 5 Nm (44 lb-in).

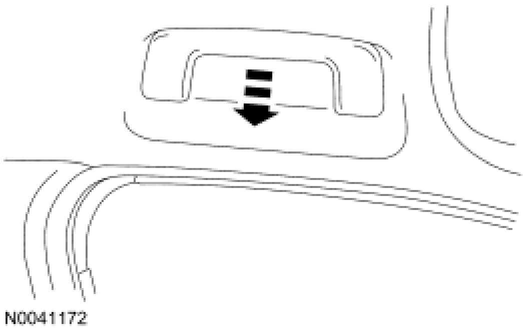

Fig. 8: Removing Handles
Courtesy of FORD MOTOR CO.

4. Remove the A-pillar trim panels. For additional information, refer to **A-Pillar Trim Panel**.
5. Disconnect the wire harness connector and the 2 pushpins.

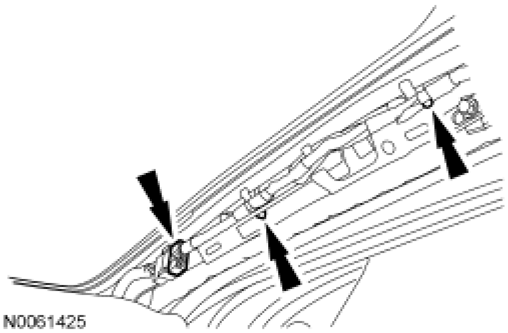

Fig. 9: Locating Wire Harness Pushpins
Courtesy of FORD MOTOR CO.

6. If equipped, disconnect the automatic dimming rear view mirror electrical connectors.

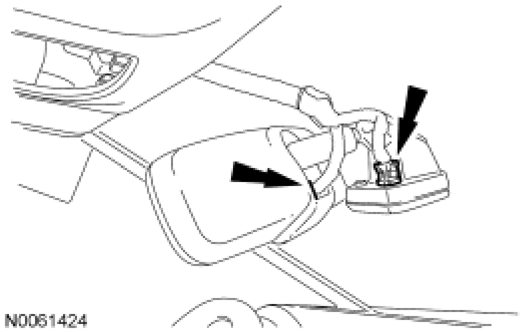

Fig. 10: Locating Rear View Mirror Electrical Connectors
Courtesy of FORD MOTOR CO.

7. Remove the B-pillar trim panels. For additional information, refer to **B-Pillar Trim Panel**.
8. Remove the C-pillar trim panels. For additional information, refer to **C-Pillar Trim Panel**.
9. Remove the overhead console.
   - Disconnect the electrical connector.
10. Remove the sun visors and the sun visor clips.
    - If equipped, disconnect the electrical connectors.
11. Remove the 2 headliner push pin retainers at the rear.
12. If equipped, position the headliner forward to gain access to disconnect the roof opening panel motor electrical connector.

NOTE: To avoid bending or crimping the headliner, an assistant is required for this step.

13. Remove the headliner through the LH rear door.
14. To install, reverse the removal procedure.

PARCEL SHELF

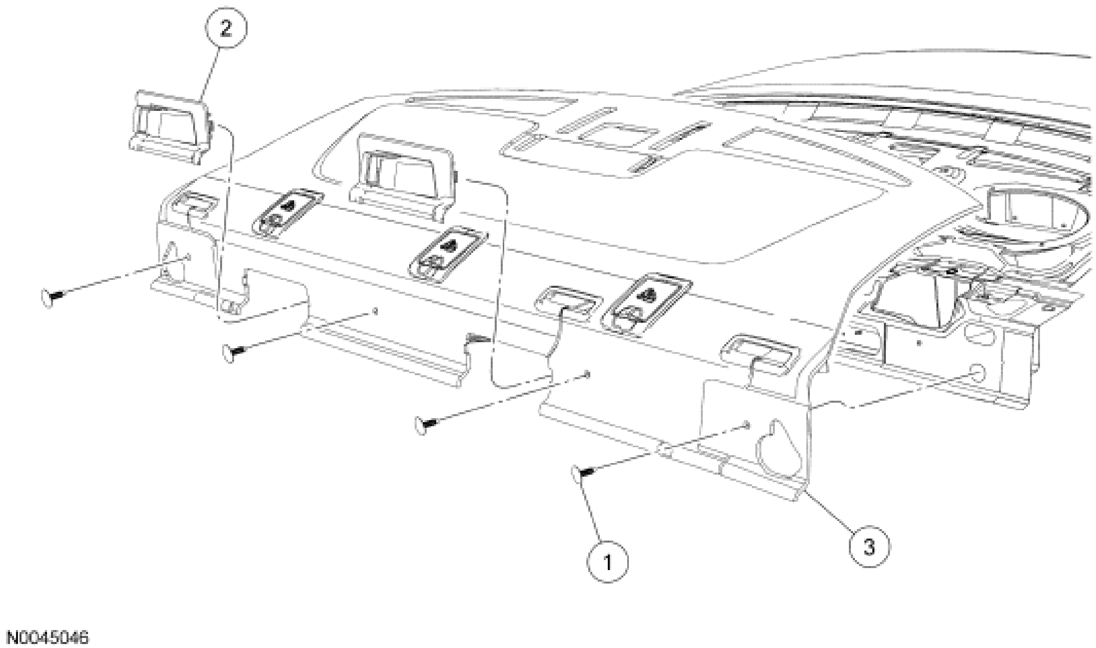

Fig. 11: Exploded View Of Parcel Shelf
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W706635	Parcel shelf push pin (4 required)
2	63874	Parcel shelf seat belt guide (2 required)
3	46668	Parcel shelf

REMOVAL AND INSTALLATION

1. Remove the C-pillar trim panels. For additional information, refer to **C-Pillar Trim Panel**.
2. Remove the rear seat bolsters. For additional information, refer to **SEATING** article.
3. Fold the rear seats down.
4. Remove the seat back latch covers.
5. Remove the high mounted stoplamp. For additional information, refer to **EXTERIOR LIGHTING** article.
6. Remove the 4 pushpins.
7. Thread the seat belts through the guides.
8. To install, reverse the removal procedure.

REMINDER INDICATOR RESET PROCEDURES

Ford / Lincoln / Mercury - 1985-14

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE

NOTE: **CHANGE OIL SOON/OIL CHANGE REQUIRED messages can also refer to Oil Life monitoring systems.**

NOTE: **To determine the appropriate reset procedure, refer to CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE RESET INDEX. Only vehicles listed in this index have a Change Oil Soon/Oil Change Required Message reset.**

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE RESET INDEX

Model & Year	Reset Procedure
Aviator	
2003-05	Change Oil Soon/Oil Change Required Message - Procedure 4
Crown Victoria	
2006-11	Change Oil Soon/Oil Change Required Message - Procedure 1
C-Max	
2013-14	Change Oil Soon/Oil Change Required Message - Procedure 5
E-Series	
2009-14	Change Oil Soon/Oil Change Required Message - Procedure 10
Edge	
2011-14	Change Oil Soon/Oil Change Required Message - Procedure 14
Escape	
2005-07	Change Oil Soon/Oil Change Required Message - Procedure 3
2008-12	Change Oil Soon/Oil Change Required Message - Procedure 4
2013-14	Change Oil Soon/Oil Change Required Message - Procedure 5
Expedition Series	
2007-14 W/Message Center Cluster	Change Oil Soon/Oil Change Required Message - Procedure 4
2007-14 W/Base Inst. Cluster	Change Oil Soon/Oil Change Required Message - Procedure 10
Explorer	
1996-01	Change Oil Soon/Oil Change Required Message - Procedure 9
2002-04	Change Oil Soon/Oil Change Required Message - Procedure 3
2005	Change Oil Soon/Oil Change Required Message - Procedure 11
2006-12	Change Oil Soon/Oil Change Required Message - Procedure 12
2013-14	Change Oil Soon/Oil Change Required Message - Procedure 14
Explorer Sport Trac	

2002-04	**Change Oil Soon/Oil Change Required Message - Procedure 3**
2005	**Change Oil Soon/Oil Change Required Message - Procedure 11**
2007-10	**Change Oil Soon/Oil Change Required Message - Procedure 12**
F-Series Trucks	
2008-10	**Change Oil Soon/Oil Change Required Message - Procedure 13**
2011-12	**Change Oil Soon/Oil Change Required Message - Procedure 15**
F-150	
2013-14	**Change Oil Soon/Oil Change Required Message - Procedure 15**
F-250 To F-550	
2013-14	**Change Oil Soon/Oil Change Required Message - Procedure 23**
Fiesta	
2011-13	**Change Oil Soon/Oil Change Required Message - Procedure 7**
2014	**Change Oil Soon/Oil Change Required Message - Procedure 5**
Five Hundred	
2005-07	**Change Oil Soon/Oil Change Required Message - Procedure 2**
Flex	
2009-12	**Change Oil Soon/Oil Change Required Message - Procedure 4**
2013-14	**Change Oil Soon/Oil Change Required Message - Procedure 14**
Focus	
2012-14	**Change Oil Soon/Oil Change Required Message - Procedure 5**
Freestar	
2005-07	**Change Oil Soon/Oil Change Required Message - Procedure 2**
Freestyle	
2005-07	**Change Oil Soon/Oil Change Required Message - Procedure 2**
Fusion	
2010-12	**Change Oil Soon/Oil Change Required Message - Procedure 6**
2013	**Change Oil Soon/Oil Change Required Message - Procedure 5**
2014	**Change Oil Soon/Oil Change Required Message - Procedure 14**
Grand Marquis	
2006-11	**Change Oil Soon/Oil Change Required Message - Procedure 1**
LS	
2000-06	**Change Oil Soon/Oil Change Required Message - Procedure 17**
Mariner	
2005-07	**Change Oil Soon/Oil Change Required Message - Procedure 20**
2008-11	**Change Oil Soon/Oil Change Required Message - Procedure 3**
Mark VIII	
1993-98	**Change Oil Soon/Oil Change Required Message - Procedure 18**
Milan	
2010-11	**Change Oil Soon/Oil Change Required Message - Procedure 6**
MKS	
2009-12	**Change Oil Soon/Oil Change Required Message - Procedure 4**
2013-14	

	Change Oil Soon/Oil Change Required Message - Procedure 14
MKT	
2010-12	**Change Oil Soon/Oil Change Required Message - Procedure 4**
2013-14	**Change Oil Soon/Oil Change Required Message - Procedure 14**
MKX	
2011	**Change Oil Soon/Oil Change Required Message - Procedure 15**
2012-14	**Change Oil Soon/Oil Change Required Message - Procedure 14**
MKZ	
2010-12	**Change Oil Soon/Oil Change Required Message - Procedure 6**
2013-14	**Change Oil Soon/Oil Change Required Message - Procedure 14**
Montego	
2005-07	**Change Oil Soon/Oil Change Required Message - Procedure 11**
Monterey	
2004-07	**Change Oil Soon/Oil Change Required Message - Procedure 19**
Mountaineer	
2005	**Change Oil Soon/Oil Change Required Message - Procedure 11**
2006-07	**Change Oil Soon/Oil Change Required Message - Procedure 12**
2008-10	**Change Oil Soon/Oil Change Required Message - Procedure 21**
Mustang (1)	
2010-14	**Change Oil Soon/Oil Change Required Message - Procedure 6**
Navigator	
2003-04	**Change Oil Soon/Oil Change Required Message - Procedure 16**
2007-14	**Change Oil Soon/Oil Change Required Message - Procedure 10**
Police Interceptor Sedan & Utility	
2014	**Change Oil Soon/Oil Change Required Message - Procedure 8**
Sable	
2003-05	**Change Oil Soon/Oil Change Required Message - Procedure 22**
2008-09	**Change Oil Soon/Oil Change Required Message - Procedure 3**
Taurus	
2008-09	**Change Oil Soon/Oil Change Required Message - Procedure 3**
2010-13	**Change Oil Soon/Oil Change Required Message - Procedure 4**
2014	**Change Oil Soon/Oil Change Required Message - Procedure 14**
Taurus X	
2008-09	**Change Oil Soon/Oil Change Required Message - Procedure 3**
Town Car	
2006-11	**Change Oil Soon/Oil Change Required Message - Procedure 1**
Transit Connect	
2014	**Change Oil Soon/Oil Change Required Message - Procedure 5**
Windstar	
1999-03	**Change Oil Soon/Oil Change Required Message - Procedure 3**

Shelby models are not equipped with the oil life monitor option.

(1)

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 1

Oil Life Reset:

1. Press the SETUP button to display PRESS SELECT TO BEGIN SYSTEM CHECK.
2. Press the SELECT button to display OIL LIFE - PRESS RESET IF NEW OIL.
3. Press and hold the RESET button until OIL LIFE SET TO 100% is displayed.

Oil Life Start Value:

1. Press the SETUP button until OIL LIFE START VALUE PRESS SELECT TO CHANGE is displayed.
2. Press and release the SELECT button until the desired start value is displayed.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 2

Oil Life Reset - Base Instrument Cluster

1. Press and release the ODO/TRIP button to toggle between the odometer and trip odometer displays.
2. Press and release the ODO/TRIP button again to toggle between the trip odometer display and the OIL LIFE XX% display.
3. Press and hold the ODO/TRIP button for approximately 2 seconds or longer until OIL LIFE 100% is displayed.
4. Press and release the ODO/TRIP button to return to the odometer display.

Oil Life Reset - Message Center Instrument Cluster

1. Press and release the SETUP button until OIL LIFE XX% RESET IF NEW is displayed.
2. Press and release the RESET button until IF NEW OIL HOLD RESET is displayed (On Freestar & Freestyle: HOLD RESET TO CONFIRM).
3. Press and hold the RESET button until OIL LIFE SET TO 100% is displayed.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 3

Oil Life Reset:

NOTE: The XXX's in the steps below represent a numeric value and displays the correct number in a percentage. For example, OIL LIFE = XXX% may display OIL LIFE = 45%.

1. Press and release the SETUP button until SYSTEM CHECK is displayed.
2. Press and release the SETUP button again to display OIL LIFE = XXX% HOLD RESET = NEW.
3. Press and hold the RESET button for 2 seconds and release to reset the oil life to 100%. "OIL LIFE SET

TO 100%" is displayed.

Oil Life Start Value:

NOTE: The oil life start value is used to reset the oil life value back to the maximum if the value was previously changed, or to lower the value by 10% increments down to 10%.

1. Press and release the SETUP button until SYSTEM CHECK is displayed.
2. Press and release the SETUP button again to display OIL LIFE = XXX% HOLD RESET = NEW.
3. Press and hold the RESET button for 2 seconds and release to reset the oil life to 100%.
4. Press and release the RESET button to lower the percentage by 10% (down to 10%) for each button press or return the value to 100%.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 4

Oil Life Reset:

1. Press and release the SETUP button twice until OIL LIFE = XXX% HOLD RESET = NEW is displayed.
2. Press and hold the RESET button for 2 seconds until OIL LIFE SET TO 100% is displayed to reset the oil life to 100%

Oil Life Start Value:

NOTE: The oil life start value is used to reset the oil life value back to the maximum if the value was previously changed, or to lower the value by 10% increments down to 10%.

1. Press and release the SETUP button twice until OIL LIFE = XXX% HOLD RESET = NEW is displayed.
2. Press and hold the RESET button for 2 seconds until OIL LIFE SET TO 100% is displayed to reset the oil life to 100%.
3. Release the RESET button then press and release the RESET button to lower the percentage by 10% (down to 10%) for each button press or return the value to 100%.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 5

NOTE: This procedure resets the oil life telltale in the Instrument Panel Cluster (IPC), and the oil change reminder message in the message center display.

1. Turn the ignition switch to the RUN position (do not start the engine)

   NOTE: For vehicles with push-button start, press and hold the start button for two seconds without pressing the brake pedal. Do not attempt to start the engine.

2. Press the brake and accelerator pedals at the same time.
3. Keep the pedals fully depressed.
4. After three seconds, the "Service: Oil reset in prog." message will be displayed.
5. After 25 seconds, the "Service: Oil reset complete" message will be displayed.
6. Release both the accelerator and brake pedals.
7. The "Service: Oil reset complete" message will no longer be displayed.
8. Rotate the key to the OFF position.

NOTE: For vehicles with push-button start, push the start/stop switch to turn the vehicle off completely.

9. Start the vehicle. Make sure that the oil life telltale is not illuminated in the IPC, and the oil change reminder message is no longer displayed in the message center.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 6

Non-Hybrid

Oil Life Reset:

NOTE: The oil life calculation is set at a maximum of approximately 12,070 km (7,500 miles) or 180 days (non-hybrid) or 16,093 km (10,000 miles) (hybrid).

1. Press and release the SETUP button to display OIL LIFE XXX% HOLD RESET = NEW.
2. Press and hold the RESET button for 2 seconds and release to reset the oil life to 100%.

NOTE: Oil Life Start Value: The oil life start value is used to reset the oil life value back to the if the value was previously changed, or to lower the value from the maximum in 10% increments down to 10%. To change oil life value to another value, proceed to next step.

3. Once "OIL LIFE SET TO XXX%" is displayed, release and press the RESET button to change the Oil Life Start Value. Each release and press will reduce the value by 10%.

Hybrid

Oil Life Reset And Oil Life Start Value

NOTE: The oil life calculation is set at a maximum of approximately 16,093 km (10,000 miles) or 12 months.

NOTE: The message center is displayed on the LH side of the speedometer and is split into several different viewing panes.

1. Press and release the SETUP button to display VEHICLE SETTINGS in the LH viewing pane of the message center.
2. Press and release the RESET button to display the next viewing pane.
3. Press and release the SETUP button to select and highlight OIL LIFE in the LH viewing pane of the message center.

NOTE: Once the RESET button is pressed, the message center highlights the currently selected oil life start value. This value can be changed or left as currently selected.

4. Press and release the RESET button to display the move to the RH viewing pane of the message center and highlight SET TO xxx%.
5. Press and release the SETUP button to highlight the desired oil life start value.

NOTE: A pop-up window appears stating HOLD RESET FOR 2 SECONDS TO CONFIRM. PRESS INFO TO CANCEL.

6. Press and release the RESET button.
7. Press and hold the RESET button for approximately 2 seconds to select and confirm the desired oil life start value.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 7

NOTE: To reset the oil service light and clear the oil change message after servicing use the following procedure:

1. Begin with the ignition off.
2. Turn the key to the accessory position for keyed vehicles and for push button start vehicles press the Start/Stop button once quickly. DO NOT attempt to start the engine.
3. Press the brake and accelerator pedals at the same time. Hold down fully for at least 20 seconds.
4. Release both the accelerator and brake pedals.
5. ENGINE OIL CHANGE DUE NEXT SERVICE and [Wrench & Oil Can icon] will display in the message center.
6. Rotate the key to the OFF position.
7. Turn the vehicle off. The message and lights will be cleared.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 8

The message center is used to program/configure various options. The message center display is located in the instrument cluster.

Use the steering wheel controls to navigate through the message center to locate the Oil Life Reset option: *Main Menu > Settings > Convenience > Oil Life Reset* .

Press the up/down arrow buttons to move up/down through the message center choices.

Press the left/right arrow buttons to move left/right through the message center choices.

- Press the left/right, up/down arrow buttons to move through the message center choices. Select SETTINGS
- Press the left/right, up/down arrow buttons to move through the message center choices. Select CONVENIENCE
- Press the left/right, up/down arrow buttons to move through the message center choices. Select OIL LIFE RESET
- Press the left/right, up/down arrow buttons to move through the message center choices. Select Percentage - 100, 90, 80, 70, 60, 50, 40, 30, 20, or 10.
- Press the OK button to select highlighted options and confirm choices/messages.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 9

To reset oil life feature, press and hold the OIL CHANGE RESET control for 5 seconds. The message center will count down for 5 seconds. If reset is successful, message center will display OIL LIFE RESET TO 100%.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 10

NOTE: **All message reset functions are carried out using the single stem SELECT/RESET button in the Base Instrument Panel Cluster**

NOTE: **The XX's in the message center displays below represent a numeric value. For example, the message center may display OIL LIFE = 80%.**

Oil Life Reset:

NOTE: **The ENGINE OIL CHANGE SOON message will be displayed on message center when remaining engine oil life is 5% or less. The ENGINE OIL CHANGE NOW message will be displayed when engine oil life is 0%.**

1. Press and release the SELECT/RESET button to scroll through the information displays until the message center displays HOLD RESET FOR SETUP MENU.
2. **For 2007-13 Expedition and Navigator (Message Center Cluster):** Press and hold the RESET button for approximately 2 seconds until the message center displays HOLD RESET FOR SYSTEM CHECK. **For all other models (Base Instrument Cluster), go to next step.**
3. Press and release the SELECT/RESET button until the message center displays OIL LIFE XX% HOLD RESET = NEW.
4. Press and hold the SELECT/RESET button for 2 seconds and release when the message center displays OIL LIFE SET TO 100%.
5. Press and release the SELECT/RESET button to exit the procedure.

Oil Life Start Value:

1. Press and release the SELECT/RESET button to scroll through the information displays until the message center displays HOLD RESET FOR SETUP MENU.
2. **For 2007-13 Expedition and Navigator (Message Center Cluster):** Press and hold the RESET button for approximately 2 seconds until the message center displays HOLD RESET FOR SYSTEM CHECK. **For all other models (Base Instrument Cluster), go to next step.**
3. Press and release the SELECT/RESET button until the message center displays OIL LIFE XX% HOLD RESET = NEW.
4. Press and hold the SELECT/RESET button for 2 seconds until the message center displays OIL LIFE SET TO 100%.

NOTE: The oil life start value can be lowered from 100% to 10% in 10% increments then the value starts again at 100%.

5. Continue to hold the SELECT/RESET button to lower the oil life in 10% increments from the default 100% until the message center displays OIL LIFE SET TO XX%.
6. Press and release the SELECT/RESET button to exit the procedure.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 11

Oil Life Reset:

1. Press and release the SETUP button until the message center displays PRESS RESET AT OIL CHANGE.
2. Press and release the RESET button until the message center displays HOLD RESET TO CONFIRM.
3. Press and hold the RESET button for 2 seconds and release to reset the oil life to 100%.
4. Press the SETUP to exit the procedure and continue with the system check.

Oil Life Start Value:

1. Press and release the SETUP button until the message center displays PRESS RESET AT OIL CHANGE.
2. Press and release the RESET button until the message center displays HOLD RESET TO CONFIRM.
3. Press and hold the RESET button for 2 seconds and release to reset the oil life to 100%.
4. Press the RESET and the SETUP buttons simultaneously for 2 seconds until the message center displays OIL LIFE XX% RESET TO ALTER.
5. Press the RESET button to lower the percentage by 10% (up to 30%) for each button press or return the value to 100%.
6. Press the SETUP to exit the procedure and continue with the system check.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 12

With Base Instrument Cluster

Oil Life & Oil Life Start Value Reset:

1. Place the ignition in the RUN position with the engine off (KOEO).
2. Press and release the TRIP/RESET button until SETUP MENU HOLD RESET is displayed.
3. Press and hold the TRIP/RESET button until RESET FOR SYS CHECK (2006 early build) or SYSTEM CHECK HOLD RESET (2006 late build and later) is displayed.
4. Release the TRIP/RESET button.
5. Press and release the TRIP/RESET button to scroll through the system check menu items until HOLD RESET IF NEW OIL is displayed.
6. Press and hold the TRIP/RESET button until OIL LIFE SET TO 100% is displayed.

NOTE: If the oil life start value was set to 100%, the next setting would be 90%. If the oil life start value was set to 10%, the next setting would be 100%

7. Release the TRIP/RESET button. The oil life is now reset.
8. To change the oil life start value, press and hold the TRIP/RESET button until the oil life display indicates the next oil life start value.
9. Repeat Step 7 for each desired 10% reduction in the oil life start value down to 10%.

With Message Center Instrument Cluster

Oil Life Reset:

NOTE: For 2008 and later vehicles, it may be possible to start with step 2.

1. Press and release the SETUP button until the message center displays PRESS RESET TO BEGIN SYSTEM CHECK.
2. Press and release the RESET button until the message center displays HOLD RESET IF NEW OIL.
3. Press and hold the RESET button for 2 seconds until the message center displays OIL CHANGE SET TO 100%.

Oil Life Start Value Reset

1. Press and release the SETUP button until the message center displays OIL LIFE START VALUE SET TO XX%.
2. Press and release the RESET button to lower the percentage by 10% (down to 10%) for each button press or return the value to 100%.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 13

With Message Center Instrument Cluster

Oil Life Reset

1. Press and release the SETUP button until the message center displays OIL LIFE XXX% HOLD RESET = NEW OIL.

2. Press and hold the RESET button for 2 seconds and release when the message center displays OIL LIFE SET TO XXX%.
3. Press and release the SETUP button to exit the procedure.

Oil Life Start Value

1. Press and release the SETUP button until the message center displays OIL LIFE XXX% HOLD RESET = NEW OIL.
2. Press and hold the RESET button for 2 seconds and release when the message center displays OIL LIFE SET TO XXX%.
3. Press and release the RESET button to decrease the oil life start value (from 100% to 10%) for each 10% reduction until the desired oil life start value is displayed.
4. Press and release the SETUP button to exit the procedure.

With Base Instrument Cluster

NOTE: All message center functions are carried out using the single stem SELECT/RESET button in the Instrument Cluster (IC).

Oil Life Reset

1. Press and release the SELECT/RESET button to scroll through the information displays until the message center displays HOLD RESET FOR SETUP MENU.
2. Press and hold the SELECT/RESET button for approximately 2 seconds until the message center displays OIL LIFE XXX% HOLD RESET = NEW.
3. Press and hold the SELECT/RESET button for approximately 2 seconds until the message center displays OIL LIFE SET TO XXX%.
4. Release the SELECT/RESET button and allow the setup timer to expire to exit the procedure.

Oil Life Start Value

1. Press and release the SELECT/RESET button to scroll through the information displays until the message center displays HOLD RESET FOR SETUP MENU.
2. Press and hold the SELECT/RESET button for approximately 2 seconds until the message center displays OIL LIFE XXX% HOLD RESET = NEW.
3. Press and hold the SELECT/RESET button for approximately 2 seconds until the message center displays OIL LIFE SET TO XXX%.

   NOTE: The oil life start value reduces by 10% for each second that the SELECT/RESET button is held once the oil life start value begins decreasing.

4. Continue to hold the SELECT/RESET button until the oil life begins to decrease in value (from 100% down to 10%), continuing to hold until the desired start value is displayed.

5. Release the SELECT/RESET button and allow the setup timer to expire to exit the procedure.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 14

The message center is used to program/configure various options. The message center display is located in the instrument cluster.

Use the left steering wheel controls to navigate through the message center to locate the Oil Life Reset option. Depending on display type, follow menu path to reset: (see **Fig. 1**)

NOTE: For Fusion, MKS, MKT, MKX, MKZ , use Type 2 instructions.

- Type 1: *Main Menu > Settings > Convenience > Oil Life Reset*
- Type 2: *Main Menu > Settings > Vehicle > Oil Life Reset*

Press the up/down arrow buttons to move up/down through the message center choices.

Press the left/right arrow buttons to move left/right through the message center choices.

- Press the left/right, up/down arrow buttons to move through the message center choices. Select SETTINGS
- Press the left/right, up/down arrow buttons to move through the message center choices. Select CONVENIENCE or VEHICLE
- Press the left/right, up/down arrow buttons to move through the message center choices. Select OIL LIFE RESET
- Press the left/right, up/down arrow buttons to move through the message center choices. Select Percentage - 100, 90, 80, 70, 60, 50, 40, 30, 20, or 10.
- Press the OK button to select highlighted options and confirm choices/messages.

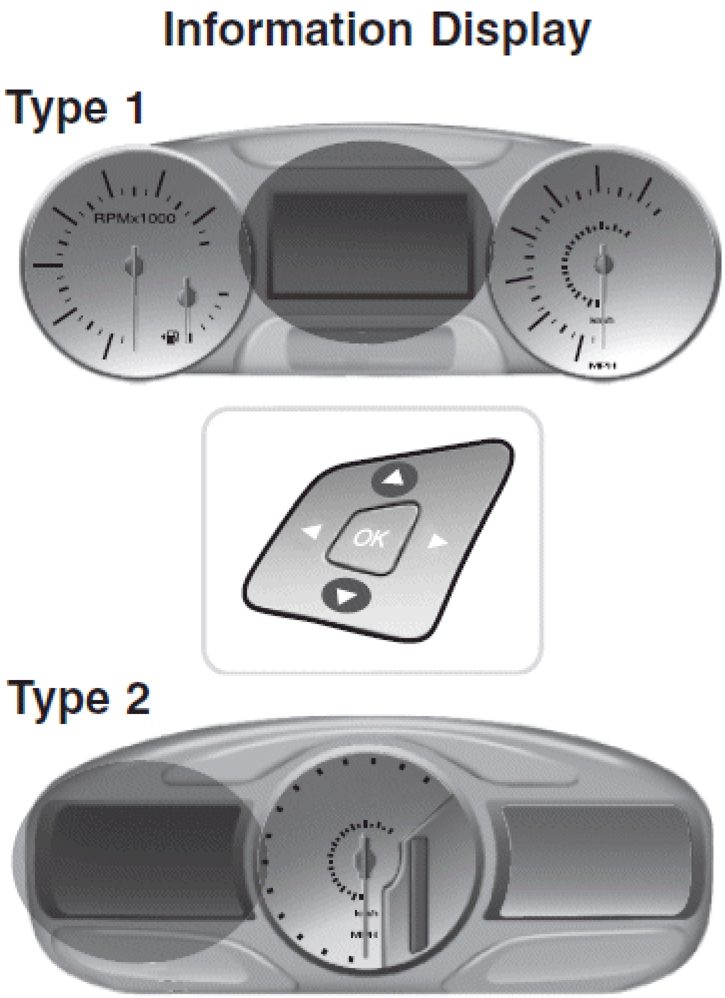

Fig. 1: Identifying Information Display Types (Edge & Flex Shown; Other Models Are Similar)
Courtesy of FORD MOTOR CO.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 15

Base Message Center

1. Press and release the SETUP button until the message center displays OIL LIFE XXX% HOLD RESET = NEW OIL.
2. Press and hold the RESET button for 2 seconds and release when the message center displays OIL LIFE SET TO XXX%.
3. Press and release the SETUP button to exit the procedure.

NOTE: To change oil life 100% value (if equipped with this feature) to a value less than 100%, proceed to next step.

4. Once "OIL LIFE SET TO XXX%" is displayed, release and press the RESET button to change the Oil Life Start Value. Each release and press will reduce the value by 10%.

Uplevel Message Center

The message center display is located in the instrument cluster. Use the steering wheel mounted buttons to navigate through the message center to locate the Oil Life Reset option. Go to *Main Menu > Settings > Oil Life Reset* .

- Press the up/down arrow buttons to move up/down through the message center choices.
- Press the left/right arrow buttons to move left/right through the message center choices.
- Press the OK button to select highlighted options and confirm choices/messages.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 16

The warning message CHANGE OIL SOON is single cycle, non-resettable and repetitive warning messages. Single cycle warning messages will display once whenever the ignition switch is turned to ON or a fault occurs in a system and can be cleared by pressing the RESET button.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 17

1. The CHANGE OIL SOON message will be displayed on message center when remaining engine oil life is 5% or less. The OIL CHANGE REQUIRED message will be displayed when engine oil life is 0%.
2. To reset the oil monitoring system to 100%, press the STATUS control to access the System Check function. Press RESET control to reset oil percentage (%). Press and hold RESET control to change setting to 100%.
3. If reset procedure is successful, the message center will display OIL LIFE SET TO 100%.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 18

1. The CHANGE OIL SOON warning will display on the message center when remaining engine oil life is 5% or less. The OIL CHANGE REQUIRED will display when engine oil life is 0%.
2. To reset display after oil change, press VEHICLE SETTINGS control until OIL CHANGE RESET display appears. On 1993-96 models, press OIL CHANGE RESET switch and hold for 5 seconds as message center display counts down to trigger an oil change reset. On 1997-98 models, press RESET switch for 5 seconds to reset display.
3. After a successful reset, the message center will display OIL LIFE RESET TO 100.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 19

The warning message displays once whenever the ignition switch is turned to the ON position or a fault occurs in a system and can be cleared by pressing the RESET button. Once cleared, the messages are not displayed again until the next ignition cycle.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 20

NOTE: Oil life calculation is set at a maximum of approximately 5,000 miles (8,000 kms) or 180 days.

1. Press the INFO button to cycle message to OIL CHANGE message.
2. Press the SET button to display PRESS SET FOR SYS CHCK.
3. Press and release the SET button to display OIL CHNG XXX% HOLD SET NEW.
4. Press and hold the SET button for about 2 seconds to display OIL CHANGE SET TO 100%. The oil life is now set to 100%.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 21

NOTE: Oil life calculation is set at a maximum of approximately 7,500 miles (12,000 kms) or 180 days.

Without Message Center

1. Press and release the SELECT/RESET button to scroll through the information displays until the message center displays HOLD RESET IF NEW OIL.
2. Press and hold the SELECT/RESET button for about 2 seconds until the message center displays OIL LIFE SET TO 100%.
3. Once OIL LIFE SET TO 100% is displayed, press and hold the SELECT/RESET button for more than 2 seconds until the message center displays OIL LIFE SET TO XXX%.
4. Press and hold SELECT/RESET button to reduce the start value (10% for each button press).
5. Press and release SELECT/RESET button to exit the procedure.

With Message Center

1. From the setup menu, press and release RESET button to display HOLD RESET IF NEW OIL.
2. Press and hold the RESET button for 2 seconds and release to reset the oil life to 100%.
3. The message center displays OIL LIFE SET TO 100%.
4. Once message center displays OIL LIFE SET TO 100%, release the RESET button then press and release the RESET button to reduce the start value (10% for each button press).

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 22

The oil life minder has 2-level warnings, both cleared by the RESET button. The critical one turns on the display after a period of time (if the condition is still active). Oil life minder warning can overwrite normal mode messages. Pressing RESET button acknowledges the warning.

1. Press the MODE button repeatedly until OIL LIFE XX% is displayed. XX will be between 6-100% when the oil life is okay. CHANGE OIL SOON is displayed if the oil life is 5% or less. CHANGE OIL NOW is displayed if the oil life is 0%.
2. Press and hold the MODE button for 5 seconds until RESET FOR NEW OIL LIFE is displayed. If the RESET button is not pressed, after one minute of inactivity or if the power is interrupted during the reset oil life mode, the message center resets the oil life to the original value. Press and release the RESET button. The oil life value will be reset to 100%.

CHANGE OIL SOON/OIL CHANGE REQUIRED MESSAGE - PROCEDURE 23

NOTE: See Fig. 2 to identify information display types.

Type 1 Information Display:

1. Press and release the SETUP button to display OIL LIFE XXX% HOLD RESET = NEW.
2. Press and hold the RESET button for 2 seconds and release to reset the oil life to 100%.

   NOTE: Oil Life Start Value: The oil life start value is used to reset the oil life value back to the if the value was previously changed, or to lower the value from the maximum in 10% increments down to 10%. To change oil life value to another value, proceed to next step.

3. Once "OIL LIFE SET TO XXX%" is displayed, release and press the RESET button to change the Oil Life Start Value. Each release and press will reduce the value by 10%.

Type 2 Information Display:

The message center is used to program/configure various options. The message center display is located in the instrument cluster.

Use the left steering wheel controls to navigate through the message center to locate the Oil Life Reset option: *Main Menu > Settings > Vehicle > Oil Life Reset* .

Press the up/down arrow buttons to move up/down through the message center choices.

Press the left/right arrow buttons to move left/right through the message center choices.

- Press the left/right, up/down arrow buttons to move through the message center choices. Select SETTINGS
- Press the left/right, up/down arrow buttons to move through the message center choices. Select VEHICLE
- Press the left/right, up/down arrow buttons to move through the message center choices. Select OIL LIFE RESET
- Press the left/right, up/down arrow buttons to move through the message center choices. Select Percentage - 100, 90, 80, 70, 60, 50, 40, 30, 20, or 10.
- Press the OK button to select highlighted options and confirm choices/messages.

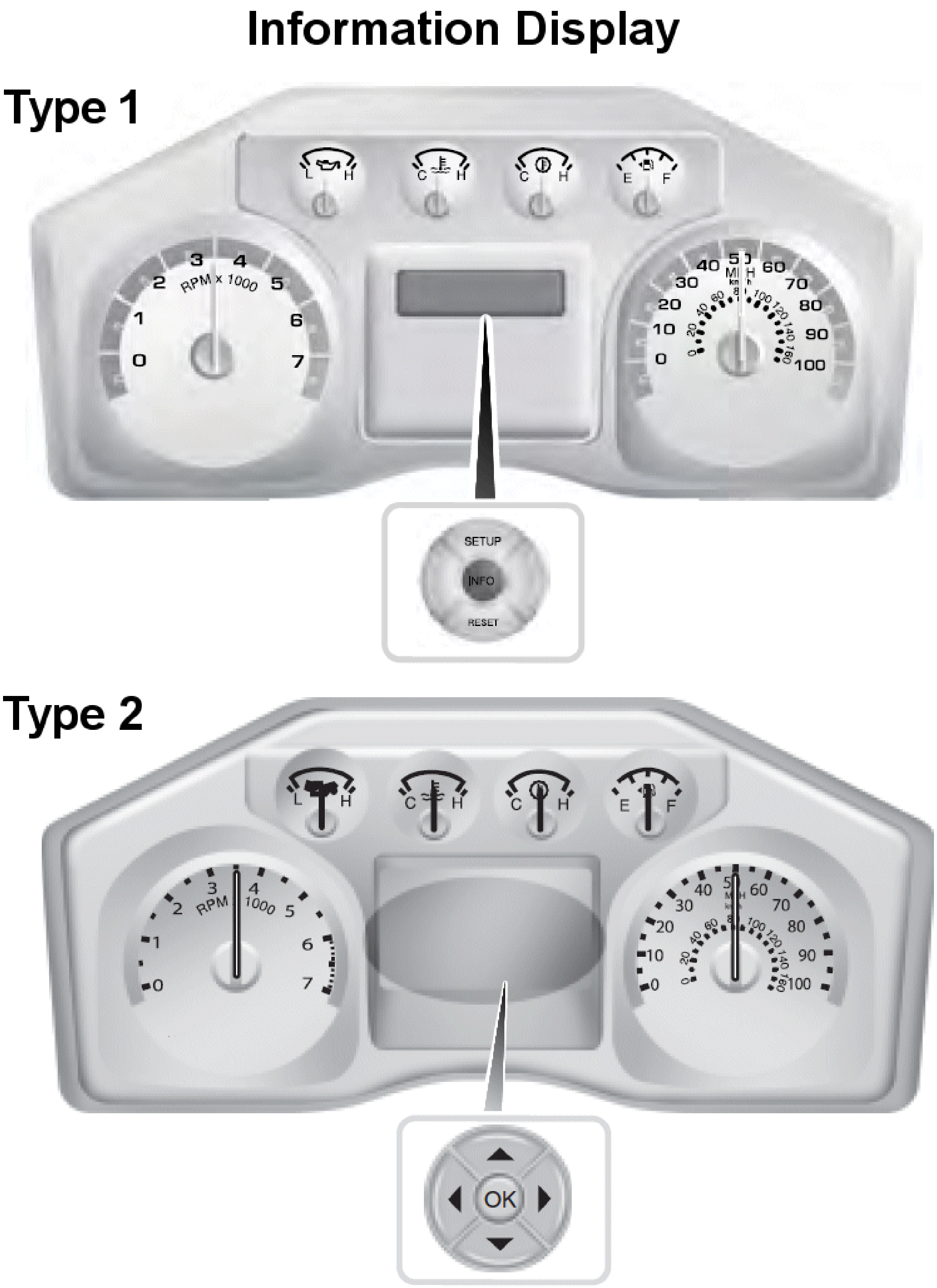

Fig. 2: Identifying Information Display Types (F-250 - F550)
Courtesy of FORD MOTOR CO.

CHECK A/C (CABIN) FILTER MESSAGE

NOTE: To determine the appropriate reset procedure, refer to CHECK A/C (CABIN) FILTER MESSAGE RESET INDEX. Only vehicles listed in this index have a Check A/C (Cabin) Filter Message reset.

CHECK A/C (CABIN) FILTER MESSAGE RESET INDEX

Model & Year	Reset Procedure
LS	
2000-06	Check A/C (Cabin) Filter Message Reset - Procedure 1

CHECK A/C (CABIN) FILTER MESSAGE RESET - PROCEDURE 1

1. To reset the A/C filter monitoring system to 100%, press the STATUS control to access the System Check function. Message center will display A/C FILTER XXX% RESET FOR NEW.
2. Press and hold RESET control to change setting to 100%. Message center will now display IF NEW FILTER HOLD RESET.
3. If reset procedure is successful, the message center will display A/C FILTER LIFE SET TO 100%.

OVERHEAD WARNING LIGHTS

NOTE: To determine the appropriate reset procedure, refer to OVERHEAD WARNING LIGHTS RESET INDEX. Only vehicles listed in this index have an Overhead Warning Lights reset.

OVERHEAD WARNING LIGHTS RESET INDEX

Model & Year	Reset Procedure
Cougar	
1992-02	Overhead Warning Lights Reset - Procedure 1

OVERHEAD WARNING LIGHTS RESET - PROCEDURE 1

1. One or more of the 7 overhead lights will turn on after about 358 days or 4800 miles to indicate routine service should be performed.
2. To reset the light, hold the SELECT and UNITS buttons on the trip computer for 5 seconds. The service interval light will be illuminated, and then turn off after about 4 seconds.

SERVICE INTERVAL REMINDER LIGHT

NOTE: To determine the appropriate reset procedure, refer to SERVICE INTERVAL REMINDER LIGHT RESET INDEX. Only vehicles listed in this index have a Service Interval Reminder Light reset.

SERVICE INTERVAL REMINDER LIGHT RESET INDEX

Model & Year	Reset Procedure

Passenger Cars	
1985-89	**Service Interval Reminder Light Reset - Procedure 1**
Continental	
1990-94	**Service Interval Reminder Light Reset - Procedure 2**
Light Duty Trucks	
1985-87	**Service Interval Reminder Light Reset - Procedure 3**
Non-EEC Light Duty Trucks	
1988	**Service Interval Reminder Light Reset - Procedure 3**

SERVICE INTERVAL REMINDER LIGHT RESET - PROCEDURE 1

Every 5000 or 7500 miles, depending upon engine application, a SERVICE interval reminder light on the dash will illuminate (for approximately 30 seconds), or begin flashing, indicating an oil change is due.

To reset reminder light, turn ignition on. Simultaneously depress and hold TRIP (ODO SEL on Taurus and Sable, SYSTEM CHECK or CHECK OUT on Continental) and RESET or TRIP RESET buttons. On Probe, depress and hold SERVICE RESET button, located on speed alarm keyboard. On all models, 3 beeps will verify that reminder light has been reset.

SERVICE INTERVAL REMINDER LIGHT RESET - PROCEDURE 2

During system check sequence, the SERVICE symbol comes on and displays the number of miles to go before the next normal service. To reset the service interval reminder, press SYSTEM CHECK and RESET buttons simultaneously. The display should now show 7200 miles. Service interval reminder light has been reset.

SERVICE INTERVAL REMINDER LIGHT RESET - PROCEDURE 3

A SRI is used to indicate emission system maintenance is required. Control unit (timer) for maintenance light is located under dash, near steering column or behind glove box. Some models use a non-resettable control unit. Replace it with a resettable type. After servicing emission system, reset SRI.

1. To reset SRI, turn ignition off. Remove tape over reset hole in timer. Lightly push a small Phillips screwdriver into hole in timer unit marked RESET. With light pressure on screwdriver, turn ignition switch to RUN position.
2. Light should stay on while screwdriver is pressed down. Hold screwdriver down for approximately 5 seconds. Remove screwdriver. Light should go out within 2-5 seconds. If light does not go out, repeat step 1
3. Cycle ignition from OFF to RUN position. Light should glow for 2-5 seconds. This verifies proper reset of maintenance reminder light.

TIRE PRESSURE MONITOR SYSTEM (TPMS)

NOTE: **To determine the appropriate reset procedure, refer to TPMS RESET INDEX. Only vehicles listed in this index have a TPMS reset.**

TPMS RESET INDEX

Model	**Application**	**Procedure**
Ford		
C-Max	2013-14	**TPMS Reset - Procedure 1**
Crown Victoria	2008-11	**TPMS Reset - Procedure 1**
E-Series Vans	2008-11	**TPMS Reset - Procedure 1**
	2012-13	**TPMS Reset - Procedure 4**
	2014	**TPMS Reset - Procedure 6**
Edge	2008-11	**TPMS Reset - Procedure 1**
	2012-14	**TPMS Reset - Procedure 4**
Escape	2006-11	**TPMS Reset - Procedure 1**
	2012-14	**TPMS Reset - Procedure 4**
Expedition/EL	2004-06	**TPMS Reset - Procedure 2**
	2007-11	**TPMS Reset - Procedure 1**
	2012-14	**TPMS Reset - Procedure 4**
Explorer	2004-05	**TPMS Reset - Procedure 2**
	2006-11	**TPMS Reset - Procedure 1**
-Intelligent Access (IA)	2012-14	**TPMS Reset - Procedure 3**
-Integrated Keyhead Transmitter (IKT)	2012-14	**TPMS Reset - Procedure 4**
Explorer Sport Trac	2008-10	**TPMS Reset - Procedure 1**
F-Series Pickups	2008-14	**TPMS Reset - Procedure 1**
Fiesta	2011	**TPMS Reset - Procedure 1**
	2012-14	**TPMS Reset - Procedure 4**
Flex	2009-11	**TPMS Reset - Procedure 1**
	2012	**TPMS Reset - Procedure 4**
-Intelligent Access (IA)	2013-14	**TPMS Reset - Procedure 3**
-Integrated Keyhead Transmitter (IKT)	2013-14	**TPMS Reset - Procedure 4**
Focus	2008-11	**TPMS Reset - Procedure 1**
-Intelligent Access (IA)	2012-14	**TPMS Reset - Procedure 3**
-Integrated Keyhead Transmitter (IKT)	2012-14	**TPMS Reset - Procedure 4**
Freestar	2004-05 (Indirect)	(1) **TPMS Reset - Procedure 5**
	2004-05 (Direct)	**TPMS Reset - Procedure 2**
	2006-07	**TPMS Reset - Procedure 1**
Fusion	2008-11	**TPMS Reset - Procedure 1**
	2012-14	**TPMS Reset - Procedure 4**
Mustang	2007-11	**TPMS Reset - Procedure 1**
	2012-14	**TPMS Reset - Procedure 4**
Police Interceptor (Sedan)		
-Intelligent Access (IA)	2014	**TPMS Reset - Procedure 3**
-Integrated Keyhead Transmitter (IKT)	2014	**TPMS Reset - Procedure 4**

Police Interceptor (Utility)		
-Intelligent Access (IA)	2014	**TPMS Reset - Procedure 3**
-Integrated Keyhead Transmitter (IKT)	2014	**TPMS Reset - Procedure 4**
Ranger	2007-11	**TPMS Reset - Procedure 1**
Taurus	2008-10 (2)	**TPMS Reset - Procedure 1**
-Intelligent Access (IA)	2011-14	**TPMS Reset - Procedure 3**
-Integrated Keyhead Transmitter (IKT)	2011-14	**TPMS Reset - Procedure 4**
Taurus X	2008-09	**TPMS Reset - Procedure 1**
Transit Connect	2010-11	**TPMS Reset - Procedure 1**
	2012-14	**TPMS Reset - Procedure 4**
Windstar	2001-03	(1) **TPMS Reset - Procedure 5**
Lincoln		
Aviator	2004-05	**TPMS Reset - Procedure 2**
Mark LT	2007-08	**TPMS Reset - Procedure 1**
MKS	2009-11	**TPMS Reset - Procedure 1**
-Integrated Keyhead Transmitter (IKT)	2012	**TPMS Reset - Procedure 4**
-Intelligent Access (IA)	2012	**TPMS Reset - Procedure 3**
	2013-14	**TPMS Reset - Procedure 4**
MKT	2010-11	**TPMS Reset - Procedure 1**
	2012-14	**TPMS Reset - Procedure 4**
MKX	2008-11	**TPMS Reset - Procedure 1**
	2012-14	**TPMS Reset - Procedure 4**
MKZ	2008-11	**TPMS Reset - Procedure 1**
	2012-14	**TPMS Reset - Procedure 4**
Navigator/L	2003-06	**TPMS Reset - Procedure 2**
	2007-10	**TPMS Reset - Procedure 1**
	2011-14	**TPMS Reset - Procedure 4**
Town Car	2008-11	**TPMS Reset - Procedure 1**
Mercury		
Grand Marquis	2008-11	**TPMS Reset - Procedure 1**
Mariner	2006-11	**TPMS Reset - Procedure 1**
Milan	2008-11	**TPMS Reset - Procedure 1**
Monterey	2004-05 (Indirect)	(1) **TPMS Reset - Procedure 5**
	2004-05 (Direct)	**TPMS Reset - Procedure 2**
	2006-07	**TPMS Reset - Procedure 1**
Mountaineer	2003-05	**TPMS Reset - Procedure 2**
	2006-10	**TPMS Reset - Procedure 1**
Sable	2008-09	**TPMS Reset - Procedure 1**

(1) This is an Indirect TPM System. A transmitter activation tool is not required for this procedure.

(2) For 2010 models with Integrated Keyhead Transmitter (IKT) or Intelligent Access (IA) type of Remote Keyless Entry system, see TPMS Reset - Procedure 3 or 4

TPMS SENSOR TYPES

Ford Motor Company uses three different designs of TPMS sensor:

- Banded Sensor
- Valve Mounted Bolt-On Sensor
- Valve Mounted Snap-In Sensor

NOTE: Although the three different system use similar methods for communicating, the tire pressure sensors are not interchangeable.

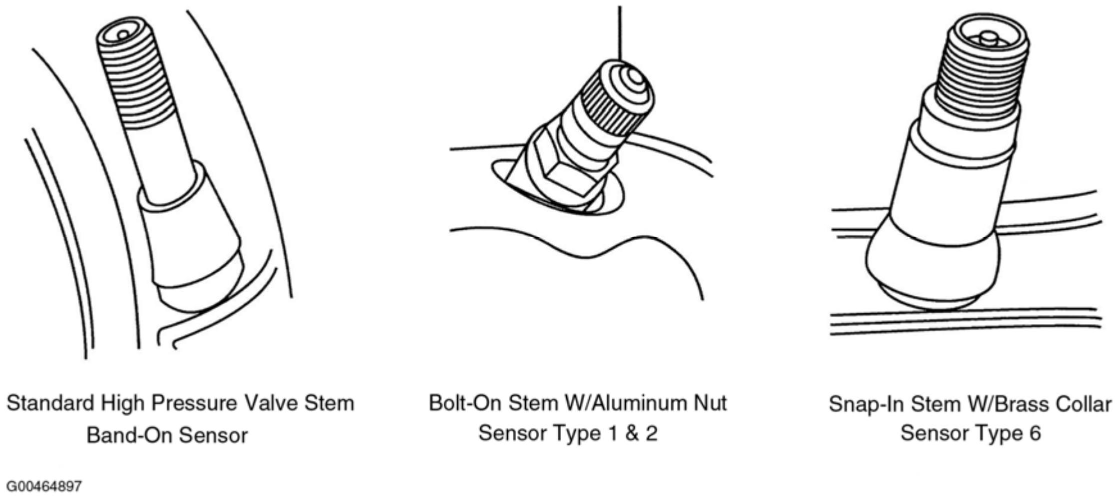

Fig. 3: Identifying Valve Stems Used With Ford TPMS Sensors

Banded Sensor

The banded (or band-on) TPMS sensor assembly consists of:

- A metal band around the center of the wheel
- A cradle or bracket to hold the sensor
- A tire pressure sensor

Valve Mounted Bolt-On Sensor

The valve mounted sensors (also known as a Schrader Valve Sensor) are one-piece "bolt-on" valve mounted sensor where the sensor and valve stem are molded together. The sensor is secured in place by a hex nut and uses a rubber grommet to prevent any leaks. This sensor was replaced by the Banded Sensor.

Valve Mounted Snap-In Sensor

Beginning in 2009 with the Escape and F-150, a two piece snap-in valve mounted sensor was used. The sensor and valve stem are separate pieces which are screwed together and can be replaced separately.

The sensor is referred to as "snap-in" because it uses a more traditional rubber valve stem for installation and does not use a hex nut fastener or rubber o-ring for attachment.

NOTE: **Snap-In Sensors MUST USE new style valve stem.**

TPMS RESET - PROCEDURE 1

NOTE: **If tire pressure sensor is replaced, it will need to be trained. The TPM system is not affected by wheel and tire rotation.**

NOTE: **As ambient temperature decreases by 6°C (10°F), tire pressure decreases 1 psi (7 kPa). Because tire pressures fluctuate with temperature changes, tire pressures must be set when tires are at outdoor ambient temperatures. If the tire pressure may drop enough to be detected by the TPM system, which will activate the low pressure warning light.**

NOTE: **When the tire pressure warning light comes on solid and message center displays "LOW TIRE PRESSURE", check the air pressure of all tires and adjust to the specified cold pressure listed on vehicle certification label (found on driver's door or door pillar). Drive the vehicle at 20 mph (32 km/h) for at least 2 minutes. If the vehicle has been stationary for more than 30 minutes, a TPM sensor Activation procedure may be needed. Make sure the warning light goes off. If the warning light stays on, there is a malfunction in the TPM system. See appropriate manufacturer service information.**

NOTE: **When the tire pressure warning light flashes for 70 seconds and then remains illuminated, after bulb-check has been performed and message center displays warning messages, there is a malfunction in the TPM system. See appropriate manufacturer service information.**

NOTE: **Under the following conditions, the TPM system may not function properly:**

- **Low tire pressure.**
- **Tire pressure sensor is missing or damaged.**
- **Spare tire is installed as a road wheel.**
- **Incorrect tire pressure sensor is installed.**
- **Tire pressure sensor installed incorrectly.**
- **Non-OEM wheels installed (aftermarket rims).**
- **Non-OEM equipped run-flat tires installed.**
- **Other non-OEM modifications (roll cages, service barriers, part racks, ladder racks, etc.)**

NOTE: The tire pressure sensor training procedure must be done on a single vehicle, in an area without Radio Frequency (RF) noise and at least 3 ft. (1 m) away from any other vehicle equipped with TPM system. RF noise is generated by electrical motor and appliance operation, cellular telephones and remote transmitters, power inverters and portable entertainment equipment.

NOTE: A new tire pressure sensor is shipped in an OFF mode (or battery saver mode), and must be turned ON before it can be trained. To turn the sensor on, inflate the tire to the recommended inflation pressure and wait at least 2 minutes, then continue with the sensor training procedure.

1. Turn ignition switch to OFF position, then press and release brake pedal.
2. Turn ignition switch from OFF position to the RUN position 3 times, ending in RUN position. Do not wait more than one minute between each key cycle.
3. Press and release the brake pedal.
4. Turn ignition switch to OFF position.
5. Turn ignition switch from OFF position to the RUN position 3 times, ending in RUN position. Do not wait more than one minute between each key cycle.

   NOTE: The horn will sound once and the tire pressure warning light will flash if train mode has been entered successfully (if equipped, the message center displays "TRAIN LF TIRE").

6. Depending on TPMS sensor type, place transmitter activation tool on the left front tire wall:
   - **Band-On Type Sensor:** Opposite (180 degrees) from the valve stem. See **Fig. 4**
   - **Valve-Mounted Type Sensor:** Near the valve stem.

   Press the activation button. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the Driver's Door Module (DDM).

   NOTE: It may take up to 6 seconds to activate a tire pressure sensor. During this time, the transmitter activation tool must remain in place, in the appropriate position relative to the valve stem.

   NOTE: If a sensor does not respond to the activation tool, move the vehicle to rotate the wheels at least 1/4 of a turn and attempt to activate the same sensor again.

   NOTE: If the DDM does not recognize any one of the 4 tire pressure sensors during the 2 minute time limit for each sensor response, the horn will sound twice and the message center (if equipped) will display "TIRE NOT TRAINED REPEAT". The training procedure must be repeated from the beginning.

7. Within 2 minutes after the horn sounds, place transmitter activation tool on the right front tire wall, in the

appropriate position relative to the valve stem. Then press the activation button to train the right front tire pressure sensor. Repeat procedure for right rear and left rear tires.

NOTE: **Do not wait more than 2 minutes between training each sensor. If the wait time is more than 2 minutes the DDM will stop and the training procedure must be repeated from the beginning.**

8. When the tire training procedure is complete, the message center (if equipped) will display "TIRE TRAINING COMPLETE". For vehicles not equipped with a message center, successful completion of the training procedure will be verified by turning the ignition switch to the OFF position without the horn sounding. If the horn sounds twice when ignition is turned off, the training procedure was not successful.

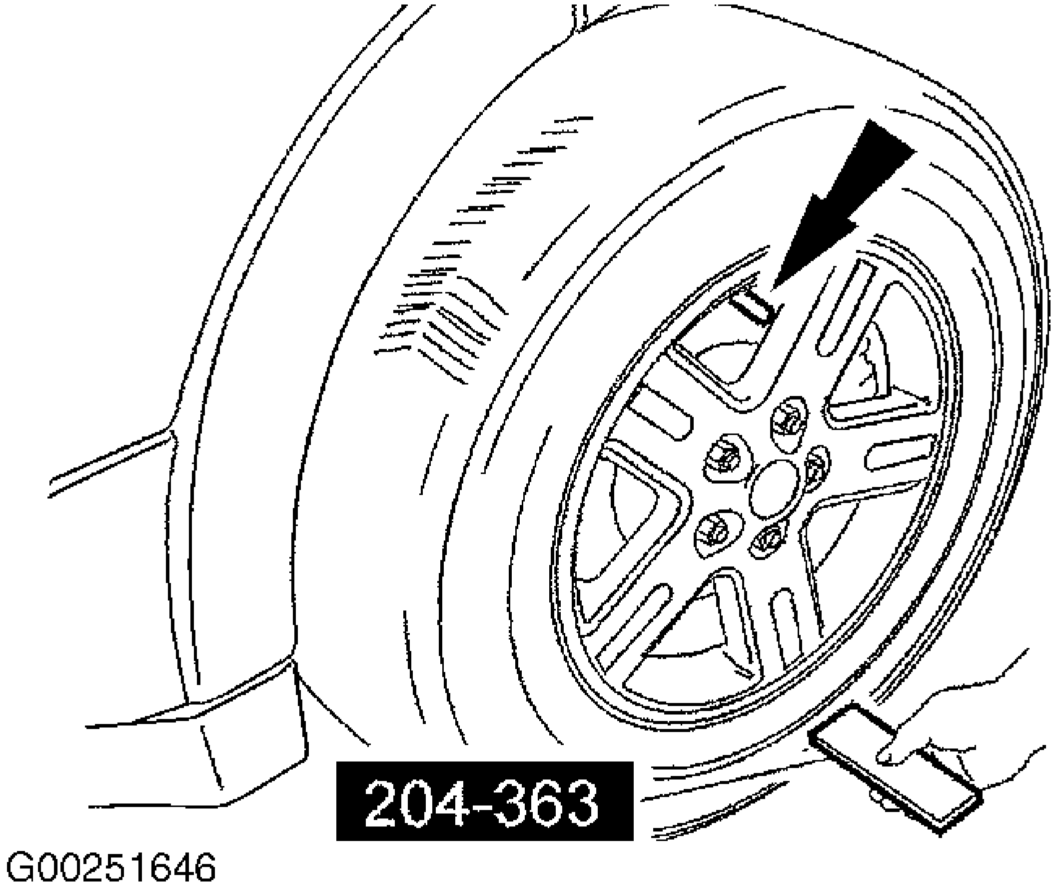

Fig. 4: Training Tire Pressure Sensors (Wheels With Band-On Sensors)
Courtesy of FORD MOTOR CO.

TPMS RESET - PROCEDURE 2

NOTE: **If vehicle is stationary overnight when outside temperature is significantly lower than daytime temperature, tire pressure may decrease about 3 psi (21 kPa) for a drop of 30°F (17°C) in ambient temperature. This pressure decrease may activate TPM warning system.**

NOTE: **Since tire pressure information is updated once every minute, it may take up to a minute for warning light to turn off after tire pressure has been adjusted. If vehicle has been parked for over 15 minutes, system information will be updated once an hour. In this case, it may take up to an hour for warning light to turn off after tire pressure has been adjusted.**

NOTE: **When the tire pressure warning light comes on solid, check the air pressure of all tires and adjust to the specified pressure listed on tire label (located on the driver's door or "B" pillar). Drive the vehicle at 20 mph (32 km/h) for at least 2 minutes. Make sure the warning light goes off. If the warning light stays on, there is a malfunction in the TPM system. See appropriate manufacturer service information.**

NOTE: **When the tire pressure warning light flashes for 20-30 seconds either at start-up or while driving, check to see if a spare tire is being used. Repair as necessary. Make sure the warning light goes off. If the tires are adjusted to the appropriate pressure, spare tire is not in use, and warning light continues to flash, there is a malfunction in the TPM system. See appropriate manufacturer service information.**

WARNING: **In the following procedure, a magnet is used. Death or serious injury can occur if magnetically sensitive devices are exposed to the relearn magnet. Magnets can affect pacemakers.**

NOTE: **The tire pressure sensor training procedure must be done on a single vehicle, in an area without radio frequency (RF) noise. RF noise is generated by electrical motor and appliance operation, cellular telephones and remote transmitters, power inverters and portable entertainment equipment.**

1. Turn ignition switch to OFF position.
2. Turn ignition switch from OFF position to the RUN position 3 times, ending in RUN position. Do not wait more than one minute between each key cycle.
3. Press and release the brake pedal.
4. Turn ignition switch to OFF position.
5. Turn ignition switch from OFF position to the RUN position 3 times, ending in RUN position. Do not wait more than one minute between each key cycle. The horn will sound once and the TPMS indicator will flash if train mode has been entered successfully (if equipped, the message center displays "TRAIN LF TIRE").
6. Place the TPM Relearn Magnet on the valve stem of the left front tire pressure sensor. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the TPMS module.
7. Within 2 minutes after the horn sounds, place the magnet on the valve stem of the right front tire pressure sensor. Repeat procedure for right rear and left rear tires.

NOTE: **If the VSM (TPMS module is integral to VSM) does not recognize any one**

of the 4 tire pressure sensors during the tire training procedure, the horn will sound twice and the message center (if equipped) will display "TIRE NOT TRAINED REPEAT". If this occurs, procedure must be repeated.

8. When the tire training procedure is complete, the horn will sound once and the message center (if equipped) will display "TIRE TRAINING MODE COMPLETE".

TPMS RESET - PROCEDURE 3

1. Set the tire pressure of all wheels to pressure specified on the tire and loading information label.
2. **Close All Doors.**
3. Turn ignition switch to OFF position, then press and release brake pedal.
4. Using the START/STOP button, switch from OFF to ACCESSORY to RUN position 3 times, ending in RUN position.
5. Press and release the brake pedal.
6. Turn ignition switch to OFF position.
7. Using the START/STOP button, switch from OFF to ACCESSORY to RUN position 3 times, ending in RUN position.
8. Place transmitter activation tool on the left front tire wall at the valve stem. Press the activation button. The horn will sound briefly to indicate that the tire pressure sensor has been recognized.
9. Within 2 minutes after the horn sounds, place transmitter activation tool on the right front tire wall at the valve stem. Then press the activation button to train the right front tire pressure sensor. Repeat procedure for right rear and left rear tires.
10. When the tire training procedure is complete, the message center (if equipped) will display "TIRE TRAINING COMPLETE". For vehicles not equipped with a message center, successful completion of the training procedure will be verified by turning the ignition switch to the OFF position without the horn sounding. If the horn sounds twice when ignition is turned off, the training procedure was not successful.

TPMS RESET - PROCEDURE 4

1. Set the tire pressure of all wheels to pressure specified on the tire and loading information label.
2. Turn ignition switch to OFF position, then press and release brake pedal.
3. Turn ignition switch from OFF position to the RUN position 3 times, ending in RUN position. Do not wait more than one minute between each key cycle.
4. Press and release the brake pedal.
5. Turn ignition switch to OFF position.
6. Turn ignition switch from OFF position to the RUN position 3 times, ending in RUN position. Do not wait more than one minute between each key cycle. The horn will sound once and the TPMS indicator will flash if the training mode has been entered successfully. If equipped, the message center will display TRAIN LF TIRE.
7. Place transmitter activation tool on the left front tire wall at the valve stem. Press the activation button. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the DDM.

NOTE: Do not wait more than 2 minutes between training each sensor. If the wait time is more than 2 minutes the DDM will stop and the training procedure must be repeated from the beginning.

8. Within 2 minutes after the horn sounds, place transmitter activation tool on the right front tire wall at the valve stem. Then press the activation button to train the right front tire pressure sensor. Repeat procedure for right rear and left rear tires.
9. When the tire training procedure is complete, the message center (if equipped) will display "TIRE TRAINING COMPLETE". For vehicles not equipped with a message center, successful completion of the training procedure will be verified by turning the ignition switch to the OFF position without the horn sounding. If the horn sounds twice when ignition is turned off, the training procedure was not successful.

TPMS RESET - PROCEDURE 5

NOTE: After tire rotation, replacement, balancing, alignment or pressure adjustment, TPM system will need to be reset.

Vehicles With Message Center

1. To reset the system, turn ignition switch to ON position.
2. Press and hold the SETUP button and wait for the message center to display "SYSTEM CHECK".
3. Press the RESET button and wait for the message center to display "HOLD RESET TO RELEARN".
4. Continue to hold the RESET button for 3 seconds. The message "HOLD RESET TO RELEARN" and the low tire warning light will flash 3 times, indicating the reset procedure is complete.
5. If the light illuminates, reset the tire pressure to specification, then repeat procedure from step 1.
6. The system normally requires 15-20 minutes of driving in each of 3 speed ranges to learn how the tires behave after the system has been reset. However, the system will become functional in each speed range as soon as learning completes in each individual speed range.

TIRE LEARNING SPEED RANGES

Speed Range	MPH (KM/H)
Low	25-42 (40-68)
Medium	42-62 (68-100)
High	Above 62 (100)

Vehicles Without Message Center

1. To reset the system, turn ignition switch to ON position.
2. Press and hold the Trip/Odometer reset button, and wait until "TIRE RESET" or "CHECK TIRE AND RESET" is displayed in odometer display window.
3. Continue to press the button for 3 seconds, then release. After 3 seconds, the low tire pressure warning light will flash 3 times, indicating that the low tire warning system reset procedure is complete.

TPMS RESET - PROCEDURE 6

1. Drive the vehicle above 20 mph (32 km/h) for at least two minutes and then park in a location where you can easily get to all four tires and have access to an air pump.
2. Turn the ignition ON, with the engine OFF.
3. Turn the hazard flashers on then off three times. This must be accomplished within 10 seconds. If the reset mode has been entered successfully, the horn will sound once, the system indicator will flash and the message center (if equipped) will display TRAIN LEFT FRONT TIRE. If this does not occur, please try again starting at Step 2.
4. Place a transmitter activation tool on the left front tire wall at the valve stem. Press the activation button. The horn will sound briefly to indicate that the tire pressure sensor has been recognized.
5. Within 2 minutes after the horn sounds, place activation tool on the right front tire wall at the valve stem. Then press the activation button to train the right front tire pressure sensor. Repeat procedure for right rear and left rear tires.
6. After all four tires have been trained, remove the valve cap from the valve stem on the left front tire; decrease the air pressure until the horn sounds. The single horn chirp confirms that the sensor identification code has been learned by the module for this position. If a double horn is heard, the reset procedure was unsuccessful, and must be repeated.
7. Repeat the air pressure decrease procedure for the remaining three tires.
8. Training is complete after the horn sounds for the last tire trained (driver's side rear tire), the system indicator stops flashing, and the message center (if equipped) displays TRAINING COMPLETE.
9. Turn the ignition off. If two short horn beeps are heard, the reset procedure was unsuccessful and must be repeated.
10. Set all four tires to the recommended air pressure as indicated on the Safety Compliance Certification Label or Tire Label.
11.

VEHICLE MAINTENANCE MONITOR (VMM)

NOTE: **To determine the appropriate reset procedure, refer to VEHICLE MAINTENANCE MONITOR RESET INDEX. Only vehicles listed in this index have a Vehicle Maintenance Monitor reset.**

VEHICLE MAINTENANCE MONITOR RESET INDEX

Model & Year	Reset Procedure
Cougar	
1989-92	**Vehicle Maintenance Monitor Reset - Procedure 1**
Probe	
1990-92 (With Standard Instrument Cluster)	**Vehicle Maintenance Monitor Reset - Procedure 1**
1990-92 (With Electronic Instrument Cluster)	**Vehicle Maintenance Monitor Reset - Procedure 2**
Thunderbird	

1989-92	**Vehicle Maintenance Monitor Reset - Procedure 3**

VEHICLE MAINTENANCE MONITOR RESET - PROCEDURE 1

NOTE: For models with Standard Instrument Cluster.

1. The SERVICE light will come on approximately every 7500 miles, indicating routine service is required. The light will remain on for 3 minutes after vehicle is started.
2. To cancel the message and reset SERVICE light on 1990 models, depress and hold SERVICE RESET button until 3 beeps are sounded. This will verify that reminder light has been reset. SERVICE RESET button is located in VMM unit, in center of overhead console.
3. To cancel the message and reset SERVICE light on 1991-92 models, insert a small diameter shank into hole centered directly above VMM display lights, and press switch once.

VEHICLE MAINTENANCE MONITOR RESET - PROCEDURE 2

NOTE: For models with Electronic Instrument Cluster.

1. SERVICE INTERVAL will be displayed on system scanner every 7500 miles, indicating that routine service is due. At 7500 miles, the message will remain on for 3 minutes after vehicle is started.
2. To cancel message and reset service interval on 1990 models, press and hold ODO SEL and TRIP RESET buttons until 3 beeps are heard. Buttons are located on speed alarm keyboard.
3. To cancel message and reset service interval on 1991-92 models, press and hold SERV button until 3 tones are heard. SERV button is located on speed alarm keyboard.

VEHICLE MAINTENANCE MONITOR RESET - PROCEDURE 3

1. Turn ignition switch to ON position. Within 16 seconds of turning ignition on, insert small diameter shank into reset switch hole, and firmly push in switch. Reset switch hole is located on left side of VMM panel.
2. Keep switch depressed until left side of display stops flashing. If switch is not kept depressed until left side of display stops flashing, VMM will not be reset.

2008 MAINTENANCE INFORMATION

Maintenance Schedule - Fusion, Milan & MKZ

DESCRIPTION AND OPERATION

MAINTENANCE SCHEDULES - GASOLINE ENGINES

The maintenance schedule is designed to protect against major repairs resulting from neglect or inadequate maintenance and to prolong the life of the vehicle.

General Maintenance Information

NOTE: This is a generic maintenance schedule for all Ford, Lincoln and Mercury vehicles. There may be items listed that do not apply to all vehicles.

The Normal Schedule applies to operation of the vehicle under typical, everyday driving conditions. The maintenance frequency in this schedule typifies what the vast majority of vehicles will require. The listed services should be carried out at specified mileage, time or hours of operation, whichever occurs first. There are, however, additional services required that only the noted vehicles require.

If the vehicle is operated in one or more of the following special operating conditions, those additional services will be required. The special operating conditions are:

- Towing a trailer or using a camper or car-top carrier
- Extensive idling and/or low-speed driving for long distances as in heavy commercial use such as delivery, taxi, patrol car or livery
- Driving in dusty conditions such as unpaved or dusty roads
- Off-road operation
- Use of E85 fuel 50% of the time or greater (flex fuel vehicles only)

There are also exceptions to the Normal Schedule which will require more frequent maintenance for some components. Those exceptions are:

- Vehicle axle - maintenance and lubrication
- Police and taxi vehicles - maintenance and lubrication
- Engine oil and Motorcraft Premium Gold Coolant - time-based and mileage-based intervals
- Change brake fluid every 2 years (Class A Motorhome)

Special Operating Condition Requirements

When towing a trailer or using a camper or car-top carrier:

- Change engine oil and install a new oil filter every 8,000 km (5,000 mi) or 6 months.
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise

every 8,000 km (5,000 mi). Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

- Change automatic transmission/transaxle fluid (not required on 6R60/6R75/TorqShift® transmissions) every 48,000 km (30,000 mi).
- Replace wheel bearing grease and install new grease seals on rear wheel drive (RWD) front wheel bearings (if non-sealed bearings) every 48,000 km (30,000 mi).
- Change transfer case fluid every 96,000 km (60,000 mi).
- Change manual transmission fluid as required.
- Inspect and lubricate U-joints and halfshafts as required.

During extensive idling and/or low speed driving for long distances, as in heavy commercial use such as delivery, taxi, patrol car or livery:

- Change engine oil and install a new oil filter every 8,000 km (5,000 mi) or 6 months or 200 hours of engine operation.
- Lube front lower control arm and steering linkage ball joints with zerk fittings (if equipped) every 8,000 km (5,000 mi).
- Inspect brake system every 8,000 km (5,000 mi).
- Inspect and lubricate U-joints (if equipped) every 8,000 km (5,000 mi).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise every 8,000 km (5,000 mi). Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Lubricate control arm and steering ball joints (if equipped).
- Install a new fuel filter every 24,000 km (15,000 mi) (not required for Fusion, Milan, MKZ, Edge, MKX, Taurus X, Taurus and Sable).
- Replace wheel bearing grease and install new grease seals on RWD front wheel bearings (if non-sealed bearings) every 48,000 km (30,000 mi).
- Change automatic transmission fluid (not required on 6R60/6R75/TorqShift® transmissions) every 48,000 km (30,000 mi).
- Install new spark plugs every 96,000 km (60,000 mi).
- Change transfer case fluid every 96,000 km (60,000 mi).
- Install a new cabin air filter as required (if equipped).

When operating in dusty conditions such as unpaved or dusty roads:

- Change engine oil and install a new oil filter every 8,000 km (5,000 mi) or 6 months.
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise every 8,000 km (5,000 mi). Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Inspect and lubricate U-joints (if equipped) every 8,000 km (5,000 mi).

- Install a new fuel filter every 24,000 km (15,000 mi) (not required for Fusion, Milan, MKZ, Edge, MKX, Taurus X, Taurus and Sable).
- Change automatic transmission fluid (not required on 6R60/6R75/TorqShift® transmissions) every 48,000 km (30,000 mi).
- Replace wheel bearing grease and install new grease seals on RWD front wheel bearings (if non-sealed bearings) every 48,000 km (30,000 mi).
- Change rear axle lubricant every 80,000 km (50,000 mi) (E-450 and F-450/550 only).
- Change transfer case fluid every 96,000 km (60,000 mi).
- Install a new engine air filter as required.
- Install a new cabin air filter as required (if equipped).

When operating in off-road conditions:

- Change engine oil and install a new oil filter every 8,000 km (5,000 mi) or 6 months.
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise every 8,000 km (5,000 mi). Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.
- Replace wheel bearing grease and install new grease seals on RWD front wheel bearings (if non-sealed bearings) every 48,000 km (30,000 mi).
- Change automatic transmission fluid (not required on 6R60/6R75/TorqShift® transmissions) every 48,000 km (30,000 mi).
- Change rear axle lubricant every 80,000 km (50,000 mi) (E-450 and F-450/550 only).
- Change transfer case fluid every 96,000 km (60,000 mi).
- Install a new cabin air filter as required (if equipped).
- Inspect and lubricate U-joints and halfshafts as required.
- Inspect and lubricate steering linkage ball joints with zerk fittings as required.

Use of E85 fuel 50% of the time or greater (flex fuel vehicles only):

- Fill fuel tank with a full tank of regular unleaded fuel every 4,800 km (3,000 mi).
- Change engine oil and install a new oil filter every 8,000 km (5,000 mi), 6 months or 200 hours of engine operation.
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise every 8,000 km (5,000 mi). Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

Checks and Services

Certain basic maintenance checks and inspections should be carried out at specified intervals. Any recognized adverse condition should be corrected as soon as possible.

Multi-Point Inspection

The following inspections are recommended at every service interval:

- Check and top off brake, coolant, manual and automatic transmission (if equipped with a underhood fluid level indicator), power steering and window washer fluids.
- Inspect tires for wear and correct air pressure, including spare tire.
- Check exhaust system for leaks, damage, loose parts and foreign material.
- Check battery performance.
- Check operation of horn, exterior lamps, turn signals and hazard warning lights.
- Check radiator, coolers, heater and air conditioning hoses.
- Inspect windshield wiper spray and wiper operation.
- Check windshield for cracks, chips and pitting.
- Inspect for oil and fluid leaks.
- Inspect engine air filter.
- Inspect halfshaft dust boots (if equipped).
- Check shocks, struts and other suspension components for leaks and damage.
- Inspect steering and linkage.
- Inspect accessory drive belt(s).
- Inspect clutch operation (if equipped).

In-Line, Service-Installed Transmission Fluid Filter

Some vehicles may be equipped with an inline, service-installed transmission fluid filter. This filter is installed in the transmission fluid cooler return line. If equipped, install a new inline filter during transmission fluid change intervals.

Maximum Oil Change Interval (Normal Schedule)

- 12,000 km (7,500 mi) or 6 months.

Maximum Oil Change Interval (Special Operating Conditions)

- 8,000 km (5,000 mi), 6 months or 200 hours of engine operation.

Engine Coolant Change Interval

- 6 years or 169,000 km (105,000 mi).
- After initial change: 3 years or 73,000 km (45,000 mi).

Monthly Checks

Check each of the following items every month:

- All interior and exterior lights for correct operation
- Tires for wear and correct air pressure, including spare tire
- Engine oil fluid level
- Windshield washer solvent fluid level

Six Month Checks

Check each of the following items at least every 6 months:

- Lap/shoulder belts and seat latches for wear and function
- External mounted spare tire is stowed correctly (tight to body)
- Power steering fluid level
- Washer spray, wiper operation and clean all wiper blades (install new wiper blades as necessary)
- Parking brake for correct operation
- Lubricate all hinges, latches, door check straps and outside locks
- Lubricate upper and lower sliding door tracks (if equipped)
- Clean sliding door contact switches (if equipped)
- Lubricate door rubber weatherstrips
- Clean body and door drain holes
- Safety warning lamps (brake, ABS, air bag, safety belt) for correct operation
- Coolant system fluid level and correct strength
- Battery connections. Clean if necessary
- Clutch fluid level, if equipped

Normal Schedule

The following check procedures should be carried out for all cars, minivan, light trucks, sport utilities, vans and four wheel drive (4WD) vehicles.

- Retighten the wheel nuts to the specified torque at 800 km (500 mi) after any wheel disturbance (tire rotation, changing a flat tire or wheel removal).
- On vehicles equipped with dual rear wheels, retighten the wheel nuts to the specified torque at 160 km (100 mi) and again at 800 km (500 mi) of new vehicle operation or after any wheel disturbance (tire rotation, changing a flat tire or wheel removal).

12,000 Km (7,500 Mi)

- Change engine oil and install a new oil filter.
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

24,000 Km (15,000 Mi)

- Change engine oil and install a new oil filter.
- Install a new cabin air filter (if equipped).
- Inspect steering linkage, suspension and if equipped, driveshaft and U-joints.
- Inspect engine cooling system and hoses.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect halfshaft boots (if equipped).
- Inspect exhaust system and heat shields.
- Inspect engine air filter.
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect and lubricate ball joints and U-joints (if equipped with zerk fittings).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

36,000 Km (22,500 Mi)

- Change engine oil and install a new oil filter.
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

48,000 Km (30,000 Mi)

- Change engine oil and install a new oil filter.
- Change automatic transmission/transaxle fluid on all vehicles equipped with the TorqShift® transmission and externally mounted remote filter.
- Install a new remote filter if equipped with a TorqShift® transmission.
- Inspect automatic transmission/transaxle fluid level using the fluid level on all other vehicles (if equipped with an underhood fluid level indicator).
- Install a new cabin air filter (if equipped).
- Install new climate controlled seat cushion filters (if equipped).
- Install a new engine air filter (except Focus with partial zero emission vehicle [PZEV] engine).
- Install a new fuel filter (not required for Fusion, Milan, MKZ, Edge, MKX, Taurus X, Taurus and Sable).
- Inspect steering linkage, suspension and, if equipped, driveshaft, ball joints and U-joints.
- Inspect engine cooling system and hoses.

- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect halfshaft boots (if equipped).
- Inspect exhaust system and heat shields.
- Inspect and lubricate ball joints (if equipped with zerk fittings).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

60,000 Km (37,500 Mi)

- Change engine oil and install a new oil filter.
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

72,000 Km (45,000 Mi)

- Change engine oil and install a new oil filter.
- Install a new cabin air filter (if equipped).
- Inspect steering linkage, suspension and, if equipped, driveshaft, ball joints and U-joints.
- Inspect engine cooling system and hoses.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect halfshaft boots (if equipped).
- Inspect exhaust system and heat shields.
- Inspect engine air filter.
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect and lubricate ball joints and U-joints (if equipped with zerk fittings).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

84,000 Km (52,500 Mi)

- Change engine oil and install a new oil filter.

- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

96,000 Km (60,000 Mi)

- Change engine oil and install a new oil filter.
- Change automatic transmission/transaxle fluid on all vehicles equipped with the TorqShift® and 4F27E transmissions.
- Install a new externally mounted remote filter element for all TorqShift® transmissions (if equipped).
- Install a new internal TorqShift® transmission fluid filter located inside the transmission bottom pan (vehicles without externally mounted remote filter only).
- Inspect automatic transmission/transaxle fluid level on all other vehicles (if equipped with an underhood fluid level indicator).
- Install a new cabin air filter (if equipped).
- Install new climate controlled seat cushion filters (if equipped).
- Install a new engine air filter.
- Install a new fuel filter (not required for Fusion, Milan, MKZ, Edge, MKX, Taurus X, Taurus and Sable).
- Replace wheel bearing grease and install new grease seals on RWD front wheel bearings (if non-sealed bearings).
- Inspect steering linkage, suspension and, if equipped, driveshaft, ball joints and U-joints.
- Inspect engine cooling system and hoses.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect halfshaft boots (if equipped).
- Inspect exhaust system and heat shields.
- Inspect and lubricate ball joints and U-joints (if equipped with zerk fittings).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

108,000 Km (67,500 Mi)

- Change engine oil and install a new oil filter.
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be

done.

120,000 Km (75,000 Mi)

- Change engine oil and install a new oil filter.
- Install a new cabin air filter (if equipped).
- Inspect steering linkage, suspension and, if equipped, driveshaft, ball joints and U-joints.
- Inspect engine cooling system and hoses.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect halfshaft boots (if equipped).
- Inspect exhaust system and heat shields.
- Inspect engine air filter.
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect and lubricate ball joints and U-joints (if equipped with zerk fittings).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

132,000 Km (82,500 Mi)

- Change engine oil and install a new oil filter.
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

144,000 Km (90,000 Mi)

- Change engine oil and install a new oil filter.
- Change automatic transmission/transaxle fluid on all vehicles equipped with the TorqShift® transmission and externally mounted remote filter.
- Install a new remote filter if equipped with a TorqShift® transmission.
- Inspect automatic transmission/transaxle fluid level using the fluid level on all other vehicles (if equipped with an underhood fluid level indicator).
- Install a new cabin air filter (if equipped).
- Install new climate controlled seat cushion filters (if equipped).
- Install a new engine air filter (except Focus with PZEV engine).
- Install a new fuel filter (not required for Fusion, Milan, MKZ, Edge, MKX, Taurus X, Taurus and Sable).

- Install new spark plugs.
- Inspect steering linkage, suspension and, if equipped, driveshaft, ball joints and U-joints.
- Inspect engine cooling system and hoses.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect halfshaft boots (if equipped).
- Inspect exhaust system and heat shields.
- Inspect drive belts.
- Inspect and lubricate ball joints and U-joints (if equipped with zerk fittings).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

156,000 Km (97,500 Mi)

- Change engine oil and install a new oil filter.
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

168,000 Km (105,000 Mi)

- Change engine oil and install a new oil filter.
- Install a new cabin air filter (if equipped).
- Install a PCV valve on all cars and light trucks under 6,000 lb GVW (except 3V engines).
- Change rear axle fluid on vehicles equipped with DANA axles which use synthetic lubricants.
- Change premium gold engine coolant.
- Inspect steering linkage, suspension and, if equipped, driveshaft, ball joints and U-joints.
- Inspect engine coolant system and hoses.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect halfshaft boots (if equipped).
- Inspect exhaust system and heat shields.
- Inspect engine air filter.
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect and lubricate ball joints and U-joints (if equipped with zerk fittings).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Carry out multi-point inspection (recommended).

- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

180,000 Km (112,500 Mi)

- Change engine oil and install a new oil filter.
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

192,000 Km (120,000 Mi)

- Change engine oil and install a new oil filter.
- Install a new cabin air filter (if equipped).
- Install new climate controlled seat cushion filters (if equipped).
- Install a new engine air filter (except Focus with PZEV engine).
- Install a new fuel filter (not required for Fusion, Milan, MKZ, Edge, MKX, Taurus X, Taurus and Sable).
- Install a new PCV valve on all cars and light trucks over 6,000 lb GVW (except 3V engines).
- Change automatic transmission/transaxle fluid on all vehicles equipped with the TorqShift® and 4F27E transmissions.
- Install a new externally mounted remote filter element for all TorqShift® transmissions (if equipped).
- Install a new internal TorqShift® transmission fluid filter located inside the transmission bottom pan (vehicles without externally mounted remote filter only).
- Inspect automatic transmission/transaxle fluid level on all other vehicles (if equipped with an underhood fluid level indicator).
- Inspect steering linkage, suspension and, if equipped, driveshaft, ball joints and U-joints.
- Inspect engine cooling system and hoses.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect halfshaft boots (if equipped).
- Inspect exhaust system and heat shields.
- Inspect drive belts.
- Replace wheel bearing grease and install new grease seals on RWD front wheel bearings (if non-sealed bearings).
- Inspect and lubricate ball joints and U-joints (if equipped with zerk fittings).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different

front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

204,000 Km (127,500 Mi)

- Change engine oil and install a new oil filter.
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

216,000 Km (135,000 Mi)

- Change engine oil and install a new oil filter.
- Install a new cabin air filter (if equipped).
- Inspect steering linkage, suspension and, if equipped, driveshaft, ball joints and U-joints.
- Inspect engine cooling system and hoses.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect halfshaft boots (if equipped).
- Inspect exhaust system and heat shields.
- Inspect engine air filter.
- Inspect automatic transmission fluid level (if equipped with an underhood fluid level indicator).
- Inspect and lubricate ball joints and U-joints (if equipped with zerk fittings).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

228,000 Km (142,500 Mi)

- Change engine oil and install a new oil filter.
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

240,000 Km (150,000 Mi)

- Change engine oil and install a new oil filter.
- Change premium gold engine coolant.

- Install a new cabin air filter (if equipped).
- Install new climate controlled seat cushion filters (if equipped).
- Install a new engine air filter (except Focus with PZEV engine).
- Install a new fuel filter (not required for Fusion, Milan, MKZ, Edge, MKX, Taurus X, Taurus and Sable).
- Change automatic transmission/transaxle fluid and filter on all vehicles except 4F27E, TorqShift® without external filter (filter not required on CD4E, 6F50, AWF-21 and FNR5).
- Install a new remote filter if equipped with a TorqShift® transmission.
- Change transfer case fluid (if equipped).
- Install new front wheel bearings (if not sealed units).
- Install a new drive belt(s) (if a new belt has not been installed within the last 160,000 km [100,000 mi]).
- Inspect steering linkage, suspension and, if equipped, driveshaft, ball joints and U-joints.
- Inspect engine cooling system and hoses.
- Inspect brake pads, shoes, rotors, drums, brake lines, hoses and parking brake system.
- Inspect halfshaft boots (if equipped).
- Inspect exhaust system and heat shields.
- Inspect PVC for flow (3V engines).
- Inspect and lubricate ball joints and U-joints (if equipped with zerk fittings).
- Inspect and lubricate 4WD front axle shaft U-joints (if equipped).
- Carry out multi-point inspection (recommended).
- Rotate tires, inspect tires for wear, measure tread depth and inspect wheel ends for end play and noise. Vehicles with dual rear wheels should only be rotated if unusual wear is noted. For vehicles with different front-to-rear tire pressures, the tire pressure must be adjusted and the tire pressure sensor training must be done.

Exceptions To Normal Schedule

Maximum Oil Change Interval

- Normal schedule: 12,000 km (7,500 mi) or 6 months, whichever occurs first.
- Special operating conditions: 8,000 km (5,000 mi), 6 months or 200 hours of operation, whichever occurs first.

Motorcraft Premium Gold Coolant

- Change premium gold engine coolant at 6 years or 168,000 km (105,000 mi) of the vehicle's life, whichever occurs first.
- After the initial change, change coolant every 3 years or 72,000 km (45,000 mi) thereafter.

Normal Vehicle Axle Maintenance

Rear axles and transfer case/power transfer unit (PTU) units containing synthetic lubricant and light duty trucks equipped with Ford-design axles are lubricated for life. These lubricants are not to be checked or changed unless service is required, or if a leak is suspected or the axle assembly has been submerged in water.

The axle and transfer case/PTU fluid should be changed anytime they have been submerged in water. Non-synthetic rear axle lubricants should be installed new every 4,800 km (3,000 mi) or 3 months, whichever occurs first, during extended trailer tow operation above 21°C (70°F) ambient and wide open throttle (WOT) for extended periods above 72 km/h (45 mph).

The 3,000 mile lube change interval may be waived if the axle was filled with 75W-140 synthetic gear lubricant. Add 4 ounces of additive friction modifier for complete refill of Traction-Lok® rear axles.

The axle lubricant should be changed anytime an axle has been submerged in water.

Police and Taxi Vehicle Axle Maintenance

Install new rear axle lubricant every 160,000 km (100,000 mi). Rear axle lubricant change may be waived if the axle was filled with 75W-140 synthetic gear lubricant. Add 4 ounces of additive friction modifier for complete refill of Traction-Lok® rear axles.

The axle lubricant should be changed anytime an axle has been submerged in water.

Class A Motorhome

- Every 2 years - change brake fluid.

2008 GENERAL INFORMATION

Manual Transaxle/Transmission & Clutch - General Information - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Clutch disc	
Minimum allowable depth to rivet head	0.3 mm (0.012 in)
Maximum runout	0.7 mm (0.027 in)
Clutch pedal	
Clutch pedal free play	1.0-3.0 mm (0.04-0.11 in)
Clutch pressure plate	
Maximum runout	0.5 mm (0.02 in)
Flywheel runout	
Maximum runout	0.1 mm (0.004 in)
Pressure plate diaphragm spring fingers	
Maximum depth	0.6 mm (0.024 in)
Maximum clearance	0.3 mm (0.012 in)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Bleeder screw	7	62

DESCRIPTION AND OPERATION

MANUAL TRANSAXLE AND CLUTCH

The transaxle and clutch system consist of the following:

- Five-speed manual transaxle

- Clutch disc
- Clutch pressure plate
- Clutch release hub and bearing
- Clutch hydraulic system
- Clutch pedal
- Flywheel

The transaxles function is to move the vehicle from a rest position to motion. The transaxle uses gears to adapt the torque to the demands of load and road conditions. It matches engine power to vehicle needs. This power is delivered from the engine's flywheel to the transaxle. The power is transmitted through a driver-operated clutch, which allows for engagement and disengagement of the engine to the transaxle.

The transaxle input shaft receives the power when the clutch is engaged. The transaxle then uses a system of gears to change the speed and torque relationship between the engine crankshaft and the transaxle differential.

The purpose of the clutch is to connect and disconnect a manually operated transaxle, and the halfshafts, from the engine. This allows starting and stopping the vehicle, shifting and changing speeds that correspond to the engine speed through gear changes.

The manual transmission has a tag to identify assemblies for repair purposes. Refer to **MANUAL TRANSAXLE/TRANSMISSION** article for the transmission tag information.

DIAGNOSTIC TESTS

MANUAL TRANSAXLE AND CLUTCH

Principles of Operation

The clutch master cylinder transmits fluid pressure to the clutch slave cylinder, which in turn moves the clutch release hub and bearing. The clutch hydraulic system uses brake fluid and has a separate reservoir. The clutch is a single-plate, dry-friction disc with a diaphragm-style spring pressure plate. The clutch disc has frictional material where it contacts the flywheel and the clutch pressure plate. The clutch pressure plate applies pressure to the clutch disc, holding it tightly against the surface of the flywheel.

In the engaged position, the clutch pressure plate diaphragm spring holds the clutch pressure plate against the clutch disc, so that the engine torque is transmitted to the input shaft. When the clutch is depressed, movement is transmitted through the clutch hydraulic system.

Inspection and Verification

CAUTION: If transaxle noise is reported, first check the fluid level. The vehicle should not be driven if the fluid level is low or damage can occur.

NOTE: Before attempting to rectify any concerns, road test the vehicle to ascertain in which system the concern falls.

NOTE: If any evaluation or inspection reveals an obvious concern, repair the vehicle.

The technician should have a thorough knowledge of transaxle/clutch operation and accepted general transaxle/clutch guidelines to detect any problems.

A gear driven unit will produce a certain amount of noise. Some noise is acceptable and audible at certain speeds or under various driving conditions. Certain conditions, such as road and weather, will amplify normal vehicle noise.

The following overview is a guide to diagnose a transaxle/clutch concern:

- Verify and document the customer concern.
  - During the customer interview, if a leak was noticed or if a leak is the concern, check the transmission fluid. The vehicle should not be driven if the fluid level is low.
- Check fluid level and condition.
- Evaluation of the clutch hydraulic system.
- Evaluation of the clutch.
- Inspect gearshift mechanism.
- Road test.
- Find the cause of the problem and correct it.

Verify Customer Concern

1. Verify and document the customer concern.
   1. When was it first noticed?
   2. Did it appear suddenly or gradually?
   3. Did anything unusual occur that would coincide with it or precede it?
   4. Identify when the condition occurs:
      - Hot or cold vehicle operating conditions
      - Type of terrain
      - City/highway driving
      - Driving at a particular speed
        - coasting
        - hard acceleration
      - Shifting
        - upshifts
        - downshifts
        - in a particular gear
        - in all gears
      - Hot or cold ambient temperatures
   5. Has the transaxle/clutch been repaired before or components installed?

- Check the vehicle service record. Note any repairs.

Check Fluid Level and Condition

NOTE: The vehicle should not be driven if the fluid level is low.

An incorrect level may affect the transaxle operation and can result in transaxle damage. To correctly check and add fluid to the transaxle, refer to transaxle draining and filling in **MANUAL TRANSAXLE/TRANSMISSION** article.

A low fluid level can result in poor transaxle shifting, engagement or damage. It can also indicate a leak in one of the transaxle seals or gaskets.

1. Check the fluid condition.
    - Observe the color and the odor of the fluid. Allow the fluid to drip onto a white cloth and examine the stain. Check the fluid for contamination or metal particles.
        - Fluid should appear nearly clear, similar to clean engine oil.

Evaluation of Clutch Hydraulic System

1. Verify that the brake/clutch hydraulic fluid reservoir is filled to the correct level.
    - If the fluid level is correct, proceed to clutch check.
    - If the rear chamber fluid level is low, add fluid as necessary. Check the clutch hydraulic system for leaks and repair as necessary.

Evaluation of the Clutch

1. Depress and release the clutch pedal slowly to check if the pedal is binding. Make sure the clutch pedal can be fully depressed and is not restricted by the floor mat. Verify that the pedal return spring is present and functions correctly.
2. Measure the clutch reserve. Go to **Pinpoint Test A**.
3. With the engine idling, the parking brake on and the clutch pedal up, gently move the gearshift lever toward reverse gear until gear clash can be heard. Depress the clutch pedal slowly.
    - If the gears cease to clash (full disengage at 1 to 38.1 mm (1.5 in) from the floor), then hold the pedal at the point of disengagement and increase engine to 4,000 RPM. The clutch should remain disengaged, clutch OK.
    - Any concerns indicate a worn or damaged clutch. Repair as necessary.
4. With the engine idling, move the gearshift lever into 4th gear. Increase the RPM to 2,000 and slowly release the clutch pedal.
    - If the engine stalls, the clutch is OK.
    - If the engine does not stall, the clutch is slipping. Repair as necessary.
5. Compare the clutch evaluation results with the following table. The following list of conditions are typical faults into which clutch concerns will fall.

SYMPTOM CHART - CLUTCH

Conditions/Sources	Action
• **Clutch Slippage** ○ Clutch pedal reserve ○ Diaphragm springs ○ Clutch pressure plate ○ Clutch disc facing ○ Hardened or oiled clutch disc facing surface ○ Flywheel	Go to **Pinpoint Test A**.
• **Clutch Chatter, Rattle or Shudder** ○ Engine mounts ○ Oil on clutch disc facing ○ Diaphragm springs ○ Clutch pressure plate ○ Clutch disc facing ○ Flywheel ○ Clutch disc	Go to **Pinpoint Test B**.
• **Clutch Drag** ○ Insufficient clutch fluid ○ Air in hydraulic system ○ Clutch pedal reserve ○ Diaphragm springs ○ Clutch disc ○ Clutch disc splines ○ Oil on facing	Go to **Pinpoint Test C**.
• **Clutch Pedal Pulsation** ○ Clutch and brake pedal pivot shaft not correctly lubricated ○ Flywheel ○ Worn springs in pressure plate	Go to **Pinpoint Test D**.
• **Clutch Related Vibrations** ○ Engine component grounding against frame ○ Accessory drive belt ○ Flywheel bolts ○ Flywheel ○ Imbalance clutch pressure plate	Go to **Pinpoint Test E**.
• **Hard Shifting** ○ Insufficient clutch fluid	Go to **Pinpoint Test F**.

◦ Clutch pedal reserve ◦ Transaxle concern	
• **Excessive Noise** ◦ Clutch pedal reserve ◦ Clutch slave cylinder ◦ Pilot bearing ◦ Excessive crankshaft end play	Go to **Pinpoint Test G**.
• **Clutch System Leakage** ◦ Clutch master cylinder ◦ Clutch slave cylinder ◦ Clutch hydraulic tubes	Go to **Pinpoint Test H**.
If the clutch was the concern, REPAIR the clutch system. TEST the system for normal operation.	

Inspect the Gearshift Mechanism

1. Inspect the cables for:
    - signs of damage.
    - broken locks.
    - binding.
    - cables not fully seated or in hold-down brackets.
    - hold-down bracket nuts are loose.
    - correct routing.
    - correct adjustment.
        - If the concern is a gear(s) cannot be selected, adjust the cables. Refer to **Gearshift Cable Adjustment**.
2. Inspect the gearshift for:
    - free play in the gearshift lever (must be no more than 5 mm). This specification is for an absolute or "no load" free play.
        - If the gearshift lever free play is too great, check the gearshift cables and repair as necessary.
        - If the gearshift lever free play is OK, adjust the gearshift linkage.

Evaluation of the Transmission

1. During the road test, use the following driving methods to diagnose the problem.
    - Start the engine.
    - Evaluate the noise in NEUTRAL while the vehicle is parked.
        - Check whether the noise is present with the clutch fully disengaged (pedal fully depressed). Check to see if the pedal pulsates abnormally (for clutch diaphragm finger run out).
        - Check whether the noise is present with the gearshift in the NEUTRAL position and the clutch fully engaged (foot off pedal). With the parking brake engaged, move the gearshift

towards the 1st gear position. Apply very slight pressure and note if the gear noise level is reduced. (for gear rollover noise).

- With the clutch fully engaged (foot off pedal), check whether the noise is present as the engine speed is raised. If the noise reduces, note the engine speed at which this occurs.
- Listen for any change in noise while depressing and releasing the clutch pedal.
- Listen for any change in noise while changing the engine RPM.
- Drive the vehicle and shift through all of the gear ranges, including reverse. Listen for any change in noise in a particular gear.
- Drive the vehicle in the gear in which the noise is most noticeable. Depress the clutch pedal and leave the gear engaged. Listen for any change in noise.
- Drive the vehicle in the gear in which the noise is most noticeable. Depress the clutch pedal and shift the transmission into NEUTRAL. Release the clutch pedal and allow the vehicle to coast.

2. Compare the road test results with the following symptom chart. It is a list of conditions that are typical faults into which the transaxle will fall:

   Go to **Symptom Chart - Transaxle** or Go to **Symptom Chart - Noise, Vibration and Harshness (NVH)**.

Symptom Chart - Transaxle

Symptom Chart - Transaxle

Condition	Possible Sources	Action
• Noisy in forward gears - While verifying the condition, determine whether the noise is a gear roll over noise, release bearing rub or some other transmission-related noise. Gear roll over noise, inherent in manual transmissions, is caused by the constant mesh gears turning at the engine idle speed while the clutch is engaged and the transmission is in NEUTRAL. Gear roll over noise will	• Lubricant	• ADD specified lubricant as necessary.

disappear when the clutch is disengaged or when the transmission is engaged in gear. Release bearing rub is sometimes mistaken for mainshaft bearing noise. Release bearing rub will disappear when the clutch is engaged. In the event that a bearing is damaged, the noise is more pronounced while engaged in gear under load or coast than in NEUTRAL		
	• Components grounding out on the transaxle • Component housing bolts • Bearings or gears	• CHECK for screws, bolts or other components grounding out. CORRECT as required. • CHECK the torque on the transaxle-to-clutch housing bolts and the clutch housing-to-engine block bolts. TIGHTEN the bolts to specification. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article. • INSPECT the bearings. INSPECT the gears and gear teeth for wear or damage. INSTALL new components as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
• Gears clash when shifting from one forward gear to another	• Clutch not fully releasing • Transaxle input shaft pilot bearing worn/damaged • Gear teeth and/or synchronizer	• INSPECT clutch release mechanism for correct operation. CHECK the clutch pedal freeplay. REFER to **Clutch Pedal Freeplay Adjustment**. • INSPECT the transaxle input shaft pilot bearing for wear and damage. REPAIR as necessary. • REPAIR or INSTALL new components as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.

	• Engine idle speed too high	• REFER to the **Introduction - Gasoline Engines** article.
• Transaxle jumps out of gear	• Excessive gearshift lever boot tension	• INSTALL a new gearshift lever boot and knob assembly. REFER to **MANUAL TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
	• Transaxle-to-engine mounting bolts	• TIGHTEN the transaxle-to-engine block bolts to specification. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
	• Internal components	• INSPECT the synchronizer sleeves for free movement on their hubs. INSPECT the synchronizer blocking rings for widened index slots, rounded clutch teeth and a smooth internal surface. CHECK the countershaft cluster gear for excessive end play. CHECK the shift forks for worn or loose mounting on the shift rails. INSPECT the synchronizer sliding sleeve and the gear clutch teeth for wear or damage. REPAIR or INSTALL new components as necessary.
	• Gear teeth worn or damaged	• INSTALL new gears. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
• Transaxle will not shift into one gear - all others OK	• Manual shifting components	• REPAIR or INSTALL new components as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
	• Reversing lamp switch ball	• If REVERSE is the problem, CHECK the reversing lamp switch for the ball frozen in the extended position.
	• Internal components	• INSPECT the shift rail and fork system, the synchronizer system and the gear clutch teeth for restricted travel. REPAIR or INSTALL new components as necessary.
• Transaxle is locked in one gear and cannot be shifted out of that gear	• Internal components	• INSPECT the problem gears, the shift rails, the forks and the synchronizer for wear or damage. REPAIR as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
	• Fork on rail	• CHECK the shift rail interlock system. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
• Transaxle leaks	• Lubricant	• CHECK the fluid level and type.
		• IDENTIFY the leaking fluid as engine, power

	• Other components leaking	steering or transaxle fluid. REPAIR as required. REMOVE all traces of fluid on exposed transaxle surfaces. CHECK the vent for free breathing. OPERATE the transaxle and INSPECT for new leakage. REPAIR as necessary.
	• Internal components	• INSPECT for leaks at the input shaft bearing retainer seal and the shift rail expansion plug. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article. INSPECT for leaks at the transaxle case-to-clutch housing seam. INSPECT the case for sand holes or cracks. REPAIR as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
	• Fill and drain plugs	• CHECK the fill plug, the drain plug and the bore threads. REPAIR as necessary. TIGHTEN to specification. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
	• Transaxle case bolt	• CHECK for loose or missing bolts. REPAIR as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
	• Halfshaft oil seals	• CHECK for cracked, loose or damaged RH intermediate shaft oil seal or LH halfshaft oil seal. INSTALL new seals as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
• Bearing failure	• Other part failure • Raceways or rollers • Lubricant	• REMOVE, CLEAN and DISASSEMBLE the transaxle, then INSTALL new bearings as necessary. (It is necessary to RESET the bearing preload if any tapered bearings are installed.) REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
	• Vibration break up of retainer and brinelling of races • Bearing(s) • Shafts or bore • Overloading of vehicle • Incorrect preload	• DETERMINE and CORRECT the cause of the vibration. • INSTALL new components and verify correct oil dam installation. REFER to

	• Input shaft oil dam	**MANUAL TRANSAXLE/TRANSMISSION** article. CHECK for correct installation of the snap ring on the mainshaft next to the oil dam.
	• Oil baffle in the input bearing shim pack	• INSTALL new components. MAKE SURE the oil baffle is not damaged during reassembly. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

Symptom Chart - Noise, Vibration and Harshness (NVH)

Condition	Possible Sources	Action
• Excessive noise	• Clutch disc damper damaged • Transaxle input shaft pilot bearing worn or damaged • Crankshaft end play excessive • Release bearing worn or damaged	• REMOVE the clutch disc and pressure plate. REFER to **CLUTCH** article. INSPECT the clutch disc for damage. INSPECT the transaxle input shaft and the transaxle input shaft pilot bearing for wear and damage. CHECK the crankshaft end play. Refer to the appropriate Engine article for the procedure. CHECK the clutch release hub and bearing, and guide tube for wear and damage. REPAIR all components as necessary. TEST the system for normal operation.
• Clutch rattling noise - occurs with clutch engaged, noise changes/disappears with clutch pedal depressed	• Flywheel bolts, clutch housing bolts or clutch pressure plate bolts loose	• TIGHTEN the bolts to specifications. CHECK the bolts for damage. REFER to **CLUTCH** article.
• Clutch squeaking noise - noise is heard when the clutch is operated. Vehicle		

moves slowly or creeps when the clutch is disengaged. Can also be difficult to shift into 1st and REVERSE gears	• Pilot bearing seized or damaged	• INSTALL a new pilot bearing. REFER to **CLUTCH** article.
• Clutch squeaking noise - occurs with clutch pedal depressed/released	• Worn clutch pedal shaft or bushings	• INSPECT the clutch pedal for wear or damage. REPAIR as necessary. REFER to **CLUTCH CONTROLS** article.
• Clutch whirring/rattle noise - occurs when clutch pedal is depressed	• Worn, damaged or misaligned clutch release bearing	• INSTALL a new clutch release bearing. REFER to **CLUTCH** article.
• Clutch grating/grinding noise - occurs when clutch pedal is depressed	• Clutch pressure plate fingers bent or worn	• INSPECT the clutch pressure plate release fingers. INSTALL a new pressure plate as necessary. REFER to **CLUTCH** article.
	• Contact surface of clutch release bearing worn or damaged	• INSTALL a new clutch release bearing. REFER to **CLUTCH** article.
• Clutch chatter - a small amount of noise when clutch pedal is released at initial take off	• Clutch engagement	• Acceptable operating condition.
• Clutch chatter/grabs - in some cases a shudder is felt. Occurs with clutch pedal depressed/released	• Damaged or worn powertrain/driveline mounts	• INSPECT the powertrain/drivetrain mounts. INSTALL new mounts as necessary. Refer to the appropriate Engine article for the procedure.
	• Binding or dragging plunger of the clutch master cylinder or slave cylinder	• CHECK the master and slave cylinder operation. INSPECT the components for damage or wear. INSTALL a new master or slave cylinder as necessary. REFER to **CLUTCH CONTROLS** article.
	• Grease or oil on the clutch disc facing	• CHECK the input shaft seal and rear main oil seal. REPAIR as necessary. INSTALL a new clutch disc. REFER to **CLUTCH** article.
	• Clutch disc surface	• INSPECT the clutch disc surface for a glazed, hardened or damage condition.

	glazed or damaged	CARRY OUT a disc check. INSTALL a new clutch disc as necessary. REFER to **CLUTCH** article.
	• Damaged or worn clutch pressure plate	• INSPECT the clutch pressure plate for wear or damage. INSTALL a new clutch pressure plate as necessary. REFER to **CLUTCH** article.
	• Flywheel surface damaged or glazed	• INSPECT the flywheel for damage or wear. CARRY OUT a flywheel runout check. INSTALL a new flywheel as necessary. Refer to the appropriate Engine article for the procedure.
• Clutch chatter noise - noise when clutch pedal is released at initial take off. Clutch is hard to engage and disengage	• Pilot bearing worn, damaged or not correctly aligned in bore	• INSPECT the clutch pressure plate release fingers for uneven wear, clutch components burnt or a seized pilot bearing. INSTALL a new pilot bearing as necessary. REFER to **CLUTCH** article.
• Transaxle rattling/clattering noise - occurs in NEUTRAL or in gear, at idle	• Incorrect fluid level or fluid quality	• CHECK that the transaxle is filled to the correct level and with the specified fluid. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article for the fluid type.
• Transaxle rattling/clattering noise - noise at idle in NEUTRAL	• Worn or rough reverse idler gear	• CHECK the reverse idler gear. REPAIR as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
	• Excessive backlash in gears	• CHECK the gear backlash. ADJUST as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
	• Worn countershaft gears	• REPAIR as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
• Transaxle whine - a mild whine at extreme speeds or high RPM	• Rotating gears/geartrain	• Acceptable noise.
• Transaxle whine - a high pitched whine, also described as a squeal	• Transaxle gears are worn (high mileage vehicle)	• Result of normal gear wear. REPAIR as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
		• INSPECT the gear sets for an uneven

	• Mismatched gear sets	wear pattern on the face of the gear teeth. REPAIR as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
	• Damaged or worn transaxle bearing	• INSPECT the transaxle bearings. INSTALL new bearings as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
• Transaxle growling/humming - noise occurs in the forward gears. The noise is more prominent when the gear is loaded. The problem gear can be located as the noise occurs in a specific gear position	• Gear is cracked, chipped or rough	• INSPECT the transaxle gears for damage or wear. INSTALL new gears as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
• Transaxle hissing - noise in NEUTRAL or in forward gears. As bearings wear or break up, the noise changes to a thumping noise	• Damaged or worn bearings	• INSPECT the transaxle bearings. INSTALL new bearings as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
• Transaxle knocking/thudding - noise at low speeds in forward gears	• Bearings with damaged balls or rollers or with pitted and spalled races	• INSPECT the transaxle bearings. INSTALL new bearings as necessary. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.
• Transaxle rumble/growl - noise at all speeds in forward gears, more pronounced in a heavy acceleration condition	• Damaged or worn transaxle bearing or gears (high mileage vehicles)	• CHECK transaxle fluid for excessive metal particles. REPAIR as necessary.

Pinpoint Tests

Pinpoint Test A: Clutch Slippage

Normal Operation

The clutch is designed to transfer the power from the engine to the transaxle, which may be either stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when both the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub and bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transaxle.

This pinpoint test is intended to diagnose the following:

- Clutch pedal
- Clutch pedal pivot

PINPOINT TEST A: CLUTCH SLIPPAGE

A1 INSPECT THE CLUTCH LINKAGE

- Key in OFF position.
- Apply the parking brake.
- Depress and slowly release the clutch pedal.
- **Does the clutch pedal release without binding?**

  YES : Go to A2.

  NO : INSPECT the clutch pedal for wear or damage. REPAIR as necessary. REFER to **CLUTCH CONTROLS** article.

A2 TEST CLUTCH SLIPPAGE

- Apply the parking brake.
- Start engine and engage 4th gear.
- Run the engine at approximately 2,000 RPM.
- Release clutch pedal slowly.
- **Does the engine stall when the clutch pedal is fully released?**

  YES : The clutch is not slipping. VERIFY customer concern.

  NO : Go to A3.

A3 MEASURE THE CLUTCH RESERVE

- Apply the parking brake.
- Start the engine.
- With the clutch pedal up, gently move the shift lever toward the REVERSE gear position.
- Hold the lever in position when gear clash can be heard.
- Slowly depress the clutch pedal.

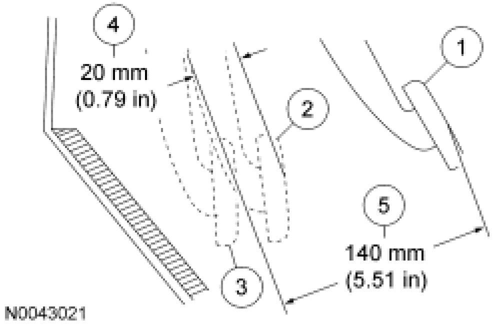

Fig. 1: Identifying Pedal Positions
Courtesy of FORD MOTOR CO.

- Stop and hold the clutch pedal when the gear clash stops. Measure the distance from when gear clash stops to the pedal fully depressed position. The difference between the measurement taken when the gear clash stopped and the measurement taken at the downstop is the clutch reserve.

Item	Pedal Position
1	Gear clash begins
2	Gear clash ends
3	Clutch pedal downstop
4	Clutch pedal disengagement stroke
5	Pedal stroke

- **Is the clutch reserve within specification?**

  YES : Clutch pedal reserve is OK. INSPECT the clutch pressure plate and clutch disc for wear or damage. INSTALL new components as necessary.

  NO : ADJUST the clutch pedal freeplay to specification. REFER to **Clutch Pedal Freeplay Adjustment**.

Pinpoint Test B:Clutch Chatter, Rattle or Shudder

Normal Operation

The clutch is designed to transfer the power from the engine to the transmission, which may be either stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when both the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub and bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

- Engine or transmission mounts
- Clutch disc
- Clutch pressure plate
- Flywheel
- Pilot bearing
- Input shaft

PINPOINT TEST B: CLUTCH CHATTER, RATTLE OR SHUDDER

B1 CHECK THE ENGINE OR TRANSMISSION MOUNTS

- Inspect all the engine and transmission mounts for looseness or damage.
- **Are any of the engine or transmission mounts loose or damaged?**

  YES : TIGHTEN or INSTALL new engine mounts or transmission mounts. TEST the system for normal operation.

  NO : Go to B2.

B2 INSPECT THE PRESSURE PLATE BOLTS

- Inspect the pressure plate-to-flywheel bolts.
- **Are any of the pressure plate-to-flywheel bolts loose?**

  YES : TIGHTEN or INSTALL new bolts. REFER to **CLUTCH** article. TEST the system for normal operation.

  NO : Go to B3.

B3 INSPECT THE PRESSURE PLATE

- Remove the clutch pressure plate.
- Inspect the clutch pressure plate for wear or damage.
- **Are any signs of damage present on the clutch pressure plate?**

  YES : INSTALL a new clutch pressure plate. REFER to **CLUTCH** article. TEST the system for normal operation.

  NO : Go to B4.

B4 CHECK THE CLUTCH DISC

NOTE: **If the internal damper of the clutch disc is damaged or contaminated with grease or oil, it will sound similar to a "transmission rattle".**

- Check the clutch disc for wear or damage.
- **Is the clutch disc OK?**

  YES : Go to B5.

  NO : INSTALL a new clutch disc. REFER to **CLUTCH** article. TEST the system for normal operation.

B5 INSPECT THE FLYWHEEL

- Inspect the flywheel for wear or damage.
- **Is the flywheel OK?**

  YES : Go to B6.

  NO : REPAIR or INSTALL a new flywheel as necessary. REFER to **CLUTCH** article. TEST the system for normal operation.

B6 INSPECT THE INPUT SHAFT

- Inspect the input shaft for signs of wear or damage.
- **Are any signs of wear or damage present on the input shaft?**

  YES : INSTALL a new input shaft. REFER to **MANUAL TRANSAXLE/TRANSMISSION** article.

  NO : VERIFY the customer concerns.

Pinpoint Test C: Clutch Drag

Normal Operation

The clutch is designed to transfer the power from the engine to the transmission, which may be either stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when both the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub and bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

- Fluid level
- Clutch pedal free play
- Clutch pressure plate
- Clutch pedal
- Clutch disc contamination

PINPOINT TEST C: CLUTCH DRAG

C1 CHECK THE FLUID LEVEL

- Key in OFF position.
- Inspect the fluid level in the brake master cylinder reservoir.
- **Is the fluid level within the MAX and MIN level marks?**

  YES : Go to C2.

  NO : ADD brake fluid and CHECK for leaks in the clutch and brake systems.

C2 CHECK CLUTCH PEDAL HEIGHT

- Measure the distance from the upper surface of the clutch pedal to the floor.
- **Is the clutch pedal height 210-216 mm (8.27-8.50 in)?**

YES : Go to C3.

NO : ADJUST the clutch pedal height. REFER to **Clutch Pedal Freeplay Adjustment**.

C3 CHECK THE CLUTCH PEDAL FREE PLAY

- Press the clutch pedal lightly by hand.
- Measure the distance the clutch pedal travels.
- **Is the clutch pedal travel within 5-13 mm (0.20-0.51 in)?**

YES : Go to C4.

NO : BLEED the clutch. REFER to **Clutch System Bleeding**.

C4 CHECK THE CLUTCH PRESSURE PLATE AND THE DIAPHRAGM SPRING

- Remove the transaxle. Refer to **MANUAL TRANSAXLE/TRANSMISSION** article.
- Inspect the clutch pressure plate for wear and the diaphragm spring for even diaphragm height. Refer to **Clutch Pressure Plate Check**.
- **Are there any signs of contamination or wear to the clutch pressure plate or diaphragm spring?**

YES : INSTALL a new clutch pressure plate. REFER to **CLUTCH** article.

NO : INSPECT the clutch disc for damage or excessive runout. REFER to **Clutch Disc Check**.

Pinpoint Test D: Clutch Pedal Pulsation

Normal Operation

The clutch is designed to transfer the power from the engine to the transmission, which may be either stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when both the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub and bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

- Clutch disc
- Clutch pressure plate
- Flywheel

PINPOINT TEST D: CLUTCH PEDAL PULSATION

D1 CHECK THE CLUTCH PEDAL PULSATION

- Start engine.
- With the transmission in NEUTRAL, slowly press the clutch pedal.
- **Does the clutch pedal pulsate while being pressed?**

YES : Go to D2.

NO : VERIFY customer concern.

D2 INSPECT THE PRESSURE PLATE BOLTS

- Inspect the pressure plate-to-flywheel bolts.
- **Are any of the pressure plate-to-flywheel bolts loose?**

  YES : TIGHTEN or INSTALL new bolts. REFER to **CLUTCH** article. TEST the system for normal operation.

  NO : Go to D3.

D3 INSPECT THE CLUTCH PRESSURE PLATE

- Remove the clutch pressure plate. Refer to **CLUTCH** article.
- Inspect the clutch pressure plate for wear or damage.
- **Are there any signs of damage present on the clutch pressure plate?**

  YES : INSTALL a new clutch pressure plate. REFER to **CLUTCH** article. TEST the system for normal operation.

  NO : Go to D4.

D4 INSPECT THE CLUTCH DISC

- Check the clutch disc for wear or damage.
- **Is the clutch disc OK?**

  YES : Go to D5.

  NO : INSTALL a new clutch disc. REFER to **CLUTCH** article. TEST the system for normal operation.

D5 INSPECT THE FLYWHEEL

- Inspect the flywheel for wear or damage.
- **Is flywheel OK?**

  YES : VERIFY customer concern.

  NO : TIGHTEN or INSTALL a new flywheel as necessary. REFER to **ENGINE - 2.3L** article, **ENGINE - 3.0L (4V)** article or **ENGINE - 3.5L** article. TEST the system for normal operation.

Pinpoint Test E: Clutch Related Vibrations

Normal Operation

The clutch is designed to transfer the power from the engine to the transmission, which may be either stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when both the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub and bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission

This pinpoint test is intended to diagnose the following:

- Engine components
- Accessory drive component

- Release bearing
- Flywheel

PINPOINT TEST E: CLUTCH RELATED VIBRATIONS

E1 CHECK FOR ENGINE COMPONENT GROUNDING

- With the vehicle in NEUTRAL, position it on a hoist. Refer to **JACKING AND LIFTING** article.
- Check the engine mount interlocks for grounding.
- Check for the exhaust manifold or other engine components grounding on the body or frame.
- **Is there evidence of grounding on the body or frame?**

  YES : REPAIR any components as necessary.

  NO : Go to E2.

E2 CHECK FOR ACCESSORY DRIVE VIBRATIONS

- Remove the accessory drive belt and check for vibration.
- **Does the vibration stop when the accessory drive belts are removed from the engine?**

  YES : REFER to **ACCESSORY DRIVE - 2.3L** article to diagnose the accessory drive belt components.

  NO : Go to E3.

E3 CHECK FOR RELEASE BEARING NOISE

- Key in START position.
- Press and hold the clutch pedal.
- **Is a whirring, grating or grinding noise present only when the pedal is pushed?**

  YES : INSTALL a new clutch slave cylinder. REFER to **CLUTCH CONTROLS** article.

  NO : Go to E4.

E4 INSPECT THE FLYWHEEL

- Remove the transaxle. Refer to **MANUAL TRANSAXLE/TRANSMISSION** article.
- Inspect for loose flywheel bolts.
- Check for an excessively burnt or severely cracked contact surface.
- Inspect the flywheel runout. Refer to **Flywheel Runout Check**.
- **Is the flywheel OK?**

  YES : Go to E5.

  NO : TIGHTEN or INSTALL a new flywheel. REFER to **ENGINE - 2.3L** article, **ENGINE - 3.0L (4V)** article or **ENGINE - 3.5L** article.

E5 CHECK FOR PRESSURE PLATE IMBALANCE

CAUTION: Failure to support the engine correctly could result in damage to the vehicle.

- Support the engine securely.

- Operate the engine with the transaxle removed.
- **Is the vibration still present?**

  YES : REFER to **NOISE, VIBRATION AND HARSHNESS** article to diagnose the engine vibration concern.

  NO : INSTALL a new clutch pressure plate. REFER to **CLUTCH** article.

Pinpoint Test F: Hard Shifting

Normal Operation

The clutch is designed to transfer the power from the engine to the transmission, which may be either stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when both the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub and bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

- Transmission fluid level
- Clutch hydraulic fluid level
- Clutch pressure plate
- Shift linkage

PINPOINT TEST F: HARD SHIFTING

F1 CHECK THE FLUID LEVEL

- Key in OFF position.
- Inspect the fluid level in the brake master cylinder reservoir.
- **Is the fluid level within the MAX and MIN level marks?**

  YES : Go to F2.

  NO : ADD brake fluid and CHECK for leaks in the clutch and brake systems.

F2 CHECK THE CLUTCH PEDAL FREE PLAY

- Press the clutch pedal lightly by hand.
- Measure the distance the clutch pedal travels.
- **Is the clutch pedal travel within 5-13 mm (0.20-0.51 in)?**

  YES : REFER to **MANUAL TRANSAXLE/TRANSMISSION** article for transaxle concerns or **MANUAL TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article for gear shifter concerns.

  NO : CHECK the clutch pressure plate for damage. REFER to **Clutch Pressure Plate Check**.

Pinpoint Test G: Excessive Noise

Normal Operation

The clutch is designed to transfer the power from the engine to the transmission, which may be either stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when both the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub and bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

- Internal transaxle components
- Clutch pedal
- Clutch slave cylinder
- Clutch pressure plate
- Clutch disc

PINPOINT TEST G: EXCESSIVE NOISE

G1 TRANSAXLE NEUTRAL GEAR ROLLOVER TEST

- Start the engine and let it idle.

NOTE: With the clutch pedal fully pressed, the input shaft should stop rotating.

- Press the clutch pedal.
- **Does the noise stop when the clutch pedal is pressed?**

  YES : REFER to **MANUAL TRANSAXLE/TRANSMISSION** article for transaxle concerns.

  NO : Go to G2.

G2 CHECK THE CLUTCH PEDAL FREE PLAY

- Press the clutch pedal lightly by hand.
- Measure the distance the clutch pedal travels.
- **Is the clutch pedal travel within 5-13 mm (0.20-0.51 in)?**

  YES : Go to G3.

  NO : CHECK the clutch pressure plate for damage. REFER to **Clutch Pressure Plate Check**.

G3 CHECK THE CLUTCH SLAVE CYLINDER

- Remove the transaxle. Refer to **MANUAL TRANSAXLE/TRANSMISSION** article.
- Inspect the clutch slave cylinder for wear or loss of lubrication.
- **Are there signs of wear or loss of lubrication?**

  YES : INSTALL a new clutch slave cylinder. REFER to **CLUTCH CONTROLS** article.

  NO : Go to G4.

G4 CHECK THE TORSION SPRINGS

- Inspect the torsion springs for fatigue or breakage.
- **Are there any signs of fatigue or breakage?**

  YES : INSTALL a new clutch pressure plate. REFER to **CLUTCH** article.

  NO : INSPECT the crankshaft end play. REFER to **ENGINE SYSTEM - GENERAL INFORMATION** article.

Pinpoint Test H: Fluid Leakage

Normal Operation

The clutch is designed to transfer the power from the engine to the transmission, which may be either stationary (starting) or rotating at a different speed (upshifting or downshifting). The clutch is functioning correctly when both the engine and transmission are rotating at the same speed with the clutch engaged. Clutch pedal movement is transmitted by fluid pressure, which actuates the clutch release hub and bearing. The clutch release hub and bearing pushes on the spring center towards the flywheel. The diaphragm spring pivots at the fulcrum, relieving the load on the clutch pressure plate. Steel spring straps riveted in the clutch pressure plate cover pull the clutch pressure plate from the clutch disc, disengaging the engine torque from the transmission.

This pinpoint test is intended to diagnose the following:

- Clutch master cylinder
- Clutch slave cylinder
- Hydraulic tubes

PINPOINT TEST H: FLUID LEAKAGE

H1 INSPECT THE CLUTCH MASTER CYLINDER

- Inspect clutch master cylinder for leakage.
- **Is the clutch master cylinder OK?**

  YES : Go to H2.

  NO : REPAIR or INSTALL a new clutch master cylinder as necessary. REFER to **CLUTCH CONTROLS** article.

H2 INSPECT THE CLUTCH SLAVE CYLINDER

- Inspect clutch slave cylinder for leaks.
- **Is the clutch slave cylinder OK?**

  YES : Go to H3.

  NO : REPAIR or INSTALL a new clutch slave cylinder as necessary. REFER to **CLUTCH CONTROLS** article.

H3 INSPECT THE SYSTEM HYDRAULIC TUBES

- Inspect clutch hydraulic tubes for loose or damaged fittings causing leakage.
- **Are the clutch hydraulic tubes OK?**

  YES : Carry out a road test to VERIFY customer complaint.

NO : REPAIR or INSTALL new components as necessary. TEST the clutch system for normal operation.

GENERAL PROCEDURES

CLUTCH DISC CHECK

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	Dial Indicator with Magnetic Base	100-D002 (D78P-4201-B) or equivalent

1. Check the clutch disc lining surface for hardening, the presence of oil or grease.
2. Check for a worn clutch disc lining. Measure the minimum allowable depth to the rivet heads with a slide caliper.
    - If the measurement is less than the minimum, install a new clutch disc.

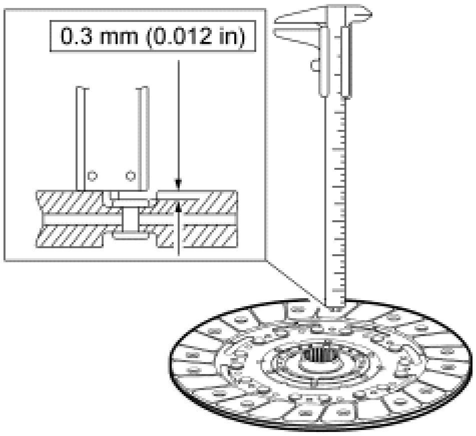

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Fig. 2: Measuring Minimum Allowable Depth With Specifications
Courtesy of FORD MOTOR CO.

3. Check for loose clutch disc lining rivets.

- Install a new clutch disc as necessary.

4. Check the clutch disc for cracking, scoring, discoloration or other surface marks.
   - Install a new clutch disc if necessary.
5. Using the special tool, check the maximum allowable runout of the clutch disc.
   - If the runout exceeds the maximum, install a new clutch disc.

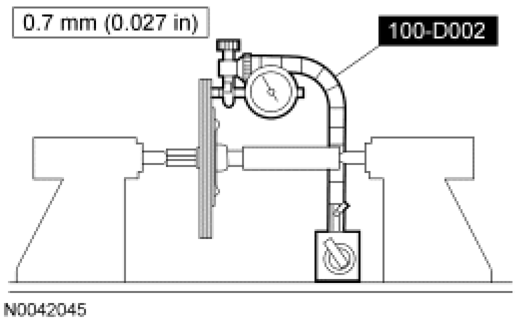


Fig. 3: Checking Maximum Allowable Runout Of Clutch Disc
Courtesy of FORD MOTOR CO.

6. Use an emery cloth to remove minor imperfections in the clutch disc lining surface.
7. Check for wear or rust on the splines. If necessary, clean them with an emery cloth.

CLUTCH PEDAL FREEPLAY ADJUSTMENT

1. Measure the clutch pedal height.
   1. If the measurement is not within specification, turn the adjustment bolt as necessary.
   2. Tighten the lock nut.
      - Recheck the measurement.

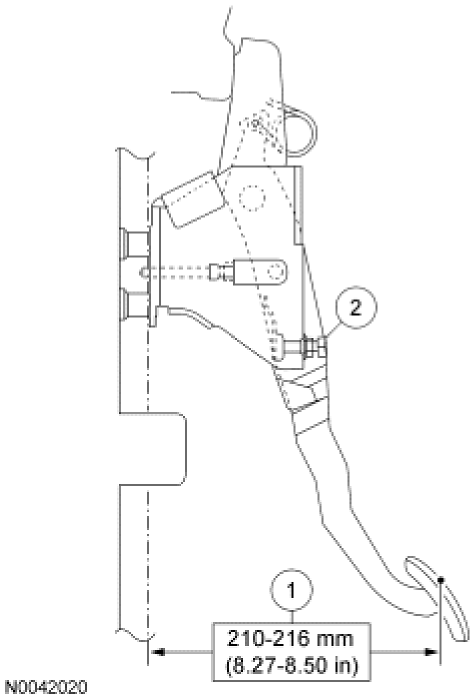


Fig. 4: Measuring Clutch Pedal Height
Courtesy of FORD MOTOR CO.

2. Measure clutch pedal free play.
    1. Depress the clutch pedal by hand until the push rod contacts the clutch master cylinder piston.
    2. If the measurement is not within specification, loosen the lock nut and turn the push rod as necessary.
        - Recheck the measurement.

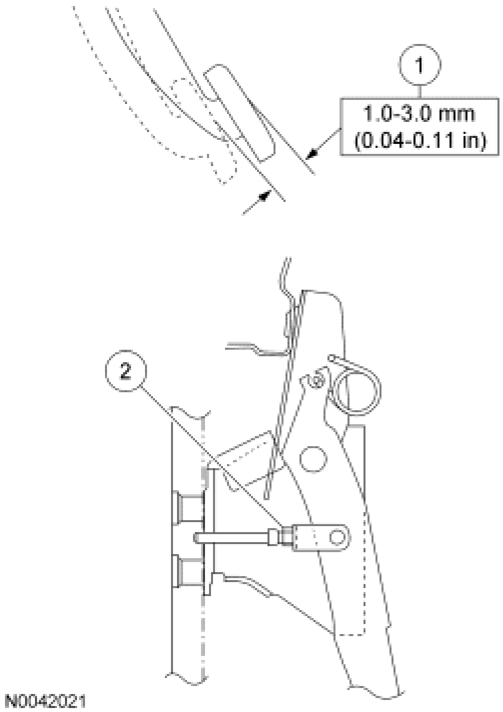


Fig. 5: Measuring Clutch Pedal Free Play
Courtesy of FORD MOTOR CO.

CLUTCH PRESSURE PLATE CHECK

1. Check the clutch pressure plate surface for scoring, cracks or discoloration.
    - Minor scratches or discoloration should be removed with a fine emery cloth.
2. Measure the flatness of the clutch pressure plate surface with a straightedge and a feeler gauge.
    - Install a new pressure plate as necessary.

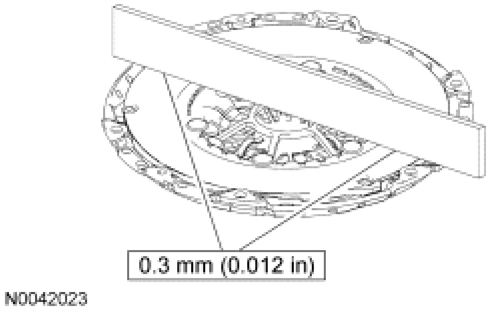


Fig. 6: Measuring Flatness Of Clutch Pressure Plate Surface With Straightedge And Feeler Gauge
Courtesy of FORD MOTOR CO.

3. Check the diaphragm spring fingers for discoloration, scoring and bent or broken segments.
4. Measure the wear of the diaphragm spring fingers.
    - Install a new pressure plate as necessary.

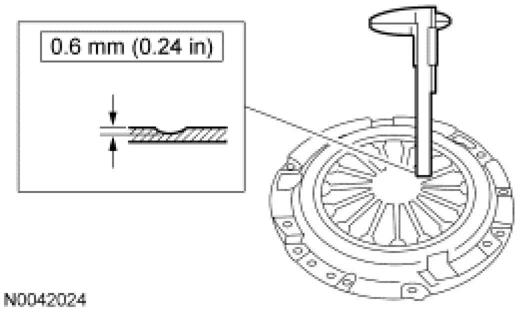


Fig. 7: Measuring Wear Of Diaphragm Spring Fingers
Courtesy of FORD MOTOR CO.

FLYWHEEL RUNOUT CHECK

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	Dial Indicator with Magnetic Base	100-D002 (D78P-4201-B) or equivalent

1. Mount the special tool so that the indicator contact point rides on the clutch disc contact surface.
2. Rotate the flywheel and check the runout.
   - If the runout exceeds the maximum allowance, install a new flywheel.

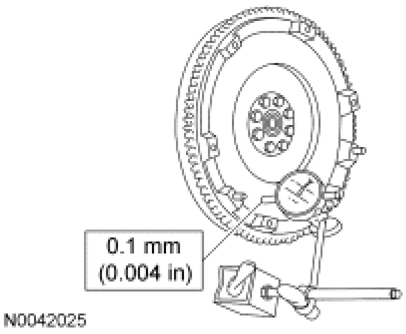


Fig. 8: Measuring Flywheel Runout
Courtesy of FORD MOTOR CO.

CLUTCH SYSTEM BLEEDING

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid	WSS-M6C62-A

PM-1-C (US); CPM-1-C (Canada)	

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with cold water.

NOTE: When any part of the hydraulic system has been disconnected for repair or new installation, air may get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

1. Attach a rubber drain hose to the bleeder screw and submerge the free end of the hose in a container partially filled with clean brake fluid.
2. Slowly pump the clutch pedal to the floor several times and hold it.
3. With the clutch pedal held to the floor, loosen the bleeder screw until fluid and air are expelled from the system.

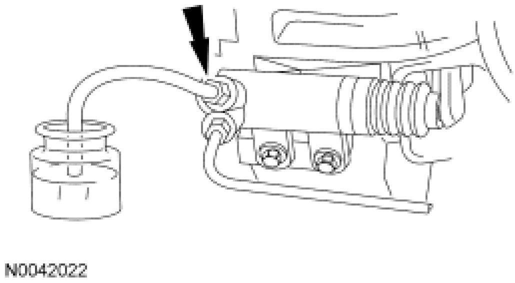


Fig. 9: Bleeding Clutch Hydraulic System
Courtesy of FORD MOTOR CO.

4. With the clutch pedal held to the floor, tighten the bleeder screw.

NOTE: Do not allow the brake master cylinder reservoir to run dry during the bleeding operation. Keep the brake master cylinder reservoir filled with clean, specified brake fluid. Never reuse the brake fluid that has been drained from the hydraulic system.

5. Repeat Steps 2 through 4 until no air bubbles appear in the fluid.

6. Tighten the bleeder screw.
    - Tighten to 7 Nm (62 lb-in).
7. Add brake fluid to the reservoir. Fill to the level in between the MIN and MAX lines.
8. Check system for normal operation.

GEARSHIFT CABLE ADJUSTMENT

1. Set the parking brake.
2. Remove the gearshift knob and the floor console finish panel.
3. Disengage the safety lock by sliding it away from the shifter ball stud.

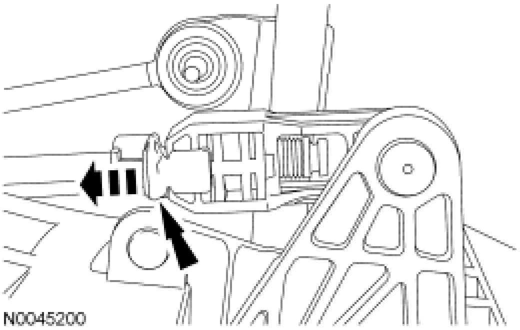


Fig. 10: Disengaging Safety Lock
Courtesy of FORD MOTOR CO.

NOTE: **If the cable lock is difficult to slide out, disconnect the shift cable from the stud, push the lock from the rear and reattach the shift cable to the ball stud.**

4. Disengage the cable lock by sliding it out from the shift cable end fitting.

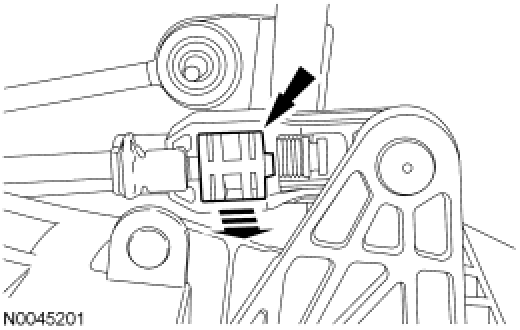


Fig. 11: Disengaging Cable Lock
Courtesy of FORD MOTOR CO.

5. Move the shift lever to the center position. With the shifter and the transmission in NEUTRAL, push the cable lock onto the cable.

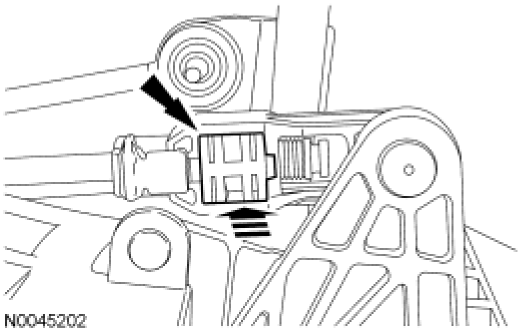


Fig. 12: Pushing Cable Lock Onto Cable
Courtesy of FORD MOTOR CO.

6. Engage the safety lock by sliding it over the primary shift cable lock.

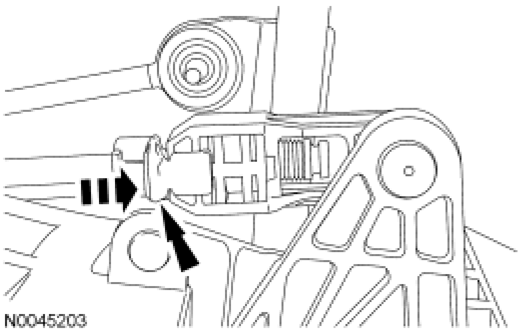


Fig. 13: Engaging Safety Lock
Courtesy of FORD MOTOR CO.

7. Install the floor console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.

2008 ENGINE PERFORMANCE

Mode 6 - 2008 Ford - Except Diesel

INTRODUCTION

Mode 6 is designed to allow access to the results of onboard diagnostic monitoring tests of specific components/systems that are not continuously monitored. These systems include the catalytic converter, EVAP system, oxygen sensor, oxygen sensor heater, EGR system, secondary AIR system, and sometimes misfire.

Mode 6 data is output from the PCM/ECM in hexadecimal form. The $ sign indicates a hexadecimal number. Depending on the software in the scanner, the output could be displayed in hexadecimal numbers (no conversion), raw data (conversion to decimal numbers), or measurable values (applying conversion factor to raw data).

Before reading mode 6 information, ensure that the monitor for the information you are accessing has run to completion. If the monitor is not complete, the mode 6 data will not be accurate.

CATALYST MONITOR

TYPICAL MALFUNCTION THRESHOLDS:
Rear-to-front O2 sensor index ratio > 0.75 (bank monitor)
Rear-to-front O2 sensor index-ratio > 0.60 (Y-pipe monitor)
Rear-to-front O2 sensor index ratio > 0.50 for E10 to > 0.90 for E85 (flex fuel vehicles)

J1979 CATALYST MONITOR MODE $06 DATA			
Monitor ID	Test ID	Description for CAN	
$21	$80	Bank 1 index-ratio and max. limit	unitless
$22	$80	Bank 2 index-ratio and max. limit	unitless

G00152358

Fig. 1: Mode $06 Data For Catalyst Monitor
Courtesy of FORD MOTOR CO.

MISFIRE MONITOR

Typical misfire monitor malfunction thresholds:
Type A (catalyst damaging misfire rate): misfire rate is an rpm/load table ranging from 40% at idle to 4% at high rpm and loads
Type B (emission threshold rate): 1% to 2%

J1979 Misfire Mode $06 Data			
Monitor ID	Test ID	Description for CAN	
A1	$80	Total engine misfire and catalyst damage misfire rate (updated every 200 revolutions)	percent
A1	$81	Total engine misfire and emission threshold misfire rate (updated every 1,000 revolutions)	percent
A1	$82	Highest catalyst-damage misfire and catalyst damage threshold misfire rate (updated when DTC set or clears)	percent
A1	$83	Highest emission-threshold misfire and emission threshold misfire rate (updated when DTC set or clears)	percent
A1	$84	Inferred catalyst mid-bed temperature	°C
A2 – AD	$0B	EWMA misfire counts for last 10 driving cycles	events
A2 – AD	$0C	Misfire counts for last/current driving cycle	events
A2 – AD	$80	Cylinder X misfire rate and catalyst damage misfire rate (updated every 200 revolutions)	percent
A2 – AD	$81	Cylinder X misfire rate and emission threshold misfire rate (updated every 1,000 revolutions)	percent

G00152359

Fig. 2: Mode $06 Data For Misfire Monitor
Courtesy of FORD MOTOR CO.

AIR SYSTEM MONITOR

Typical AIR functional check malfunction thresholds:
On and Off Flow ratio < 0.4 (P0491 - Low Flow or, P0410 - Inlet Hose Off)
On Flow ratio > 1.6 (P2448 – Outlet Hose Off)

J1979 Secondary Air Mode $06 Data			
Mon ID	Comp ID	Description for CAN	Units
$72	$80	HO2S21 voltage for upstream flow test and rich limit	volts
$72	$81	HO2S lean timer test	
$72	$82	On Flow Ratio and limits	unitless
$72	$83	Off Flow Ratio and limits	unitless
$72	$84	Flow Ratio AF indicator and limits PETA_AF_SHIFT	unitless
$72	$85	Timer to indicate if a valid AF shift can be calculated PETA_CL_TMR	seconds

G00152360

Fig. 3: Mode $06 Data For AIR System Monitor
Courtesy of FORD MOTOR CO.

EVAP MONITOR

Typical 0.040 EVAP monitor malfunction thresholds:
P1450 (Excessive vacuum): < -8.0 in H_2O over a 30 second evaluation time or > -4. in H_2O vapor generation
P0455 (Gross leak): > -8.0 in H_2O over a 30 second evaluation time.
P0457 (Gross leak, cap off): > -8.0 in H_2O over a 30 second evaluation time after a refueling event.
P0442 (0.040" leak): > 2.5 in H_2O bleed-up over a 15 second evaluation time at 75% fuel fill. (Note: bleed-up and evaluation times vary as a function of fuel fill level and ambient air temperature)
P0442 vapor generation limit: < 2.5 in H_2O over a 120 second evaluation time

J1979 Evaporative System Mode $06 Data			
Test ID	Comp ID	Description	Units
$61	$00	Phase 0 Initial tank vacuum and minimum vacuum limit (data for P1450 – excessive vacuum)	in H_20
$62	$00	Phase 4 Vapor generation minimum change in pressure and minimum vacuum limit (data for P1450, VMV stuck open)	in H_20
$63	$00	Phase 0 Initial tank vacuum and gross leak maximum vacuum limit (data for P0455/P0457 – gross leak/cap off)	in H_20
$64	$00	Phase 2 0.040" cruise leak check vacuum bleed-up and maximum vacuum limit (data for P0442 – 0.040" leak)	in H_20
Note: Default values (0.0 in H_20) will be displayed for all the above TIDs if the evap monitor has never completed. Each TID is associated with a particular DTC. The TID for the appropriate DTC will be updated based on the current or last driving cycle, default values will be displayed for any phases that have not completed.			

G00152361

Fig. 4: Mode $06 Data For EVAP Monitor (0.040" Leak)
Courtesy of FORD MOTOR CO.

Typical 0.020 EVAP monitor malfunction thresholds:

P1450 (Excessive vacuum): < -8.0 in H_2O over a 30 second evaluation time or > -4. in H_2O vapor generation.

P0455 (Gross leak): > -8.0 in H_2O over a 30 second evaluation time.

P0457 (Gross leak, cap off): > -8.0 in H_2O over a 30 second evaluation time after a refueling event.

P0442 (0.040" leak): > 2.5 in H_2O bleed-up over a 15 sec. evaluation time at 75% fuel fill.

(Note: bleed-up and evaluation times vary as a function of fuel fill level and ambient temperature).

P0456 (0.020" leak): > 2.5 in H_2O bleed-up over a 30 sec. evaluation time at 75% fuel fill.

(Note: bleed-up and evaluation times vary as a function of fuel fill level and ambient temperature)

P0442 vapor generation limit: < 2.5 in H_2O over a 100 second evaluation time.

J1979 Evaporative System Mode $06 Data

Monitor ID	Test ID	Description for CAN	Units
$3A	$80	Phase 0 Initial tank vacuum and minimum vacuum limit (data for P1450 – excessive vacuum)	Pascals
$3A	$81	Phase 4 Vapor generation minimum change in pressure and minimum vacuum limit (data for P1450, VMV stuck open)	Pascals
$3A	$82	Phase 0 Initial tank vacuum and gross leak maximum vacuum limit (data for P0455/P0457 – gross leak/cap off)	Pascals
$3B	$80	Phase 2 0.040" cruise leak check vacuum bleed-up and maximum vacuum limit (data for P0442 – 0.040" leak)	Pascals
$3C	$80	Phase 2 0.020" idle leak check vacuum bleed-up and maximum vacuum limit (data for P0456 – 0.020" leak)	Pascals
Note: Default values (0.0 in H_20) will be displayed for all the above TIDs if the evap monitor has never completed. Each TID is associated with a particular DTC. The TID for the appropriate DTC will be updated based on the current or last driving cycle, default values will be displayed for any phases that have not completed.			

G00152362

Fig. 5: Mode $06 Data For EVAP Monitor (0.020" Leak)
Courtesy of FORD MOTOR CO.

Typical 0.020 EONV EVAP monitor malfunction thresholds:
P0456 (0.020" leak): < 0.75 in H_2O pressure build and < 0.50 in H_2O vacuum build over a 45 minute maximum evaluation time
Note: EONV monitor can be calibrated to illuminate the MIL after two malfunctions (an average of four key-off EONV tests, eight runs in all) or after a single malfunction (an average of five key-off EONV tests, five runs in all). Most new 2006 MY and later vehicles will use the five-run approach.

J1979 EONV EVAP monitor Mode $06 Data			
Monitor ID	Comp ID	Description for CAN	Units
$3C	$81	EONV Positive Pressure Test Result and Limits	in H_20
$3C	$82	EONV Negative Pressure (Vacuum) Test Result and Limits	in H_20
$3C	$83	Normalized Average of Four EONV Tests Results and Limits (where 0 = pass, 1 = fail)	unitless
Note: Default values (0.0 in H_20) will be displayed for all the above TIDs if the evap monitor has never completed. The appropriate TID will be updated based on the current or last driving cycle, default values will be displayed for any phases that have not completed.			

G00152363

Fig. 6: Mode $06 Data For EVAP Monitor (EONV 0.020" Leak)
Courtesy of FORD MOTOR CO.

FRONT HO2S MONITOR

Typical HO2Sresponse rate malfunction thresholds:
Voltage amplitude: < 0.5 volts

J1979 Front HO2S Mode $06 Data			
Monitor ID	Test ID	Description for CAN	
$01	$80	HO2S11 voltage amplitude and voltage threshold	Volts
$01	$01	H02S11 sensor switch-point voltage	Volts
$05	$80	HO2S21 voltage amplitude and voltage threshold	Volts
$05	$01	H02S21 sensor switch-point voltage	Volts

G00152364

Fig. 7: Mode $06 Data For Front HO2S Monitor
Courtesy of FORD MOTOR CO.

REAR HO2S MONITOR

Typical Rear HO2S functional check malfunction thresholds:
Does not exceed rich and lean threshold envelope:
Rich < 0.42 volts
Lean > 0.48 volts
> 1.1 volts for 25 seconds for over voltage test

J1979 Rear HO2S Functional Check Mode $06 Data			
Monitor ID	Test ID	Description for CAN	
$02	$01	HO2S12 sensor switch-point voltage	volts
$06	$01	HO2S22 sensor switch-point voltage	volts
$03	$01	HO2S13 sensor switch-point voltage	volts
$07	$01	HO2S23 sensor switch-point voltage	volts

G00152365

Fig. 8: Mode $06 Data For Rear HO2S Functional Check Monitor
Courtesy of FORD MOTOR CO.

Typical Rear HO2S response rate malfunction thresholds:	
Rich to lean slew rate thresholds:	= <1.25 mV volts/msec (NTK Thimble)
	= < 1.0 mV/msec (Bosch Thimble)
	= < 0.75 mV/msec (Bosch Planar)
Lean to rich slew rate thresholds:	= < 1.67 mV/msec (NTK Thimble)
	= < 1.0 mV/msec (Bosch Thimble)
	= < 1.5 mV/msec (Bosch Planar)

J1979 Rear HO2S response rate Mode $06 Data			
Monitor ID	Test ID	Description for CAN	
$02	$82	HO2S12 sensor Lean to Rich Response Rate	Volts/msec
$02	$83	HO2S12 sensor Rich to Lean Response Rate	Volts/msec
$06	$82	HO2S22 sensor Lean to Rich Response Rate	Volts/msec
$06	$83	HO2S22 sensor Rich to Lean Response Rate	Volts/msec

G00152366

Fig. 9: Mode $06 Data For Rear HO2S Response Rate Monitor
Courtesy of FORD MOTOR CO.

HO2S HEATER MONITOR

Typical HO2S heater check malfunction thresholds:	
Smart driver status indicated malfunction	
Heater current outside limits:	< 0.220 amps or > 3 amps, (NTK)
	< 0.400 amps or > 3 amps, (Bosch)
	< 0.465 amps or > 3 amps, (NTK Fast Light Off)
	< 0.230 amps or > 3 amps, (Bosch Fast Light Off)
Number monitor retries allowed for malfunction > = 30	

J1979 HO2S Heater Mode $06 Data

Monitor ID	Test ID	Description for CAN	Units
$01	$81	HO2S11 Heater Current	Amps
$05	$81	HO2S21 Heater Current	Amps
$02	$81	HO2S12 Heater Current	Amps
$06	$81	HO2S22 Heater Current	Amps
$03	$81	HO2S13 Heater Current	Amps
$07	$81	HO2S23 Heater Current	Amps

G00152367

Fig. 10: Mode $06 Data For HO2S Heater Monitor
Courtesy of FORD MOTOR CO.

UEGO MONITOR

Typical UEGO "Response Rate" malfunction thresholds:
Line length (Voltage amplitude): < 90 units

J1979 Front UEGO Mode $06 Data

Monitor ID	Test ID	Description for CAN	
$01	$84	UEGO11 voltage length	unitless
$05	$84	UEGO21 voltage length	unitless

Fig. 11: Mode $06 Data For UEGO Response Rate Monitor
Courtesy of FORD MOTOR CO.

UEGO HEATER MONITOR

Typical UEGO heater check malfunction thresholds:
Smart driver status indicated malfunction (heater voltage check)
Number monitor retries allowed for malfunction > = 30 (heater voltage check)
Heater current outside limits: < 1.0 amps or > 3 amps (intrusive test) or < 0.55 amps or > 3 amps (Bosch)
Heater temperature control monitor: > = 10 seconds to register a malfunction while the heater control integrator is at its maximum or minimum limit

J1979 UEGO Heater Mode $06 Data			
Monitor ID	Test ID	Description for CAN	Units
$01	$81	HO2S11 Heater Current	Amps
$05	$81	HO2S21 Heater Current	Amps

Fig. 12: Mode $06 Data For UEGO Heater Monitor
Courtesy of FORD MOTOR CO.

EGR MONITOR

Typical DPFE EGR stuck open check malfunction thresholds:
DPFE sensor voltage at idle versus engine-off signal: > 0.6 volts

J1979 DPFE EGR Stuck Open Mode $06 Data			
Monitor ID	Test ID	Description for CAN Conventional DPFE	Units
$31	$84	Delta pressure for stuck open test and threshold	kPa

G00152368

Fig. 13: Mode $06 Data For EGR Stuck Open Monitor (DPFE)
Courtesy of FORD MOTOR CO.

Typical DPFE EGR hose check malfunction thresholds:
DPFE sensor voltage: < 7 in H_2O, > 7 in H_2O

J1979 DPFE EGR Hose Check Mode $06 Data			
Monitor ID	Test ID	Description for CAN Conventional DPFE	
$31	$80	Delta pressure for upstream hose test and threshold	kPa
$31	$81	Delta pressure for downstream hose test and threshold	kPa

G00152369

Fig. 14: Mode $06 Data For EGR Hose Check Monitor (DPFE)
Courtesy of FORD MOTOR CO.

Typical EGR flow check malfunction thresholds:
DPFE sensor voltage: < 6 in H_2O

J1979 EGR Flow Check Mode $06 Data			
Monitor ID	Test ID	Description for CAN Conventional DPFE	Units
$31	$85	Delta pressure for flow test and threshold	kPa

G00152370

Fig. 15: Mode $06 Data For EGR Flow Check Monitor (DPFE)
Courtesy of FORD MOTOR CO.

Typical ESM EGR hose check malfunction thresholds:
DPFE sensor voltage: < -0.122 volts (-11.06 in H_2O), > 4.69 volts (122.82 in H_2O)

J1979 Mode $06 Data			
Monitor ID	Test ID	Description for CAN ESM DPFE	
$32	$82	Delta pressure for upstream hose test and threshold	kPa
$32	$83	Delta pressure for downstream hose test and threshold	kPa

G00152371

Fig. 16: Mode $06 Data For EGR Hose Check Monitor (ESM DPFE)
Courtesy of FORD MOTOR CO.

Typical EGR stuck open check malfunction thresholds:
DPFE sensor voltage at idle versus engine-off signal: > 0.6 volts

J1979 Mode $06 Data			
Monitor ID	Test ID	Description for CAN ESM DPFE	Units
$32	$84	Delta pressure for stuck open test and threshold	kPa

G00152372

Fig. 17: Mode $06 Data For EGR Stuck Open Monitor (ESM DPFE)
Courtesy of FORD MOTOR CO.

Typical EGR flow check malfunction thresholds:
DPFE sensor voltage: < 6 in H_2O

J1979 Mode $06 Data			
Monitor ID	Test ID	Description for CAN ESM DPFE	Units
$32	$85	Delta pressure for flow test and threshold	kPa

G00152373

Fig. 18: Mode $06 Data For EGR Flow Check Monitor (ESM DPFE)
Courtesy of FORD MOTOR CO.

Typical EGR flow check malfunction thresholds:
< 0.50 degradation index

J1979 Mode $06 Data			
Monitor ID	Test ID	Description for CAN	Units
$33	$82	EGR Degradation Index	unitless

G00152375

Fig. 19: Mode $06 Data For EGR Flow Check Monitor (Stepper Motor - Non-Intrusive)
Courtesy of FORD MOTOR CO.

VARIABLE CAM TIMING SYSTEM MONITOR

Typical In-Use Performance monitoring thresholds:
Monitoring thresholds to increment the numerator:
Amount of cam change required for target error fault: > 160 degrees squared
Amount of rate of change required for slow response fault: > 5 degrees squared

J1979 VCT Monitor Mode $06 Data			
Monitor ID	Test ID	Description for CAN	Units
$35	$80	Camshaft Advanced Position Error Bank 1	Unsigned, Angular degrees
$35	$81	Camshaft Retarded Position Error Bank 1	Unsigned, Angular degrees
$36	$80	Camshaft Advanced Position Error Bank 2	Unsigned, Angular degrees
$36	$81	Camshaft Retarded Position Error Bank 2	Unsigned, Angular degrees

Fig. 20: Mode $06 Data For VCT System Monitor
Courtesy of FORD MOTOR CO.

2008 ACCESSORIES & BODY, CAB

Module Communications Network - Fusion, Milan & MKZ

DESCRIPTION AND OPERATION

COMMUNICATIONS NETWORK

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Vehicle communication utilizes both medium and high speed controller area network (CAN) communications. CAN is used for many modules to communicate with each other on a common network. CAN in-vehicle networking is a method for transferring data among distributed electronic modules using a serial data bus. Without serial networking, intermodule communication requires dedicated, point to point wiring resulting in bulky, expensive, complex, and difficult to install wiring harnesses. Applying a serial data network reduces the number of wires, thereby combining the signals on a single network. Information is sent to the individual control modules that control each function.

The vehicle has 2 module communication networks:

- Medium speed (MS) CAN
- High speed (HS) CAN

Both networks are connected to the data link connector (DLC), located under the dash. This makes diagnosis and testing of these systems easier by allowing one scan tool to be able to diagnose and control any module on both networks from one connector. The DLC can be found under the instrument panel between the steering column and the audio control module (ACM).

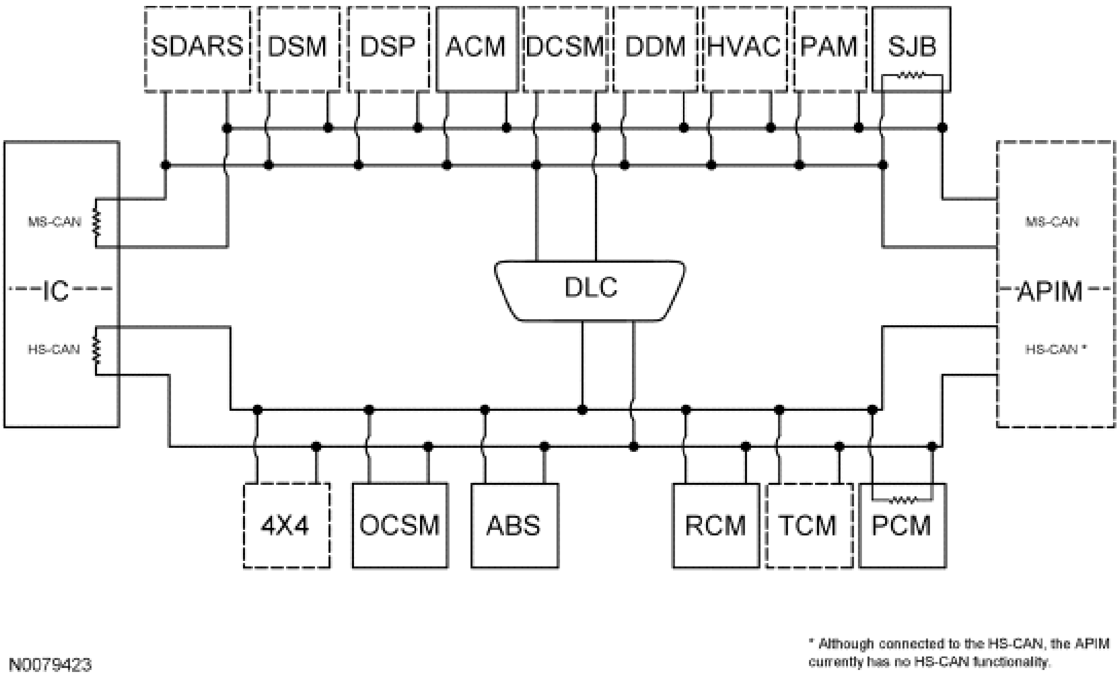


Fig. 1: Network Topology
Courtesy of FORD MOTOR CO.

Module Name	Network Type	Termination Module
Accessory protocol interface module (APIM) (if equipped)	HS-CAN MS-CAN	No No
Audio control module (ACM)	MS-CAN	No
Audio digital signal processing (DSP) module (if equipped)	MS-CAN	No
ABS module	HS-CAN	No
Driver door module (DDM) (if equipped)	MS-CAN	No
Driver seat module (DSM) (if equipped)	MS-CAN	No
Heating ventilation air conditioning (HVAC) module (if equipped)	MS-CAN	No
Dual climate control seat module (DCSM) (if equipped)	MS-CAN	No
4X4 control module (if equipped)	HS-CAN	No
Instrument cluster (IC) (gateway module)	HS-CAN MS-CAN	Yes Yes
Occupant classification system module (OCSM)	HS-CAN	No
PCM	HS-CAN	Yes
Restraints control module (RCM)	HS-CAN	No

Smart junction box (SJB)	MS-CAN	Yes
Satellite digital audio receiver system (SDARS) module (if equipped)	MS-CAN	No
Transmission control module (TCM)	HS-CAN	No

MS-CAN Operation

The MS-CAN communicates using bussed messages. The MS-CAN has an unshielded twisted pair cable, data bus (+) and data bus (-) circuits. In addition to scan tool communication, this network allows sharing of information between all modules on the network.

The MS-CAN is a medium speed communication network used for the following modules:

- Accessory protocol interface module (APIM) (if equipped)
- Audio control module (ACM)
- Audio digital signal processing (DSP) module (if equipped)
- Driver door module (DDM) (if equipped)
- Driver seat module (DSM) (if equipped)
- Dual climate control seat module (DCSM) (if equipped)
- Heating ventilation air conditioning (HVAC) module
- Instrument cluster (IC)
- Parking aid module (PAM)
- Satellite digital audio receiver system (SDARS) module (if equipped)
- Smart junction box (SJB)

HS-CAN Operation

The HS-CAN communicates using bussed messages. The HS-CAN uses an unshielded twisted pair cable, data bus (+) and data bus (-) circuits. In addition to scan tool communication, this network allows sharing of information between all modules on the network.

The HS-CAN is a high speed communication network used for the following modules:

- Accessory protocol interface module (APIM) (if equipped)
- ABS module
- Instrument cluster (IC)
- Occupant classification system module (OCSM)
- PCM
- Restraints control module (RCM)
- Transmission control module (TCM) (if equipped)
- 4X4 control module

Network Termination

The CAN uses a network termination circuit to improve communication reliability. The network termination of the CAN bus takes place inside the termination modules by termination resistors. Termination modules are located at either end of the bus network. As network messages are broadcast in the form of voltage signals, the network voltage signals are stabilized by the termination resistors. Each termination module has a 120 ohm resistor across the positive and negative bus connection in the termination module. With 2 termination modules on each network and the 120 ohm resistors located in a parallel circuit configuration, the total network impedance, or total resistance, is 60 ohms.

Network termination improves bus message reliability by:

- stabilizing bus voltage.
- eliminating electrical interference.

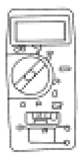
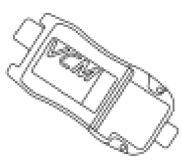
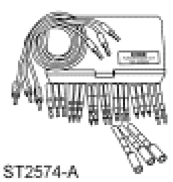
Gateway Module

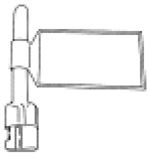
The IC is the gateway module, translating HS-CAN to MS-CAN and vice versa. This information allows a message to be distributed throughout both networks. The IC is the only module on this vehicle that has this ability.

DIAGNOSTIC TESTS

COMMUNICATIONS NETWORK

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent
	Diagnostic Tool, Restraint System	418-133

 ST2507-A		

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Vehicle communication utilizes both medium and high speed controller area network (CAN) communications. CAN is a method for transferring data among distributed electronic modules using a serial data bus.

The vehicle is equipped with 2 module communication networks:

- Medium speed (MS) CAN
- High speed (HS) CAN

MS-CAN

The MS-CAN is a medium speed communication network that uses an unshielded twisted pair cable of data (+) and data (-) circuits. The data (+) and the data (-) circuits are each regulated to approximately 2.5 volts during neutral or rested network traffic. As bus messages are sent on the data (+) circuit, voltage is increased by approximately 1.0 volt. Inversely, the data (-) circuit is reduced by approximately 1.0 volt when a bus message is sent. Multiple bus messages can be sent over the network CAN circuits allowing multiple modules to communicate with each other. The MS-CAN will not communicate while certain faults are present, but will operate with diminished performance with other faults present. The MS-CAN may remain operational when 1 of the 2 termination resistors are not present.

The MS-CAN operates at a maximum data transfer speed of 125 Kbps for bus messages and designed for general information transfer. The network will remain operational, but at a degraded level when certain circuit faults are present. The MS-CAN may remain operational with only one termination resistor present.

The following modules are on the MS-CAN:

- Accessory protocol interface module (APIM) (if equipped)
- Audio control module (ACM)
- Audio digital signal processing (DSP) module (if equipped)
- Driver door module (DDM) (if equipped)
- Driver seat module (DSM) (if equipped)
- Dual climate control seat module (DCSM) (if equipped)
- Heating ventilation air conditioning (HVAC) module (if equipped)
- Instrument cluster (IC)

- Parking aid module (PAM) (if equipped)
- Satellite digital audio receiver system (SDARS) module (if equipped)
- Smart junction box (SJB)

The following fault chart describes the specific MS-CAN failures and their resulting symptom:

MS-CAN COMMUNICATION FAULT CHART

Failure Description	Symptom
MS-CAN (+) shorted to MS-CAN (-)	No communication
MS-CAN (+) short to voltage	No communication
MS-CAN (-) short to voltage	No communication
MS-CAN (+) short to ground	No communication
MS-CAN (-) short to ground	Unreliable communication possible in all network modules
MS-CAN (+) open	Unreliable communication possible in all network modules
MS-CAN (-) open	Unreliable communication possible in all network modules
Module loss of voltage or ground	No communication
Module internal failure	No communication

HS-CAN

The HS-CAN is a high speed communication network that uses an unshielded twisted pair cable of data (+) and data (-) circuits. The data (+) and the data (-) circuits are each regulated to approximately 2.5 volts during neutral or rested network traffic. As bus messages are sent on the data (+) circuit, voltage is increased by approximately 1.0 volt. Inversely, the data (-) circuit is reduced by approximately 1.0 volt when a bus message is sent. Multiple bus messages can be sent over the network CAN circuits allowing multiple modules to communicate with each other. The HS-CAN will not communicate while certain faults are present, but will operate with diminished performance with other faults present. The HS-CAN bus may remain operational when 1 of the 2 termination resistors are not present.

The HS-CAN operates at a maximum data transfer speed of 500 Kbps and is designed for real time information transfer and control. The network will remain operational, but at a degraded level when certain circuit faults are present. The HS-CAN may remain operational with only one termination resistor present.

The following modules are on the HS-CAN:

- ABS module
- Accessory protocol interface module (APIM) (if equipped)
- Instrument cluster (IC)
- Occupant classification system module (OCSM)
- PCM
- Restraints control module (RCM)

- Transmission control module (TCM)
- 4X4 control module (if equipped)

The following fault chart describes the specific HS-CAN failures and their resulting symptom:

HS-CAN COMMUNICATION FAULT CHART

Failure Description	Symptom
HS-CAN (+) shorted to HS-CAN (-)	No communication
HS-CAN (+) short to voltage	No communication
HS-CAN (-) short to voltage	No communication
HS-CAN (+) short to ground	No communication
HS-CAN (-) short to ground	Unreliable communication possible in all network modules
HS-CAN (+) open	Unreliable communication possible in all network modules
HS-CAN (-) open	Unreliable communication possible in all network modules
Module loss of voltage or ground	No communication
Module internal failure	No communication

NOTE: This chart describes the specific high speed controller area network (HS-CAN) and medium speed controller area network (MS-CAN) messages broadcast by each module, and the module(s) that receive the message.

CAN MODULE COMMUNICATION MESSAGE CHART

Broadcast Message	Originating Module	Network Type	Receiving Module(s)
ABS event in progress	ABS module	HS-CAN	• PCM • Restraints control module (RCM) • Transmission control module (TCM)
ABS/TRAC system configuration	ABS module	HS-CAN	• TCM
ABS malfunction indicator request	ABS module	HS-CAN	• Instrument cluster (IC)
A/C clutch inhibit request	TCM	HS-CAN	• PCM
A/C clutch request	Heating ventilation air conditioning (HVAC) module	MS-CAN	• IC
A/C clutch request (gateway)	IC	HS-CAN	• PCM
A/C clutch status	PCM	HS-CAN	• IC

A/C clutch status (gateway)	IC	MS-CAN	• HVAC module
A/C evaporator temperature	PCM	HS-CAN	• IC
A/C evaporator temperature (gateway)	IC	MS-CAN	• HVAC module
Accelerator pedal position	PCM	HS-CAN	• ABS module • RCM • TCM • 4X4 control module
Accessory delay status	Smart junction box (SJB)	MS-CAN	• Audio control module (ACM)
Airbag deployment event status	RCM	HS-CAN	• Occupant classification system module (OCSM) • PCM
Airbag malfunction indicator request	RCM	HS-CAN	• IC
AWD active indicator request	4X4 control module	HS-CAN	• IC
AWD coupling mode and status	4X4 control module	HS-CAN	• ABS module • IC
AWD malfunction indicator request	4X4 control module	HS-CAN	• IC
Axle ratio	PCM	HS-CAN	• ABS module
Barometric pressure	PCM	HS-CAN	• IC • TCM
Barometric pressure (gateway)	IC	MS-CAN	• SJB
Battery saver status	SJB	MS-CAN	• IC
Brake fluid level status	SJB	MS-CAN	• IC
Brake malfunction indicator request	ABS module	HS-CAN	• IC
Brake switch status	PCM	HS-CAN	• RCM • TCM • 4X4 control module
Charging system warning indicator request	PCM	HS-CAN	• IC
Charging system status	PCM	HS-CAN	• IC
Climate control seat setting	HVAC module	MS-CAN	• Dual climate control seat

			module (DCSM)
Climate control seat status	DCSM	MS-CAN	• HVAC module
Door ajar status	SJB	MS-CAN	• IC
Door lock command (w/memory)	SJB	MS-CAN	• Driver door module (DDM)
Door lock switch status, driver (w/memory)	DDM	MS-CAN	• SJB
Easy entry/exit command	IC	MS-CAN	• Driver seat module (DSM)
Easy entry/exit status	DSM	MS-CAN	• IC
Engine coolant temperature	PCM	HS-CAN	• IC • TCM • 4X4 control module
Engine coolant temperature (gateway)	IC	MS-CAN	• HVAC module
Engine cooling fan request	TCM	HS-CAN	• PCM
Engine fail-safe cooling mode status	PCM	HS-CAN	• IC • TCM
Engine fail-safe electronic throttle control (ETC) mode status	PCM	HS-CAN	• IC
Engine fuel consumption data	PCM	HS-CAN	• IC
Engine intake air temperature	PCM	HS-CAN	• TCM
Engine load %	PCM	HS-CAN	• TCM
Engine malfunction indicator lamp (MIL) request	PCM	HS-CAN	• IC • TCM
Engine malfunction indicator lamp (MIL) request	TCM	HS-CAN	• PCM
Engine off timer	PCM	HS-CAN	• IC • 4X4 control module
Engine off timer (gateway)	IC	MS-CAN	• HVAC module
Engine oil pressure low	SJB	MS-CAN	• IC
Engine RPM	PCM	HS-CAN	• ABS module • IC • TCM • 4X4 control module

Engine RPM (gateway)	IC	MS-CAN	• Accessory protocol interface module (APIM) • DCSM • HVAC module
Engine torque data	PCM	HS-CAN	• ABS module • TCM
Engine torque data	TCM	HS-CAN	• PCM
Engine torque reduction request	ABS module	HS-CAN	• PCM
Engine torque reduction request	TCM	HS-CAN	• PCM
Engine torque transfer request	4X4 control module	HS-CAN	• ABS module
Engine torque transfer status	ABS module	HS-CAN	• 4X4 control module
English/Metric display mode	IC	MS-CAN	• HVAC module
Fuel cap off indicator request	PCM	HS-CAN	• IC
Fuel level input status (instant) sender 1 & 2	IC	HS-CAN	• PCM
Head lamp high beam status	SJB	MS-CAN	• IC
Head/park lamp switch status	SJB	MS-CAN	• IC
Ignition switch position	IC	MS-CAN	• ACM • APIM • DCSM • DDM • DSM • HVAC module • PAM • SDARS module • Audio digital signal processing (DSP) module
Ignition switch position	IC	HS-CAN	• ABS module • PCM • RCM • TCM • 4X4 control module

Illumination dimmer level	SJB	MS-CAN	• ACM • HVAC module • IC
Integrated key head transmitter (IKT) data	IC	MS-CAN	• SJB
IKT program request	IC	MS-CAN	• SJB
IKT response	SJB	MS-CAN	• IC
Key fob button status	SJB	MS-CAN	• DSM
Key-in-ignition status	IC	MS-CAN	• SJB • DSM
Key pad button status	SJB	MS-CAN	• DSM
Lamp outage status	SJB	MS-CAN	• IC
Memory 1/Memory 2 switch status	DDM	MS-CAN	• DSM
Mirror adjust switch status	DDM	MS-CAN	• DSM
Navigation radio rolling wheel count	ABS module	HS-CAN	• IC
Navigation radio rolling wheel count (gateway)	IC	MS-CAN	• ACM
Occupant classification system (OCS) data	OCSM	HS-CAN	• RCM
OCS data	RCM	HS-CAN	• OCSM
OCS serial number and calibration	OCSM	HS-CAN	• RCM
Odometer count	PCM	HS-CAN	• IC
Parking aid disable switch status	IC	MS-CAN	• PAM
Parking aid sounder audio mute command	PAM	MS-CAN	• ACM
Parking aid system status	PAM	MS-CAN	• IC
Parking brake status	SJB	MS-CAN	• IC
Parking brake status (gateway)	IC	HS-CAN	• PCM • 4X4 control module
Passive anti-theft system (PATS) OK to start	IC	HS-CAN	• PCM
PATS security data	PCM	HS-CAN	• IC
PATS theft condition	PCM	HS-CAN	• IC
Perimeter alarm disable switch status	DDM	MS-CAN	• SJB

RCM serial number	RCM	HS-CAN	• OCSM
Safety belt indicator request	RCM	HS-CAN	• IC
Safety belt indicator status	IC	HS-CAN	• RCM
Safety Belt-Minder® chime/flash request	RCM	HS-CAN	• IC
Speed control deactivate switch status	PCM	HS-CAN	• TCM
Speed control indicator request	PCM	HS-CAN	• IC
Speed control status	PCM	HS-CAN	• IC • TCM
Throttle position	PCM	HS-CAN	• TCM
Tire pressure monitoring system (TPMS) status	SJB	MS-CAN	• IC
TPMS sensor status (LF, RF, RR, LR)	SJB	MS-CAN	• IC
Tire size information	ABS module	HS-CAN	• PCM
Traction control disable switch status	IC	HS-CAN	• ABS module • PCM
Traction control indicator request	ABS module	HS-CAN	• PCM • RCM
Transmission gear ratio	TCM	HS-CAN	• ABS module • PCM • 4X4 control module
Transmission gear ratio desired	PCM	HS-CAN	• TCM
Transmission malfunction indicator request	TCM	HS-CAN	• IC
Transmission output shaft speed	TCM	HS-CAN	• PCM
Transmission overdrive indicator request	TCM	HS-CAN	• IC
Transmission selector (PRNDL) range	TCM	HS-CAN	• ABS module • IC • PCM
Transmission selector (PRNDL) range (gateway)	IC	MS-CAN	• ACM • DSM • PAM

			• SJB
Transmission shift in progress	TCM	HS-CAN	• ABS module • PCM
Transmission temperature	TCM	HS-CAN	• PCM
Transmission torque converter lockup request	PCM	HS-CAN	• TCM
Transmission torque converter lockup status	TCM	HS-CAN	• PCM
Transmission turbine shaft speed	TCM	HS-CAN	• PCM
Turn signal request	SJB	MS-CAN	• IC
Vehicle speed	PCM	HS-CAN	• APIM • IC • RCM
Vehicle speed (gateway)	IC	MS-CAN	• ACM • HVAC module • DCSM • PAM • SJB • DSP module
VIN information	PCM	HS-CAN	• RCM • OCSM • TCM • IC • ABS module • 4X4 control module
Wheel speed output (RF, LF, RR, LR)	ABS module	HS-CAN	• PCM • TCM • 4X4 control module

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical
• Battery junction box (BJB) fuse(s):

- 11 (30A) (no communication with dual climate control seat module [DCSM])
- 12 (30A) (no communication with DCSM)
- 13 (10A) (no communication with accessory protocol interface module [APIM])
- 15 (10A) (no communication with driver seat module [DSM])
- 16 (15A) (no communication with transmission control module [TCM])
- 19 (40A) (no communication with smart junction box [SJB])
- 20 (20A) (no communication with audio digital signal processing [DSP] module)
- 21 (20A) (no communication with audio DSP module)
- 23 (10A) (no communication with TCM-FNR5 transaxle, PCM)
- 23 (10A) (no communication with the PCM)
- 26 (7.5A) (no communication with the PCM)
- 42 (15A) (no communication with the PCM, 3.0L and 3.5L engines)
- 47 (15A) (no communication with the PCM, 2.3L engine)

- SJB fuse(s):
  - 12 (7.5A) (no communication with audio control module [ACM])
  - 13 (10A) (no communication with instrument cluster [IC], heating ventilation air conditioning [HVAC] module)
  - 18 (20A) (no power to scan tool, no communication with ACM)
  - 20 (7.5A) (no communication with driver door module [DDM], satellite digital audio receiver system [SDARS] module, 4X4 control module)
  - 23 (7.5A) (no communication with IC)
  - 24 (7.5A) (no communication with occupant classification system module [OCSM])
  - 25 (7.5A) (no communication with restraints control module [RCM])
  - 26 (7.5A) (no communication with TCM, PCM)
  - 27 (7.5A) (no communication with HVAC module, IC)

- 28 (10A) (no communication with ABS module, 4X4 control module, PAM)
- Data link connector (DLC)
- Wiring harness
- Wiring, terminals or connectors

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

4. If the cause is not visually evident, connect the scan tool to the DLC.

   If the scan tool does not communicate with the VCM:

   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Go to **Pinpoint Test V**, to diagnose no power to the scan tool.

NOTE: During the network test, the scan tool will first attempt to communicate with the PCM, after establishing communication with the PCM, the scan tool will then attempt to communicate with all other modules on the vehicle.

5. Carry out the network test.
   - If the network test passes, retrieve and record the continuous memory DTCs and proceed to Step 6.
   - If the network test fails, go to **Symptom Chart** to identify the module not communicating.

NOTE: Follow the non-network DTC diagnostics (BXXXX, CXXXX, PXXXX) prior to the network DTC diagnostics (UXXXX).

6. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
7. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

NOTE: Network DTCs (U-codes) are often a result of intermittent concerns such as faulty wiring or low battery voltage occurrences. Additionally, vehicle service procedures such as module reprogramming will often set network DTCs.

Replacing a module to resolve a network DTC is unlikely to resolve the concern. To prevent repeat network DTC concerns, inspect all network wiring, especially connectors. Test the vehicle battery, refer to BATTERY, MOUNTING AND CABLES article.

NOTE: **DTC U1900 will set in a module that is reporting a communication fault from another module on the data bus. The module that reports the fault is not the problem module.**

COMMUNICATION NETWORK DTC CHART

DTC	Description	Source	Action
U0002	High Speed CAN Communication Bus Performance	Instrument cluster (IC)	The module could not communicate on the network at a point in time. The fault is currently not present. CLEAR the DTC. REPEAT the network test with the scan tool.
U0020	Low Speed CAN Communication Bus Performance	IC	The module could not communicate on the network at a point in time. The fault is currently not present. CLEAR the DTC. REPEAT the network test with the scan tool.
U0073	Control Module Communication Bus Off	Heating ventilation air conditioning (HVAC) module	The module could not communicate on the network at a point in time. The fault is currently not present. CLEAR the DTC. REPEAT the network test with the scan tool.
U0073	Control Module Communication Bus Off	Smart junction box (SJB)	The module could not communicate on the network at a point in time. The fault is currently not present. CLEAR the DTC. REPEAT the network test with the scan tool.
U0073	Control Module Communication Bus Off	Transmission control module (TCM)	The module could not communicate on the network at a point in time. The fault is currently not present. CLEAR the DTC. REPEAT the network test with the scan tool.
U0100	Lost Communication With ECM/PCM	4X4 control module	The module could not communicate on the network at a point in time. The fault is currently not present. CLEAR the DTC. REPEAT the network test with the scan tool.
U0100	Lost Communication With ECM/PCM	TCM	The module could not communicate on the network at a point in time. The fault is currently not present. CLEAR the DTC. REPEAT the network test with the scan tool.
U0101	Lost Communication With TCM	4X4 control module	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	4X4 control module	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the

			network test.
U0140	Lost Communication With Body Control Module (GEM)	Audio control module (ACM)	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0140	Lost Communication With Body Control Module (GEM)	HVAC module	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0140	Lost Communication With Body Control Module (GEM)	Parking aid module (PAM)	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0155	Lost Communication With Instrument Cluster Module	ACM	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0155	Lost Communication With Instrument Cluster Module	Audio digital signal processing (DSP) module	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0155	Lost Communication With Instrument Cluster Module	HVAC module	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0155	Lost Communication With Instrument Cluster Module	PAM	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0155	Lost Communication With Instrument Cluster Module	4X4 control module	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0159	Lost Communication With Parking Assist Control Module (PAM)	ACM	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0184	Lost Communication With Radio (ACM)	Accessory protocol interface module (APIM)	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0184	Lost Communication With Radio (ACM)	DSP module	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0184	Lost Communication With	Satellite digital	CLEAR the DTC. REPEAT the network test

	Radio (ACM)	audio receiver system (SDARS) module	with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0193	Lost Communication With Digital Audio Control Module (SDARS)	ACM	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	APIM	DISREGARD this DTC.
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	ACM	DISREGARD this DTC.
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	SDARS module	DISREGARD this DTC.
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	DSP module	DISREGARD this DTC.
U0197	Lost Communication With Telephone Control Module	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0197	Lost Communication With Telephone Control Module	DSP module	DISREGARD this DTC.
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	DSP module	DISREGARD this DTC.
U0238	Lost Communication With Digital Audio Control Module "D" (DSP)	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0246	Lost Communication With Seat Control Module (DCSM)	HVAC module	CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	ACM	DISREGARD this DTC.
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	APIM	DISREGARD this DTC.
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	SDARS module	DISREGARD this DTC.
U0255	Lost Communication With Front Controls Interface Module	APIM	DISREGARD this DTC.

U0255	Lost Communication With Front Controls Interface Module	SDARS module	DISREGARD this DTC.
U0256	Lost Communication With Front Display Interface Module	APIM	DISREGARD this DTC.
U0256	Lost Communication With Front Display Interface Module	SDARS module	DISREGARD this DTC.
U0401	Invalid Data Received from ECM/PCM A	4X4 control module	RETRIEVE and FOLLOW the DTCs from the PCM.
U0402	Invalid Data Received from TCM	4X4 control module	RETRIEVE and FOLLOW the DTCs from the TCM.
U0415	Invalid Data Received from Anti-Lock Brake System (ABS) Control Module	4X4 control module	RETRIEVE and FOLLOW the DTCs from the ABS module.
U1900	CAN Communication Bus Fault-Receive Error	ABS module	Go to **Symptom Chart** for module that failed network test.
U1900	CAN Communication Bus Fault-Receive Error	Driver seat module (DSM)	Go to **Symptom Chart** for module that failed network test.
U1900	CAN Communication Bus Fault-Receive Error	IC	Go to **Symptom Chart** for module that failed network test.
U1900	CAN Communication Bus Fault-Receive Error	RCM	Go to **Symptom Chart** for module that failed network test.
U1900	CAN Communication Bus Fault-Receive Error	SJB	Go to **Symptom Chart** for module that failed network test.
U1900	CAN Communication Bus Fault-Receive Error	Occupant classification system module (OCSM)	Go to **Symptom Chart**. for module that failed network test.
U1901	CAN #2 Communication Bus Fault - Receive Error	IC	The module had an invalid network input/message from another module. RETRIEVE and FOLLOW the non-network DTCs from other modules. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.
U2013	Compass Module is not Responding	IC	RETRIEVE and FOLLOW the non-network DTCs from other modules. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
U2023	Fault Received From External Node	ABS module	The module had an invalid network input/message from another module. RETRIEVE and FOLLOW the non-network DTCs from other modules. REFER to **MULTIFUNCTION ELECTRONIC**

			MODULES article.
U2023	Fault Received From External Node	IC	The module had an invalid network input/message from another module. RETRIEVE and FOLLOW the non-network DTCs from other modules. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.
U2510	CAN - Invalid data for Vehicle Security	IC	The module had an invalid network input/message from another module. RETRIEVE and FOLLOW the non-network DTCs from other modules. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
U2511	CAN - Data Mis-Match (Receive data does not match expected)	IC	The module had an invalid network input/message from another module. RETRIEVE and FOLLOW the non-network DTCs from other modules. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The PCM does not respond to the scan tool	• Wiring, terminals or connectors • PCM	• REFER to the **Introduction - Gasoline Engines** article, pinpoint test QA before proceeding to Pinpoint Test A. If pinpoint test QA has been completed, go to **Pinpoint Test A**.
• The transmission control module (TCM) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • TCM	• Go to **Pinpoint Test B**.
• The ABS module does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • ABS module	• Go to **Pinpoint Test C**.
• The restraints control module (RCM) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • Case ground open	• Go to **Pinpoint Test D**.

	• RCM	
• The 4X4 control module (if equipped) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • 4X4 control module	• Go to **Pinpoint Test E**.
• The occupant classification system module (OCSM) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • OCSM	• Go to **Pinpoint Test F**.
• The instrument cluster (IC) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • IC	• Go to **Pinpoint Test G**.
• The smart junction box (SJB) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • SJB	• Go to **Pinpoint Test H**.
• The heating ventilation air conditioning (HVAC) module (if equipped) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • HVAC module	• Go to **Pinpoint Test I**.
• The parking aid module (PAM) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • PAM	• Go to **Pinpoint Test J**.
• The audio control module (ACM) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • ACM	• Go to **Pinpoint Test K**.
• The audio digital signal processing (DSP) module not respond to the scan tool	• Fuse • Wiring, terminals or connectors • DSP module	• Go to **Pinpoint Test L**.
• The satellite digital audio receiver system (SDARS) module does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • SDARS module	• Go to **Pinpoint Test M**.
	• Fuse	

• The driver door module (DDM) does not respond to the scan tool	• Wiring, terminals or connectors • DDM	• Go to **Pinpoint Test N**.
• The driver seat module (DSM) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • DSM	• Go to **Pinpoint Test O**.
• The dual climate control seat module (DCSM) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • DCSM	• Go to **Pinpoint Test P**.
• The accessory protocol interface module (APIM) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • APIM	• Go to **Pinpoint Test Q**.
• No medium speed controller area network (MS-CAN) communication, all modules are not responding	• Wiring, terminals or connectors • APIM (if equipped) • ACM • DSP module (if equipped) • DDM (if equipped) • DSM (if equipped) • DCSM (if equipped) • HVAC module (if equipped) • IC • PAM (if equipped) • SDARS module (if equipped) • SJB	• Go to **Pinpoint Test R**.
• Intermittent no medium speed controller area network (MS-CAN) communication, one or more modules are not responding during network test	• Wiring, terminals or connectors	• Go to **Pinpoint Test S**.
	• Wiring, terminals or connectors • ABS module	

• No high speed controller area network (HS-CAN) communication, all modules are not responding	• APIM (if equipped) • IC • OCSM • PCM • RCM • TCM • 4X4 control module (if equipped)	• Go to **Pinpoint Test T**.
• Intermittent no high speed controller area network (HS-CAN) communication, one or more modules are not responding during network test	• Wiring, terminals or connectors	• Go to **Pinpoint Test U**.
• No power to the scan tool	• Fuse • Wiring, terminals or connectors • Scan tool	• Go to **Pinpoint Test V**.

Pinpoint Tests

Pinpoint Test A: The PCM Does Not Respond To The Scan Tool

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Electronic Engine Controls - 2.3L for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Electronic Engine Controls - 3.0L for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Electronic Engine Controls - 3.5L for schematic and connector information.

Normal Operation

The PCM communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the PCM.

The PCM shares the HS-CAN with the following modules:

- ABS module
- Accessory protocol interface module (APIM) (if equipped)
- Instrument cluster (IC)
- Occupant classification system module (OCSM)
- Restraints control module (RCM)
- Transmission control module (TCM) (if equipped)
- 4X4 control module (if equipped)

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PCM

PINPOINT TEST A: THE PCM DOES NOT RESPOND TO THE SCAN TOOL

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

A1 POWERTRAIN CONTROL/EMISSIONS DIAGNOSIS (PC/ED) MANUAL PINPOINT TEST QA VERIFICATION CHECK

- Verify that the PC/ED pinpoint test QA has been performed.
- **Has the PC/ED pinpoint test QA been performed?**

  YES : Go to A2.

  NO : REFER to **Introduction - Gasoline Engines** article, pinpoint test QA, to diagnose no communication with the PCM.

A2 CHECK THE HS-CAN TERMINATION RESISTANCE

- Key in OFF position.

NOTE: **Failure to disconnect the battery will result in false resistance readings.**

- Disconnect the battery ground cable.

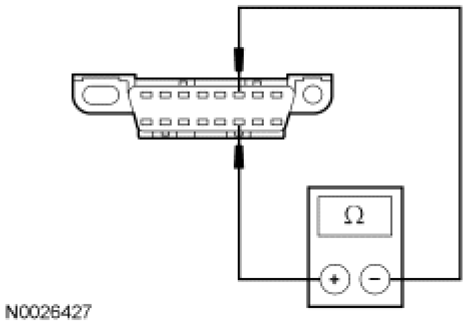


Fig. 2: Checking HS-CAN Termination Resistance

Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Is the resistance between 54 and 66 ohms?**

  YES : Go to A4.

  NO : Go to A3.

A3 CHECK THE HS-CAN CIRCUITS BETWEEN THE DLC AND THE PCM FOR AN OPEN

- Disconnect: PCM C175b

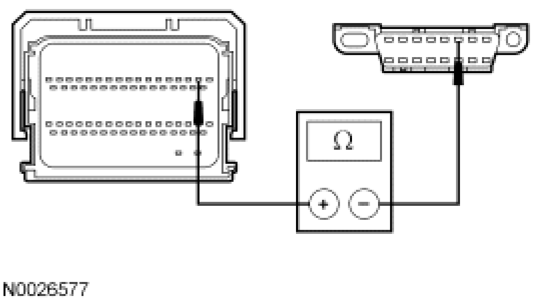


Fig. 3: Checking HS-CAN (+) Circuit
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-2, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.

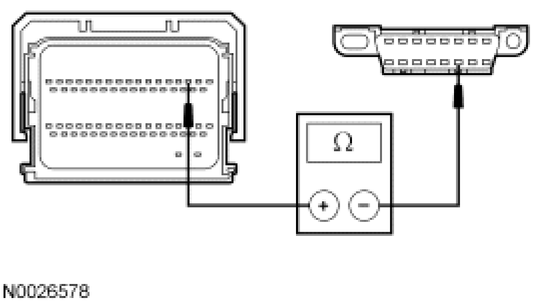


Fig. 4: Checking HS-CAN (-) Circuit
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-3, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to A4.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

A4 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test B: The Transmission Control Module (TCM) Does Not Respond To The Scan Tool

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Transmission Controls - 6 Speed for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Transmission Controls - FNR5 for schematic and connector information.

Normal Operation

The transmission control module (TCM) communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the TCM. The FNR5 transaxle TCM and the 6-speed transaxle TCM both communicate on the HS-CAN. Voltage for the TCM is provided by circuits CBP18 (GY/OG), SBP07 (WH/RD) and SBB16 (VT/RD). Both circuits GD120 (BK/GN) provide ground.

The TCM shares the HS-CAN with the following modules:

- ABS module
- Accessory protocol interface module (APIM) (if equipped)
- Instrument cluster (IC)
- Occupant classification system module (OCSM)

- PCM
- Restraints control module (RCM)
- 4X4 control module (if equipped)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- TCM

PINPOINT TEST B: THE TRANSMISSION CONTROL MODULE (TCM) DOES NOT RESPOND TO THE SCAN TOOL

NOTE: **Use the correct probe adapter(s) when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.**

B1 CHECK THE TCM VOLTAGE SUPPLY CIRCUITS FOR AN OPEN

- Key in OFF position.
- Disconnect: TCM C2352a (FNR5 Transaxle)
- Disconnect: TCM C1533 (6-Speed Transaxle)
- Key in ON position.

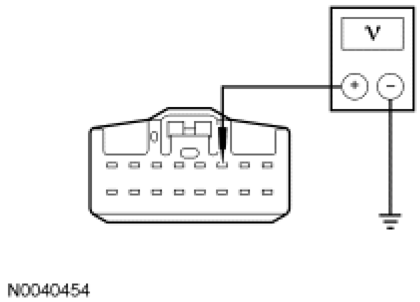


Fig. 5: Checking Power From Smart Junction Box (SJB)
Courtesy of FORD MOTOR CO.

- For FNR5 transaxles, measure the voltage between the TCM C2352a-3, circuit SBP23 (WH/RD), harness side and ground.

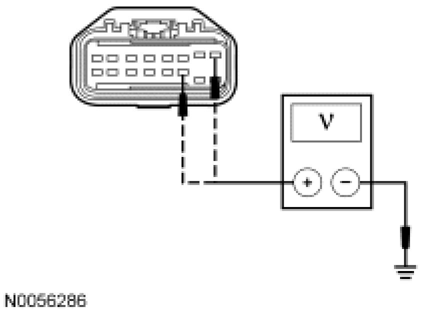


Fig. 6: Checking TCM Voltage Supply Circuits For An Open (2 Of 2)
Courtesy of FORD MOTOR CO.

- For 6-speed transaxles, measure the voltage between the TCM C1533-1, circuit SBB16 (VT/RD), harness side and ground; and between the TCM C1533-11, circuit CBP18 (GY/OG), harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to B2.

  NO : For FNR5 transaxles, VERIFY the battery junction box (BJB) fuse 23 (10A) is OK.

  For 6-speed transaxles, VERIFY the battery junction box (BJB) fuse 16 (15A) or SJB fuse 26 (7.5A), are OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

B2 CHECK THE TCM GROUND(S)

- Key in OFF position.

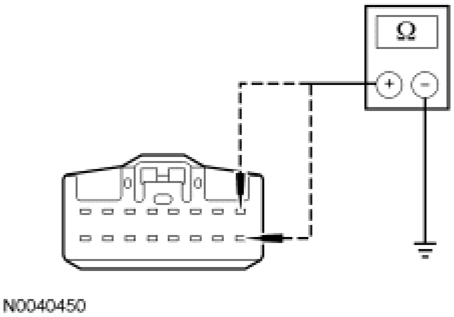


Fig. 7: Checking TCM Ground Supply Circuit For Open
Courtesy of FORD MOTOR CO.

- For FNR5 transaxles, measure the resistance between the TCM C2352a-1, circuit GD120 (BK/GN), harness side and ground; and between the TCM C2352a-9, circuit GD120 (BK/GN), harness side and ground.

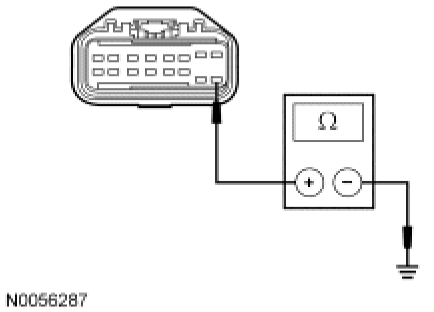


Fig. 8: Checking TCM Ground Supply Circuit For Open (2 Of 2)
Courtesy of FORD MOTOR CO.

- For 6-speed transaxles, measure the resistance between TCM C1533-9, circuit GD120 (BK/GN), harness side and ground.
- **Are the resistances less than 5 ohms?**

  YES : For FNR5 transaxles, go to B3 .

  For 6-speed transaxles, go to B4 .

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

B3 CHECK THE HS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE FNR5 TRANSAXLE TCM FOR AN OPEN

- Disconnect: TCM C2352b

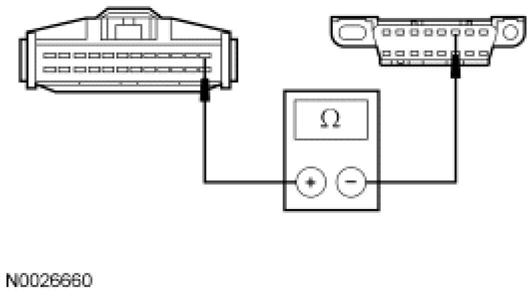
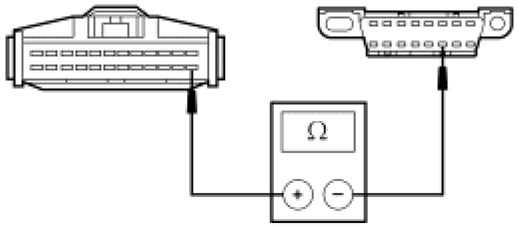


Fig. 9: Checking High Speed CAN Circuits Between DLC And TCM C2352B For Open (1 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the TCM C2352b-1, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.



N0026661

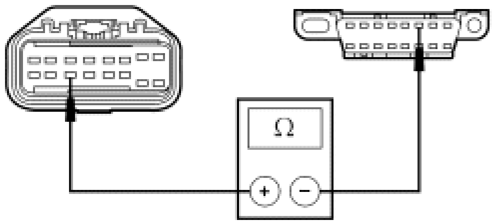
Fig. 10: Checking High Speed CAN Circuits Between DLC And TCM C2352B For Open (2 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the TCM C2352b-13, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to B5.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

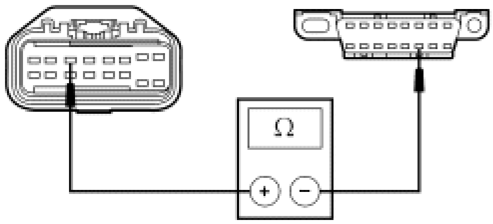
B4 CHECK THE HS-CAN CIRCUITS BETWEEN THE DLC AND THE 6-SPEED TRANSAXLE TCM FOR AN OPEN



N0026662

Fig. 11: Checking High Speed CAN Circuits Between DLC And TCM C1533 For Open (1 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the TCM C1533-14, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.



N0026663

Fig. 12: Checking High Speed CAN Circuits Between DLC And TCM C1533 For Open (2 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the TCM C1533-6, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to B5.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

B5 CHECK FOR CORRECT TCM OPERATION

- Disconnect the TCM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the TCM connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new TCM. REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article or **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test C: The ABS module Does Not Respond To The Scan Tool

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The ABS module communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the ABS module. Voltage for the ABS module is provided by circuit CBP19 (BN/WH). Ground is provided by circuit GD123 (BK/GY).

The ABS module shares the HS-CAN with the following modules:

- ABS module
- Accessory protocol interface module (APIM) (if equipped)
- Instrument cluster (IC)
- Occupant classification system module (OCSM)
- PCM
- Restraints control module (RCM)
- Transmission control module (TCM) (if equipped)
- 4X4 control module (if equipped)

This pinpoint test is intended to diagnose the following:

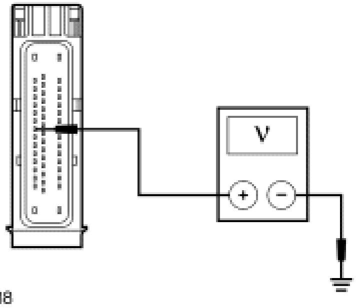
- Fuse
- Wiring, terminals or connectors
- ABS module

PINPOINT TEST C: THE ABS module DOES NOT RESPOND TO THE SCAN TOOL

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

C1 CHECK THE ABS MODULE VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Key in OFF position.
- Disconnect: ABS Module C135
- Key in ON position.



N0056288

Fig. 13: Checking Circuit CBP19 (BN/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the ABS module C135-8, circuit CBP19 (BN/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to C2.

  NO : VERIFY the smart junction box (SJB) fuse 28 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

C2 CHECK THE ABS MODULE GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.

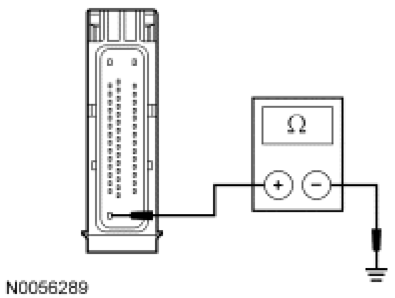


Fig. 14: Checking Circuit GD123 (BK/GY) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the ABS module C135-16, circuit GD123 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to C3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

C3 CHECK THE HS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE ABS MODULE FOR AN OPEN

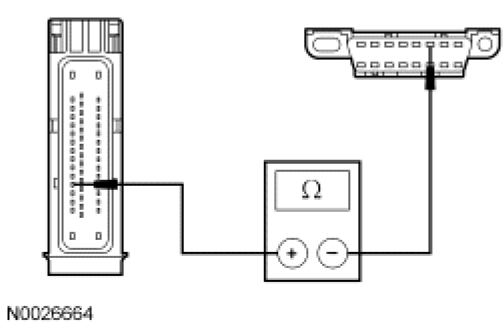


Fig. 15: Checking High Speed CAN Circuits Between DLC And ABS Module For Open (1 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the ABS module C135-12, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.

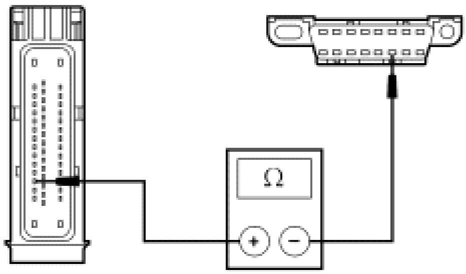


Fig. 16: Checking High Speed CAN Circuits Between DLC And ABS Module For Open (2 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the ABS module C135-13, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to C4.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

C4 CHECK FOR CORRECT ABS MODULE OPERATION

- Disconnect the ABS module connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the ABS module connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ABS module. REFER to **VEHICLE DYNAMIC SYSTEMS** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test D: The Restraints Control Module (RCM) Does Not Respond To The Scan Tool

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for

Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the RCM. Voltage for the RCM is provided by circuit CBP21 (BU/GY), and the RCM is case grounded.

The RCM shares the HS-CAN with the following modules:

- ABS module
- Accessory protocol interface module (APIM) (if equipped)
- Instrument cluster (IC)
- Occupant classification system module (OCSM)
- PCM
- Transmission control module (TCM) (if equipped)
- 4X4 control module (if equipped)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Case ground open
- RCM

PINPOINT TEST D: THE RESTRAINTS CONTROL MODULE (RCM) DOES NOT RESPOND TO THE SCAN TOOL

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough

inspection and verification before proceeding with the pinpoint test.

D1 CHECK THE RCM CONNECTION

- Key in OFF position.
- Depower the SRS. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: RCM C310a
- Disconnect: RCM C310b
- **Are RCM C310a pin 24, and RCM C310b pins 17 and 18 OK?**

  YES : Go to D2.

  NO : REPAIR the RCM connector pins as necessary. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

D2 CHECK THE RCM VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Deactivate the SRS. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Repower the SRS. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Key in ON position.

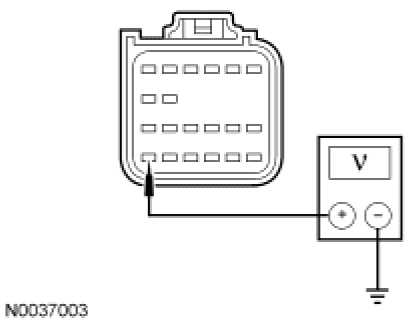


Fig. 17: Checking RCM Voltage Supply Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the RCM C310a-24, circuit CBP21 (BU/GY), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to D3.

  NO : VERIFY the smart junction box (SJB) fuse 25 (7.5A) is OK. If OK, REPAIR the circuit. REACTIVATE the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

D3 CHECK THE RCM CASE GROUND

- Key in OFF position.
- Measure the resistance between the RCM case and a good chassis ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to D4.

NO : REPAIR the RCM case ground as necessary. REACTIVATE the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

D4 CHECK THE HS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE RCM FOR AN OPEN

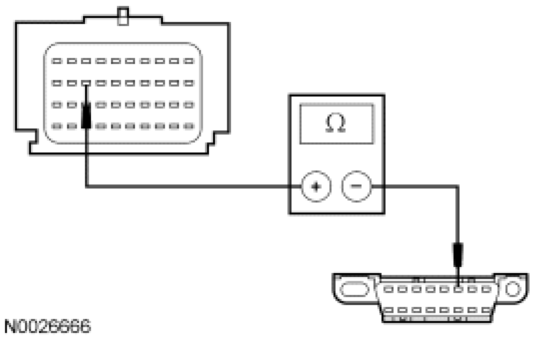


Fig. 18: Measuring Resistance Between RCM C310B-18 & DLC C251-6, Circuit VDB04 (WH/BU) & VDB04 (WH/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the RCM C310b-18, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.

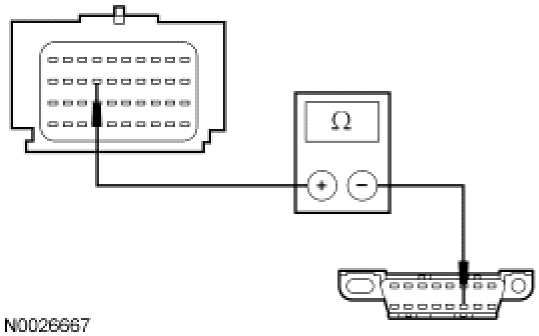


Fig. 19: Measuring Resistance Between RCM C310B-17 & DLC C251-14, Circuit VDB05 (WH) & VDB05 (WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the RCM C310b-17, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to D5.

  NO : REPAIR the circuit in question. REACTIVATE the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

D5 CHECK FOR CORRECT RCM OPERATION

- Disconnect all the RCM connectors.
- Check for:

    - corrosion
    - damaged pins
    - pushed-out pins
- Connect all the RCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new RCM. REACTIVATE the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. REACTIVATE the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test E: The 4X4 Control Module Does Not Respond To The Scan Tool

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, All-Wheel Drive (AWD) for schematic and connector information.

Normal Operation

The 4X4 control module communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the 4X4 control module. Voltage to the 4X4 control module is supplied by circuits CBP19 (BN/WH) and SBP15 (WH/RD). Ground is supplied by circuit GD126 (BK/WH).

The 4X4 control module shares the HS-CAN with the following modules:

- ABS module
- Accessory protocol interface module (APIM) (if equipped)
- Instrument cluster (IC)
- Occupant classification system module (OCSM)
- PCM
- Restraints control module (RCM)
- Transmission control module (TCM) (if equipped)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- 4X4 control module

PINPOINT TEST E: THE 4X4 CONTROL MODULE DOES NOT RESPOND TO THE SCAN TOOL

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

E1 CHECK VOLTAGE TO THE 4X4 CONTROL MODULE

- Key in OFF position.
- Disconnect: 4X4 Control Module C3253
- Key in ON position.

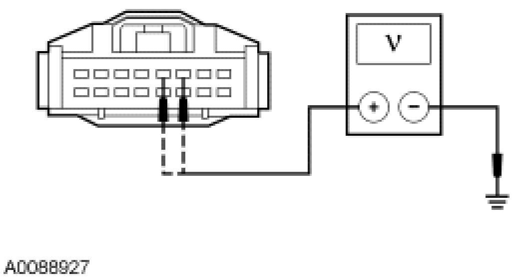


Fig. 20: Checking Voltage To 4X4 Control Module
Courtesy of FORD MOTOR CO.

- Measure the voltage between the 4X4 control module C3253-5, circuit CBP19 (BN/WH), harness side and ground; and between the 4X4 control module C3253-6, circuit SBP15 (WH/RD), harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to E2.

  NO : VERIFY the smart junction box (SJB) fuse 20 (7.5A) or 28 (10A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

E2 CHECK THE 4X4 CONTROL MODULE GROUND

- Key in OFF position.

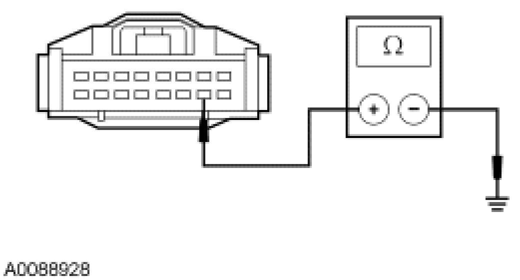


Fig. 21: Checking 4X4 Control Module Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the 4X4 control module C3253-15, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to E3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

E3 CHECK THE HS-CAN CIRCUITS BETWEEN THE 4X4 CONTROL MODULE AND THE DATA LINK CONNECTOR (DLC) FOR AN OPEN

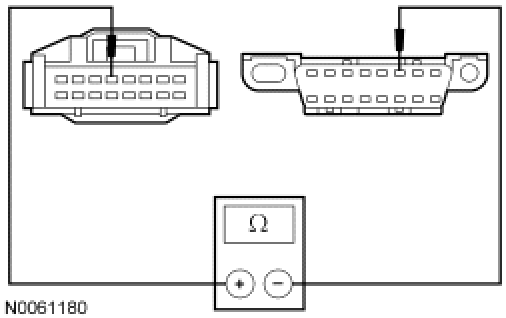


Fig. 22: Measuring Resistance Between 4WD Control Module C281-4, Circuit VDB04 (WH/BU) & DLC C251-6
Courtesy of FORD MOTOR CO.

- Measure the resistance between the 4X4 control module C3253-4, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.

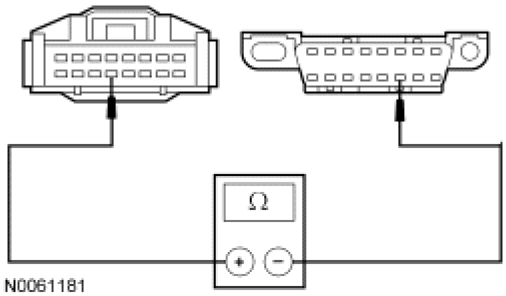


Fig. 23: Measuring Resistance Between 4WD Control Module C281-12, Circuit VDB05 (WH) & DLC C251-14
Courtesy of FORD MOTOR CO.

- Measure the resistance between the 4X4 control module C3253-12, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to E4.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

E4 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION

- Disconnect all the 4X4 control module connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the 4X4 control module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new 4X4 control module. REFER to **FOUR WHEEL DRIVE (4WD) SYSTEMS** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test F: The Occupant Classification System Module (OCSM) Does Not Respond To The Scan Tool

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

The occupant classification system module (OCSM) communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the OCSM. Voltage to the OCSM is supplied by circuit CBP24 (VT/GN). Ground is supplied by circuit GD127 (BK/BU).

The OCSM shares the HS-CAN with the following modules:

- ABS module
- Accessory protocol interface module (APIM) (if equipped)
- Instrument cluster (IC)
- PCM
- Restraints control module (RCM)
- Transmission control module (TCM) (if equipped)
- 4X4 control module (if equipped)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- OCSM

PINPOINT TEST F: THE OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM) DOES NOT RESPOND TO THE SCAN TOOL

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

F1 CHECK THE OCSM VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: OCSM C3159
- Deactivate the SRS. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Repower the SRS. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Key in ON position.

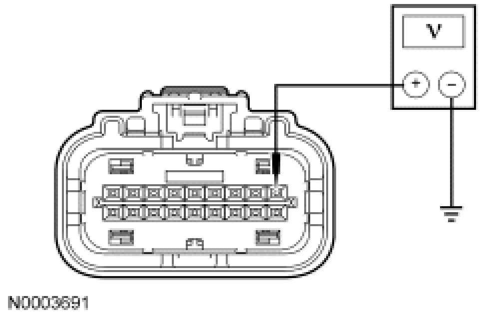


Fig. 24: Checking OCSM Voltage Supply Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the OCSM C3159-1, circuit CBP24 (VT/GN), harness side and

ground.

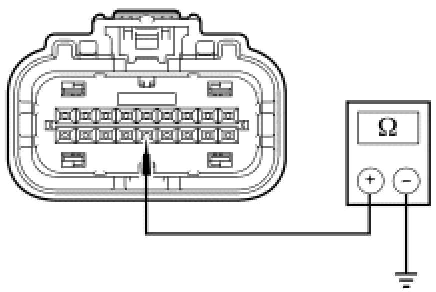
- **Is the voltage greater than 10 volts?**

  YES : Go to F2.

  NO : VERIFY the smart junction box (SJB) fuse 24 (7.5A) is OK. If OK, REPAIR the circuit. REACTIVATE the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

F2 CHECK THE OCSM GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.



N0003692

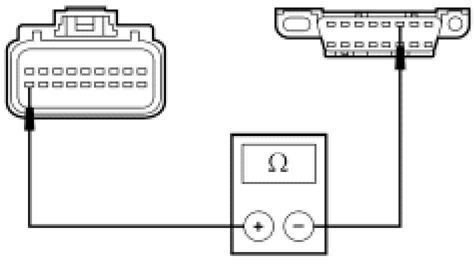
Fig. 25: Checking OCSM Ground Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the OCSM C3159-14, circuit GD127 (BK/BU), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to F3.

  NO : REPAIR the circuit. REACTIVATE the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

F3 CHECK THE HS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE OCSM FOR AN OPEN



N0026670

Fig. 26: Measuring Resistance Between OCSM C3159-18 & DLC C251-6, Circuit VDB04 (WH/BU) & VDB04 (WH/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the OCSM C3159-18, circuit VDB04 (WH/BU), harness side and

the DLC C251-6, circuit VDB04 (WH/BU), harness side.

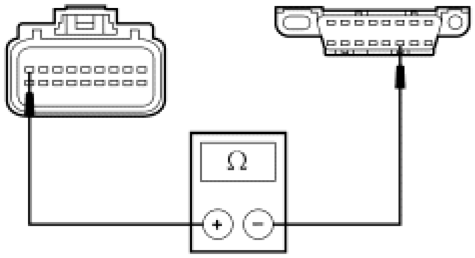


Fig. 27: Measuring Resistance Between OCSM C3159-9 & DLC C251-14, Circuit VDB05 (WH) & VDB05 (WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the OCSM C3159-9, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to F4.

  NO : REPAIR the circuit. REACTIVATE the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

F4 CHECK FOR CORRECT OCSM OPERATION

- Disconnect the OCSM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the OCSM connector and make sure it seats correctly.
- Verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new OCSM. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. REACTIVATE the SRS. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. REACTIVATE the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test G: The Instrument Cluster (IC) Does Not Respond To The Scan Tool

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for

Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Instrument Cluster for schematic and connector information.

Normal Operation

The instrument cluster (IC) communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the HS-CAN connection to the IC and circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the MS-CAN connection to the IC. Voltage for the IC is provided by circuits CBP23 (BN/YE), SBP07 (WH/RD) and CBP20 (YE/VT). Circuit GD116 (BK/VT) provides ground.

The IC shares the HS-CAN with the following modules:

- ABS module
- Accessory protocol interface module (APIM) (if equipped)
- Instrument cluster (IC)
- Occupant classification system module (OCSM)
- PCM
- Restraints control module (RCM)
- Transmission control module (TCM) (if equipped)
- 4X4 control module (if equipped)

The IC shares the MS-CAN with the following modules:

- APIM (if equipped)
- Audio control module (ACM)
- Audio digital signal processing (DSP) module (if equipped)
- Driver seat module (DSM) (if equipped)
- Driver door module (DDM) (if equipped)
- Dual climate control seat module (DCSM) (if equipped)
- Heating ventilation air conditioning (HVAC) module (if equipped)
- Parking aid module (PAM) (if equipped)
- Satellite digital audio receiver system (SDARS) module (if equipped)
- Smart junction box (SJB)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- IC

PINPOINT TEST G: THE INSTRUMENT CLUSTER (IC) DOES NOT RESPOND TO THE SCAN TOOL

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

G1 CHECK THE HS-CAN TERMINATION RESISTANCE

- Key in OFF position.

NOTE: **Failure to disconnect the battery will result in false resistance readings.**

- Disconnect the battery ground cable.
- Disconnect the scan tool cable from the data link connector (DLC).

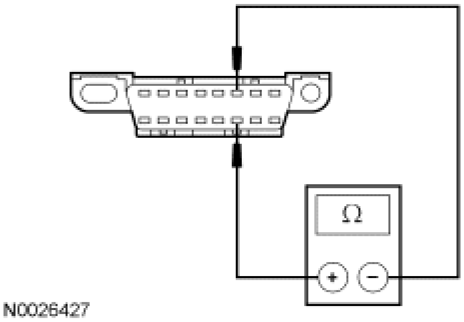


Fig. 28: Checking HS-CAN Termination Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Is the resistance between 54 and 66 ohms?**

  YES : Go to G2.

  NO : Go to G4.

G2 CHECK THE INSTRUMENT CLUSTER (IC) VOLTAGE SUPPLY

- Disconnect: IC C220
- Connect the battery ground cable.
- Key in ON position.
- Measure the voltage between the IC, harness side and ground as follows:

IC Connector-Pin	Circuit
C220-6	CBP23 (BN/YE)
C220-19	SBP07 (WH/RD)
	CBP20

C220-20	(YE/VT)

- **Are the voltages greater than 10 volts?**

  YES : Go to G3.

  NO : VERIFY the smart junction box (SJB) fuses 13 (10A), 23 (7.5A), or 27 (7.5A) are OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

G3 CHECK THE IC GROUND CIRCUITS

- Key in OFF position.
- Measure the resistance between the IC, harness side and ground as follows:

IC Connector-Pin	Circuit
C220-9	GD116 (BK/VT)
C220-10	GD116 (BK/VT)

- **Are the resistances less than 5 ohms?**

  YES : Go to G5.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

G4 CHECK THE HS-CAN CIRCUITS BETWEEN THE DLC AND THE IC FOR AN OPEN

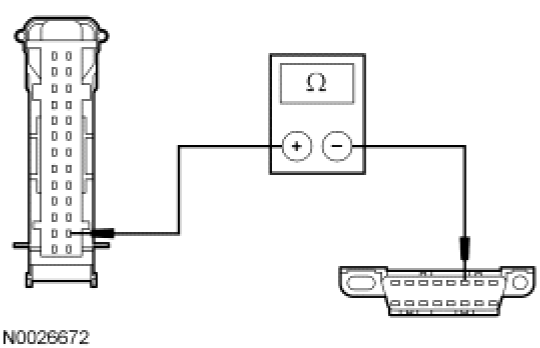


Fig. 29: Measuring Resistance Between IC C220-15 & DLC C251-6, Circuit VDB04 (WH/BU) & VDB04 (WH/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the IC C220-15, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.

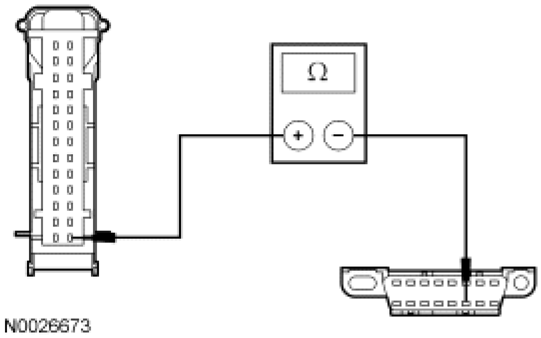


Fig. 30: Measuring Resistance Between IC C220-14 & DLC C251-14, Circuit VDB05 (WH) & VDB05 (WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the IC C220-14, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to G5.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

G5 CHECK THE MS-CAN CIRCUITS BETWEEN THE DLC AND THE INSTRUMENT CLUSTER (IC) FOR AN OPEN

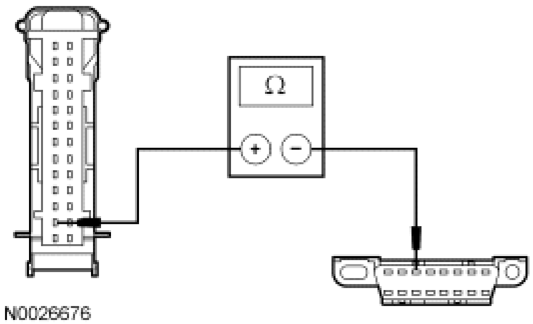


Fig. 31: Measuring Resistance Between IC C220-2 & DLC C251-3, Circuit VDB06 (GY/OG) & VDB06 (GY/OG)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the IC C220-2, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.

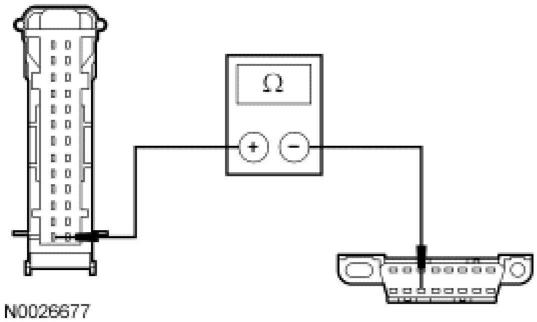


Fig. 32: Measuring Resistance Between IC C220-1 & DLC C251-11, Circuit VDB07 (VT/OG) & VDB07 (VT/OG)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the IC C220-1, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to G6.

  NO : REPAIR the circuit in question. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

G6 CHECK FOR CORRECT IC OPERATION

- Disconnect the IC connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the IC connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test H: The Smart Junction Box (SJB) Does Not Respond To The Scan Tool

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Grounds for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Distribution/SJB for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Normal Operation

The smart junction box (SJB) communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the SJB. Voltage for the SJB is provided by circuit SBB19 (BU/RD). Circuit GD116 (BK/VT) provides ground.

The SJB shares the MS-CAN with the following modules:

- Accessory protocol interface module (APIM) (if equipped)
- Audio control module (ACM)
- Audio digital signal processing (DSP) module (if equipped)
- Driver seat module (DSM) (if equipped)
- Driver door module (DDM) (if equipped)
- Dual climate control seat module (DCSM) (if equipped)
- Heating ventilation air conditioning (HVAC) module (if equipped)
- Instrument cluster (IC)
- Parking aid module (PAM) (if equipped)
- Satellite digital audio receiver system (SDARS) module (if equipped)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- SJB

PINPOINT TEST H: THE SMART JUNCTION BOX (SJB) DOES NOT RESPOND TO THE SCAN TOOL

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

H1 CHECK THE SJB VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280a
- Key in ON position.

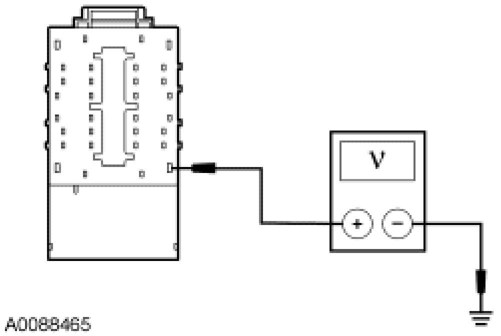


Fig. 33: Checking SJB Voltage Supply Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the SJB C2280a-4, circuit SBB19 (BU/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to H2.

  NO : VERIFY the battery junction box (BJB) fuse 19 (40A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

H2 CHECK THE SJB GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280d

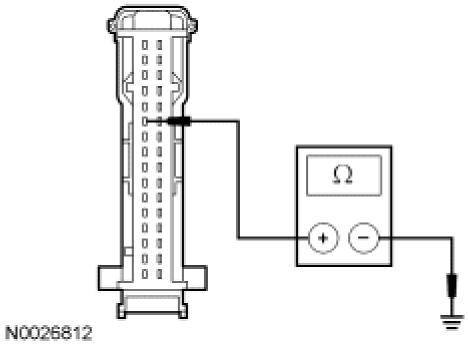


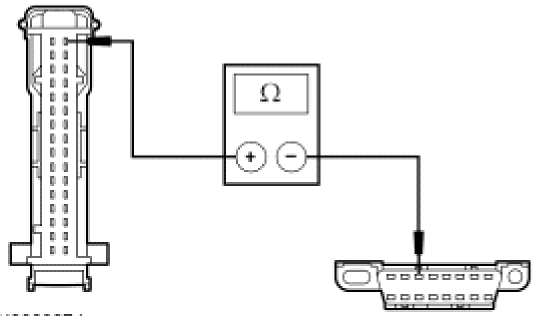
Fig. 34: Checking SJB Ground Circuit GD116 (BK/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280d-6, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to H3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

H3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE SJB FOR AN OPEN



N0026674

Fig. 35: Checking Medium Speed CAN Circuits Between DLC And SJB For Open (1 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280d-17, circuit VDB06 (GY/OG) , harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.

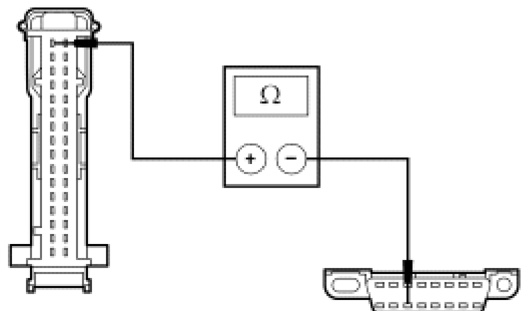


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Fig. 36: Checking Medium Speed CAN Circuits Between DLC And SJB For Open (2 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280d-1, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to H4.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

H4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES**

article. CLEAR the DTCs. REPEAT the network test with the scan tool.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test I: The Heating Ventilation Air Conditioning (HVAC) Module Does Not Respond To The Scan Tool

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Automatic Climate Control System for schematic and connector information.

Normal Operation

The vehicle may be equipped with either a single-zone or dual-zone automatic HVAC module or a manual (non-HVAC) climate control system. This test diagnoses the HVAC module systems. Voltage for the HVAC module is provided by circuits CBP20 (YE/VT) and SBP07 (WH/RD). Circuit GD116 (BK/VT) provides ground.

The HVAC module shares the MS-CAN with the following modules:

- Accessory protocol interface module (APIM) (if equipped)
- Audio control module (ACM)
- Audio digital signal processing (DSP) module (if equipped)
- Driver seat module (DSM) (if equipped)
- Driver door module (DDM) (if equipped)
- Dual climate control seat module (DCSM) (if equipped)
- Instrument cluster (IC)
- Parking aid module (PAM) (if equipped)
- Satellite digital audio receiver system (SDARS) module (if equipped)
- Smart junction box (SJB)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- HVAC module

PINPOINT TEST I: THE HEATING VENTILATION AIR CONDITIONING (HVAC) MODULE DOES NOT RESPOND TO THE SCAN TOOL

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

I1 CHECK THE HVAC VOLTAGE SUPPLY CIRCUITS FOR AN OPEN

- Key in OFF position.
- Disconnect: HVAC Module C228a (Single-Zone) or C2356a (Dual-Zone)
- Key in ON position.
- Measure the voltage between the HVAC module C228a-26 (single-zone) or HVAC module C2356a-26 (dual-zone), circuit SBP07 (WH/RD) circuit CBP20 (YE/VT), harness side and ground.

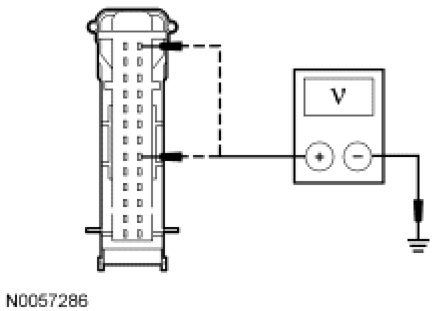


Fig. 37: Checking HVAC Voltage Supply Circuits For An Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the HVAC module C228a-19 (single-zone) or HVAC module C2356a-19 (dual-zone), circuit CBP20 (YE/VT), harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to I2.

  NO : VERIFY smart junction box (SJB) fuses 13 (10A) or 27 (7.5A) are OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

I2 CHECK THE HVAC GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.

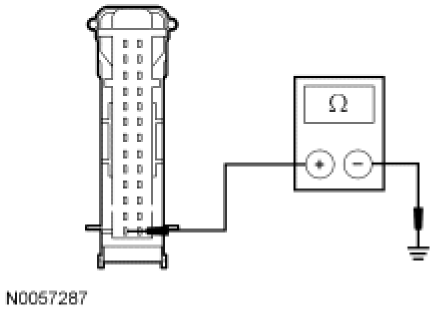


Fig. 38: Checking HVAC Ground Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the HVAC module C228a-1 (single-zone) or C2356a-1 (dual-zone), circuit GD116 (BK/VT) and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to I3.

NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

I3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE HVAC MODULE FOR AN OPEN

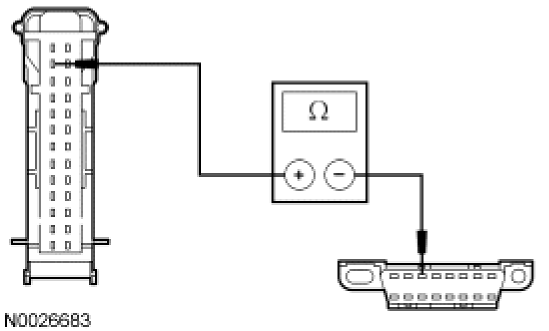


Fig. 39: Checking Medium Speed CAN Circuits Between DLC And EATC Module Or DATC Module For Open (1 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the HVAC module C228a-12 (single-zone) or C2356a-12 (dual-zone), circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.

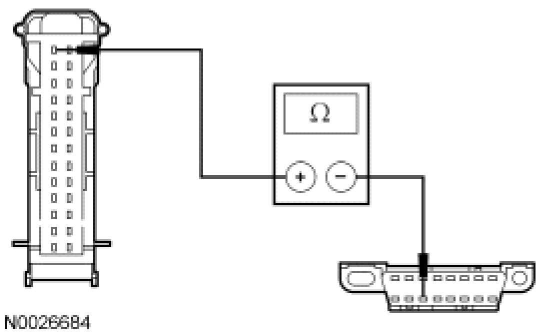


Fig. 40: Checking Medium Speed CAN Circuits Between DLC And EATC Module Or DATC Module For Open (2 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the HVAC module C228a-13 (single-zone) or C2356a-13 (dual-zone), circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to I4.

  NO : REPAIR the circuit as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.

I4 CHECK FOR CORRECT HVAC MODULE OPERATION

- Disconnect all the HVAC module connectors.

- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the HVAC module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test J: The Parking Aid Module (PAM) Does Not Respond To The Scan Tool

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Parking Aid for schematic and connector information.

Normal Operation

The parking aid module (PAM) communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the PAM. Voltage for the PAM is provided by circuit CBP35 (YE/GY). Circuit GD133 (BK) provides ground.

The PAM shares the MS-CAN with the following modules:

- Accessory protocol interface module (APIM) (if equipped)
- Audio control module (ACM)
- Audio digital signal processing (DSP) module (if equipped)
- Driver seat module (DSM) (if equipped)
- Driver door module (DDM) (if equipped)
- Dual climate control seat module (DCSM) (if equipped)
- Heating ventilation air conditioning (HVAC) module (if equipped)
- Instrument cluster (IC)
- Satellite digital audio receiver system (SDARS) module (if equipped)
- Smart junction box (SJB)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- PAM

PINPOINT TEST J: THE PARKING AID MODULE (PAM) DOES NOT RESPOND TO THE SCAN TOOL

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

J1 CHECK THE PAM VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Key in OFF position.
- Disconnect: PAM C4014
- Key in ON position.

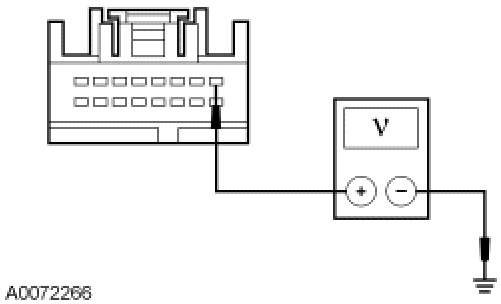


Fig. 41: Checking PAM Voltage Supply Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the PAM C4014-1, circuit CBP19 (BN/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to J2.

  NO : VERIFY the smart junction box (SJB) fuse 28 (10A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

J2 CHECK THE PAM GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.

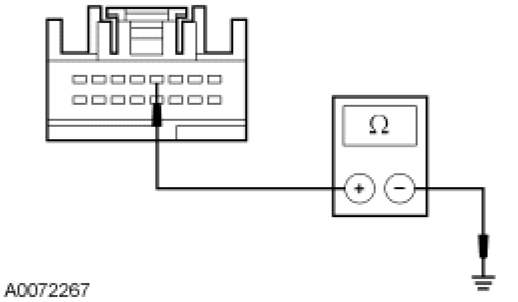


Fig. 42: Checking PAM Ground Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PAM C4014-4, circuit GD171 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to J3.

  NO : REPAIR the circuit. TEST the system for normal operation.

J3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE PAM FOR AN OPEN

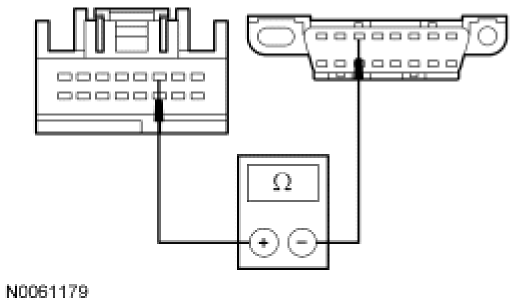


Fig. 43: Measuring Resistance Between Parking Aid Module C4014-3, Circuit VDB06 (GY/OG) & DLC C251-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PAM C4014-3, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.

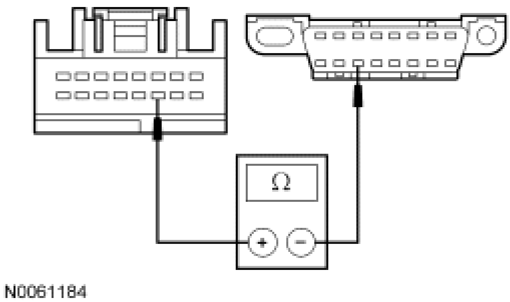


Fig. 44: Measuring Resistance Between Parking Aid Module C4014-11, Circuit VDB07 (VT/OG) & DLC C251-11
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PAM C4014-11, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to J4.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

J4 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PAM. REFER to **PARKING AID** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test K: The Audio Control Module (ACM) Does Not Respond To The Scan Tool

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Audio System/Navigation for schematic and connector information.

Normal Operation

The audio control module (ACM) communicate with the scan tool through the medium speed controller area network (MS-CAN) circuits VDB06 (GY/OG) and VDB07 (VT/OG).

Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the ACM. Voltage for the ACM is provided by circuits CBP02 (GN) and SBP11 (BU/RD). Circuit GD114 (BK/BU) provides ground.

The ACM shares the MS-CAN with the following modules:

- Accessory protocol interface module (APIM) (if equipped)
- Audio digital signal processing (DSP) module (if equipped)
- Driver seat module (DSM) (if equipped)
- Driver door module (DDM) (if equipped)
- Dual climate control seat module (DCSM) (if equipped)
- Heating ventilation air conditioning (HVAC) module (if equipped)
- Instrument cluster (IC)
- Parking aid module (PAM) (if equipped)
- Satellite digital audio receiver system (SDARS) module (if equipped)
- Smart junction box (SJB)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- ACM

PINPOINT TEST K: THE AUDIO CONTROL MODULE (ACM) DOES NOT RESPOND TO THE SCAN TOOL

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

K1 CHECK THE ACM VOLTAGE SUPPLY CIRCUITS FOR AN OPEN

- Key in OFF position.
- Disconnect: ACM C290a (Base Audio/Audiophile) or C240a (THX® Audio/Navigation)
- Key in ON position.

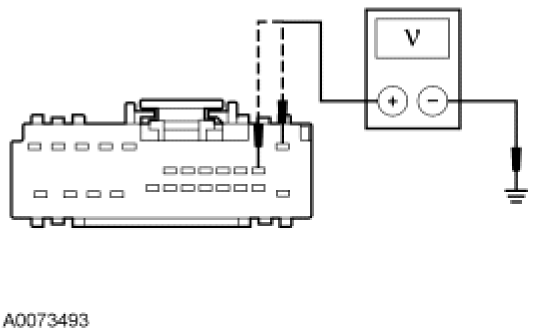


Fig. 45: Checking ACM Voltage Supply Circuits For An Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the base ACM C290a-1 (base audio/audiophile) or ACM C240a-1 (THX® audio/navigation), circuit SBP11 (BU/RD), harness side and ground; and between C290a-2 (base audio/audiophile) or C240a-2 (THX® audio/navigation), circuit CBP02 (GN), harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to K2.

  NO : VERIFY the smart junction box (SJB) fuse 12 (7.5A) or fuse 18 (20A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

K2 CHECK THE ACM GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.

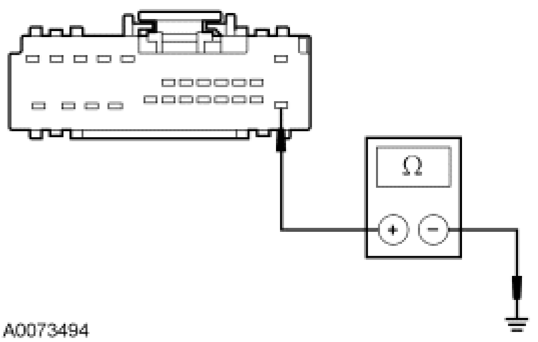


Fig. 46: Checking ACM Ground Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the ACM C290a-13 (Base Audio/Audiophile) or the ACM C240a-13 (THX® Audio/Navigation), circuit GD114 (BK/BU), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to K3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

K3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE ACM FOR AN OPEN

- Key in OFF position.

- Disconnect: ACM C290c (Base Audio/Audiophile) or C240c (THX® Audio/Navigation)

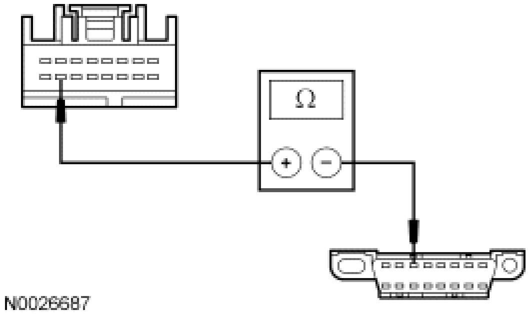


Fig. 47: Checking MS-CAN Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between C290c-15 (base audio/audiophile) or C240c-15 (THX® audio/navigation), circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.

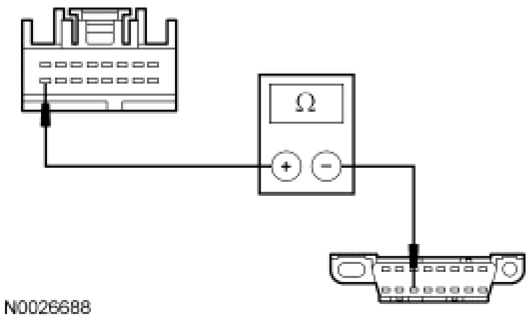


Fig. 48: Checking MS-CAN Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the base ACM C290c-16 or the audio digital signal processing (DSP) module ACM C240c-16 (THX® audio/navigation), circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to K4.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

K4 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins

- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test L: The Audio Digital Signal Processing (DSP) Module Does Not Respond To The Scan Tool

Normal Operation

The audio digital signal processing (DSP) module communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the DSP module. Voltage for the DSP module amplifier is provided by circuits SBB20 (GN/RD) and SBB21 (GY/RD). Circuit GD148 (BK/YE) provides ground.

The DSP module shares the MS-CAN with the following modules:

- Accessory protocol interface module (APIM) (if equipped)
- Audio control module (ACM)
- Driver seat module (DSM) (if equipped)
- Driver door module (DDM) (if equipped)
- Dual climate control seat module (DCSM) (if equipped)
- Heating ventilation air conditioning (HVAC) module (if equipped)
- Instrument cluster (IC)
- Parking aid module (PAM) (if equipped)
- Satellite digital audio receiver system (SDARS) module (if equipped)
- Smart junction box (SJB)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- DSP module

PINPOINT TEST L: PINPOINT TEST L: THE AUDIO DIGITAL SIGNAL PROCESSING (DSP) MODULE DOES NOT RESPOND TO THE SCAN TOOL

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

L1 CHECK THE DSP MODULE VOLTAGE SUPPLY CIRCUITS FOR AN OPEN

- Key in OFF position.
- Disconnect: DSP Module C4326b
- Key in ON position.
- Measure the voltage between the DSP module, harness side and ground as follows:

Connector-Pin	Circuit
C4326b-9	SBB21 (GY/RD)
C4326b-10	SBB21 (GY/RD)
C4326b-11	SBB20 (GN/RD)
C4326b-12	SBB20 (GN/RD)

- **Are the voltages greater than 10 volts?**

  YES : Go to L2.

  NO : VERIFY the battery junction box (BJB) fuse 20 (20A) or fuse 21 (20A) are OK. If OK, REPAIR the circuit in question. CONNECT the PCM. CLEAR the DTCs. REPEAT the network test with the scan tool.

L2 CHECK THE DSP MODULE GROUND CIRCUITS FOR AN OPEN

- Key in OFF position.
- Measure the resistance between the DSP module amplifier, harness side and ground as follows:

Connector-Pin	Circuit
C4326b-22	GD148 (BK/YE)
C4326b-23	GD148 (BK/YE)
C4326b-24	GD148 (BK/YE)

- **Are the resistances less than 5 ohms?**

  YES : Go to L3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

L3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE DSP MODULE FOR AN OPEN

- Key in OFF position.
- Disconnect: DSP Module C4326c

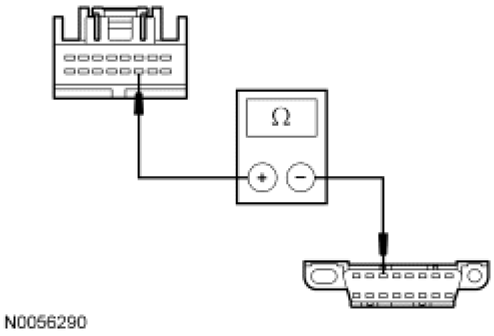


Fig. 49: Measuring Resistance Between DSP Module C4326c-11, Circuit VDB06 (GY/OG) & DLC C251-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DSP module C4326c-11, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.

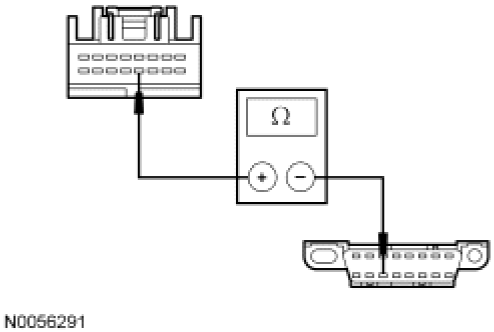


Fig. 50: Measuring Resistance Between DSP Module C4326c-12, Circuit VDB07 (VT/OG) & DLC C251-11
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DSP module C4326c-12, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to L4.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

L4 CHECK FOR CORRECT DSP MODULE OPERATION

- Disconnect all the DSP module connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the DSP module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.

- **Is the concern still present?**

  YES : INSTALL a new DSP module. REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test M: The Satellite Digital Audio Receiver System (SDARS) Module Does Not Respond To The Scan Tool

Normal Operation

The satellite digital audio receiver system (SDARS) module communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the SDARS module. Voltage for the SDARS module is provided by circuit SBP15 (WH/RD). Circuit GD148 (BK/YE) provides ground.

The SDARS module shares the MS-CAN with the following modules:

- Accessory protocol interface module (APIM) (if equipped)
- Audio control module (ACM)
- Audio digital signal processing (DSP) module (if equipped)
- Driver seat module (DSM) (if equipped)
- Driver door module (DDM) (if equipped)
- Dual climate control seat module (DCSM) (if equipped)
- Heating ventilation air conditioning (HVAC) module (if equipped)
- Instrument cluster (IC)
- Parking aid module (PAM) (if equipped)
- Smart junction box (SJB)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- SDARS module

PINPOINT TEST M: THE SATELLITE DIGITAL AUDIO RECEIVER SYSTEM (SDARS) MODULE DOES NOT RESPOND TO THE SCAN TOOL

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

M1 CHECK THE SDARS MODULE VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Key in OFF position.
- Disconnect: SDARS Module C4300

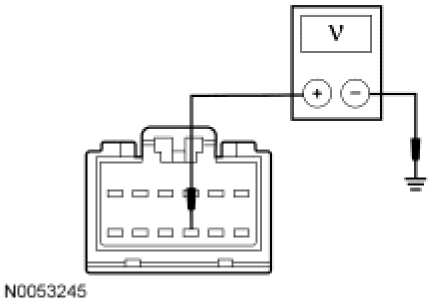


Fig. 51: Checking SDARS Module Voltage Supply Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the SDARS module C4300-9, circuit SBP15 (WH/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to M2.

  NO : VERIFY the smart junction box (SJB) fuse 20 (7.5A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

M2 CHECK THE SDARS MODULE GROUND CIRCUIT FOR AN OPEN

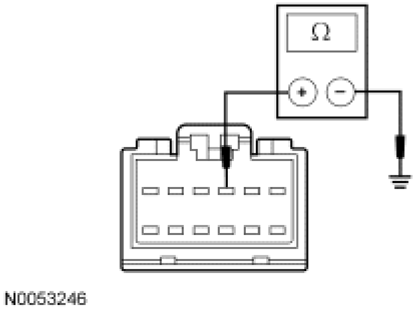


Fig. 52: Checking SDARS Module Ground Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SDARS module C4300-3, circuit GD148 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to M3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

M3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE SDARS MODULE FOR AN OPEN

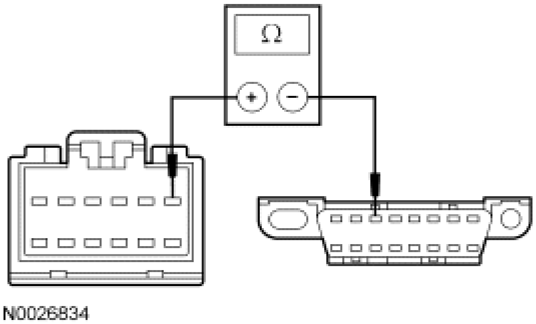


Fig. 53: Checking MS-CAN Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SDARS module C4300-1, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.

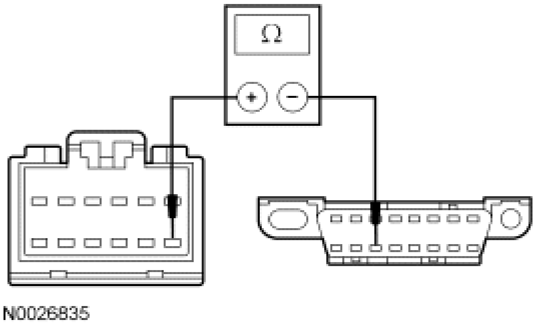


Fig. 54: Checking MS-CAN Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SDARS module C4300-7, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to M4.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

M4 CHECK FOR CORRECT SDARS MODULE OPERATION

- Disconnect the SDARS module connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the SDARS module connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SDARS module. REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article. CLEAR the DTCs. REPEAT the network test with the

scan tool.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test N: The Driver Door Module (DDM) Does Not Respond To The Scan Tool

Normal Operation

The driver door module (DDM) communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the DDM. Voltage for the DDM is provided by circuit SBP15 (RD/WH). Circuit GD126 (BK/WH) provides ground.

The DDM shares the MS-CAN with the following modules:

- Accessory protocol interface module (APIM) (if equipped)
- Audio control module (ACM)
- Audio digital signal processing (DSP) module (if equipped)
- Driver seat module (DSM) (if equipped)
- Dual climate control seat module (DCSM) (if equipped)
- Heating ventilation air conditioning (HVAC) module (if equipped)
- Instrument cluster (IC)
- Parking aid module (PAM) (if equipped)
- Satellite digital audio receiver system (SDARS) module (if equipped)
- Smart junction box (SJB)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- DDM

PINPOINT TEST N: THE DRIVER DOOR MODULE (DDM) DOES NOT RESPOND TO THE SCAN TOOL

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

N1 CHECK THE DDM VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Key in OFF position.
- Disconnect: DDM C568b
- Key in ON position.

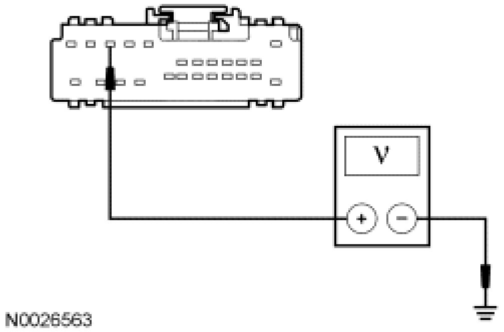


Fig. 55: Checking Circuit SBP15 (RD/WH) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the DDM C568b -10, circuit SBP15 (WH/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to N2.

  NO : VERIFY the SJB fuse 20 (7.5A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

N2 CHECK THE DDM GROUND CIRCUIT FOR AN OPEN

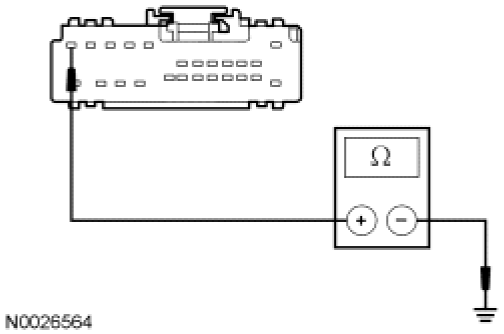


Fig. 56: Checking Circuit GD126 (BK/WH) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DDM C568b-12, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to N3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

N3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE DDM FOR AN OPEN

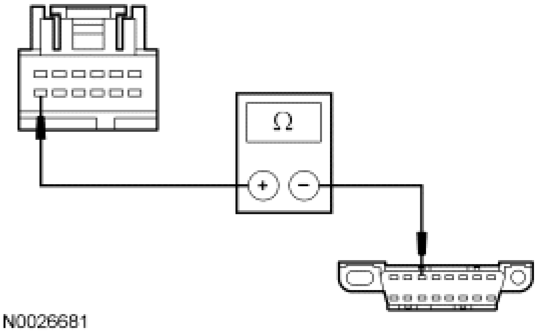


Fig. 57: Checking Medium Speed CAN Circuits Between DLC And DDM For Open (1 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DDM C568a-12, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.

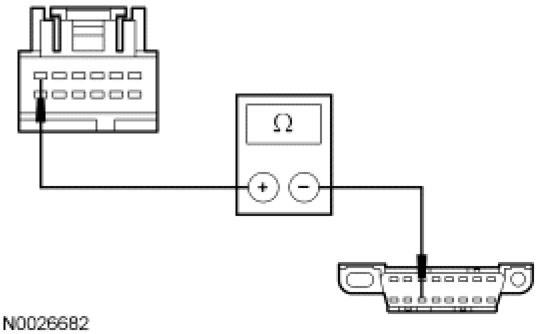


Fig. 58: Checking Medium Speed CAN Circuits Between DLC And DDM For Open (2 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DDM C568a-6, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to N4.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

N4 CHECK FOR CORRECT DDM OPERATION

- Disconnect all the DDM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the DDM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DDM. REFER to **MULTIFUNCTION ELECTRONIC MODULES**

article. CLEAR the DTCs. REPEAT the network test with the scan tool.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test O: The Driver Seat Module (DSM) Does Not Respond To The Scan Tool

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Memory Seats for schematic and connector information.

Normal Operation

The driver seat module (DSM) communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the DSM. Voltage for the DSM is provided by circuit SBB15 (WH/RD). Circuit GD126 (BK/WH) provides ground.

The DSM shares the MS-CAN with the following modules:

- Accessory protocol interface module (APIM) (if equipped)
- Audio control module (ACM)
- Audio digital signal processing (DSP) module (if equipped)
- Driver door module (DDM) (if equipped)
- Dual climate control seat module (DCSM) (if equipped)
- Heating ventilation air conditioning (HVAC) module (if equipped)
- Instrument cluster (IC)
- Parking aid module (PAM) (if equipped)
- Satellite digital audio receiver system (SDARS) module (if equipped)
- Smart junction box (SJB)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- DSM

PINPOINT TEST O: THE DRIVER SEAT MODULE (DSM) DOES NOT RESPOND TO THE SCAN TOOL

NOTE:	**Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

O1 CHECK THE VOLTAGE SUPPLY CIRCUIT SBB15 (WH/RD) FOR AN OPEN

- Key in OFF position.
- Disconnect: DSM C3299c
- Key in ON position.

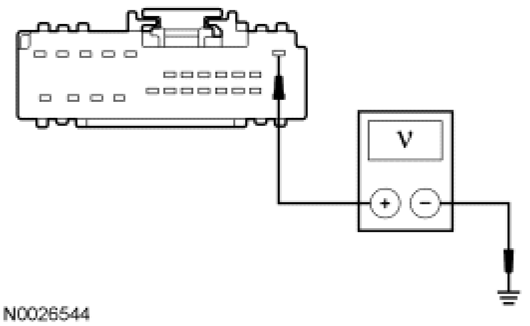


Fig. 59: Checking Voltage Supply Circuit SBB15 (WH/RD) For An Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the DSM C3299c-1, circuit SBB15 (WH/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to O2.

  NO : VERIFY the battery junction box (BJB) fuse 15 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

O2 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

- Key in OFF position.

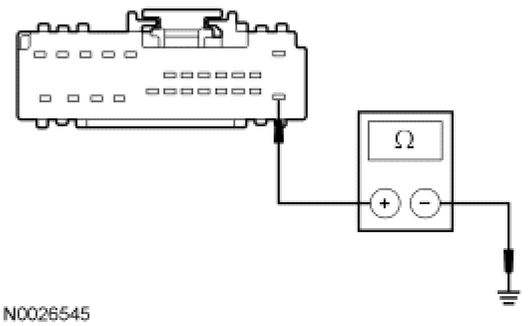


Fig. 60: Checking Circuit GD126 (BK/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DSM C3299c-13, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to O3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

O3 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE DSM FOR AN OPEN

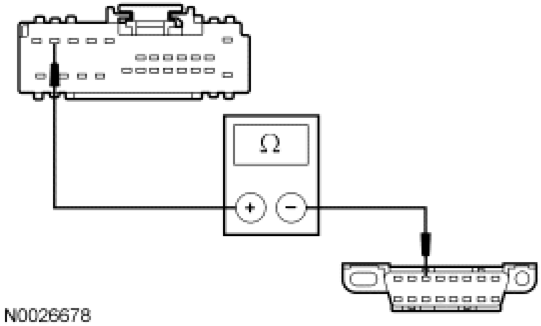


Fig. 61: Measuring Resistance Between DSM C3299C-11, Circuit VDB06 (GY/OG) & DLC C251-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DSM C3299c-11, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.

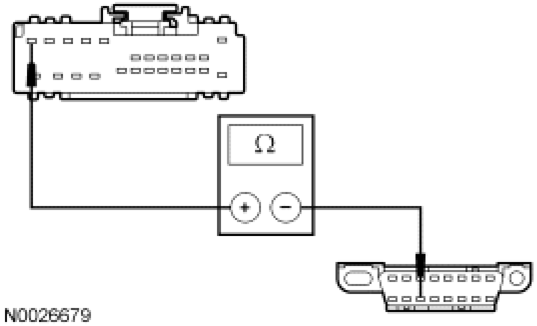


Fig. 62: Measuring Resistance Between DSM C3299C-12, Circuit VDB07 (VT/OG) & DLC C251-11
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DSM C3299c-12, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to O4.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

O4 CHECK FOR CORRECT DSM OPERATION

- Disconnect all the DSM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins

- Connect all the DSM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test P: The Dual Climate Control Seat Module (DCSM) Does Not Respond To The Scan Tool

Normal Operation

The dual climate control seat module (DCSM) communicates with the scan tool through the medium speed controller area network (MS-CAN). Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the network connection to the DCSM. Voltage for the DCSM is provided by circuits SBB11 (BU/RD) and SBB12 (GN/RD). Circuit GD139 (BK/YE) provides ground.

The DCSM shares the MS-CAN with the following modules:

- Accessory protocol interface module (APIM) (if equipped)
- Audio control module (ACM)
- Audio digital signal processing (DSP) module (if equipped)
- Driver seat module (DSM) (if equipped)
- Driver door module (DDM) (if equipped)
- Heating ventilation air conditioning (HVAC) module (if equipped)
- Instrument cluster (IC)
- Parking aid module (PAM) (if equipped)
- Satellite digital audio receiver system (SDARS) module (if equipped)
- Smart junction box (SJB)

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- DCSM

PINPOINT TEST P: PINPOINT TEST P: THE DUAL CLIMATE CONTROL SEAT MODULE (DCSM) DOES NOT RESPOND TO THE SCAN TOOL

WARNING: **Remove restraint system diagnostic tools from the vehicle prior to road testing. If tools are not removed, the supplemental restraint system (SRS) device may not deploy in a crash. Failure to follow this instruction may result in serious personal injury or death in a crash and possibly violate vehicle safety standards.**

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: If a seat equipped with a supplemental restraint system (SRS) component is being serviced, the SRS must be depowered. Refer to SUPPLEMENTAL RESTRAINT SYSTEM article.

NOTE: The air bag warning lamp illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

P1 VERIFY VEHICLE EQUIPMENT - SEAT SIDE AIR BAGS

- Inspect the vehicle for seat side air bags.
- **Is the vehicle equipped with seat side air bags?**

  YES : Go to P2.

  NO : Go to P3.

P2 CHECK THE DCSM VOLTAGE SUPPLY CIRCUITS FOR AN OPEN

- Key in OFF position.
- For vehicles with seat side air bags, carry out the following:
  - Depower the SRS. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
  - Disconnect the driver seat side air bag module C3226.
  - Connect the restraint system diagnostic tool (418-133) to the driver seat side air bag module C3226.
  - Disconnect the passenger seat side air bag module C3227.
  - Connect the restraint system diagnostic tool (418-133) to the passenger seat side air bag module C3227.
  - Connect the battery ground cable.
- Disconnect: DCSM C3305a
- Key in ON position.
- Measure the voltage between the DCSM, harness side and ground as follows:

Connector-Pin	Circuit
C3305a-E	SBB11 (BU/RD)
C3305a-F	SBB12 (GN/RD)

- **Are the voltages greater than 10 volts?**

  YES : Go to P4.

  NO : VERIFY the battery junction box (BJB) fuse 11 (30A) or fuse 12 (30A) are OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

P3 CHECK THE DCSM VOLTAGE SUPPLY CIRCUITS FOR AN OPEN

- Key in OFF position.
- Disconnect: DCSM C3305a
- Key in ON position.
- Measure the voltage between the DCSM, harness side and ground as follows:

Connector-Pin	Circuit
C3305a-E	SBB11 (BU/RD)
C3305a-F	SBB12 (GN/RD)

- **Are the voltages greater than 10 volts?**

  YES : Go to P4.

  NO : VERIFY the battery junction box (BJB) fuse 11 (30A) and fuse 12 (30A) are OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

P4 CHECK THE DCSM GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.

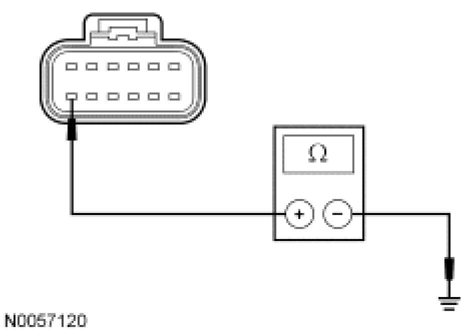


Fig. 63: Checking DCSM Ground Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DCSM C3305a-M, circuit GD139 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to P5.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

P5 CHECK THE MS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC)

AND THE DCSM FOR AN OPEN

- Disconnect: DCSM C3305c

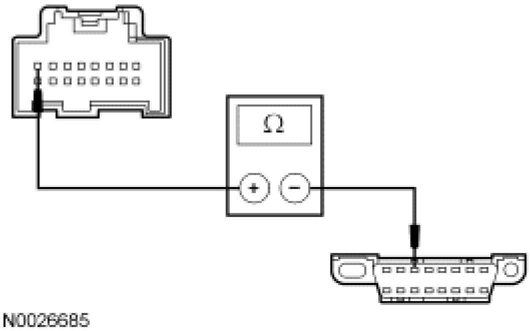


Fig. 64: Checking Medium Speed CAN Circuits Between DLC And Climate Controlled Seat Module For Open (1 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DCSM C3305c-1, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.

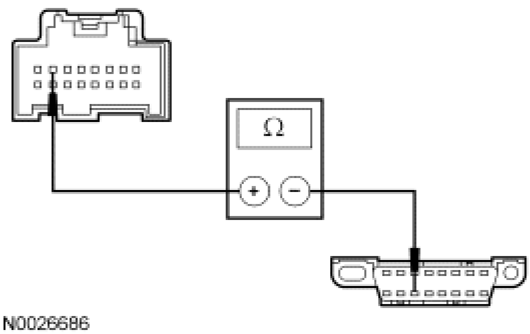


Fig. 65: Checking Medium Speed CAN Circuits Between DLC And Climate Controlled Seat Module For Open (2 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DCSM C3305c-2, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to P6.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

P6 CHECK FOR CORRECT DCSM OPERATION

- Disconnect all the DCSM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins

- Connect all the DCSM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DCSM. REFER to **SEATING** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test Q: The Accessory Protocol Interface Module (APIM) Does Not Respond To The Scan Tool

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Normal Operation

The accessory protocol interface module (APIM) communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the HS-CAN connection to the APIM. Circuits VDB06 (GY/OG) (MS-CAN +) and VDB07 (VT/OG) (MS-CAN -) provide the MS-CAN connection to the APIM. Voltage for the APIM is provided by circuit SBB13 (GY/RD) . Circuit GD148 (BK/YE) provides ground.

The APIM shares the HS-CAN with the PCM, the ABS module, the instrument cluster (IC), the occupant classification system module (OCSM), the transmission control module (TCM) and the restraints control module (RCM).

The APIM shares the MS-CAN with the audio control module (ACM), the parking aid module (PAM), the driver seat module (DSM), the driver door module (DDM), the dual climate control seat module (DCSM), the audio digital signal processing (DSP) module, the satellite digital audio receiver system (SDARS) module, the HVAC module, the instrument cluster (IC) and the smart junction box (SJB).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- APIM

PINPOINT TEST Q: THE ACCESSORY PROTOCOL INTERFACE MODULE (APIM) DOES NOT RESPOND TO THE SCAN TOOL

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Q1 CHECK THE APIM VOLTAGE SUPPLY CIRCUIT FOR AN OPEN

- Disconnect: APIM C3338
- Key in ON position.

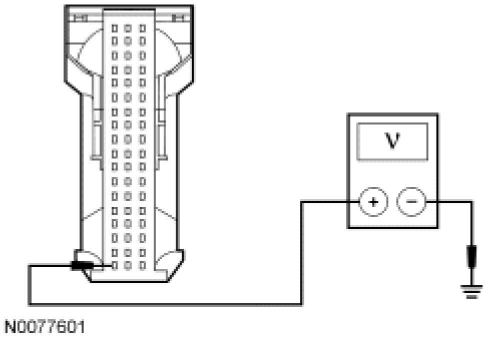


Fig. 66: Checking APIM Voltage Supply Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the APIM C3338-1, circuit SBB13 (GY/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to Q2.

NO : VERIFY the battery junction box (BJB) fuse 13 (10A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

Q2 CHECK THE APIM GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.

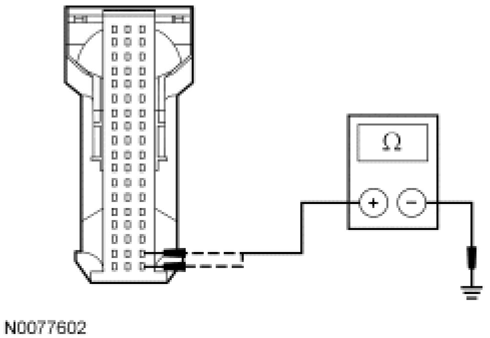


Fig. 67: Checking APIM Ground Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the APIM C3338-37, circuit GD148 (BK/YE), harness side and ground; and between the APIM C3338-38, circuit GD148 (BK/YE), harness side and ground.
- **Are the resistances less than 5 ohms?**

YES : Go to Q3.

NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

Q3 CHECK THE HS-CAN CIRCUITS BETWEEN THE APIM AND THE DATA LINK CONNECTOR (DLC) FOR AN OPEN

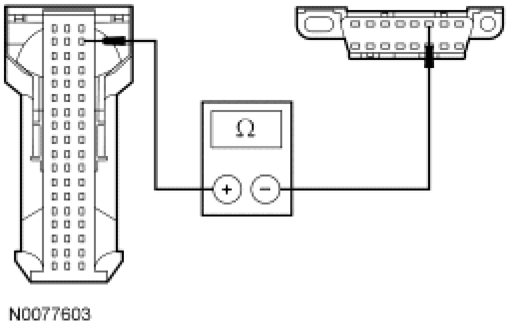


Fig. 68: Measuring Resistance Between APIM C3338-53, Circuit VDB04 (WH/BU) & DLC C251-6
Courtesy of FORD MOTOR CO.

- Measure the resistance between the APIM C3338-53, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.

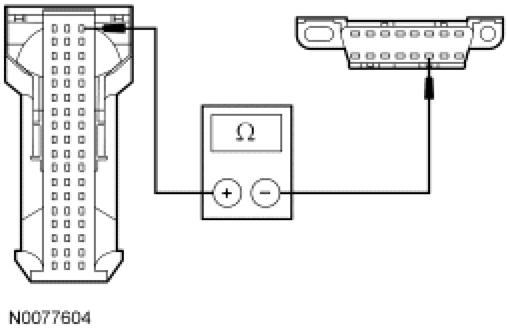


Fig. 69: Measuring Resistance Between APIM C3338-54, Circuit VDB05 (WH) & DLC C251-14
Courtesy of FORD MOTOR CO.

- Measure the resistance between the APIM C3338-54, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to Q4.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

Q4 CHECK THE MS-CAN CIRCUITS BETWEEN THE DLC AND THE APIM FOR AN OPEN

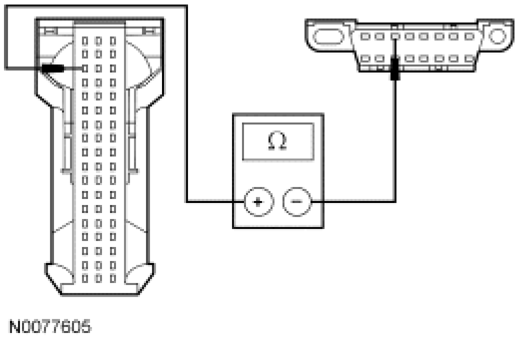


Fig. 70: Measuring Resistance Between APIM C3338-16, Circuit VDB06 (GY/OG) & DLC C251-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between the APIM C3338-16, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.

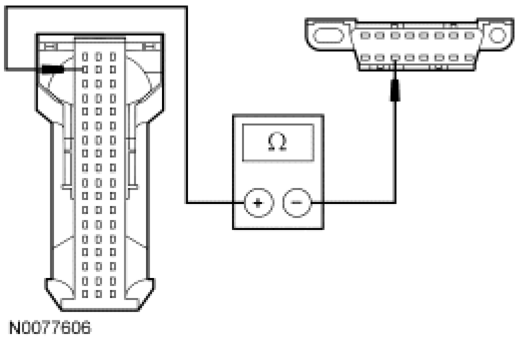


Fig. 71: Measuring Resistance Between APIM C3338-17, Circuit VDB07 (VT/OG) & DLC C251-11
Courtesy of FORD MOTOR CO.

- Measure the resistance between the APIM C3338-17, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to Q5.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

Q5 CHECK FOR CORRECT APIM OPERATION

- Disconnect all the APIM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the APIM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.

- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test R: No Medium Speed Controller Area Network (MS-CAN) Communication, All Modules Are Not Responding

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Normal Operation

The MS-CAN uses an unshielded twisted pair cable, circuits VDB06 (GY/OG) and VDB07 (VT/OG).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- SJB
- Instrument cluster (IC)
- Accessory protocol interface module (APIM) (if equipped)
- Audio control module (ACM)
- Audio digital signal processing (DSP) module (if equipped)
- Heating ventilation air conditioning (HVAC) module (if equipped)
- Parking aid module (PAM) (if equipped)
- Driver door module (DDM) (if equipped)
- Driver seat module (DSM) (if equipped)
- Dual climate control seat module (DCSM) (if equipped)
- Satellite digital audio receiver system (SDARS) module (if equipped)

PINPOINT TEST R: NO MEDIUM SPEED CONTROLLER AREA NETWORK (MS-CAN) COMMUNICATION, ALL MODULES ARE NOT RESPONDING

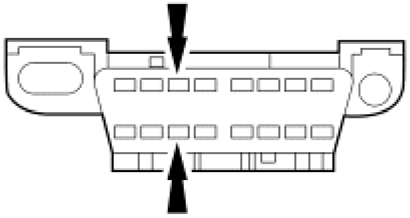
NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

R1 CHECK THE DATA LINK CONNECTOR (DLC) PINS FOR DAMAGE

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

- Key in OFF position.

- Disconnect the scan tool cable from the DLC.



N0053178

Fig. 72: Checking DLC Pins For Damage
Courtesy of FORD MOTOR CO.

- Inspect DLC pins 3 and 11 for damage.
- **Are DLC pins 3 and 11 OK?**

  YES : Go to R2.

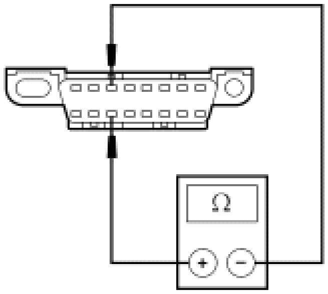
  NO : REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.

R2 CHECK THE MS-CAN TERMINATION RESISTANCE

- Key in OFF position.

NOTE: Failure to disconnect the battery will result in false resistance readings.

- Disconnect the battery ground cable.



N0050701

Fig. 73: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Is the resistance between 54 and 66 ohms?**

  YES : Go to R5.

NO : Go to R3.

R3 CHECK THE MS-CAN TERMINATION RESISTOR

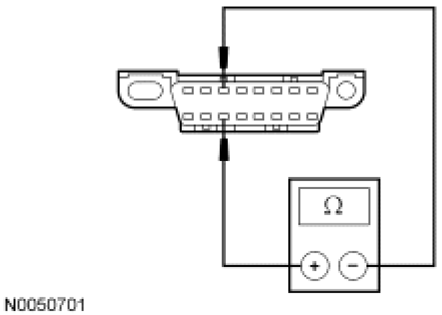


Fig. 74: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Is the resistance between 108 and 132 ohms?**

YES : Go to R7.

NO : Go to R4.

R4 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER

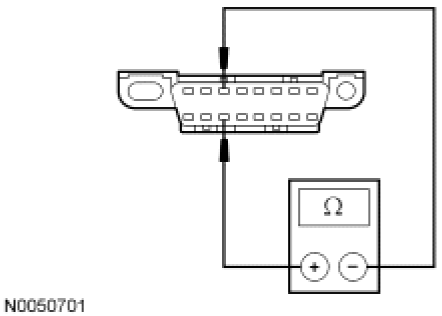


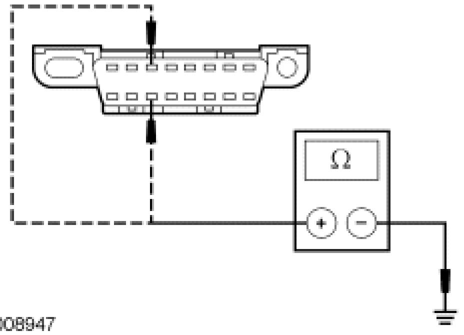
Fig. 75: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to R9.

NO : Go to R7.

R5 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND



N0008947

Fig. 76: Checking Circuits For Short To Ground
Courtesy of FORD MOTOR CO.

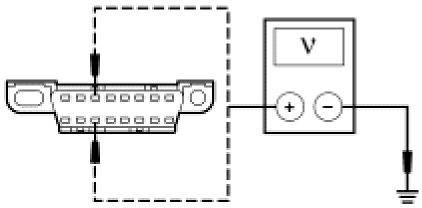
- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to R6.

  NO : Go to R28.

R6 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO VOLTAGE

- Connect the battery ground cable.
- Key in ON position.



N0050702

Fig. 77: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.
- **Is the voltage greater than 6 volts?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : VERIFY all module fuses are OK. If OK, REPEAT the network test with the scan tool.

R7 CHECK THE MS-CAN CIRCUITS BETWEEN THE DLC AND THE SMART JUNCTION BOX (SJB) FOR AN OPEN

- Disconnect: SJB C2280c

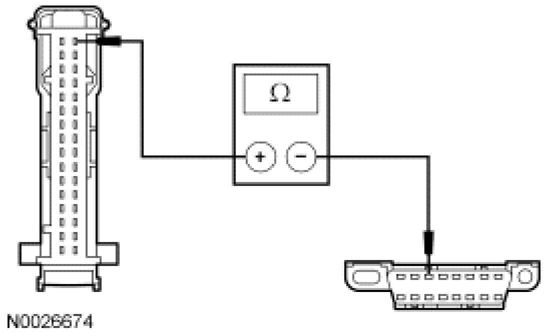


Fig. 78: Checking Medium Speed CAN Circuits Between DLC And SJB For Open (1 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280d-17, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.

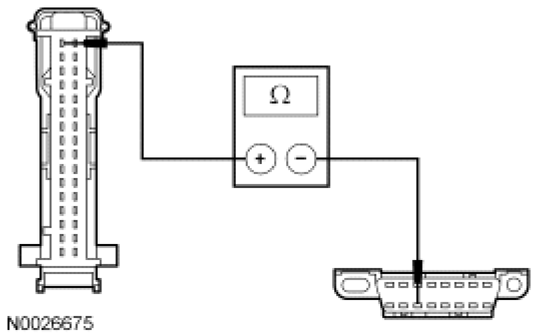


Fig. 79: Checking Medium Speed CAN Circuits Between DLC And SJB For Open (2 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280d-1, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to R8.

  NO : REPAIR the circuit in question. CONNECT the battery ground cable. CONNECT the SJB. CLEAR the DTCs. REPEAT the network test with the scan tool.

R8 CHECK THE MS-CAN CIRCUITS BETWEEN THE DLC AND THE INSTRUMENT CLUSTER (IC) FOR AN OPEN

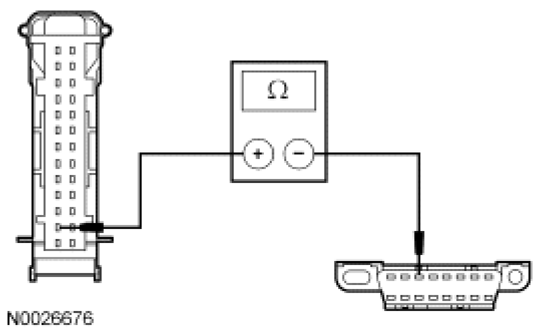


Fig. 80: Measuring Resistance Between IC C220-2, Circuit VDB06 (GY/OG) & DLC C251-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between the IC C220-2, circuit VDB06 (GY/OG), harness side and the DLC C251-3, circuit VDB06 (GY/OG), harness side.

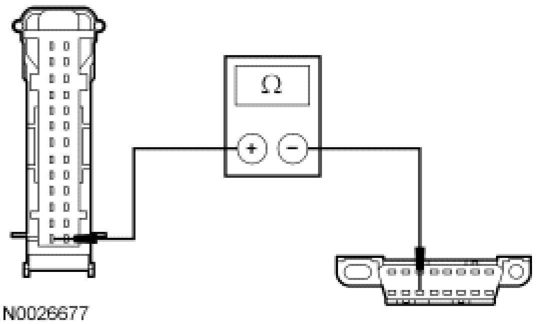


Fig. 81: Measuring Resistance Between IC C220-1, Circuit VDB07 (VT/OG) & DLC C251-11
Courtesy of FORD MOTOR CO.

- Measure the resistance between the IC C220-1, circuit VDB07 (VT/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : VERIFY all module fuses are OK. If OK, CONNECT all modules. CONNECT the battery ground cable. REPEAT the network test with the scan tool.

  NO : REPAIR the circuit in question. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

R9 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE SJB DISCONNECTED

- Disconnect: SJB C2280d

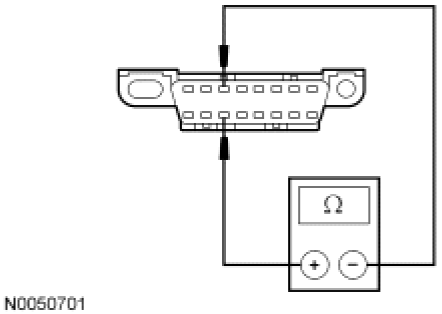


Fig. 82: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short Together With SJB Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.

- **Is the resistance less than 5 ohms?**

  YES : Go to R10.

  NO : Go to R47.

R10 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE IC DISCONNECTED

- Disconnect: IC C220

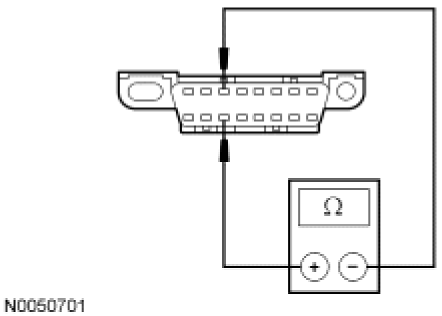


Fig. 83: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short Together With IC Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to R11.

  NO : Go to R48.

R11 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE AUDIO CONTROL MODULE (ACM) DISCONNECTED

- Disconnect: ACM C290c (Base Audio/Audiophile) or C240c (THX® Audio/Navigation)

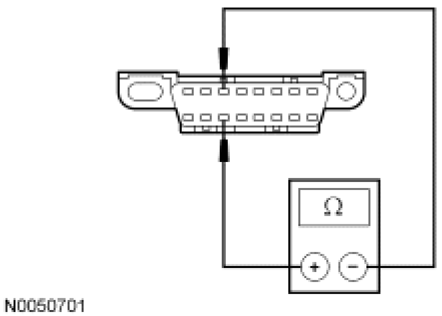


Fig. 84: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short Together With Audio Control Module (ACM) Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the

DLC C251-11, circuit VDB07 (VT/OG), harness side.

- **Is the resistance less than 5 ohms?**

  YES : Go to R12.

  NO : Go to R49.

R12 VERIFY VEHICLE EQUIPMENT - AUDIO DIGITAL SIGNAL PROCESSING (DSP) MODULE

- Inspect the vehicle for a DSP module.
- **Is the vehicle equipped with a DSP module?**

  YES : Go to R13.

  NO : Go to R14.

R13 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE DSP MODULE DISCONNECTED

- Disconnect: DSP Module C4326c

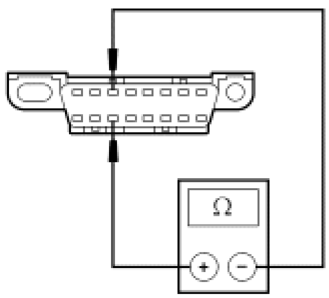


Fig. 85: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short Together With DSP Module Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to R14.

  NO : Go to R50.

R14 VERIFY VEHICLE EQUIPMENT - HEATING VENTILATION AIR CONDITIONING (HVAC) MODULE

- Inspect the vehicle for a HVAC module.
- **Is the vehicle equipped with a HVAC module?**

  YES : Go to R15.

  NO : Go to R16.

R15 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE HVAC MODULE DISCONNECTED

- Disconnect: HVAC Module C228a (Single-Zone) or C2356a (Dual-Zone)

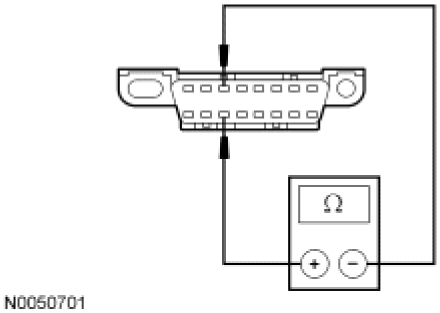


Fig. 86: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short Together With HVAC Module Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to R16.

  NO : Go to R51.

R16 VERIFY VEHICLE EQUIPMENT - PARKING AID MODULE (PAM)

- Inspect the vehicle for a PAM.
- **Is the vehicle equipped with a PAM?**

  YES : Go to R17.

  NO : Go to R18.

R17 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE PAM DISCONNECTED

- Disconnect: PAM C4014

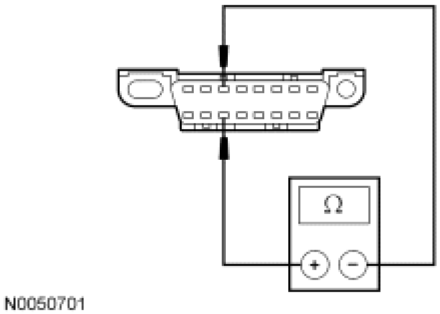


Fig. 87: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short Together With PAM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to R18.

NO : Go to R52.

R18 VERIFY VEHICLE EQUIPMENT - DRIVER DOOR MODULE (DDM)

- Inspect the vehicle for a DDM.
- **Is the vehicle equipped with a DDM?**

YES : Go to R19.

NO : Go to R20.

R19 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE DDM DISCONNECTED

- Disconnect: DDM C568a

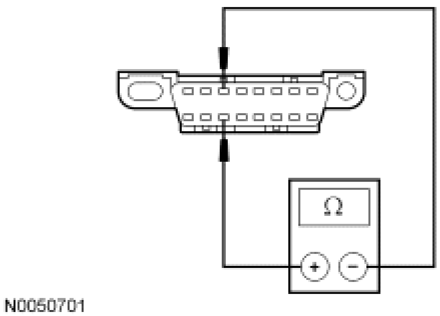


Fig. 88: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short Together With DDM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to R20.

NO : Go to R53.

R20 VERIFY VEHICLE EQUIPMENT - DRIVER SEAT MODULE (DSM)

- Inspect the vehicle for a DSM.
- **Is the vehicle equipped with a DSM?**

YES : Go to R21.

NO : Go to R22.

R21 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE DSM DISCONNECTED

- Disconnect: DSM C3299c

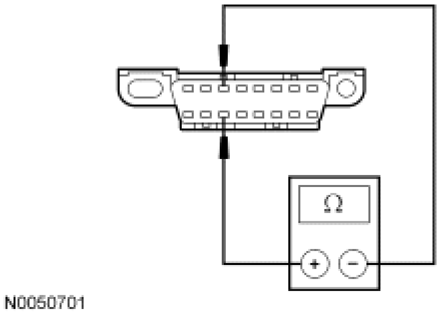


Fig. 89: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short Together With DSM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to R22.

  NO : Go to R54.

R22 VERIFY VEHICLE EQUIPMENT - DUAL CLIMATE CONTROL SEAT MODULE (DCSM)

- Inspect the vehicle for a DCSM.
- **Is the vehicle equipped with a DCSM?**

  YES : Go to R23.

  NO : Go to R24.

R23 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE DCSM DISCONNECTED

- Disconnect: DCSM C3305c

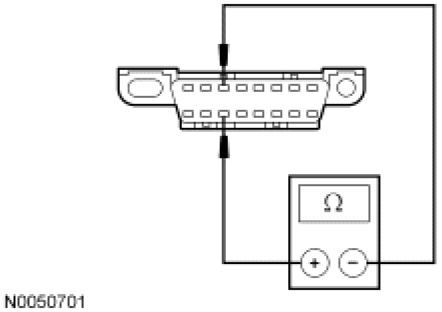


Fig. 90: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short Together With DCSM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.

- **Is the resistance less than 5 ohms?**

  YES : Go to R24.

  NO : Go to R55.

R24 VERIFY VEHICLE EQUIPMENT - SATELLITE DIGITAL AUDIO RECEIVER SYSTEM (SDARS) MODULE

- Inspect the vehicle for a SDARS module.
- **Is the vehicle equipped with a SDARS module?**

  YES : Go to R25.

  NO : Go to R26.

R25 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE SDARS MODULE DISCONNECTED

- Disconnect: SDARS Module C4300

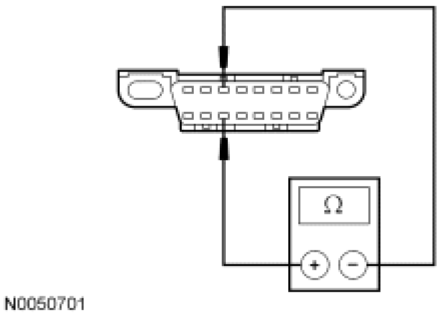


Fig. 91: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short Together With SDARS Module Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to R26.

  NO : Go to R56.

R26 VERIFY VEHICLE EQUIPMENT - ACCESSORY PROTOCOL INTERFACE MODULE (APIM)

- Inspect the vehicle for an APIM.
- **Is the vehicle equipped with an APIM?**

  YES : Go to R27.

  NO : REPAIR the circuit. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

R27 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE APIM DISCONNECTED

- Disconnect: APIM C3338

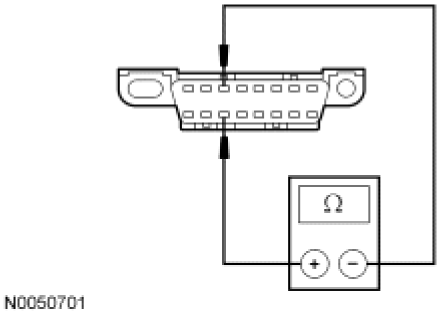


Fig. 92: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short Together With APIM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : REPAIR the circuit. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : Go to R57.

R28 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE SJB DISCONNECTED

- Disconnect: SJB C2280d

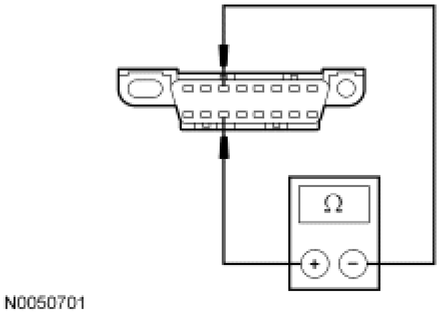


Fig. 93: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short To Ground With SJB Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to R47.

  NO : Go to R29.

R29 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE IC DISCONNECTED

- Disconnect: IC C220

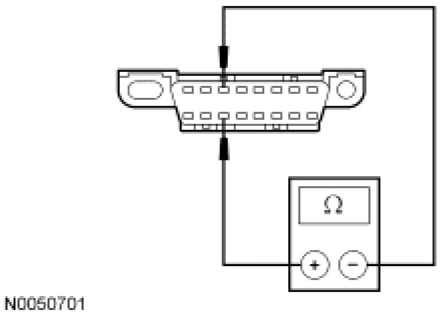


Fig. 94: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short To Ground With IC Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to R48.

  NO : Go to R30.

R30 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE ACM DISCONNECTED

- Disconnect: ACM C290c (Base Audio/Audiophile) or C240c (THX® Audio/Navigation)

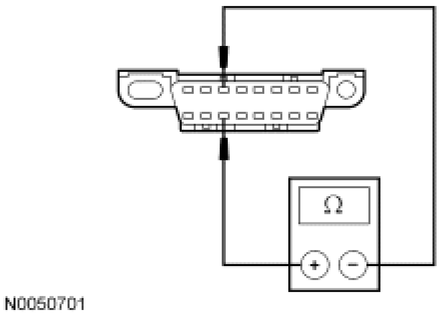


Fig. 95: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short To Ground With ACM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to R49.

  NO : Go to R31.

R31 VERIFY VEHICLE EQUIPMENT - DSP MODULE

- Inspect the vehicle for a DSP module.
- **Is the vehicle equipped with a DSP module?**

  YES : Go to R32.

  NO : Go to R33.

R32 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE DSP MODULE DISCONNECTED

- Disconnect: DSP Module C4326c

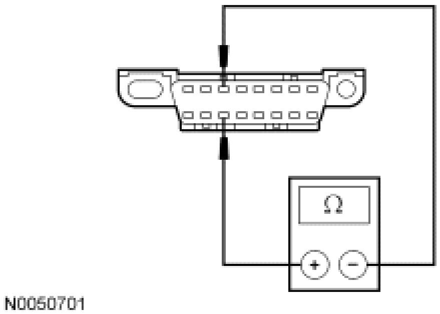


Fig. 96: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short To Ground With DSP Module Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to R50.

  NO : Go to R33.

R33 VERIFY VEHICLE EQUIPMENT - HVAC MODULE

- Inspect the vehicle for an HVAC module.
- **Is the vehicle equipped with an HVAC module?**

  YES : Go to R34.

  NO : Go to R35.

R34 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE HVAC MODULE DISCONNECTED

- Disconnect: HVAC Module C228a (Single-Zone) or C2356a (Dual-Zone)

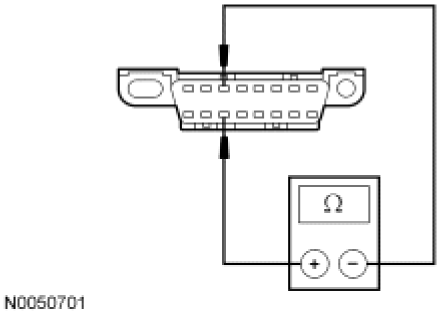


Fig. 97: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short To Ground With HVAC Module Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to R51.

  NO : Go to R35.

R35 VERIFY VEHICLE EQUIPMENT - PAM

- Inspect the vehicle for a PAM.
- **Is the vehicle equipped with a PAM?**

  YES : Go to R36.

  NO : Go to R37.

R36 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE PAM DISCONNECTED

- Disconnect: PAM C4014

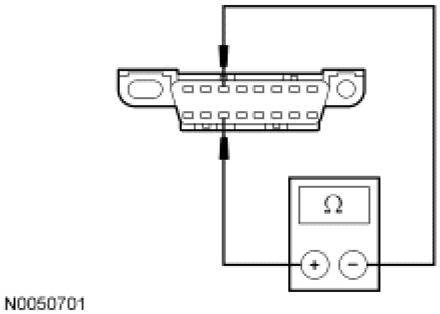


Fig. 98: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short To Ground With PAM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances greater than 1,000 ohms?**

YES : Go to R52.

NO : Go to R37.

R37 VERIFY VEHICLE EQUIPMENT - DDM

- Inspect the vehicle for a DDM.
- **Is the vehicle equipped with a DDM?**

YES : Go to R38.

NO : Go to R39.

R38 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE DDM DISCONNECTED

- Disconnect: DDM C568a

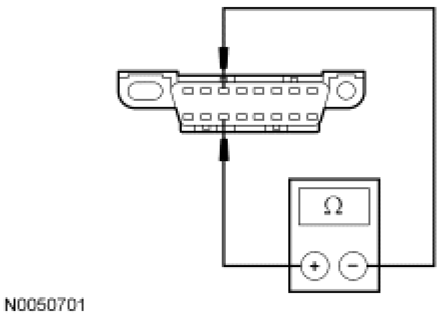


Fig. 99: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short To Ground With DDM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances greater than 1,000 ohms?**

YES : Go to R53.

NO : Go to R39.

R39 VERIFY VEHICLE EQUIPMENT - DSM

- Inspect the vehicle for a DSM.
- **Is the vehicle equipped with a DSM?**

YES : Go to R40.

NO : Go to R41.

R40 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE DSM DISCONNECTED

- Disconnect: DSM C3299c

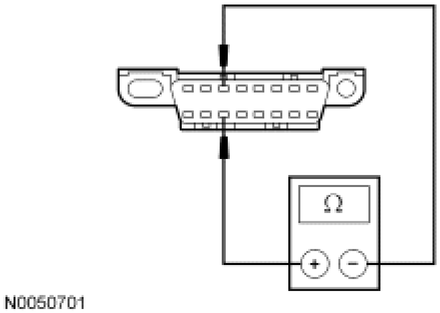


Fig. 100: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short To Ground With DSM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to R54.

  NO : Go to R41.

R41 VERIFY VEHICLE EQUIPMENT - DUAL CLIMATE CONTROL SEAT MODULE (DCSM)

- Inspect the vehicle for a DCSM.
- **Is the vehicle equipped with a DCSM?**

  YES : Go to R42.

  NO : Go to R43.

R42 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE DCSM DISCONNECTED

- Disconnect: DCSM C3305c

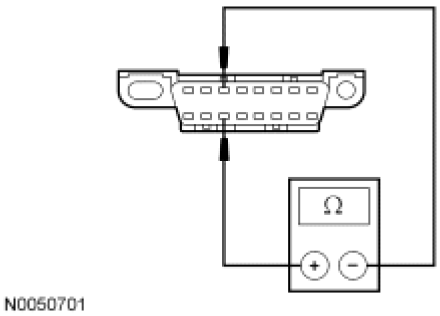


Fig. 101: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short To Ground With DCSM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.

- **Are the resistances greater than 1,000 ohms?**

  YES : Go to R55.

  NO : Go to R43.

R43 VERIFY VEHICLE EQUIPMENT - SDARS MODULE

- Inspect the vehicle for a SDARS module.
- **Is the vehicle equipped with a SDARS module?**

  YES : Go to R44.

  NO : Go to R45.

R44 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE SDARS MODULE DISCONNECTED

- Disconnect: SDARS Module C4300

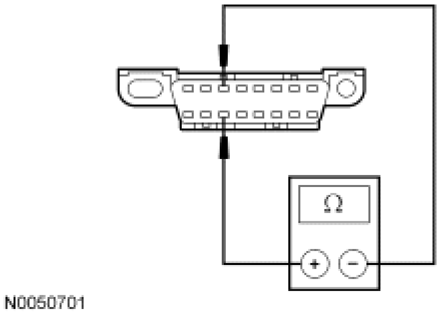


Fig. 102: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short To Ground With SDARS Module Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to R56.

  NO : Go to R45.

R45 VERIFY VEHICLE EQUIPMENT - APIM

- Inspect the vehicle for an APIM.
- **Is the vehicle equipped with an APIM?**

  YES : Go to R46.

  NO : REPAIR the circuit. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

R46 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE APIM DISCONNECTED

- Disconnect: APIM C3338

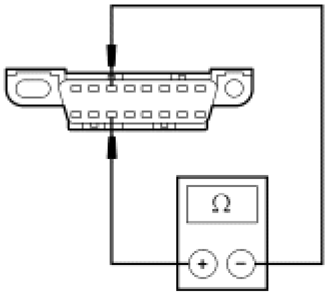


Fig. 103: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short To Ground With APIM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to R57.

  NO : REPAIR the circuit. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

R47 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

R48 CHECK FOR CORRECT IC OPERATION

- Disconnect the IC connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the IC connector and make sure it seats correctly.

- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

R49 CHECK FOR CORRECT ACM OPERATION

- Disconnect all the ACM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ACM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ACM. REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

R50 CHECK FOR CORRECT DSP MODULE OPERATION

- Disconnect all the DSP module connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the DSP module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DSP module. REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT the battery ground cable. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.

R51 CHECK FOR CORRECT HEATING VENTILATION AIR CONDITIONING (HVAC) MODULE OPERATION

- Disconnect all the HVAC module connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the HVAC module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

R52 CHECK FOR CORRECT PAM OPERATION

- Disconnect all the PAM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PAM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PAM. REFER to **PARKING AID** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT the battery ground cable. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.

R53 CHECK FOR CORRECT DDM OPERATION

- Disconnect all the DDM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the DDM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DDM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT

the network test with the scan tool.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

R54 CHECK FOR CORRECT DSM OPERATION

- Disconnect all the DSM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the DSM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

R55 CHECK FOR CORRECT DCSM OPERATION

- Disconnect all the DCSM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the DCSM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DCSM. REFER to **SEATING** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT the battery ground cable. CONNECT all modules. CLEAR the DTCs. REPEAT the network test with the scan tool.

R56 CHECK FOR CORRECT SDARS MODULE OPERATION

- Disconnect the SDARS module connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins

- Connect the SDARS module connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SDARS module. REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

R57 CHECK FOR CORRECT APIM OPERATION

- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new APIM. REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test S: Intermittent No Medium Speed Controller Area Network (MS-CAN) Communication, One Or More Modules Are Not Responding During Network Test

Normal Operation

The MS-CAN uses an unshielded twisted pair cable, circuits VDB06 (GY/OG) and VDB07 (VT/OG).

The following modules communicate on the MS-CAN:

- Accessory protocol interface module (APIM) (if equipped)
- Audio control module (ACM)
- Audio digital signal processing (DSP) module (if equipped)
- Driver seat module (DSM) (if equipped)
- Driver door module (DDM) (if equipped)
- Dual climate controlled seat module (DCSM) (if equipped)
- Heating ventilation air conditioning (HVAC) module (if equipped)
- Instrument cluster (IC)

- Parking aid module (PAM) (if equipped)
- Satellite digital audio receiver system (SDARS) module (if equipped)
- Smart junction box (SJB)

In the event that one of the 2 network circuits (HS-CAN + or HS-CAN -) becomes open to a module on the network, unreliable network communication to all modules on the network may result.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

PINPOINT TEST S: INTERMITTENT NO MEDIUM SPEED CONTROLLER AREA NETWORK (MS-CAN) COMMUNICATION, ONE OR MORE MODULES ARE NOT RESPONDING DURING NETWORK TEST

NOTE: **Various modules will set network DTCs during this test procedure. Clear the DTCs from all modules after the diagnostic procedure is complete.**

S1 CHECK THE DATA LINK CONNECTOR (DLC) PINS FOR DAMAGE

- Key in OFF position.
- Disconnect the scan tool cable from the DLC.

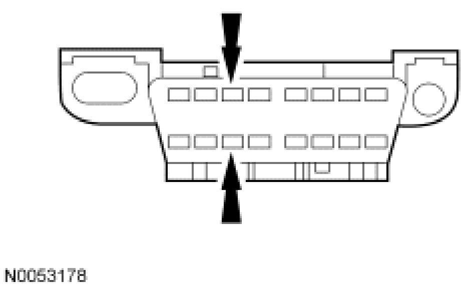


Fig. 104: Checking DLC Pins For Damage
Courtesy of FORD MOTOR CO.

- Inspect DLC pins 3 and 11 for damage.
- **Are DLC pins 3 and 11 OK?**

  YES : Go to S2.

  NO : REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.

S2 CHECK THE MS-CAN TERMINATION RESISTANCE

NOTE: **Failure to disconnect the battery will result in false resistance readings.**

- Disconnect the battery ground cable.

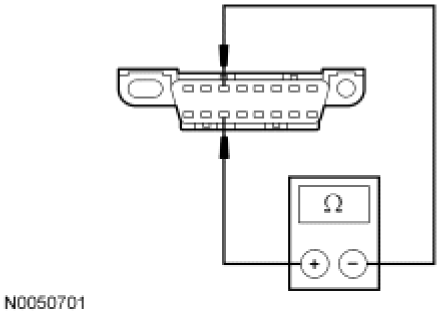


Fig. 105: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Is the resistance between 54 and 66 ohms?**

  YES : Go to S3.

  NO : Go to **Pinpoint Test Q**.

S3 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO GROUND

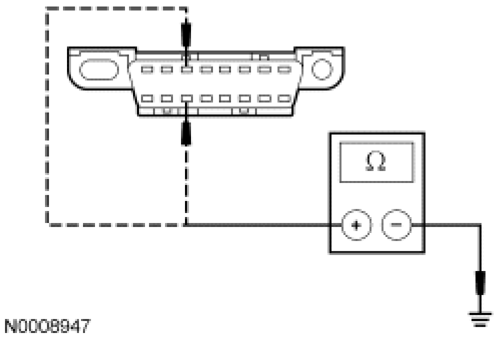


Fig. 106: Checking Circuits For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to S4.

  NO : Go to **Pinpoint Test Q**.

S4 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TO VOLTAGE

- Connect the battery ground cable.
- Key in ON position.

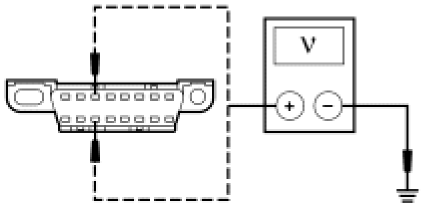


Fig. 107: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the DLC C251-3, circuit VDB06 (GY/OG), harness side and ground; and between the DLC C251-11, circuit VDB07 (VT/OG), harness side and ground.
- **Is the voltage greater than 6 volts?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : Go to S5.

S5 VERIFY VEHICLE EQUIPMENT - DRIVER SEAT MODULE (DSM)

- Inspect the vehicle for a DSM.
- **Is the vehicle equipped with a DSM?**

  YES : Go to S6.

  NO : Go to S7.

S6 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE DSM DISABLED

NOTE:	When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.

- Disconnect: BJB Fuse 15 (10A)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : INSTALL the removed fuse. Go to **Pinpoint Test O**.

  NO : INSTALL the removed fuse. Go to S7.

S7 VERIFY VEHICLE EQUIPMENT - DRIVER DOOR MODULE (DDM) AND/OR SATELLITE DIGITAL AUDIO RECEIVER SYSTEM (SDARS) MODULE

- Inspect the vehicle for a DDM and/or SDARS module.
- **Is the vehicle equipped with a DDM, SDARS module, or both?**

  YES : Go to S8.

  NO : Go to S10.

S8 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE DDM AND/OR

SDARS MODULE DISABLED

NOTE: **When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.**

- Disconnect: SJB Fuse 20 (7.5A)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : INSTALL the removed fuse. For vehicles equipped with BOTH a DDM and SDARS module, go to S9.

  For vehicles equipped with a DDM only, go to **Pinpoint Test N**.

  For vehicles equipped with a SDARS module only, go to **Pinpoint Test M**.

  NO : INSTALL the removed fuse. Go to S10.

S9 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE DDM DISCONNECTED

NOTE: **When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.**

- Disconnect: DDM C568b
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : CONNECT the DDM. Go to **Pinpoint Test N**.

  NO : CONNECT the DDM. Go to **Pinpoint Test M**.

S10 VERIFY VEHICLE EQUIPMENT - HVAC MODULE

- Inspect the vehicle for a HVAC module.
- **Is the vehicle equipped with a HVAC module?**

  YES : Go to S11.

  NO : Go to S13.

S11 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE HVAC MODULE DISABLED

NOTE: **When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.**

- Disconnect: SJB Fuse 13 (10A)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : INSTALL the removed fuse. Go to **Pinpoint Test I**.

  NO : Go to S12.

S12 VERIFY VEHICLE EQUIPMENT - ACCESSORY PROTOCOL INTERFACE MODULE (APIM)

- Inspect the vehicle for an APIM.
- **Is the vehicle equipped with an APIM?**

  YES : Go to S13.

  NO : Go to S14.

S13 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE APIM DISCONNECTED

NOTE: **When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.**

- Disconnect: Battery Junction Box (BJB) Fuse 13 (10A)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : Go to S14.

  NO : CONNECT the APIM. Go to **Pinpoint Test Q**.

S14 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE INSTRUMENT CLUSTER (IC) DISCONNECTED

NOTE: **When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.**

- Disconnect: IC C220
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : CONNECT the IC. Go to **Pinpoint Test G**.

  NO : Go to S15.

S15 VERIFY VEHICLE EQUIPMENT - DUAL CLIMATE CONTROLLED SEAT MODULE (DCSM)

- Inspect the vehicle for a DCSM.
- **Is the vehicle equipped with a DCSM?**

  YES : Go to S16.

  NO : Go to S17.

S16 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE DCSM DISABLED

NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.

- Disconnect: BJB Fuses 11 (30A) and 12 (30A)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : INSTALL the removed fuses. Go to **Pinpoint Test P**.

  NO : Go to S17.

S17 VERIFY VEHICLE EQUIPMENT - AUDIO DIGITAL SIGNAL PROCESSING (DSP) MODULE

- Inspect the vehicle for an audio DSP module.
- **Is the vehicle equipped with an audio DSP module?**

  YES : Go to S17.

  NO : Go to S18.

S18 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE AUDIO DSP MODULE DISABLED

NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.

- Disconnect: BJB Fuses 20 (20A) and 21 (20A)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : INSTALL the removed fuses. Go to **Pinpoint Test L**.

  NO : Go to S19.

S19 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE SJB DISABLED

NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.

- Disconnect: BJB Fuse 19 (40A)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : INSTALL the removed fuse. Go to **Pinpoint Test H**.

  NO : Go to S20.

S20 VERIFY VEHICLE EQUIPMENT - PARKING AID MODULE (PAM) AND/OR 4X4 CONTROL MODULE

- Inspect the vehicle for a PAM and/or 4X4 control module.
- **Is the vehicle equipped with a PAM and/or 4X4 control module?**

  YES : Go to S21.

  NO : Go to S23.

S21 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE PAM AND/OR 4X4 CONTROL MODULE DISABLED

NOTE:	**When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.**

- Disconnect: SJB Fuse 28 (10A)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : INSTALL the removed fuse. For vehicles equipped with BOTH a PAM and 4X4 control module, go to S22.

  For vehicles equipped with a PAM only, go to **Pinpoint Test J**.

  For vehicles equipped with a 4X4 control module only, go to **Pinpoint Test E**.

  NO : Go to S22.

S22 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE 4X4 CONTROL MODULE DISCONNECTED

NOTE:	**When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.**

- Disconnect: 4X4 Control Module C3253
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

YES : CONNECT the 4X4 control module. Go to **Pinpoint Test E**.

NO : CONNECT the 4X4 control module. Go to **Pinpoint Test J**.

S23 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE AUDIO CONTROL MODULE (ACM) DISABLED

NOTE: **When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.**

- Disconnect: SJB Fuse 12 (7.5A)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : INSTALL the removed fuse. Go to **Pinpoint Test K**.

  NO : INSTALL the removed fuse. Go to S24.

S24 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE ACM DISCONNECTED

NOTE: **When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.**

- Disconnect: ACM C240c (Base Audio/Audiophile) or C290c (THX® Audio/Navigation)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : CONNECT the ACM. Go to **Pinpoint Test K**.

  NO : CONNECT the ACM. An intermittent fault is not present. Go to **Pinpoint Test Q**.

Pinpoint Test T: No High Speed Controller Area Network (HS-CAN) Communication, All Modules Are Not Responding

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Normal Operation

The HS-CAN uses an unshielded twisted pair cable, circuits VDB04 (WH/BU) and VDB05 (WH).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PCM

- ABS module
- Accessory protocol interface module (APIM) (if equipped)
- Transmission control module (TCM)
- 4X4 control module (if equipped)
- Instrument cluster (IC)
- Occupant classification system module (OCSM)
- Restraints control module (RCM)

PINPOINT TEST T: NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION, ALL MODULES ARE NOT RESPONDING

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

T1 CHECK THE DATA LINK CONNECTOR (DLC) PINS FOR DAMAGE

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

- Key in OFF position.
- Disconnect the scan tool cable from the DLC.

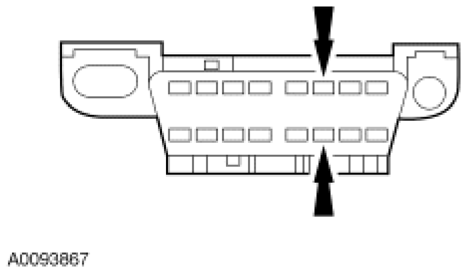


Fig. 108: Checking Data Link Connector (DLC) Pins For Damage
Courtesy of FORD MOTOR CO.

- Inspect DLC pins 6 and 14 for damage.
- **Are DLC pins 6 and 14 OK?**

  YES : Go to T2.

  NO : REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.

T2 CHECK THE HS-CAN TERMINATION RESISTANCE

- Key in OFF position.

NOTE: Failure to disconnect the battery will result in false resistance readings.

- Disconnect the battery ground cable.

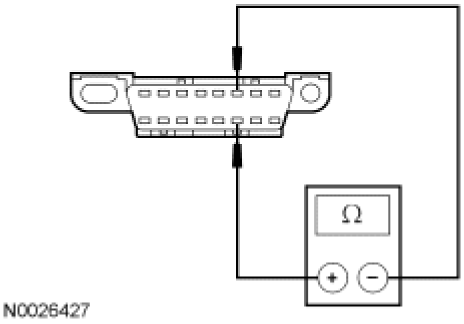


Fig. 109: Checking HS-CAN Termination Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Is the resistance between 54 and 66 ohms?**

  YES : Go to T3.

  NO : Go to T5.

T3 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND

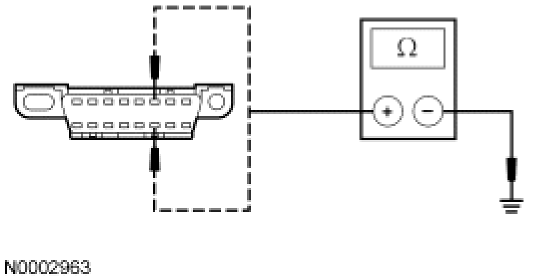


Fig. 110: Checking Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to T4.

  NO : Go to T21.

T4 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO VOLTAGE

- Connect the battery ground cable.

- Key in ON position.

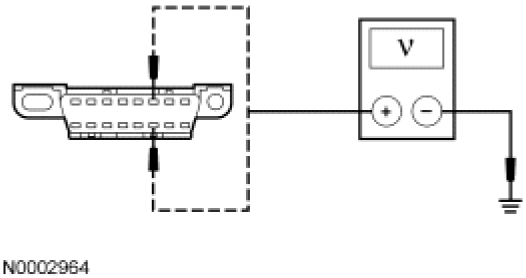


Fig. 111: Checking HS-CAN Circuits For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.
- **Is the voltage greater than 6 volts?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The CAN has tested within specifications. VERIFY the scan tool operation on a substitute vehicle, and REPEAT the network test on the suspect vehicle.

T5 CHECK THE HS-CAN TERMINATION RESISTOR

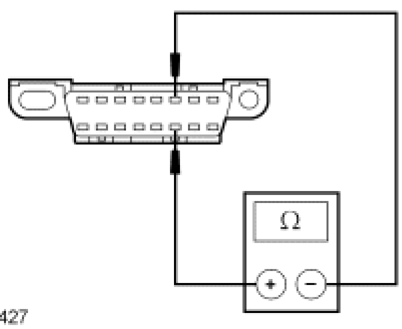


Fig. 112: Checking HS-CAN Termination Resistor
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Is the resistance between 108 and 132 ohms?**

  YES : Go to T6.

  NO : Go to T9.

T6 CHECK THE HS-CAN TERMINATION RESISTOR WITH THE PCM DISCONNECTED

- Disconnect: PCM C175b

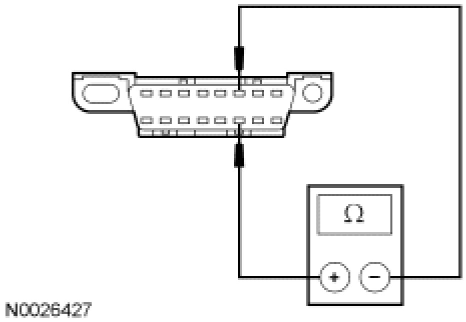


Fig. 113: Checking HS-CAN Termination Resistor With PCM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Is the resistance between 108 and 132 ohms?**

  YES : Go to T7.

  NO : Go to T8.

T7 CHECK THE HS-CAN CIRCUITS BETWEEN THE DLC AND THE PCM FOR AN OPEN

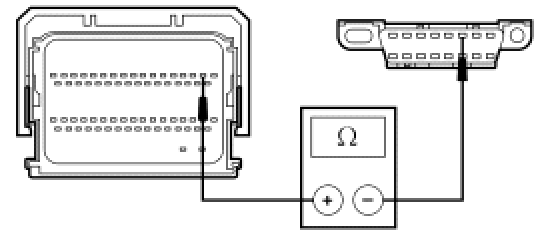


Fig. 114: Checking HS-CAN (+) Circuit
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-2, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.

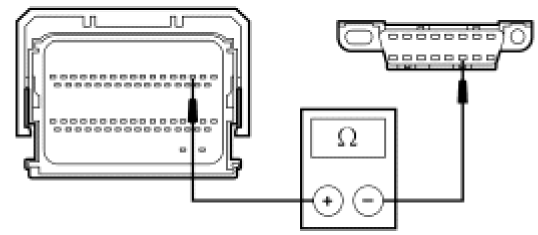


Fig. 115: Checking HS-CAN (-) Circuit
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-3, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to T31.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

T8 CHECK THE HS-CAN CIRCUITS BETWEEN THE DLC AND THE INSTRUMENT CLUSTER (IC) FOR AN OPEN

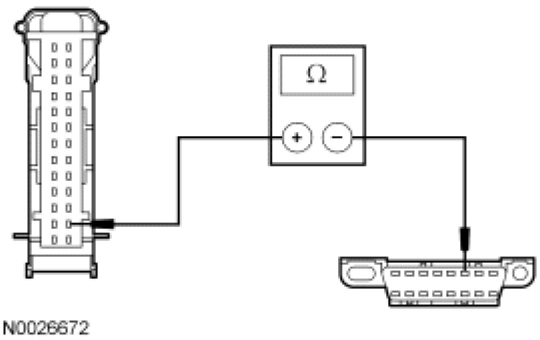


Fig. 116: Measuring Resistance Between IC C220-15, Circuit VDB04 (WH/BU) & DLC C251-6
Courtesy of FORD MOTOR CO.

- Measure the resistance between the IC C220-15, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.

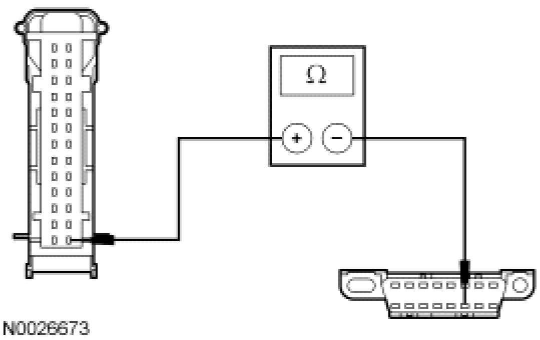


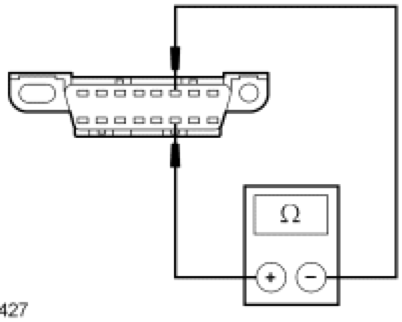
Fig. 117: Measuring Resistance Between IC C220-14, Circuit VDB05 (WH) & DLC C251-14
Courtesy of FORD MOTOR CO.

- Measure the resistance between the IC C220-14, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to T35.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

T9 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER



N0026427

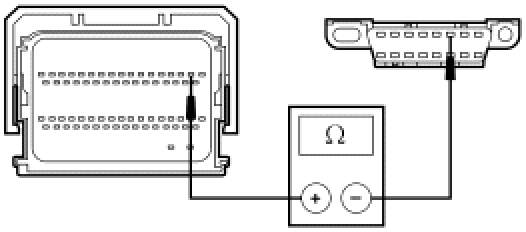
Fig. 118: Checking HS-CAN (+) & HS-CAN (-) Circuits For A Short Together
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to T11.

  NO : Go to T10.

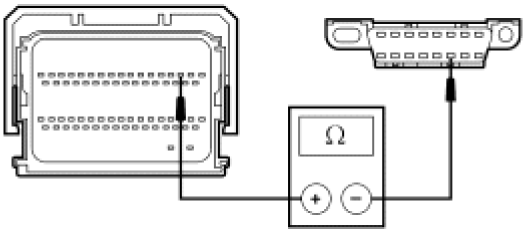
T10 CHECK THE HS-CAN CIRCUITS BETWEEN THE DLC AND THE PCM FOR AN OPEN



N0026577

Fig. 119: Checking HS-CAN (+) Circuit
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-2, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.



N0026578

Fig. 120: Checking HS-CAN (-) Circuit
Courtesy of FORD MOTOR CO.

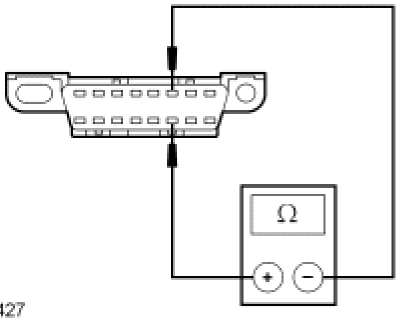
- Measure the resistance between the PCM C175b-3, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : The CAN has tested within specifications. VERIFY the scan tool operation on a substitute vehicle, and REPEAT the network test on the suspect vehicle.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

T11 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE PCM DISCONNECTED

- Disconnect: PCM C175b



N0026427

Fig. 121: Checking HS-CAN (+) & HS-CAN (-) Circuits For A Short Together With PCM Disconnected
Courtesy of FORD MOTOR CO.

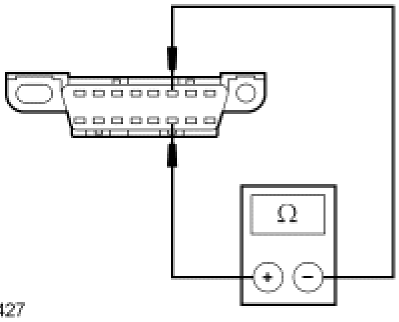
- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to T12.

  NO : Go to T31.

T12 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE ABS MODULE DISCONNECTED

- Disconnect: ABS Module C135



N0026427

Fig. 122: Checking HS-CAN (+) & HS-CAN (-) Circuits For A Short Together With ABS

Module Disconnected
Courtesy of FORD MOTOR CO.

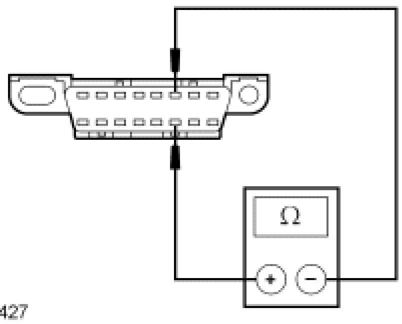
- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to T13.

  NO : Go to T32.

T13 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE TRANSMISSION CONTROL MODULE (TCM) DISCONNECTED

- Disconnect: TCM C2352b (FNR5 Transaxle)
- Disconnect: TCM C1533 (6-Speed Transaxle)



N0026427

Fig. 123: Checking HS-CAN (+) & HS-CAN (-) Circuits For A Short Together With Transmission Control Module (TCM) Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to T14.

  NO : Go to T33.

T14 VERIFY VEHICLE EQUIPMENT - 4X4 CONTROL MODULE

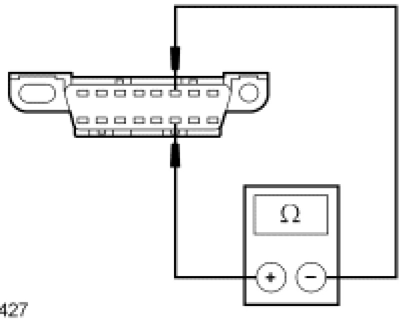
- Inspect the vehicle for a 4X4 control module.
- **Is the vehicle equipped with a 4X4 control module?**

  YES : Go to T15.

  NO : Go to T16.

T15 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE 4X4 CONTROL MODULE DISCONNECTED

- Disconnect: 4X4 Control Module C3253



N0026427

Fig. 124: Checking HS-CAN (+) & HS-CAN (-) Circuits For A Short Together With 4X4 Control Module Disconnected
Courtesy of FORD MOTOR CO.

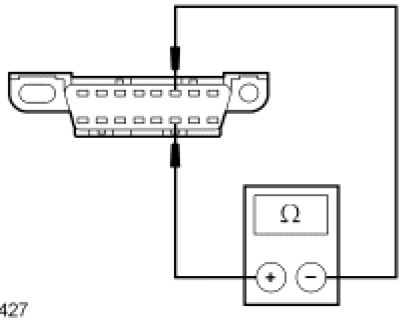
- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to T16.

  NO : Go to T34.

T16 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE INSTRUMENT CLUSTER (IC) DISCONNECTED

- Disconnect: IC C220



N0026427

Fig. 125: Checking HS-CAN (+) & HS-CAN (-) Circuits For A Short Together With Instrument Cluster (IC) Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to T17.

  NO : Go to T35.

T17 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM) DISCONNECTED

- Disconnect: OCSM C3159

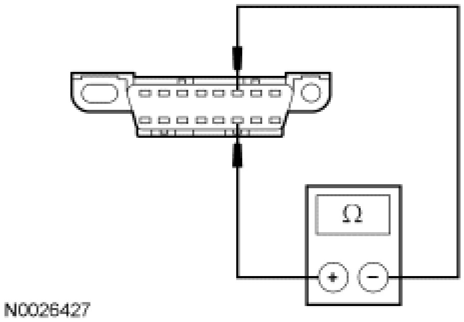


Fig. 126: Checking HS-CAN (+) & HS-CAN (-) Circuits For A Short Together With Occupant Classification System Module (OCSM) Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to T18.

  NO : Go to T36.

T18 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE RESTRAINTS CONTROL MODULE (RCM) DISCONNECTED

- Disconnect: RCM C310b

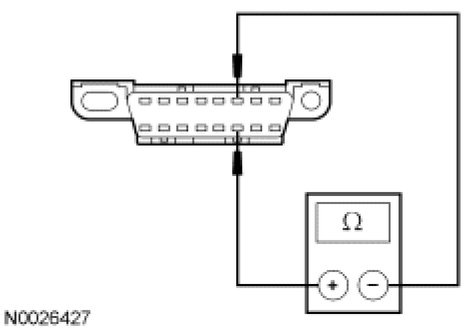


Fig. 127: Checking HS-CAN (+) & HS-CAN (-) Circuits For A Short Together With Restraints Control Module (RCM) Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to T19.

  NO : Go to T37.

T19 VERIFY VEHICLE EQUIPMENT - ACCESSORY PROTOCOL INTERFACE MODULE (APIM)

- Inspect the vehicle for an APIM.

- **Is the vehicle equipped with an APIM?**

  YES : Go to T20.

  NO : REPAIR the circuit. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

T20 CHECK THE MS-CAN (+) AND MS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE APIM DISCONNECTED

- Disconnect: APIM C3338

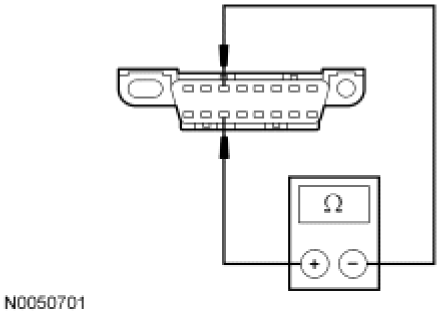


Fig. 128: Checking MS-CAN (+) & MS-CAN (-) Circuits For A Short Together With APIM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-3, circuit VDB06 (GY/OG), harness side and the DLC C251-11, circuit VDB07 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : REPAIR the circuit. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : Go to T38.

T21 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE PCM DISCONNECTED

- Disconnect: PCM C175b

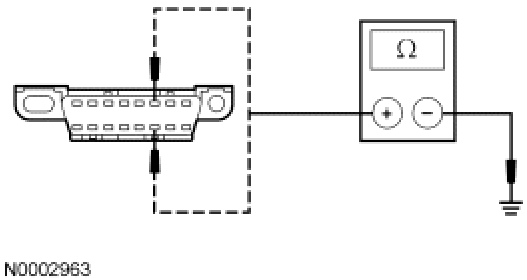


Fig. 129: Checking Circuits For A Short To Ground With PCM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to T31.

  NO : Go to T22.

T22 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE ABS MODULE DISCONNECTED

- Disconnect: ABS Module C135

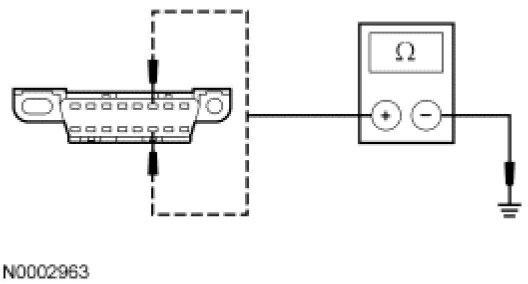


Fig. 130: Checking Circuits For A Short To Ground With ABS Module Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to T32.

  NO : Go to T23.

T23 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE TCM DISCONNECTED

- Disconnect: TCM C2352b (FNR5 Transaxle)
- Disconnect: TCM C1533 (6-Speed Transaxle)

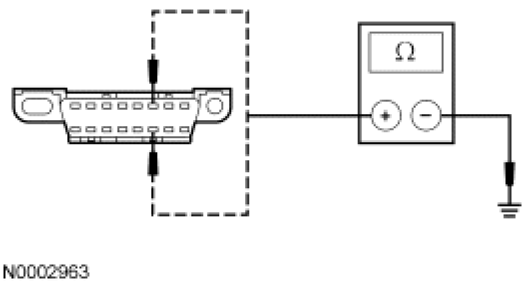


Fig. 131: Checking Circuits For A Short To Ground With TCM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to T33.

  NO : Go to T24.

T24 VERIFY VEHICLE EQUIPMENT - 4X4 CONTROL MODULE

- Inspect the vehicle for a 4X4 control module.
- **Is the vehicle equipped with a 4X4 control module?**

  YES : Go to T25.

  NO : Go to T26.

T25 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE 4X4 CONTROL MODULE DISCONNECTED

- Disconnect: 4X4 Control Module C3253

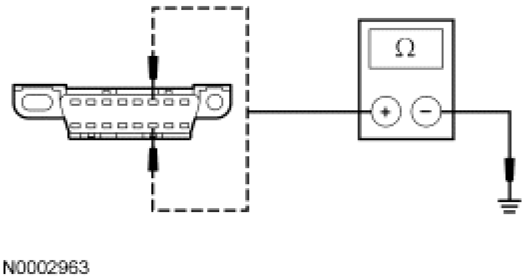


Fig. 132: Checking Circuits For A Short To Ground With 4X4 Control Module Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to T34.

  NO : Go to T26.

T26 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE IC DISCONNECTED

- Disconnect: IC C220

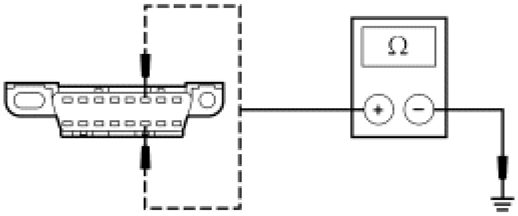


Fig. 133: Checking Circuits For A Short To Ground With IC Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to T35.

  NO : Go to T27.

T27 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE OCSM DISCONNECTED

- Disconnect: OCSM C3159

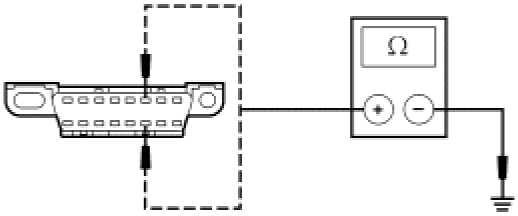


Fig. 134: Checking Circuits For A Short To Ground With OCSM Disconnected
Courtesy of FORD MOTOR CO.

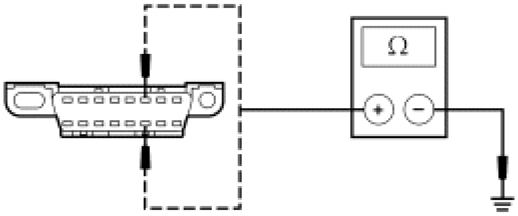
- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to T36.

  NO : Go to T28.

T28 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE RCM DISCONNECTED

- Disconnect: RCM C310b



N0002963

Fig. 135: Checking Circuits For A Short To Ground With RCM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to T37.

  NO : Go to T29.

T29 VERIFY VEHICLE EQUIPMENT - APIM

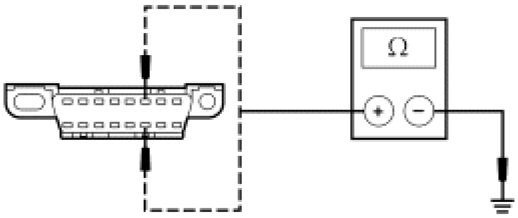
- Inspect the vehicle for an APIM.
- **Is the vehicle equipped with an APIM?**

  YES : Go to T30.

  NO : REPAIR the circuit. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

T30 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE APIM DISCONNECTED

- Disconnect: APIM C3338



N0002963

Fig. 136: Checking Circuits For A Short To Ground With APIM Disconnected
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to T38.

NO : REPAIR the circuit. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

T31 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

T32 CHECK FOR CORRECT ABS MODULE OPERATION

- Disconnect the ABS module connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the ABS module connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ABS module. REFER to **VEHICLE DYNAMIC SYSTEMS** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

T33 CHECK FOR CORRECT TCM OPERATION

- Disconnect the TCM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the TCM connector and make sure it seats correctly.

- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new TCM. REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article or **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

T34 CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION

- Disconnect the 4X4 control module connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the 4X4 control module connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new 4X4 control module. REFER to **FOUR WHEEL DRIVE (4WD) SYSTEMS** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

T35 CHECK FOR CORRECT IC OPERATION

- Disconnect the IC connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the IC connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

T36 CHECK FOR CORRECT OCSM OPERATION

- Disconnect the OCSM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the OCSM connector and make sure it seats correctly.
- Verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new OCSM. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CONNECT the modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. CONNECT all modules. CONNECT the battery ground cable. The concern may have been caused by a loose or corroded connector. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the network test with the scan tool.

T37 CHECK FOR CORRECT RCM OPERATION

- Disconnect all the RCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the RCM connectors and make sure they seat correctly.
- Verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new RCM. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

T38 CHECK FOR CORRECT APIM OPERATION

- Disconnect the APIM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the APIM connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

YES : INSTALL a new APIM. REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CONNECT all modules. CONNECT the battery ground cable. CLEAR the DTCs. REPEAT the network test with the scan tool.

Pinpoint Test U: Intermittent No High Speed Controller Area Network (HS-CAN) Communication, One Or More Modules Are Not Responding During Network Test

Normal Operation

An open circuit VDB04 (WH/BU) (HS-CAN +) or VDB05 (WH) (HS-CAN -) may cause intermittent or unreliable communication to all modules on the HS-CAN. In the event that one of the 2 network circuits (HS-CAN + or HS-CAN -) becomes open to a module on the network, unreliable network communication to all modules on the network may result.

The following modules communicate on the HS-CAN:

- Accessory protocol interface module (APIM) (if equipped)
- Audio control module (ACM)
- Audio digital signal processing (DSP) module (if equipped)
- Driver seat module (DSM) (if equipped)
- Driver door module (DDM) (if equipped)
- Dual climate controlled seat module (DCSM) (if equipped)
- Heating ventilation air conditioning (HVAC) module (if equipped)
- Instrument cluster (IC)
- Parking aid module (PAM) (if equipped)
- Satellite digital audio receiver system (SDARS) module (if equipped)
- Smart junction box (SJB)

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

PINPOINT TEST U: INTERMITTENT NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION, ONE OR MORE MODULES ARE NOT RESPONDING DURING NETWORK TEST

NOTE: Various modules will set network DTCs during this test procedure. Clear the DTCs from all modules after the diagnostic procedure is complete.

U1 CHECK THE DATA LINK CONNECTOR (DLC) PINS FOR DAMAGE

- Key in OFF position.
- Disconnect the scan tool cable from the DLC.

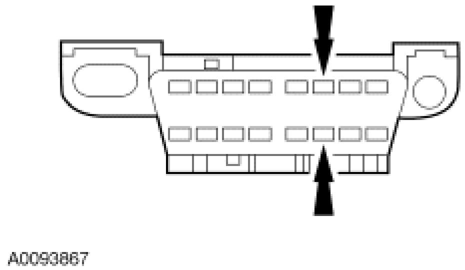


Fig. 137: Checking Data Link Connector (DLC) Pins For Damage
Courtesy of FORD MOTOR CO.

- Inspect DLC pins 6 and 14 for damage.
- **Are DLC pins 6 and 14 OK?**

  YES : Go to U2.

  NO : REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.

U2 CHECK THE HS-CAN TERMINATION RESISTANCE

- Key in OFF position.

NOTE: Failure to disconnect the battery will result in false resistance readings.

- Disconnect the battery ground cable.

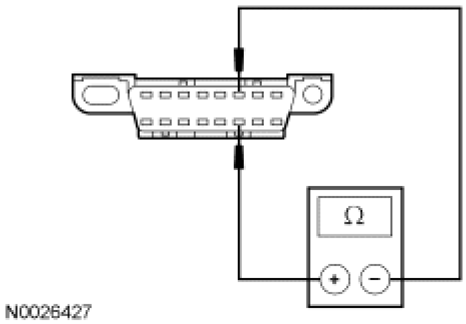


Fig. 138: Checking HS-CAN Termination Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.
- **Is the resistance between 54 and 66 ohms?**

  YES : Go to U3.

  NO : Go to **Pinpoint Test S**.

U3 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND

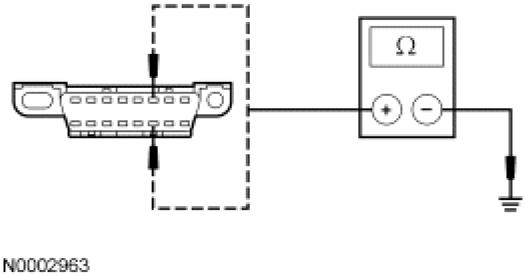


Fig. 139: Checking Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.
- **Are the resistances greater than 1,000 ohms?**

  YES : Go to U4.

  NO : Go to **Pinpoint Test S**.

U4 CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO VOLTAGE

- Connect the battery ground cable.
- Key in ON position.

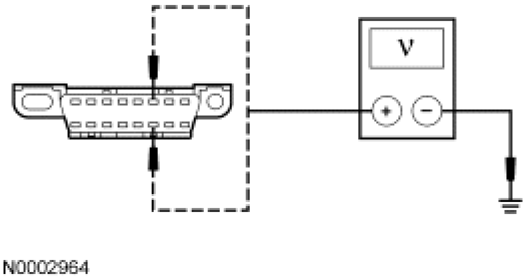


Fig. 140: Checking HS-CAN Circuits For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.
- **Is the voltage greater than 6 volts?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

  NO : Go to U5.

U5 CHECK FOR RESTORED COMMUNICATION WITH THE PCM DISABLED

NOTE:	**An integrated diagnostic system (IDS) session must be established prior to disabling the PCM in this test step. If the PCM has failed communication**

during multiple attempts to identify the vehicle, first identify the vehicle manually by entering a PCM part number, calibration number or tear tag when prompted by IDS.

NOTE: When a vehicle is manually identified by a PCM part number, calibration number or tear tag, the IDS will not automatically run a network test. The network test must be manually selected and run.

NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.

- Disconnect: BJB Fuses 23 (10A), 26 (7.5A), 42 (15A (3.0L, 3.5L) or 47 (15A) (2.3L)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : INSTALL the removed fuses. Go to **Pinpoint Test A**.

  NO : INSTALL the removed fuses. Go to U6.

U6 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE ABS MODULE AND 4X4 CONTROL MODULE (IF EQUIPPED) DISABLED

NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.

- Disconnect: SJB Fuses 28 (20A) and 20 (7.5A) (if equipped)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : INSTALL the removed fuses. If the vehicle is equipped with a 4X4 control module, go to U7. If the vehicle is not equipped with a 4X4 control module, go to **Pinpoint Test C**.

  NO : INSTALL the removed fuses. Go to U8.

U7 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE ABS MODULE DISCONNECTED

NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.

- Disconnect: ABS Module C135
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.

- **Do all other modules pass the network test?**

  YES : CONNECT the ABS module. Go to **Pinpoint Test C**.

  NO : CONNECT the ABS module. Go to **Pinpoint Test E**.

U8 VERIFY VEHICLE EQUIPMENT - AUTOMATIC TRANSAXLE

- Inspect the vehicle for an automatic transaxle.
- **Is the vehicle equipped with an automatic transaxle?**

  YES : Go to U9.

  NO : Go to U10.

U9 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE TRANSMISSION CONTROL MODULE (TCM) DISABLED

NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.

- Disconnect: BJB Fuses 16 (15A) and 23 (10A) (FNR5 Transaxle Only) or Fuse 26 (7.5A)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : INSTALL the removed fuses. Go to **Pinpoint Test B**.

  NO : INSTALL the removed fuses. Go to U10.

U10 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE INSTRUMENT CLUSTER (IC) DISABLED

NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.

- Disconnect: SJB Fuses 13 (10A), 23 (7.5A) and 27 (7.5A)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : INSTALL the removed fuses. Go to **Pinpoint Test G**.

  NO : INSTALL the removed fuses. Go to U11.

U11 VERIFY VEHICLE EQUIPMENT - ACCESSORY PROTOCOL INTERFACE MODULE (APIM)

- Inspect the vehicle for an APIM.
- **Is the vehicle equipped with an APIM?**

  YES : Go to U12.

  NO : Go to U13.

U12 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE APIM DISCONNECTED

NOTE:	**When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.**

- Disconnect: APIM C3338
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : CONNECT the APIM. Go to **Pinpoint Test Q**.

  NO : Go to U13.

U13 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE RESTRAINTS CONTROL MODULE (RCM) DISABLED

NOTE:	**When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.**

- Disconnect: SJB Fuse 25 (7.5A)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : INSTALL the removed fuse. Go to **Pinpoint Test D**.

  NO : INSTALL the removed fuse. Go to U14.

U14 CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM) DISABLED

NOTE:	**When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results.**

- Disconnect: SJB Fuse 24 (7.5A)
- Enter the following diagnostic mode on the diagnostic tool: Network Test
- Repeat the network test.
- **Do all other modules pass the network test?**

  YES : INSTALL the removed fuse. Go to **Pinpoint Test F**.

  NO : INSTALL the removed fuse. An intermittent fault is not present. Go to **Pinpoint Test S**.

Pinpoint Test V: No Power To The Scan Tool

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Module Communications Network for schematic and connector information.

Normal Operation

The scan tool is connected to the data link connector (DLC) to communicate with the high speed controller area network (HS-CAN) and the medium speed controller area network (MS-CAN) communications network. Voltage for the scan tool is provided by circuit SBP11 (BU/RD). Ground is provided by both circuits GD116 (BK/VT).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Scan tool

PINPOINT TEST V: NO POWER TO THE SCAN TOOL

V1 CHECK THE DLC PINS FOR DAMAGE

NOTE:	**Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

- Disconnect the scan tool cable from the DLC.

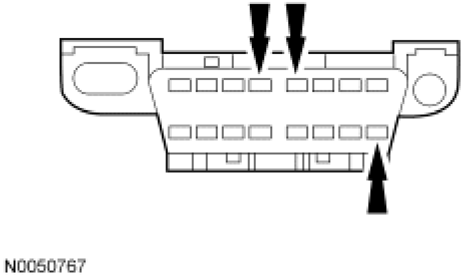


Fig. 141: Checking DLC Pins For Damage
Courtesy of FORD MOTOR CO.

- Inspect DLC pins 4, 5 and 16 for damage.
- **Are DLC pins 4, 5 and 16 OK?**

  YES : Go to V2.

  NO : REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.

V2 CHECK THE DLC VOLTAGE SUPPLY CIRCUIT SBP11 (BU/RD) FOR AN OPEN

- Measure the voltage between the DLC C251-16, circuit SBP11 (BU/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to V3.

  NO : VERIFY the smart junction box (SJB) fuse 18 (20A) is OK. If OK, REPAIR the circuit. REPEAT the network test with the scan tool.

V3 CHECK THE DLC GROUND CIRCUITS GD116 (BK/VT) FOR AN OPEN

- Measure the resistance between the DLC C251-4, circuit GD116 (BK/VT), harness side and ground; and between the DLC C251-5, circuit GD116 (BK/VT), harness side and ground.
- **Are the resistances less than 5 ohms?**

  YES : REPAIR the scan tool. REPEAT the network test with the scan tool.

  NO : REPAIR the circuit in question. REPEAT the network test with the scan tool.

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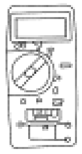
Module Configuration - Fusion, Milan & MKZ

DIAGNOSTIC TESTS

MODULE CONFIGURATION

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Configurable modules accommodate a variety of vehicle options, eliminating the need for many unique modules for one vehicle line. These modules must be configured when replaced as part of a repair procedure.

Configurable modules should not be exchanged between vehicles since the settings are unique to each vehicle. Failure to configure a new module may result in improper operation and/or any of the following DTCs setting:

- B2477 - sets when a body/chassis module is not configured or is configured incorrectly.
- B2900 - sets when there is a VIN mismatch between the module with the B2900 and the PCM. The stored VIN in either module may be incorrect.
- P0602, P0605 and/or P1639 - sets when the PCM vehicle identification (VID) block is not configured.
- U0300 and/or U0301 - sets when the configuration between 2 or more modules do not match.
- U2050 and/or U2051 - sets when a valid strategy/calibration is not present.

The following are the 3 different methods of configuration:

- Programmable module installation (PMI)
- Module reprogramming ("flashing")
- Programmable parameters

Some modules do not support all 3 methods.

Definition of Terms

The following are definitions of configuration terms:

Programmable Module Installation (PMI)

PMI is a scan tool process which configures settings in a new module. Data used for the PMI process is automatically downloaded from the original module and stored when a scan tool session is started. If this data cannot be retrieved from the module being replaced, the scan tool may prompt for As-Built data entry or display a list of parameter values that need to be manually selected. Some modules are reprogrammed during PMI when a strategy/calibration update is available. Module reprogramming is carried out through the vehicle data link connector (DLC).

NOTE: **It is important that the scan tool identifies the vehicle and obtains configuration data prior to removing any modules. The new module must be able to communicate with the scan tool in order to carry out PMI.**

To carry out PMI, refer to Programmable Module Installation in this article.

Module Reprogramming

Module reprogramming (also referred to as "flashing") is a scan tool process which updates the strategy/calibration in a module. Module reprogramming is automatically carried out during PMI when a later strategy/calibration is available. Module reprogramming is carried out through the vehicle DLC.

Reprogramming a module with the same level of software will not improve module operation or repair a hardware failure.

NOTE: **Module reprogramming should be limited to circumstances where a published Technical Service Bulletin (TSB) procedure recommends doing so.**

NOTE: **A module cannot communicate with other modules on the communication network while being reprogrammed. Clear any network communication DTCs which may have been set in other modules during the reprogramming process.**

Accessory Protocol Interface Module (APIM) Programming

APIM programming is a process which updates the APIM consumer interface processor (CIP) and vehicle interface processor (VIP) software. The VIP programming updates the calibration files in the portion of the APIM which interfaces with the controller area network (CAN). The CIP programming updates calibration files in the portion of the APIM which interfaces with mobile phones and other customer devices.

APIM programming uses the vehicle communication module (VCM) to read and program the VIP software through the DLC. A web-based OASIS application is used to read and program the CIP software via a universal serial bus (USB) cable between the scan tool and vehicle USB port. Both the VCM and OASIS application must be running on the scan tool during APIM programming.

Programmable Parameters

Programmable parameters are customer preference items that may be modified by the dealer via scan tool or in some cases modified by the customer following a procedure listed in the vehicle Owner's Literature. While many configuration options may exist for a module, only a few of these options are programmable parameters.

Adaptive Learning and Calibration

Some modules require a separate learning procedure be carried out if replaced as part of a repair procedure. For adaptive learning and calibration instructions, refer to the specific module removal and installation procedures.

Vehicle Identification (VID) Block

Some PCMs contain a memory area called a vehicle identification (VID) block. The PCM VID block commonly stores powertrain configuration items such as VIN, tire size, axle ratio, and whether or not the vehicle is equipped with speed control.

As-Built Data

As-Built data is a VIN-specific module configuration record. During vehicle build, the configuration from all modules is downloaded and stored in the As-Built database. As-Built data will not reflect customer preference items that have been changed from the default state. These items will need to be changed using programmable parameters after the module is configured.

NOTE: It is not necessary to obtain As-Built data unless directed to do so by the scan tool. This data may be accessed from the technician service publication website.

BODY/CHASSIS MODULE ADDRESSES FOR AS-BUILT ENTRY

Module Name	Module Address
Accessory protocol interface module (APIM)	7D0
Audio control module (ACM)	727
Audio digital signal processing (DSP) module	783
Driver door module (DDM)	740
Driver seat module (DSM)	744
Dual climate control seat module (DCSM)	776
Instrument cluster (IC)	720
Occupant classification system module (OCSM)	765
Parking aid module (PAM)	736
Restraints control module (RCM)	737
Satellite digital audio receiver system (SDARS) module	782
Smart junction box (SJB)	726

MODULE CONFIGURATION AND PARAMETER CHART

Module Name	Reprogram/ Flash Capable	Requires PMI	Requires Adaptive Learning	Requires Calibration	Available Programmable Parameters

Accessory protocol interface module (APIM)	Yes	Yes[a]	No	No	• None
ABS module	No	No	No	No	• None
Audio control module (ACM)	Yes	Yes	No	No	• Aux jack • Display units (NAV only) • Language (NAV only) • Phone module • SDARS module
Audio digital signal processing (DSP) module	Yes	Yes	No	No	• None
Driver door module (DDM)	Yes	No	No	No	• None
Driver seat module (DSM)	Yes	Yes	No	No	• Easy entry/exit
Dual climate control seat module (DCSM)	Yes	Yes	No	No	• None
Heating ventilation air conditioning (HVAC) module	Yes	No	No	No	• None
Instrument cluster (IC)	Yes	Yes	No	No	• Belt-Minder®
Occupant classification system module (OCSM)	Yes	No	No	• Seat weight sensor re-zero	• None
Parking aid module (PAM)	Yes	Yes	No	No	• None
PCM	Yes	Yes	Yes	No	• Speed control enable/disable
Restraints control module (RCM)	Yes	Yes	No	• Seat weight sensor re-zero	• Driver seat Belt-Minder® activation • Passenger seat Belt-Minder® activation
Satellite digital audio receiver system (SDARS) module	Yes	Yes	No	No	• Canadian broadcast
					• Customer auto

Smart junction box (SJB)	Yes	Yes	No	No	locking • Customer auto-unlocking • Customer perimeter lighting • Customer central/2-stage toggle • Customer trim switch inhibit • RKE transmitter panic activation button press mode • Global open
Transmission control module (TCM)	Yes	No	Yes	No	• None
4X4 control module	Yes	No	No	No	• None
a. Sync/APIM OASIS application required for programming					

a

Inspection and Verification

This section provides step-by-step module configuration procedures. Carry out the programmable module installation (PMI) procedure in this article when another workshop manual section directs to carry out configuration or when DTCs from the list below are present:

DTC CHART

DTC	Description	Source	Action
B2477	Module Configuration Failure	• Audio control module (ACM) • Audio digital signal processing (DSP) module • Driver seat module (DSM) • Dual climate control seat module (DCSM) • Instrument cluster (IC) • Occupant classification system module (OCSM)	CARRY OUT PMI. REFER to **Programmable Module Installation** in this article.

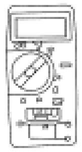
		• Parking aid module (PAM) • Restraints control module (RCM) • Satellite digital audio receiver system (SDARS) module • Smart junction box (SJB)	
B2477	Module Configuration Failure	• Accessory protocol interface module (APIM)	REFER to **Accessory Protocol Interface Module (APIM) Programming** in this article.
B2900	VIN mismatch	• 4X4 control module • ABS module • RCM	CARRY OUT PMI. REFER to **Programmable Module Installation** in this article.
P0602	Powertrain Control Module Programming Error	• PCM	CARRY OUT PMI. REFER to **Programmable Module Installation** in this article.
P0605	Internal Control Module Read Only Memory (ROM) Error	• PCM	CARRY OUT PMI. REFER to **Programmable Module Installation** in this article.
P1635	Tire/Axle Out of Acceptable Range	• 4X4 control module	CARRY OUT PMI. REFER to **Programmable Module Installation** in this article.
P1639	Vehicle ID Block Corrupted, Not Programmed	• PCM	CARRY OUT PMI. REFER to **Programmable Module Installation** in this article.
U0300	Internal Control Module Software Incompatibility	• PCM • RCM	CARRY OUT PMI. REFER to **Programmable Module Installation** in this article.
U2050	No Application Present	• 4X4 control module • ABS module • ACM • DCSM • DSM • Driver door module (DDM) • DSP module • Heating ventilation air conditioning (HVAC) module • IC • OCSM	CARRY OUT PMI. REFER to **Programmable Module Installation** in this article.

		• PCM • RCM • SJB • SDARS module • Transmission control module (TCM)	
U2050	No Application Present	• APIM	REFER to **Accessory Protocol Interface Module (APIM) Programming** in this article.
U2051	No Application Present	• 4X4 control module • ACM • DSP module • HVAC module • IC • OCSM • PAM • PCM • RCM	CARRY OUT PMI. REFER to **Programmable Module Installation** in this article.

GENERAL PROCEDURES

PROGRAMMABLE MODULE INSTALLATION

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Programmable Module Installation (PMI) Using the Integrated Diagnostic System (IDS) When the Original Module is Available

NOTE: Following module installation, some modules require a separate learning procedure be carried out. For adaptive learning and calibration instructions, refer to the specific module removal and installation procedures.

1. Connect the IDS and identify the vehicle as normal.
2. From the Tool box icon, select Module Programming and press the check mark.

3. Select Programmable Module Installation.
4. Select the module that is being replaced.
5. Follow the on-screen instructions, turn the ignition key to the OFF position, and press the check mark.
6. Install the new module and press the check mark.
7. Follow the on-screen instructions, turn the ignition key to the ON position, and press the check mark.
8. The IDS downloads the data into the new module and displays Module Configuration Complete.
9. Test module for correct operation.

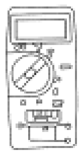
Programmable Module Installation (PMI) Using the Integrated Diagnostic System (IDS) When the Original Module is NOT Available

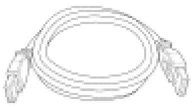
NOTE: Following module installation, some modules require a separate learning procedure be carried out. For adaptive learning and calibration instructions, refer to the specific module removal and installation procedures.

1. Install the new module.
2. Connect the IDS and identify the vehicle as normal.
3. From the Tool box icon, select Module Programming and press the check mark.
4. Select Programmable Module Installation.
5. Select the module that was replaced.
6. Follow the on-screen instructions, turn the ignition key to the OFF position, and press the check mark.
7. Follow the on-screen instructions, turn the ignition key to the ON position, and press the check mark.
8. If the data is not available, the IDS displays a screen stating to contact the As-Built Data Center. Retrieve the data from the technician service publication website at this time and press the check mark.
9. Enter the module data and press the check mark.
10. The IDS downloads the data into the new module and displays Module Configuration Complete.
11. Test module for correct operation.

ACCESSORY PROTOCOL INTERFACE MODULE (APIM) PROGRAMMING

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
	Universal Serial Bus (USB) Male-A to Male-A Cable	CCMUSB2-AM-AM-10 or equivalent

 ST3051-A		

Accessory Protocol Interface Module (APIM) Programming Using the Integrated Diagnostic System (IDS)

NOTE: If a new accessory protocol interface module (APIM) is being installed, install the new APIM before carrying out the following procedure. For additional information, refer to INFORMATION AND ENTERTAINMENT SYSTEMS article.

1. Turn the audio control module (ACM) on.
2. Connect the scan tool to the data link connector (DLC).
3. Connect one end of the universal serial bus (USB) male-A to male-A cable to the scan tool.
4. Connect the other end of the USB male-A to male-A cable to the vehicle USB port.
5. From the technician service publication website, run OASIS using Quick Start or by manually entering the vehicle identification number (VIN).
6. From the OASIS tab, select the "Sync/APIM" bullet.
7. Select the "Read APIM" button to verify the current APIM vehicle interface processor (VIP) and consumer interface processor (CIP) software levels.

   NOTE: Do not disconnect the vehicle communication module (VCM) or USB cables during APIM programming.

8. Select the desired software level from the list of available software for programming then select the "Program APIM" button to begin the APIM programming process. Enter the APIM As-Built data if prompted.
   - When only the CIP is being programmed, select cancel when prompted whether or not to program the VIP.
   - When the VIP is programmed, the CIP will be programmed automatically.
9. The Sync/APIM application downloads the software into the APIM and displays "Programming has been completed successfully".
10. Test the audio system for correct operation.

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Multifunction Electronic Modules - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Driver door module (DDM) nuts	3	27
Smart junction box (SJB) nuts	5	44

DESCRIPTION AND OPERATION

MODULE CONTROLLED FUNCTIONS

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

There are 3 multifunction electronic modules on this vehicle. They include the smart junction box (SJB), the driver door module (DDM) and the driver seat module (DSM).

Smart Junction Box (SJB)

The SJB is a combination of a multifunction electronic module and an interior fuse panel. It is located on the LH A-pillar, under the instrument panel. SJB functions control multiple vehicle systems, which include:

- Battery saver relay
- Brake shift interlock
- Delayed accessory
- Exterior lighting
- Global open (front windows only) (MKZ only, if equipped)
- Heated rear window
- Horn
- Interior lighting
- Moon roof (MKZ only, if equipped)
- Perimeter anti-theft
- Power locks
- Remote keyless entry (RKE)
- Tire pressure monitoring system (TPMS)
- Windshield wipers

Driver Door Module (DDM)

The DDM (if equipped), is located behind the LH front door panel. It controls the memory functions of the exterior driver memory mirror and, in conjunction with the driver seat module (DSM) (located under the driver seat), indirectly controls the memory seat functions. The DDM also controls the lock and unlock functions of the driver door lock actuator on vehicles with memory (seats and mirror) and receives lock/unlock input information from the door lock key cylinder switch and reset information from the driver door lock actuator.

Driver Seat Module (DSM)

The DSM (if equipped), controls the exterior passenger memory mirror and the memory seat functions.

DIAGNOSTIC TESTS

DIAGNOSTIC TROUBLE CODE (DTC) CHART

NOTE: **Most powertrain (P-code) DTCs are diagnosed in the Powertrain Control/Emissions Diagnosis (PC/ED) article. If the P-code retrieved is not listed below, refer to the Introduction - Gasoline Engines article to continue diagnostics.**

NOTE: **The smart junction box (SJB) is also known as the generic electronic module (GEM).**

DIAGNOSTIC TROUBLE CODE (DTC) CHART

DTC	Description	Source	Action
B1003	Mode Door Circuit Failure	Heating Ventilation Air Conditioning (HVAC) Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B1013	Occupant Classification System Calibration Fault	Occupant Classification System Module (OCSM)	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article (late build vehicles only).
B1031	SDARS Satellite Antenna Open	Satellite Digital Audio Receiver System (SDARS) Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1032	SDARS Satellite Antenna Short	SDARS Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1038	Microphone Input Circuit Failure	Accessory Protocol Interface Module (APIM)	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B103B	Thermoelectric Driver	Dual Climate Control Seat	REFER to **SEATING** article.

	Overcurrent Low	Module (DCSM)	
B103C	Thermoelectric Driver Open Load	DCSM	REFER to **SEATING** article.
B103D	Blower Driver Overtemperature	DCSM	REFER to **SEATING** article.
B106A	TPMS Sensor Pressure Range Bit Incorrect State	Smart Junction Box (SJB)	REFER to **WHEELS AND TIRES** article.
B106B	Tire Pressure Sensor Low Battery	SJB	REFER to **WHEELS AND TIRES** article.
B1111	Driver Thermal Electric Device Control Overtemperature Fault	DCSM	REFER to **SEATING** article.
B1113	Passenger Thermal Electric Device Control Overtemperature Fault	DCSM	REFER to **SEATING** article.
B1117	Audio Steering Wheel Button Stuck	APIM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1117	Audio Steering Wheel Button Stuck	Audio Control Module (ACM)	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1119	Audio Disc DVD Player Thermal Shutdown	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B111B	Passenger Thermoelectric Driver Overcurrent Low	DCSM	REFER to **SEATING** article.
B111C	Passenger Thermoelectric Driver Open Load	DCSM	REFER to **SEATING** article.
B111D	Passenger Blower Driver Overtemperature	DCSM	REFER to **SEATING** article.
B1136	Audio Steering Wheel Switch #2 Circuit Failure	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1136	Audio Steering Wheel Switch #2 Circuit Failure	APIM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1137	Data Not Programmed	Instrument Cluster (IC)	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1138	Memory Full	IC	The SJB has 4 integrated key head transmitter (IKT) keys stored in memory and cannot program any more IKTs into the SJB memory. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1138	Memory Full	SJB	The SJB has 4 integrated key head transmitter (IKT) keys stored in memory and cannot program any more IKTs into the SJB memory. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

B1139	Invalid Transmitter Identification Code	IC	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B1139	Invalid Transmitter Identification Code	SJB	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B1140	Map Disk Invalid	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1158	Subwoofer #2 Open	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1158	Subwoofer #2 Open	Audio Digital Signal Processing (DSP) Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1200	Climate Control Push-button Circuit Failure	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B1202	Fuel Sender Circuit Open	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B1204	Fuel Sender Circuit Short to Ground	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B1205	EIC Switch-1 Assembly Circuit Failure	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B1209	EIC Switch-2 Assembly Circuit Failure	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B1213	Anti-Theft Number of Programmed Keys Is Below Minimum	IC	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1231	Event Threshold Exceeded	OCSM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B1231	Event Threshold Exceeded	Restraints Control Module (RCM)	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B1234	Mirror Switch Invalid Code	Driver Door Module (DDM)	REFER to **REAR VIEW MIRRORS** article.
B1247	Panel Dim Switch Circuit Open	SJB	REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article.
B1251	Air Temperature Internal Sensor Circuit Open	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B1253	Air Temperature Internal Sensor Circuit Short to	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION**

	Ground		**AND DIAGNOSTICS** article.
B1255	Air Temperature External Sensor Circuit Open	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B1257	Air Temperature External Sensor Circuit Short to Ground	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B1299	Power Supply Sensor Circuit Short to Ground	Parking Aid Module (PAM)	REFER to **PARKING AID** article.
B1309	Power Door Lock Circuit Short to Ground	SJB	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B1317	Battery Voltage High	4X4 Control Module	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1317	Battery Voltage High	APIM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1317	Battery Voltage High	DDM	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1317	Battery Voltage High	Driver Seat Module (DSM)	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1317	Battery Voltage High	DSP Module	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1317	Battery Voltage High	IC	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1317	Battery Voltage High	OCSM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B1317	Battery Voltage High	RCM	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1317	Battery Voltage High	SJB	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1318	Battery Voltage Low	4X4 Control Module	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1318	Battery Voltage Low	ACM	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1318	Battery Voltage Low	APIM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1318	Battery Voltage Low	DDM	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1318	Battery Voltage Low	DSM	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1318	Battery Voltage Low	DSP Module	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1318	Battery Voltage Low	IC	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.

B1318	Battery Voltage Low	OCSM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B1318	Battery Voltage Low	RCM	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1318	Battery Voltage Low	SDARS Module	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1318	Battery Voltage Low	SJB	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1320	Driver Door Ajar Circuit Open	SJB	REFER to **INTERIOR LIGHTING** article.
B1328	Passenger Door Ajar Circuit Open	SJB	REFER to **INTERIOR LIGHTING** article.
B1331	Decklid Ajar Rear Door Circuit Failure	SJB	REFER to **INTERIOR LIGHTING** article.
B1336	Door Ajar RR Circuit Open	SJB	REFER to **INTERIOR LIGHTING** article.
B1341	Power Door Unlock Circuit Short to Ground	SJB	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B1342	ECU is Faulted	4X4 Control Module	REFER to **FOUR WHEEL DRIVE (4WD) SYSTEMS** article.
B1342	ECU is Faulted	ABS Module	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
B1342	ECU is Faulted	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1342	ECU is Faulted	APIM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1342	ECU is Faulted	DCSM	REFER to **SEATING** article.
B1342	ECU is Faulted	DDM	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new driver door module (DDM). REFER to **Driver Door Module (DDM)**. TEST the system for normal operation.
B1342	ECU is Faulted	DSM	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new driver seat module (DSM). REFER to **Driver Seat Module (DSM)**. TEST the system for normal operation.
B1342	ECU is Faulted	DSP Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1342	ECU is Faulted	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B1342	ECU is Faulted	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

B1342	ECU is Faulted	OCSM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B1342	ECU Is Faulted	PAM	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new parking aid module (PAM). REFER to **PARKING AID** article.
B1342	ECU Is Faulted	PCM	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new PCM. REFER to the appropriate part in **ENGINE SYSTEM - GENERAL INFORMATION** article. REPEAT the self-test.
B1342	ECU is Faulted	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B1342	ECU is Faulted	SDARS Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B1342	ECU is Faulted	SJB	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new SJB. REFER to **Smart Junction Box (SJB)**. TEST the system for normal operation.
B1345	Heated Backlight Input Circuit Short to Ground	SJB	REFER to **GLASS, FRAMES AND MECHANISMS** article.
B1352	Ignition Key-In Circuit Failure	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B1360	Ignition Run/ACC Circuit Open	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B1432	Wiper Brake/Run Relay Circuit Short to Battery	SJB	REFER to **WIPERS AND WASHERS** article.
B1433	Wiper Brake/Run Relay Circuit Short to Ground	SJB	REFER to **WIPERS AND WASHERS** article.
B1447	Wiper Park Sense Circuit Open	SJB	REFER to **WIPERS AND WASHERS** article.
B1472	Lamp Headlamp Input Circuit Short to Ground	SJB	REFER to **EXTERIOR LIGHTING** article.
B1483	Brake Pedal Input Circuit Failure	ABS Module	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
B1485	Brake Pedal Input Short to Battery	SJB	REFER to **EXTERIOR LIGHTING** article.
B1510	Flash to Pass Switch Circuit Short to Ground	SJB	REFER to **EXTERIOR LIGHTING** article.
B1520	Hood Switch Circuit Open	SJB	REFER to **ANTI-THEFT - PERIMETER** article.

B1530	Memory Set Switch Circuit Short to Ground	DDM	REFER to **SEATING** article.
B1534	Memory 1 Switch Circuit Short to Ground	DDM	REFER to **SEATING** article.
B1538	Memory 2 Switch Circuit Short to Ground	DDM	REFER to **SEATING** article.
B1554	Decklid Release Circuit Short to Ground	SJB	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B1570	Lamp Headlamp High-Beam Circuit Short to Ground	SJB	REFER to **EXTERIOR LIGHTING** article.
B1572	Door Ajar LR Circuit Open	SJB	REFER to **INTERIOR LIGHTING** article.
B1578	Lamp Park Input Circuit Short to Ground	SJB	REFER to **EXTERIOR LIGHTING** article.
B1600	PATS Ignition Key Transponder Signal is Not Received	IC	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	IC	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	IC	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1623	Lamp Keypad Output Circuit Failure	SJB	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B1663	Seat Driver Front Up/Down Motor Stalled	DSM	REFER to **SEATING** article.
B1664	Seat Driver Rear Up/Down Motor Stalled	DSM	REFER to **SEATING** article.
B1665	Seat Driver Forward/Backward Motor Stalled	DSM	REFER to **SEATING** article.
B1666	Seat Driver Recline Motor Stalled	DSM	REFER to **SEATING** article.
B1667	Mirror Driver Up/Down Motor Stalled	DDM	REFER to **REAR VIEW MIRRORS** article.
B1667	Mirror Driver Up/Down Motor Stalled	DSM	REFER to **REAR VIEW MIRRORS** article.
B1668	Mirror Driver Right/Left Motor Stalled	DDM	REFER to **REAR VIEW MIRRORS** article.
B1668	Mirror Driver Right/Left Motor Stalled	DSM	REFER to **REAR VIEW MIRRORS** article.
B1669	Mirror Passenger Up/Down Motor Stalled	DSM	REFER to **REAR VIEW MIRRORS** article.

B1670	Mirror Passenger Right/Left Motor Stalled	DSM	REFER to **REAR VIEW MIRRORS** article.
B1676	Battery Pack Voltage Out of Range	ABS Module	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
B1676	Battery Pack Voltage Out of Range	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B1681	PATS Transceiver Module Signal Is Not Received	IC	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1688	Lamp Dome Input Circuit Short to Ground	SJB	REFER to **INTERIOR LIGHTING** article.
B1692	Autolamp Delay Circuit Short to Ground	SJB	REFER to **EXTERIOR LIGHTING** article.
B1703	Seat Driver Recline Forward Switch Circuit Short to Battery	DSM	REFER to **SEATING** article.
B1707	Seat Driver Recline Rearward Switch Circuit Short to Battery	DSM	REFER to **SEATING** article.
B1711	Seat Driver Front Up Switch Circuit Short to Battery	DSM	REFER to **SEATING** article.
B1715	Seat Driver Front Down Switch Circuit Short to Battery	DSM	REFER to **SEATING** article.
B1719	Seat Driver Forward Switch Circuit Short to Battery	DSM	REFER to **SEATING** article.
B1723	Seat Driver Rearward Switch Circuit Short to Battery	DSM	REFER to **SEATING** article.
B1727	Seat Driver Rear Up Switch Circuit Short to Battery	DSM	REFER to **SEATING** article.
B1731	Seat Driver Rear Down Switch Circuit Short to Battery	DSM	REFER to **SEATING** article.
B1791	Autolamp Sensor Input Circuit Open	SJB	REFER to **EXTERIOR LIGHTING** article.
B1793	Autolamp Sensor Input Circuit Short to Ground	SJB	REFER to **EXTERIOR LIGHTING** article.
B1795	Lamp Headlamp Low-Beam Circuit Open	SJB	REFER to **EXTERIOR LIGHTING** article.
B1797	Lamp Headlamp Low-Beam Circuit Short to Ground	SJB	REFER to **EXTERIOR LIGHTING** article.
B1799	Lamp Turn Signal Front Output Circuit Open	SJB	REFER to **EXTERIOR LIGHTING** article.
B1801	Lamp Turn Signal Front Output Circuit Short to	SJB	REFER to **EXTERIOR LIGHTING** article.

	Ground		
B1868	Lamp Air Bag Warning Indicator Circuit Failure	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B1875	Turn Signal / Hazard Switch Signal Circuit Failure	SJB	REFER to **EXTERIOR LIGHTING** article.
B1884	PAD Warning Lamp Circuit Failure	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B1890	PAD Warning Lamp Circuit Short to Battery	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B1952	Seat Rear Up/Down Position Feedback Circuit Short to Battery	DSM	REFER to **SEATING** article.
B1953	Seat Rear Up/Down Position Feedback Circuit Short to Ground	DSM	REFER to **SEATING** article.
B1956	Seat Front Up/Down Position Feedback Circuit Short to Battery	DSM	REFER to **SEATING** article.
B1957	Seat Front Up/Down Position Feedback Circuit Short to Ground	DSM	REFER to **SEATING** article.
B1960	Seat Recline Forward/Backward Position Feedback Circuit Short to Battery	DSM	REFER to **SEATING** article.
B1961	Seat Recline Forward/Backward Position Feedback Circuit Short to Ground	DSM	REFER to **SEATING** article.
B1964	Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Battery	DSM	REFER to **SEATING** article.
B1965	Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Ground	DSM	REFER to **SEATING** article.
B19A1	Passenger Seat Cushion Blower Speed Short to Battery	DCSM	REFER to **SEATING** article.
B19A2	Passenger Seat Back Blower Speed Short to Battery	DCSM	REFER to **SEATING** article.
B19A3	Driver Seat Cushion Blower Speed Short to Battery	DCSM	REFER to **SEATING** article.

B19A4	Driver Seat Back Blower Speed Short to Battery	DCSM	REFER to **SEATING** article.
B19A5	Passenger Seat Cushion Blower Speed Short to Ground	DCSM	REFER to **SEATING** article.
B19A6	Passenger Seat Back Blower Speed Short to Ground	DCSM	REFER to **SEATING** article.
B19A7	Driver Seat Cushion Blower Speed Short to Ground	DCSM	REFER to **SEATING** article.
B19A8	Driver Seat Back Blower Speed Short to Ground	DCSM	REFER to **SEATING** article.
B2026	Incandescent Back lighting Output Circuit Failure	SJB	REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article.
B2027	LED Back lighting Output Circuit Failure	SJB	REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** article.
B2030	Front Fog Lamp Relay CKT Failure	SJB	REFER to **EXTERIOR LIGHTING** article.
B2048	Left Rear Turn Lamp Circuit Short to Ground	SJB	REFER to **EXTERIOR LIGHTING** article.
B2049	Left Rear Turn Lamp Circuit Open	SJB	REFER to **EXTERIOR LIGHTING** article.
B2050	Right Rear Turn Lamp Circuit Short to Ground	SJB	REFER to **EXTERIOR LIGHTING** article.
B2051	Right Rear Turn Lamp Circuit Open	SJB	REFER to **EXTERIOR LIGHTING** article.
B2084	Memory Set Indicator Short to Ground	DDM	REFER to **SEATING** article.
B2103	Antenna Not Connected	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B2103	Antenna Not Connected	IC	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2108	Trunk Key Cylinder Switch Failure	SJB	REFER to **ANTI-THEFT - PERIMETER** article.
B2116	Door Driver Reset Switch Stuck Failure	DDM	REFER to **ANTI-THEFT - PERIMETER** article.
B2116	Door Driver Reset Switch Stuck Failure	SJB	REFER to **ANTI-THEFT - PERIMETER** article.
B2141	NVM Configuration Failure	IC	CARRY OUT a parameter reset of the instrument cluster (IC) and the PCM. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2143	NVM Memory Failure	DDM	INSTALL a new driver door module (DDM). REFER to **Driver Door Module (DDM)**. REPEAT the self-test.
			INSTALL a new driver seat module (DSM).

B2143	NVM Memory Failure	DSM	REFER to **Driver Seat Module (DSM)**. REPEAT the self-test.
B2143	NVM Memory Failure	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B2179	Front Wiper Select Switch "A" Short to Ground	SJB	REFER to **WIPERS AND WASHERS** article.
B2180	Front Wiper Select Switch "B" Short to Ground	SJB	REFER to **WIPERS AND WASHERS** article.
B2181	Front Wiper Select Switch "C" Short to Ground	SJB	REFER to **WIPERS AND WASHERS** article.
B2183	Front Wiper Select Switch "H" Short to Ground	SJB	REFER to **WIPERS AND WASHERS** article.
B2184	Front Wiper Select Switch "W" Short to Ground	SJB	REFER to **WIPERS AND WASHERS** article.
B2204	GPS Antenna Connection Open or Short	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B2207	ECU ROM Checksum Error	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B2223	Mirror Driver Drive Circuit Failure	DDM	REFER to **REAR VIEW MIRRORS** article.
B2223	Mirror Driver Drive Circuit Failure	DSM	REFER to **REAR VIEW MIRRORS** article.
B2224	Mirror Passenger Drive Circuit Failure	DSM	REFER to **REAR VIEW MIRRORS** article.
B2254	Front Fog Lamp Switch Failure	SJB	REFER to **EXTERIOR LIGHTING** article.
B2266	Left Side Blend Door Circuit Failure	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B2267	Right Side Blend Door Circuit Failure	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B2274	Phone Transceiver Active Circuit Failure	ACM	DISREGARD the DTC. It is not applicable to this vehicle. CLEAR the DTCs. REPEAT the self-test.
B2276	Less Than 2 Transmitters Programmed	SJB	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B2281	Right Turn Switch Short to Ground	SJB	REFER to **EXTERIOR LIGHTING** article.
B2282	Left Turn Switch Short to Ground	SJB	REFER to**EXTERIOR LIGHTING** article.
	Occupant Classification		REFER to **SUPPLEMENTAL**

B2290	System Fault	OCSM	**RESTRAINT SYSTEM** article.
B2290	Occupant Classification System Fault	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2292	Restraint System - Seatbelt Pretensioner Fault	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2293	Restraint System - Airbag Fault	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2294	Restraint System - Curtain Fault	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2295	Restraint System - Side Airbag Fault	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2296	Restraint System - Impact Sensor Fault	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B229A	Occupant Classification Sensor Contamination	OCSM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B229B	Occupant Classification System Obstruction	OCSM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2312	Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	DSM	REFER to **REAR VIEW MIRRORS** article.
B2314	Mirror Passenger Horizontal Feedback Potentiometer Circuit Short to Battery	DSM	REFER to **REAR VIEW MIRRORS** article.
B2316	Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	DSM	REFER to **REAR VIEW MIRRORS** article.
B2318	Mirror Passenger Vertical Feedback Potentiometer Circuit Short to Battery	DSM	REFER to **REAR VIEW MIRRORS** article.
B2320	Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	DDM	REFER to **REAR VIEW MIRRORS** article.
B2322	Mirror Driver Horizontal Feedback Potentiometer Circuit Short to Battery	DDM	REFER to **REAR VIEW MIRRORS** article.
B2324	Mirror Driver Vertical Feedback Potentiometer Circuit Failure	DDM	REFER to **REAR VIEW MIRRORS** article.
B2326	Mirror Driver Vertical Feedback Potentiometer Circuit Short to Battery	DDM	REFER to **REAR VIEW MIRRORS** article.
B2384	Audio Reverse Aid Mute Input CKT. Failure	ACM	DISREGARD the DTC. It is not applicable to this vehicle. CLEAR the DTCs. REPEAT the self-test.
			REFER to **INSTRUMENT CLUSTER**

B2390	Master/Slave Communication Failure	IC	**(IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B2404	Audio Steering Wheel Switch Circuit Fault	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B2405	Audio Disc CD Player Thermal Shutdown Fault	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B2406	Audio Disc CD Player Internal Fault	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B2425	Remote Keyless Entry Out of Synchronization	SJB	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B2426	Passenger Solar Radiation Sensor Circuit Open	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B2427	Passenger Solar Radiation Sensor Circuit Short to Ground	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B2431	Transponder Programming Failed	IC	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2434	Drivers Seat Belt Buckle Switch Circuit Short to Ground	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2435	Drivers Seat Belt Buckle Switch Resistance Out of Range	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2438	Passengers Seat Belt Buckle Switch Circuit Short to Ground	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2439	Passengers Seat Belt Buckle Switch Resistance Out of Range	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2477	Module Configuration Failure	ACM	REFER to **MODULE CONFIGURATION** article.
B2477	Module Configuration Failure	APIM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B2477	Module Configuration Failure	DCSM	REFER to **MODULE CONFIGURATION** article.
B2477	Module Configuration Failure	DSM	REFER to **MODULE CONFIGURATION** article.
B2477	Module Configuration Failure	DSP Module	REFER to **MODULE CONFIGURATION** article.
B2477	Module Configuration Failure	IC	REFER to **MODULE CONFIGURATION** article.
B2477	Module Configuration Failure	OCSM	REFER to **MODULE CONFIGURATION** article.

B2477	Module Configuration Failure	PAM	REFER to **MODULE CONFIGURATION** article.
B2477	Module Configuration Failure	RCM	REFER to **MODULE CONFIGURATION** article.
B2477	Module Configuration Failure	SDARS Module	REFER to **MODULE CONFIGURATION** article.
B2477	Module Configuration Failure	SJB	CONFIGURE the SJB. REFER to **MODULE CONFIGURATION** article. CLEAR the DTCs. RETRIEVE the DTCs and VERIFY successful module configuration. If DTC B2477 is retrieved again, INSTALL a new SJB. REFER to **Smart Junction Box (SJB)**. REPEAT the self-test.
B2479	Park Brake Switch Circuit Short to Ground	SJB	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B2486	Climate Control Seat Module Voltage Out of Range	DCSM	REFER to **SEATING** article.
B2498	Headlamp Switch Multiple Signals Input Active	SJB	REFER to **EXTERIOR LIGHTING** article.
B2499	Courtesy Lamp Output Failure	SJB	REFER to **INTERIOR LIGHTING** article.
B2572	Brake Shift Interlock Output Circuit Failure	SJB	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS** article.
B2574	Drivers Door LOCK Switch Short to Ground	DDM	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B2575	Drivers Door UNLOCK Switch Short to Ground	DDM	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B2607	Harness/Configuration Mismatch	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2627	Fuel Sender Circuit Open #2	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B2628	Fuel Sender Circuit Short to Ground #2	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B2633	Driver-Front Microphone Circuit Failure	ACM	DISREGARD the DTC. It is not applicable to this vehicle. CLEAR the DTCs. REPEAT the self-test.
B2656	DVD (Digital Versatile Disk) Error	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.

B2691	Seat Belt Buckle Switch Circuit Fault, Front Driver's Side	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2692	Front Passenger's Seat Belt Buckle Switch Circuit Fault	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2695	Keypad_A Switch Circuit Failure	SJB	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B2696	Keypad_B Switch Circuit Failure	SJB	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B2697	Keypad_C Switch Circuit Failure	SJB	REFER to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
B2729	Cushion Over-Temp Detected	DCSM	REFER to **SEATING** article.
B272A	Passenger Cushion Over-Temp Detected	DCSM	REFER to **SEATING** article.
B272B	Passenger Back Over-Temp Detected	DCSM	REFER to **SEATING** article.
B272C	Driver Differential Temperature Fault	DCSM	REFER to **SEATING** article.
B272D	Passenger Differential Temperature Fault	DCSM	REFER to **SEATING** article.
B2730	Back-Over Temp Detected	DCSM	REFER to **SEATING** article.
B2792	Cross Link Between Firing Loops	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2795	Driver Solar Radiation Sensor Circuit Short to Ground	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B2796	Driver Solar Radiation Sensor Circuit Open	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B2826	Front Evaporator Temp Sensor Circuit Failure	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B2827	Front Evaporator Temp Sensor Short to Ground	HVAC Module	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.
B2844	Ignition Fault	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B2868	Left Front Tire Pressure Sensor Fault	SJB	This DTC is only present when a new SJB is installed, or the SJB is configured. REFER to **WHEELS AND TIRES** article to carry out

			the tire pressure monitoring system (TPMS) sensor training in order to clear this DTC.
B2869	Right Front Tire Pressure Sensor Fault	SJB	This DTC is only present when a new SJB is installed, or the SJB is configured. REFER to **WHEELS AND TIRES** article to carry out the TPMS sensor training in order to clear this DTC.
B2870	Right Rear Tire Pressure Sensor Fault	SJB	This DTC is only present when a new SJB is installed, or the SJB is configured. REFER to **WHEELS AND TIRES** article to carry out the TPMS sensor training in order to clear this DTC.
B2871	Left Rear Tire Pressure Sensor Fault	SJB	This DTC is only present when a new SJB is installed, or the SJB is configured. REFER to **WHEELS AND TIRES** article to carry out the TPMS sensor training in order to clear this DTC.
B2872	Tire Pressure Sensor Fault	SJB	REFER to **WHEELS AND TIRES** article.
B2879	Fuel Tank Jet Pump Fault	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B287A	Tire Pressure System Fault	SJB	REFER to **WHEELS AND TIRES** article.
B2900	VIN Mismatch	4X4 Control Module	REFER to **MODULE CONFIGURATION** article.
B2913	Audio Subwoofer Not Connected	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B2913	Audio Subwoofer Not Connected	DSP Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B2924	Audio Button Stuck	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B2925	Subwoofer Speaker Short Circuit	DSP Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B292A	Subwoofer #2 Speaker Short Circuit	DSP Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B2947	Global Opening/Closing Circuit Open	SJB	REFER to **GLASS, FRAMES AND MECHANISMS** article.
B2949	Global Opening/Closing Circuit Short to Battery	SJB	REFER to **GLASS, FRAMES AND MECHANISMS** article.
B2965	Audio System Speaker Circuit Fault	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
B2965	Audio System Speaker Circuit Fault	DSP Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
C1093	Traction Control Disable Switch Circuit Failure	IC	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
	ABS Hydraulic Pump Motor		REFER to **VEHICLE DYNAMIC**

C1095	Circuit Failure	ABS Module	**SYSTEMS** article.
C1125	Brake Fluid Level Sensor Input Circuit Failure	SJB	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
C1145	Speed Wheel Sensor RF Input Circuit Failure	ABS Module	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
C1155	Speed Wheel Sensor LF Input Circuit Failure	ABS Module	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
C1165	Speed Wheel Sensor RR Input Circuit Failure	ABS Module	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
C1175	Speed Wheel Sensor LR Input Circuit Failure	ABS Module	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
C1233	Speed Wheel LF Input Signal Missing	ABS Module	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
C1234	Speed Wheel RF Input Signal Missing	ABS Module	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
C1235	Speed Wheel RR Input Signal Missing	ABS Module	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
C1236	Speed Wheel LR Input Signal Missing	ABS Module	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
C1284	Oil Pressure Switch Failure	SJB	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
C1414	Incorrect Module Design Level	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
C1699	Left Rear Sensor Circuit Short to Vbat	PAM	REFER to **PARKING AID** article.
C1700	Left Rear Sensor Circuit Failure or Blockage	PAM	REFER to **PARKING AID** article.
C1701	Left Rear Sensor Circuit Fault	PAM	REFER to **PARKING AID** article.
C1702	Right Rear Sensor Circuit Short to Vbat	PAM	REFER to **PARKING AID** article.
C1703	Right Rear Sensor Circuit Failure or Blockage	PAM	REFER to **PARKING AID** article.
C1704	Right Rear Sensor Circuit Fault	PAM	REFER to **PARKING AID** article.
C1705	Left Rear Center Sensor Circuit Short to Vbat	PAM	REFER to **PARKING AID** article.
C1706	Left Rear Center Sensor Circuit Failure	PAM	REFER to **PARKING AID** article.
C1707	Left Rear Center Sensor Circuit Fault	PAM	REFER to **PARKING AID** article.
C1708	Right Rear Center Sensor	PAM	REFER to **PARKING AID** article.

	Circuit Short to Vbat		
C1709	Right Rear Center Sensor Circuit Failure	PAM	REFER to **PARKING AID** article.
C1710	Right Rear Center Sensor Circuit Fault	PAM	REFER to **PARKING AID** article.
C1742	Rear Sounder Circuit Failure	PAM	REFER to **PARKING AID** article.
C1743	Rear Sounder Circuit Short to Vbatt	PAM	REFER to **PARKING AID** article.
C1941	Zero Seat Weight Test Failure	OCSM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article
C1946	Front Driver's Seat Track Position Switch Circuit Open	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
C1947	Front Driver's Seat Track Position Switch Circuit Short to Ground	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
C1948	Front Driver's Seat Track Position Switch Circuit Resistance Out of Range	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
C1981	Front Driver's Seat Track Position Switch Circuit Fault	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
C1991	Module Calibration Failure	ABS Module	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
C1992	Vehicle Speed Circuit Failure	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
C1992	Vehicle Speed Circuit Failure	DSP Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
C2780	ECU in Manufacturer Sub-State	SJB	**NOTE:** **If DTC B2477 is also present, REFER to the Action for DTC B2477 in this DTC Chart.** This DTC is only present when a new SJB is installed, or the SJB is configured. REFER to **WHEELS AND TIRES** article to carry out the TPMS sensor training, then CARRY OUT the SJB self-test in order to clear this DTC.
C2784	RAM Checksum Failure	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
P0512	Starter Request Circuit	PCM	REFER to **STARTING SYSTEM** article.
P0562	System Voltage Low	Transmission Control Module (TCM) (6 Speed Transaxle)	REFER to the **Introduction - Gasoline Engines** article.
		TCM (6 Speed	REFER to the **Introduction - Gasoline

P0563	System Voltage High	Transaxle)	**Engines** article.
P0601	Internal Control Module Memory Check Sum Error	TCM (6 Speed Transaxle)	REFER to the **Introduction - Gasoline Engines** article.
P0603	Internal Control Module Keep Alive Memory (KAM) Error	TCM (6 Speed Transaxle)	REFER to the **Introduction - Gasoline Engines** article.
P0604	Internal Control Module Random Access Memory (RAM) Error	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0604	Internal Control Module Random Access Memory (RAM) Error	TCM (6 Speed Transaxle)	REFER to the **Introduction - Gasoline Engines** article.
P0605	Internal Control Module Read Only Memory (ROM) Error	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0625	Generator Field Terminal Circuit Low	PCM	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
P0626	Generator Field Terminal Circuit High	PCM	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
P0706	Transmission Range Sensor A Circuit Range/Performance	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0706	Transmission Range Sensor A Circuit Range/Performance	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0707	Transmission Range Sensor A Circuit Low	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0707	Transmission Range Sensor A Circuit Low	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0708	Transmission Range Sensor A Circuit High	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0708	Transmission Range Sensor A Circuit High	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0711	Transmission Fluid Temperature Sensor A Circuit Range/Performance	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0711	Transmission Fluid Temperature Sensor A Circuit Range/Performance	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0712	Transmission Fluid Temperature Sensor A	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5**

	Circuit Low		article.
P0712	Transmission Fluid Temperature Sensor A Circuit Low	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0713	Transmission Fluid Temperature Sensor A Circuit High	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0713	Transmission Fluid Temperature Sensor A Circuit High	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0715	Turbine/Input Shaft Speed Sensor A Circuit	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0717	Turbine/Input Shaft Speed Sensor A Circuit No Signal	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0720	Output Shaft Speed Sensor Circuit	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0722	Output Shaft Speed Sensor Circuit No Signal	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0729	Gear 6 Incorrect Ratio	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0730	Incorrect Gear Ratio	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0731	Gear 1 Incorrect Ratio	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0731	Gear 1 Incorrect Ratio	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0732	Gear 2 Incorrect Ratio	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0732	Gear 2 Incorrect Ratio	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0733	Gear 3 Incorrect Ratio	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0733	Gear 3 Incorrect Ratio	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN**

			AW21 article.
P0734	Gear 4 Incorrect Ratio	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0734	Gear 4 Incorrect Ratio	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0735	Gear 5 Incorrect Ratio	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0735	Gear 5 Incorrect Ratio	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0736	Reverse Incorrect Ratio	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0741	Torque Converter Clutch Solenoid Circuit Performance Or Stuck Off	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0742	Torque Converter Clutch Solenoid Circuit Stuck On	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0744	Torque Converter Clutch Solenoid Circuit Intermittent	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0745	Pressure Control Solenoid A	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0751	Shift Solenoid A Performance or Stuck Off	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0752	Shift Solenoid A Stuck On	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0753	Shift Solenoid A Electrical	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0756	Shift Solenoid B Performance or Stuck Off	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0757	Shift Solenoid B Stuck On	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0758	Shift Solenoid B Electrical	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5**

			article.
P0761	Shift Solenoid C Performance or Stuck Off	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0762	Shift Solenoid C Stuck On	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0763	Shift Solenoid C Electrical	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0766	Shift Solenoid D Performance or Stuck Off	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0767	Shift Solenoid D Stuck On	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0768	Shift Solenoid D Electrical	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0771	Shift Solenoid E Performance or Stuck Off	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0772	Shift Solenoid E Stuck On	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0773	Shift Solenoid E Electrical	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0777	Pressure Control Solenoid B Stuck On	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0778	Pressure Control Solenoid B Electrical	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0780	Shift Malfunction	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0791	Intermediate Shaft Speed Sensor A Circuit	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0812	Reverse Input Circuit	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
P0817	Starter Disable Circuit/Open	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.

P0841	Transmission Fluid Pressure Sensor/Switch A Circuit Range/Performance	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0882	TCM Power Input Signal Low	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0894	Transmission Component Slipping	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P0961	Pressure Control Solenoid A Control Circuit Range/Performance	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0962	Pressure Control Solenoid A Control Circuit Low	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0963	Pressure Control Solenoid A Control Circuit High	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0973	Shift Solenoid A Control Circuit Low	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0974	Shift Solenoid A Control Circuit High	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0976	Shift Solenoid B Control Circuit Low	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0977	Shift Solenoid B Control Circuit High	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0978	Shift Solenoid C Control Circuit Range/Performance	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0979	Shift Solenoid C Control Circuit Low	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0980	Shift Solenoid C Control Circuit High	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0981	Shift Solenoid D Control Circuit Range/Performance	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0982	Shift Solenoid D Control Circuit Low	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.

P0983	Shift Solenoid D Control Circuit High	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0984	Shift Solenoid E Control Circuit Range/Performance	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0985	Shift Solenoid E Control Circuit Low	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0986	Shift Solenoid E Control Circuit High	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0997	Shift Solenoid F Control Circuit Range/Performance	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0998	Shift Solenoid F Control Circuit Low	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P0999	Shift Solenoid F Control Circuit High	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P1260	Theft Detected, Vehicle Immobilized	PCM	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
P1576	Pedal Position Not Available	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P1635	Tire/Axle Out of Acceptable Range	4X4 Control Module	REFER to **MODULE CONFIGURATION** article.
P1657	CAN Link Chip Malfunction	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P1700	Transmission Indeterminate Failure (Failed to Neutral)	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P1701	Reverse Engagement Error	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P1719	Engine Torque Signal	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P1783	Transmission Fluid Pressure Sensor/Switch A Circuit Range/Performance	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P1824	4-Wheel Drive Clutch Relay Circuit Failure	4X4 Control Module	REFER to **FOUR WHEEL DRIVE (4WD) SYSTEMS** article.

P1825	4-Wheel Drive Clutch Relay Open Circuit	4X4 Control Module	REFER to **FOUR WHEEL DRIVE (4WD) SYSTEMS** article.
P1919	Engine Coolant Temperature Signal	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P1920	Engine Speed Signal	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P2544	Torque Management Request Input Signal A	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P2707	Shift Solenoid F Performance or Stuck Off	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P2708	Shift Solenoid F Stuck On	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P2709	Shift Solenoid F Electrical	TCM (FNR5 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
P2757	Torque Converter Clutch Pressure Control Solenoid Control Circuit Perf or Stuck Off	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P2758	Torque Converter Clutch Pressure Control Solenoid Stuck On	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P2762	Torque Converter Clutch Pressure Control Solenoid Control Circuit Range / Perf	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P2763	Torque Converter Clutch Pressure Control Solenoid Control Circuit High	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
P2764	Torque Converter Clutch Pressure Control Solenoid Control Circuit Low	TCM (6 Speed Transaxle)	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
PXXXX	All other DTCs	PCM	REFER to the **Introduction - Gasoline Engines** article.
U0002	High Speed CAN Communication Bus Performance	IC	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0020	Low Speed CAN Communication Bus Performance	IC	REFER to **MODULE COMMUNICATIONS NETWORK** article.
	Control Module		REFER to **MODULE**

U0073	Communication Bus A Off	HVAC Module	**COMMUNICATIONS NETWORK** article.
U0073	Control Module Communication Bus A Off	SJB	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0073	Control Module Communication Bus A Off	TCM (FNR5 Speed Transaxle)	REFER to the **Introduction - Gasoline Engines** article.
U0073	Control Module Communication Bus A Off	TCM (6 Speed Transaxle)	REFER to the **Introduction - Gasoline Engines** article.
U0100	Lost Communication With ECM/PCM	4X4 Control Module	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0100	Lost Communication With ECM/PCM	OCSM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article (late build vehicles only).
U0100	Lost Communication With ECM/PCM	TCM (FNR5 Speed Transaxle)	REFER to the **Introduction - Gasoline Engines** article.
U0100	Lost Communication With ECM/PCM	TCM (6 Speed Transaxle)	REFER to the **Introduction - Gasoline Engines** article.
U0101	Lost Communication with TCM	4X4 Control Module	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	4X4 Control Module	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0140	Lost Communication With Body Control Module (GEM)	ACM	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0140	Lost Communication With Body Control Module (GEM)	HVAC Module	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0140	Lost Communication With Body Control Module (GEM)	PAM	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0151	Lost Communication With Restraints Control Module	OCSM	REFER to **MODULE COMMUNICATIONS NETWORK** article (late build vehicles only).
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	4X4 Control Module	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	ACM	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0155	Lost Communication With Instrument Panel Cluster	HVAC Module	REFER to **MODULE COMMUNICATIONS NETWORK**

	(IC) Control Module		article.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	DSP Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	PAM	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0159	Lost Communication With Parking Assist Control Module (PAM)	ACM	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0184	Lost Communication With Radio (ACM)	APIM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0184	Lost Communication With Radio (ACM)	DSP Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0184	Lost Communication With Radio (ACM)	SDARS Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0193	Lost Communication With Digital Audio Control Module (SDARS)	ACM	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	APIM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	DSP Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0196	Lost Communication With Entertainment Control Module - Rear (AUX)	SDARS Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0197	Lost Communication With Telephone Control Module	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0197	Lost Communication With Telephone Control Module	DSP Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0197	Lost Communication With Telephone Control Module	SDARS Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0238	Lost Communication With Digital Audio Control Module "D" (DSP)	ACM	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0246	Lost Communication With Seat Control Module (DCSM)	HVAC Module	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0249	Lost Communication With Entertainment Control	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.

	Module - Rear "B" (RCU)		
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	APIM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0249	Lost Communication With Entertainment Control Module - Rear "B" (RCU)	SDARS Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0255	Lost Communication With Front Controls Interface Module	APIM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0255	Lost Communication With Front Controls Interface Module	SDARS Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0256	Lost Communication With Front Display Interface Module	APIM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0256	Lost Communication With Front Display Interface Module	SDARS Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U0300	Internal Control Module Software Incompatibility	RCM	REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
U0401	Invalid Data Received from ECM/PCM A	4X4 Control Module	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0402	Invalid Data Received from TCM	4X4 Control Module	REFER to **MODULE COMMUNICATIONS NETWORK** article.
U0415	Invalid Data Received from Anti-Lock Brake System (ABS) Control Module	4X4 Control Module	REFER to **VEHICLE DYNAMIC SYSTEMS** article.
U1900	CAN Communication Bus Fault - Receive Error	ABS Module	REPAIR all other DTCs first. CLEAR the DTCs. CYCLE the key OFF then ON and wait 10 seconds. REPEAT the self-test. If DTC U1900 is still present, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U1900	CAN Communication Bus Fault - Receive Error	DSM	REPAIR all other DTCs first. CLEAR the DTCs. CYCLE the key OFF then ON and wait 10 seconds. REPEAT the self-test. If DTC U1900 is still present, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U1900	CAN Communication Bus Fault - Receive Error	IC	REPAIR all other DTCs first. CLEAR the DTCs. CYCLE the key OFF then ON and wait 10 seconds. REPEAT the self-test. If DTC U1900 is still present, REFER to

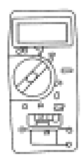
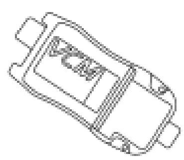
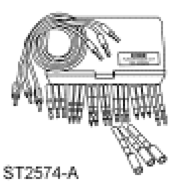
			MODULE COMMUNICATIONS NETWORK article.
U1900	CAN Communication Bus Fault - Receive Error	OCSM	REPAIR all other DTCs first. CLEAR the DTCs. CYCLE the key OFF then ON and wait 10 seconds. REPEAT the self-test. If DTC U1900 is still present, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U1900	CAN Communication Bus Fault - Receive Error	RCM	REPAIR all other DTCs first. CLEAR the DTCs. CYCLE the key OFF then ON and wait 10 seconds. REPEAT the self-test. If DTC U1900 is still present, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U1900	CAN Communication Bus Fault - Receive Error	SJB	REPAIR all other DTCs first. CLEAR the DTCs. CYCLE the key OFF then ON and wait 10 seconds. REPEAT the self-test. If DTC U1900 is still present, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U1901	CAN Network #2 Communication Bus Fault - Receive Error	IC	REPAIR all other DTCs first. CLEAR the DTCs. CYCLE the key OFF then ON and wait 10 seconds. REPEAT the self-test. If DTC U1901 is still present, REFER to **MODULE COMMUNICATIONS NETWORK** article.
U2013	Compass Module is not Responding	IC	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
U2023	Fault Received From External Node	ABS Module	RETRIEVE and FOLLOW non-network DTCs from other modules.
U2023	Fault Received From External Node	IC	RETRIEVE and FOLLOW non-network DTCs from other modules.
U2023	Fault Received From External Node	OCSM	RETRIEVE and FOLLOW non-network DTCs from other modules (late build vehicles only).
U2050	No Application Present	4X4 Control Module	REFER to **MODULE CONFIGURATION** article.
U2050	No Application Present	ABS Module	REFER to **MODULE CONFIGURATION** article.
U2050	No Application Present	ACM	REFER to **MODULE CONFIGURATION** article.
U2050	No Application Present	APIM	REFER to **MODULE CONFIGURATION** article.
U2050	No Application Present	HVAC Module	REFER to **MODULE CONFIGURATION** article.

U2050	No Application Present	DCSM	REFER to **MODULE CONFIGURATION** article.
U2050	No Application Present	DDM	REFER to **MODULE CONFIGURATION** article.
U2050	No Application Present	DSM	REFER to **MODULE CONFIGURATION** article.
U2050	No Application Present	DSP Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U2050	No Application Present	IC	REFER to **MODULE CONFIGURATION** article.
U2050	No Application Present	OCSM	REFER to **MODULE CONFIGURATION** article.
U2050	No Application Present	RCM	REFER to **MODULE CONFIGURATION** article.
U2050	No Application Present	SDARS Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U2050	No Application Present	SJB	CONFIGURE the SJB. REFER to **MODULE CONFIGURATION** article. CLEAR the DTCs. RETRIEVE the DTCs and VERIFY successful module configuration. If DTC U2050 is retrieved again, INSTALL a new SJB. REFER to **Smart Junction Box (SJB)**. REPEAT the self-test.
U2050	No Application Present	TCM (FNR5 Speed Transaxle)	INSTALL a new transmission control module (TCM). REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.
U2050	No Application Present	TCM (6 Speed Transaxle)	INSTALL a new transmission control module (TCM). REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.
U2051	One or More Calibration Files Missing / Corrupt	4X4 Control Module	REFER to **FOUR WHEEL DRIVE (4WD) SYSTEMS** article.
U2051	One or More Calibration Files Missing / Corrupt	ACM	REFER to **MODULE CONFIGURATION** article.
U2051	One or More Calibration Files Missing / Corrupt	HVAC Module	REFER to **MODULE CONFIGURATION** article.
U2051	One or More Calibration Files Missing / Corrupt	DSP Module	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U2051	One or More Calibration Files Missing / Corrupt	IC	REFER to **MODULE CONFIGURATION** article.
U2051	One or More Calibration Files Missing / Corrupt	OCSM	REFER to **MODULE CONFIGURATION** article (late build vehicles only).
	One or More Calibration		REFER to **MODULE**

U2051	Files Missing / Corrupt	PAM	**COMMUNICATIONS NETWORK** article.
U2051	One or More Calibration Files Missing / Corrupt	RCM	REFER to **MODULE CONFIGURATION** article.
U2473	Unexpected Vehicle Speed (VSS)	ACM	REFER to **INFORMATION AND ENTERTAINMENT SYSTEMS** article.
U2510	CAN-Invalid Data for Vehicle Security	IC	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
U2511	CAN-Data Mis-Match (Receive Data Does Not Match Expected)	IC	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

DRIVER DOOR MODULE (DDM)

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The driver door module (DDM) is on the controller area network (CAN) communication network. In order to support several vehicle subsystems, the module supports communications between various modules and also supports scan tool communications.

The DDM controls the driver memory power exterior mirror. This feature allows the driver to program personalized mirror positions. Once the driver stores a mirror position, the driver can recall the setting by pressing the corresponding memory switch or by using a programmed remote keyless entry (RKE) transmitter.

Refer to **REAR VIEW MIRRORS** article. The DDM also controls the lock/unlock functions of the driver door lock actuator and receives lock/unlock input information from the door lock key cylinder switch and reset information from the driver door lock actuator on vehicles with memory.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical
• Smart junction box (SJB) fuse 20 (7.5A) • Wiring, terminals or connectors • Driver door module (DDM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power to The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the DDM.
9. If the DTCs retrieved are related to the concern, go to **Diagnostic Trouble Code (DTC) Chart**.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

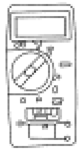
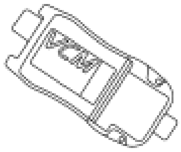
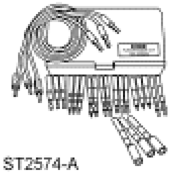
Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the driver door module (DDM)	• Fuse • Wiring, terminals or connectors • DDM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.

DRIVER SEAT MODULE (DSM)

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

The driver seat module (DSM) is on the controller area network (CAN) communication network. To support several vehicle subsystems, the module permits intermodule and scan tool communications.

The DSM controls the memory driver seat and the passenger memory power exterior mirror. This passenger memory power exterior mirror feature allows the driver to program personalized mirror positions. Once the driver stores a memory position, the driver can recall the setting by pressing the corresponding memory switch or by using a programmed remote keyless entry (RKE) transmitter. Refer to **SEATING** article.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical
• Battery junction box (BJB) fuses: ○ 15 (10A) ○ 32 (30A) • Wiring, terminals or connectors • Driver seat module (DSM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power to The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the DSM.
9. If the DTCs retrieved are related to the concern, go to **Diagnostic Trouble Code (DTC) Chart**.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

Symptom Chart

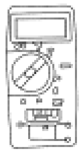
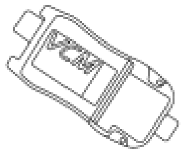
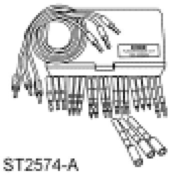
Symptom Chart

Condition	Possible Sources	Action
	• Fuse	

• No communication with the driver seat module (DSM)	• Wiring, terminals or connectors • DSM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.

SMART JUNCTION BOX (SJB)

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Inspection and Verification

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical
• Battery junction box (BJB) fuse 19 (40A) • Wiring, terminals or connectors • Smart junction box (SJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power to The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB.
9. If the DTCs retrieved are related to the concern, go to **Diagnostic Trouble Code (DTC) Chart**.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the smart junction box (SJB)	• Fuse • SJB • Wiring, terminals or connectors	• REFER to **MODULE COMMUNICATIONS NETWORK** article.

REMOVAL AND INSTALLATION

DRIVER DOOR MODULE (DDM)

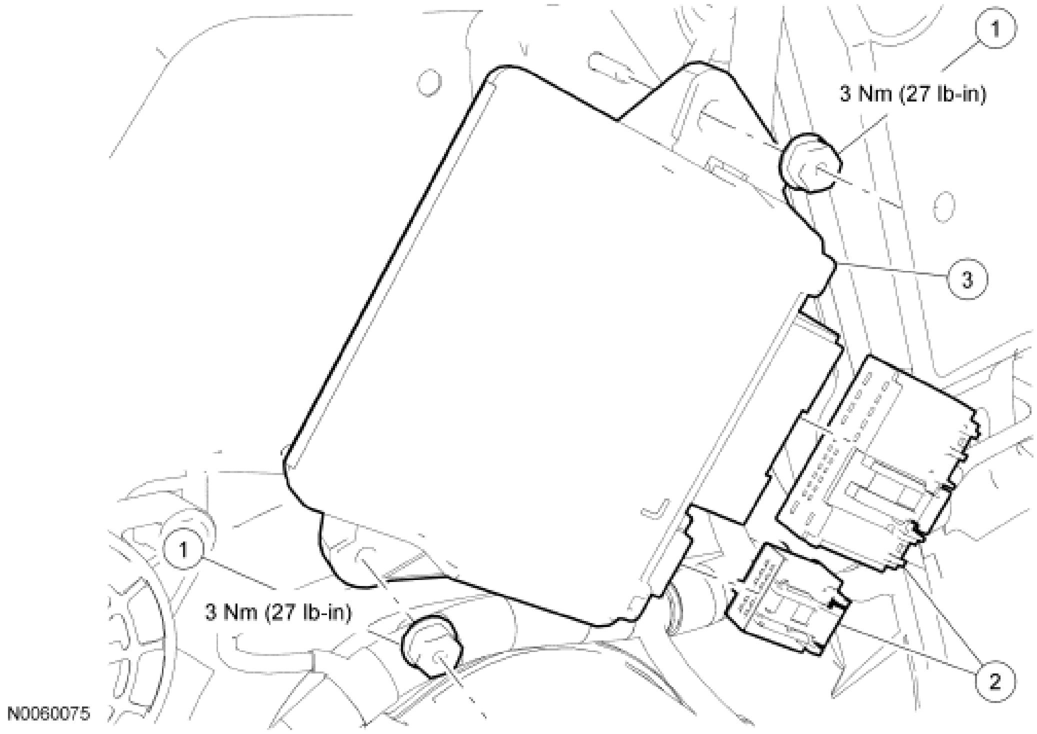


Fig. 1: Exploded View Of Driver Door Module (DDM) With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Driver door module (DDM) nuts (2 required)
2	-	DDM electrical connectors (part of 14631)
3	13C791	DDM

REMOVAL AND INSTALLATION

NOTE: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

NOTE: Prior to the removal of the module, it is necessary to upload the module configuration information to the appropriate scan tool. This information needs to be downloaded into the new module once installed. For additional information, refer to MODULE CONFIGURATION article.

1. Upload the module configuration information from the driver door module (DDM) into the scan tool. For additional information, refer to **MODULE CONFIGURATION** article.
2. Remove the driver door trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
3. Remove the 2 nuts.

- To install, tighten to 3 Nm (27 lb-in).

4. Disconnect the 2 electrical connectors and remove the DDM.
5. To install, reverse the removal procedure.
   - Download the DDM configuration from the scan tool into the new DDM. For additional information, refer to **MODULE CONFIGURATION** article.

DRIVER SEAT MODULE (DSM)

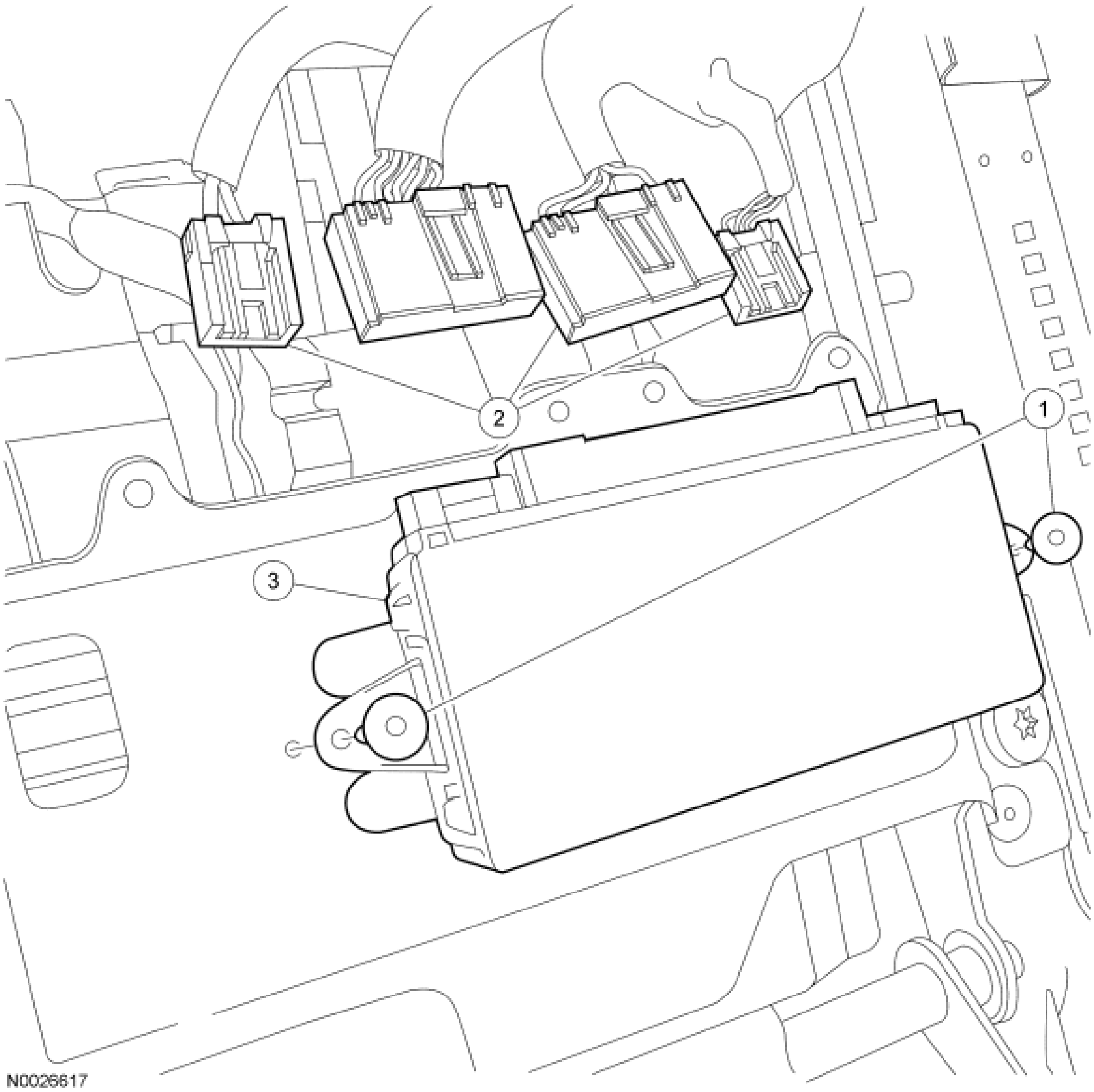


Fig. 2: Exploded View Of Driver Seat Module (DSM)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Driver seat module (DSM) rivets (2 required)

2	-	DSM electrical connectors (part of 14A699)
3	13C789	DSM

REMOVAL AND INSTALLATION

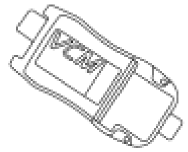
NOTE: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

NOTE: Prior to the removal of the module, it is necessary to upload the module configuration information to the appropriate scan tool. This information needs to be downloaded into the new module once installed. For additional information, refer to MODULE CONFIGURATION article.

1. Upload the module configuration information from the driver seat module (DSM) into the scan tool. For additional information, refer to **MODULE CONFIGURATION** article.
2. Disconnect the battery. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Remove the driver seat. For additional information, refer to **SEATING** article.
4. Drill out the 2 rivets.
5. Disconnect the 4 electrical connectors and remove the DSM.
6. To install, reverse the removal procedure.
   - Download the DSM configuration from the scan tool into the new DSM. For additional information, refer to **MODULE CONFIGURATION** article.

SMART JUNCTION BOX (SJB)

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

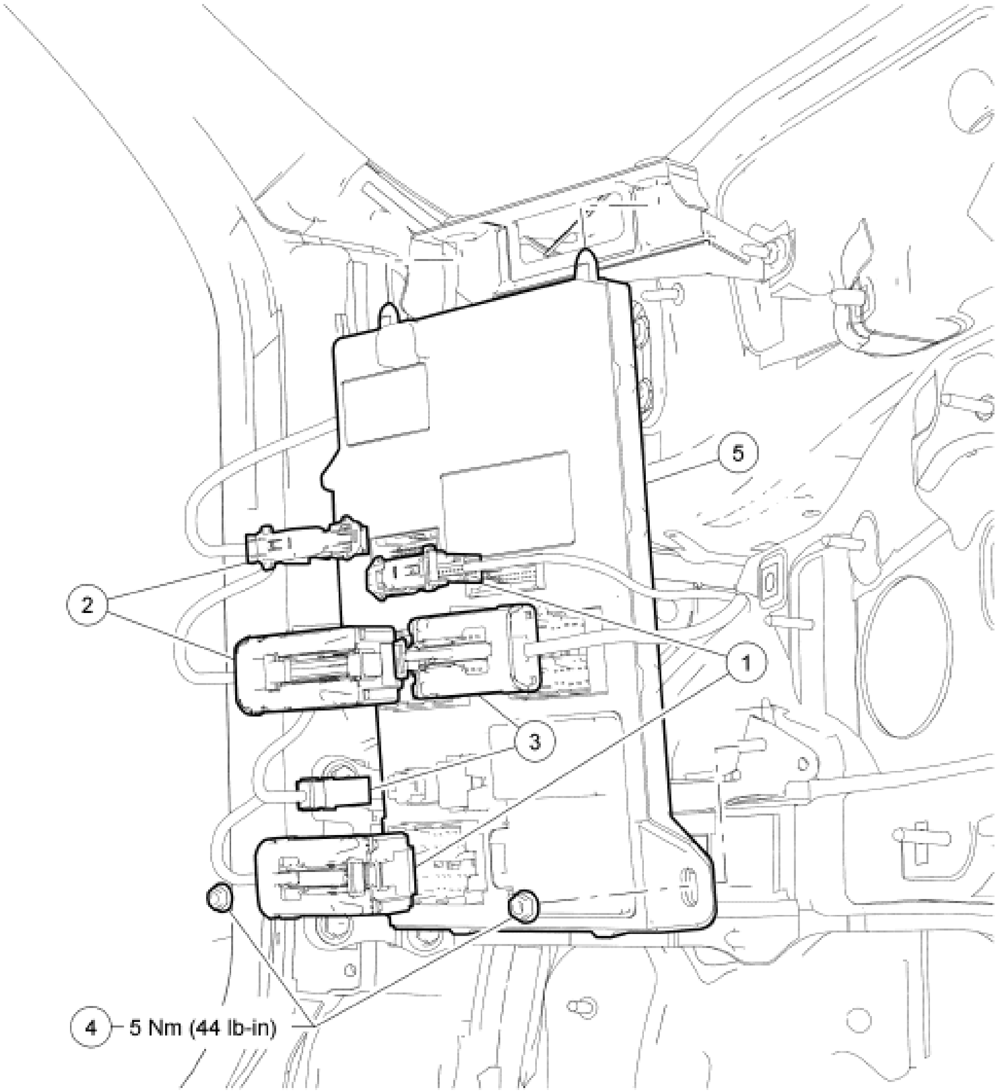


Fig. 3: Exploded View Of Smart Junction Box (SJB) With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Smart junction box (SJB) electrical connectors (part of 14401)
2	-	SJB electrical connectors (part of 14A005)
3	-	SJB electrical connectors (part of 14290)
4	-	SJB nuts (2 required)
5	-	SJB

REMOVAL

NOTE: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage to the module may result.

NOTE: Prior to the removal of the module, it is necessary to upload the module configuration information to a scan tool. This information must be downloaded into the new SJB after installation. For additional information, refer to <u>MODULE CONFIGURATION</u> article.

NOTE: The tire pressure monitoring system (TPMS) functionality is integral to the SJB.

NOTE: This step is only necessary if the SJB is being replaced.

NOTE: A new SJB is delivered in a "manufacturing mode" with 7 pre-set DTCs. A successful configuration of the SJB, then a successful TPMS sensor training, then a successful self-test including the clearing of all DTCs is required in order to clear the 7 pre-set manufacturing mode DTCs. The 7 manufacturing mode DTCs are:

- **B106D (Tire Pressure Monitor System [TPMS] Initiators Not Configured) This DTC is present when the SJB is not configured, even on applications that are not equipped with initiators.**
- **B2477 (Module Configuration Failure)**
- **B2868 (Left Front Tire Pressure Sensor Fault)**
- **B2869 (Right Front Tire Pressure Sensor Fault)**
- **B2870 (Right Rear Tire Pressure Sensor Fault)**
- **B2871 (Left Rear Tire Pressure Sensor Fault)**
- **C2780 (ECU in Manufacturer Sub-State)**

1. Upload the module configuration information from the SJB into the scan tool. For additional information, refer to **<u>MODULE CONFIGURATION</u>** article.
2. Disconnect the 6 electrical connectors.
3. Remove the 2 nuts and the SJB.

INSTALLATION

1. Position the SJB and install the 2 nuts.
   - Tighten to 5 Nm (44 lb-in).

NOTE: If the SJB is not being replaced, this is the last step that is necessary.

2. Connect the 6 electrical connectors.

NOTE: When successful, this step provides the calibration necessary for the SJB operation and clears the DTCs B106D and B2477. The clearing of these DTCs indicates the calibration data has been successfully downloaded to

the SJB.

NOTE: **If the PMI procedure was not followed when a new SJB was installed, the remote keyless entry (RKE) function (from the integrated key head transmitter [IKT]) of the SJB must be programmed, or the IKT RKE functions will be inoperative. IKTs can be programmed to the new SJB by cycling each IKT key to the ON position for a minimum of 6 seconds. If a new instrument cluster was installed, the IKT keys must be programmed to the new instrument cluster. For additional information, refer to ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS) article.**

3. Download the SJB configuration information from the scan tool to the SJB. For additional information, refer to **MODULE CONFIGURATION** article.

NOTE: **When successful, this step clears DTCs B2868, B2869, B2870 and B2871. The clearing of these DTCs indicates the SJB has recognized the tire pressure sensors during the training procedure.**

4. Train the tire pressure sensors. For additional information, refer to **WHEELS AND TIRES** article.

NOTE: **DTC C2780 will not clear if any other DTCs are present in the SJB.**

5. Carry out the SJB on-demand self-test by clearing the DTCs and then retrieving the DTCs to confirm all DTCs have been cleared.

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Parking Aid - Fusion, Milan & MKZ

SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Azimuth system check object position 1 (P1) and position 5 (P5), distance from sensor	30 cm (12 in) rear
Azimuth system check object position 2 (P2) and position 4 (P4), distance from sensor	91 cm (36 in) rear
Azimuth system check object position 3 (P3), distance from sensor	152 cm (60 in) rear

DESCRIPTION AND OPERATION

PARKING AID

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The parking aid system calculates the distance to an object around the rear of the vehicle by the use of 4 ultrasonic sensors. The parking aid system detects objects behind the vehicle when the REVERSE (R) gear is selected.

The parking aid system consists of:

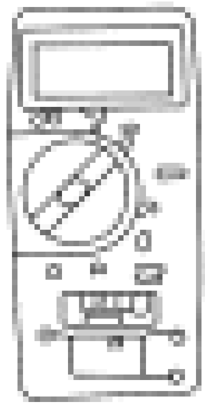
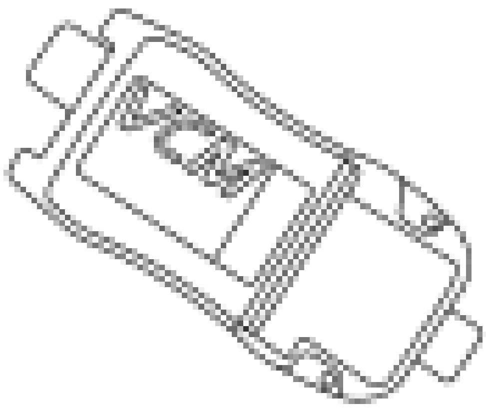
- Parking aid sensors (located in the rear bumper cover)
- Parking aid module (PAM) (located behind the LH rear seat trim panel)
- Parking aid speaker (located under the left side of the parcel shelf)
- Parking aid disable feature (integral to the instrument cluster message center)

DIAGNOSTIC TESTS

PARKING AID

Special Tools

Illustration	Tool Name	Tool Number
	73III Automotive Meter	105-R0057 or equivalent

 ST1137-A		
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The parking aid sensors detect objects approximately 1.6 m (5.3 ft) from the rear of the vehicle, 50 cm (1.6 ft) from the rear side of the vehicle, and 16 cm (6 in) above the ground. The parking aid module (PAM) calculates the distance to an object within the 170 degree semicircular azimuth area around the rear of the vehicle. A variable warning tone is generated from a parking aid speaker attached to the PAM. The parking aid speaker increases its warning tone rate as the vehicle gets closer to an obstacle. When an object is detected within 25 cm (10 in) of the sensors, the warning tone becomes continuous.

The parking aid system is enabled when the ignition switch is in the RUN position and the REVERSE (R) gear is selected. The parking aid system is disabled if a fault is detected in 1 of the 4 sensors, the parking aid speaker, or the PAM. This is indicated by the parking aid disabled warning in the message center.

The PAM is on the medium speed controller area network (MS-CAN) and can be diagnosed with a scan tool. The PAM communicates with the scan tool, the SJB, the audio control module (ACM) and the instrument cluster (IC). The following chart describes network messages used by the parking aid module:

NOTE: Both the medium speed controller area network (MS-CAN) and the high speed controller area network (HS-CAN) are used for intermodule communication. A gateway message is transferred from one network to another network through the instrument cluster (IC). Refer to MODULE COMMUNICATIONS NETWORK article for network communication information.

PARKING AID MODULE (PAM) NETWORK COMMUNICATION MESSAGES

Broadcast Message	Originating Module	Network Type	Receiving Module
Ignition switch position	IC	MS-CAN	PAM
Parking air audio volume cutback command	PAM	MS-CAN	ACM
Parking aid enabled status	IC	MS-CAN	PAM
Parking aid system status	PAM	MS-CAN	IC
Transmission selector (PRNDL) range	TCM	HS-CAN	IC
Transmission selector (PRNDL) range (gateway)	IC	MS-CAN	PAM
Vehicle speed	PCM	HS-CAN	IC
Vehicle speed (gateway)	IC	MS-CAN	PAM

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical
• Smart junction box (SJB) fuse 28 (10A) • Wiring, terminals or connectors • Parking aid module (PAM) • Parking aid sensors • Parking aid speaker

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record the continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the PAM.

NOTE: Follow the non-network DTC diagnostics (B-codes, C-codes, P-codes) prior to the network DTC diagnostics (U-codes).

9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

PARAMETER IDENTIFICATION (PID) CHART

PID	Description
LRI_DIST	Left rear inner sensor distance to object
LRO_DIST	Left rear outer sensor distance to object
RRI_DIST	Right rear inner sensor distance to object
RRO_DIST	Right rear outer sensor distance to object
LRI_ATTEN	Left rear inner sensor attenuation
LRO_ATTEN	Left rear outer sensor attenuation
RRI_ATTEN	Right rear inner sensor attenuation
RRO_ATTEN	Right rear outer sensor attenuation
TRANSGR	Transmission gear position

DTC Charts

PARKING AID MODULE (PAM) DTC CHART

DTC	Description	Action
B1299	Power Supply Sensor Circuit Short to Ground	Go to **Pinpoint Test E**.
B1342	ECU is Faulted	CLEAR the DTCs. REPEAT the parking aid module (PAM) self-test. If DTC B1342 is retrieved again, INSTALL a new PAM. REFER to **Parking Aid Module (PAM)**. CLEAR all DTCs. REPEAT the self-test.
B2477	Module Configuration Failure	The PAM is not configurable. CLEAR the DTCs. REPEAT the PAM self-test. If DTC B2477 is retrieved again, INSTALL a new PAM. REFER to **Parking Aid Module (PAM)**. CLEAR all DTCs. REPEAT the self-test.
C1699	Left Rear Sensor Circuit Short to Vbat	Go to **Pinpoint Test C**.
C1700	Left Rear Sensor Circuit Failure or Blockage	Go to **Pinpoint Test B**.
C1701	Left Rear Sensor Circuit Fault	Go to **Pinpoint Test D**.
C1702	Right Rear Sensor Circuit Short to Vbat	Go to **Pinpoint Test C**.
C1703	Right Rear Sensor Circuit Failure or Blockage	Go to **Pinpoint Test B**.
C1704	Right Rear Sensor Circuit Fault	Go to **Pinpoint Test D**.
C1705	Left Rear Center Sensor Circuit Short to Vbat	Go to **Pinpoint Test C**.
C1706	Left Rear Center Sensor Circuit Failure	Go to **Pinpoint Test B**.
C1707	Left Rear Center Sensor Circuit Fault	Go to **Pinpoint Test D**.
C1708	Right Rear Center Sensor Circuit Short to Vbat	Go to **Pinpoint Test C**.
C1709	Right Rear Center Sensor Circuit Failure	Go to **Pinpoint Test B**.
C1710	Right Rear Center Sensor Circuit Fault	Go to **Pinpoint Test D**.

C1742	Rear Sounder Circuit Failure	Go to **Pinpoint Test F**.
C1743	Rear Sounder Circuit Short to Vbat	Go to **Pinpoint Test F**.
U0140	Lost Communication With Body Control Module (GEM)	Go to **Pinpoint Test G**.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	Go to **Pinpoint Test H**.
U2051	One or More Calibration Files Missing/Corrupt	INSTALL a new PAM. REFER to **Parking Aid Module (PAM)**. CLEAR all DTCs. REPEAT the self-test.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the parking aid module (PAM)	• Fuse • Wiring, terminals or connectors • PAM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• The parking aid is inoperative/does not operate correctly	• Parking aid sensors alignment • PAM • Rear bumper cover	• Go to **Pinpoint Test A**.
• Continuous or intermittent tone when no obstacles or fault codes are present (certain obstacles may appear "stealthy" to the system, depending on geometric shape, size and material)	• Dirty or iced over parking aid sensor (s)	• CLEAN the rear bumper and sensors with high-pressure water.
	• Parking aid sensor bezel(s) or parking aid sensor(s) locked into the rear bumper cover incorrectly • Parking aid sensors are not aligned correctly	• REMOVE and correctly INSTALL the parking aid sensor(s) and or bezel(s) as necessary. REFER to **Parking Aid Sensor**.
	• Parking aid sensor (s) • PAM	• CARRY OUT the azimuth system check and elevation system check. REFER to **Azimuth System Check** and **Elevation System Check**.

• The audio control module (ACM) volume does not decrease when the transmission is selected to reverse and the reverse sensing system is enabled	• Wiring, terminals or connectors • PAM	• Go to **Pinpoint Test I**.

Pinpoint Tests

Pinpoint Test A: The Parking Aid Is Inoperative/Does Not Operate Correctly

Normal Operation

The parking aid system is enabled when the ignition switch is in the RUN position and the REVERSE (R) gear is selected. The parking aid module (PAM) receives reverse gear input from the instrument cluster (IC) through the medium speed controller area network (MS-CAN). Voltage is supplied to the parking aid sensors from the PAM on circuit LMP07 (BU/WH). The PAM supplies ground to the parking aid sensors on circuit RMP07 (GN/WH). The parking aid module (PAM) receives a signal from the parking aid sensors on circuits VMP14 (WH/OG), VMP15 (YE/GN), VMP16 (YE/GY) and VMP17 (YE/OG). The system can be disabled through the message center which is part of the IC.

This pinpoint test is intended to diagnose the following:

- Rear bumper cover
- Parking aid sensors alignment
- PAM

PINPOINT TEST A: THE PARKING AID IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 CHECK THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PAM SELF-TESTS

- Check the PAM DTCs from the continuous and on-demand self-tests.
- **Are any PAM DTCs recorded?**

  YES : REFER to **DTC Charts**.

  NO : Go to A2.

A2 CHECK THE PARKING AID SENSORS FOR CORRECT ALIGNMENT

NOTE: If the vehicle was in a rear end collision, the parking aid sensors may not be aligned correctly.

- Check the bumper for correct alignment.
- Carry out the azimuth system check. Refer to **Azimuth System Check**.

- Carry out the elevation system check. Refer to **Elevation System Check**.
- **Does the parking aid system pass both system checks?**

  YES : Go to A3 .

  NO : REALIGN or INSTALL a new bumper cover. REFER to **BUMPERS** article. If the vehicle was in a rear end collision, further body work may be required to bring the parking aid sensors into correct alignment.

A3 CHECK FOR CORRECT REVERSE GEAR INPUT

- Apply the parking brake.
- Key in ON position.
- Select REVERSE.
- Enter the following diagnostic mode on the diagnostic tool: PAM DataLogger
- Monitor the PAM TRANSGR PID.
- **Does the PID indicate YES (transmission in reverse)?**

  YES : Go to A4.

  NO : INSTALL a new PAM. REFER to **Parking Aid Module (PAM)**. TEST the system for normal operation.

A4 CHECK THE MESSAGE CENTER FOR PARKING AID DISABLE OPERATION

- While observing the instrument cluster (IC) message center, disable and enable the parking aid system.
- **Does the message center display PARK AID OFF when the parking aid system is disabled, and display PARK AID ON when the parking aid system is enabled?**

  YES : Go to A5.

  NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

A5 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PAM. REFER to **Parking Aid Module (PAM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: DTCs C1700, C1703, C1706 And C1709 - Parking Aid Sensor Circuit Failure or Blockage

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Parking Aid for schematic and connector information.

Normal Operation

Voltage is supplied to the parking aid sensors from the parking aid module (PAM) on circuit LMP07 (BU/WH). The PAM supplies ground to the parking aid sensors on circuit RMP07 (GN/WH). The PAM receives a signal from the parking aid sensors on circuits VMP14 (WH/OG), VMP15 (YE/GN), VMP16 (YE/GY) and VMP17 (YE/OG).

DTC Description	Fault Trigger Conditions
C1700 - Left Rear Sensor Circuit Failure or Blockage	A continuous and on-demand DTC that sets when any of the left rear parking aid sensor circuits are open or the sensor signal line is shorted to ground.
C1703 - Right Rear Sensor Circuit Failure or Blockage	A continuous and on-demand DTC that sets when any of the right rear parking aid sensor circuits are open or the sensor signal line is shorted to ground.
C1706 - Left Rear Center Sensor Circuit Failure	A continuous and on-demand DTC that sets when any of the left rear center parking aid sensor circuits are open or the sensor signal line is shorted to ground.
C1709 - Right Rear Center Sensor Circuit Failure	A continuous and on-demand DTC that sets when any of the right rear center parking aid sensor circuits are open or the sensor signal line is shorted to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Parking aid sensor(s)
- Parking aid bumper harness
- PAM

PINPOINT TEST B: DTCs C1700, C1703, C1706 AND C1709 - PARKING AID SENSOR CIRCUIT FAILURE OR BLOCKAGE

NOTE: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 RETRIEVE THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PAM SELF-TESTS

- Check the PAM DTCs from the continuous and on-demand self-tests.
- **Are multiple DTCs recorded?**

  YES : Go to B2.

NO : For DTCs C1700, C1703, C1706 or C1709, go to B3.

For all other DTCs, REFER to **DTC Charts**.

B2 CHECK THE BUMPER WIRING HARNESS

- Inspect the bumper wiring harness for opens, shorts, grounds, or corrosion.
- **Is the bumper wiring harness OK?**

  YES : Go to B3.

  NO : REPAIR or INSTALL a new bumper wiring harness. CLEAR the DTCs. REPEAT the self-test.

B3 CHECK THE SENSOR CIRCUITRY FOR OPENS

- Key in OFF position.
- Disconnect: Suspect Parking Aid Sensor C4009, C4010, C4011 or C4012
- Disconnect: PAM C4014
- Measure the resistance between the PAM C4014, harness side and the suspect parking aid sensor, harness side as follows:

DTC	Rear Sensor	PAM Connector-Pin	Sensor Connector-Pin	Circuit
C1700	LH outer	C4014-9	C4009-1	LMP07 (BU/WH)
C1700	LH outer	C4014-15	C4009-2	VMP15 (YE/GN)
C1700	LH outer	C4014-12	C4009-3	RMP07 (GN/WH)
C1703	RH outer	C4014-9	C4011-1	LMP07 (BU/WH)
C1703	RH outer	C4014-16	C4011-2	VMP17 (YE/OG)
C1703	RH outer	C4014-12	C4011-3	RMP07 (GN/WH)
C1706	LH inner	C4014-9	C4010-1	LMP07 (BU/WH)
C1706	LH inner	C4014-14	C4010-2	VMP14 (WH/OG)
C1706	LH inner	C4014-12	C4010-3	RMP07 (GN/WH)
C1709	RH inner	C4014-9	C4012-1	LMP07 (BU/WH)
C1709	RH inner	C4014-13	C4012-2	VMP16 (YE/GY)
C1709	RH inner	C4014-12	C4012-3	RMP07 (GN/WH)

- **Are the resistances less than 5 ohms?**

  YES : Go to B4.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

B4 CHECK THE SENSOR CIRCUITRY FOR SHORTS TO GROUND

- Measure the resistance between the suspect parking aid sensor, harness side and ground as follows:

DTC	Rear Sensor	Connector-Pin	Circuit
C1700	LH outer	C4009-2	VMP15 (YE/GN)
C1703	RH outer	C4011-2	VMP17 (YE/OG)
C1706	LH inner	C4010-2	VMP14 (WH/OG)
C1709	RH inner	C4012-2	VMP16 (YE/GY)

- **Is the resistance greater than 10,000 ohms?**

  YES : If all of the parking aid sensors recorded DTCs, go to B5.

  If one or more parking aid sensor(s) recorded DTCs, INSTALL a new sensor(s) for the one in question. REFER to **Parking Aid Sensor**. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

B5 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PAM. REFER to **Parking Aid Module (PAM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: DTCs C1699, C1702, C1705 And C1708 - Sensor Circuit Short To Vbat

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Parking Aid for schematic and connector

information.

Normal Operation

Voltage is supplied to the parking aid sensors from the parking aid module (PAM) on circuit LMP07 (BU/WH). The PAM supplies ground to the parking aid sensors on circuit RMP07 (GN/WH). The PAM receives a signal from the parking aid sensors on circuits VMP14 (WH/OG), VMP15 (YE/GN), VMP16 (YE/GY) and VMP17 (YE/OG).

DTC Description	Fault Trigger Conditions
C1699 - Left Rear Sensor Circuit Short to Vbat	A continuous and on-demand DTC that sets when the left rear parking aid sensor signal line is shorted to voltage.
C1702 - Right Rear Sensor Circuit Short to Vbat	A continuous and on-demand DTC that sets when the right rear parking aid sensor signal line is shorted to voltage.
C1705 - Left Rear Center Sensor Circuit Short to Vbat	A continuous and on-demand DTC that sets when the left rear center parking aid sensor signal line is shorted to voltage.
C1708 - Right Rear Center Sensor Circuit Short to Vbat	A continuous and on-demand DTC that sets when the right rear center parking aid sensor signal line is shorted to voltage.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Parking aid sensor(s)
- Parking aid bumper harness
- PAM

PINPOINT TEST C: DTCs C1699, C1702, C1705 AND C1708 - SENSOR CIRCUIT SHORT TO VBAT

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

C1 RETRIEVE THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PAM SELF-TESTS

- Check the PAM DTCs from the continuous and on-demand self-tests.
- **Are multiple DTCs recorded?**

  YES : Go to C2.

  NO : For DTCs C1699, C1702, C1705 or C1708, go to C3.

  For all other DTCs, REFER to **DTC Charts**.

C2 CHECK THE BUMPER WIRING HARNESS

- Inspect the bumper wiring harness for opens, shorts, grounds, or corrosion.
- **Is the bumper wiring harness OK?**

  YES : Go to C3.

  NO : REPAIR or INSTALL a new bumper wiring harness. CLEAR the DTCs. REPEAT the self-test.

C3 CHECK THE SENSOR CIRCUITRY FOR SHORTS TO VOLTAGE

- Key in OFF position.
- Disconnect: Suspect Parking Aid Sensor C4009, C4010, C4011 or C4012
- Disconnect: PAM C4014
- Key in ON position.
- Measure the voltage between the suspect parking aid sensor, harness side and ground as follows:

DTC	Rear Sensor	Connector-Pin	Circuit
C1699	LH outer	C4009-2	VMP15 (YE/GN)
C1702	RH outer	C4011-2	VMP17 (YE/OG)
C1705	LH inner	C4010-2	VMP14 (WH/OG)
C1708	RH inner	C4012-2	VMP16 (YE/GY)

- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to C4.

C4 CHECK THE PARKING AID SENSORS

- Install a known good parking aid sensor(s) for each of the suspect parking aid sensor(s).
- Clear the DTCs. Repeat the self-test.
- Test the system for normal operation.
- **Is the concern still present?**

  YES : If all of the parking aid sensors recorded DTCs, go to C5.

  If one or more parking aid sensor(s) recorded DTCs, INSTALL a new sensor(s) for the one in question. REFER to **Parking Aid Sensor**. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C5 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:
  - corrosion

  - damaged pins
  - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PAM. REFER to **Parking Aid Module (PAM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: DTCs C1701, C1704, C1707 And C1710 - Sensor Circuit Fault

Normal Operation

The parking aid system is enabled when the ignition switch is in the RUN position and the REVERSE (R) gear is selected. The parking aid module (PAM) calculates the distance to an object by the use of 4 ultrasonic sensors mounted in the rear bumper. The parking aid sensors can detect obstructions in the path behind the vehicle.

DTC Description	Fault Trigger Conditions
C1701 - Left Rear Sensor Circuit Fault	A continuous and on-demand DTC that sets when the left rear parking aid sensor has internally failed or has an incorrect attenuation time.
C1704 - Right Rear Sensor Circuit Fault	A continuous and on-demand DTC that sets when the right rear parking aid sensor has internally failed or has an incorrect attenuation time.
C1707 - Left Rear Center Sensor Circuit Fault	A continuous and on-demand DTC that sets when the left rear center parking aid sensor has internally failed or has an incorrect attenuation time.
C1710 - Right Rear Center Sensor Circuit Fault	A continuous and on-demand DTC that sets when the right rear center parking aid sensor has internally failed or has an incorrect attenuation time.

This pinpoint test is intended to diagnose the following:

- Dirty or obstructed parking aid sensor
- Parking aid sensor
- Parking aid bumper harness
- PAM

PINPOINT TEST D: DTCs C1701, C1704, C1707 AND C1710 - SENSOR CIRCUIT FAULT

D1 CHECK THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND PAM SELF-TESTS

- Check the PAM DTCs from the continuous and on-demand self-tests.
- **Are parking aid DTCs other than C1701, C1704, C1707 or C1710 recorded?**

  YES : DIAGNOSE the other DTCs first. REFER to **DTC Charts**.

  NO : Go to D2.

D2 CHECK THE PARKING AID SENSOR OPERATION

NOTE: Make sure the area around the vehicle is clear of anything that might activate the parking aid system.

- Clean the rear bumper and sensors with high-pressure water.
- Carry out the azimuth system check. Refer to **Azimuth System Check**.
- Carry out the elevation system check. Refer to **Elevation System Check**.
- **Does the parking aid system pass both system checks?**

  YES : The system is operating correctly at this time. The concern may have been caused by a dirty or blocked parking aid sensor. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to D3.

D3 CHECK THE PARKING AID SENSOR DISTANCE PIDs

- Make sure the suspect parking aid sensor(s) is flush-mounted in the bezel.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: PAM DataLogger
- With the brake pedal applied, shift the transmission into REVERSE (R) and monitor the parking aid sensor distance PID. The PID will read 255 cm (100 in) on a correctly functioning sensor.
- **Does the PID read 255 cm (100 in)?**

  YES : Go to D4.

  NO : Go to D5.

D4 CHECK THE PARKING AID SENSOR ATTENUATION PIDs

- Check the parking aid sensor attenuation PIDs.
- **Do the attenuation PIDs read between 0 and 16?**

  YES : Go to D6.

  NO : Go to D5.

D5 INSTALL A KNOWN GOOD SENSOR

- Install a known good sensor for the suspect parking aid sensor.
- Key in ON position.
- Clear the DTCs. Repeat the self-test. Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : Go to D6.

  NO : INSTALL a new parking aid sensor. REFER to **Parking Aid Sensor**. CLEAR the DTCs. REPEAT the self-test.

D6 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PAM. REFER to **Parking Aid Module (PAM)**. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test E: DTC B1299 - Power Supply Sensor Circuit Short To Ground

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Parking Aid for schematic and connector information.

Normal Operation

Voltage is supplied to the parking aid sensors from the parking aid module (PAM) on circuit LMP07 (BU/WH). The PAM supplies ground to the parking aid sensors on circuit RMP07 (GN/WH).

- DTC B1299 (Power Supply Sensor Circuit Short to Ground) - sets when the sensor power supply circuit is shorted to ground or to circuit RMP07 (GN/WH).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Parking aid sensor(s)
- Parking aid bumper harness
- PAM

PINPOINT TEST E: DTC B1299 - POWER SUPPLY SENSOR CIRCUIT SHORT TO GROUND

NOTE:	**Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

E1 CHECK THE BUMPER WIRING HARNESS

- Inspect the bumper wiring harness for opens, shorts, grounds, or corrosion.
- **Is the bumper wiring harness OK?**

  YES : Go to E2.

  NO : REPAIR or INSTALL a new bumper wiring harness. CLEAR the DTCs. REPEAT the self-

test.

E2 CHECK THE LH OUTER SENSOR FOR AN INTERNAL SHORT

- Key in OFF position.
- Disconnect: Parking Aid Sensor C4009
- Key in ON position.
- Clear the DTCs. Repeat the on-demand self-test.
- **Is DTC B1299 still present?**

YES : Go to E3.

NO : INSTALL a new LH outer parking aid sensor. REFER to **Parking Aid Sensor**. CLEAR the DTCs. REPEAT the self-test.

E3 CHECK THE RH OUTER SENSOR FOR AN INTERNAL SHORT

- Key in OFF position.
- Disconnect: Parking Aid Sensor C4011
- Key in ON position.
- Clear the DTCs. Repeat the on-demand self-test.
- **Is DTC B1299 still present?**

YES : Go to E4.

NO : INSTALL a new RH outer parking aid sensor. REFER to **Parking Aid Sensor**. CLEAR the DTCs. REPEAT the self-test.

E4 CHECK THE LH INNER SENSOR FOR AN INTERNAL SHORT

- Key in OFF position.
- Disconnect: Parking Aid Sensor C4010
- Key in ON position.
- Clear the DTCs. Repeat the on-demand self-test.
- **Is DTC B1299 still present?**

YES : Go to E5.

NO : INSTALL a new LH inner parking aid sensor. REFER to **Parking Aid Sensor**. CLEAR the DTCs. REPEAT the self-test.

E5 CHECK THE RH INNER SENSOR FOR AN INTERNAL SHORT

- Key in OFF position.
- Disconnect: Parking Aid Sensor C4012
- Key in ON position.
- Clear the DTCs. Repeat the on-demand self-test.
- **Is DTC B1299 still present?**

YES : Go to E6.

NO : INSTALL a new RH inner parking aid sensor. REFER to **Parking Aid Sensor**. CLEAR the DTCs. REPEAT the self-test.

E6 CHECK CIRCUIT LMP07 (BU/WH) FOR A SHORT TO GROUND

- Key in OFF position.

- Disconnect: Parking Aid Module C4014

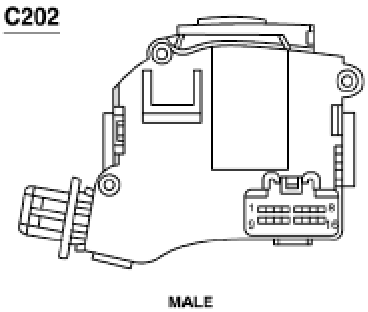


Fig. 1: Checking Circuit LMP07 (BU/WH) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PAM C4014-9, circuit LMP07 (BU/WH), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to E7.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E7 CHECK CIRCUIT LMP07 (BU/WH) FOR A SHORT TO CIRCUIT RMP07 (GN/WH)

- Key in OFF position.

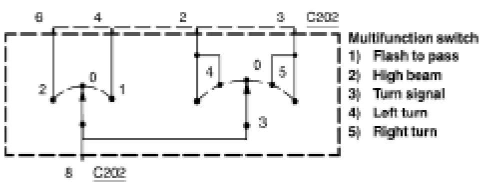


Fig. 2: Checking Circuit LMP07 (BU/WH) For A Short To Circuit RMP07 (GN/WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the parking aid module C4014-9, circuit LMP07 (BU/WH), harness side and the PAM C4014-12, circuit RMP07 (GN/WH).
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to E8.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E8 CHECK FOR CORRECT PAM OPERATION

- Disconnect the parking aid module connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the parking aid module connector and make sure it seats correctly.

- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new parking aid module. REFER to **Parking Aid Module (PAM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: DTC C1742 And C1743 - Rear Sounder Circuit Short To Voltage & Rear Sounder Circuit Failure

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Parking Aid for schematic and connector information.

Normal Operation

A 750 Hz variable warning tone is generated from a parking aid speaker. The parking aid speaker increases the warning tone rate as the vehicle gets closer to an obstacle. Circuits CMP09 (BN/BU) and RMP09 (BU/GN) provide the connection between the parking aid module (PAM) and speaker.

- DTC C1742 (Rear Sounder Circuit Failure) - sets when the sounder circuit is open or shorted to ground.
- DTC C1743 (Rear Sounder Circuit Short to Vbat) - sets when the sounder circuit is shorted to voltage.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PAM
- Parking aid speaker

PINPOINT TEST F: DTC C1742 - REAR SOUNDER CIRCUIT FAILURE AND DTC C1743 - REAR SOUNDER CIRCUIT SHORT TO VOLTAGE

NOTE: **Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

F1 RETRIEVE THE DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SELF-TESTS

- Key in ON position.
- Retrieve the parking aid module DTCs from the continuous and on-demand self-tests.
- **Is DTC C1742 or C1743 present?**

  YES : Go to F2.

  NO : For all other DTCs, REFER to **DTC Charts**.

F2 MEASURE THE PARKING AID SPEAKER RESISTANCE

- Disconnect: Parking Aid Speaker C4015

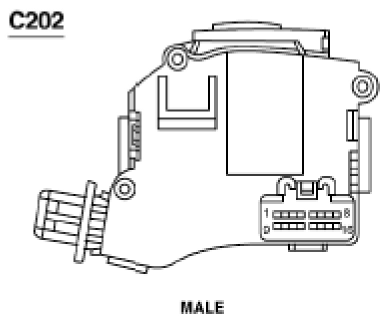


Fig. 3: Measuring Parking Aid Speaker Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between the parking aid speaker pin 1, component side and the parking aid speaker pin 2, component side.
- **Is the resistance between 40 and 60 ohms?**

  YES : If DTC C1742 was recorded, go to F3.

  If DTC C1743 was recorded, go to F7.

  NO : INSTALL a new parking aid speaker. REFER to **Parking Aid Speaker**. CLEAR the DTCs. REPEAT the self-test.

F3 CHECK CIRCUIT CMP09 (BN/BU) FOR A SHORT TO GROUND

- Connect: Parking Aid Speaker C4015
- Disconnect: Parking Aid Module C4014
- Measure the resistance between the PAM C4014-2, circuit CMP09 (BN/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to F5.

  NO : Go to F4.

F4 CHECK CIRCUIT CMP09 (BN/BU) FOR A SHORT TO GROUND WITH THE PARKING AID SPEAKER DISCONNECTED

- Disconnect: Parking Aid Speaker C4015
- Measure the resistance between the PAM C4014-2, circuit CMP09 (BN/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR circuit RMP09 (BU/GN). CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR circuit CMP09 (BN/BU). CLEAR the DTCs. REPEAT the self-test.

F5 CHECK CIRCUIT CMP09 (BN/BU) FOR AN OPEN

- Disconnect: Parking Aid Speaker C4015

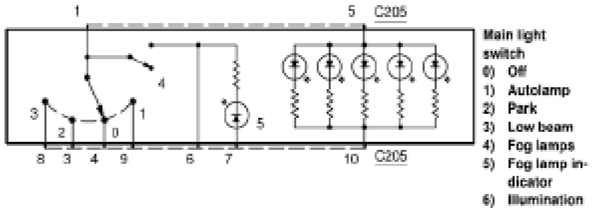


Fig. 4: Checking Circuit CMP09 (BN/BU) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PAM C4014-2, circuit CMP09 (BN/BU), harness side and the parking aid speaker C4015-2, circuit CMP09 (BN/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to F6.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

F6 CHECK CIRCUIT RMP09 (BU/GN) FOR AN OPEN

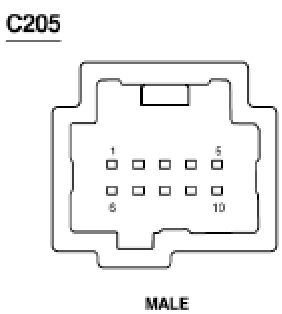


Fig. 5: Checking Circuit RMP09 (BU/GN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PAM C4014-6, circuit RMP09 (BU/GN), harness side and the parking aid speaker C4015-1, circuit RMP09 (BU/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to F8.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

F7 CHECK THE PARKING AID SPEAKER CIRCUITRY FOR SHORTS TO VOLTAGE

- Key in ON position.

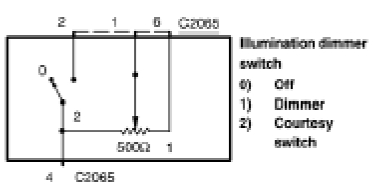


Fig. 6: Checking Parking Aid Speaker Circuitry For Shorts To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the PAM C4014-2, circuit CMP09 (BN/BU), harness side and ground; and between the PAM C4014-6, circuit RMP09 (BU/GN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to F8.

F8 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PAM. The PAM and speaker are serviced as one assembly. REFER to **Parking Aid Module (PAM)**. CLEAR the DTCs. REPEAT the self-test. CARRY OUT the scan tool data link test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: DTC U0140 - Ignition Switch Position Missing

Normal Operation

The parking aid module (PAM) receives the ignition switch state from the smart junction box (SJB) as a network message.

- DTC U0140 (Lost Communication With Body Control Module [GEM])- is a continuous and on-demand DTC that sets in the parking aid module when ignition switch state messages are not received from the SJB.

This pinpoint test is intended to diagnose the following:

- SJB
- Networked data fault

PINPOINT TEST G: DTC U0140 - IGNITION SWITCH POSITION MISSING

G1 CONFIRM THE DTC WILL SET IN CONTINUOUS MEMORY

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Parking Aid Module (PAM) Continuous DTCs
- Clear the DTCs. Operate the system and determine if the concern is still present.

- Retrieve continuous PAM DTCs.
- **Is DTC U0140 present?**

  YES : Go to G2.

  NO : System is operating normally at this time.

G2 CHECK THE IGNITION SWITCH VOLTAGE PID

- Enter the following diagnostic mode on the diagnostic tool: PAM DataLogger
- Check the PAM ignition switch voltage PID (IGN_V).
- **Does the PID match the ignition switch position?**

  YES : REFER to **STEERING COLUMN SWITCHES** article.

  NO : Go to G3.

G3 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test H: DTC U0155 - PRNDL Missing

Normal Operation

The parking aid module (PAM) receives the transmission selector (PRNDL) state from the instrument cluster (IC) as a gateway message from the TCM.

- DTC U0155 (Lost Communication With IC) - is a continuous and on-demand DTC that sets in the parking aid module (PAM) when PRNDL messages are not received from the IC.

This pinpoint test is intended to diagnose the following:

- IC
- Networked data fault

PINPOINT TEST H: DTC U0155 - PRNDL MISSING

H1 CONFIRM THE DTC WILL SET IN CONTINUOUS MEMORY

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: PAM Continuous DTCs
- Clear the DTCs. Operate the system and determine if the concern is still present.
- Retrieve continuous PAM DTCs.
- **Is DTC U0155 present?**

  YES : Go to H2.

  NO : System is operating normally at this time.

H2 VERIFY THE IC PRNDL DISPLAY FUNCTIONS CORRECTLY

- Monitor the IC PRNDL display while moving the gearshift lever through the range of positions.
- **Does the PRNDL match all range positions?**

  YES : Go to H3.

  NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article to diagnose the PRNDL.

H3 CHECK FOR CORRECT IC OPERATION

- Disconnect the IC connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the IC connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new IC. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test I: The Audio Volume Cutback Command Is Inoperative

Normal Operation

With the ignition switch in the RUN position and the gear selector in REVERSE (R), the parking aid system calculates the distance to an object by the use of a radar sensor. A 750 Hz variable warning tone is generated by the parking aid sounder. A volume cutback request message is sent to the audio unit from parking aid module (PAM) over the medium speed controller area network (MS-CAN) to decrease the volume of the audio unit. The sounder increases its warning tone rate as the vehicle gets closer to an obstacle. When an object is detected within 46 cm (18 in) of the vehicle, the warning tone becomes continuous.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PAM

- Audio Unit

PINPOINT TEST I: THE AUDIO VOLUME CUTBACK COMMAND IS INOPERATIVE

I1 VERIFY THE PAM COMMUNICATES WITH THE INSTRUMENT CLUSTER (IC) MESSAGE CENTER DISPLAY.

- Apply the parking brake.
- Key in ON position.
- Apply the brake pedal and place the gear selector in REVERSE (R).
- Disable/enable the parking aid system by pressing the reset button on the message center switch.
- **Can the PAM be disabled/enabled in the IC message center display?**

  YES : Go to I3.

  NO : Go to I2.

I2 VERIFY THE CORRECT PAM IS INSTALLED

- Check to make sure the correct PAM is installed.
- **Has the PAM been replaced prior?**

  YES : VERIFY the correct PAM is installed. If correct, go to I3.

  NO : INSTALL the correct PAM. REFER to **Parking Aid Module (PAM)**. TEST the system for normal operation.

I3 CHECK FOR CORRECT PAM OPERATION

- Disconnect the PAM connector.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect the PAM connector and make sure it seats correctly.
- Operate the system and determine if the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PAM. REFER to **Parking Aid Module (PAM)**. TEST the system for normal operation.

  NO : The system is operating correctly at this time.

GENERAL PROCEDURES

AZIMUTH SYSTEM CHECK

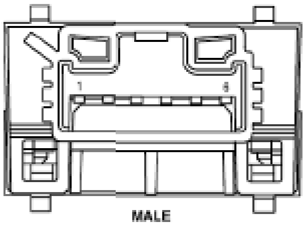


Fig. 7: Minimum Detectable Object Locations
Courtesy of FORD MOTOR CO.

NOTE:	**The object used in this system check can be fabricated from 9 cm O.D. (3 in I.D) plastic pipe 100 cm (39 in) in length (available as PVC pipe, or similar from a hardware or plumbing supply).**

NOTE:	**The following system check should be carried out with the vehicle on a level surface. The specified object locations are approximate, not absolute**

NOTE:	**The parking aid system will default to on when the ignition key is cycled from OFF to ON.**

NOTE:	**The scan tool may be used to monitor distance PIDs. The distance PIDs read between 0 and 255 cm (0 and 8 ft) on a correctly functioning system.**

1. Turn the ignition to the ON position, engine off.
2. Set the parking brake on.
3. Place the gear shift in REVERSE (R).
4. Verify that the parking aid system detects the specified object when placed within the 5 specified locations (P1, P2, P3, P4, P5). The pipe should be inside of these locations.
   - The speaker should beep slowly when objects are detected on the outer edges of the detection zone, and increase as the object is moved closer to the vehicle.

     When the object is within 46 cm (18 in) of the rear bumper, the sounder should be on continuously.

ELEVATION SYSTEM CHECK

NOTE:	**The following system check should be carried out with the vehicle on a 3.0 m wide by 4.5 m deep (10 ft wide by 15 ft deep) smooth concrete surface, free of all obstacles and noise from fan and pneumatic tools.**

1. Turn the ignition to the ON position, engine off.

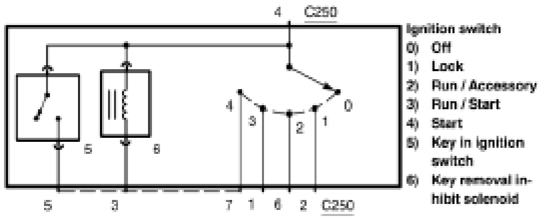


Fig. 8: Checking Parking Aid System
Courtesy of FORD MOTOR CO.

2. Set the parking brake.
3. Place the gear shift in REVERSE (R).
4. Verify that no audible alerts are heard. If audible alerts are heard, check to make sure the bumper is correctly installed and is not tilted downward so that the sensor is pointing at the ground.

REMOVAL AND INSTALLATION

PARKING AID MODULE (PAM)

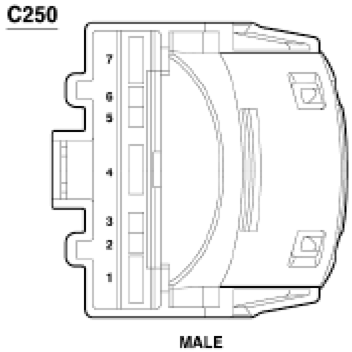


Fig. 9: Exploded View Of Parking Aid Module (PAM)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	15K866	Parking aid module (PAM)
2	W706350	PAM screws (2 required)
3	-	PAM electrical connectors (part of 13A412)

REMOVAL AND INSTALLATION

1. Remove the LH side C-pillar trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the LH rear seat bolster. For additional information, refer to **SEATING** article.
3. Remove the 2 screws and the parking aid module (PAM).

- Disconnect the PAM electrical connectors.

4. To install, reverse the removal procedure.

PARKING AID SPEAKER

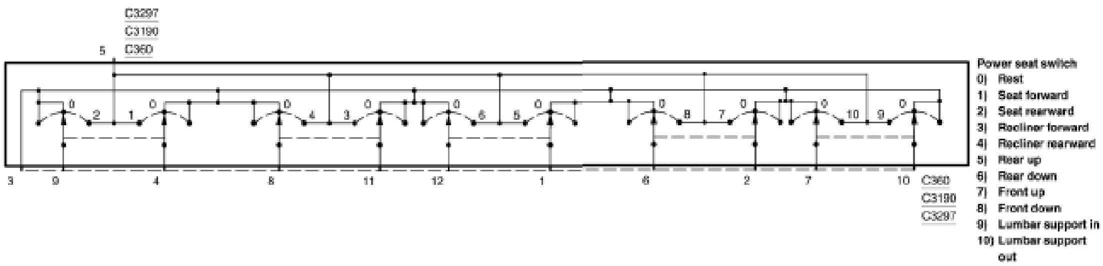


Fig. 10: Exploded View Of Parking Aid Speaker
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W713167	Parking aid speaker push pins (2 required)
2	15K864	Parking aid speaker
3	-	Parking aid speaker electrical connector (part of 14A005)

REMOVAL AND INSTALLATION

1. Remove the parcel shelf. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the 2 push pins and the parking aid speaker.
    - Disconnect the parking aid speaker electrical connector.
3. To install, reverse the removal procedure.

PARKING AID SENSOR

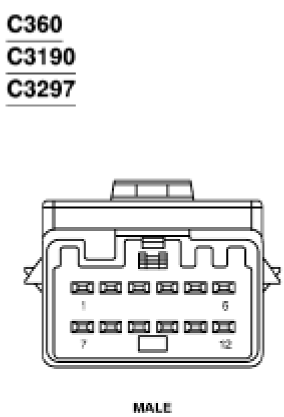


Fig. 11: Exploded View Of Parking Aid Sensor

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14489	Parking aid sensor(s)
2	-	Parking aid sensor electrical connectors (part of 14N139)

1. Remove the rear bumper cover. For additional information, refer to **BUMPERS** article.
2. Disconnect the parking aid sensor(s) electrical connector(s).
3. Press the retaining tabs and remove the parking aid sensor(s).
4. To install, reverse the removal procedure.

2008 BRAKES

Parking Brake & Actuation - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Catalytic converter-to-exhaust flexible pipe nut	40	30	-
Parking brake cable routing bracket bolts	23	17	-
Parking brake cable routing bracket nuts	9	-	80
Parking brake control bolt	20	15	-
Parking brake control nuts	20	15	-

DESCRIPTION AND OPERATION

PARKING BRAKE

The parking brake system consists of the following components:

- Parking brake control
- Parking brake warning indicator switch
- Rear parking brake cable assembly

The parking brake system is a mechanical system that activates a self-adjusting brake system within the rear brake caliper.

The parking brake system is cable-actuated and controlled by an independent handle-operated parking brake control. The parking brake control applies tension to rear brake pads through the front parking brake cable and conduit and the LH and RH rear parking brake cables. The parking brake warning indicator is located in the instrument cluster. It illuminates to signal the driver that the parking brake is applied or to signal a low brake fluid condition. The warning indicator system is diagnosed in **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

DIAGNOSTIC TESTS

PARKING BRAKE

Principles of Operation

Parking Brake System - The parking brake system is cable-actuated and controlled by an independent hand-operated parking brake control that is not self adjusting. The parking brake system is actuated when the parking brake control is pulled up. When the parking brake control is pulled, tension is applied to the front parking

brake cable. This tension pulls on both rear parking brake cables, which are attached to the brake caliper parking brake actuators and apply the brake pads. When the parking brake release button is pressed and the brake control is released, the return springs on the brake calipers and the parking brake control return the system to the released position.

Inspection and Verification

NOTE: Prior to carrying out any diagnosis, make sure the red brake warning indicator is functional. Refer to INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES article.

The first indication that something may be wrong in the brake system is a change in the feeling through the parking brake control. The parking brake not holding on an incline or dragging after being released are also indicators of system concerns.

Check the operation of the parking brake system with the vehicle on a hoist and the parking brake control fully released. Check for any damaged cables and install new components as necessary. Carry out the brake system diagnosis.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

VISUAL INSPECTION CHART

Mechanical
• Front parking brake cable and conduit • Parking brake control • Parking brake equalizer • Rear brake calipers • Rear parking brake cables and conduits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and Go to **Symptom Chart**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The red brake warning indicator is always/never on	• Brake fluid level switch • Parking brake switch • Wiring, terminals and connectors • Instrument cluster	• REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article to diagnose the red brake warning indicator.

	• Smart junction box (SJB)	
• Rear brakes drag	• Parking brake cables out of adjustment • Parking brake component(s) • Rear brake caliper guide pins • Brake caliper • Brake booster • Brake master cylinder	• ADJUST the parking brake cables. REFER to **Parking Brake Cable Adjustment**. • INSPECT the parking brake system for corrosion, rust or kinked cables. REPAIR or INSTALL new parking brake components as necessary. • INSPECT the brake caliper guide pins. REFER to Brake Caliper Guide Pins in **BRAKE SYSTEM - GENERAL INFORMATION** article. • INSPECT the brake caliper. REFER to Brake Caliper in **BRAKE SYSTEM - GENERAL INFORMATION** article. • CARRY OUT the Brake Booster Component Test. REFER to Diagnosis and Testing in **BRAKE SYSTEM - GENERAL INFORMATION** article. • CARRY OUT the Brake Master Cylinder Component Test. REFER to Diagnosis and Testing in **BRAKE SYSTEM - GENERAL INFORMATION** article.
• The parking brake will not apply	• Parking brake control • Parking brake cables • Parking brake rear wheel components	• Go to **Pinpoint Test A**.
• The parking brake will not release	• Parking brake cables • Parking brake control • Parking brake rear wheel components	• Go to **Pinpoint Test B**.

Pinpoint Tests

Pinpoint Test A: The Parking Brake Will Not Apply

Normal Operation

The parking brake system is cable-actuated and controlled by an independent hand-operated parking brake control that is not self adjusting, The parking brake system is actuated when the parking brake control is pulled up. When the parking brake control is pulled, tension is applied to the front parking brake cable. This tension pulls on both rear parking brake cables, which are attached to the brake caliper parking brake actuators and apply the brake pads.

This pinpoint test is intended to diagnose the following:

- Parking brake control
- Parking brake cables
- Rear brake calipers

PINPOINT TEST A: THE PARKING BRAKE WILL NOT APPLY

A1 CHECK THE PARKING BRAKE CONTROL

- Apply the parking brake control.
- **Does the parking brake control move?**

  YES : Go to A2.

  NO : Go to A3.

A2 CHECK FOR BROKEN CABLES

NOTE: Have an assistant apply and release the parking brake control to help isolate disconnected cables or cables that do not move.

- Inspect the following items for damage and correct connections:
  - Parking brake control
  - Front cable
  - Equalizer
  - LH rear cable
  - RH rear cable
  - Rear brake caliper actuators
- **Is any damage found or are any components disconnected?**

  YES : CONNECT the component(s) or INSTALL a new parking brake component(s) as necessary. TEST the system for normal operation.

  NO : VERIFY that the rear pads are within thickness specifications. REFER to Specifications in **BRAKE SYSTEM - GENERAL INFORMATION** article. If the rear pads are OK, INSTALL new rear brake calipers. REFER to **REAR DISC BRAKE** article.

A3 ISOLATE THE PARKING BRAKE CONTROL AND FRONT PARKING BRAKE CABLE

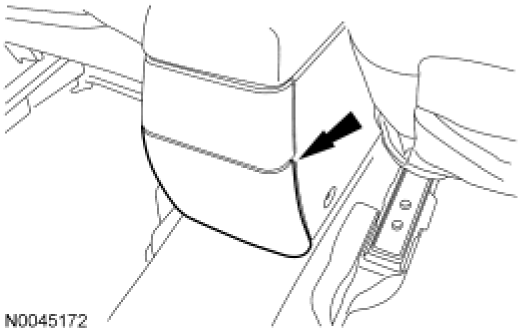


Fig. 1: Locating Floor Console Rear Access Panel
Courtesy of FORD MOTOR CO.

- Remove the floor console rear access panel.
- Loosen the parking brake adjustment nut and disconnect the rear cables from the equalizer.
- Apply the parking brake control.
- **Does the parking brake control move?**

  YES : Go to A4.

  NO : INSTALL a new parking brake control. REFER to **Parking Brake Control**. TEST the system for normal operation.

A4 ISOLATE THE REAR PARKING BRAKE CABLES

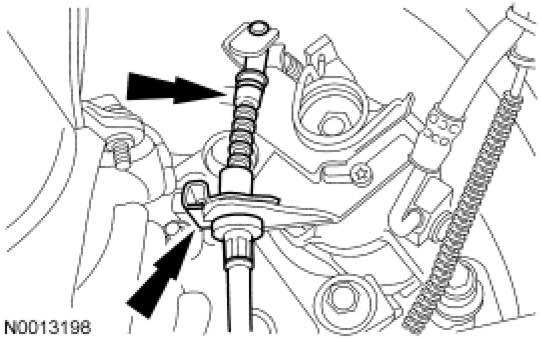


Fig. 2: Locating Parking Brake Cable Retaining Clip
Courtesy of FORD MOTOR CO.

- Disconnect the LH and RH parking brake cables from the brake calipers.
- While holding the cable conduit, attempt to slide the cable inside the conduit.
- **Does the cable slide freely inside the conduit?**

  YES : INSTALL new rear brake calipers. REFER to **REAR DISC BRAKE** article. ADJUST the parking brake cable. REFER to **Parking Brake Cable Adjustment** in this section.

  NO : INSTALL a new rear brake cable(s). REFER to **Parking Brake Cable - Rear**. TEST the system for normal operation.

Pinpoint Test B: The Parking Brake Will Not Release

Normal Operation

When the parking brake release button is pressed and the brake control is released, the return springs on the brake calipers and the parking brake control return the system to the released position.

This pinpoint test is intended to diagnose the following:

- Parking brake cables
- Parking brake control
- Parking brake rear wheel components

PINPOINT TEST B: THE PARKING BRAKE WILL NOT RELEASE

B1 CHECK THE PARKING BRAKE CONTROL

- Press the release button on the parking brake control and release the handle.
- **Does the parking brake control move?**

  YES : Go to B2.

  NO : INSTALL a new parking brake control. REFER to **Parking Brake Control**. TEST the system for normal operation.

B2 CHECK THE REAR PARKING BRAKE CABLES

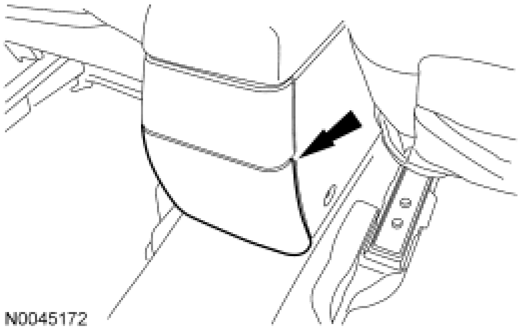


Fig. 3: Locating Floor Console Rear Access Panel
Courtesy of FORD MOTOR CO.

- Remove the floor console rear access panel.
- Loosen the parking brake adjustment nut and disconnect the rear cables from the equalizer.

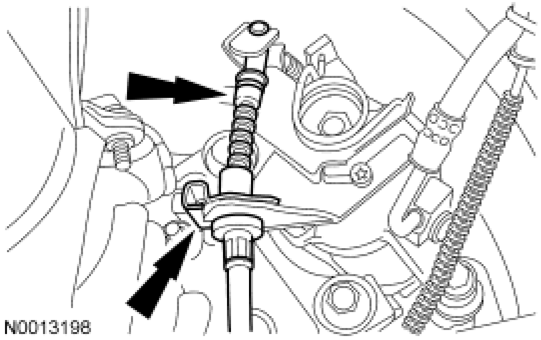


Fig. 4: Locating Parking Brake Cable Retaining Clip

Courtesy of FORD MOTOR CO.

- Disconnect the LH and RH parking brake cables from the brake calipers.
- While holding the rear cable conduit, attempt to slide the rear cable inside the conduit.
- **Does the cable slide freely inside the conduit?**

  YES : INSTALL new rear brake calipers. REFER to **REAR DISC BRAKE** article. ADJUST the parking brake cable. REFER to **Parking Brake Cable Adjustment** in this section.

  NO : INSTALL new rear brake cable(s). REFER to **Parking Brake Cable - Rear**. TEST the system for normal operation.

GENERAL PROCEDURES

PARKING BRAKE CABLE ADJUSTMENT

NOTE: **Do not pry at the floor console rear access panel with a screwdriver or damage to the panel may occur.**

1. Remove the floor console rear access panel.

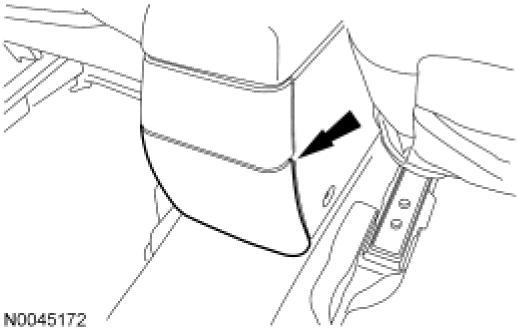


Fig. 5: Locating Floor Console Rear Access Panel
Courtesy of FORD MOTOR CO.

2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

NOTE: **The dimension will vary depending on the amount of cable stretch. New cables require cycling the parking brake control 5-10 times to remove the cable slack.**

3. Adjust the parking brake adjustment nut as shown.

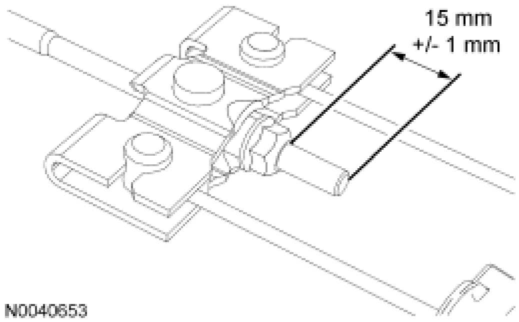


Fig. 6: Identifying Parking Brake Adjustment Nut Dimension
Courtesy of FORD MOTOR CO.

4. Verify correct operation of the parking brake system.
   - At 2 clicks of the parking brake control, slight drag at the rear wheels should be present.
   - At 5 clicks of the parking brake control, no movement at the rear wheels should be present.
5. Install the floor console rear access panel.

REMOVAL AND INSTALLATION

PARKING BRAKE WARNING INDICATOR SWITCH

NOTE: Park brake control cover removed for clarity.

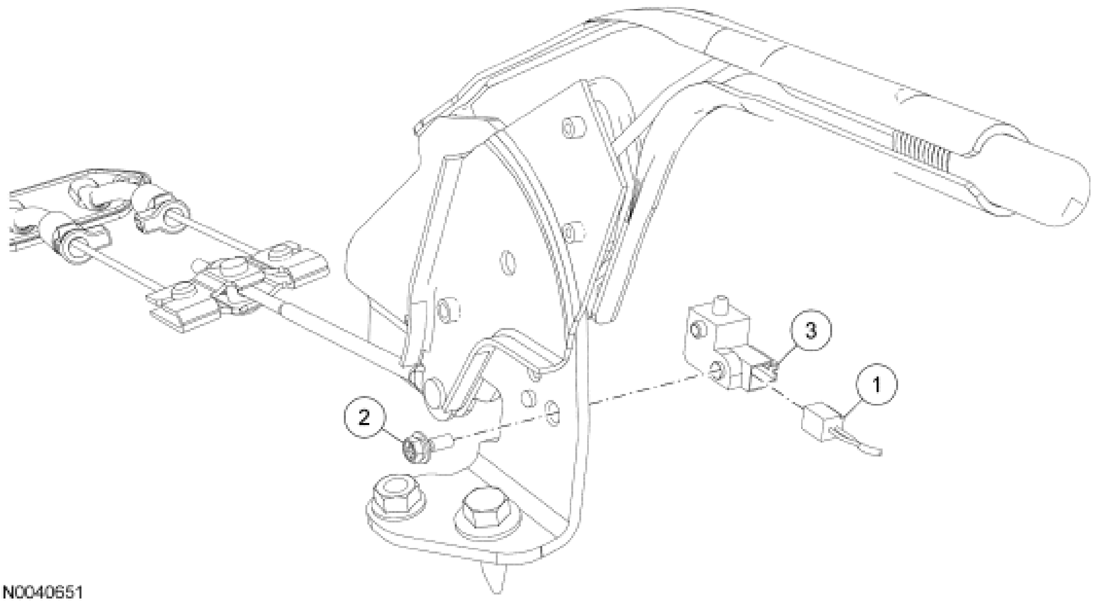


Fig. 7: Exploded View Of Parking Brake Warning Indicator Switch

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Parking brake warning indicator switch electrical connector
2	-	Parking brake warning indicator switch screw
3	-	Parking brake warning indicator switch

REMOVAL AND INSTALLATION

1. Remove the floor console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Disconnect the parking brake warning indicator switch electrical connector.
3. Remove the parking brake warning indicator switch screw.
4. Remove the parking brake warning indicator switch.
5. To install, reverse the removal procedure.

PARKING BRAKE CONTROL

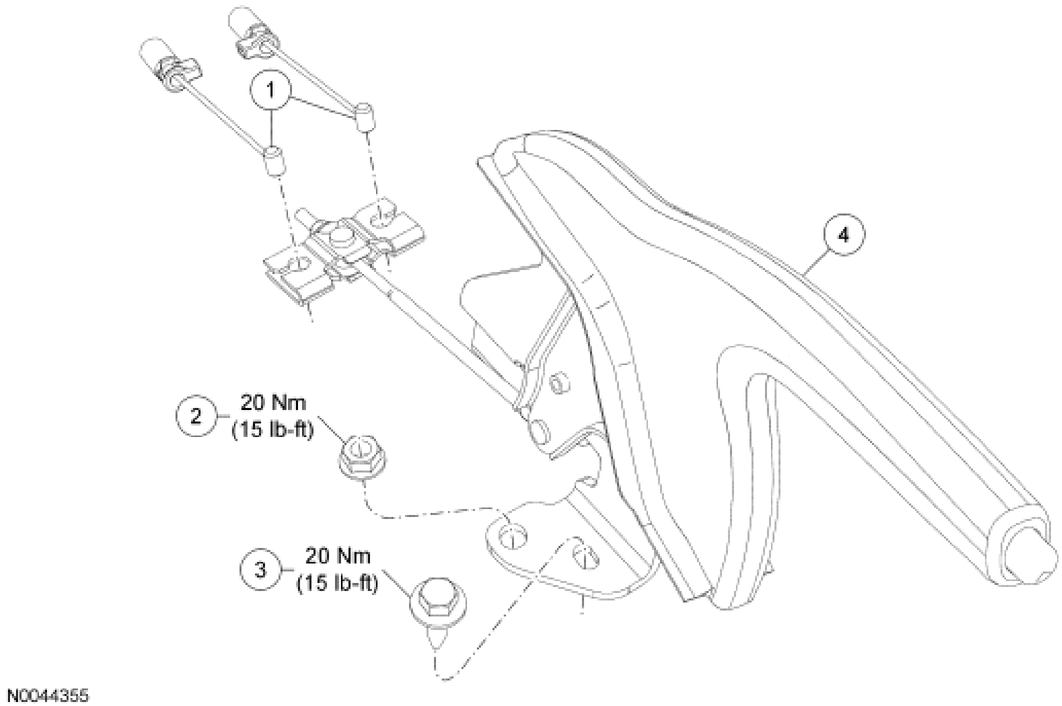


Fig. 8: Exploded View Of Parking Brake Control With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2A815	Rear parking brake cables

2	W520413	Parking brake control nut (2 required)
3	W706246	Parking brake control bolt
4	2780	Parking brake control

REMOVAL AND INSTALLATION

1. Remove the floor console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Make sure the parking brake control is in the released position.
3. Disconnect the warning indicator switch electrical connector.
4. Loosen the parking brake control adjusting nut.
5. Remove the 2 parking brake control nuts.
    - To install, tighten to 20 Nm (15 lb-ft).
6. Remove the parking brake control bolt and the parking brake control.
    - To install, tighten to 20 Nm (15 lb-ft).
7. To install, reverse the removal procedure.
    - Adjust the parking brake cable. For additional information, refer to **Parking Brake Cable Adjustment**.

PARKING BRAKE CABLE - REAR

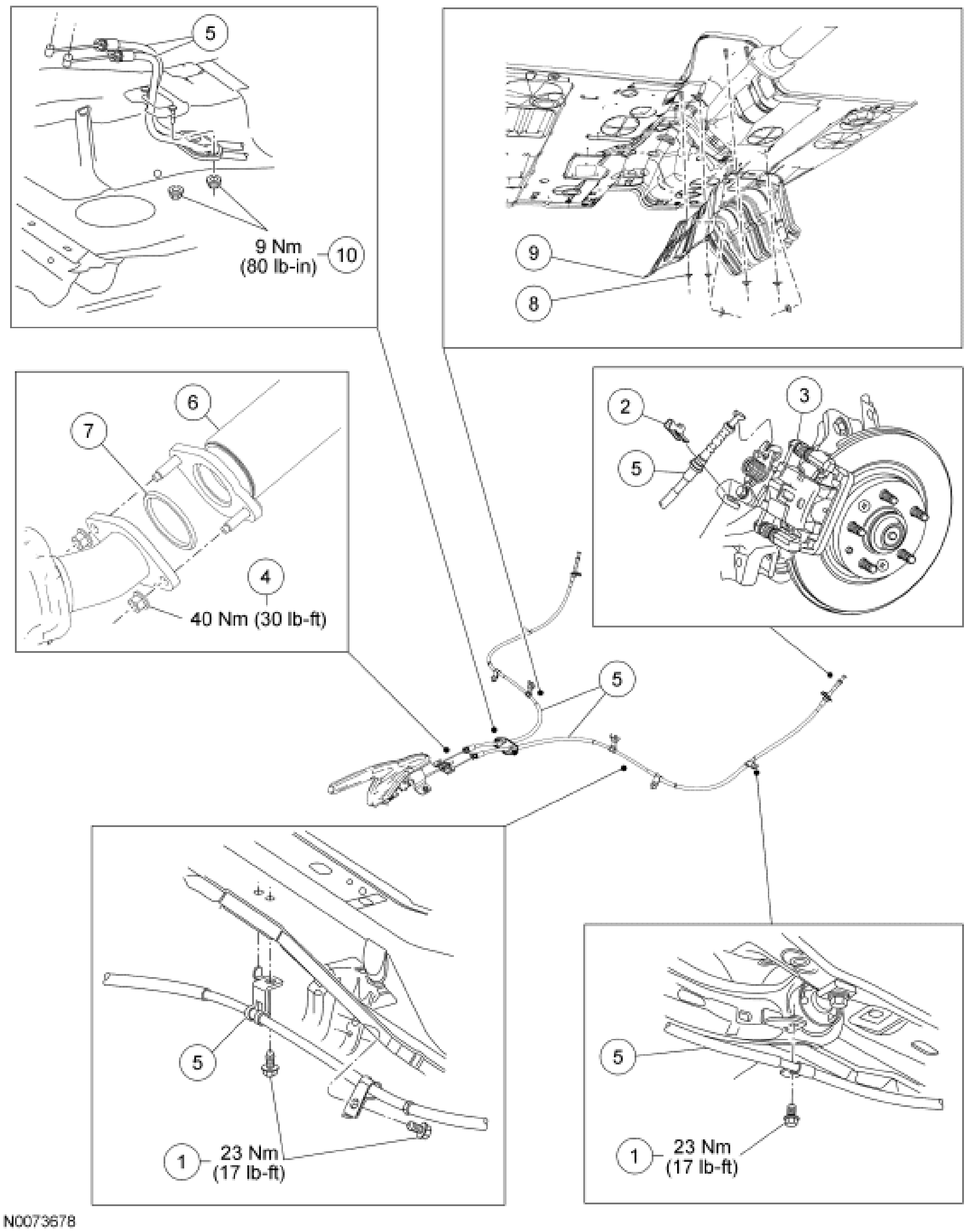


Fig. 9: Exploded View Of Rear Parking Brake Cable With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505263	Parking brake cable routing bracket bolts (6 required)
2	2860	Parking brake cable routing clip (2 required)
3	2552 LH/ 2553 RH	Brake caliper

4	W705443	Catalytic converter-to-exhaust flexible pipe nut (2 required)
5	2A815	Rear parking brake cable assembly
6	5G203	Exhaust flexible pipe
7	9451	Gasket
8	W709729	Heat shield nut (6 required)
9	114B04	Heat shield
10	W707142	Parking brake cable routing bracket nuts (2 required)

REMOVAL AND INSTALLATION

NOTE: **Do not use oil or grease-based lubricants on the isolators. They may cause deterioration of the rubber.**

NOTE: **Oil or grease-based lubricants on the isolators may cause the exhaust hanger isolator to separate from the exhaust hanger bracket during vehicle operation.**

1. Remove the floor console. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.
2. Loosen the parking brake control adjusting nut.
3. Disconnect the rear parking brake cables from the equalizer.
4. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
5. Support the muffler and tailpipe with a suitable jackstand.
6. Separate the 2 muffler and tailpipe isolators from the vehicle.
7. Remove and discard the 2 catalytic converter-to-exhaust flexible pipe nuts and separate the exhaust flexible pipe and the catalytic converter.
   - Discard the gasket.
   - To install, tighten new nuts to 40 Nm (30 lb-ft).
8. Remove the heat shield.
   - Remove the 6 nuts, the 2 pin-type retainers and the heat shield.
9. Remove the 2 parking brake cable routing bracket nuts.
   - To install, tighten to 9 Nm (80 lb-in).
10. Remove the 6 parking brake cable routing bracket bolts.
    - To install, tighten to 23 Nm (17 lb-ft).
11. Remove the 2 parking brake cable routing clips.
12. Disconnect the rear parking brake cables from the calipers and remove the cables.
13. To install, reverse the removal procedure.
    - Adjust the parking brake cable. For additional information, refer to **Parking Brake Cable Adjustment**.

1996-08 ACCESSORIES & BODY, CAB

Passive Anti-Theft System Job Aid - Ford/Lincoln/Mercury Vehicles

PASSIVE ANTI-THEFT SYSTEM (PATS) SPECIFICATIONS

FORD SYSTEM (PATS) SPECIFICATIONS

NOTE: PATS may not be present on alternative fuel (Bi-fuel, Natural Gas, etc) vehicles.

NOTE: To determine appropriate procedure, refer to Fig. 1. For procedures, refer to PROGRAMMING PROCEDURES.

NOTE: For PATS key type, refer to PATS KEY TYPES.

Passive Anti-Theft System (SecuriLock™)

	Vehicle	Model Year (1996-2008)	PATS Control Function Type	Max Keys	Minimum Keys Required	Starter Interrupt Present	Theft Indicator Flashes at Ignition OFF	Procedures: Parameter Reset	Procedures: Key Programming Using Diagnostic Tools	Procedures: Spare Key Programming Using Diagnostic Tools	Procedures: Spare Key Programming Using Programmed Keys	PATS Key Type
Ford	Contour (V6-only)	98 (before 2/2/98)	A	16	1	Yes	Yes	N/A	#1	N/A	#5	23
		98 (2/2/98 build or later)-00	E	8	2	Yes	Yes	N/A	#2	#4	#6	23
	Crown Victoria	98-02	B	8	2	No	Yes	#7	#2	#4	#6	1,19
		03-08	E	8	2 or 3	Yes	Yes	N/A	#2	#4	#6	9,14,15
	Edge	07-08	C	8	2	Yes	Yes	#8	#2	#4	#6	IKT
	Escape	01-04	E	8	2	Yes	Yes	N/A	#2	#4	#6	3
		05-07	E	8	2	Yes	Yes	N/A	#2	#4	#6	15
		08	C	8	2	Yes	Yes	#8	#2	#4	#6	IKT
	Escape HEV	06-07	F	8	2	No	Yes	#8	#2	#4	#6	15
		08	C	8	2	No	Yes	#8	#2	#4	#6	IKT
	E-Series	08	C	8	2	Yes	10 sec.	#8	#2	#4	#6	15
		08	G	N/A	N/A	Yes	No	#8	N/A	N/A	N/A	27
	Excursion	00-05	B	8	2	No	Yes	#7	#2	#4	#6	1
	Expedition	97-98	A	16	1	No	No	N/A	#1	N/A	#5	1
		99-02	C	8	2	No	Yes	#7	#2	#4	#6	1
		03-06	E	8	2	Yes	Yes	N/A	#2	#4	#6	9,15
		07-08	C	8	2	Yes	Yes	#8	#2	#4	#6	9
	Explorer (4dr)	98-01	B	8	2	No	Yes	#7	#2	#4	#6	1
		02-05	E	8	2	Yes	Yes	N/A	#2	#4	#6	9,15
		06-08	C	8	2	Yes	Yes	#8	#2	#4	#6	15
	Explorer Sport (2dr)	98-01 (before 7/24/00)	B	8	2	No	Yes	#7	#2	#4	#6	1
		01 (7/24/00 build or later)-03	E	8	2	Yes	Yes	N/A	#2	#4	#6	9,15
	Explorer Sport Trac	01 (before 7/24/00)	B	8	2	No	Yes	#7	#2	#4	#6	1
		01 (7/24/00 build or later)-05	E	8	2	Yes	Yes	N/A	#2	#4	#6	9,15
		07-08	C	8	2	Yes	Yes	#8	#2	#4	#6	15
	F-150	04-08	E	8	2	Yes	Yes	N/A	#2	#4	#6	9,15
	F-150 Harley-Davidson	01-03	C	8	2	No	Yes	#7	#2	#4	#6	18
		06-08	E	8	2	Yes	Yes	N/A	#2	#4	#6	26
	F-150 Heritage	99-06	C	8	2	No	Yes	#7	#2	#4	#6	1
	F-250 (under 8500# GVW)	99-00	C	8	2	No	Yes	#7	#2	#4	#6	1
	Five Hundred	05-07	E	8	2	Yes	Yes	N/A	#2	#4	#6	15
	Focus	00-05	E	8	2	Yes	Yes	N/A	#2	#4	#6	3
		06-07	E	8	2	Yes	Yes	N/A	#2	#4	#6	15
		08	C	8	2	Yes	Yes	#8	#2	#4	#6	15
	Freestar	04-07	E	8	2	Yes	Yes	N/A	#2	#4	#6	15
	Freestyle	05-07	E	8	2	Yes	Yes	N/A	#2	#4	#6	15
	F-Series > 8500	08	C	8	2	Yes	10 sec.	#8	#2	#4	#6	15
		08	G	N/A	N/A	Yes	No	#8	N/A	N/A	N/A	27
	Fusion	06-08	C	8	2	Yes	Yes	#8	#2	#4	#6	IKT
	GT	05-06	B	8	2	No	No	#7	#2	#4	#6	25
	Mustang	96-97	A	16	1	No	No	N/A	#1	N/A	#5	1,23
		98	B	8	2	No	No	#7	#2	#4	#6	1
		99-04	C	8	2	No	Yes	#7	#2	#4	#6	1
		05-08	E	8	2	Yes	Yes	N/A	#2	#4	#6	15
	Ranger (3.0L & 4.0L only)	99-00	B	8	2	Yes	Yes	#7	#2	#4	#6	1
		06	E	8	2	Yes	Yes	N/A	#2	#4	#6	15
	Ranger (2.3L, 3.0L, & 4.0L)	01-04	E	8	2	Yes	Yes	N/A	#2	#4	#6	9,15
		07-08	C	8	2	Yes	10 sec.	#8	#2	#4	#6	15
		07-08	G	N/A	N/A	Yes	No	#8	N/A	N/A	N/A	27
	Taurus (Duratec & SHO only)	96-97	A	16	1	No	No	N/A	#1	N/A	#5	1
		98-99	B	8	2	Yes	Yes	#7	#2	#4	#6	1
	Taurus	00-06	E	8	2	Yes	Yes	N/A	#2	#4	#6	9,15
		08	C	8	2	Yes	Yes	#8	#2	#4	#6	IKT
	Taurus X	08	C	8	2	Yes	Yes	#8	#2	#4	#6	IKT
	Thunderbird	02	C	8	2	Yes	Yes	#7	#2	#4	#6	17
		03-06	C	8	2	Yes	No	#7	#2	#4	#6	9
	Windstar	99-00	C	8	2	Yes	Yes	#7	#2	#4	#6	1
		01-03	E	8	2	Yes	Yes	N/A	#2	#4	#6	9

Control Function Type

- A&B: Stand Alone Module (PATS)
- C: Instrument Cluster
  - Virtual Image Cluster (VIC)
  - Hybrid Electronic Cluster (HEC)
  - Instrument Cluster Module (ICM)
- D: Steering Column Ignition Lock Module (SCIL)
- E: Powertrain Control Module (PCM)
- F: Powertrain Control Module (PCM)
- G: Instrument Cluster Module (ICM)

Fig. 1: Ford System (PATS) Specifications
Courtesy of FORD MOTOR CO.

LINCOLN SYSTEM (PATS) SPECIFICATIONS

NOTE: PATS may not be present on alternative fuel (Bi-fuel, Natural Gas, etc) vehicles.

NOTE: To determine appropriate procedure, refer to Fig. 2. For procedures, refer to PROGRAMMING PROCEDURES.

NOTE: For PATS key type, refer to PATS KEY TYPES.

Passive Anti-Theft System (SecuriLock™)

	Vehicle	Model Year (1996-2008)	PATS Control Function Type	Max Keys	Minimum Keys Required	Starter Interrupt Present	Theft Indicator Flashes at Ignition OFF	Procedures: Parameter Reset	Procedures: Key Programming Using Diagnostic Tools	Procedures: Spare Key Programming Using Diagnostic Tools	Procedures: Spare Key Programming Using Programmed Keys	PATS Key Type
Lincoln	Aviator	03-05	E	8	2	Yes	Yes	N/A	#2	#4	#6	12,13
	Blackwood	02-03	C	8	2	No	Yes	#7	#2	#4	#6	6,7
	Continental	98-02	C	8	2	No	Yes	#7	#2	#4	#6	6,7
	LS	00-02	C	8	2	Yes	No	#7	#2	#4	#6	5,16
		03-07	C	8	2	Yes	No	#7	#2	#4	#6	12,13
	Mark LT	06-08	E	8	2	Yes	Yes	N/A	#2	#4	#6	12
	Mark VIII	97-98	D	16	2	Yes	No	N/A	#3	N/A	#5	21
	MKX	07-08	C	8	2	Yes	Yes	#8	#2	#4	#6	IKT
	MKZ	07-08	C	8	2	Yes	Yes	#8	#2	#4	#6	IKT
	Navigator	98	A	16	1	No	No	N/A	#1	N/A	#5	6
		99-02	C	8	2	No	Yes	#7	#2	#4	#6	6
		03-06	E	8	2	Yes	Yes	N/A	#2	#4	#6	12,13
		07-08	C	8	2	Yes	Yes	#8	#2	#4	#6	12
	Town Car	98-02	C	8	2	No	Yes	#7	#2	#4	#6	4,6,7
		03-08	E	8	2 or 3	Yes	Yes	N/A	#2	#4	#6	12,13
	Zephyr	06	C	8	2	Yes	Yes	#8	#2	#4	#6	IKT

Control Function Type

- A&B: Stand Alone Module (PATS)
- C: Instrument Cluster
  - Virtual Image Cluster (VIC)
  - Hybrid Electronic Cluster (HEC)
  - Instrument Cluster Module (ICM)
- D: Steering Column Ignition Lock Module (SCIL)
- E: Powertrain Control Module (PCM)
- F: Powertrain Control Module (PCM)
- G: Instrument Cluster Module (ICM)

Fig. 2: Lincoln System (PATS) Specifications
Courtesy of FORD MOTOR CO.

MERCURY SYSTEM (PATS) SPECIFICATIONS

NOTE: PATS may not be present on alternative fuel (Bi-fuel, Natural Gas, etc) vehicles.

NOTE: To determine appropriate procedure, refer to Fig. 3. For procedures, refer to PROGRAMMING PROCEDURES.

NOTE: For PATS key type, refer to PATS KEY TYPES.

Passive Anti-Theft System (SecuriLock™)

	Vehicle	Model Year (1996-2008)	PATS Control Function Type	Max Keys	Minimum Keys Required	Starter Interrupt Present	Theft Indicator Flashes at Ignition OFF	Procedures: Parameter Reset	Procedures: Key Programming Using Diagnostic Tools	Procedures: Spare Key Programming Using Diagnostic Tools	Procedures: Spare Key Programming Using Programmed Keys	PATS Key Type
Mercury	Cougar	99-02	E	8	2	Yes	Yes	N/A	#2	#4	#6	24
	Grand Marquis	98-02	B	8	2	No	Yes	#7	#2	#4	#6	2,20
		03-08	E	8	2 or 3	Yes	Yes	N/A	#2	#4	#6	10,11
	Marauder	03	E	8	2 or 3	Yes	Yes	N/A	#2	#4	#6	10
	Mariner	05-07	E	8	2	Yes	Yes	N/A	#2	#4	#6	10
		08	C	8	2	Yes	Yes	#8	#2	#4	#6	IKT
	Milan	06-08	C	8	2	Yes	Yes	#8	#2	#4	#6	IKT
	Montego	05-07	E	8	2	Yes	Yes	N/A	#2	#4	#6	10
	Monterey	04-07	E	8	2	Yes	Yes	N/A	#2	#4	#6	10
	Mountaineer (4dr)	98-01	B	8	2	No	Yes	#7	#2	#4	#6	2
		02-05	E	8	2	Yes	Yes	N/A	#2	#4	#6	10
		06-08	C	8	2	Yes	No	#8	#2	#4	#6	10
	Mystique (V-6 only)	98 (before 2/2/98)	A	16	1	Yes	Yes	N/A	#1	N/A	#5	24
		98 (2/2/98 build or later)-00	E	8	2	Yes	Yes	N/A	#2	#4	#6	24
	Sable (Duratec only)	96-97	A	16	1	No	No	N/A	#1	N/A	#5	2
		98-99	B	8	2	Yes	Yes	#7	#2	#4	#6	2
	Sable	00-05	E	8	2	Yes	Yes	N/A	#2	#4	#6	10
		08	C	8	2	Yes	Yes	#8	#2	#4	#6	IKT

Control Function Type

A&B: Stand Alone Module (PATS)
C: Instrument Cluster
- Virtual Image Cluster (VIC)
- Hybrid Electronic Cluster (HEC)
- Instrument Cluster Module (ICM)

D: Steering Column Ignition Lock Module (SCIL)
E: Powertrain Control Module (PCM)
F: Powertrain Control Module (PCM)
G: Instrument Cluster Module (ICM)

Fig. 3: Mercury System (PATS) Specifications
Courtesy of FORD MOTOR CO.

PATS KEY TYPES

Fig. 4: PATS Key Types
Courtesy of FORD MOTOR CO.

DIAGNOSTIC TROUBLE CODES

DIAGNOSTIC TROUBLE CODE DESCRIPTIONS

DTC	Description
B1213	Less than 2 (or 3 if equipped w/Valet key) keys programmed to the system.
B1232/B2103	Transceiver internal antenna damaged. Replace transceiver.
B1342	ECU is defective (EEPROM in PCM is not working - replace PCM). PATS related when stored in PCM only.
B1600	Non-PATS Key or damaged key.
B1601	Unprogrammed encoded ignition key detected (leave ignition on for 20 seconds before trying a programmed key, in Anti-Scan Mode).
B1602	Partial detection of encoded ignition key.
B1681	Transceiver signal not detected.
B2141	Non-Volatile Memory (NVM) configuration failure - No PCM ID stored in PATS.
B2139/U2510	PCM ID does not match between the PCM and PATS control (PATS/ICM/VIC/HEC/SCIL).
B2431	Key program failure (defective key or transceiver).
U1147/U1262	Communications issue, SCP (J1850), between PCM and PATS control (PATS/ICM/ VIC/HEC/SCIL).
U1900/U0100 Or U2511/B2009	Communications issue, CAN (J2284), between PCM and PATS control (ICM).
P1260	PCM disabled the vehicle because of a PATS concern. Retrieve DTCs from applicable PATS control function (PATS/ICM/VIC/HEC/SCIL).

NON-PATS ISSUES

The following are NOT Passive Anti-Theft System issues: :

- The "Service Engine Soon" light is illuminated. (Investigate PCM system).
- There is no communication with PCM: PCM will always communicate on the diagnostic link regardless of theft status. (Investigate PCM system).
- Engine stalls on road: Once the engine runs for one second, PATS CANNOT disable the engine. Running stalls are not PATS related issues.
- Remote Entry/Keyless Entry problems: PATS is completely separate from the Remote Entry/Keyless Entry systems.
- There is a no-crank problem on vehicles without PATS Starter disable. Check chart, on reverse side, for presence of Starter Interrupt.
- PATS Theft Indicator flashes every 2 seconds at Ignition OFF. This is normal operation for PATS to act as a visual theft deterrent. See **PASSIVE ANTI-THEFT SYSTEM (PATS) SPECIFICATIONS** for applicable system.
- PATS Theft Indicator stays on for 2 or 3 seconds (depending on system type) at Ignition RUN or START and then off: This is normal operation for PATS proveout on all vehicles except LS and Thunderbird.

THINGS TO DO:

- Review Service Procedures and Technical Service Bulletins (TSBs) for latest information.
- Disconnect the diagnostic tool for 20 seconds before cycling ignition to OFF, ACC, or RUN.
- When replacing ignition keys, make sure the owner throws out **ALL** old keys.
- Disconnect battery cables when replacing PATS module, ICM, VIC, HEC, SCIL, PCM, or EEC.
- Look for fault codes in PATS. The PATS function will store fault codes when the PCM records a P1260.
- Be certain of the vehicle model year. Use only parts and keys specified for the appropriate model year.
- Check to make sure the issue is not with multiple PATS keys, small electronic devices that can be used to purchase gasoline, or other items on same key ring.
- Check to ensure vehicle does not have an aftermarket remote starter. Disable any Remote Starter equipment, especially anything nearby the PATS Transceiver. Ford FCSD Dealer installed Remote Starter systems are approved for use in Ford vehicles.
- Check to ensure vehicle does not have an aftermarket engine immobilizer. The Ford FCSD aftermarket remote entry system comes with a starter interrupt that should be disabled on PATS equipped vehicles.
- If the Alarm sounds when the ignition is turned to RUN or START, refer to the appropriate PERIMETER ALARM article.

THINGS NOT TO DO:

- Do not use aftermarket keys that are **NOT** Ford qualified.
- Do not reprogram keys unless a defective key or control function has been replaced. Reprogramming keys does not fix any known problem by itself.
- Do not perform more Security Access functions than required: Perform only the functions specified in the appropriate service information for this repair. Selection of extra functions may continue the no-crank condition.

PROGRAMMING PROCEDURES

NOTE: **To determine appropriate procedure, refer to PASSIVE ANTI-THEFT SYSTEM (PATS) SPECIFICATIONS.**

KEY PROGRAMMING USING DIAGNOSTIC TOOLS

PROCEDURE #1

1 key required. Cycle key to RUN. Enter "Ignition Key Code Erase." Disconnect Tool and leave key in RUN for 20 seconds. Cycle key to OFF and then RUN.

PROCEDURE #2

2 keys required. Cycle key 1 to RUN. **Enter Security Access on the PATS control function module.** Select "Ignition Key Code Erase." Disconnect Tool and leave key in RUN for 20 seconds. Cycle key 1 to OFF, then RUN, and back to OFF. Cycle key 2 to RUN.

PROCEDURE #3

2 keys required. Cycle key 1 to RUN. Select "Ignition Key Code Erase." Disconnect Tool and leave key in RUN for 20 seconds. Cycle key 1 to OFF, then RUN, and back to OFF. Cycle key 2 to RUN.

SPARE KEY PROGRAMMING USING DIAGNOSTIC TOOLS

PROCEDURE #4

Cycle an unprogrammed key in ignition to RUN. **Enter Security Access on the PATS control function module.** Select "Ignition Key Code Program." Disconnect Tool and leave key in RUN for 20 seconds.

SPARE KEY PROGRAMMING USING PROGRAMMED KEYS

PROCEDURE #5

1 key required. Cycle key 1 to RUN, then OFF. Cycle new key to RUN.

PROCEDURE #6

2 keys required. Cycle key 1 to RUN, then OFF. Cycle key 2 to RUN, then OFF. Cycle new key to RUN.

REPLACING PATS CONTROL MODULE OR PCM

PROCEDURE #7

Cycle a key in ignition to RUN. **Enter Security Access on the PATS control function module.** Select "Parameter Reset" and then Exit Security Access. Perform a PCM Keep Alive Memory (KAM).

PROCEDURE #8

Cycle a key in the ignition to RUN. **Enter Security Access on the PATS control function module.** Select "ICM/**PCM** Parameter Reset." Select "PCM/**TCM** Parameter Reset" and then Exit Security Access **(type F)** .

2008 BRAKES

Power Brake Actuation - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Brake booster nuts	23	17	-
Ground cable bolt	12	-	106
Push rod jam nut	17	-	150
Transmission fluid level indicator tube bolt	8	-	71

DESCRIPTION AND OPERATION

BRAKE BOOSTER

The power brake actuation system consists of the following components:

- Brake booster
- Brake booster check valve
- Brake booster vacuum supply hose

The brake booster uses engine vacuum from the intake manifold to create a partial vacuum inside the vacuum booster on both sides of the diaphragm. When the brake pedal is pressed, the booster rod opens a valve, allowing air to enter the booster on one side of the diaphragm while sealing off the opposite side. This increases pressure on that side of the diaphragm so that it helps push the rod, which in turn pushes the piston in the master cylinder. As the brake pedal is released, the valve seals off the outside air supply while opening the vacuum valve. This restores vacuum to both sides of the diaphragm, allowing everything to return to its original position.

DIAGNOSTIC TESTS

POWER BRAKE SYSTEM

Refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

BRAKE BOOSTER

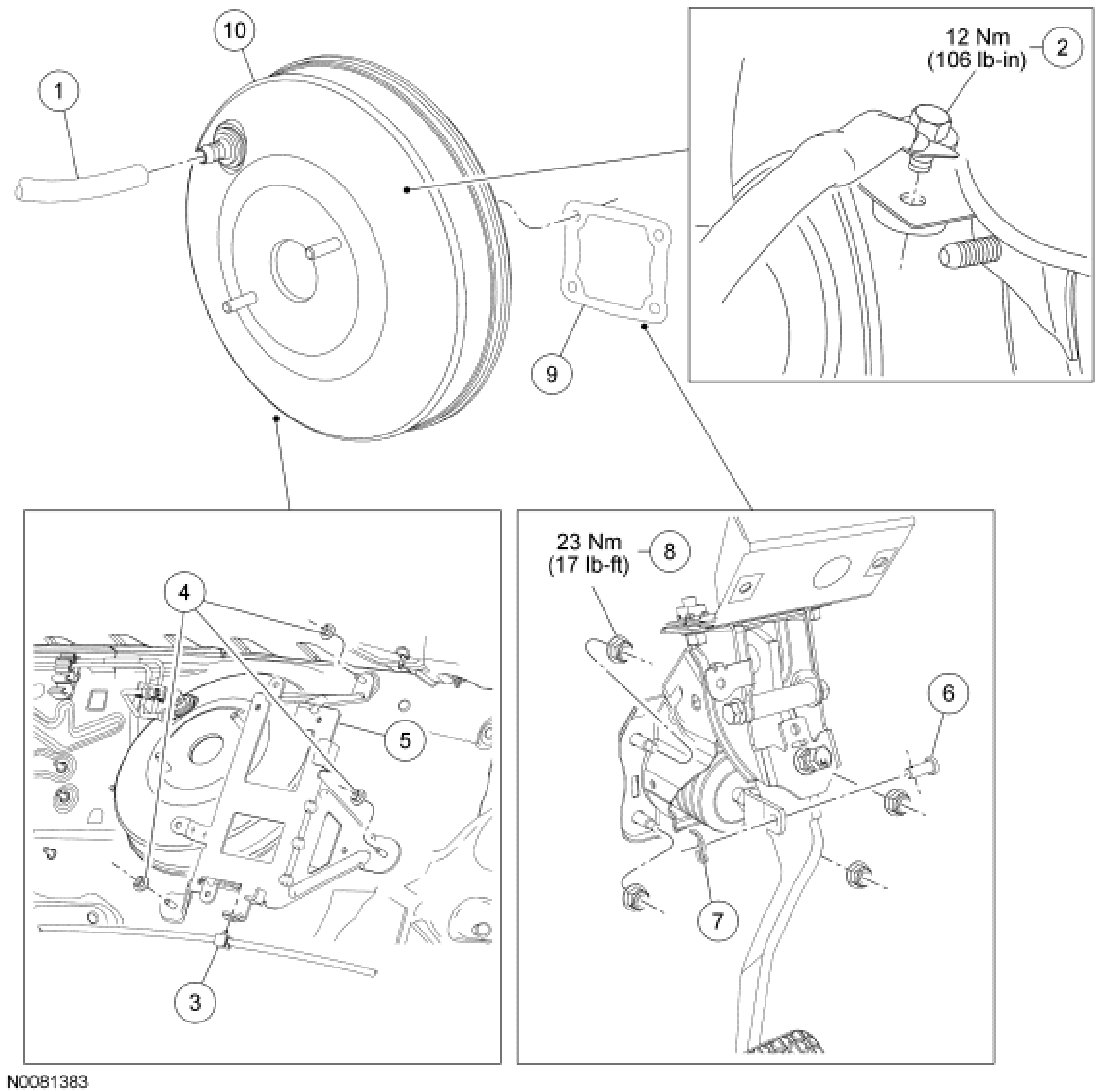


Fig. 1: Exploded View Of Brake Booster Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	9C840	Vacuum hose/aspirator assembly
2	W705936	Ground cable bolt
3	-	Harness fastener (part of 14290)
4	N804795	PCM bracket nuts
5	12A659	PCM bracket
6	2N513	Brake booster push rod pin
7	7B096	Brake booster push rod clip
8	W520212	Brake booster nut (4 required)
9	2B022	Brake booster-to-cowl gasket
10	2B195	Brake booster with check valve

REMOVAL AND INSTALLATION

All vehicles

1. Remove the brake master cylinder. For additional information, refer to **HYDRAULIC BRAKE ACTUATION** article.
2. Remove the PCM. For additional information, refer to **ELECTRONIC ENGINE CONTROLS - 2.3L** article or **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article.
3. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
4. Remove the bolt and disconnect the ground cable.
   - To install, tighten to 12 Nm (106 lb-in).
5. Disconnect the harness fastener and remove the 3 nuts and the PCM bracket.

NOTE: **Make sure that the aspirator tube is routed correctly and that the clamps are positioned so they do not make contact with surrounding components or damage to the tube may occur.**

6. Disconnect the vacuum hose/check valve assembly from the brake booster.

Automatic transmission vehicles

NOTE: **It is not necessary to remove the fluid level indicator tube from the transmission. The tube can be positioned aside with only the bolt removed.**

7. Remove the transmission fluid level indicator tube bolt and position the tube aside.
   - To install, tighten to 8 Nm (71 lb-in).

All vehicles

8. Remove the brake booster push rod pin and clip and disconnect the push rod from the brake pedal.
9. Remove the 4 nuts and the brake booster.
   - To install, tighten the nuts in a criss-cross pattern to 23 Nm (17 lb-ft).

NOTE: **Prior to installation, make sure that the distance between the booster mating surface and the push rod center point is as shown or reduced brake assist may occur.**

10. To install, reverse the removal procedure.
    - Check for correct booster push rod distance and adjust as necessary.
      - Tighten the booster push rod jam nut to 17 Nm (150 lb-in).

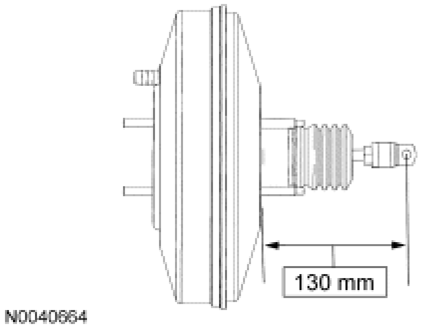


Fig. 2: Identifying Booster Push Rod Distance
Courtesy of FORD MOTOR CO.

2008 STEERING

Power Steering - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V	1.4L (2.5 pt)[a]

[a] Capacities listed are average system capacities and may vary.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Catalytic converter-to-exhaust flexible pipe nuts	40	30	-
Inner tie-rod	103	76	-
Outer tie-rod end nuts	48	35	-
Power steering fluid reservoir bracket bolts (3.5L)	7	-	62
Power steering fluid reservoir nuts (3.0L)	9	-	80
Power steering pump bolts	24	18	-
Pressure line bracket-to-engine bolts (3.0L-3.5L)	9	-	80
Pressure line bracket-to-power steering fluid reservoir bolt (3.0L)	9	-	80
Pressure line bracket-to-RH valve cover stud nut (3.5L)	9	-	80
Pressure line bracket-to-steering gear bolt (2.3L)	9	-	80
Pressure line bracket-to-steering gear bolt (3.0L-3.5L)	15	-	133
Pressure line bracket-to-subframe bolt (2.3L)	9	-	80
Pressure line-to-power steering pump banjo bolt	48	35	-
Pressure line-to-steering gear banjo bolts	55	41	-
Steering column shaft-to-steering gear bolt	25	18	-
Steering gear heat shield bolts	15	-	133
Steering gear bolts	107	79	-
Subframe bolts	103	76	-
Subframe nuts	150	111	-
Tie-rod jam nuts	90	66	-
Underbody splash shield bolts-to-subframe	7	-	62

DESCRIPTION AND OPERATION

POWER STEERING

The power steering system consists of the following components:

- Power steering pump
- Power steering fluid reservoir
- Power steering pressure and return lines/hoses
- Power steering fluid cooler
- Power steering gear
- Inner tie rod

The power steering system uses a vane-type pump to move the fluid from the reservoir to the steering gear and through the rest of the steering hydraulic system. The power steering pump is mounted to the engine and driven by the engine accessory drive belt. Power steering fluid flows into the pump from the reservoir. The power steering fluid is then trapped between the pump vanes and moved to the high-pressure side of the pump creating a flow of fluid. The restriction of this flow by the steering gear creates the pressure that provides the steering assist. A combined pressure relief/flow valve is built into the pump to control the maximum pressure and flow provided to the steering system. This action prevents damage to the system and provides the correct level of assist during all engine speeds. While under pressure, the power steering fluid flows through the high-pressure power steering line to the steering gear. The fluid exits the gear and flows through the return line, cooler and finally to the reservoir. The reservoir slows the fluid, allows air to escape and filters the fluid before returning it to the pump.

DIAGNOSTIC TESTS

POWER STEERING

Refer to **STEERING SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

POWER STEERING FLUID RESERVOIR - 3.0L

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

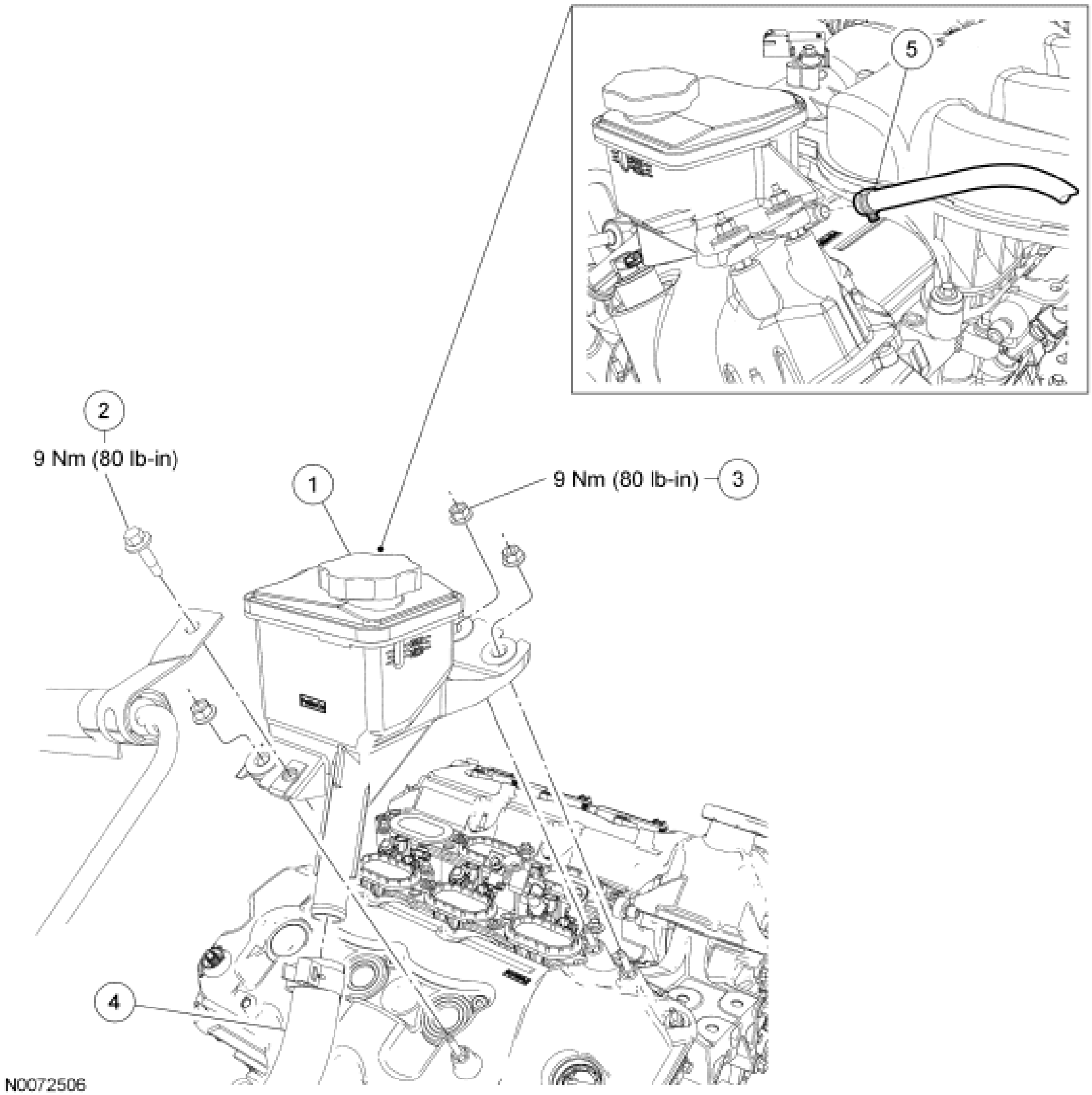


Fig. 1: Exploded View Of Power Steering Fluid Reservoir With Torque Specifications - 3.0L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3R700	Power steering fluid reservoir
2	W506413	Pressure line bracket-to-power steering fluid reservoir bolt
3	W520111	Power steering fluid reservoir nut (3 required)
4	3691	Power steering pump supply hose
5	3A713A	Power steering return hose

REMOVAL AND INSTALLATION

NOTE: **While repairing the power steering system, care should be taken to prevent the**

entry of foreign material or failure of the power steering components may result.

1. Using a suitable suction device, remove the power steering fluid from the fluid reservoir.
2. Release the clamp and disconnect the power steering return hose from the power steering fluid reservoir.
3. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

NOTE: **It is easier to access the power steering pump supply hose clamp from underneath the vehicle at the power steering pump.**

4. Release the clamp and disconnect the power steering pump supply hose from the power steering pump.

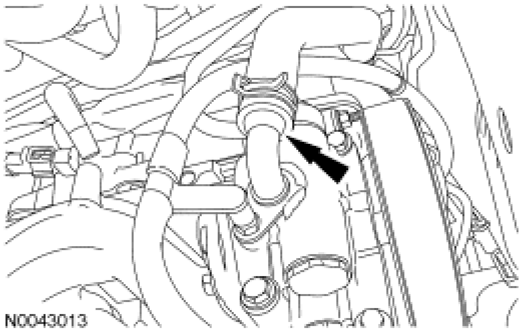


Fig. 2: Locating Power Steering Reservoir Supply Hose
Courtesy of FORD MOTOR CO.

5. Remove the pressure line bracket-to-power steering fluid reservoir bolt and position the bracket aside.
   - To install, tighten to 9 Nm (80 lb-in).
6. Remove the 3 power steering fluid reservoir nuts and remove the reservoir.
   - To install, tighten to 9 Nm (80 lb-in).
7. To install, reverse the removal procedure.
   - Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.

POWER STEERING FLUID RESERVOIR - 3.5L

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

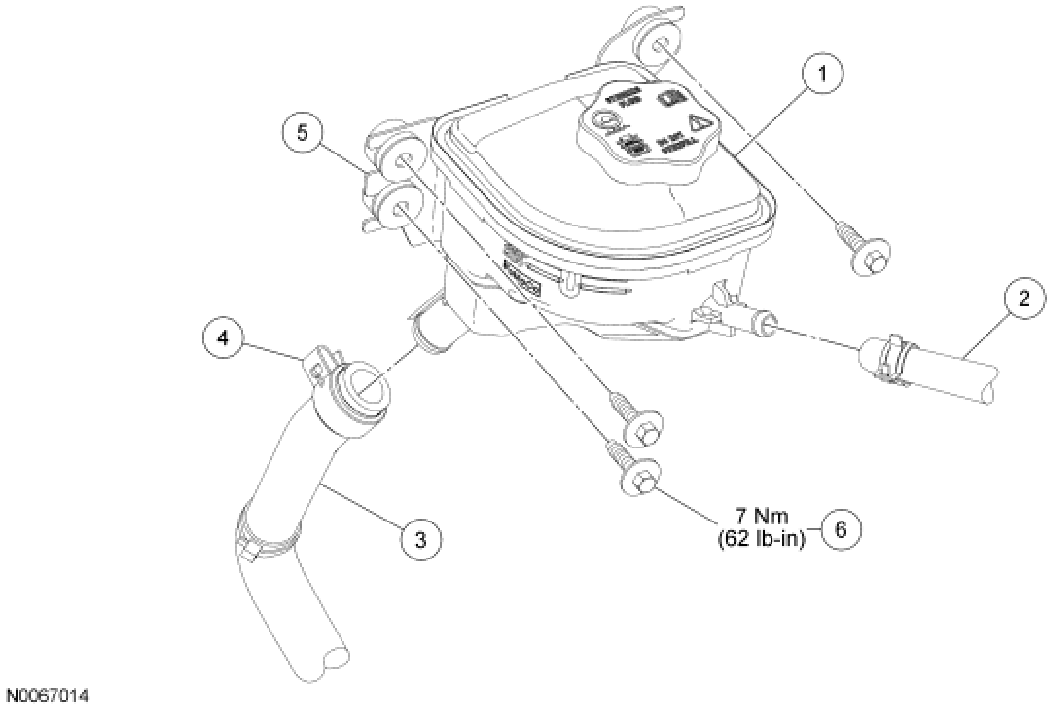


Fig. 3: Exploded View Of Power Steering Fluid Reservoir With Torque Specification - 3.5L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3A697	Power steering fluid reservoir
2	3A713A	Power steering return hose and clamp
3	3691	Power steering pump supply hose
4	-	Power steering pump supply hose clamp (part of 3691)
5	3490	Power steering fluid reservoir bracket
6	W712963	Power steering fluid reservoir bracket bolt (3 required)

REMOVAL AND INSTALLATION

NOTE: When repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

1. Using a suitable suction device, remove the power steering fluid from the fluid reservoir.
2. Release the clamp and disconnect the power steering return hose from the power steering fluid reservoir.
3. Remove the 3 power steering fluid reservoir bracket bolts.
    - To install, tighten to 7 Nm (62 lb-in).
4. Release the power steering pump supply hose clamp and disconnect the supply hose from the reservoir.

NOTE: **If a new power steering fluid reservoir is being installed, a new reservoir mounting bracket must also be installed.**

5. Remove the power steering fluid reservoir and bracket as an assembly.
6. To install, reverse removal procedure.
   - Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.

POWER STEERING PUMP - 2.3L

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

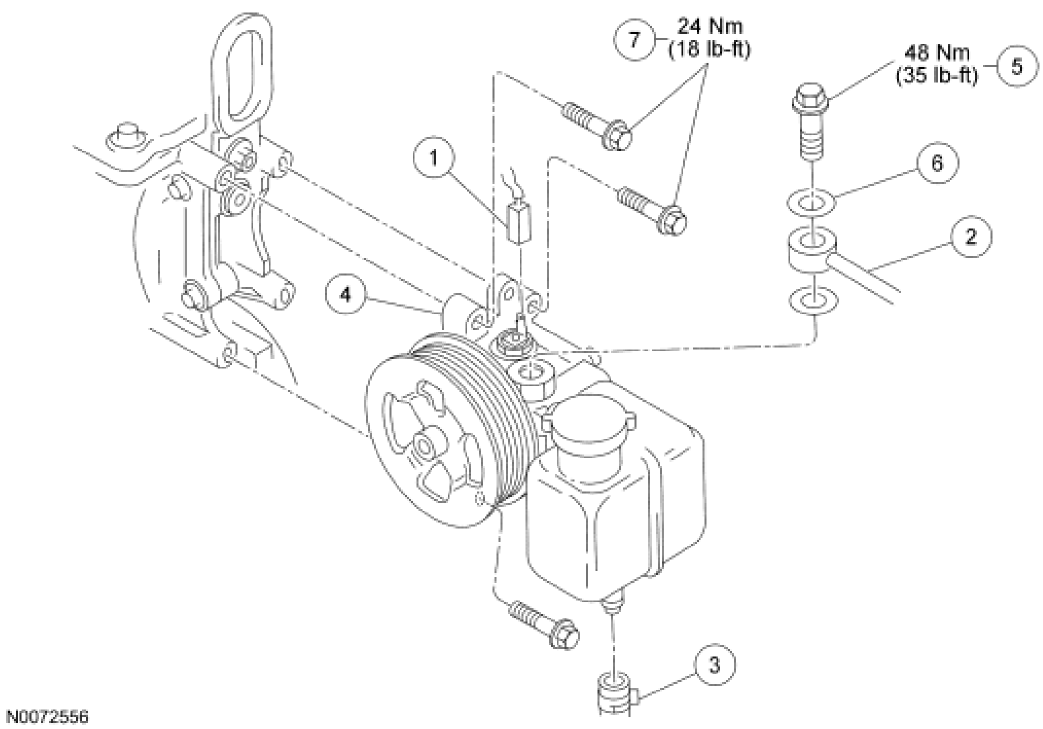


Fig. 4: Exploded View Of Power Steering Pump With Torque Specifications - 2.3L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Power steering pressure switch electrical connector
2	-	Power steering pressure line (part of 3A719)
3	3R807	Power steering return hose

4	3D639	Power steering pump
5	-	Pressure line-to-power steering pump banjo bolt (part of 3A705)
6	-	Power steering pressure line seal (part of 3A705)
7	W500111	Power steering pump bolts (3 required)

REMOVAL AND INSTALLATION

NOTE: While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

1. Using a suitable suction device, remove the power steering fluid from the fluid reservoir.
2. Remove the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 2.3L** article.
3. Release the clamp and disconnect the power steering return hose from the power steering fluid reservoir.
4. Disconnect the power steering pressure switch electrical connector.
5. Remove the pressure line-to-power steering pump banjo bolt and disconnect the line from the power steering pump.
    - Discard the bolt and 2 seals.
    - To install, tighten the new bolt to 48 Nm (35 lb-ft).
6. Remove the 3 power steering pump bolts and the power steering pump.
    - To install, tighten to 24 Nm (18 lb-ft).

    NOTE: A new bolt and new seals must be installed any time the power steering pressure line is disconnected from the power steering pump or a fluid leak may occur.

7. To install, reverse the removal procedure.
8. Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.

POWER STEERING PUMP - 3.0L, 3.5L

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

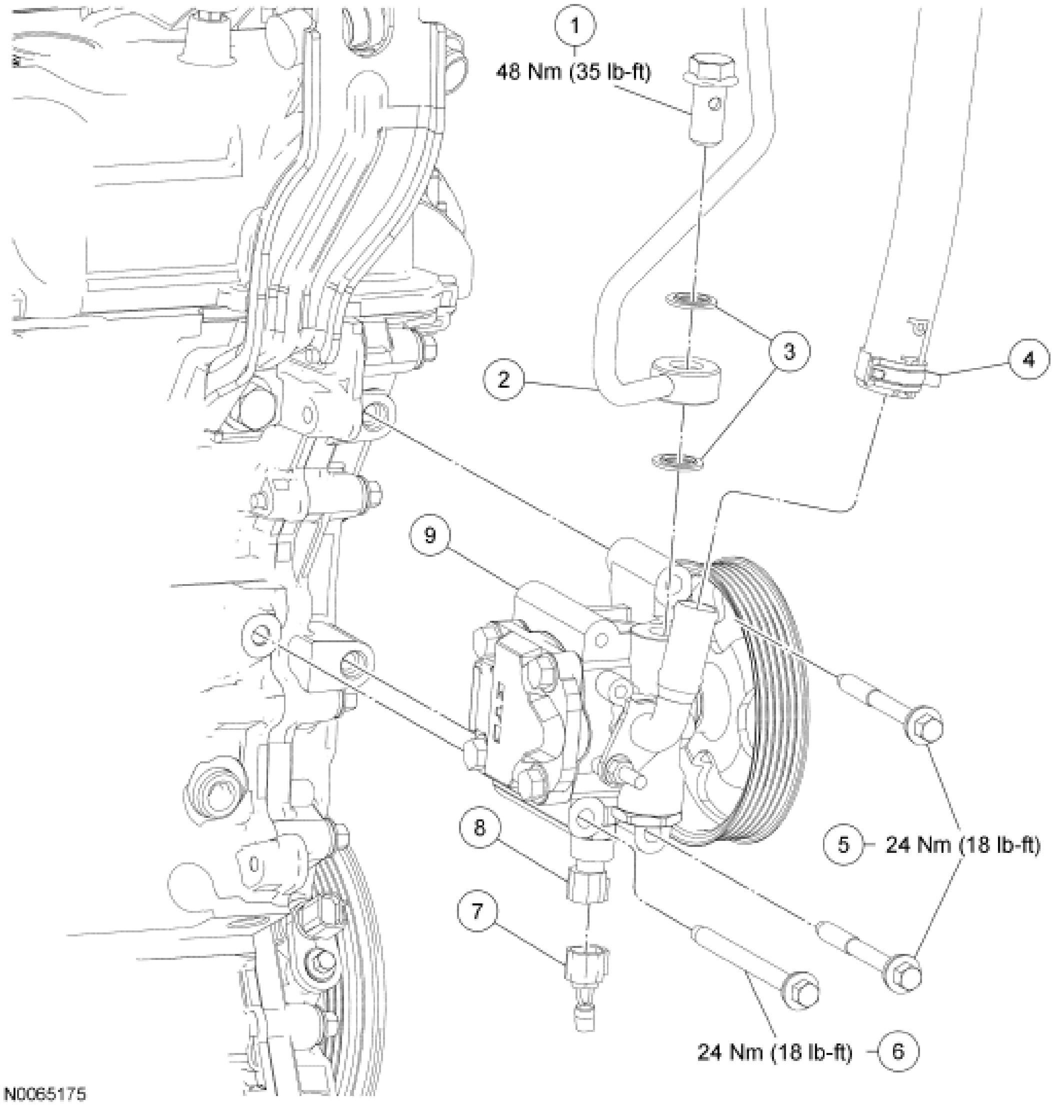


Fig. 5: Exploded View Of Power Steering Pump With Torque Specifications - 3.0L Engine
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Pressure line-to-power steering pump banjo bolt (part of 3A705)
2	-	Power steering pressure line (part of 3A719)
3	-	Power steering pressure line seals (part of 3A705)
4	3691	Power steering pump supply hose
5	W701526	Power steering pump bolts (2 required)
6	W701234	Power steering pump bolt
7	-	Power steering pressure switch electrical connector

8	3N824	Power steering pressure switch
9	3A696	Power steering pump

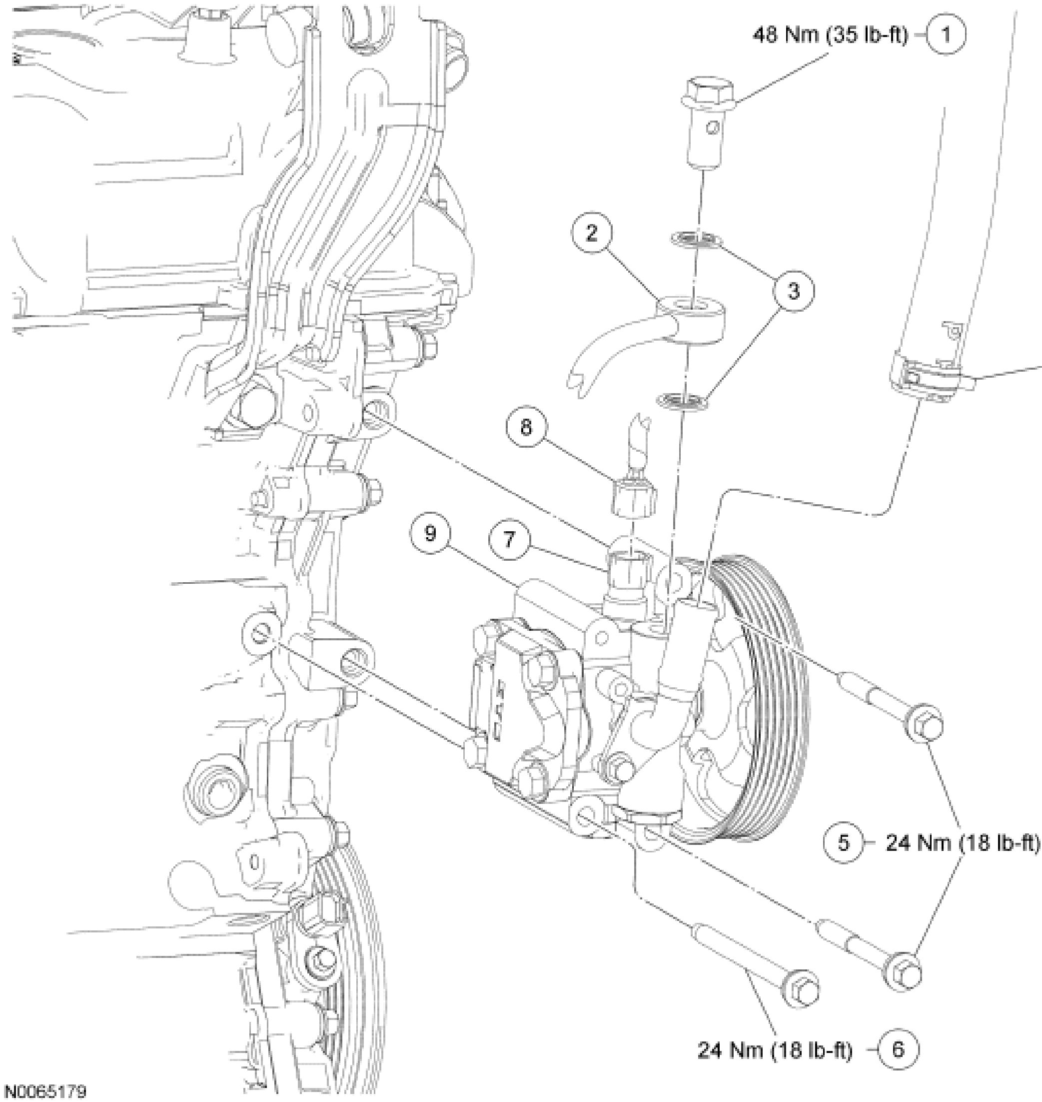


Fig. 6: Exploded View Of Power Steering Pump With Torque Specifications - 3.5L Engine
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Pressure line-to-power steering pump banjo bolt (part of 3A705)
2	-	Power steering pressure line (part of 3A719)
3	-	Power steering pressure line seals (part of 3A705)
4	3691	Power steering pump supply hose

5	W701526	Power steering pump bolts (2 required)
6	W701234	Power steering pump bolt
7	-	Power steering pressure switch electrical connector
8	3N824	Power steering pressure switch
9	3A696	Power steering pump

REMOVAL AND INSTALLATION

NOTE: When repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

3.0L engine

1. Using a suitable suction device, remove the power steering fluid from the fluid reservoir.
2. Remove the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 3.0L (4V)** article.
3. Release the clamp and disconnect the power steering pump supply hose.

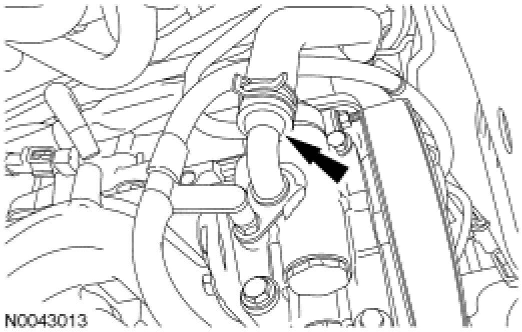


Fig. 7: Locating Power Steering Reservoir Supply Hose
Courtesy of FORD MOTOR CO.

4. Detach the electrical harness from the stud on the power steering pump.

3.5L engine

5. Remove the power steering fluid reservoir. For additional information, refer to **Power Steering Fluid Reservoir - 3.5L**.
6. Remove the power steering pump belt. For additional information, refer to **ACCESSORY DRIVE - 3.5L** article.

3.0L and 3.5L engines

7. Disconnect the power steering pressure switch electrical connector.

8. If equipped, detach the engine block heater electrical harness from the power steering pressure line.
9. Remove the pressure line-to-power steering pump banjo bolt and disconnect the line from the power steering pump.
   - Discard the bolt and 2 seals.
   - To install, tighten the new bolt to 48 Nm (35 lb-ft).
10. Remove the 3 bolts and the power steering pump.
    - To install, tighten to 24 Nm (18 lb-ft).

NOTE: **A new banjo bolt and new seals must be installed any time the power steering pressure line is disconnected from the power steering pump or a fluid leak may occur.**

11. To install, reverse the removal procedure.
12. Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.

POWER STEERING PUMP TO STEERING GEAR PRESSURE LINE - FRONT WHEEL DRIVE (FWD)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

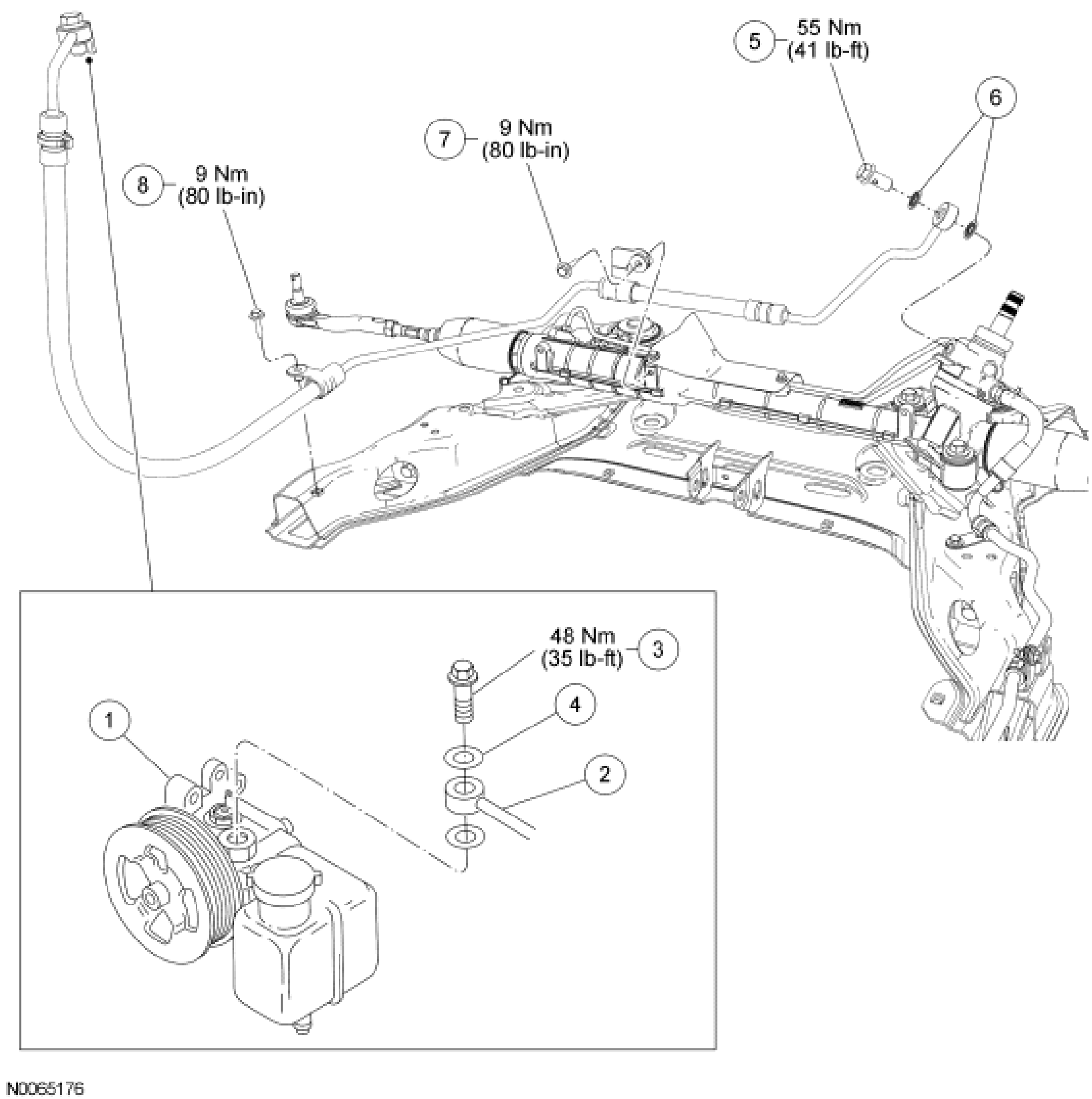


Fig. 8: Exploded View Of Power Steering Pump To Steering Gear Pressure Line With Torque Specifications - 2.3L Engine
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3D639	Power steering pump
2	-	Power steering pressure line (part of 3A719)
3	-	Pressure line-to-power steering pump banjo bolt (part of 3A719)
4	-	Power steering pressure line seal (part of 3A719)
5	-	Pressure line-to-steering gear banjo bolt (part of 3A719)
		Power steering pressure line seals (part of

6	-	3A719)
7	W505425	Pressure line bracket-to-steering gear bolt
8	W505425	Pressure line bracket-to-subframe bolt

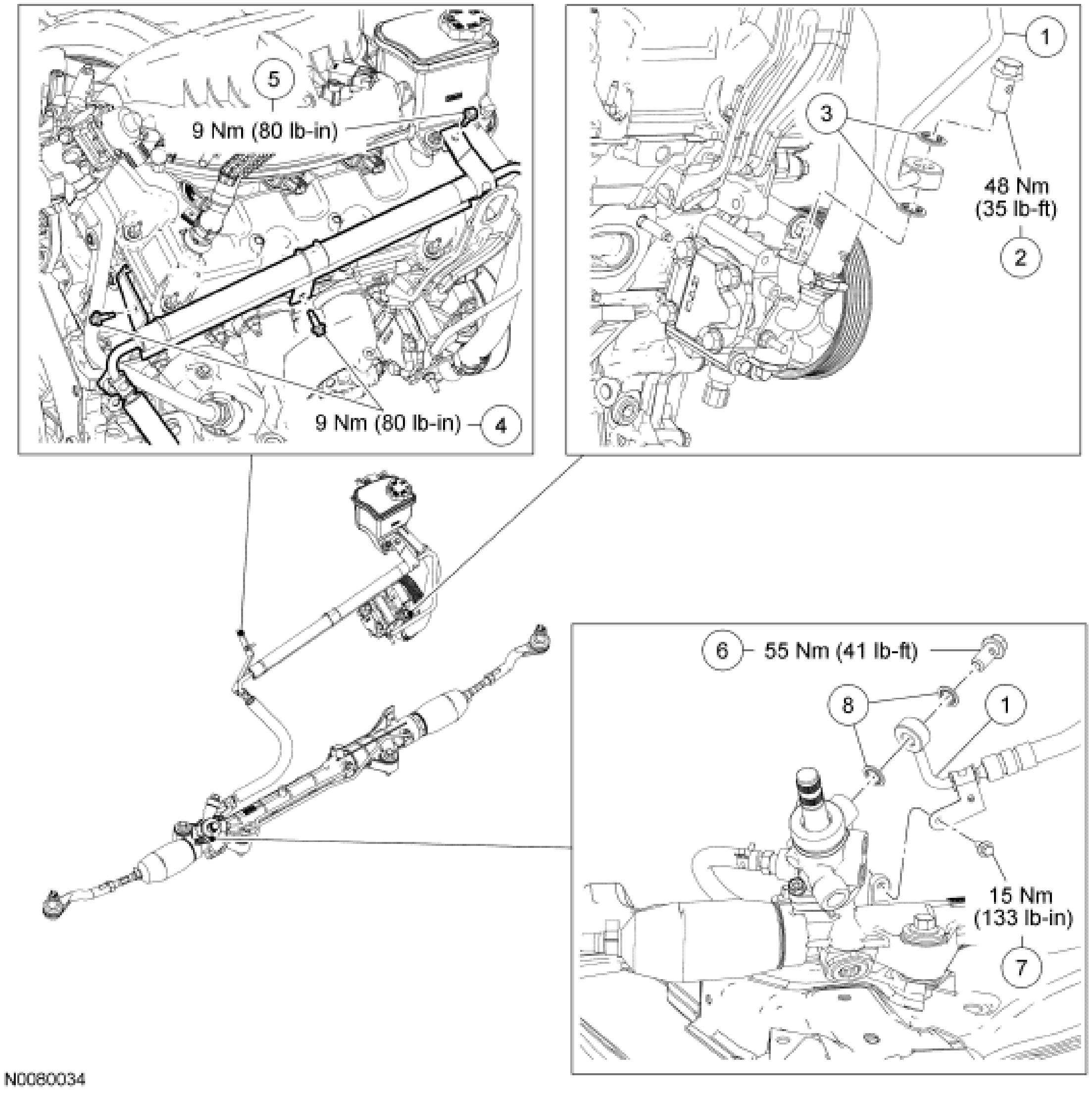


Fig. 9: Exploded View Of Power Steering Pump To Steering Gear Pressure Line With Torque Specifications - 3.0L Engine
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Power steering pressure line (part of 3A719)
2	-	Pressure line-to-power steering pump banjo bolt (part of 3A719)
3	-	Power steering pressure line seals (part of 3A719)

4	W506413	Pressure line bracket-to-engine bolts (2 required)
5	W506413	Pressure line bracket-to-power steering fluid reservoir bolt
6	-	Pressure line-to-steering gear banjo bolt (part of 3A719)
7	W712155	Pressure line bracket-to-steering gear bolt
8	-	Power steering pressure line seals (part of 3A719)

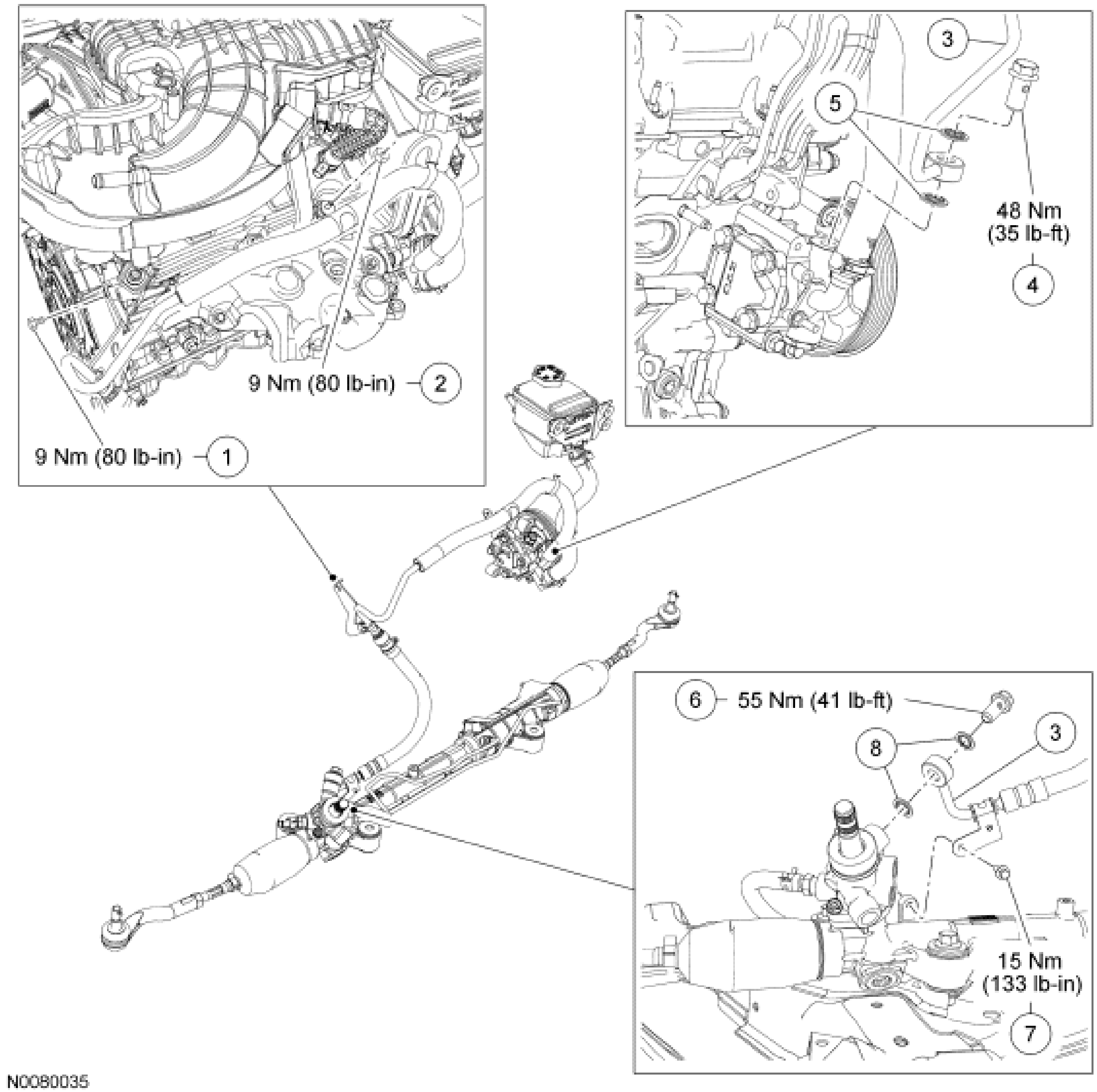


Fig. 10: Exploded View Of Power Steering Pump To Steering Gear Pressure Line With Torque Specifications - 3.5L Engine
Courtesy of FORD MOTOR CO.

Item	**Part Number**	**Description**

1	W506413	Pressure line bracket-to-engine bolt
2	W703836	Pressure line bracket-to-RH valve cover stud nut
3	-	Power steering pressure line (part of 3A719)
4	-	Pressure line-to-power steering pump banjo bolt (part of 3A719)
5	-	Power steering pressure line seals (part of 3A719)
6	-	Pressure line-to-steering gear banjo bolt (part of 3A719)
7	W712115	Pressure line bracket-to-steering gear bolt
8	-	Power steering pressure line seals (part of 3A719)

REMOVAL AND INSTALLATION

NOTE: When repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

All engines

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

2.3L engine

2. Remove the pressure line-to-power steering pump banjo bolt.
   - Discard the bolt and the 2 seals.
   - To install, tighten the new bolt to 48 Nm (35 lb-ft).
3. Remove the 4 screws and position the RH fender splash shield aside.

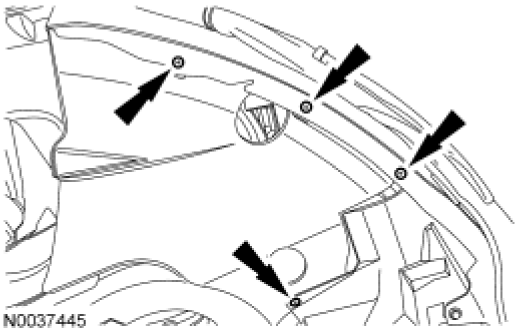


Fig. 11: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

4. Remove the 6 pin-type retainers (4 shown) and the RH splash shield.

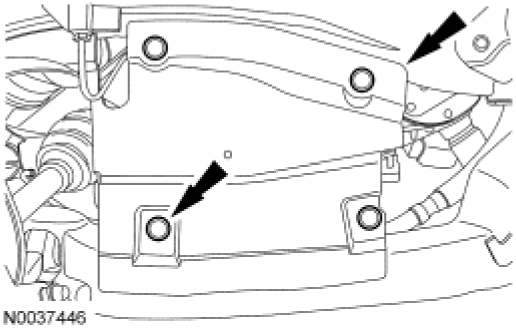


Fig. 12: Locating Splash Shield Pin-Type Retainers
Courtesy of FORD MOTOR CO.

3.0L and 3.5L engines

5. Remove the battery and battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

3.0L engine

6. Remove the pressure line bracket-to-power steering fluid reservoir bolt.
   - Detach the electrical harness retainer from the pressure line bracket.
   - To install, tighten to 9 Nm (80 lb-in).
7. Remove the 2 pressure line bracket-to-engine bolts.
   - Detach the electrical harness retainer from the pressure line bracket.
   - To install, tighten to 9 Nm (80 lb-in).

3.5L engine

8. Remove the pressure line clip from the RH cylinder head engine lift hook.
9. Remove the pressure line bracket-to-RH valve cover stud nut.
   - Detach the electrical harness retainer from the pressure line bracket.
     - To install, tighten to 9 Nm (80 lb-in).
10. Remove the pressure line bracket-to-engine bolt.
    - Detach the electrical harness retainer from the pressure line bracket.
    - To install, tighten to 9 Nm (80 lb-in).

2.3L engine

11. Remove the pressure line bracket-to-subframe bolt.
    - To install, tighten to 9 Nm (80 lb-in).
12. Remove the pressure line bracket-to-steering gear bolt.

- To install, tighten to 9 Nm (80 lb-in).

3.0L and 3.5L engines

13. Remove the pressure line-to-power steering pump banjo bolt.
    - Discard the bolt and the 2 seals.
    - To install, tighten the new bolt to 48 Nm (35 lb-ft).
14. Remove the pressure line bracket-to-steering gear bolt.
    - To install, tighten to 15 Nm (133 lb-in).

All engines

15. If equipped, detach the engine block heater harness from the power steering pressure line.
16. Remove the pressure line-to-steering gear banjo bolt and remove the pressure line.
    - Discard the bolt and the 2 seals.
    - To install, tighten the new bolt to 55 Nm (41 lb-ft).

NOTE: New banjo bolts and new seals must be installed any time the power steering pressure line is disconnected from the power steering pump and/or the power steering gear or a fluid leak may occur.

17. To install, reverse removal procedure.
18. Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.

POWER STEERING PUMP TO STEERING GEAR PRESSURE LINE - ALL WHEEL DRIVE (AWD)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

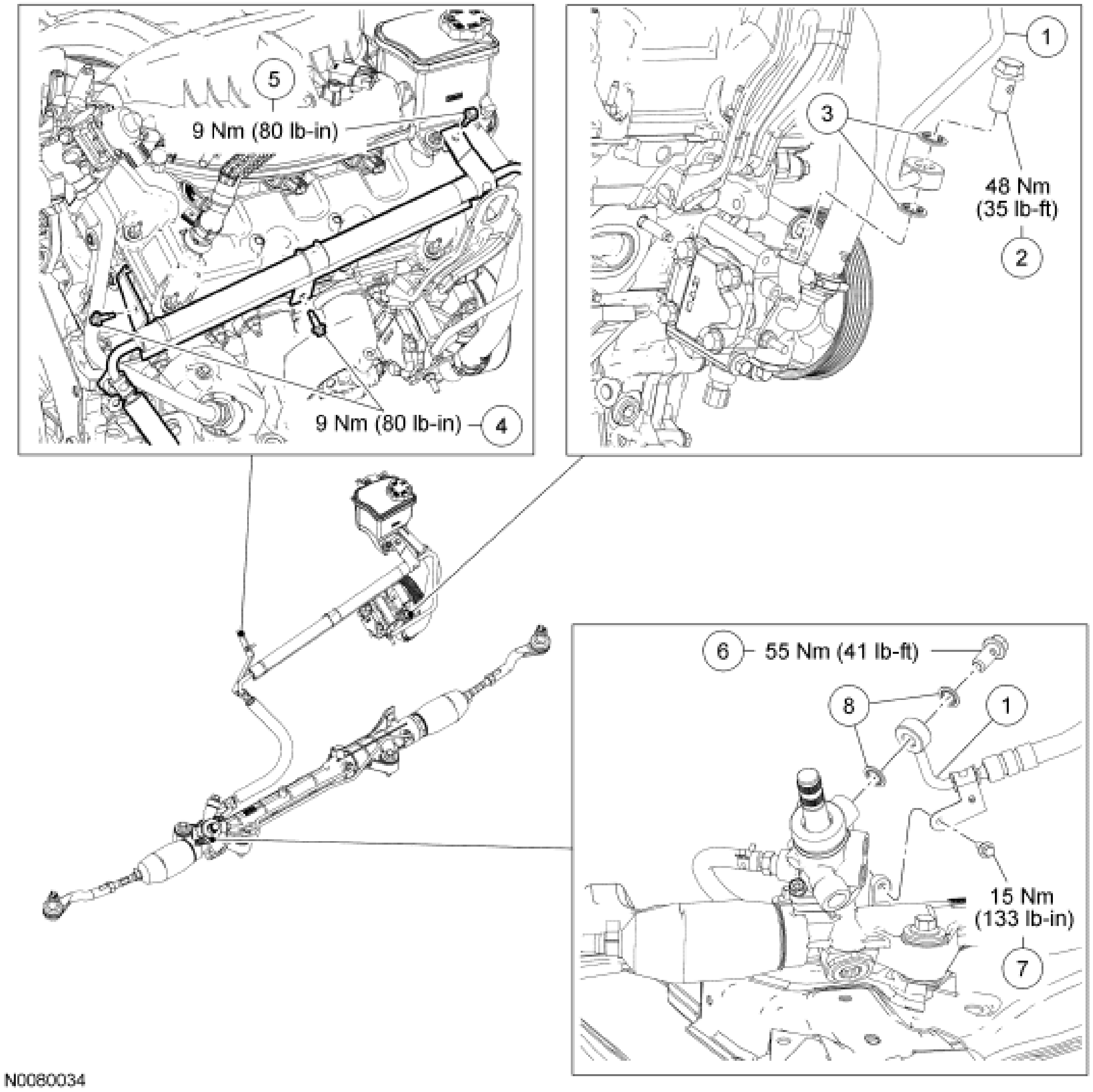


Fig. 13: Exploded View Of Power Steering Pump to Steering Gear Pressure Line With Torque Specifications - 3.0L Engine
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Power steering pressure line (part of 3A719)
2	-	Pressure line-to-power steering pump banjo bolt (part of 3A719)
3	-	Power steering pressure line seals (part of 3A719)
4	W506413	Pressure line bracket-to-engine bolts (2 required)
5	W506413	Pressure line bracket-to-power steering fluid reservoir bolt

6	-	Pressure line-to-steering gear banjo bolt (part of 3A719)
7	W712155	Pressure line bracket-to-steering gear bolt
8	-	Power steering pressure line seals (part of 3A719)

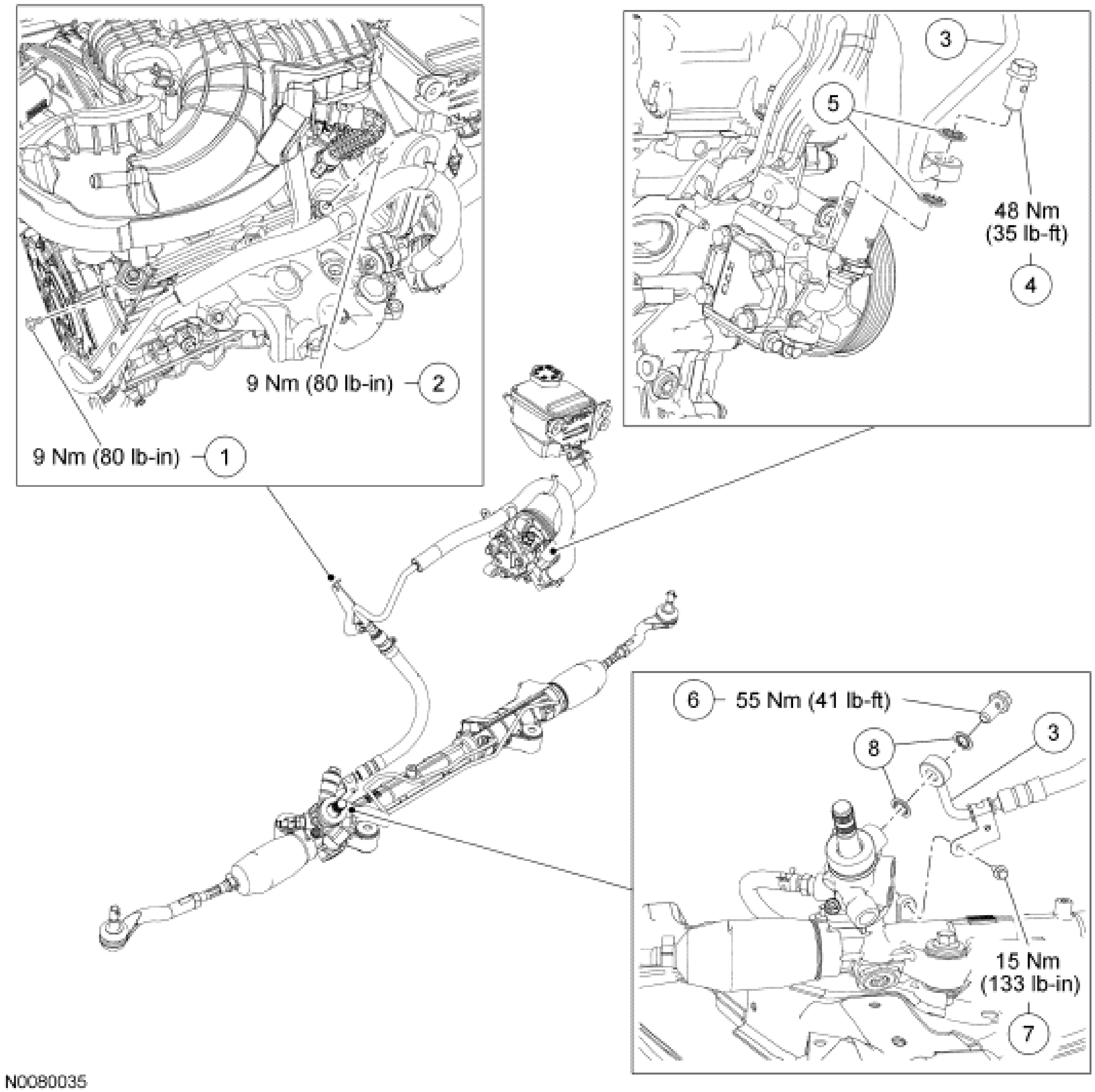


Fig. 14: Exploded View Of Power Steering Pump to Steering Gear Pressure Line With Torque Specifications - 3.5L Engine
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W506413	Pressure line bracket-to-engine bolt
2	W703836	Pressure line bracket-to-RH valve cover stud nut
		Power steering pressure line (part of

3	-	3A719)
4	-	Pressure line-to-power steering pump banjo bolt (part of 3A719)
5	-	Power steering pressure line seals (part of 3A719)
6	-	Pressure line-to-steering gear banjo bolt (part of 3A719)
7	W712115	Pressure line bracket-to-steering gear bolt
8	-	Power steering pressure line seals (part of 3A719)

REMOVAL AND INSTALLATION

NOTE: When repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

3.0L and 3.5L engines

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the battery and battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

   NOTE: Battery mounting bracket removed for clarity.

3. Disconnect the electrical connectors from the PCM.
   - Detach the wiring harness retainer from the PCM bracket, position harness aside.

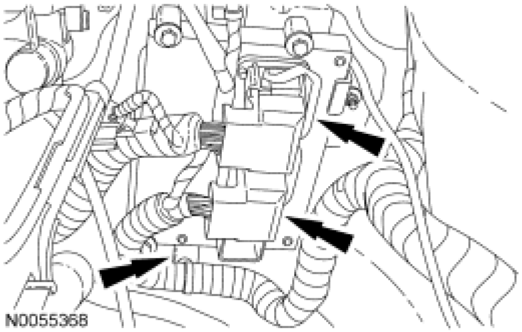


Fig. 15: Identifying Electrical Connectors From Power Control Module (PCM)
Courtesy of FORD MOTOR CO.

4. Remove the lower cowl panel grille. For additional information, refer to **FRONT END BODY PANELS** article.

3.0L engine

5. Remove the pressure line bracket-to-power steering fluid reservoir bolt.
   - Detach the electrical harness retainer from the pressure line bracket.
   - To install, tighten to 9 Nm (80 lb-in).
6. Remove the 2 pressure line bracket-to-engine bolts.
   - Detach the electrical harness retainer from the pressure line bracket.
   - To install, tighten to 9 Nm (80 lb-in).

3.5L engine

7. Remove the pressure line bracket-to-RH valve cover stud nut.
   - Detach the electrical harness retainer from the pressure line bracket.
   - To install, tighten to 9 Nm (80 lb-in).

3.0L and 3.5L engines

8. If equipped detach the engine block heater harness from the power steering pressure line.
9. Remove the pressure line bracket-to-steering gear bolt.
   - To install, tighten to 15 Nm (133 lb-in).
10. Remove the pressure line-to-power steering pump banjo bolt.
    - Discard the bolt and the 2 seals.
    - To install, tighten the new bolt to 48 Nm (35 lb-ft).
11. Remove the pressure line-to-steering gear banjo bolt and remove the power steering pressure line.
    - Discard the bolt and the 2 seals.
    - To install, tighten the new bolt to 55 Nm (41 lb-ft).

NOTE: New banjo bolts and new seals must be installed any time the power steering pressure line is disconnected from the power steering pump and/or the power steering gear or a fluid leak may occur.

12. To install, reverse removal procedure.
13. Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.

POWER STEERING FLUID COOLER

NOTE: The power steering fluid cooler is integral to the A/C condenser core. Refer to the CLIMATE CONTROL article.

STEERING GEAR - FRONT WHEEL DRIVE (FWD)

Special Tools

Illustration	Tool Name	Tool Number
	Tie-Rod End Remover	211-105 (T85M-3395-A)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTE: **The 3.0L shown, 3.5L similar.**

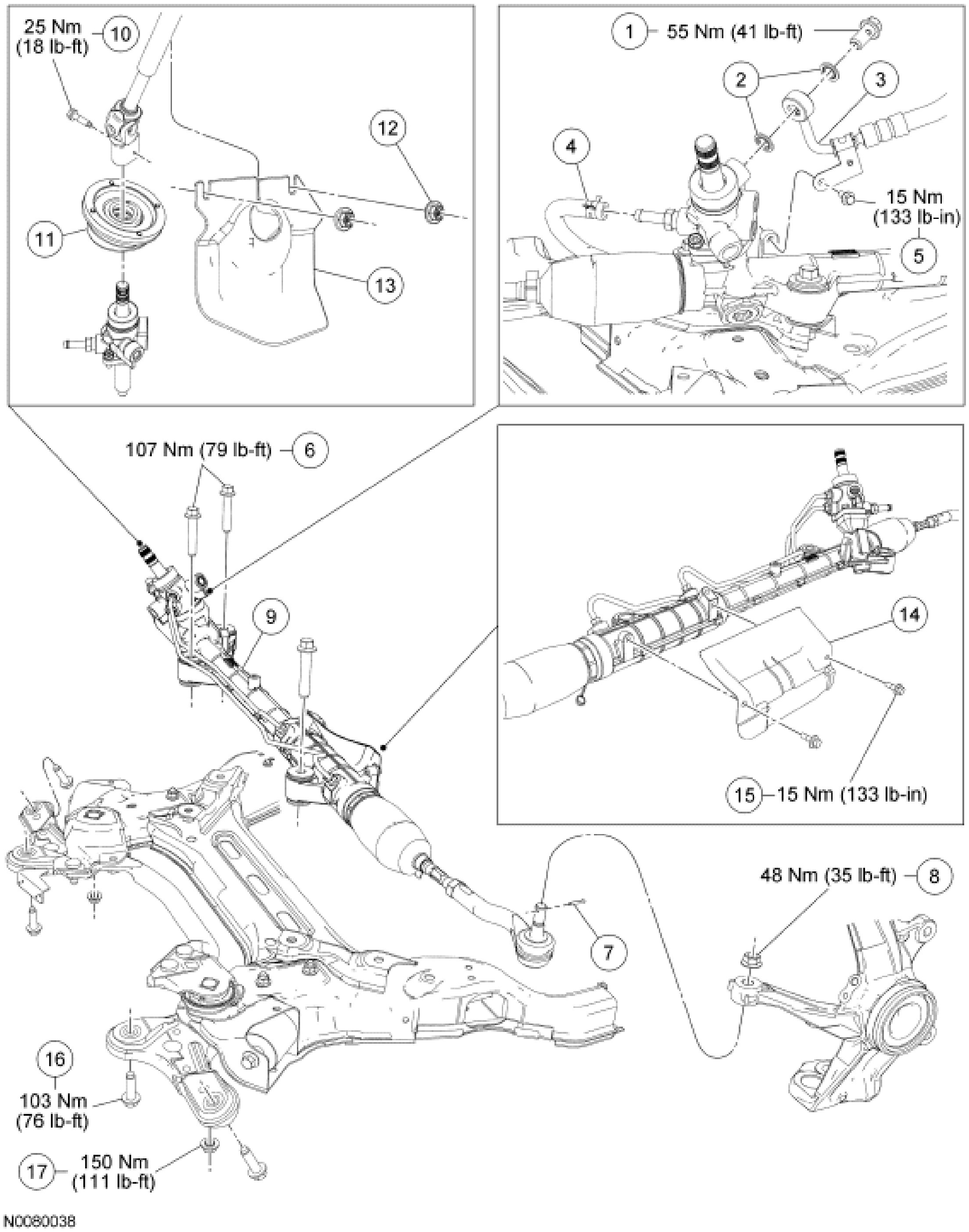


Fig. 16: Exploded View Of Steering Gear With Torque Specifications - Front Wheel Drive (FWD)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Pressure line-to-steering gear banjo bolt (part of 3A705)
2	-	Power steering pressure line seals (part of

		3A705)
3	-	Power steering pressure line (part of 3A719)
4	3A713	Steering gear-to-fluid cooler return hose
5	W712155	Pressure line bracket-to-steering gear bolt
6	3C497	Steering gear bolts (3 required)
7	99221	Cotter pin (2 required)
8	6E5C	Outer tie-rod end nut (2 required)
9	3504	Steering gear
10	3R827	Steering column shaft-to-steering gear bolt
11	3611B	Steering gear/dash seal
12	W704904	Lower steering column shaft joint cover nut (2 required)
13	3611A	Lower steering column shaft joint cover
14	391727	Steering gear heat shield
15	3530B	Steering gear heat shield bolt (2 required)
16	3C496	Subframe bolt (4 required)
17	W520416	Subframe nut (2 required)

REMOVAL

NOTE: **When repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.**

All engines

1. Turn the steering wheel to the straight-ahead position and turn the ignition switch to the OFF position.
   - Remove the key.
2. Remove the wheels and tires. For additional information, refer to **WHEELS AND TIRES** article.
3. Remove the 2 lower steering column shaft joint cover nuts and the cover.

   NOTE: **Make sure to correctly index-mark the steering gear-to-steering column shaft position or unequal right-to-left turns may occur, causing tire contact with the body and/or clockspring damage.**

4. Index-mark the steering column shaft-to-steering gear position for reference during installation.

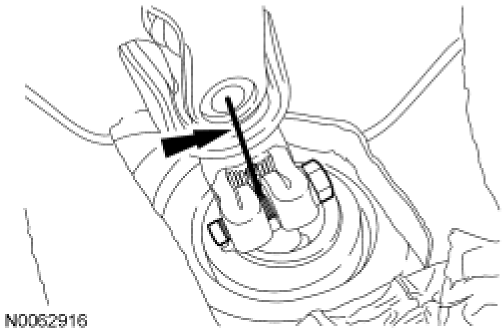


Fig. 17: Locating Steering Column Shaft-To-Steering Gear Position Index-Mark
Courtesy of FORD MOTOR CO.

NOTE: **Do not allow the steering column to rotate while the steering column shaft is disconnected from the steering gear or damage to the clockspring may occur. If there is evidence that the steering column has rotated, the clockspring must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.**

5. Remove the bolt and disconnect the steering column shaft from the steering gear.
   - Discard the bolt.

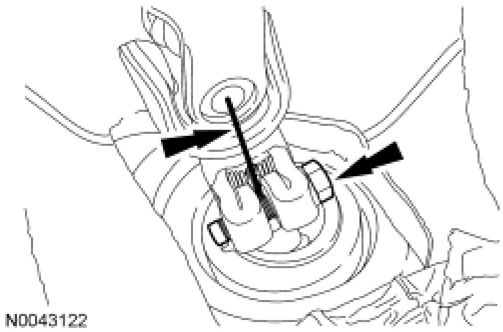


Fig. 18: Locating Steering Column Shaft Index Mark And Bolt
Courtesy of FORD MOTOR CO.

NOTE: **Remove the steering gear/dash seal or damage to the seal may occur.**

6. Remove the steering gear/dash seal.

NOTE: **RH side shown, LH side similar.**

7. Remove 4 screws from each side and position the RH and LH fender splash shield aside.

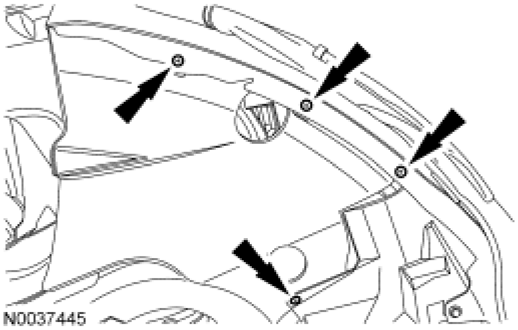


Fig. 19: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

NOTE: RH side shown, LH side similar.

8. Remove the 6 pin-type retainers (4 shown) from the LH and RH splash shield.

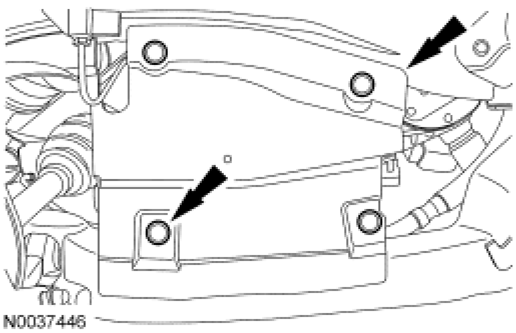


Fig. 20: Locating Splash Shield Pin-Type Retainers
Courtesy of FORD MOTOR CO.

9. If equipped, remove the bolts and the underbody splash shield.
10. Remove the 2 outer tie-rod end cotter pins and nuts.
    - Discard the cotter pins.

NOTE: Do not use a hammer to separate the outer tie-rod end from the wheel knuckle or damage to the wheel knuckle may result.

11. Using the Tie-Rod End Remover, separate the outer tie-rod ends from the knuckle.

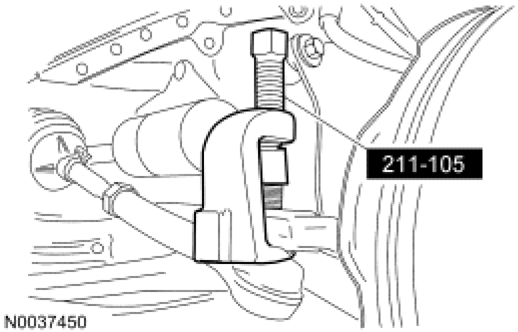


Fig. 21: Separating Tie-Rod Ends From Wheel Knuckles Using Special Tool (211-105)
Courtesy of FORD MOTOR CO.

NOTE: Always install new fasteners and gaskets. Clean flange faces prior to new gasket installation to make sure of proper sealing.

12. Remove and discard the 2 catalytic converter-to-exhaust flexible pipe nuts and separate the exhaust flexible pipe.

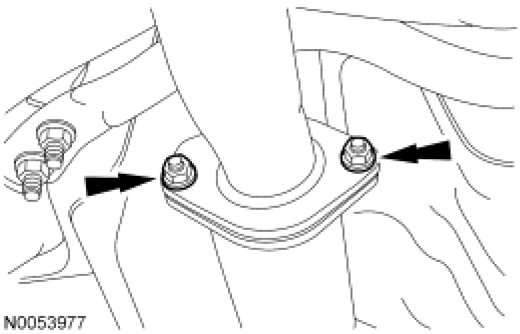


Fig. 22: Identifying Catalytic Converter-To-Exhaust Flexible Pipe Nuts
Courtesy of FORD MOTOR CO.

13. Remove the 2 bolts and the steering gear heat shield.

2.3L engine

14. Remove the pressure line bracket-to-steering gear bolt.

3.0L and 3.5L engines

15. Remove the pressure line bracket-to-steering gear bolt.

All engines

16. Remove the pressure line-to-steering gear banjo bolt.
    - Discard the bolt and 2 seals.
17. Support the rear of the subframe with a suitable jack and remove the 4 rear subframe bolts and 2 rear

subframe nuts.

18. Lower the rear of the front subframe 76.2 mm (3 in) with the support of the jack.
19. Release the clamp and disconnect the steering gear-to-fluid cooler return hose.
20. Remove the 3 steering gear bolts.
21. Remove the steering gear from the LH side of the vehicle.

INSTALLATION

All engines

NOTE: **While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.**

1. From the LH side of the vehicle, install the steering gear.
2. Install the 3 steering gear bolts.
   - Tighten to 107 Nm (79 lb-ft).
3. Release the clamp and connect the steering gear-to-fluid cooler return hose.
4. Using a suitable jack, raise the rear of the front subframe.
5. Install the 4 rear subframe bolts and 2 rear subframe nuts.
   - To install, tighten the bolts and nuts in 2 stages.
     - Stage 1: Tighten the nuts to 150 Nm (111 lb-ft).
     - Stage 2: Tighten the bolts to 103 Nm (76 lb-ft).

NOTE: **New banjo bolts and new seals must be installed any time the power steering pressure line is disconnected from the power steering pump and/or the steering gear or a fluid leak may occur.**

6. Install the new pressure line-to-steering gear banjo bolt.
   - Install 2 new seals.
   - Tighten to 55 Nm (41 lb-ft).

3.0L and 3.5L engines

7. Install the pressure line bracket-to-steering gear bolt.
   - Tighten to 15 Nm (133 lb-in).

2.3L engines

8. Install the pressure line bracket-to-steering gear bolt.
   - Tighten to 9 Nm (80 lb-in).

All engines

9. Install the steering gear heat shield and the 2 bolts.
   - To install, tighten to 15 Nm (133 lb-in).

NOTE: Always install new fasteners and gaskets. Clean flange faces prior to new gasket installation to make sure of proper sealing.

10. Position the exhaust flexible pipe and install 2 new catalytic converter-to-exhaust flexible pipe nuts.
    - Tighten to 40 Nm (30 lb-ft).

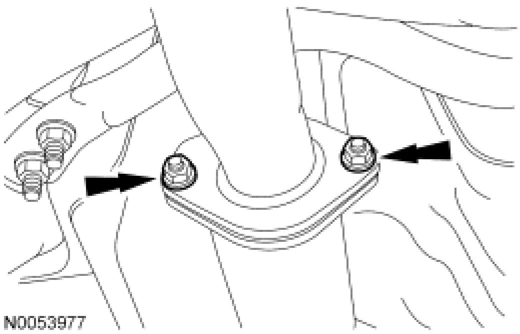


Fig. 23: Identifying Catalytic Converter-To-Exhaust Flexible Pipe Nuts
Courtesy of FORD MOTOR CO.

11. Install the 2 outer tie-rod end nuts.
    - Tighten to 48 Nm (35 lb-ft).
    - Install 2 new cotter pins.
12. If equipped, install the underbody splash shield and bolts.
    - Tighten to 7 Nm (62 lb-in).

NOTE: RH side shown, LH side similar.

13. Install the LH and RH splash shield and the 6 pin-type retainers (4 shown).

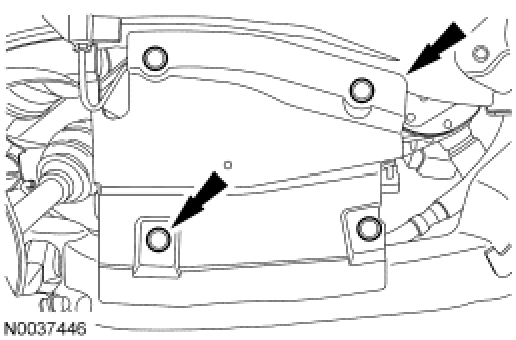


Fig. 24: Locating Splash Shield Pin-Type Retainers
Courtesy of FORD MOTOR CO.

NOTE: RH side shown, LH side similar.

14. Install the RH and LH fender splash shield and the 4 screws from each side.

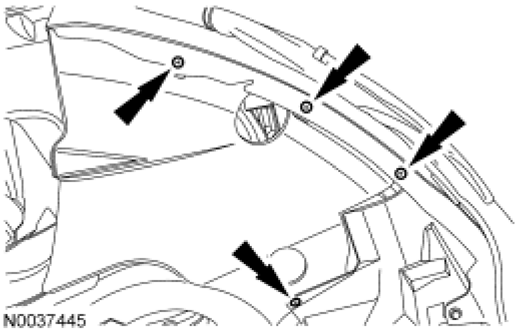


Fig. 25: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

NOTE: The steering gear/dash seal must be fully seated in the steering gear valve tower groove before the retaining clips are fully engaged into the body. If the steering gear/dash seal is not seated to the steering gear valve tower groove and the clips are not fully engaged to the body, water and foreign material may enter the passenger compartment, and damage the vehicle interior.

15. Applying hand force to the center of the seal, install the steering gear/dash seal onto the steering gear valve tower until the seal is fully seated in the valve tower groove.

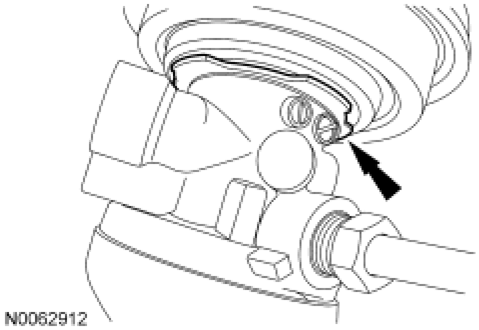


Fig. 26: Locating Valve Tower Groove
Courtesy of FORD MOTOR CO.

16. Install the steering gear/dash seal until the retaining clips are fully engaged into the body.

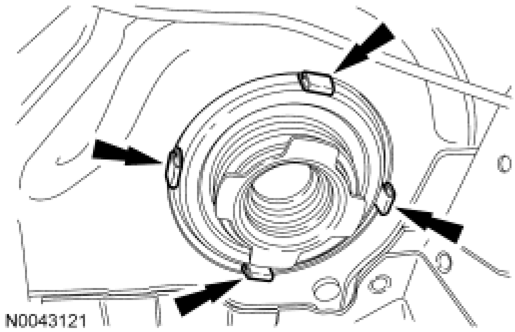


Fig. 27: Locating Steering Column Shaft-To-Dash Seal
Courtesy of FORD MOTOR CO.

NOTE: **Do not allow the steering column to rotate while the steering column shaft is disconnected from the steering gear or damage to the clockspring may occur. If there is evidence that the steering column has rotated, the clockspring must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.**

NOTE: **Make sure to correctly align the index marks when installing the steering gear-to-steering column shaft or unequal right-to-left turns may occur, causing tire contact with the body and/or clockspring damage.**

17. With the index marks properly aligned, connect the steering column shaft to the steering gear and install the new bolt.
    - Tighten to 25 Nm (18 lb-ft).

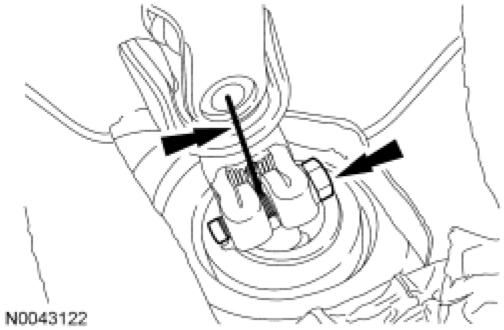


Fig. 28: Locating Steering Column Shaft Index Mark And Bolt
Courtesy of FORD MOTOR CO.

18. Install the lower steering column shaft joint cover and the 2 nuts.
19. Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.
20. Check and, if necessary, adjust the front toe. For additional information, refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

STEERING GEAR - ALL WHEEL DRIVE (AWD)

Special Tools

Illustration	Tool Name	Tool Number
	Tie-Rod End Remover	211-105 (T85M-3395-A)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTE: **The 3.0L shown, 3.5L similar.**

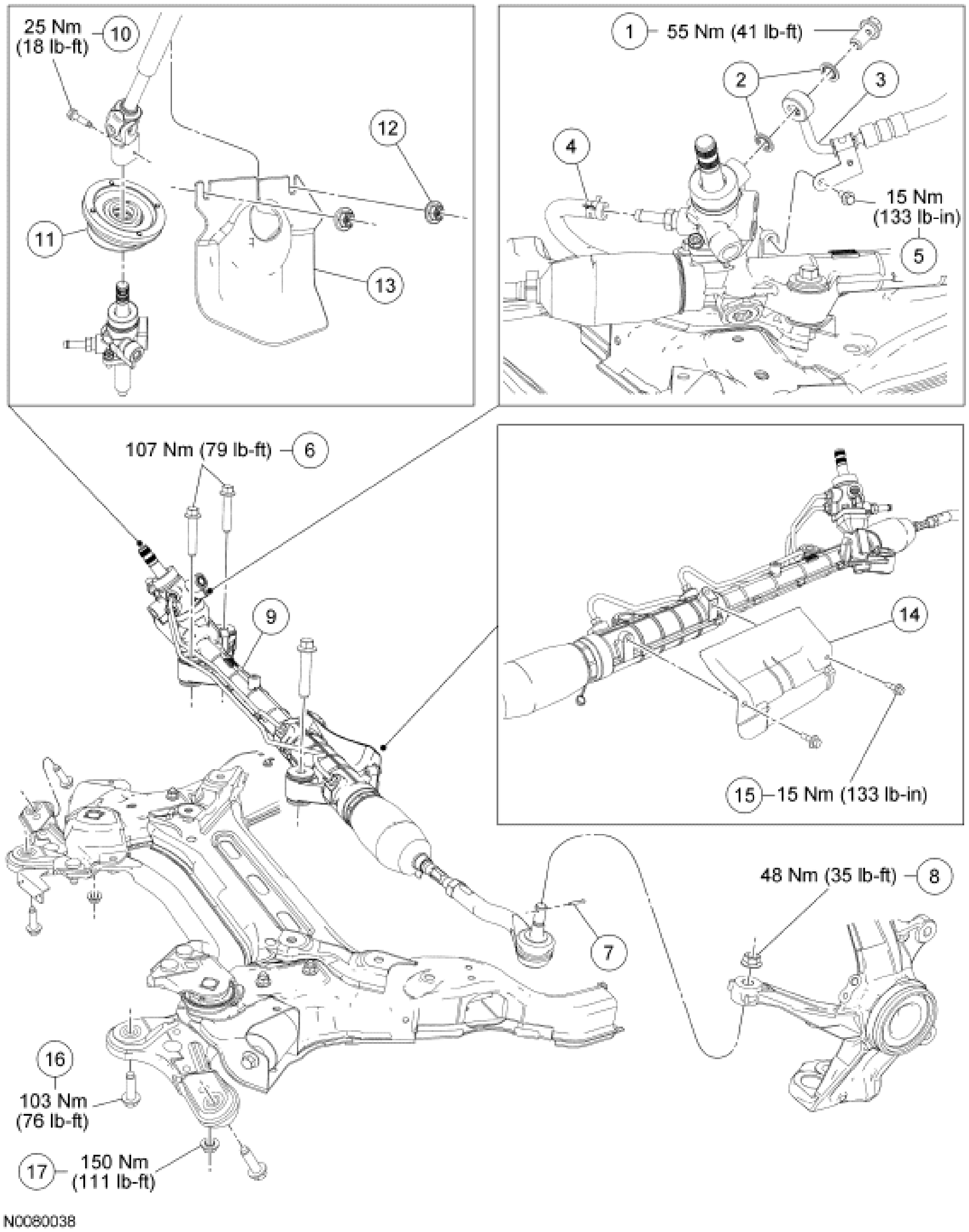


Fig. 29: Exploded View Of Steering Gear With Torque Specifications - All Wheel Drive (AWD)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Pressure line-to-steering gear banjo bolt (part of 3A705)
2	-	Power steering pressure line seals (part of

		3A705)
3	-	Power steering pressure line (part of 3A719)
4	3A713	Steering gear-to-fluid cooler return hose
5	W712155	Pressure line bracket-to-steering gear bolt
6	3C497	Steering gear bolts (3 required)
7	99221	Cotter pin (2 required)
8	6E5C	Outer tie-rod end nut (2 required)
9	3504	Steering gear
10	3R827	Steering column shaft-to-steering gear bolt
11	3611B	Steering gear/dash seal
12	W704904	Lower steering column shaft joint cover nut (2 required)
13	3611A	Lower steering column shaft joint cover
14	391727	Steering gear heat shield
15	3530B	Steering gear heat shield bolt (2 required)
16	3C496	Subframe bolt (4 required)
17	W520416	Subframe nut (2 required)

REMOVAL

NOTE: **When repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.**

All engines

1. Place the steering wheel in the straight-ahead position and the ignition key in the OFF position.
2. Remove the front wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
3. Remove the 2 lower steering column shaft joint cover nuts and the cover.

   NOTE: **Make sure to correctly index-mark the steering gear to steering column shaft position or unequal right-to-left turns may occur, causing tire contact with the body and/or clockspring damage.**

4. Index-mark the steering column shaft-to-steering gear position for reference during installation.

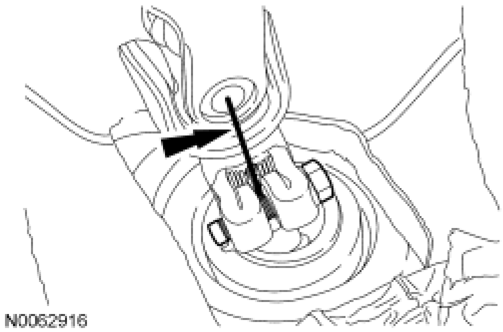


Fig. 30: Locating Steering Column Shaft-To-Steering Gear Position Index-Mark
Courtesy of FORD MOTOR CO.

NOTE: **Do not allow the steering column to rotate while the steering column shaft is disconnected from the steering gear or damage to the clockspring may occur. If there is evidence that the steering column has rotated, the clockspring must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.**

5. Remove the bolt and disconnect the steering column shaft from the steering gear.
    - Discard the bolt.

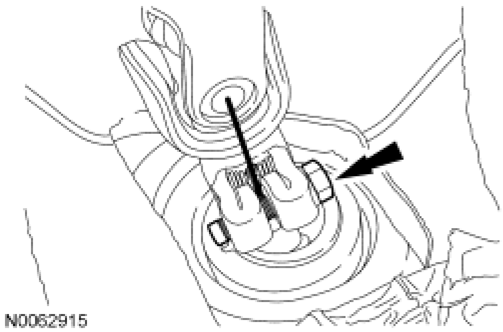


Fig. 31: Locating Steering Column Shaft Bolt
Courtesy of FORD MOTOR CO.

NOTE: **Remove the steering gear/dash seal or damage to the seal may occur.**

6. Remove the steering gear/dash seal.
7. Remove the battery and battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

NOTE: **Battery mounting bracket removed for clarity.**

8. Disconnect the electrical connectors from the PCM.
    - Detach the wiring harness retainer from the PCM bracket and position the harness aside.

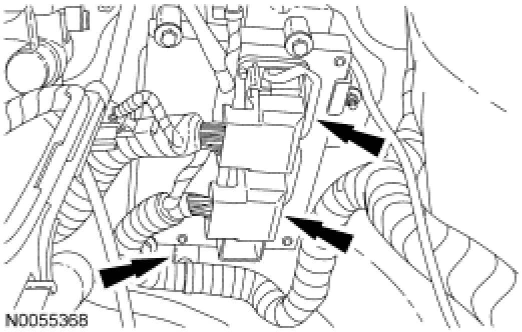


Fig. 32: Identifying Electrical Connectors From Power Control Module (PCM)
Courtesy of FORD MOTOR CO.

9. Remove the pressure line-to-steering gear banjo bolt.
   - Discard the bolt and 2 seals.
10. Remove the pressure line bracket-to-steering gear bolt.

NOTE: RH side shown, LH side similar.

11. Remove 4 screws from each side and position the RH and LH fender splash shield aside.

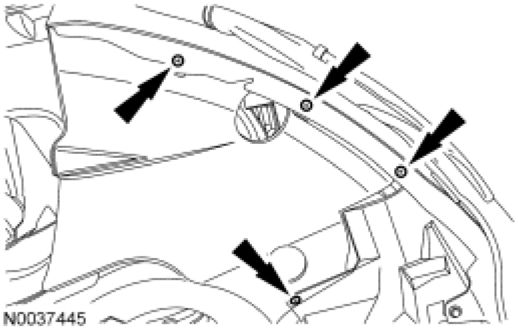


Fig. 33: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

NOTE: RH side shown, LH side similar.

12. Remove the 6 pin-type retainers (4 shown) from the LH and RH splash shield.

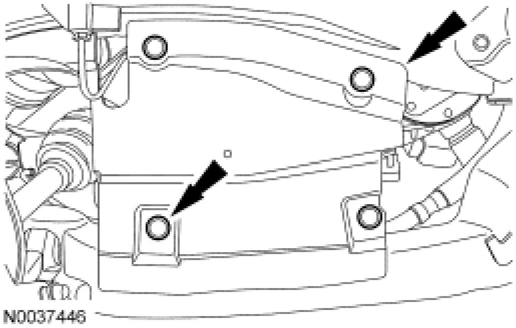


Fig. 34: Locating Splash Shield Pin-Type Retainers
Courtesy of FORD MOTOR CO.

13. If equipped, remove the bolts and the underbody splash shield.
14. Remove the 2 outer tie-rod end cotter pins and nuts.
    - Discard the cotter pins.

NOTE:	**Do not use a hammer to separate the outer tie-rod end from the wheel knuckle or damage to the wheel knuckle may result.**

15. Using the Tie-Rod End Remover, separate the outer tie-rod ends from the knuckle.

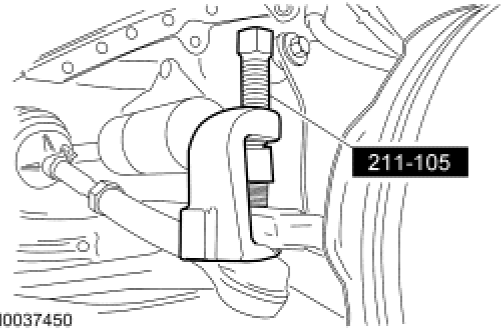


Fig. 35: Separating Tie-Rod Ends From Wheel Knuckles Using Special Tool (211-105)
Courtesy of FORD MOTOR CO.

NOTE:	**Always install new fasteners and gaskets. Clean flange faces prior to new gasket installation to make sure of proper sealing.**

16. Remove and discard the 2 catalytic converter-to-exhaust flexible pipe nuts and separate the exhaust flexible pipe.

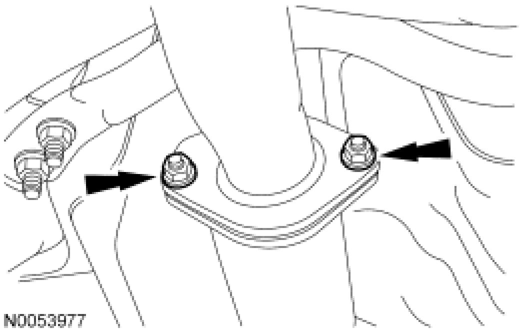


Fig. 36: Identifying Catalytic Converter-To-Exhaust Flexible Pipe Nuts
Courtesy of FORD MOTOR CO.

17. Remove the 2 bolts and the steering gear heat shield.
18. Support the rear of the subframe with a suitable jack and remove the 4 rear subframe bolts and 2 rear subframe nuts.
19. Lower the rear of the front subframe 76.2 mm (3 in) with the support of the jack.

3.5L engine

20. Remove the pressure line bracket-to-steering gear bolt.

All engines

21. Release the clamp and disconnect the steering gear-to-fluid cooler return hose.
22. Remove the 3 steering gear bolts.
23. Remove the steering gear from the LH side of the vehicle.

INSTALLATION

NOTE:	**When installing the steering gear, it is important to have the steering gear in the centered position or unequal right-to-left turns may occur, causing tire contact with the body and/or clockspring damage. A new steering gear is centered and ready for installation.**

NOTE:	**When repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.**

1. From the LH side of the vehicle, install the steering gear.
2. Install the 3 steering gear bolts.
    - Tighten to 107 Nm (79 lb-ft).
3. Connect the steering gear-to-fluid cooler return hose and connect the clamp.
4. Using a suitable jack, raise the rear of the front subframe.
5. Install the 4 rear subframe bolts and 2 rear subframe nuts.

- To install, tighten the bolts and nuts in 2 stages.
    - Stage 1: Tighten the nuts to 150 Nm (111 lb-ft).
    - Stage 2: Tighten the bolts to 103 Nm (76 lb-ft).

6. Install the steering gear heat shield and the 2 bolts.
    - To install, tighten to 15 Nm (133 lb-in).

NOTE: Always install new fasteners and gaskets. Clean flange faces prior to new gasket installation to make sure of correct sealing.

7. Position the exhaust flexible pipe and install the 2 new catalytic converter-to-exhaust flexible pipe nuts.
    - Tighten to 40 Nm (30 lb-ft).

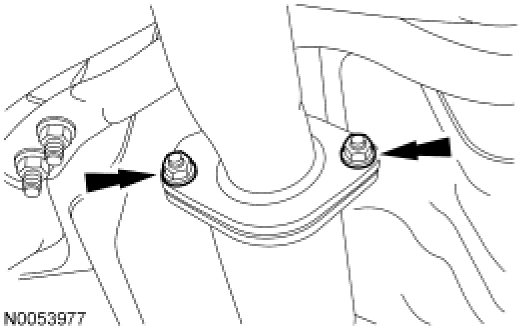


Fig. 37: Identifying Catalytic Converter-To-Exhaust Flexible Pipe Nuts
Courtesy of FORD MOTOR CO.

8. Install the 2 outer tie-rod end nuts.
    - Tighten to 48 Nm (35 lb-ft).
    - Install 2 new cotter pins.
9. If equipped, install the underbody splash shield and bolts.
    - Tighten to 7 Nm (62 lb-in).

NOTE: RH side shown, LH side similar.

10. Install the LH and RH splash shield and the 6 pin-type retainers (4 shown).

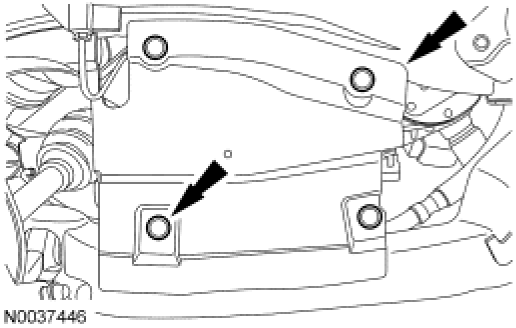


Fig. 38: Locating Splash Shield Pin-Type Retainers
Courtesy of FORD MOTOR CO.

NOTE: RH side shown, LH side similar.

11. Install the RH and LH fender splash shield and the 4 screws from each side.

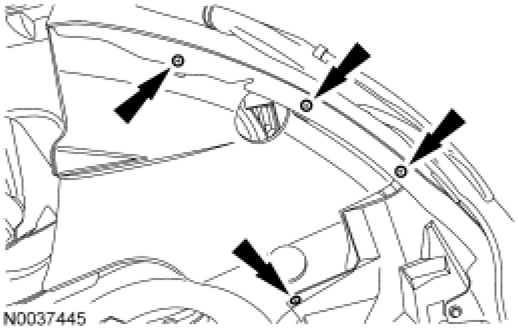


Fig. 39: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

12. Install the pressure line bracket-to-steering gear bolt.
    - Tighten to 15 Nm (133 lb-in).

NOTE: New banjo bolts and new seals must be installed any time the power steering pressure line is disconnected from the power steering pump and/or the steering gear or a fluid leak may occur.

13. Install the new pressure line-to-steering gear banjo bolt and seals.
    - Tighten to 55 Nm (41 lb-ft).

NOTE: Battery mounting bracket removed for clarity.

14. Connect the electrical connectors to the PCM.
    - Attach the wiring harness retainer to the PCM bracket.

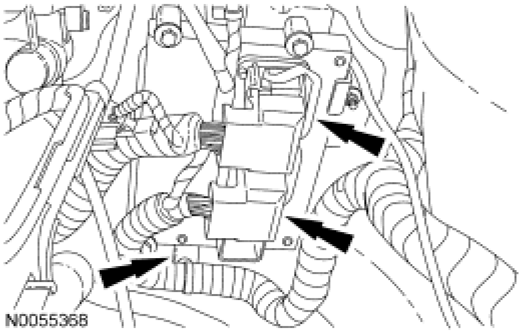


Fig. 40: Identifying Electrical Connectors From Power Control Module (PCM)

Courtesy of FORD MOTOR CO.

15. Install the battery tray and battery. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

NOTE: The steering gear/dash seal must be fully seated in the steering gear valve tower groove before the retaining clips are fully engaged into the body. If the steering gear/dash seal is not seated to the steering gear valve tower groove and the clips are not fully engaged to the body, water and foreign material may enter the passenger compartment and damage the vehicle interior.

16. Applying hand force to the center of the seal, install the steering gear/dash seal onto the steering gear valve tower until the seal is fully seated in the valve tower groove.

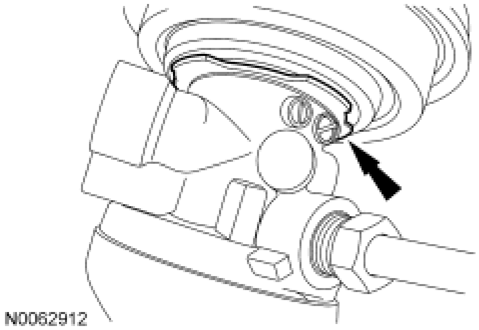


Fig. 41: Locating Valve Tower Groove
Courtesy of FORD MOTOR CO.

17. Install the steering gear/dash seal until the retaining clips are fully engaged into the body.

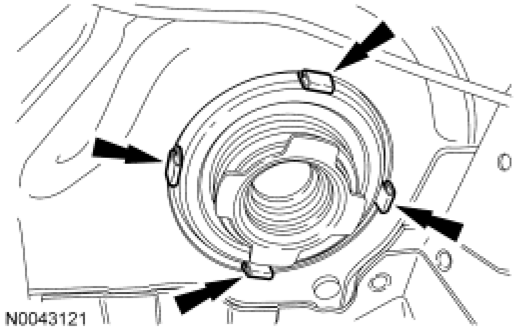


Fig. 42: Locating Steering Column Shaft-To-Dash Seal
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the steering column to rotate while the steering column shaft is disconnected from the steering gear or damage to the clockspring may occur. If there is evidence that the steering column has rotated, the clockspring must be removed and recentered. For additional information,

refer to SUPPLEMENTAL RESTRAINT SYSTEM article.

NOTE:	**Make sure to correctly align the index marks when installing the steering gear to steering column shaft or unequal right-to-left turns may occur, causing tire contact with the body and/or clockspring damage.**

18. With the index marks correctly aligned, connect the steering column shaft to the steering gear and install the new bolt.
    - Tighten to 25 Nm (18 lb-ft).

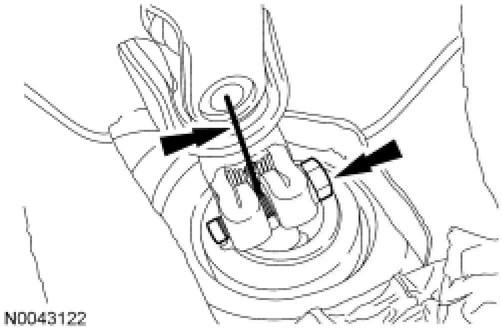


Fig. 43: Locating Steering Column Shaft Index Mark And Bolt
Courtesy of FORD MOTOR CO.

19. Install the lower steering column shaft joint cover and the 2 nuts.
20. Fill the power steering system. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.
21. Check and, if necessary, adjust the front toe. For additional information, refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

TIE ROD - INNER

NOTE:	**Left side shown, right side similar.**

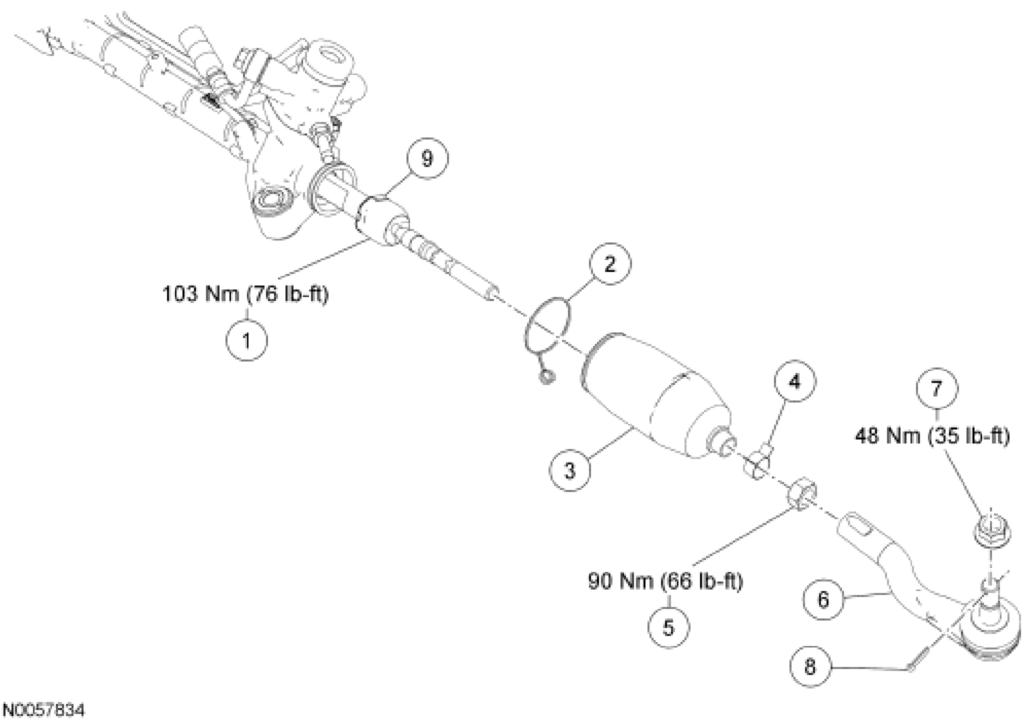


Fig. 44: Exploded View Of Inner Tie Rod With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3280	Inner tie-rod end
2	3C650A	Inner bellows boot clamp
3	3K668	Bellows boot
4	3C650	Outer bellows boot clamp
5	-	Tie-rod jam nut
6	3290	Outer tie-rod end
7	6E5C	Outer tie-rod end nut
8	-	Cotter pin
9	32132	Rock washer

REMOVAL AND INSTALLATION

1. Remove the steering gear. For additional information, refer to **Steering Gear - All Wheel Drive (AWD)** or **Steering Gear - Front Wheel Drive (FWD)**.
2. Mark the pinion shaft and the steering gear housing for correct reference during installation.

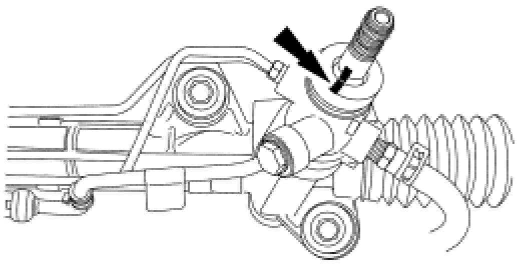


Fig. 45: Locating Pinion Shaft And Steering Gear Mark
Courtesy of FORD MOTOR CO.

NOTE: **Position the steering gear in a soft-jaw vise or damage to the steering gear may occur.**

3. Loosen the tie-rod jam nut and remove the outer tie-rod end.
   - To install, tighten to 90 Nm (66 lb-ft).

NOTE: **It is necessary to remove both bellows boots when removing the RH inner tie-rod end.**

4. Remove the 4 bellow clamps and the 2 steering gear bellows boots.
5. Using a suitable wrench, hold the piston shaft.
6. Using a suitable wrench, remove the inner tie-rod end.
   - To install, tighten to 103 Nm (76 lb-ft).

NOTE: **Using a suitable wrench, hold the piston shaft while tightening the inner tie rod.**

NOTE: **The new rock washer must be crimped after tightening the inner tie rod end.**

7. To install, reverse the removal procedure.

2008 BRAKES

Rear Disc Brake - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	227.5 ml (0.48 pt)
High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A	-
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Brake Disc	
Brake disc minimum thickness	8.0 mm (0.314 in)
Brake Pad	
Brake pad maximum taper wear (in any direction)	3.0 mm (0.118 in)
Brake pad minimum thickness	3.0 mm (0.118 in)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Bleeder screw	8	-	71
Brake caliper anchor plate bolts	70	52	-
Brake caliper flow bolt	25	18	-
Brake caliper guide pin bolts	26	19	-
Brake disc screws	20	-	177
Brake disc shield bolts	23	17	-
Brake tube fitting	17	-	150

DESCRIPTION AND OPERATION

REAR DISC BRAKE

The rear disc brake system consists of the following components:

- Brake caliper anchor plate
- Brake caliper
- Brake disc
- Brake flexible hose
- Brake pads

When mechanical force is applied by the driver to the brake pedal, the force is converted into hydraulic pressure by the master cylinder. The hydraulic force is directed to the disc brake calipers and transferred to the brake pads. The brake pads are then forced against the brake friction surfaces by the brake caliper pistons. The friction of the brake pads on the brake disc causes the slowing or stopping of wheel rotation and the vehicle.

DIAGNOSTIC TESTS

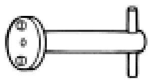
REAR DISC BRAKE

Refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

BRAKE PADS

Special Tools

Illustration	Tool Name	Tool Number
 ST1112-A	Adapter, Rear Brake Caliper Piston Adjuster	206-026 (T87P-2588-A) or equivalent

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

NOTE: Front wheel drive (FWD) shown, all wheel drive (AWD) similar.

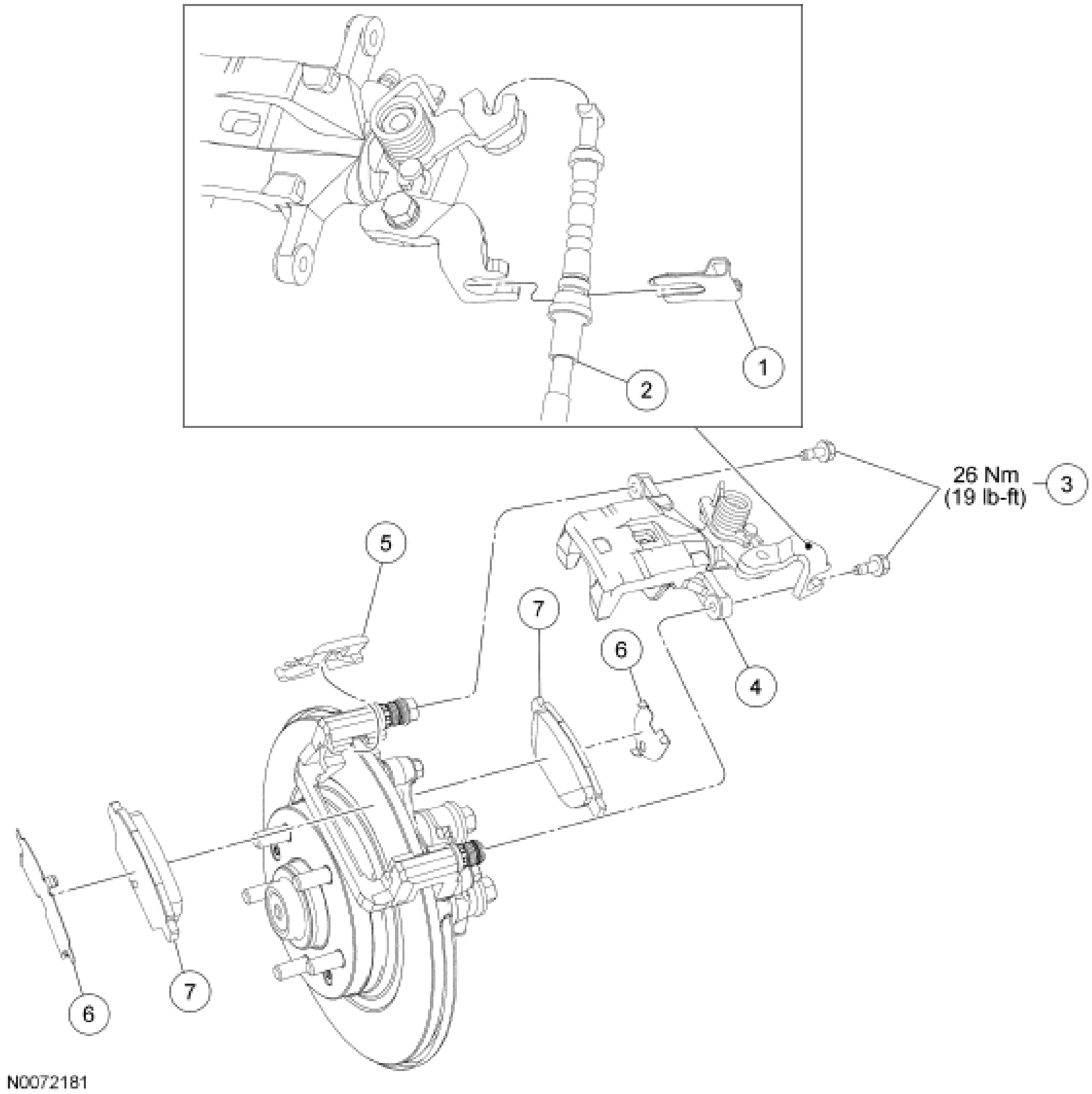


Fig. 1: Exploded View Of Brake Pads With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2860	Parking brake cable conduit retaining clip
2	2A815	Parking brake cable
3	-	Brake caliper guide pin bolts (2 required) (part of 2386)
4	2552 LH/ 2553 RH	Brake caliper
5	-	Brake pad slide clip (2 required) (part of 2200)
6	-	Brake pad shims (2 required) (part of 2200)
7	2200	Brake pads (2 required)

REMOVAL

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

WARNING: **Always install new brake shoes or pads at both ends of an axle to reduce the possibility of brakes pulling vehicle to one side. Failure to follow this instruction may result in uneven braking and serious personal injury.**

NOTE: Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.

1. Check the brake fluid level in the brake master cylinder reservoir.
    - If required, remove the fluid until the brake master cylinder reservoir is 1/2 full.
2. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
3. Disconnect the parking brake cable from the brake caliper.
    - Pull back the parking brake lever.
    - Disconnect the cable from the parking brake lever.
    - Remove the cable conduit retaining clip.
    - Disconnect the cable from the brake caliper.

NOTE: Do not pry in the caliper sight hole to retract the pistons, as this can damage the pistons and boots.

NOTE: Do not allow the brake caliper to hang from the brake hose or damage to the hose can occur.

4. Remove the 2 brake caliper guide pin bolts and position the caliper aside.
    - Support the caliper using mechanic's wire.
5. Remove the 2 brake pads, shims and retraction clips. Inspect the brake pads and shims for wear, damage or contamination.
    - Discard the slide clips.
    - Inspect the brake pads for wear and contamination.

INSTALLATION

NOTE: Make sure the caliper piston boot is clean and free of foreign material.

1. Using the Rear Brake Caliper Piston Adjuster Adapter, compress the brake caliper piston into the brake caliper bore.

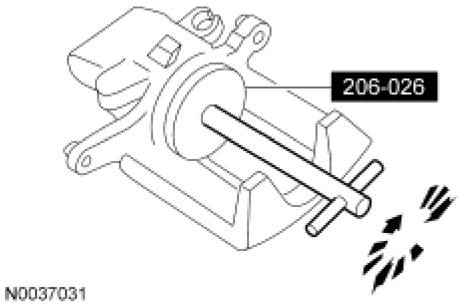


Fig. 2: Compressing Brake Caliper Piston Into Caliper
Courtesy of FORD MOTOR CO.

2. Position the notch in the caliper piston so that it will correctly align with the pin on the backside of the inboard brake pad.

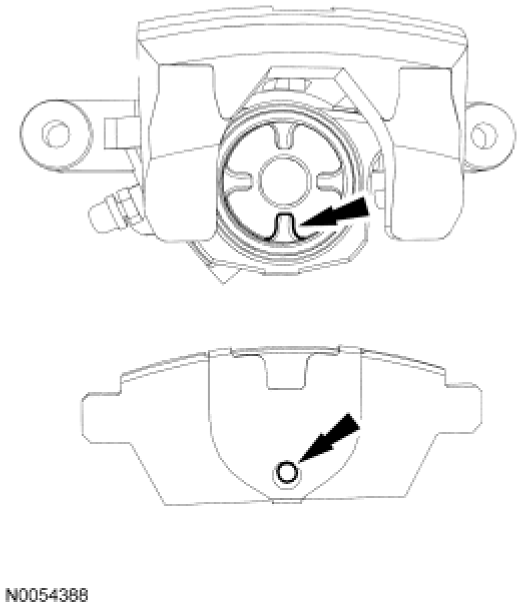


Fig. 3: Positioning Notch In Caliper Piston So That It Will Correctly Align With Pin On Backside Of Inboard Brake Pad
Courtesy of FORD MOTOR CO.

NOTE: If installing new brake pads, install all new hardware as supplied with the

brake pad kit.

3. Install the 2 brake pads, shims and slide clips to the brake caliper anchor plate.

NOTE: Make sure that the brake caliper hose is not twisted.

4. Position the brake caliper on the anchor plate and install the 2 bolts.
    - Tighten to 26 Nm (19 lb-ft).
5. Install the parking brake cable to the brake caliper.
    - Pull back the parking brake lever.
    - Connect the cable to the parking brake lever.
    - Install the cable conduit retaining clip.
6. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
7. Fill the brake master cylinder reservoir with clean, specified brake fluid.
8. Cycle the park brake several times to verify normal operation. For additional information on parking brake adjustment, refer to **PARKING BRAKE AND ACTUATION** article.
    - Apply brakes several times to verify correct brake operation.

BRAKE CALIPER

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

NOTE: Front wheel drive (FWD) shown, all wheel drive (AWD) similar.

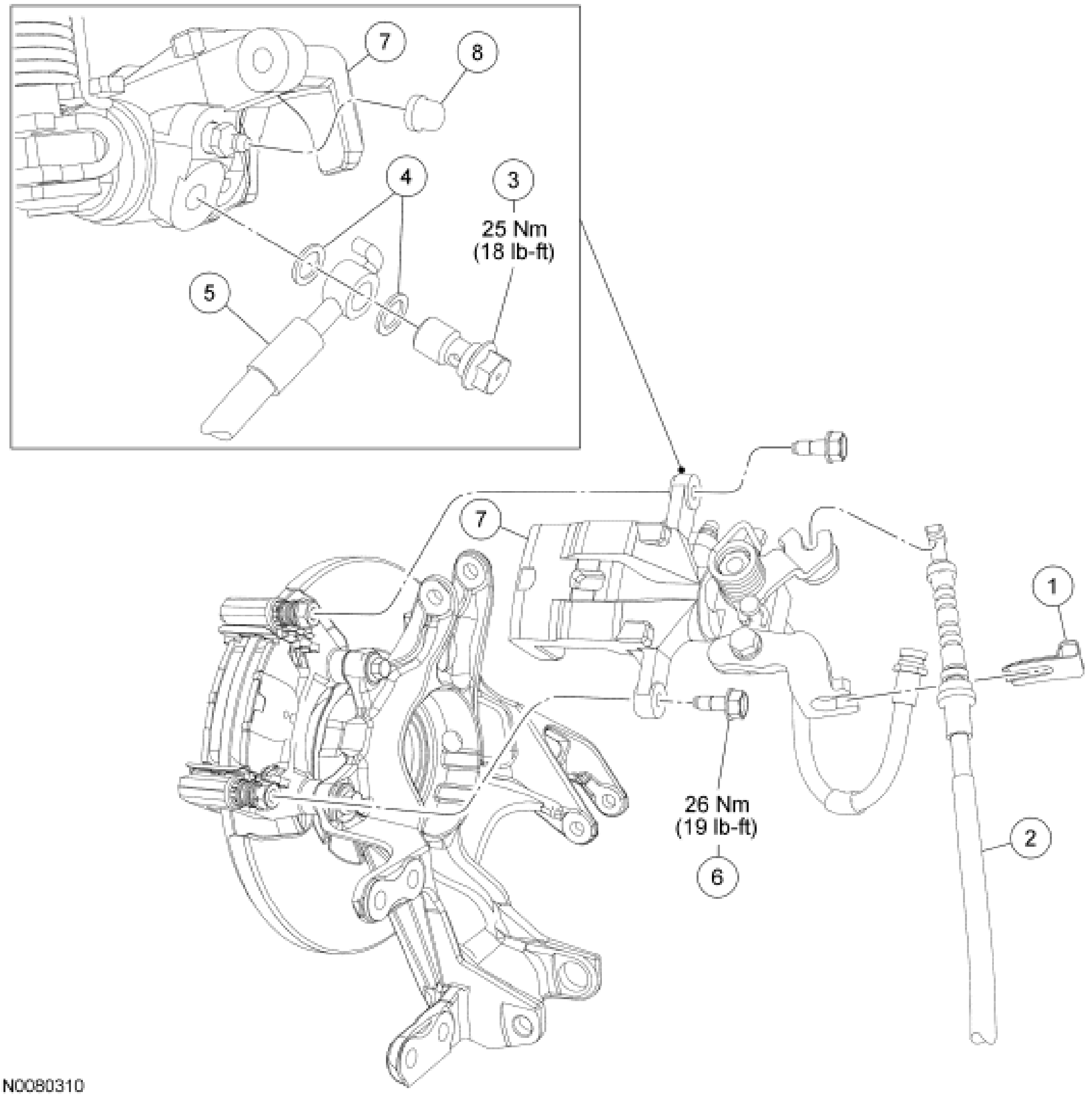


Fig. 4: Exploded View Of Brake Caliper With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2860	Parking brake cable conduit retaining clip
2	2A815	Parking brake cable
3	2M085	Brake caliper flow bolt
4	99562	Copper washers (2 required)
5	2282	Brake hose
6	-	Brake caliper guide pin bolt (2 required) (part of 2386)
7	2552 LH/ 2553 RH	Brake caliper
8	2426	Brake caliper bleeder screw cap

REMOVAL

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

NOTE: Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. Disconnect the parking brake cable from the brake caliper.
   - Pull back the parking brake lever.
   - Disconnect the cable from the parking brake lever.
   - Remove the cable conduit retaining clip.
   - Disconnect the cable from the brake caliper.
3. Remove the brake caliper flow bolt and position the brake hose aside.
   - Discard the 2 copper washers.
4. Remove the 2 brake caliper guide pin bolts and the brake caliper.
   - If a leaking or damaged caliper piston boot is found, install a new disc brake caliper.

INSTALLATION

1. Position the notch in the caliper piston so that it will correctly align with the pin on the backside of the inboard brake pad.

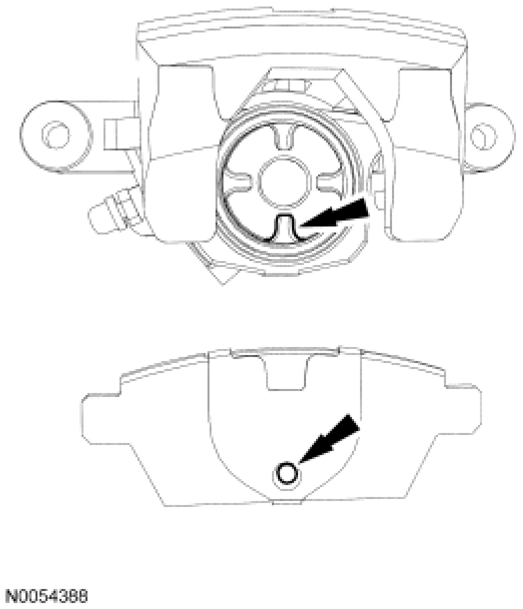


Fig. 5: Positioning Notch In Caliper Piston So That It Will Correctly Align With Pin On Backside Of Inboard Brake Pad
Courtesy of FORD MOTOR CO.

NOTE: Make sure that the brake caliper hose is not twisted.

2. Position the brake caliper onto the anchor plate.
3. Install the 2 brake caliper guide pin bolts.
   - To install, tighten to 26 Nm (19 lb-ft).
4. Using 2 new copper washers, position the brake hose and install the brake caliper flow bolt.
   - Tighten to 25 Nm (18 lb-ft).
5. Install the parking brake cable to the brake caliper.
   - Pull back the parking brake lever.
   - Connect the cable to the parking brake lever.
   - Install the cable conduit retaining clip.
6. Bleed the brake caliper. For additional information, refer to **BRAKE SYSTEM - GENERAL INFORMATION** article Component Bleeding.
7. Cycle the park brake several times to verify normal operation.

BRAKE CALIPER ANCHOR PLATE

NOTE: Front wheel drive (FWD) shown, all wheel drive (AWD) similar.

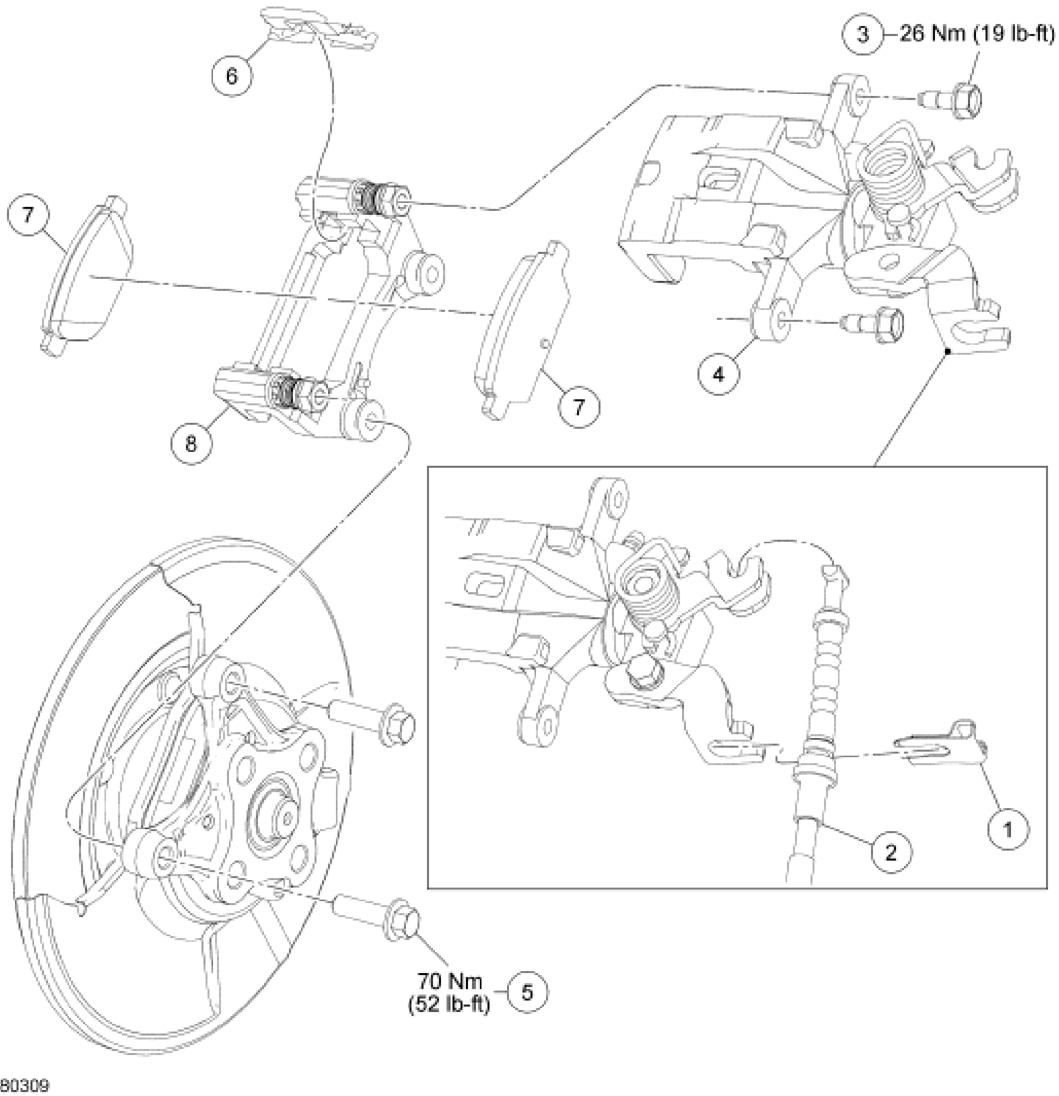


Fig. 6: Exploded View Of Brake Caliper Anchor Plate With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	**Part Number**	**Description**
1	2860	Parking brake cable conduit retaining clip
2	2A815	Parking brake cable
3	-	Brake caliper guide pin bolt (2 required) (part of 2386)
4	2552 LH/ 2553 RH	Brake caliper
5	W711240	Brake caliper anchor plate bolt (2 required)
6	-	Brake pad retraction clip (2 required) (part of 2200)
7	2200	Brake pads (2 required)
8	2B512 LH/ 2B511 RH	Brake caliper anchor plate

REMOVAL

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. Disconnect the parking brake cable from the brake caliper.
   - Pull back the parking brake lever.
   - Disconnect the cable from the parking brake lever.
   - Remove the cable conduit retaining clip.
   - Disconnect the cable from the brake caliper.

NOTE: Do not pry in the caliper sight hole to retract the pistons, as this can damage the pistons and boots.

NOTE: Do not allow the brake caliper to hang from the brake hose or damage to the hose can occur.

3. Remove the 2 brake caliper guide pin bolts and position the caliper aside.
   - Support the caliper using mechanic's wire.
4. Remove the 2 brake pads, shims and slide clips.
5. Remove the 2 brake caliper anchor plate bolts and the anchor plate.

INSTALLATION

1. Install the brake caliper anchor plate and the 2 brake caliper anchor plate bolts.
   - Tighten to 70 Nm (52 lb-ft).
2. Install the 2 brake pads and slide clips to the brake caliper anchor plate.

NOTE: Make sure that the brake caliper hose is not twisted.

3. Position the brake caliper on the anchor plate and install the 2 guide pin bolts.
   - Tighten to 26 Nm (19 lb-ft).
4. Install the parking brake cable to the brake caliper.
   - Pull back the parking brake lever.
   - Connect the cable to the parking brake lever.
   - Install the cable conduit retaining clip.
5. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
6. Cycle the park brake several times to verify normal operation.
   - Apply brakes several times to verify correct brake operation.

BRAKE DISC

Material

Item	Specification

High Temperature Nickel Anti-Seize Lubricant XL-2	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-

NOTE: Front wheel drive (FWD) shown, all wheel drive (AWD) similar.

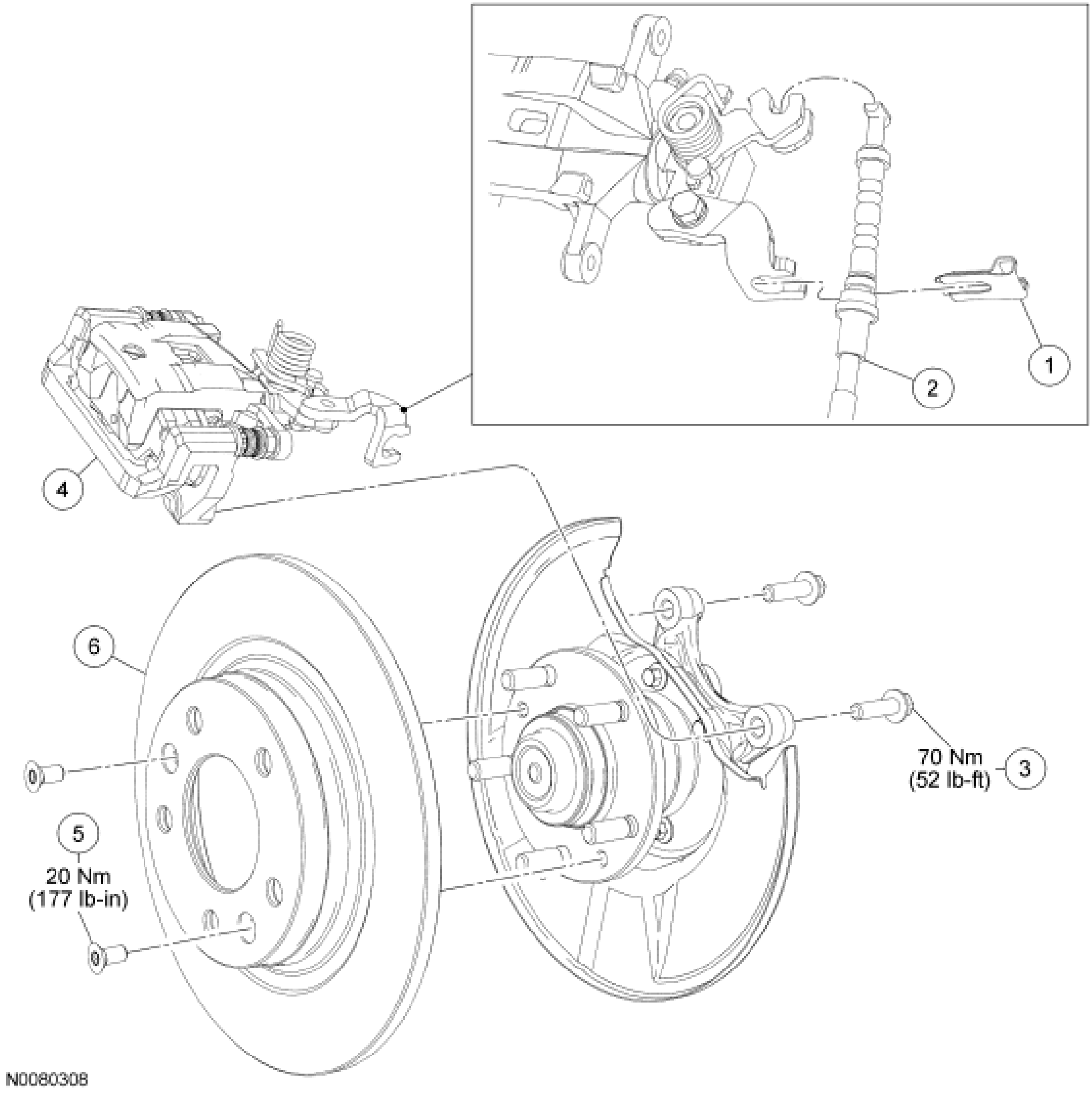


Fig. 7: Exploded View Of Brake Disc With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2860	Parking brake cable conduit retaining clip
2	2A815	Parking brake cable
3	W711240	Brake caliper anchor plate bolt (2

		required)
4	-	Brake caliper, brake pads and brake caliper anchor plate assembly
5	W505741	Brake disc screw (2 required)
6	2C026	Brake disc

REMOVAL

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. Disconnect the parking brake cable from the brake caliper.
   - Pull back the parking brake lever.
   - Disconnect the cable from the parking brake lever.
   - Remove the cable conduit retaining clip.
   - Disconnect the cable from the brake caliper.

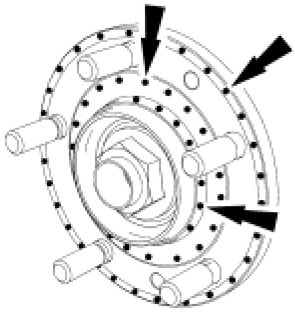
NOTE: Do not allow the brake caliper to hang from the brake hose or damage to the hose can occur.

3. Remove the 2 brake caliper anchor plate bolts and position the brake caliper, brake pads and brake caliper anchor plate aside as an assembly.
   - Support the brake caliper, brake pads and brake caliper anchor plate assembly using mechanic's wire.
4. Remove the 2 brake disc screws and the brake disc.

INSTALLATION

NOTE: Make sure the brake disc-to-hub mounting surface is free of rust and foreign material before applying anti-seize lubricant.

1. Install the brake disc and the 2 brake disc screws.
   - Using the specified brake cleaner, clean the mating surfaces.
   - Apply specified lubricant as shown.
   - Tighten the screws to 20 Nm (177 lb-in).



N0057940

Fig. 8: Locating Brake Disc Screws
Courtesy of FORD MOTOR CO.

NOTE: Make sure that the brake caliper hose is not twisted.

2. Position the brake caliper, brake pads and brake caliper anchor plate assembly and install the 2 brake caliper anchor plate bolts.
   - Tighten to 70 Nm (52 lb-ft).
3. Install the parking brake cable to the brake caliper.
   - Pull back the parking brake lever.
   - Connect the cable to the parking brake lever.
   - Install the cable conduit retaining clip.
4. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
5. Cycle the park brake several times to verify normal operation.
   - Apply brakes several times to verify correct brake operation.

BRAKE DISC SHIELD - FRONT WHEEL DRIVE (FWD)

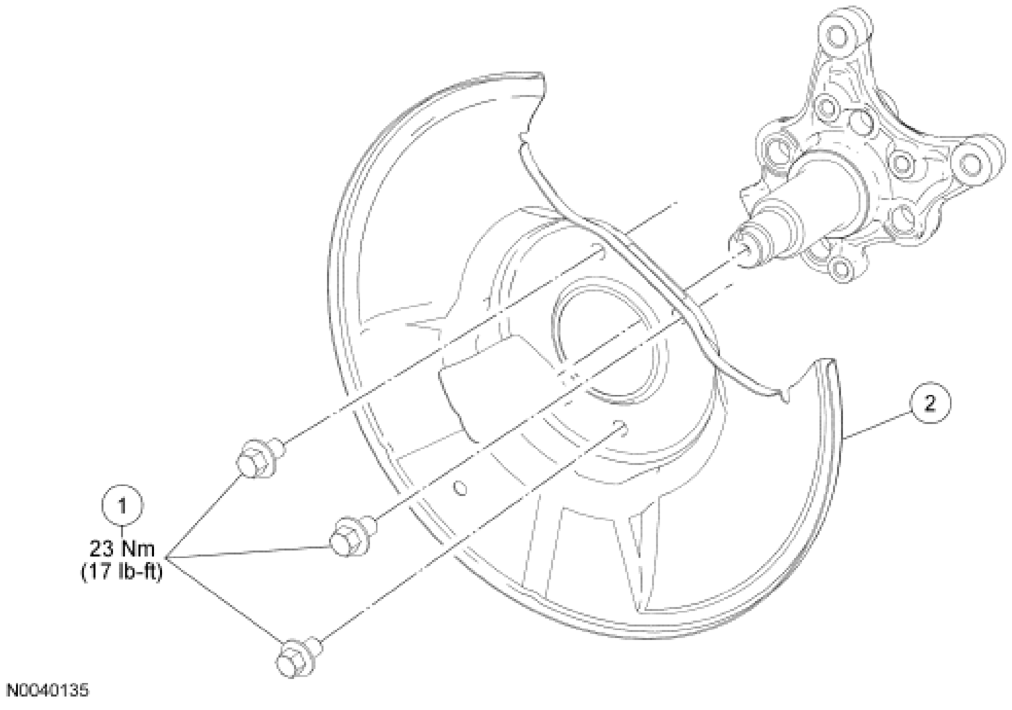


Fig. 9: Exploded View Of Brake Disc Shield With Torque Specification - Front Wheel Drive (FWD)
Courtesy of FORD MOTOR CO.

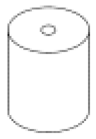
Item	Part Number	Description
1	N500020	Brake disc shield bolts (3 required)
2	2K045 RH/ 2K046 LH	Brake disc shield

REMOVAL AND INSTALLATION

1. Remove the wheel bearing and wheel hub. For additional information, refer to **REAR SUSPENSION** article.
2. Remove the 3 brake disc shield bolts and the brake disc shield.
   - To install, tighten to 23 Nm (17 lb-ft).
3. To install, reverse the removal procedure.

BRAKE DISC SHIELD - ALL WHEEL DRIVE (AWD)

Special Tools

Illustration	Tool Name	Tool Number
 ST1569-A	Remover/Installer, Front Subframe Bushing	204-362/2

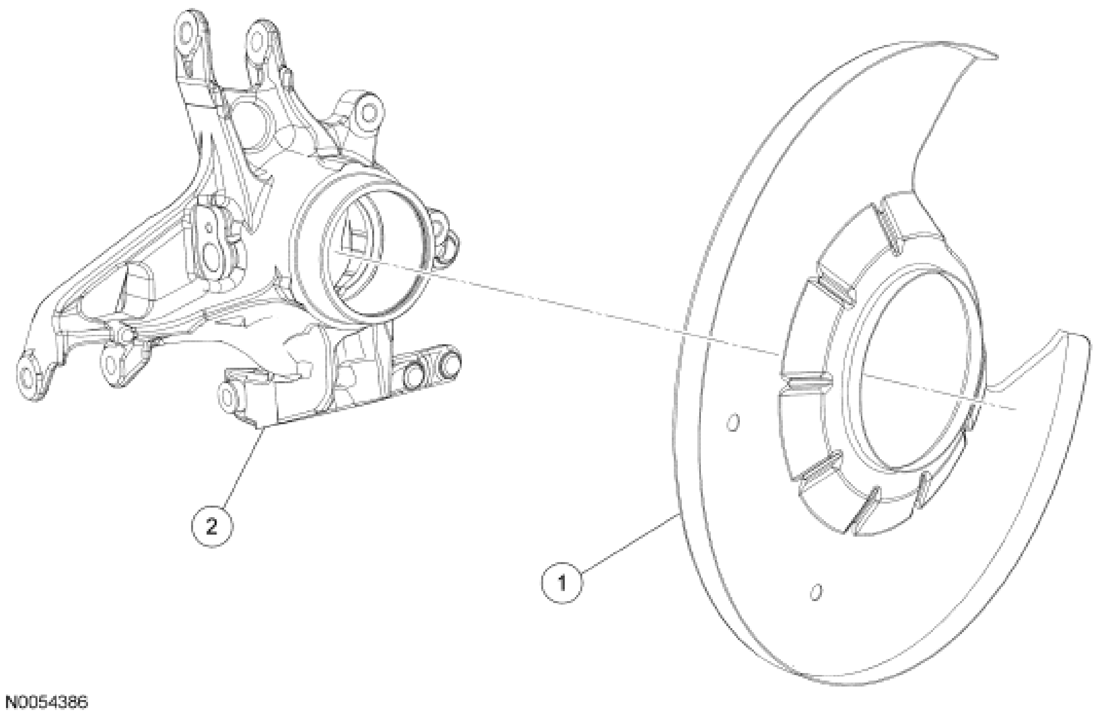


Fig. 10: Exploded View Of Brake Disc Shield - All Wheel Drive (AWD)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	2K005 LH/ 2K004 RH	Brake disc shield
2	3K186 LH/ 3K185 RH	Wheel knuckle

REMOVAL

1. Remove the wheel bearing and wheel hub. For additional information, refer to **REAR SUSPENSION** article.
2. Index-mark the brake disc shield to the wheel knuckle.

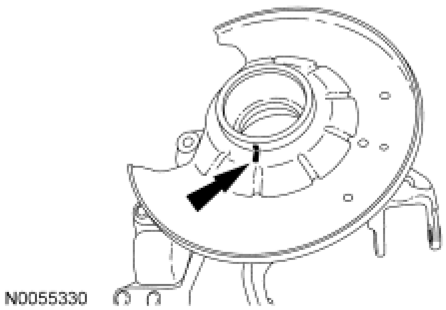


Fig. 11: Identifying Index-Mark On Brake Disc Shield To Wheel Knuckle
Courtesy of FORD MOTOR CO.

3. Cut the brake disc shield and remove it from the wheel knuckle.

INSTALLATION

1. Transfer the index mark from the removed brake disc shield to the new brake disc shield.
2. Position the brake disc shield onto the wheel knuckle.
3. Align the index marks and install the brake disc shield onto the wheel knuckle using the Front Subframe Bushing Remover/Installer.

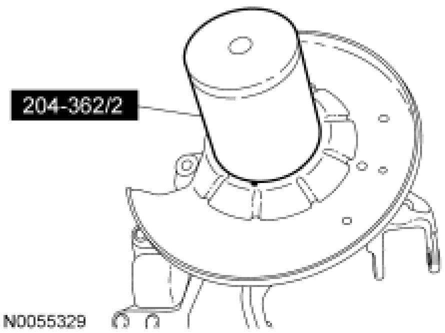


Fig. 12: Aligning Index Marks & Installing Brake Disc Shield Onto Wheel Knuckle Using Special Tool (204-362/2)
Courtesy of FORD MOTOR CO.

BRAKE FLEXIBLE HOSE

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake	

Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

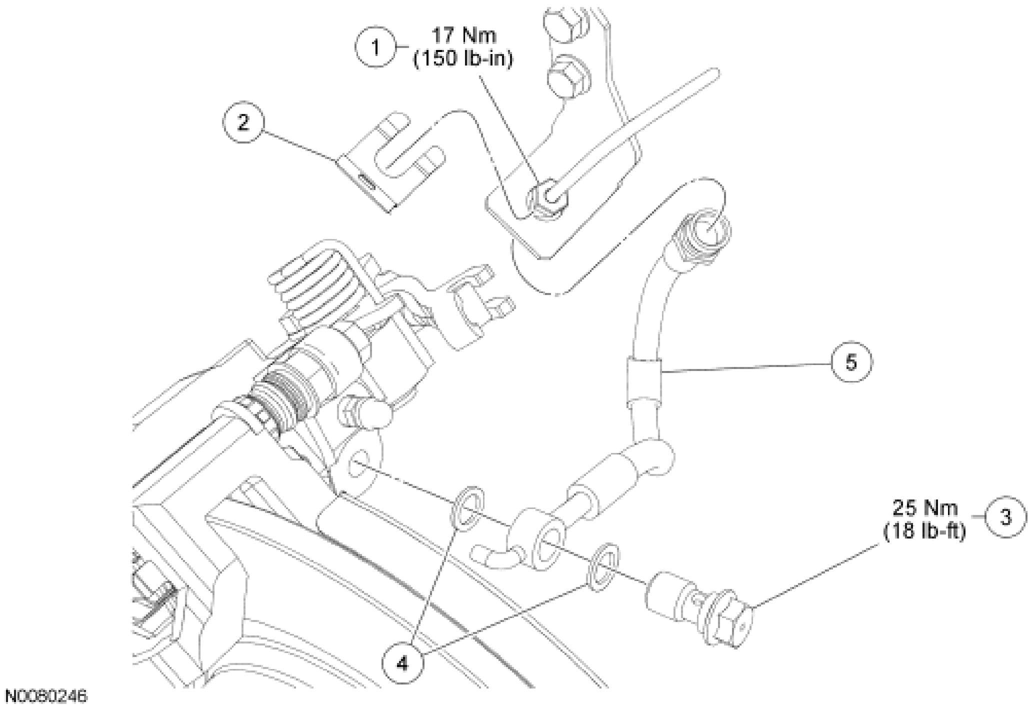


Fig. 13: Exploded View Of Brake Flexible Hose With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Brake tube fitting (part of 2268 RH/ 9J279 LH)
2	2L198	Brake flexible hose retaining clip (part of 2282)
3	2L122	Brake caliper flow bolt
4	2149	Copper washers (2 required)
5	2282	Brake flexible hose

REMOVAL AND INSTALLATION

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on**

Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

NOTE: **Do not spill brake fluid on painted or plastic surfaces or damage to the surface may occur. If brake fluid is spilled onto a painted or plastic surface, immediately wash the surface with water.**

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. Remove the brake caliper flow bolt and discard the 2 copper washers.
    - To install, tighten to 25 Nm (18 lb-ft).
3. Disconnect the brake tube fitting from the brake flexible hose.
    - To install, tighten to 17 Nm (150 lb-in).
4. Remove the brake flexible hose retaining clip and the brake hose.
5. To install, reverse the removal procedure.
    - Bleed the brake caliper. For additional information, refer to **BRAKE SYSTEM - GENERAL INFORMATION** article Component Bleeding.

2008 DRIVELINE/AXLES

Rear Drive Axle/Differential - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Clear Silicone Rubber TA-32	ESB-M4G92-A	-
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada); (Model 60/70 axles)	WSP-M2C197-A	1.15L (2.43 pt)
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B	-

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Differential housing cover bolts	23	17
Differential housing-to-front insulator bracket bolts	90	66
Filler plug	29	21
Front insulator bracket-to-subframe bolts	90	66
Pinion nut	244	180
Rear driveshaft U-joint flange bolts	70	52
Side insulator bracket-to-rear axle differential bolts	90	66

DESCRIPTION AND OPERATION

REAR DRIVE AXLE AND DIFFERENTIAL

The rear drive axle consists of the following components:

- Dished circular flange
- Full-time fluid drive coupling
- Aluminum housing with steel housing cover
- Matched ring and pinion
- Conventional open differential
- Rubber bushing isolated mounting points

- Cover mounted axle vent
- The differential housing cover uses a silicone sealant rather than a gasket
- The active torque coupling is installed new as an assembly with the rear axle
- The pinion seal and the differential halfshaft seals are the only serviced components of the rear drive axle. If other components of the rear drive axle are worn or damaged, the assembly must be installed new.

The rear axle drive pinion receives power from the engine through the transaxle, power transfer unit (PTU), driveshaft and active torque coupling, and is engaged "ON DEMAND". The pinion gear rotates the differential ring gear, which is bolted to the differential case outer flange. Inside the differential case, 2 differential pinion gears are mounted on a differential pinion shaft, which is pinned to the case. These differential pinion gears are engaged with the splined differential side gears. The halfshafts are held in the differential side gears by a retainer circlip that is located on the inboard constant velocity (CV) joint stub shaft. When each halfshaft is installed, the retainer circlip engages a step in the differential side gear. There are no stub shaft bearings in the differential housing. As the differential case turns, it rotates the halfshafts and rear wheels. When it is necessary for one wheel and halfshaft to rotate faster than the other, the faster turning differential side gear causes the differential pinion gears to roll on the slower turning differential side gear. This allows differential action between the 2 halfshafts.

DIAGNOSTIC TESTS

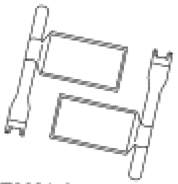
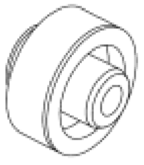
REAR DRIVE AXLE AND DIFFERENTIAL

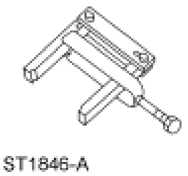
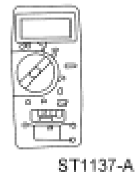
Refer to **DRIVELINE SYSTEM - GENERAL INFORMATION** article.

IN-VEHICLE SERVICING

STUB SHAFT SEAL

Special Tools

Illustration	Tool Name	Tool Number
 ST2621-A	Adapter for 303-224 (Handle)	205-153 (T80T-4000-W)
 ST1786-A	Installer, Front Axle Oil Seal	205-350 (T95T-3010-A)
	Remover, Torque Converter Fluid Seal	307-309 (T94P-77001-BH)

		
	Slide Hammer	100-001 (T50T-100-A)

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

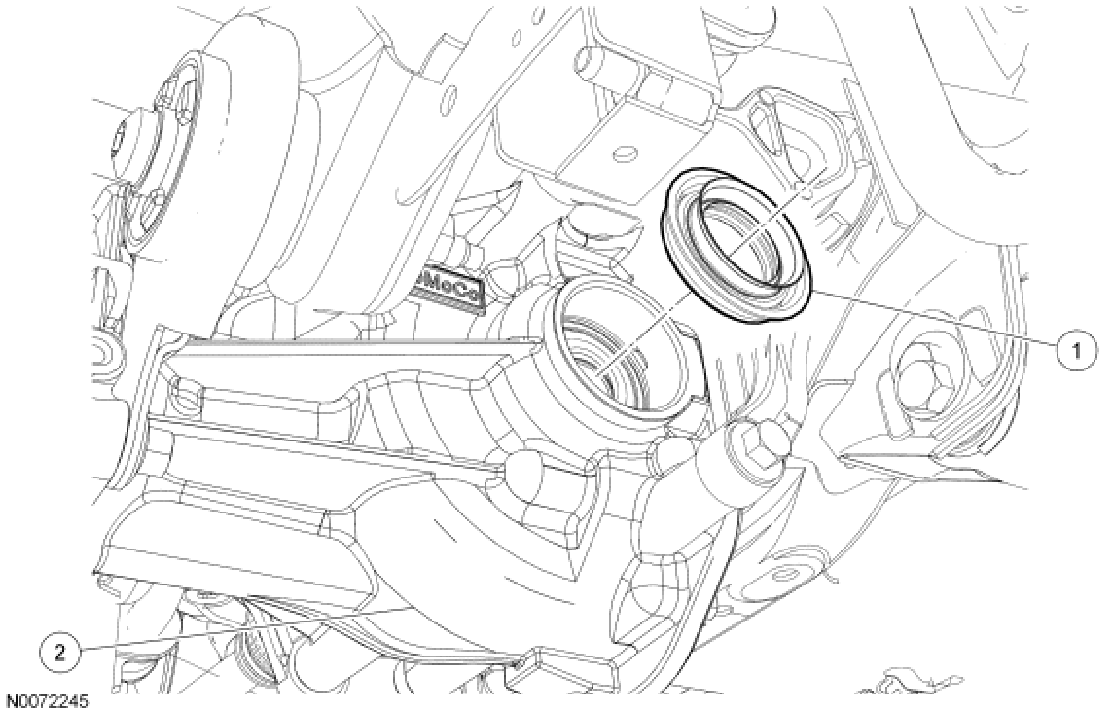


Fig. 1: Exploded View Of Stub Shaft Seal
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	4B416	Stub shaft seal
2	4010	Differential housing

REMOVAL

NOTE: The rear drive unit (RDU) does not have stub shaft pilot bearings. It has stub shaft seals only.

1. Remove the halfshaft assembly. For additional information, refer to **REAR DRIVE HALFSHAFTS** article.
2. Using the special tools, remove the stub shaft seal.

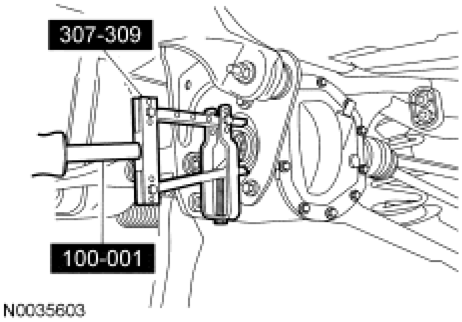


Fig. 2: Removing Stub Shaft Seal Using Special Tools (307-309, 100-001)
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: Lubricate the new stub shaft seal with grease.

1. Using the special tools, install the stub shaft pilot bearing housing seal.

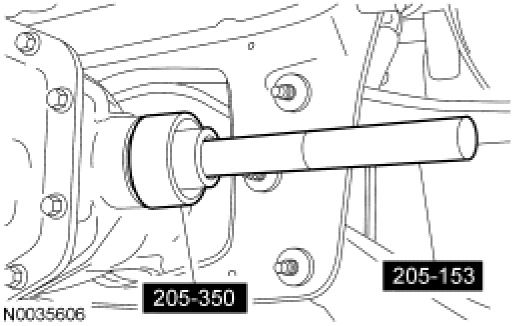


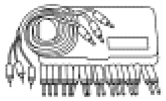
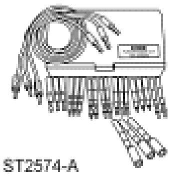
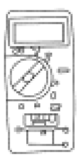
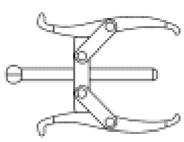
Fig. 3: Installing Stub Shaft Pilot Bearing Housing Seal Using Special Tools (205-350, 205-153)
Courtesy of FORD MOTOR CO.

2. Install the halfshaft assembly. For additional information, refer to **REAR DRIVE HALFSHAFTS** article.

DRIVE PINION SEAL

Special Tools

Illustration	Tool Name	Tool Number

 ST1138-A	Converter Seal Remover	307-309 (T94P-77001-BH)
 ST2574-A	Holding Fixture, Drive Pinion Flange	205-126 (T78P-4851-A)
 ST1957-A	Pinion Seal Replacer	205-133 (T79P-4676-A)
 ST1137-A	Slide Hammer	100-001 (T50T-100-A)
 ST1321-A	2-Jaw Puller	205-D072 (D97L-4221-A) or equivalent

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

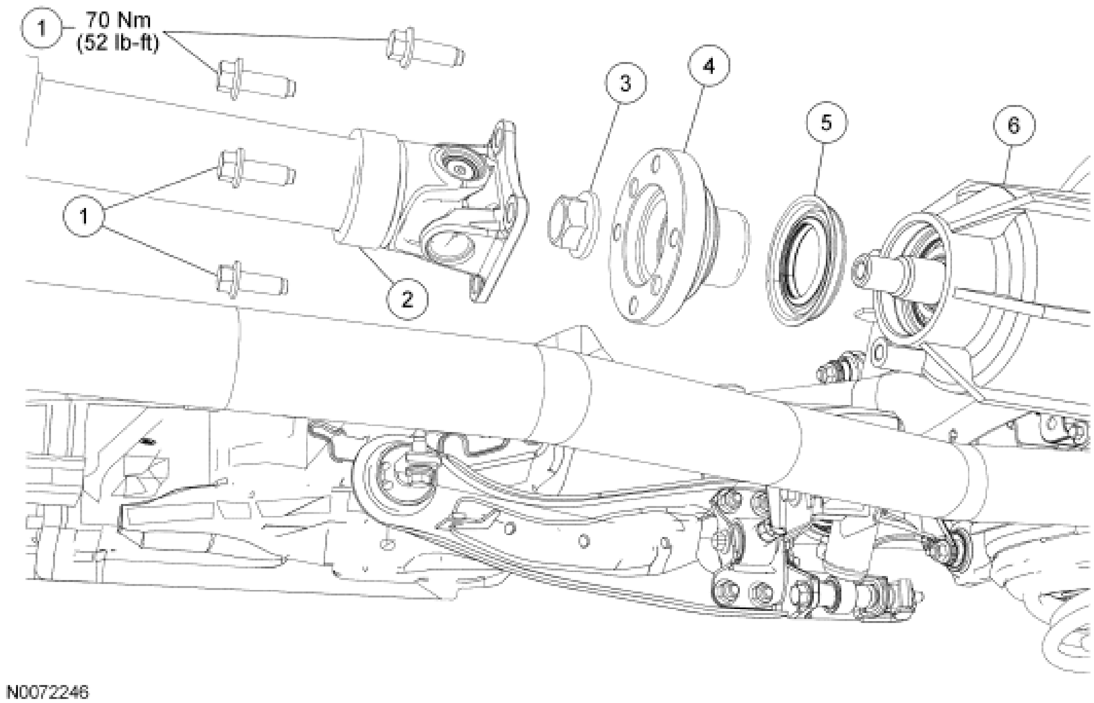


Fig. 4: Exploded View Of Drive Pinion Seal With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711918-S	Rear driveshaft flange-to-pinion flange bolts (4 required)
2	4K357	Driveshaft
3	4320	Drive pinion nut
4	4858	Drive pinion flange
5	4676	Drive pinion seal
6	49924	Coupler housing

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove and discard the 4 rear driveshaft U-joint flange bolts.
   - Support the driveshaft.

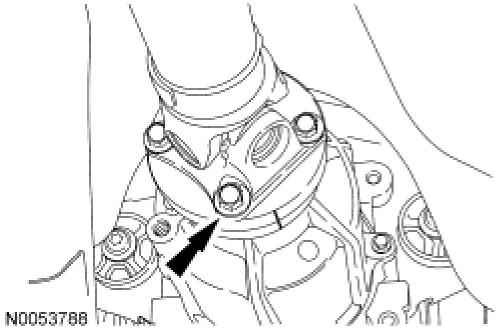


Fig. 5: Locating Rear Driveshaft Universal Joint Flange Bolts
Courtesy of FORD MOTOR CO.

3. Using the special tool, hold the pinion flange and remove and discard the nut.

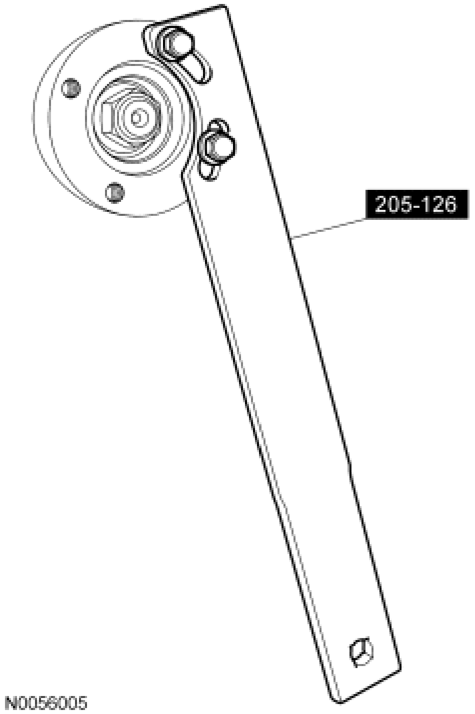


Fig. 6: Identifying Special Tool (205-126)
Courtesy of FORD MOTOR CO.

4. Index-mark the location of the pinion to the yoke.

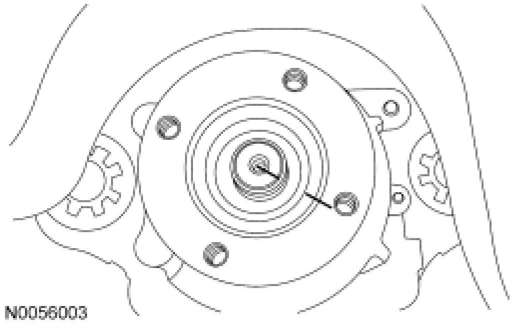


Fig. 7: Identifying Index-Mark On Pinion Of Yoke
Courtesy of FORD MOTOR CO.

5. Using the special tool, remove the pinion flange.

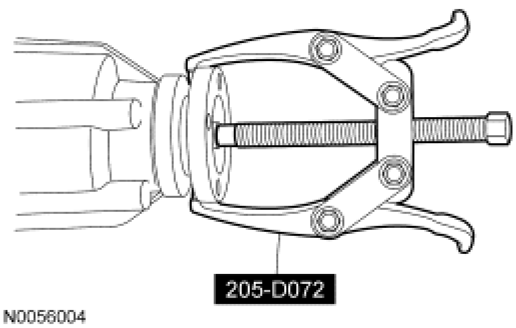


Fig. 8: Identifying Special Tool (205-D072)
Courtesy of FORD MOTOR CO.

6. Using the special tools, remove and discard the drive pinion seal.

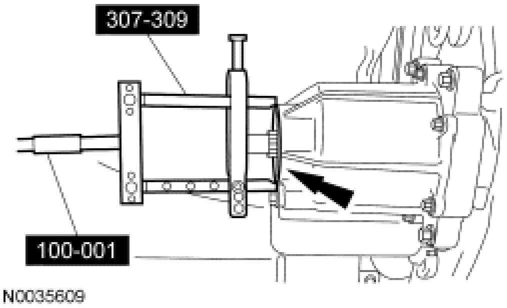


Fig. 9: Removing Drive Pinion Seal Using Special Tools (307-309, 100-001)
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: Make sure that the mating surface is clean before installing the new seal.

1. Using the special tool, install the drive pinion seal.

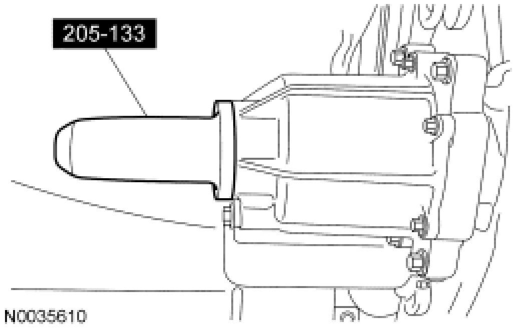


Fig. 10: Installing Drive Pinion Seal Using Special Tool (205-133)
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the pinion flange splines with grease.

2. Line up the index marks and position the pinion flange.

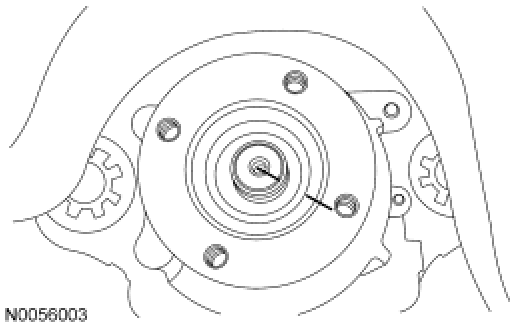


Fig. 11: Identifying Index-Mark On Pinion Of Yoke
Courtesy of FORD MOTOR CO.

3. Using the special tool, install the new pinion nut.
    - Tighten to 244 Nm (180 lb-ft).

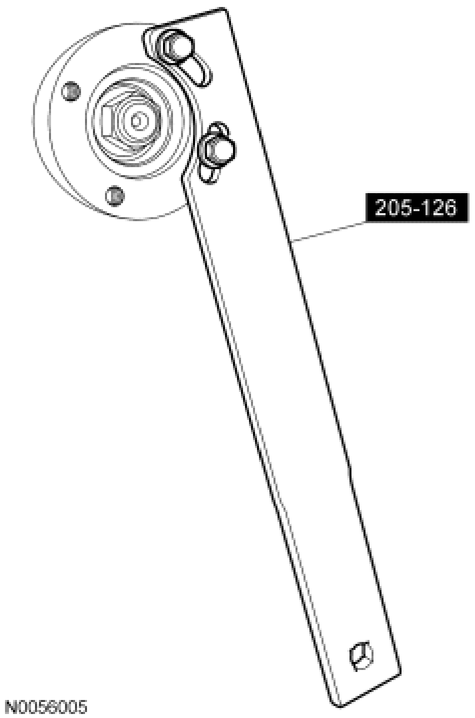


Fig. 12: Identifying Special Tool (205-126)
Courtesy of FORD MOTOR CO.

4. Line up the index marks and install the rear driveshaft U-joint flange with 4 new bolts.
   - Tighten to 70 Nm (52 lb-ft).

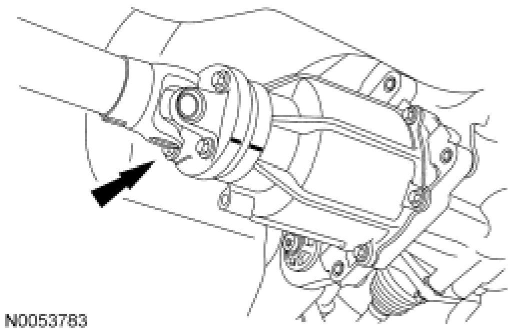


Fig. 13: Locating U-Joint Flange Bolts
Courtesy of FORD MOTOR CO.

DIFFERENTIAL HOUSING COVER

Material

Item	Specification
Clear Silicone Rubber TA-32	ESB-M4G92-A
Motorcraft SAE 80W-90 Premium Rear Axle	

Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A

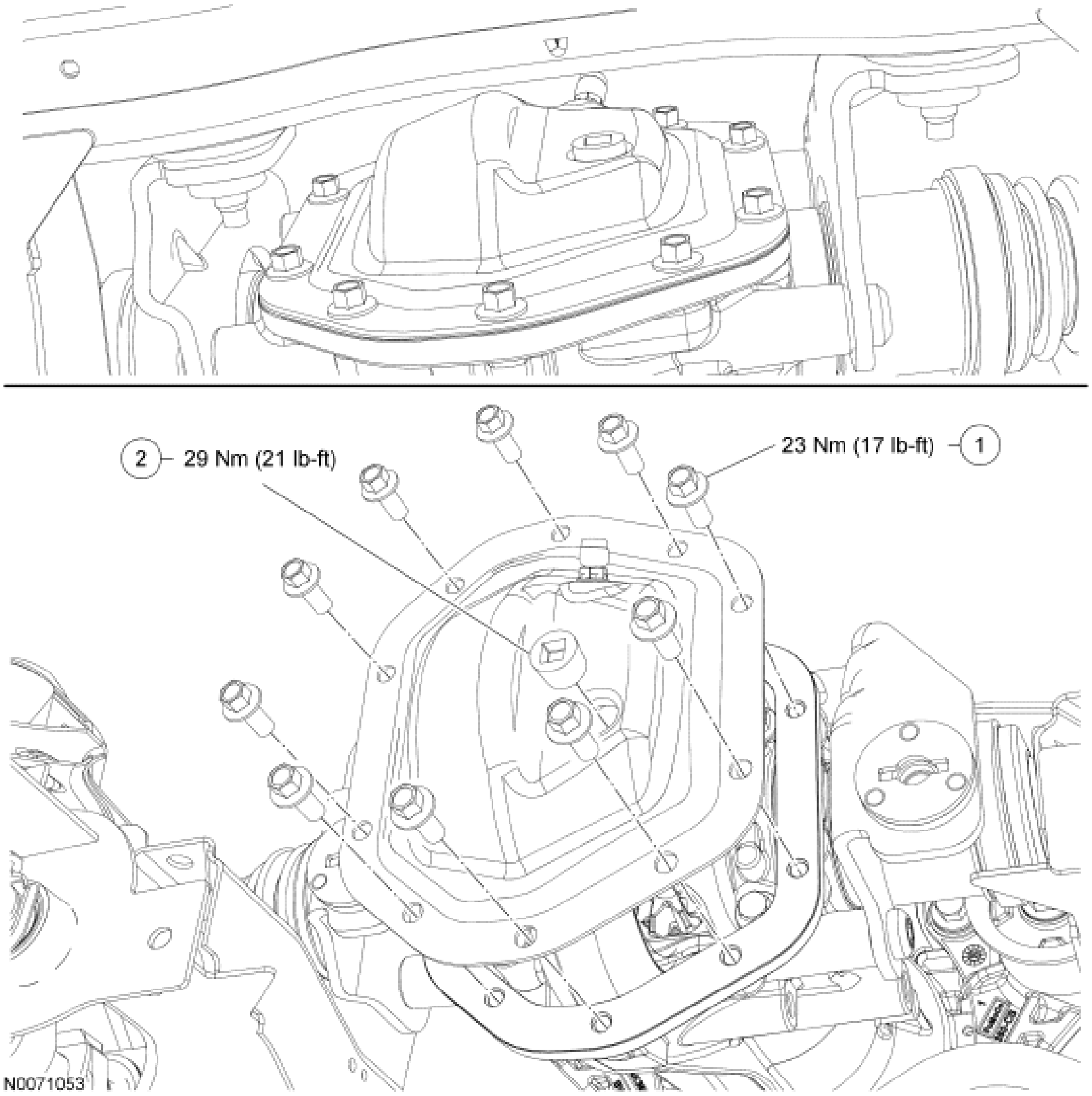


Fig. 14: Exploded View Of Differential Housing Cover Bolts With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505262-S439	Differential cover bolt (10 required)
2	4N282	Differential fill plug

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the 10 bolts and the rear differential housing cover.

- Drain the differential fluid from the housing.

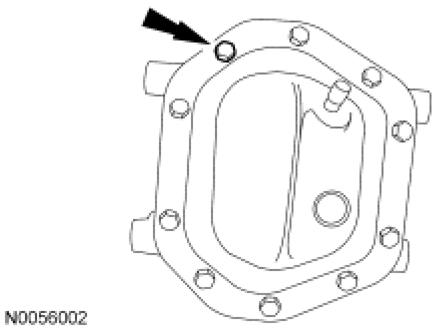


Fig. 15: Locating Rear Differential Housing Cover Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

CAUTION: Make sure the machined surfaces on the rear axle housing and the differential housing cover are clean and free of oil before installing the new silicone sealant. The inside of the rear axle must be covered when cleaning the machined surface to prevent damage to the component.

NOTE: Make sure the differential vent located on the rear cover is free of obstruction.

1. Clean the gasket mating surfaces of the differential housing and the differential housing cover.

NOTE: The differential housing cover must be installed within 15 minutes of application of the silicone, or new sealant must be applied. If possible, allow one hour before filling with lubricant to make sure the silicone sealant has correctly cured.

2. Apply a new continuous bead of clear silicone rubber as shown in the illustration.

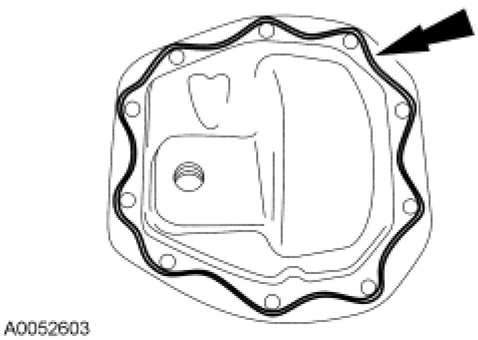


Fig. 16: Applying Sealant
Courtesy of FORD MOTOR CO.

3. Install the differential housing cover and the 10 bolts.
   - Tighten to 23 Nm (17 lb-ft).
4. Remove the filler plug, fill the rear axle with 1.15L (2.43 pt) of rear axle lubricant, 3-5 mm (0.118-0.196 in) below the bottom of the filler hole and install the filler plug.
   - Tighten to 29 Nm (21 lb-ft).

REMOVAL AND INSTALLATION

AXLE ASSEMBLY

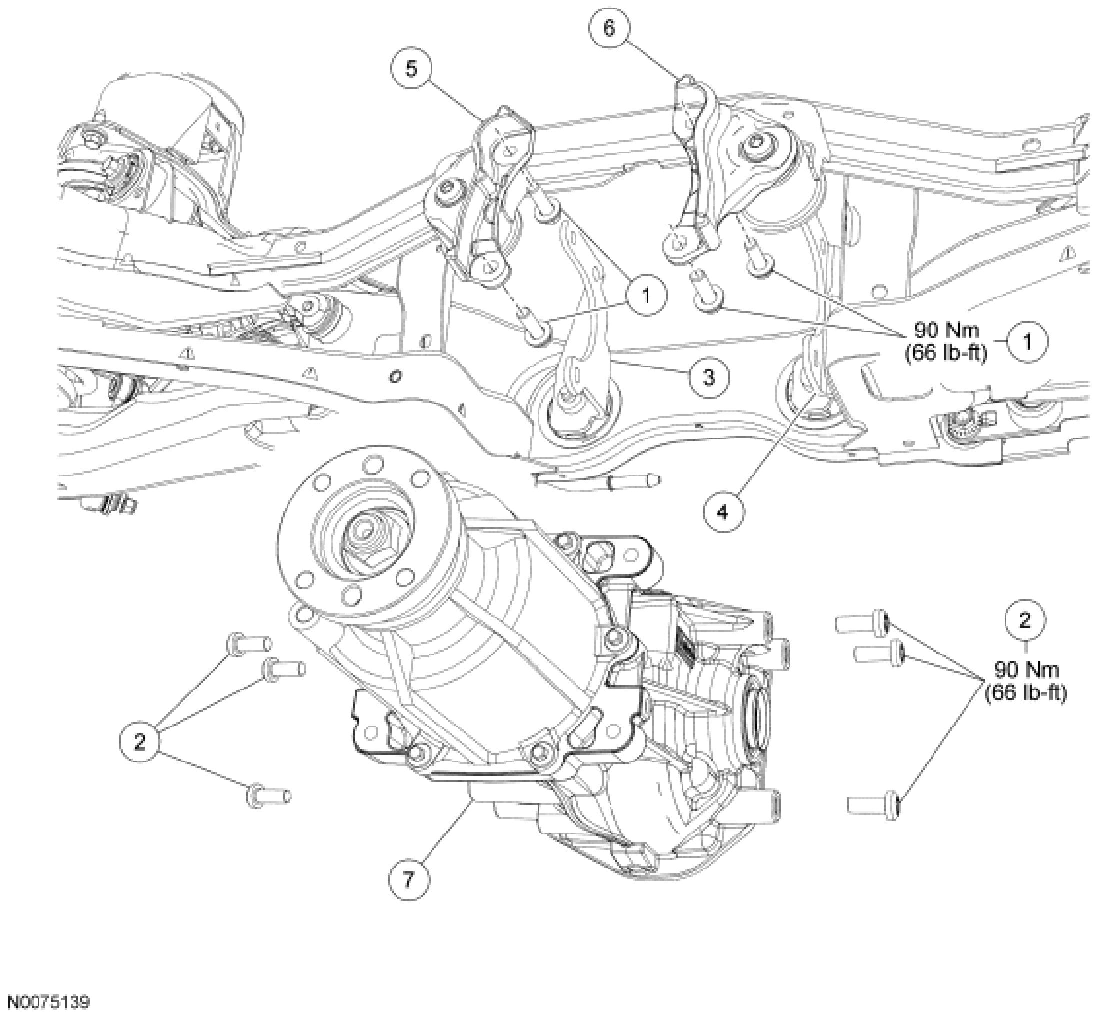


Fig. 17: Exploded View Of Axle Assembly With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description

1	W506540-S	Differential housing-to-front insulator bracket bolts (4 required)
2	W500043-S	Side insulator bracket-to-rear axle differential bolts (6 required)
3	4k630	Right rear insulator bracket
4	4K630	Left rear insulator bracket
5	4K360	Right front insulator bracket
6	4K630	Left rear insulator bracket
7	5L84	Rear axle assembly

REMOVAL AND INSTALLATION

1. Remove the driveshaft. For additional information, refer to **DRIVESHAFT** article.
2. Remove the rear halfshafts. For additional information, refer to **REAR DRIVE HALFSHAFTS** article.
3. Position a suitable transmission hydraulic jack to the axle housing. Securely strap the jack to the housing.

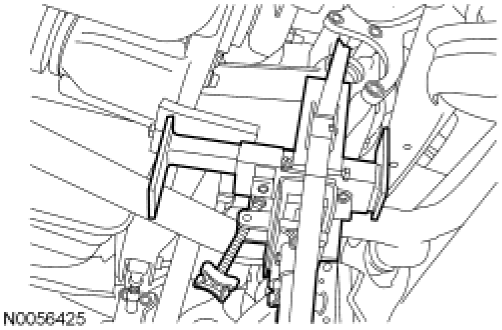


Fig. 18: Positioning Suitable Transmission Hydraulic Jack To Axle Housing
Courtesy of FORD MOTOR CO.

4. Disconnect the active torque coupling electrical connector.

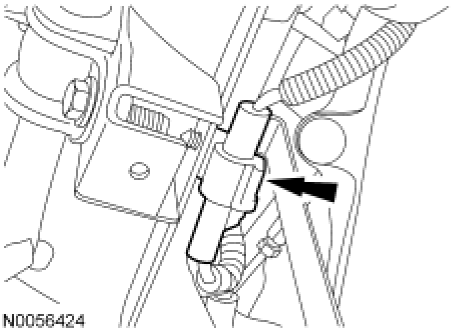


Fig. 19: Identifying Active Torque Coupling Electrical Connector
Courtesy of FORD MOTOR CO.

5. Remove the 4 differential housing-to-front insulator bracket bolts.
   - To install, tighten to 90 Nm (66 lb-ft).

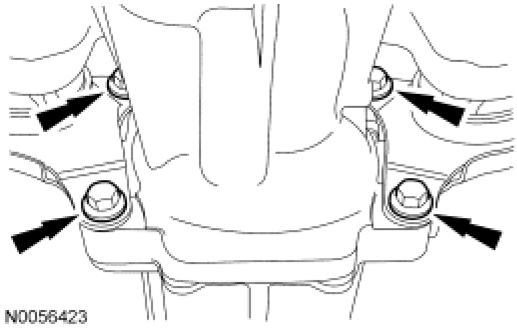


Fig. 20: Locating Differential Housing-To-Front Insulator Bracket Bolts
Courtesy of FORD MOTOR CO.

6. Loosen the LH front insulator bracket-to-subframe bolt, and rotate the bracket aside.
   - To install, tighten to 90 Nm (66 lb-ft).
7. Loosen the RH front insulator bracket-to-subframe bolt and the bracket, and rotate the bracket aside.
   - To install, tighten to 90 Nm (66 lb-ft).
8. Remove the 3 RH side insulator bracket-to-rear axle differential bolts.
   - To install, tighten to 90 Nm (66 lb-ft).

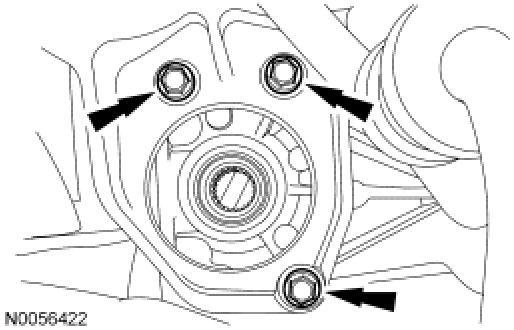


Fig. 21: Locating RH Side Insulator Bracket-To-Rear Axle Differential Bolts
Courtesy of FORD MOTOR CO.

9. Remove the 3 LH side insulator or bracket-to-rear axle differential bolts.
   - To install, tighten to 90 Nm (66 lb-ft).

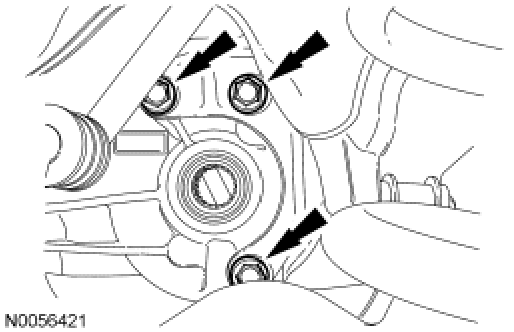


Fig. 22: Locating LH Side Insulator Or Bracket-To-Rear Axle Differential Bolts
Courtesy of FORD MOTOR CO.

10. Lower the rear axle assembly.
11. To install, reverse the removal procedure.

2008 TRANSMISSIONS

Rear Drive Halfshafts - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Axle shaft speed sensor bolt	23	17
Lower shock absorber bolt	115	85
Rear wheel hub nut	255	188
Toe link bracket nut	90	66
Upper arm bolt	110	81

DESCRIPTION AND OPERATION

REAR DRIVE HALFSHAFTS

The halfshafts consist of the following components:

- Inner constant velocity (CV) joints
- Outer CV joints
- Interconnecting shafts

The halfshafts are splined on the outboard stub shaft to drive the wheel hubs. They are retained in the wheel hubs by special wheel hub nuts which also control the wheel bearing preload. The halfshafts are splined on the inboard stub shaft and are retained by circlips. New circlips must be installed whenever the halfshafts are removed.

Halfshaft Joint

CV joints consist of the following components:

- CV joint boot clamps
- Convoluted CV joint boots
- Tripod joint housings
- Ball and cage housings
- Retainer circlips
- Special CV high temperature grease
- Never pick up or hold the halfshaft only by the inboard or outboard CV joint.
- Do not over angle the CV joints.

- Damage will occur to an assembled inboard CV joint if it is over plunged outward from the joint housing.
- Never use a hammer to remove or install the halfshafts from the rear hub.
- Never use the halfshaft assembly as a lever to position other components. Always support the free end of the halfshaft.
- Do not allow the boots to contact sharp edges or hot exhaust components.
- Handle the halfshaft only by the interconnecting shaft to avoid pull-apart and potential damage to the CV joints.
- Excessive pulling force on the interconnecting shaft between joints of the halfshaft will result in internal joint damage. Axial loads used in assisting removal must be applied through the inboard joint housing only.
- Do not drop assembled halfshafts. The impact will cut the boots from the inside without evidence of external damage.
- Do not remove the outer CV joint by pulling on the interconnecting shaft.
- Inspect all machined surfaces and splines for damage.

The CV joints mate the interconnecting shaft with the stub shaft. The joints allow for smooth rotation of the interconnecting shaft and the stub shafts. They also adjust for length variances and angle requirements as the vehicle goes through jounce and rebound.

The halfshaft joints are not repairable and are serviced as assemblies only.

DIAGNOSTIC TESTS

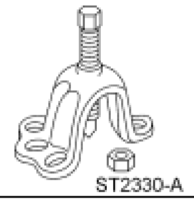
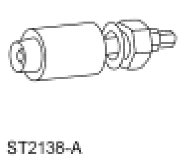
REAR DRIVE HALFSHAFTS

Refer to **DRIVELINE SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

HALFSHAFT

Special Tools

Illustration	Tool Name	Tool Number
	Front Hub Remover	205-D070 (D93P-1175-B) or equivalent
	Halfshaft Installer	204-161 (T97P-1175-A)

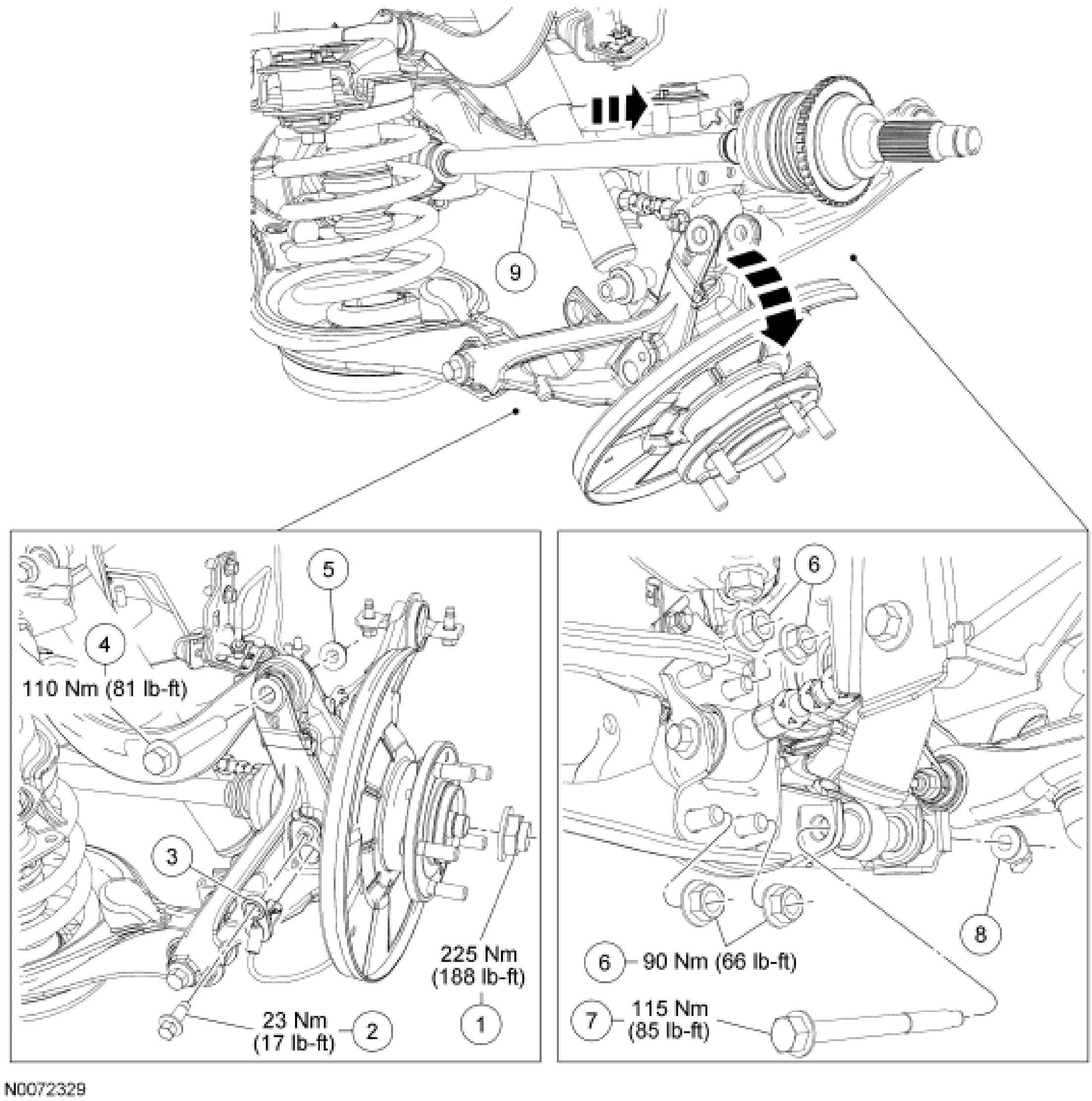


Fig. 1: Exploded View Of Halfshaft Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3N405	Rear wheel hub nut
2	W500547-S	Shaft speed sensor bolt
3	2C187	Shaft speed sensor
4	W500547-S	Upper arm bolt
5	W520515-S	Upper arm nut
6	W520515-S	Tie-rod bracket nuts (4 required)
7	W712880-S	Lower shock absorber bolt
8	W712848-S	Lower shock absorber nut
9	4B402	Rear halfshaft assembly

REMOVAL

1. Remove the tire and wheel. For additional information, refer to **WHEELS AND TIRES** article.
2. Remove and discard the rear wheel hub nut.
3. Remove the bolt and position aside the shaft speed sensor.

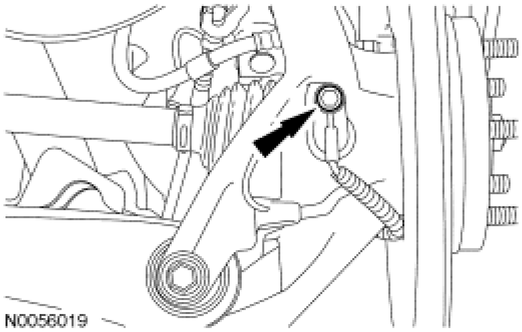


Fig. 2: Locating Shaft Speed Sensor Bolt
Courtesy of FORD MOTOR CO.

4. Remove the nut and lower shock absorber bolt.

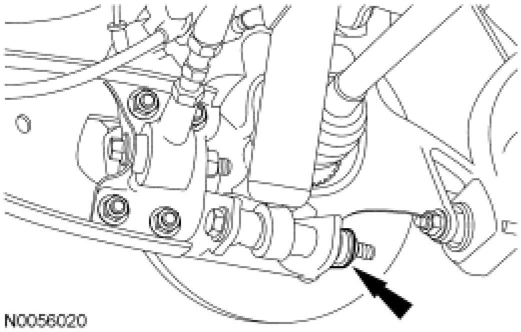


Fig. 3: Locating Lower Shock Absorber Bolt
Courtesy of FORD MOTOR CO.

5. Support the lower arm.

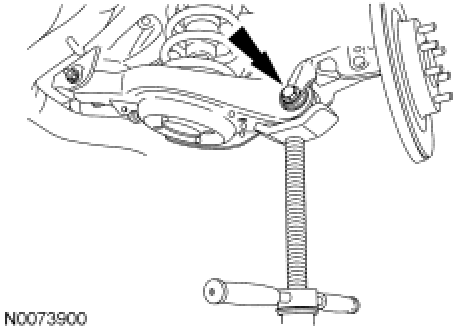


Fig. 4: Supporting Lower Arm

Courtesy of FORD MOTOR CO.

6. Remove the 4 toe link bracket nuts.

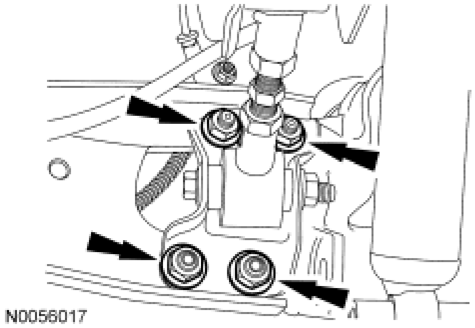


Fig. 5: Locating Link Bracket Nuts
Courtesy of FORD MOTOR CO.

7. Using the special tool, separate the halfshaft from the rear axle hub assembly.

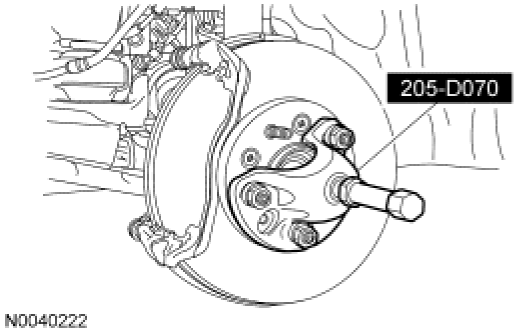


Fig. 6: Separating Halfshaft From Wheel Hub Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

CAUTION: Do not damage the oil seal protector when removing the axle halfshaft from the differential.

8. Using a suitable pry bar, remove the halfshaft.

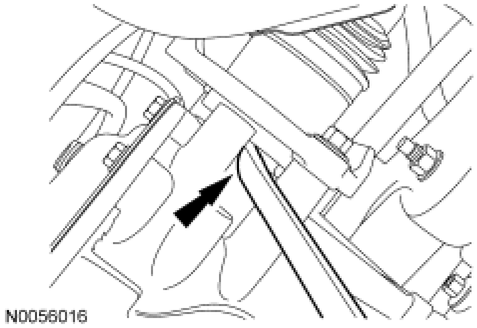


Fig. 7: Removing Halfshaft Using A Suitable Pry Bar
Courtesy of FORD MOTOR CO.

9. Remove and discard the circlip from the stub shaft.

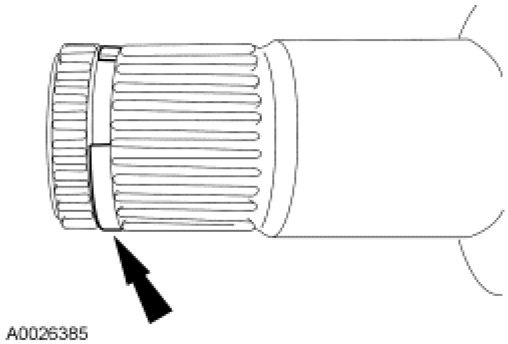


Fig. 8: Locating Halfshaft Circlip
Courtesy of FORD MOTOR CO.

INSTALLATION

CAUTION: Make sure to install the correct circlip for each application. Failure to use the correct diameter circlip may result in shaft removal concerns or shaft separation during vehicle operation.

1. Install a new circlip on the stub shaft.

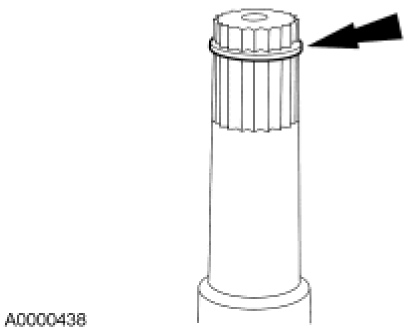


Fig. 9: Locating Intermediate Shaft Circlip
Courtesy of FORD MOTOR CO.

2. Install the stub shaft in the rear drive unit.
   - Make sure the circlip locks in the side gear.

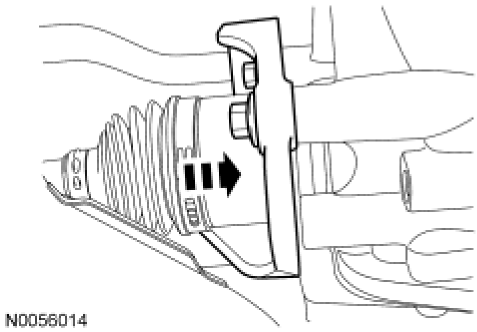


Fig. 10: Installing Stub Shaft In Rear Drive Unit
Courtesy of FORD MOTOR CO.

3. Using the special tool, install the outer halfshaft end into the hub assembly.

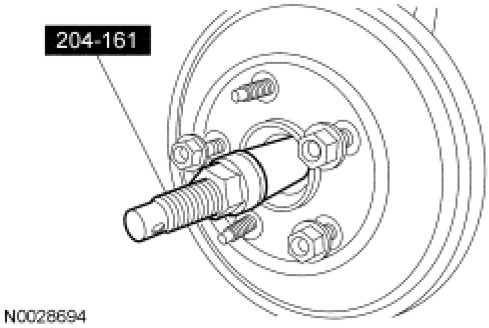


Fig. 11: Installing Outer Halfshaft End Into Hub Assembly
Courtesy of FORD MOTOR CO.

4. Position the lower arm.

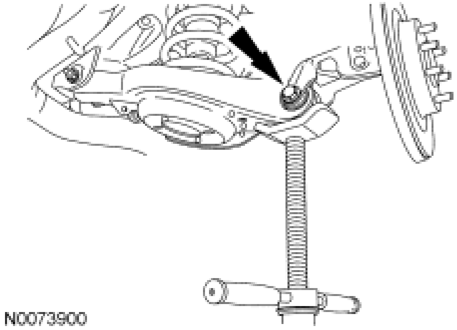


Fig. 12: Supporting Lower Arm
Courtesy of FORD MOTOR CO.

CAUTION: Do not tighten the rear wheel hub nut with the vehicle on the ground. The nut must be tightened to specification before the vehicle is lowered to the ground. Wheel bearing damage will occur if the wheel bearing is loaded with the weight of the vehicle applied.

5. Install the new rear wheel hub nut.
    - To install, tighten to 255 Nm (188 lb-ft).
6. Stake the new nut in line with the keyway to a recommended minimum depth of 1 mm (0.039 in) below the keyway diameter to engage the locking feature.

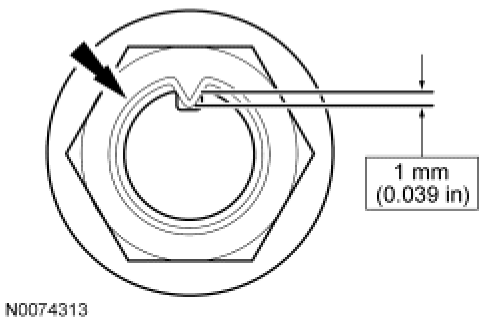


Fig. 13: Identifying Rear Wheel Hub Nut
Courtesy of FORD MOTOR CO.

7. Install the 4 rear toe link bracket nuts.
    - Tighten to 90 Nm (66 lb-ft).

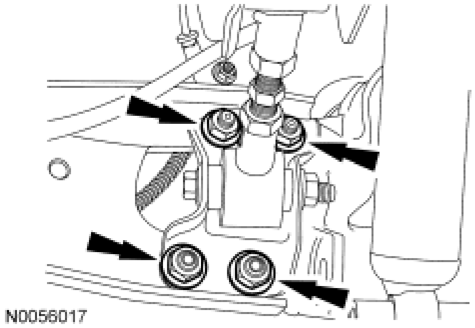


Fig. 14: Locating Link Bracket Nuts
Courtesy of FORD MOTOR CO.

8. Install the lower shock absorber bolt and nut.
    - Tighten to 115 Nm (85 lb-ft).

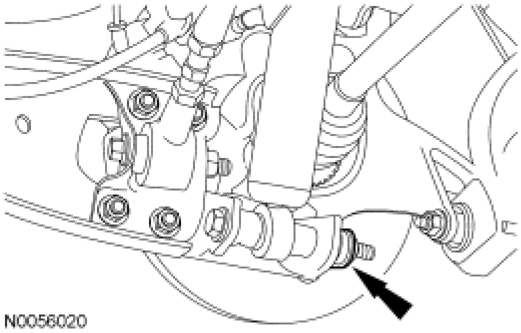


Fig. 15: Locating Lower Shock Absorber Bolt
Courtesy of FORD MOTOR CO.

9. Install the axle shaft speed sensor and bolt.
   - Tighten to 23 Nm (17 lb-ft).

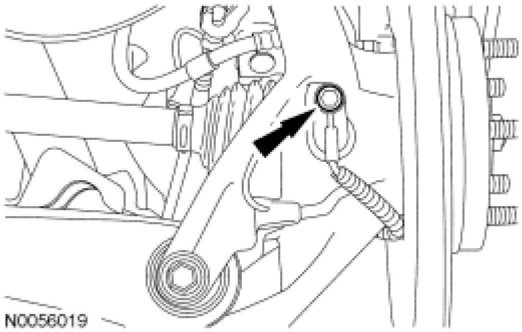


Fig. 16: Locating Shaft Speed Sensor Bolt
Courtesy of FORD MOTOR CO.

10. Fill the axle with the specified quantity of the specified lubricant.
11. Install the tire and wheel. For additional information, refer to **WHEELS AND TIRES** article.

2008 SUSPENSION

Rear Suspension - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Brake caliper anchor plate bolt	70	52	-
Brake disc bolt	20	15	-
Brake disc shield bolt	23	17	-
Jounce stop	55	41	-
Lower arm cam adjuster nut	101	74	-
Lower arm outboard bolt	103	76	-
Lower arm outboard nut	103	76	-
Parking brake cable bracket bolt	10	-	89
Shock absorber bracket bolt	40	30	-
Shock absorber lower bolt - all wheel drive (AWD)	90	66	-
Shock absorber lower bolt - front wheel drive (FWD)	115	85	-
Shock absorber upper bolt - AWD	90	66	-
Shock absorber upper bolt - FWD	103	76	-
Stabilizer bar bracket bolt	40	30	-
Stabilizer bar bracket nut	40	30	-
Stabilizer bar link lower bolt	45	33	-
Stabilizer bar link upper nut	40	30	-
Toe link bolts and nuts	110	81	-
Toe link shield bolt	8	-	71
Trailing arm-to-frame bolt	125	92	-
Trailing arm-to-knuckle nut	90	66	
Upper arm inboard bolt [a]	-	-	-
Upper arm outboard bolt - FWD	110	81	-
Upper arm outboard nut - AWD	110	81	-
Wheel hub nut	255	189	-
Wheel speed sensor bolt	23	17	-
Wheel speed sensor harness bracket nut	23	17	-
Wheel spindle bolt	140	103	-

[a] Refer to the procedure.

DESCRIPTION AND OPERATION

REAR SUSPENSION

The rear suspension consists of the following components:

- Wheel bearing and wheel hub assemblies
- Wheel studs
- Upper arms
- Lower arms
- Toe links
- Stabilizer bar
- Stabilizer bar bushings
- Stabilizer bar links
- Trailing arms
- Wheel knuckles
- Wheel spindles
- Shock absorbers
- Coil springs

The rear suspension utilizes an independent short/long arm design. This suspension system incorporates a separate wheel knuckle for each wheel and allows the wheels to react to road imperfections independent of each other. This independent action offers improved isolation from the effects of jounce and rebound.

DIAGNOSTIC TESTS

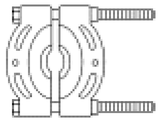
REAR SUSPENSION

Refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

WHEEL BEARING AND WHEEL HUB

Special Tools

Illustration	Tool Name	Tool Number
	Remover, Drive Pinion Bearing Cone	205-D002 (D79L-4621-A) or equivalent
	Installer, Wheel Bearing Cup	205-147

 ST2446-A		
 ST2446-A	Remover/Installer, Wheel Bearing Cup	204-020
 ST2446-A	Step Plate	205-117

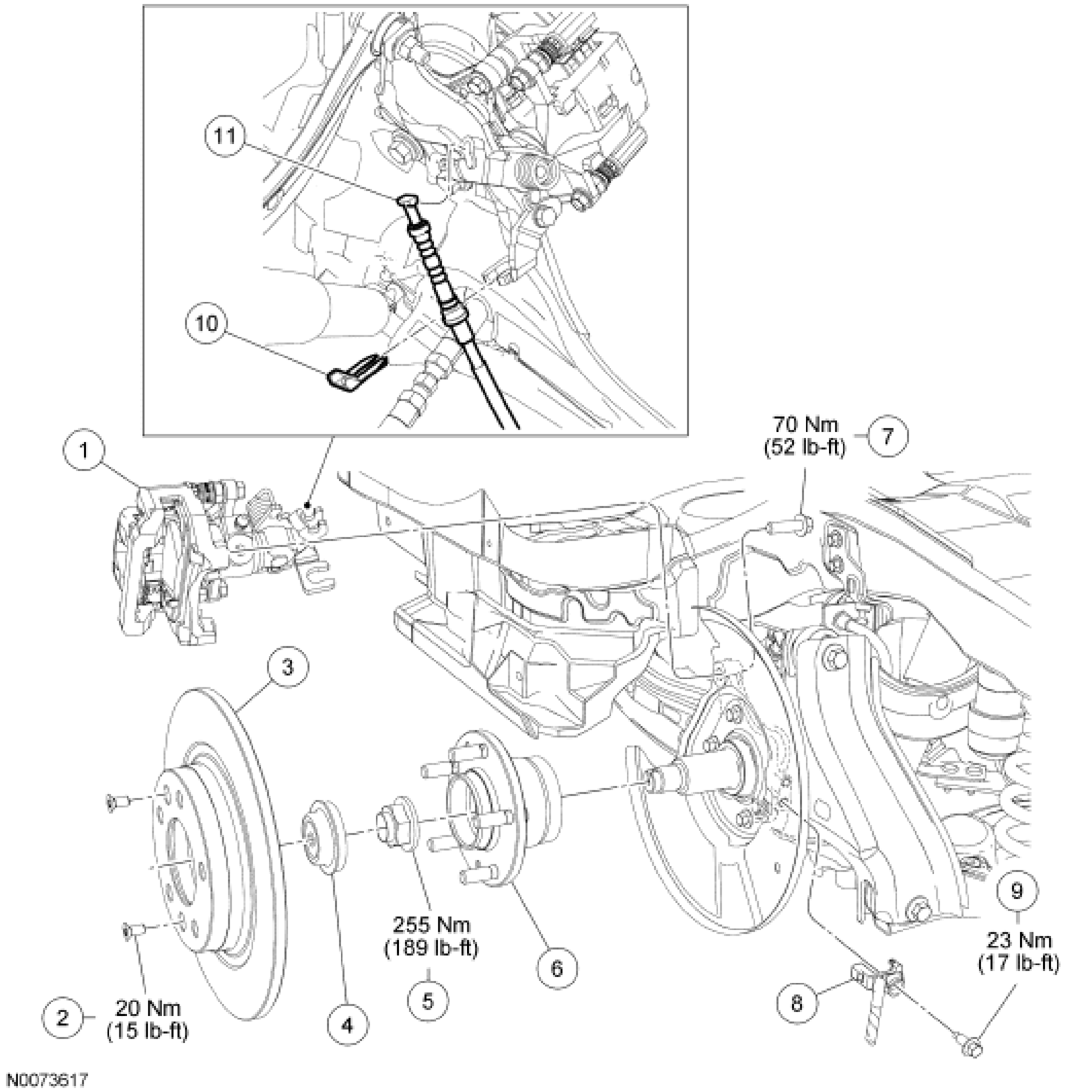


Fig. 1: Exploded View Of Wheel Bearing & Wheel Hub With Torque Specifications - Front Wheel Drive (FWD) Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Brake caliper and anchor plate assembly
2	W505741	Brake disc bolt (2 required)
3	2C026	Brake disc
4	1N135	Grease cap
5	W712435	Wheel hub nut
6	1104	Wheel hub and bearing assembly
7	W711240	Brake caliper anchor plate bolt (2 required)
8	2C187	Wheel speed sensor

9	W500222	Wheel speed sensor bolt
10	2860	Parking brake cable clip
11	2A815	Rear parking brake cable assembly

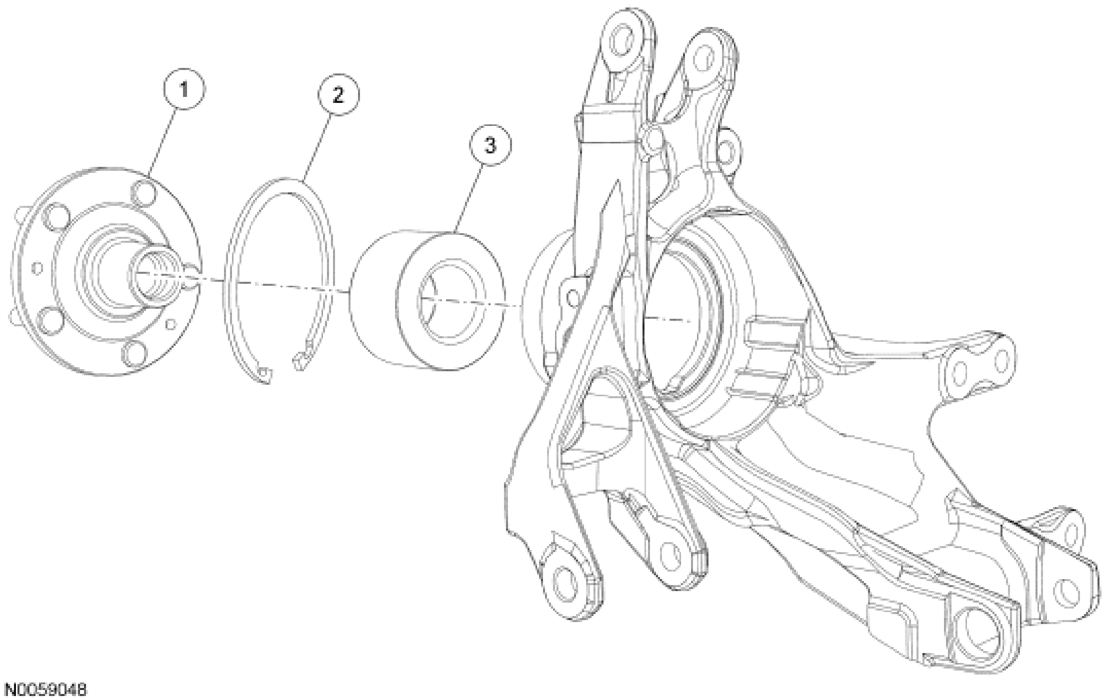


Fig. 2: Exploded View Of Wheel Bearing & Wheel Hub - All Wheel Drive (AWD) Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	1104	Wheel hub
2	W303280	Snap ring
3	1215	Wheel bearing

REMOVAL

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

Front wheel drive (FWD) vehicles

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

2. If equipped, remove the wheel speed sensor bolt and position the sensor aside.
3. Disconnect the parking brake cable from the brake caliper in the following sequence.
    1. Remove the clip.
    2. Disconnect the parking brake cable from the brake caliper.

CAUTION: Do not allow the brake caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.

4. Remove the anchor plate bolts and position the brake caliper and anchor plate assembly aside.
    - Support the brake caliper and anchor plate assembly using mechanic's wire.
5. Remove the 2 brake disc bolts and the brake disc.
6. Remove and discard the grease cap.
7. Remove and discard the wheel hub nut and remove the wheel hub and bearing assembly.

All wheel drive (AWD) vehicles

8. Remove the wheel knuckle. For additional information, refer to **Wheel Knuckle**.
9. Using the special tool, press the wheel hub from the wheel bearing.

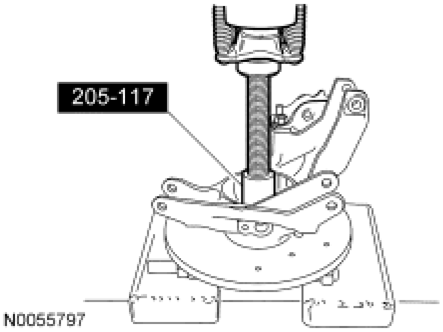


Fig. 3: Pressing Wheel Hub From Wheel Bearing Using Special Tool (205-117)
Courtesy of FORD MOTOR CO.

NOTE: This step may be necessary if the inner wheel bearing race remains in the wheel knuckle after removing the wheel hub.

10. Install the special tool, position in a suitable press and press the inner wheel bearing race from the wheel hub.

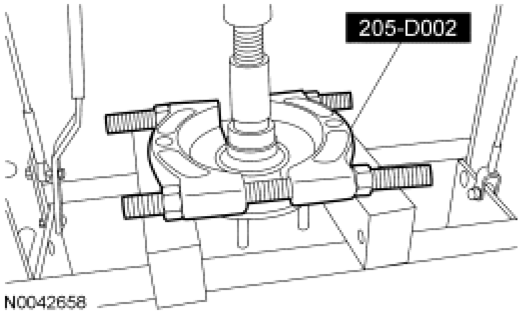


Fig. 4: Pressing Inner Wheel Bearing Race From Wheel Hub Using Special Tool (205-D002)
Courtesy of FORD MOTOR CO.

11. Remove the span ring.
12. Using the special tool, press the outer wheel bearing race from the wheel knuckle.

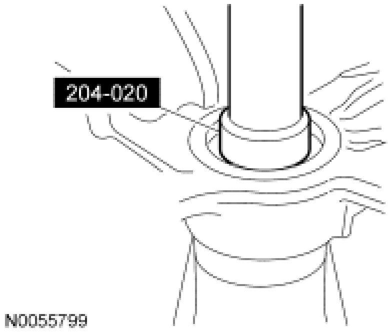


Fig. 5: Pressing Outer Wheel Bearing Race From Wheel Knuckle Using Special Tool (204-020)
Courtesy of FORD MOTOR CO.

INSTALLATION

AWD vehicles

1. Using the special tool, press the wheel bearing into the wheel knuckle.

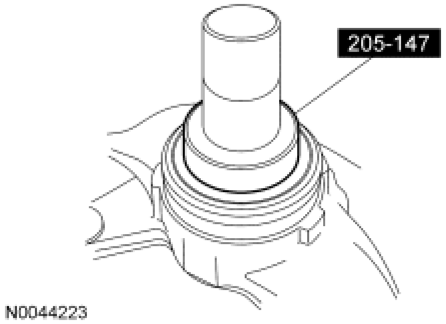


Fig. 6: Pressing Wheel Bearing Into Wheel Knuckle Using Special Tool (205-147)
Courtesy of FORD MOTOR CO.

2. Using the special tool, press the wheel hub into the wheel bearing.

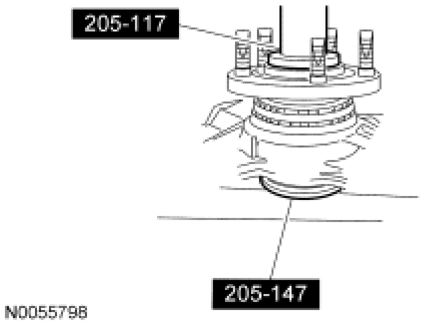


Fig. 7: Pressing Wheel Hub Into Wheel Bearing Using Special Tools (205-147, 205-117)
Courtesy of FORD MOTOR CO.

3. Install the wheel knuckle. For additional information, refer to **Wheel Knuckle**.

   FWD vehicles

4. If equipped, position the sensor and install the wheel speed sensor bolt.
   - Tighten to 23 Nm (17 lb-ft).
5. Connect the parking brake cable to the brake caliper in the following sequence.
   1. Install the clip.
   2. Connect the parking brake cable to the brake caliper.
6. Position the brake caliper and install the brake caliper anchor plate bolts.
   - Tighten to 70 Nm (52 lb-ft).
7. Install the brake disc and the 2 brake disc bolts.
   - Tighten to 20 Nm (15 lb-ft).
8. Install the grease cap.
9. Install the wheel hub and bearing assembly and the wheel hub nut.
   - Tighten to 255 Nm (189 lb-ft).
10. Install the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

WHEEL STUDS

NOTE: **Front wheel drive (FWD) vehicle shown, all wheel drive vehicle (AWD) similar.**

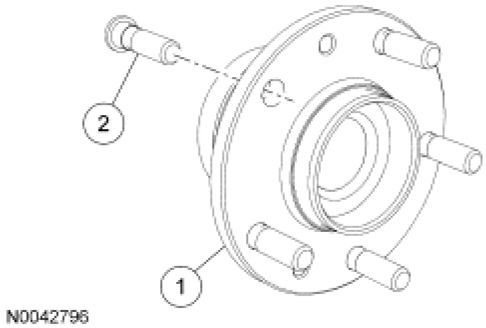


Fig. 8: Exploded View Of Wheel Studs
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	1104	Wheel bearing and wheel hub assembly
2	1107	Wheel stud

REMOVAL

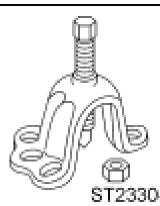
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the wheel bearing and wheel hub. For additional information, refer to **Wheel Bearing and Wheel Hub**.
3. Using a press, remove the wheel stud from the wheel hub.

INSTALLATION

1. Position the new wheel stud in the wheel hub, aligning the serrations in the wheel hub flange made by the original wheel stud.
2. Using a press, install the wheel stud.
3. Install the wheel bearing and wheel hub. For additional information, refer to **Wheel Bearing and Wheel Hub**.

WHEEL KNUCKLE

Special Tools

Illustration	Tool Name	Tool Number
	Remover, Front Wheel Hub	205-D070 (D93P-1175-B) or equivalent
	Installer, Halfshaft	204-161 (T97P-1175-4)

 ST2138-A		

NOTE: All wheel drive (AWD) MKZ vehicle shown, other vehicles similar.

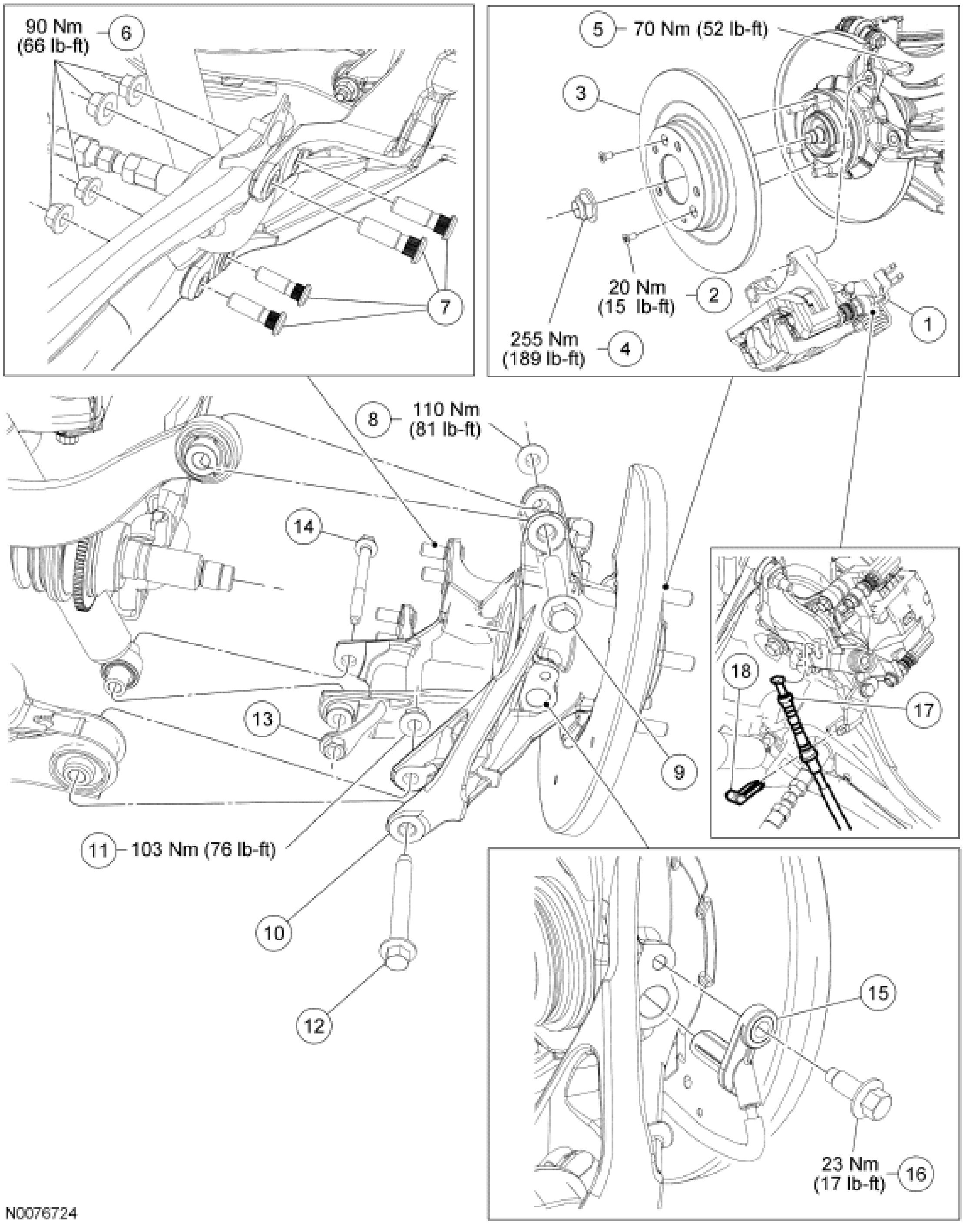


Fig. 9: Exploded View Of Wheel Knuckle With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Brake caliper and anchor plate assembly
2	W505741	Brake disc bolt (2 required)
3	2C026	Brake disc

4	W712435	Wheel hub nut
5	W711240	Brake caliper anchor plate bolt (2 required)
6	W520515	Trailing arm-to-wheel knuckle nut (4 required)
7	5B860	Trailing arm-to-wheel knuckle bolts (4 required)
8	W520515	Upper arm outboard nut
9	W500547	Upper arm outboard bolt
10	5A968	Wheel knuckle
11	W520215	Lower arm outboard nut
12	W513798	Lower arm outboard bolt
13	W302116	Shock absorber lower flag nut
14	W704586	Shock absorber lower bolt
15	2C187 LH/ 2C187 RH	Wheel speed sensor
16	W500222	Wheel speed sensor bolt
17	2860	Parking brake cable clip
18	2A815	Parking brake cable assembly

REMOVAL

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. If equipped, remove the wheel speed sensor bolt and position the sensor aside.
3. Disconnect the parking brake cable from the brake caliper in the following sequence.
    1. Remove the clip.
    2. Disconnect the parking brake cable from the brake caliper.

NOTE: Apply the brake to keep the halfshaft from rotating.

4. Remove and discard the wheel hub nut.

CAUTION: Do not allow the brake caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.

5. Remove the anchor plate bolts and position the brake caliper and anchor plate assembly aside.
    - Support the brake caliper and anchor plate assembly using mechanic's wire.
6. Remove the 2 brake disc bolts and the brake disc.
7. Using the special tool, separate the halfshaft from the wheel hub.

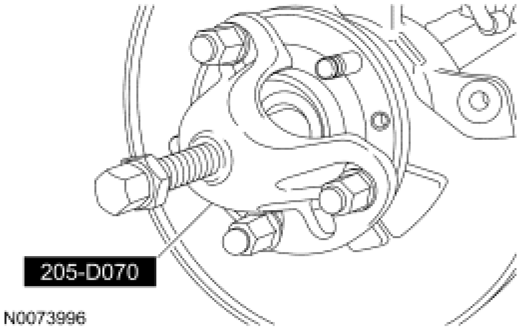


Fig. 10: Separating Halfshaft From Wheel Hub Using Special Tool (205-D070)
Courtesy of FORD MOTOR CO.

8. Remove and discard the shock absorber lower bolt and flag nut.
    - If equipped, remove the shock absorber damper.
9. Using a suitable jack, raise the lower arm.

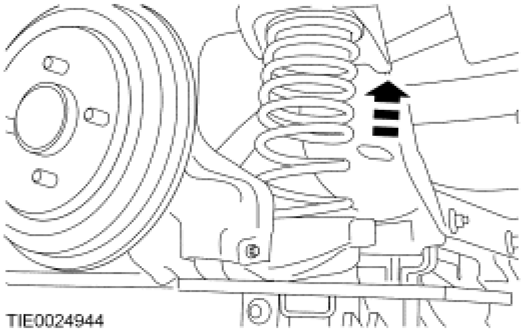


Fig. 11: Raising Rear Lower Arm
Courtesy of FORD MOTOR CO.

10. Remove and discard the upper arm outboard bolt.
11. Remove and discard the lower arm outboard bolt.
12. Remove the 4 trailing arm-to-knuckle nuts and the wheel knuckle.
    - Discard the nuts.

INSTALLATION

CAUTION: Before tightening any suspension bushing fasteners, the suspension must be at the bushing fastener tightening position. Use a suitable jack to raise the suspension until the distance between the center of the hub and the lip

of the fender is equal to 395 mm (15.55 in). This will prevent incorrect clamp load and bushing damage.

NOTE: Do not tighten the bolt at this time.

1. Position the wheel knuckle and install the 4 trailing arm-to-knuckle nuts.

NOTE: Do not tighten the bolt at this time.

2. Install the lower arm outboard bolt.

NOTE: Do not tighten the bolt at this time.

3. Install the upper arm outboard bolt.

NOTE: Do not tighten the bolt at this time.

4. Install the shock absorber lower bolt and flag nut.
5. Install the brake disc and the 2 brake disc bolts.
   - Tighten the bolts to 20 Nm (15 lb-ft).
6. Position the brake caliper and anchor plate assembly and install the 2 bolts.
   - Tighten the bolts to 70 Nm (52 lb-ft).
7. Using the special tool, install the halfshaft into the wheel hub.

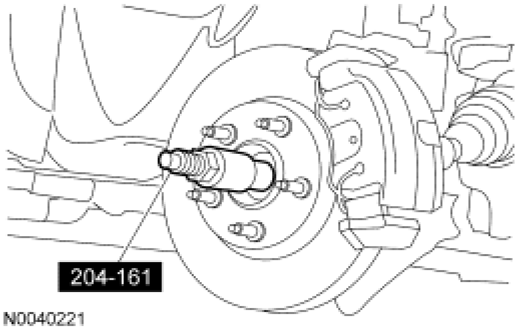


Fig. 12: Identifying Special Tool 204-161
Courtesy of FORD MOTOR CO.

CAUTION: Do not tighten the wheel hub nut with the vehicle on the ground. The nut must be tightened to specification before the vehicle is lowered onto the wheels. Wheel bearing damage will occur if the wheel bearing is loaded with the weight of the vehicle applied.

8. Install a new wheel hub nut.
   - While applying the brakes to prevent the wheel hub nut from turning, tighten the nut to 255 Nm

(189 lb-ft).

9. Connect the parking brake cable to the brake caliper in the following sequence.
    1. Install the clip.
    2. Connect the parking brake cable to the brake caliper.
10. If equipped, install the wheel speed sensor and the bolt.
    - Tighten to 23 Nm (17 lb-ft).

CAUTION: Before tightening any suspension bushing fasteners, the suspension must be at the bushing fastener tightening position. Use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to 395 mm (15.55 in). This will prevent unequal clamp load and bushing damage.

11. Using the positioned suitable jack, raise the lower arm to bushing fastener tightening position.

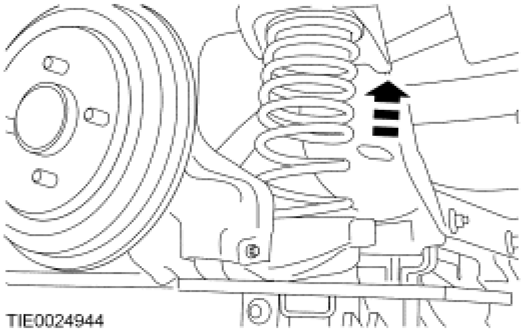


Fig. 13: Raising Rear Lower Arm
Courtesy of FORD MOTOR CO.

12. Tighten the 4 trailing arm-to-knuckle nuts to 90 Nm (66 lb-ft).
13. Tighten the lower arm outboard nut to 103 Nm (76 lb-ft).
14. Tighten the upper arm outboard bolt to 110 Nm (81 lb-ft).
15. Tighten the shock absorber lower bolt.
    - Tighten to 90 Nm (66 lb-ft), all wheel drive (AWD) vehicles.
    - Tighten to 115 Nm (85 lb-ft), front wheel drive (FWD) vehicles.
16. Lower and remove the jack.

WHEEL SPINDLE

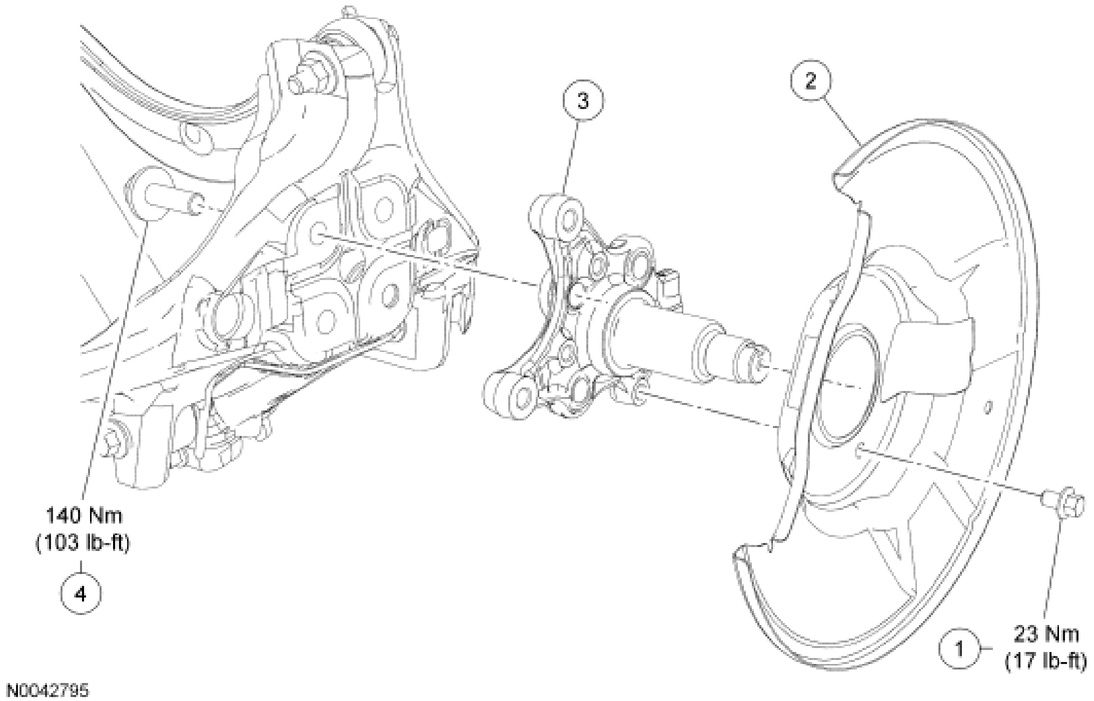


Fig. 14: Exploded View Of Wheel Spindle With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500020	Brake disc shield bolt (3 required)
2	2K046 LH/ 2K045 RH	Brake disc shield
3	4A013	Wheel spindle
4	W500547	Wheel spindle bolt (4 required)

REMOVAL AND INSTALLATION

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the wheel bearing and wheel hub assembly. For additional information, refer to **Wheel Bearing and Wheel Hub**.
2. Remove the 3 brake disc shield bolts and remove the brake disc shield.
    - To install, tighten to 23 Nm (17 lb-ft).
3. Remove the 4 wheel spindle bolts and remove the wheel spindle.
    - To install, tighten to 140 Nm (103 lb-ft).

4. To install, reverse the removal procedure.

LOWER ARM

NOTE: Front wheel drive (FWD) shown, all wheel drive (AWD) similar.

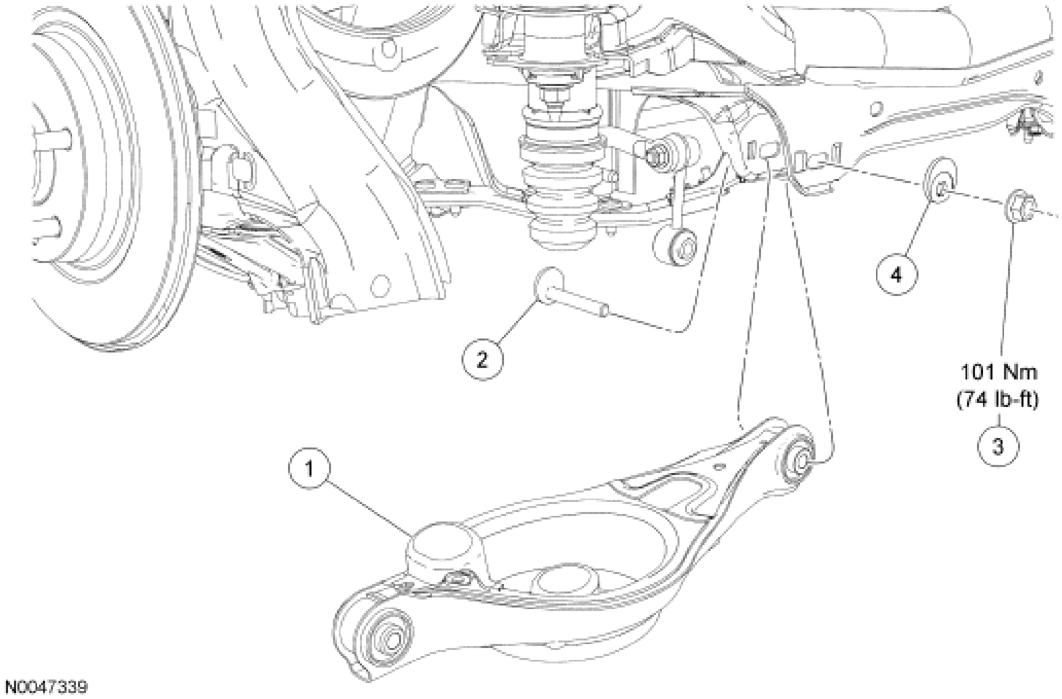


Fig. 15: Exploded View Of Lower Arm With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5A649	Lower arm
2	5K751	Cam bolt
3	W520515	Cam adjuster nut
4	6269	Cam adjuster

REMOVAL AND INSTALLATION

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the spring. For additional information, refer to **Spring**.
2. Remove the cam adjuster nut, cam adjuster, cam bolt and the lower arm.
   - Discard the nut.
   - To install, tighten to 101 Nm (74 lb-ft) with the suspension at the bushing fastener tightening position.

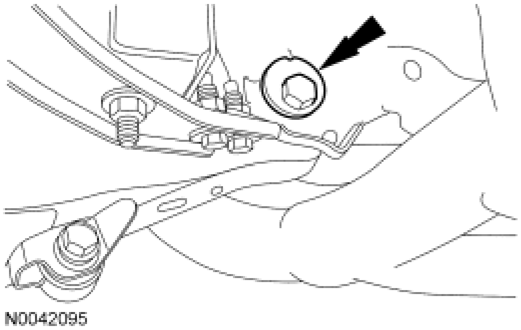


Fig. 16: Locating Cam Adjuster Nut
Courtesy of FORD MOTOR CO.

CAUTION: Before tightening any suspension bushing fasteners, the suspension must be at the bushing fastener tightening position. Use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to 395 mm (15.55 in). This will prevent incorrect clamp load and bushing damage.

NOTE: Do not fully tighten the cam adjuster nut until the rear alignment has been checked and, if necessary, adjusted.

NOTE: Install the cam bolt and the cam adjuster with the cam facing upward.

3. To install, reverse the removal procedure.

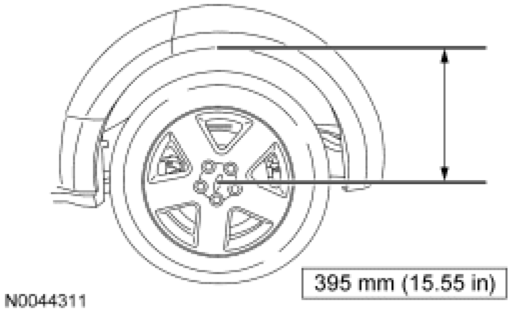


Fig. 17: Identifying Distance Between Center Of Hub And Lip Of Fender
Courtesy of FORD MOTOR CO.

UPPER ARM

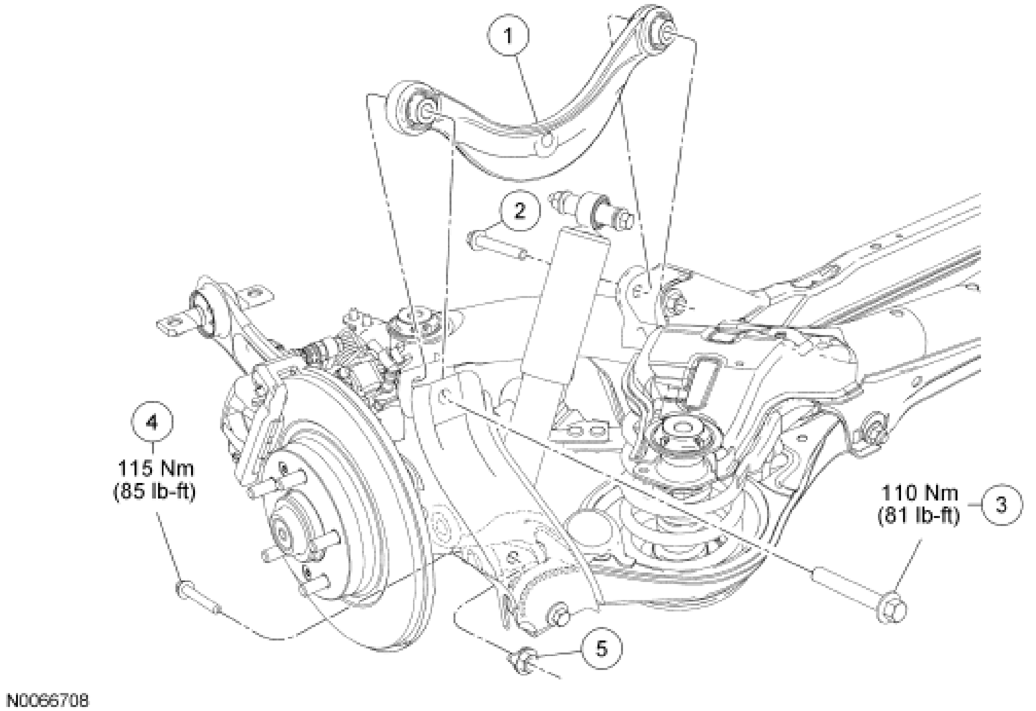


Fig. 18: Exploded View Of Upper Arm With Torque Specifications - Front Wheel Drive (FWD) Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5500	Upper arm
2	W712769	Upper arm inboard bolt
3	W500546	Upper arm outboard bolt
4	W704586	Shock absorber lower bolt
5	W302116	Shock absorber lower flag nut

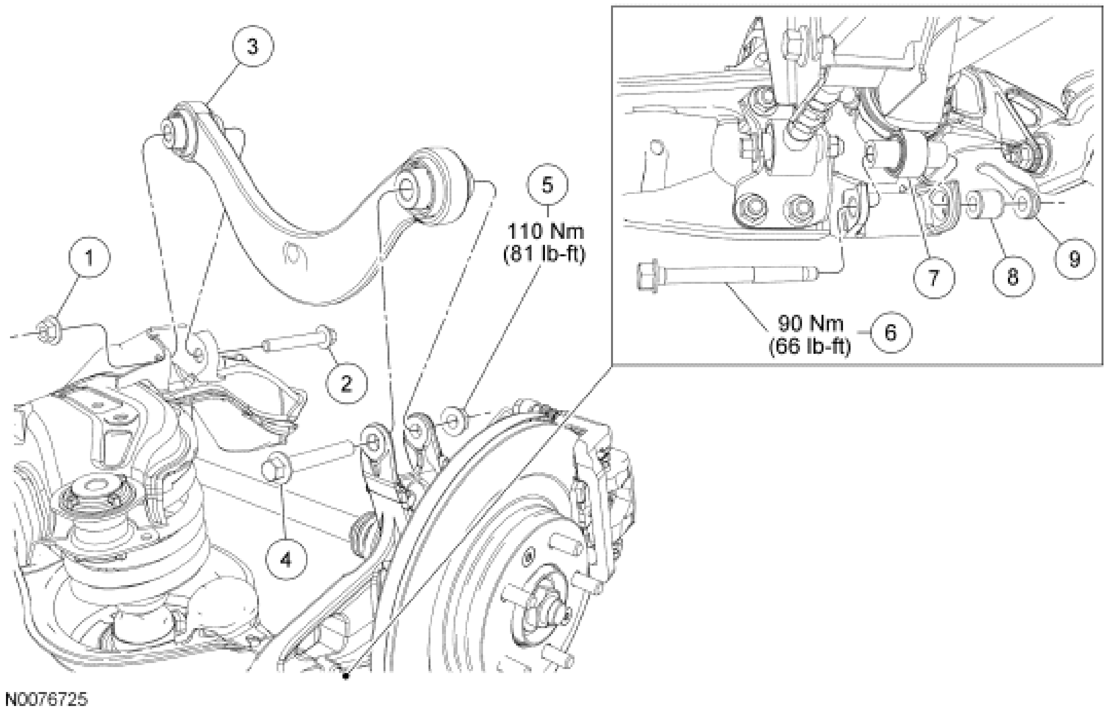


Fig. 19: Exploded View Of Upper Arm With Torque Specifications - All Wheel Drive (AWD) Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W520215	Upper arm inboard nut
2	W712769	Upper arm inboard bolt
3	5500	Upper arm
4	W500547	Upper arm outboard bolt
5	W520215	Upper arm outboard nut
6	W712880	Shock absorber lower bolt
7	18080	Shock absorber
8	-	Shock absorber lower mount bushing
9	W302116	Shock absorber lower flag nut

REMOVAL AND INSTALLATION

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

All vehicles

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
2. Using a suitable jack, support the trailing arm.

CAUTION: Do not fully tighten the shock absorber lower nut until the suspension is at the bushing fastener tightening position. This will prevent incorrect clamp load and bushing damage.

3. Remove and discard the shock absorber lower bolt and flag nut.
   - To install, tighten to 90 Nm (66 lb-ft), all wheel drive (AWD) vehicles.
   - To install, tighten to 115 Nm (85 lb-ft), front wheel drive (FWD) vehicles.

Front wheel drive (FWD) vehicles

4. Remove and discard the upper arm outboard bolt.
   - To install, tighten the bolt to 110 Nm (81 lb-ft) with the suspension at the bushing fastener tightening position.

All wheel drive (AWD) vehicles

5. Remove and discard the upper arm outboard bolt and nut.
   - To install, tighten the nut to 110 Nm (81 lb-ft) with the suspension at the bushing fastener tightening position.

All vehicles

6. Carefully lower the trailing arm and remove the jack.

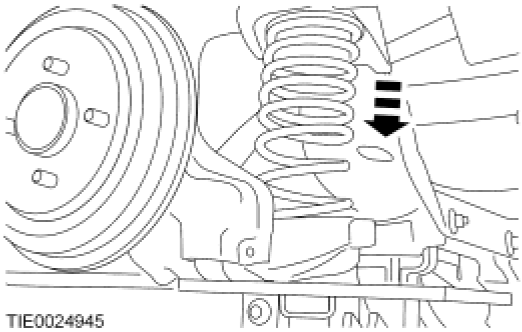


Fig. 20: Lowering Rear Lower Arm
Courtesy of FORD MOTOR CO.

NOTE: Position the shock absorber as necessary to remove the upper arm.

NOTE: When tightening the upper arm inboard bolt the suspension must be at the bushing fastener tightening position.

7. Remove and discard the upper arm inboard bolt and remove the upper arm.
   - To install, tighten the bolt to 100 Nm (74 lb-ft) and then rotate an additional 90 degrees.

CAUTION: Before tightening any suspension bushing fasteners, the suspension must be at the bushing fastener tightening position. Use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to 395 mm (15.55 in). This will prevent incorrect clamp load and bushing damage.

8. To install, reverse the removal procedure.

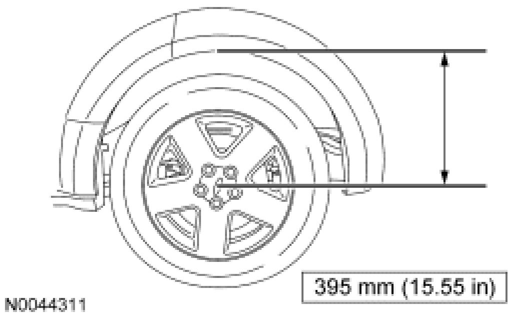


Fig. 21: Identifying Distance Between Center Of Hub And Lip Of Fender
Courtesy of FORD MOTOR CO.

9. Check and, if necessary, adjust the rear camber. For additional information, refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

TOE LINK

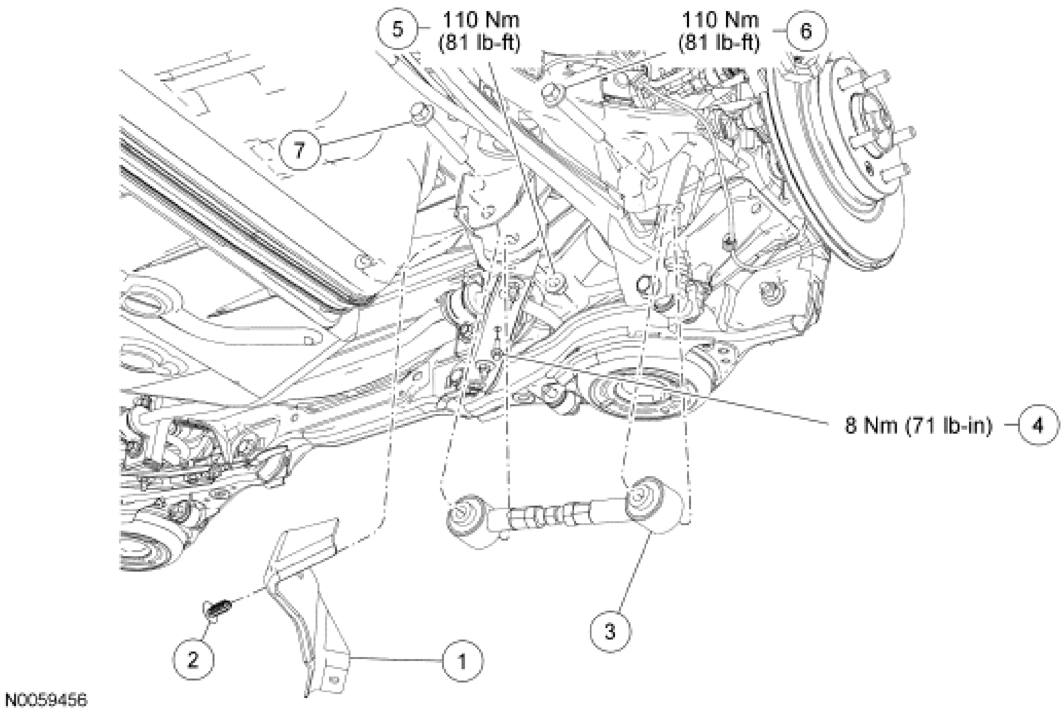


Fig. 22: Exploded View Of Toe Link With Torque Specifications - Front Wheel Drive (FWD) Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5G095	Toe link shield
2	W709453	Push pin
3	5B674	Toe link
4	W500214	Toe link shield bolt
5	W520515	Toe link inboard nut
6	W500547	Toe link outboard bolt
7	W500547	Toe link inboard bolt

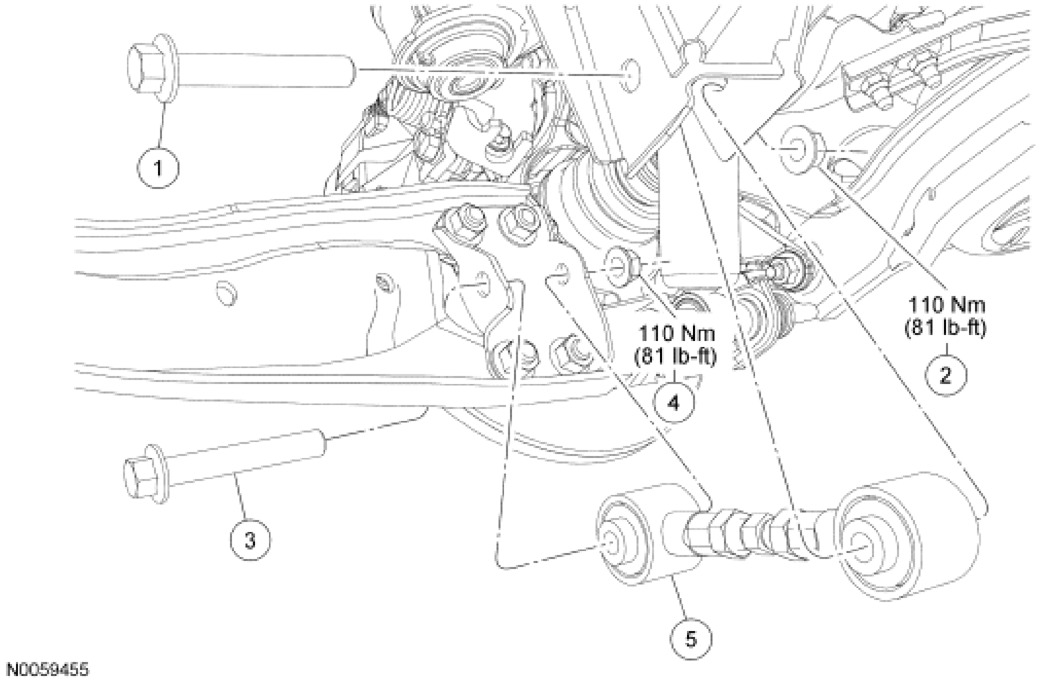


Fig. 23: Exploded View Of Toe Link With Torque Specifications - All Wheel Drive (AWD) Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500547	Toe link inboard bolt
2	W520515	Toe link inboard nut
3	W500547	Toe link outboard bolt
4	W520515	Toe link outboard nut
5	5B674	Toe link

REMOVAL AND INSTALLATION

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

All vehicles

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

Front wheel drive (FWD) vehicles

2. Remove the toe link shield bolt.
    - To install, tighten to 8 Nm (71 lb-in).
3. Remove the push pin and the shield.

    All vehicles

4. Remove and discard the toe link inboard nut and bolt.
    - To install, tighten the nut to 110 Nm (81 lb-ft) with the suspension at the bushing fastener tightening position.
5. Remove and discard the toe link outboard bolt and remove the toe link.
    - To install, tighten to 110 Nm (81 lb-ft) with the suspension at the bushing fastener tightening position.

    CAUTION: Before tightening any suspension bushing fasteners, the suspension must be at the bushing fastener tightening position. Use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to 395 mm (15.55 in). This will prevent incorrect clamp load and bushing damage.

6. To install, reverse the removal procedure.

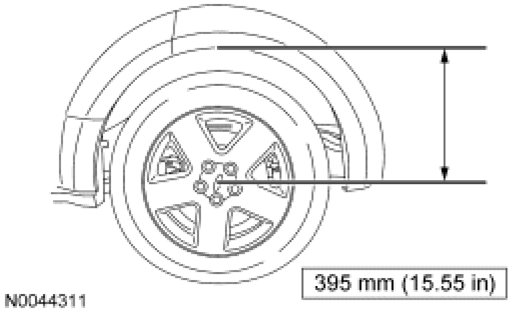


Fig. 24: Identifying Distance Between Center Of Hub And Lip Of Fender
Courtesy of FORD MOTOR CO.

7. Check and, if necessary, adjust the rear toe. For additional information, refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

TRAILING ARM

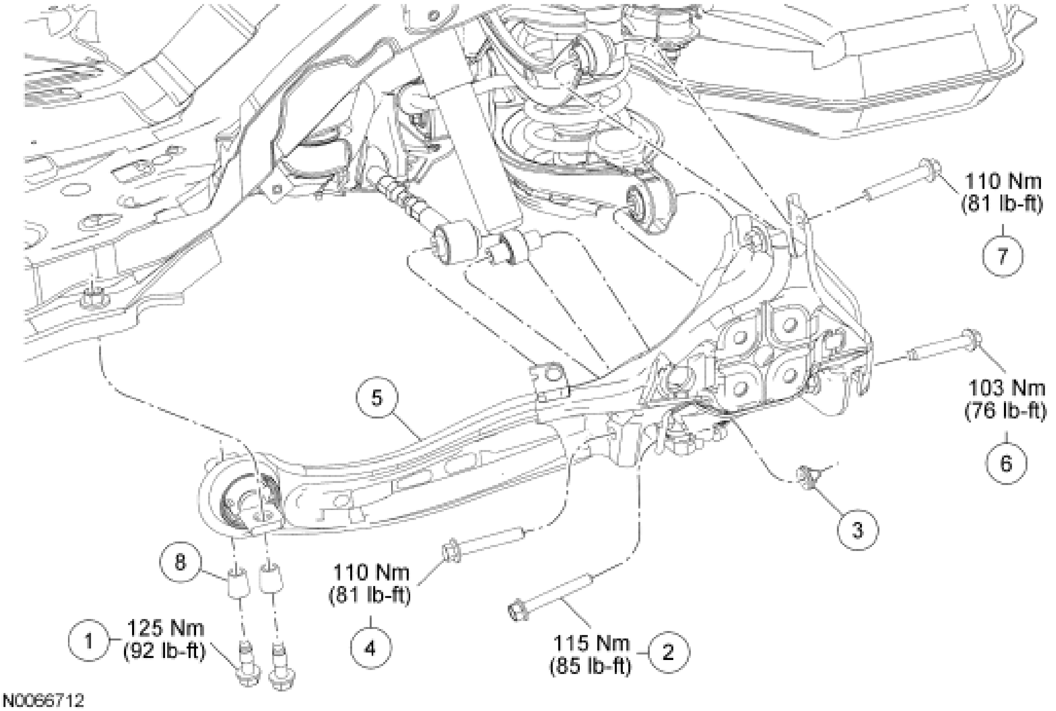


Fig. 25: Exploded View Of Trailing Arm With Torque Specifications - Front Wheel Drive (FWD) Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711493	Trailing arm-to-frame bolt (2 required)
2	W704586	Shock absorber lower bolt
3	W302116	Shock absorber lower flag nut
4	W500546	Toe link outboard bolt
5	5A995 LH/ 5A994 RH	Trailing arm
6	W513798	Lower arm outboard bolt
7	W500546	Upper arm outboard bolt
8	6C028	Cone washer (2 required)

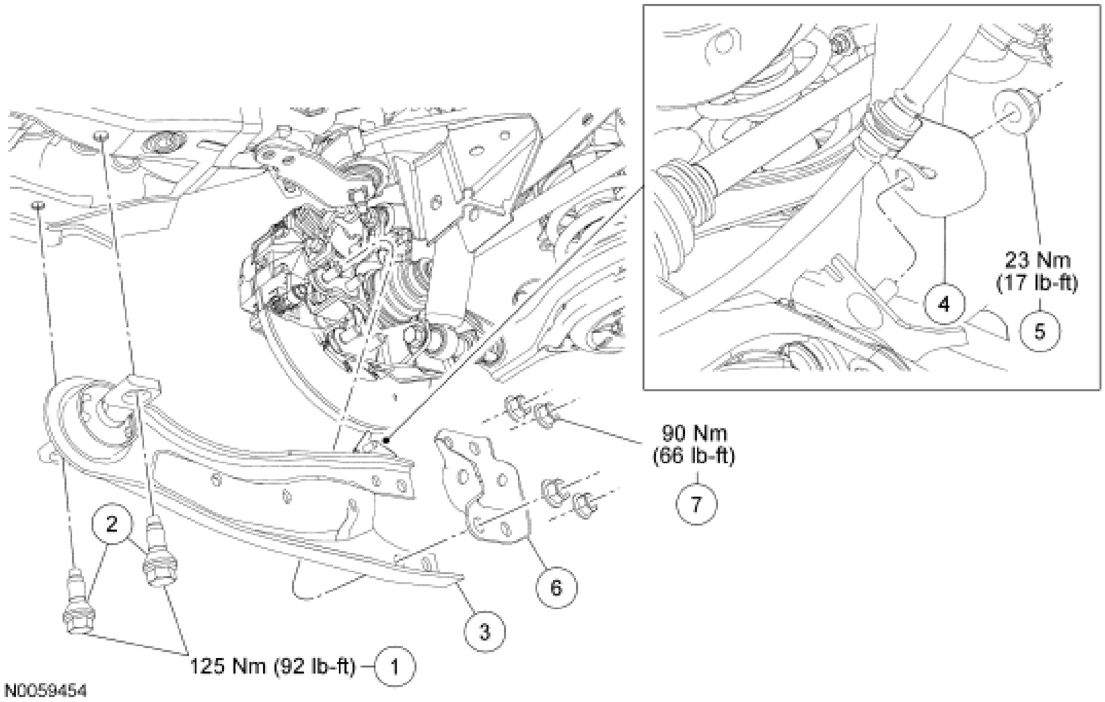


Fig. 26: Exploded View Of Trailing Arm With Torque Specifications - All Wheel Drive (AWD) Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W711493	Trailing arm-to-frame bolts (2 required)
2	6C028	Cone washers (2 required)
3	5A995 LH/ 5A994 RH	Trailing arm
4	-	Wheel speed sensor bracket (part of 2C186 RH/2C187 LH)
5	W520102	Wheel speed sensor bracket nut
6	5A757	Trailing arm toe link bracket
7	5B860	Trailing arm-to-knuckle nut (4 required)

REMOVAL AND INSTALLATION

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

All wheel drive (AWD) vehicles

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

   All vehicles

2. Remove the parking brake cable bracket bolt and position the parking brake cable aside.
   - To install, tighten to 10 Nm (89 lb-in).

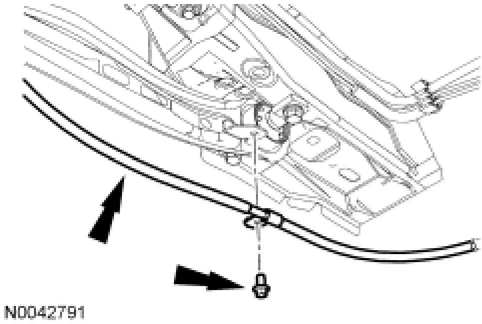


Fig. 27: Locating Parking Brake Cable Bracket Bolt
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

3. Remove the wheel spindle. For additional information, refer to **Wheel Spindle**.
4. If equipped, detach the wheel speed sensor harness from the trailing arm.

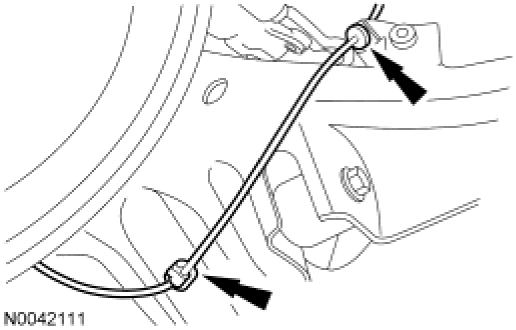


Fig. 28: Locating Wheel Speed Sensor Harness From Trailing Arm
Courtesy of FORD MOTOR CO.

5. Using a suitable jack, support the trailing arm.

> WARNING: **The coil spring is under extreme load. Care must be taken at all times when removing or installing a loaded spring. Failure to follow this instruction may result in serious personal injury.**

6. Remove and discard the lower arm outboard bolt.
   - To install, tighten to 103 Nm (76 lb-ft) with the suspension at the bushing fastener tightening

position.

7. Remove and discard the upper arm outboard bolt.
    - To install, tighten to 110 Nm (81 lb-ft) with the suspension at the bushing fastener tightening position.
8. Carefully lower the trailing arm and remove the jack.
9. Remove and discard the shock absorber lower bolt and flag nut.
    - To install, tighten to 115 Nm (85 lb-ft) with the suspension at the bushing fastener tightening position.
10. Remove and discard the toe link outboard bolt.
    - To install, tighten to 110 Nm (81 lb-ft) with the suspension at the bushing fastener tightening position.

AWD vehicles

11. Remove the wheel speed sensor harness bracket nut and position aside the bracket.
    - To install, tighten to 23 Nm (17 lb-ft).
12. Remove the toe link. For additional information, refer to **Toe Link**.
13. Remove the 4 trailing arm-to knuckle nuts and the trailing arm toe link bracket.
    - Discard the nuts.
    - To install, tighten to 90 Nm (66 lb-ft).

All vehicles

14. Remove the 2 trailing arm-to-frame bolts, cone washers and the trailing arm.
    - Discard the nuts.
    - To install, tighten the bolts to 125 Nm (92 lb-ft).

CAUTION: Before tightening any suspension bushing fasteners, the suspension must be at the bushing fastener tightening position. Use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to 395 mm (15.55 in). This will prevent incorrect clamp load and bushing damage.

15. To install, reverse the removal procedure.

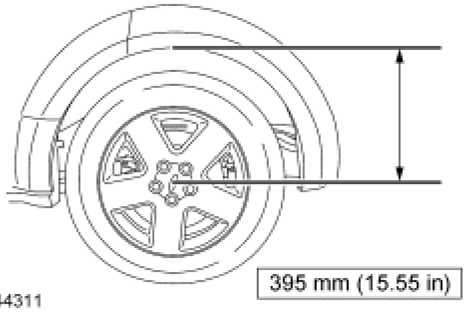


Fig. 29: Identifying Distance Between Center Of Hub And Lip Of Fender
Courtesy of FORD MOTOR CO.

16. Check and, if necessary, align the rear end. For additional information, refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

STABILIZER BAR AND LINK

NOTE: Front wheel drive (FWD) shown, all wheel drive (AWD) similar.

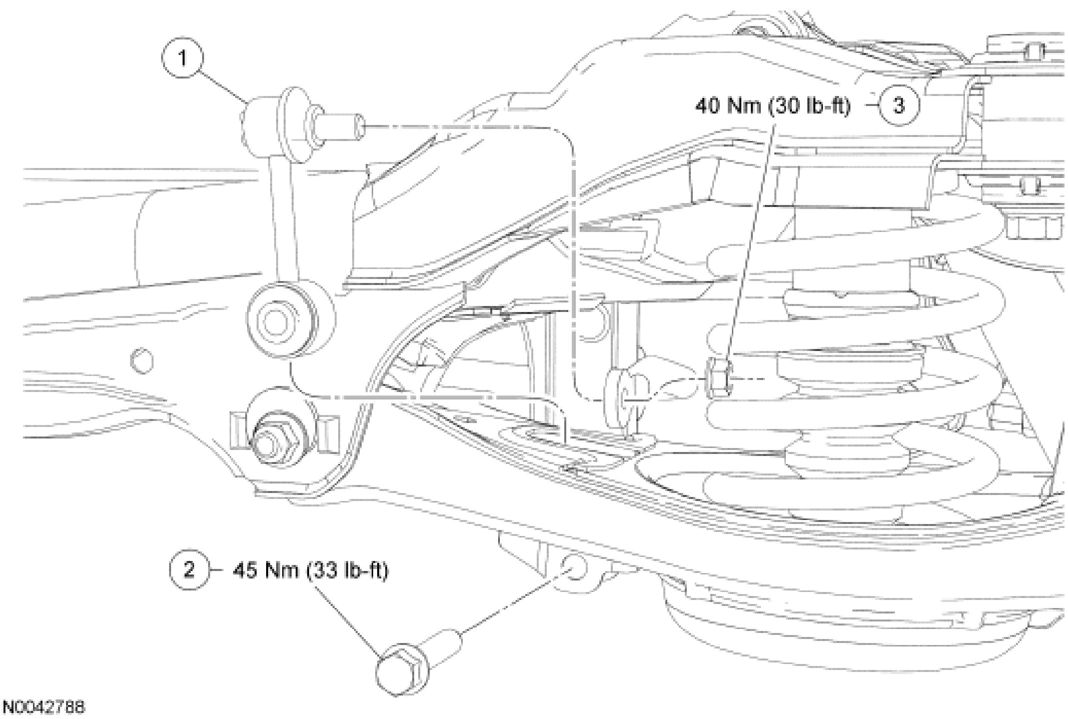


Fig. 30: Exploded View Of Stabilizer Bar & Link With Torque Specifications (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5A486	Stabilizer bar link
2	W302134	Stabilizer bar link lower bolt

3	W302118	Stabilizer bar link upper nut

NOTE: **FWD shown, AWD similar.**

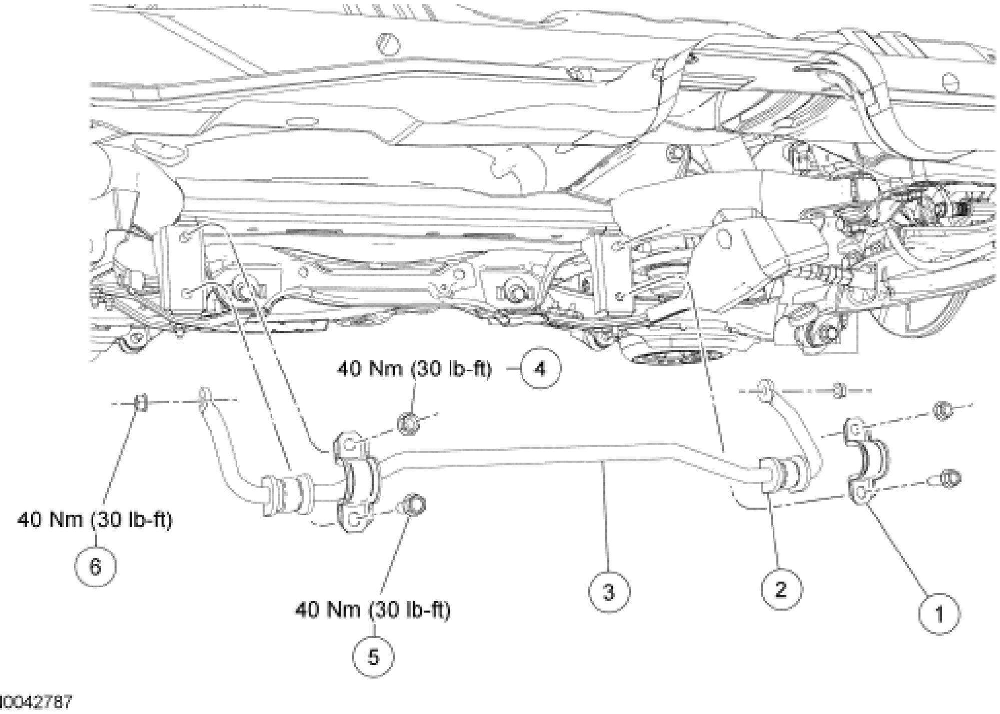


Fig. 31: Exploded View Of Stabilizer Bar & Link With Torque Specifications (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5B498	Stabilizer bar bracket (2 required)
2	5493	Stabilizer bar bushing (2 required)
3	5A772	Stabilizer bar
4	W302118	Stabilizer bar bracket nut (2 required)
5	W302131	Stabilizer bar bracket bolt (2 required)
6	W302118	Stabilizer bar link upper nut (2 required)

REMOVAL AND INSTALLATION

CAUTION: **Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.**

All wheel drive (AWD) vehicles

1. Remove the rear halfshafts. For additional information, refer to **REAR DRIVE HALFSHAFTS** article
2. Remove the RH side spring.

   Front wheel drive (FWD) vehicles

3. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

   All vehicles

4. Remove the 2 stabilizer bar link upper nuts.
   - Discard the nuts.
   - To install, tighten to 40 Nm (30 lb-ft).
5. Remove the 2 stabilizer bar link lower bolts and the stabilizer bar links.
   - Discard the bolts.
   - To install, tighten to 45 Nm (33 lb-ft) with the suspension at the bushing fastener tightening position.
6. Remove the stabilizer bar bracket nuts.
   - Discard the nuts.
   - To install, tighten to 40 Nm (30 lb-ft) with the suspension at the bushing fastener tightening position.
7. Remove the stabilizer bar bracket bolts and the brackets.
   - Discard the bolts.
   - To install, tighten to 40 Nm (30 lb-ft) with the suspension at the bushing fastener tightening position.

   FWD vehicles

8. Remove the stabilizer bar.

   AWD vehicles

   CAUTION: Be careful not to contact the fuel lines or wiring harness when removing and installing the stabilizer bar or damage to the wiring harness or fuel lines may occur.

9. Remove the stabilizer bar from the RH side of the vehicle.

   All vehicles

10. Inspect the stabilizer bar bushings and install a new bushing(s) if necessary.

CAUTION: Before tightening any suspension bushing fasteners, the suspension must be at the bushing fastener tightening position. This will prevent incorrect clamp load and bushing damage.

11. To install, reverse the removal procedure.

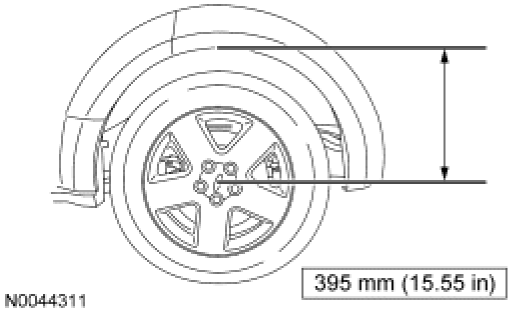


Fig. 32: Identifying Distance Between Center Of Hub And Lip Of Fender
Courtesy of FORD MOTOR CO.

SPRING

NOTE: Front wheel drive (FWD) shown, all wheel drive (AWD) similar.

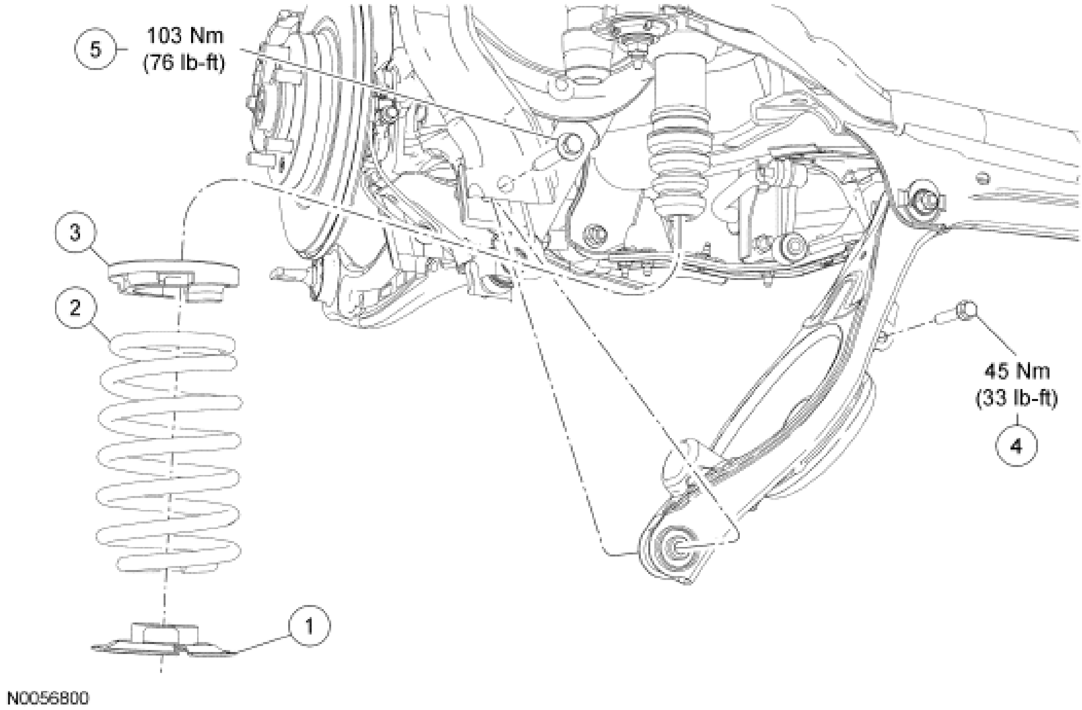


Fig. 33: Exploded View Of Spring With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5536A	Spring lower seat
2	5560	Spring
3	5536B	Spring upper seat
4	W302134	Stabilizer bar link lower bolt
5	W302125	Lower arm outboard bolt

REMOVAL

CAUTION: The coil spring is coated with long-term corrosion protective paint. Do not damage the paint during component servicing or spring damage may occur.

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

NOTE: Do not fully tighten the cam adjuster nut until the rear alignment has been checked and, if necessary, adjusted.

2. Index-mark the cam bolt and cam adjuster and then loosen the cam adjuster nut.

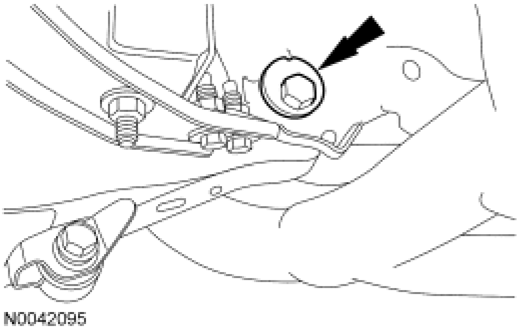


Fig. 34: Locating Cam Adjuster Nut
Courtesy of FORD MOTOR CO.

3. Remove the stabilizer bar link lower bolt.
4. Using a suitable jack, support the lower arm.

WARNING: The coil spring is under extreme load. Care must be taken at all

times when removing or installing a loaded spring. Failure to follow this instruction may result in serious personal injury.

5. Remove the lower arm outboard bolt.
6. Lower the lower arm and remove the spring.
   - Inspect the spring upper and lower seats, install new seats as necessary.

INSTALLATION

1. Position the spring upper seat onto the spring with the end of the spring 0-10 mm (0-0.39 in) from the step on the seat.

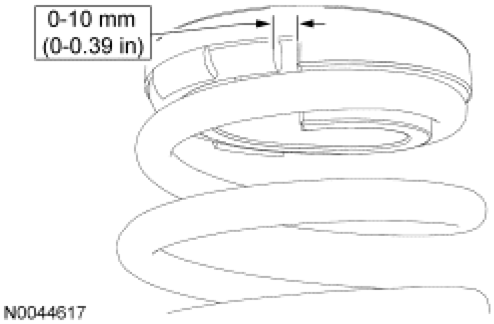


Fig. 35: Positioning Spring Upper Seat Onto Spring
Courtesy of FORD MOTOR CO.

2. If removed, position the spring lower seat into the lower arm aligning the recess in the seat with the projection on the lower arm.

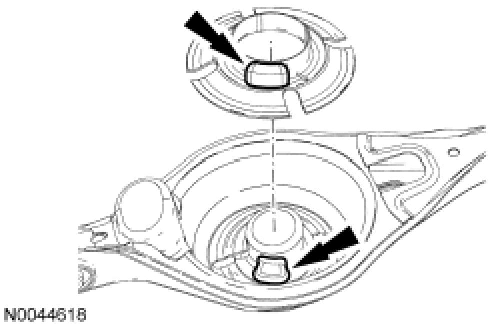


Fig. 36: Locating Spring Lower Seat Into Lower Arm
Courtesy of FORD MOTOR CO.

3. Position the spring onto the lower arm with the end of the spring 0-10 mm (0-0.39 in) from the step on the spring seat.

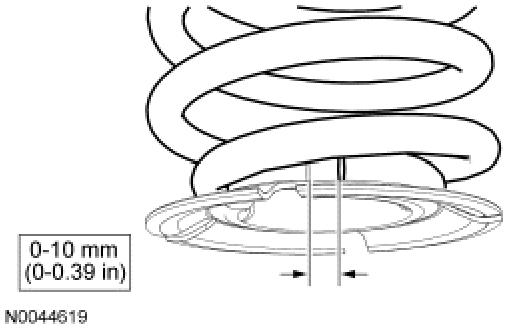


Fig. 37: Positioning Spring Onto Lower Arm With End Of Spring
Courtesy of FORD MOTOR CO.

NOTE: **Do not tighten the bolt at this time.**

4. Using the jack, raise the lower arm and install the lower arm outboard bolt.

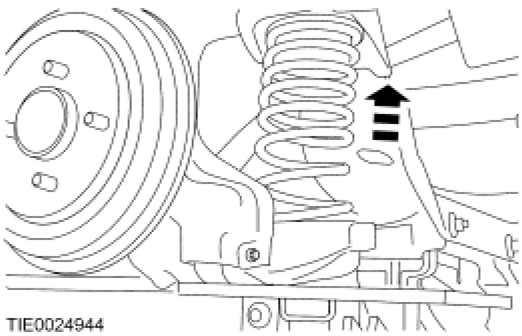


Fig. 38: Raising Rear Lower Arm
Courtesy of FORD MOTOR CO.

CAUTION: **Before tightening any suspension bushing fasteners, the suspension must be at the bushing fastener tightening position. This will prevent incorrect clamp load and bushing damage.**

5. Using the jack, raise the suspension until the distance between the center of the hub and the lip of the fender is equal to 395 mm (15.55 in).

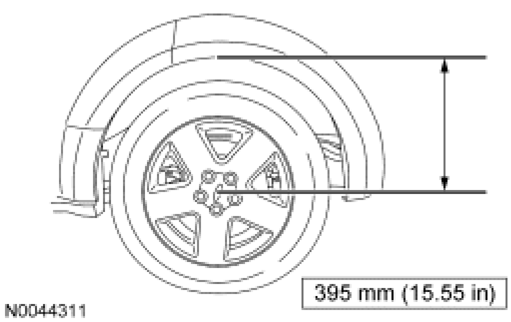


Fig. 39: Identifying Distance Between Center Of Hub And Lip Of Fender
Courtesy of FORD MOTOR CO.

6. Tighten the lower arm outboard bolt to 103 Nm (76 lb-ft).
7. Install the stabilizer bar link lower bolt.
    - Tighten to 45 Nm (33 lb-ft).
8. Align the index mark on the cam bolt and cam adjuster with the index mark on the lower arm and tighten the cam adjuster nut to 101 Nm (74 lb-ft).
9. Check and, if necessary, align the rear end. For additional information, refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

SHOCK ABSORBER

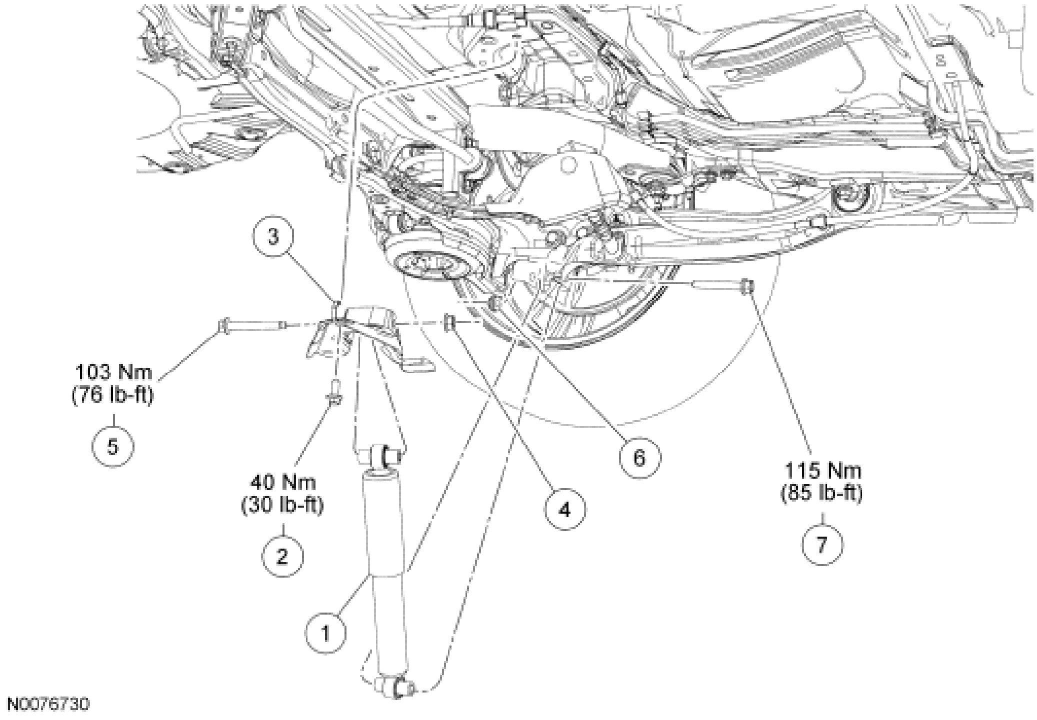


Fig. 40: Exploded View Of Shock Absorber With Torque Specifications - Front Wheel Drive (FWD) Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	18125	Shock absorber
2	W302277	Bracket bolt (3 required)
3	18165 LH/ 18164 RH	Shock absorber bracket
4	W520515	Shock absorber upper nut
5	W500748	Shock absorber upper bolt
6	W302116	Shock absorber lower flag nut

7	W704586	Shock absorber lower bolt

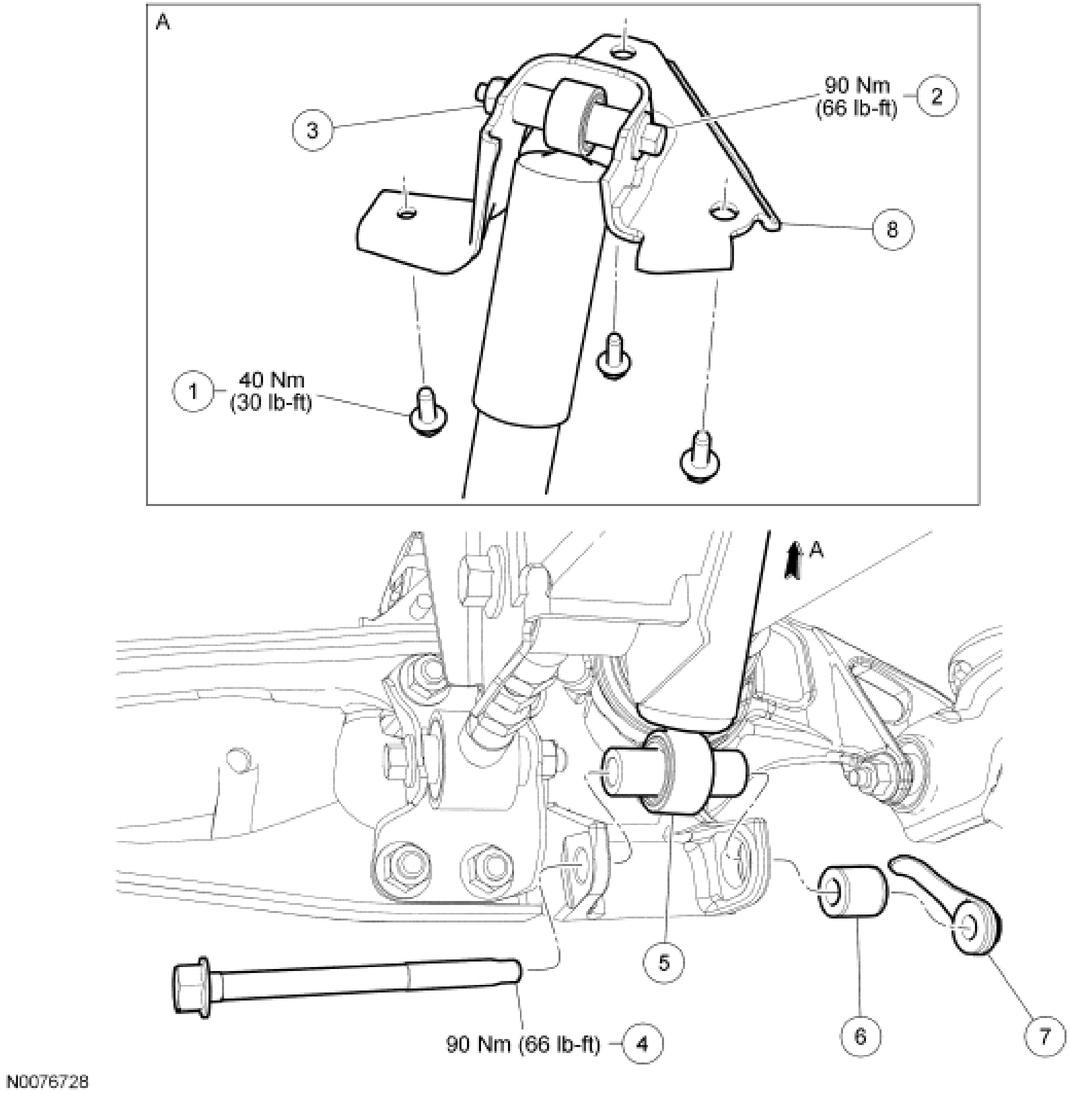


Fig. 41: Exploded View Of Shock Absorber With Torque Specifications - All Wheel Drive (AWD) MKZ Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W302277	Bracket bolt (3 required)
2	W500748	Shock absorber upper bolt
3	W520515	Shock absorber upper nut
4	W704586	Shock absorber lower bolt
5	18125	Shock absorber
6	18199	Shock absorber lower mount bushing
7	W302117	Shock absorber lower flag nut

8	18165 LH/ 18164 RH	Shock absorber bracket

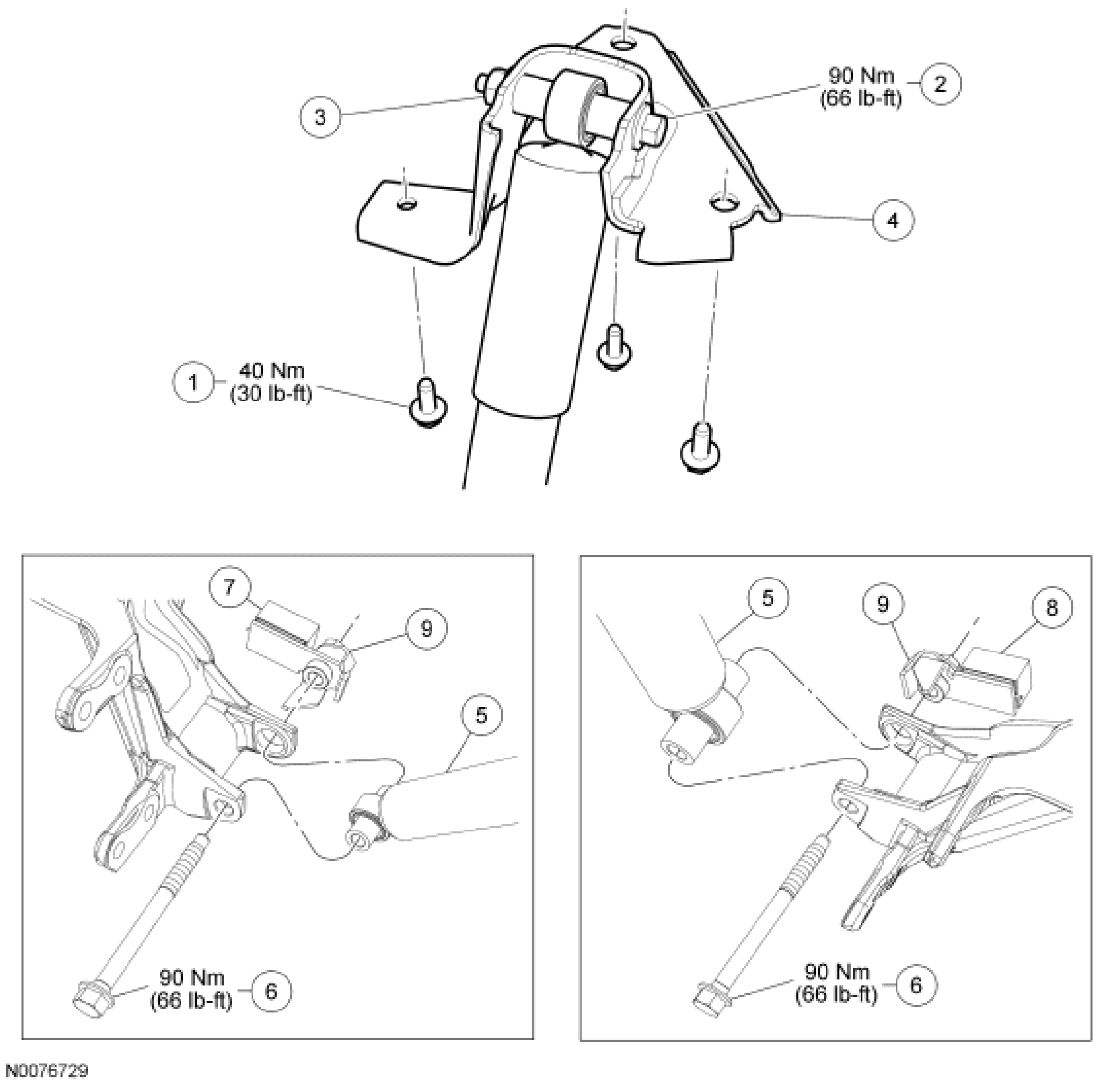


Fig. 42: Exploded View Of Shock Absorber With Torque Specifications - All Wheel Drive (AWD) Fusion/Milan Vehicles
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W302277	Bracket bolt (3 required)
2	W500748	Shock absorber upper bolt
3	W520515	Shock absorber upper nut
4	18165 LH/ 18164 RH	Shock absorber upper bracket
5	18125	Shock absorber
6	W712880	Shock absorber lower bolt
7	5B695	Shock absorber damper LH side

8	5B695	Shock absorber damper LH side
9	W712848	Shock absorber lower flag nut (with 17 in wheel)
9	W302117	Shock absorber lower flag nut (with 16 in wheel)

REMOVAL

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent part, if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

NOTE: The new shock absorber is shipped with a strap securing it in the compressed position. Do not remove this strap until the shock absorber and bracket assembly are in position and the 3 bracket bolts have been installed.

1. Remove the upper arm. For additional information, refer to **Upper Arm**.
2. Compress the shock absorber and secure it in the compressed position using tie straps or a similar item.
3. Remove the 3 shock absorber bracket bolts and remove the shock absorber and upper bracket.
   - Discard the bolts.
4. Index-mark the shock absorber to the bracket.
5. Remove the shock absorber upper bolt, nut and the bracket.

INSTALLATION

1. Copy the index mark from the shock absorber that was removed to the shock absorber that is being installed.

   NOTE: Do not fully tighten the shock absorber upper bolt and nut at this time.

2. Position the shock absorber into the bracket and loosely install a new shock absorber upper bolt and nut.

   CAUTION: Do not allow the angle between the shock absorber and bracket to change while tightening the shock absorber upper nut or damage to the shock absorber may occur.

3. Align the index marks so the center line of the shock absorber is approximately 118 degrees from the alignment tab on the bracket and tighten the shock absorber upper nut.
   - Tighten to 90 Nm (66 lb-ft), all wheel drive (AWD) vehicles.
   - Tighten to 103 Nm (76 lb-ft), front wheel drive (FWD) vehicles.

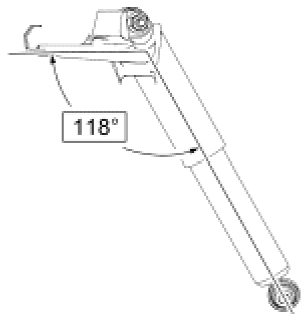


Fig. 43: Identifying Center Line Of Shock Absorber Angle
Courtesy of FORD MOTOR CO.

4. Position the shock absorber and bracket assembly and install the 3 bracket bolts.
   - Tighten to 40 Nm (30 lb-ft).
5. Install the upper arm. For additional information, refer to **Upper Arm**.

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Rear View Mirrors - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-in
Exterior mirror mounting nuts	8	71

DESCRIPTION AND OPERATION

REAR VIEW MIRRORS

The main components of the rear view mirrors are:

- Exterior mirror control switch
- Exterior mirror cover
- Exterior mirror glass
- Exterior mirror glass adjustment motors
- Exterior mirror plastic housing
- Heated exterior mirror glass (optional)
- Interior auto-dimming rear view mirror
- LH exterior auto-dimming mirror glass (optional)
- Memory exterior mirrors (optional)
- Puddle lamps (optional)

For information on the puddles lamps, refer to **EXTERIOR LIGHTING** article.

Power Exterior Mirrors - Power mirrors allow the driver or passenger mirror glass to be positioned electronically. The position of the power mirror glass is controlled by the exterior rear view mirror control switch. Adjusting the exterior rear view mirror control switch to the LH or RH position determines which power mirror glass will be controlled.

Heated Exterior Mirrors - The power exterior rear view mirrors are available with a heated mirror glass feature, which heats the mirror glass to remove frost, snow, ice and condensation. The rear window defrost switch controls the operation of the heated exterior rear view mirrors. The heated exterior rear view mirrors only operate when the rear window defrost system is on.

Memory Exterior Mirrors - The memory mirror function recalls the preferred positioning of the LH and RH exterior mirror glass. The preferred positioning of the LH exterior mirror glass is retained in the driver door module (DDM) memory, while the preferred positioning of the RH exterior mirror glass is retained in the driver

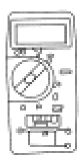
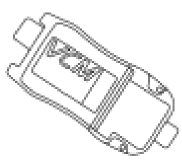
seat module (DSM) memory. The memory mirror function is activated by the door mounted switches or the remote keyless entry (RKE) transmitter. When a memory position is recalled by the operator, the LH and RH exterior mirror glass will automatically adjust to the preferred position. The DDM and DSM are capable of setting a DTC for the memory mirror system when a system concern exists. For information on the DDM, refer to **MULTIFUNCTION ELECTRONIC MODULES** article. For information on the DSM and Memory Position Programming, refer to **SEATING** article.

Auto-Dimming Rear View Mirror(s) - The interior rear view and LH exterior mirror may be equipped with an auto-dimming feature. This feature automatically reduces the glare caused by headlamps reflecting in the mirror. The auto-dimming feature is activated when the ignition is in the RUN or ACC position. The interior rear view mirror adjusts the reflectance level of the interior rear view mirror and LH exterior mirror to eliminate unwanted glare. The reflectance level of the mirror glass is variable and depends on the amount of rear glare in relation to ambient light conditions in front of the interior rear view mirror. To provide increased visibility when backing up, the interior rear view mirror will automatically return to a high reflectance mode whenever the vehicle is in REVERSE.

DIAGNOSTIC TESTS

REAR VIEW MIRRORS

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operation

The LH and RH exterior mirror motors are controlled by the exterior rear view mirror control switch. Adjusting the exterior control switch to the LH or RH position determines which exterior mirror motor will be controlled. Power is supplied to the exterior mirror switch from the smart junction box (SJB). Only vehicles equipped with memory exterior rear view mirrors are capable of setting DTCs. The exterior mirrors use a jumper harness between the vehicle wire harness connector and the exterior mirror motor. The exterior mirror jumper harness is integral to the exterior mirror. If a concern with the exterior mirror jumper harness exists and cannot be repaired, a new exterior mirror must be installed.

Heated Exterior Mirror

The rear window defrost switch controls the operation of the heated exterior mirror glass. The heated exterior

mirror glass only operates when the rear window defrost system is ON. The heated exterior mirror glass power is supplied by the rear window defrost relay through SJB fuse 9 (10A), which isolates the heated exterior mirror system from the rear window defrost system in the event of a concern.

Memory Exterior Mirror

The memory mirror function recalls the preferred positioning of the exterior mirror motors when the transmission is in the PARK or NEUTRAL position and the door mounted switches or the remote keyless entry (RKE) transmitter are activated.

Each exterior mirror motor is equipped with a potentiometer, which the driver door module (DDM) and driver seat module (DSM) use to monitor the position of the mirrors. The DDM constantly tracks LH mirror motor position. The DSM constantly tracks RH mirror motor position. When a mirror motor position is stored in memory by the operator, the module will retain this position in memory for future recall. The position of the mirror motors are stored within the DDM and DSM memory as long as the modules retain power. When a memory position is recalled by the operator, the DDM and DSM will power the exterior mirror motors simultaneously and monitor the potentiometer circuits. When the stored memory position is reached, the DDM and DSM will remove power from the exterior mirror motors. If the exterior mirror control switch is operated during a memory recall, the DDM and DSM will stop the memory recall and respond to the exterior mirror control switch command.

For information on the DDM, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.

For information on the DSM and Memory Position Programming, refer to **SEATING** article.

Auto-Dimming Mirrors

The interior rear view and LH exterior mirror may be equipped with an auto-dimming feature. This feature automatically reduces the glare caused by headlamps reflecting in the mirror. The auto-dimming feature is disabled when the vehicle is in REVERSE. Power is supplied to the auto-dimming interior mirror when the ignition is in the RUN or ACC position.

The auto-dimming interior rear view mirror has 2 photoelectric sensors that detect forward and rearward light conditions, and based on those inputs, adjusts the reflectance level of the interior rear view mirror and LH exterior mirror to eliminate unwanted glare. The reflectance level of the mirror glass is variable and depends on the amount of rear glare in relation to ambient light conditions in front of the interior mirror.

When the forward sensor detects daytime conditions, the rearward sensor is inactive, and the mirror glass stays in a high reflectance mode. When the forward sensor detects nighttime conditions, the rearward sensor is active and detects glare from the headlights of vehicles approaching from the rear, or other glare producing light sources. To provide increased visibility when backing up, the interior rear view mirror glass and LH exterior mirror glass will automatically return to a high reflectance mode whenever the selector lever is placed in REVERSE.

If the forward or rearward sensors are blocked, the auto-dimming interior rear view mirror and LH exterior mirror might not work correctly.

Puddle Lamps

The exterior mirrors may be equipped with puddle lamps, which will illuminate when the interior lights are turned on by opening a door or by pressing the unlock button on the remote transmitter, if equipped. For information on the mirror-mounted puddle lamps, refer to **EXTERIOR LIGHTING** article.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage:

VISUAL INSPECTION CHART

Mechanical	Electrical
• Exterior mirror • Exterior mirror control switch • Exterior mirror cover • Exterior mirror glass • Interior rear view mirror	• Smart junction box (SJB) fuse(s): ○ 9 (10A) ○ 12 (7.5A) ○ 20 (7.5A) • Circuitry • Driver door module (DDM) • Driver seat module (DSM) • Exterior mirror control switch • Exterior mirror glass • Exterior mirror motor • Exterior mirror • Interior auto-dimming rear view mirror • Loose or corroded connections

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.

- check the scan tool connection to the VCM.
- refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:
    - verify the ignition key is in the ON position.
    - verify the scan tool operation with a known good vehicle.
    - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the DSM.
7. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the DSM.
9. If the DTCs retrieved are related to the concern, go to Driver Door Module (DDM) DTC Chart or Driver Seat Module (DSM) DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart - Rear View Mirrors** or Go to **Symptom Chart - Noise, Vibration and Harshness (NVH)**.

DRIVER DOOR MODULE (DDM) DTC CHART

DTC	Description	Action
B1234	Mirror Switch Invalid Code	Go to **Pinpoint Test D**.
B1667	Mirror Driver Up/Down Motor Stalled	Go to **Pinpoint Test D**.
B1668	Mirror Driver Right/Left Motor Stalled	Go to **Pinpoint Test D**.
B2223	Driver Mirror Drive Circuit Failure	Go to **Pinpoint Test D**.
B2320	Driver Mirror Horizontal Feedback Potentiometer Circuit Failure	Go to **Pinpoint Test D**.
B2322	Driver Mirror Horizontal Feedback Potentiometer Circuit Short to Battery	Go to **Pinpoint Test D**.
B2324	Driver Mirror Vertical Feedback Potentiometer Circuit Failure	Go to **Pinpoint Test D**.
B2326	Driver Mirror Vertical Feedback Potentiometer Circuit Short to Battery	Go to **Pinpoint Test D**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

DRIVER SEAT MODULE (DSM) DTC CHART

DTC	Description	Action
B1669	Mirror Passenger Up/Down Motor Stalled	Go to **Pinpoint Test D**.
B1670	Mirror Passenger Right/Left Motor Stalled	Go to **Pinpoint Test D**.
B2224	Passenger Mirror Drive Circuit Failure	Go to **Pinpoint Test D**.

B2312	Passenger Mirror Horizontal Feedback Potentiometer Circuit Failure	Go to **Pinpoint Test D**.
B2314	Passenger Mirror Horizontal Feedback Potentiometer Circuit Short to Battery	Go to **Pinpoint Test D**.
B2316	Passenger Mirror Vertical Feedback Potentiometer Circuit Failure	Go to **Pinpoint Test D**.
B2318	Passenger Mirror Vertical Feedback Potentiometer Circuit Short to Battery	Go to **Pinpoint Test D**.
All other DTCs	-	REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart - Rear View Mirrors

Symptom Chart - Rear View Mirrors

Condition	Possible Sources	Action
• No communication with the driver door module (DDM)	• Circuitry • DDM communication network	• Go to **MODULE COMMUNICATIONS NETWORK** article.
• The mirrors are inoperative - non-memory mirrors	• Fuse • Circuitry • Exterior mirror control switch	• Go to **Pinpoint Test A**.
• A single mirror is inoperative - non-memory mirrors	• Circuitry • Exterior mirror control switch • Exterior mirror motor • Exterior mirror	• Go to **Pinpoint Test B**.
• A single mirror does not function with switch logic - non-memory mirrors	• Circuitry • Exterior mirror control switch • Exterior mirror motor • Exterior mirror	• Go to **Pinpoint Test C**.
• The memory mirror is inoperative	• Fuse • DDM • Driver seat module (DSM) • Circuitry • Exterior mirror motor • Exterior mirror	• Go to **Pinpoint Test D**.

	• Exterior mirror control switch	
• The heated exterior mirrors is inoperative	• Fuse • Circuitry • Exterior mirror glass • Exterior mirror	• Go to **Pinpoint Test E**.

• The auto-dimming mirror does not operate correctly	• Obstructed rearward-facing sensor:
	  • stickers, window decals, tags
	  • non-OEM window tinting
	• Obstructed forward-facing sensor:
	  • stickers, window decals, tags
	  • non-OEM window tinting
		• If possible, REMOVE the obstruction. If the obstruction cannot be removed, go to **Pinpoint Test F** to test the auto-dimming mirror for correct function.

	• Light source near or inside of vehicle	• None. Any light source the rearward-facing sensor is exposed to can be considered glare.
	• Vehicle inside garage or tunnel	• None. Ambient conditions are similar to nighttime conditions.
	• Fuse • Circuitry • Interior auto-dimming mirror • LH exterior mirror glass • LH exterior mirror	• Go to **Pinpoint Test F**.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: **Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.**

Symptom Chart - Noise, Vibration and Harshness (NVH)

Condition	Possible Sources	Action
• Mirror vibrates/loose	• Exterior mirror mounting nuts loose	• TIGHTEN nuts to 8 N.m (71 lb-in).
	NOTE: **Compare the LH and RH exterior mirror glass to verify that the exterior mirror glass is loose.** • Mirror glass loose	• PRESS the center of the exterior mirror glass up, down, left and right to make sure that the exterior mirror glass is seated correctly. If the exterior mirror glass is still loose, REMOVE the exterior mirror glass and INSPECT the exterior mirror backing plate for damage. If the exterior mirror backing plate is damaged, INSTALL a new exterior mirror glass. REFER to **Exterior Mirror Glass**.
	• Aftermarket air deflector/stone shields	• If possible, REMOVE aftermarket air deflector/stone shield, then ROAD TEST the vehicle. If concern is no longer present, ADVISE customer that aftermarket components were causing undesired vibration.
• Wind noise	• Foam gasket between the exterior mirror and door is missing or damaged	• VERIFY gasket is present and in good condition. REPOSITION gasket or INSTALL a new foam gasket between exterior mirror and door frame if necessary.
	• Exterior mirror is not correctly fitted to the door	• VERIFY that there are no gaps between the exterior mirror and the door. If necessary, LOOSEN the exterior mirror nuts and REPOSITION the exterior mirror.
	• Exterior mirror cover	• VERIFY that the exterior mirror cover is not loose or broken. If necessary, INSTALL a new exterior

		mirror cover. REFER to **Exterior Mirror Cover**.

Pinpoint Tests

Pinpoint Test A: The Mirrors are Inoperative - Non-Memory Mirrors

Refer to **SYSTEM WIRING DIAGRAMS** , Power Mirrors for schematic and connector information.

Normal Operation

Under normal operation, the exterior mirror control switch receives power through circuit SBP15 (WH/RD) and ground through circuit GD126 (BK/WH). The exterior mirror control switch uses circuit CPM23 (GY) as the common circuit for both exterior mirror up/down and right/left movement.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Exterior mirror control switch

PINPOINT TEST A: THE MIRRORS ARE INOPERATIVE - NON-MEMORY MIRRORS

A1 CHECK THE VOLTAGE TO THE EXTERIOR MIRROR CONTROL SWITCH - CIRCUIT SBP15 (WH/RD)

- Key in OFF position.
- Disconnect: Exterior Mirror Control Switch C527

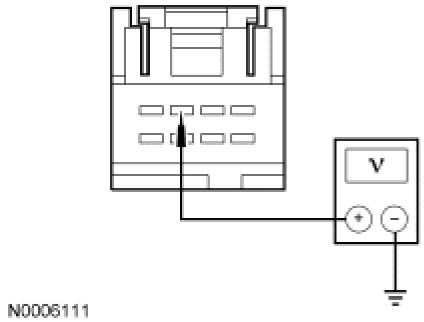


Fig. 1: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between exterior mirror control switch C527-3, circuit SBP15 (WH/RD) harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A2.

  NO : VERIFY smart junction box (SJB) fuse 20 (7.5A) is OK. If OK, REPAIR the circuit. TEST

the system for normal operation.

A2 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

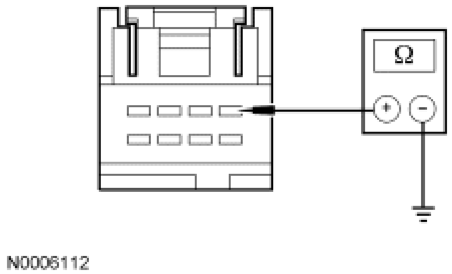


Fig. 2: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between exterior mirror control switch C527-1, circuit GD126 (BK/WH) harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to A3.

  NO : REPAIR the circuit. TEST the system for normal operation.

A3 CHECK CIRCUIT CPM23 (GY) FOR A SHORT TO VOLTAGE

- Key in ON position.

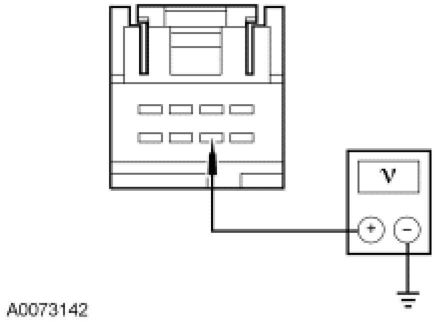


Fig. 3: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between exterior mirror control switch C527-6, circuit CPM23 (GY) harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to A4.

A4 CHECK CIRCUIT CPM23 (GY) FOR A SHORT TO GROUND

- Key in OFF position.

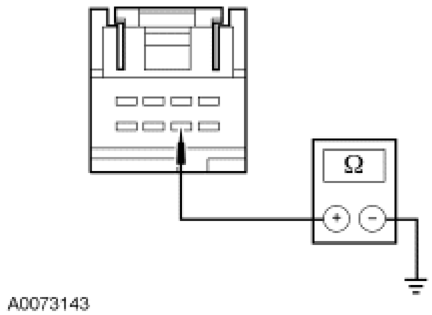


Fig. 4: Checking Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY) harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to A5.

  NO : REPAIR the circuit. TEST the system for normal operation.

A5 CHECK CIRCUIT CPM23 (GY) FOR AN OPEN

- Disconnect: LH Exterior Mirror C516 (without heated mirrors) or C517 (with heated mirrors)

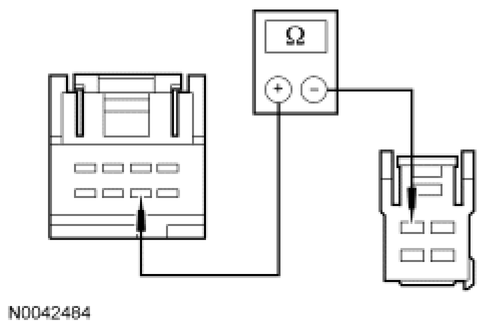


Fig. 5: Checking Circuit CPM23 (GY) For Open (Without Heated Mirror)
Courtesy of FORD MOTOR CO.

NOTE: Without heated mirrors.

- Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY) harness side and LH exterior mirror C516-2, circuit CPM23 (GY) harness side.

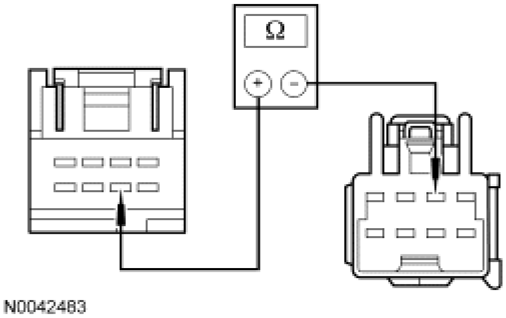


Fig. 6: Checking Circuit CPM23 (GY) For Open (With Heated Mirror)
Courtesy of FORD MOTOR CO.

NOTE: With heated mirrors.

- Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY) harness side and LH exterior mirror C517-2, circuit CPM23 (GY) harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new exterior mirror control switch. REFER to **Exterior Mirror Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST system for normal operation.

Pinpoint Test B: A Single Mirror is Inoperative - Non-Memory Mirrors

Refer to **SYSTEM WIRING DIAGRAMS** , Power Mirrors for schematic and connector information.

Normal Operation

Under normal operation, the exterior mirror control switch uses circuit CPM23 (GY) as the common circuit for both exterior mirror down/up and left/right movement.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Exterior mirror control switch
- Exterior mirror motor
- Exterior mirror

PINPOINT TEST B: A SINGLE MIRROR IS INOPERATIVE - NON-MEMORY MIRRORS

B1 CHECK THE LH MIRROR OPERATION

- Operate the LH exterior mirror using the exterior mirror control switch.
- **Does the LH exterior mirror operate?**

  YES : Go to B2.

  NO : Go to B4.

B2 CHECK THE EXTERIOR MIRROR CONTROL SWITCH

- Key in OFF position.
- Disconnect: Exterior Mirror Control Switch C527
- Carry out the Exterior Mirror Control Switch component test. Refer to COMPONENT TESTING.
- **Did the exterior mirror control switch pass the component test?**

  YES : Go to B3.

  NO : INSTALL a new exterior mirror control switch. REFER to **Exterior Mirror Control Switch**. TEST the system for normal operation.

B3 CHECK CIRCUIT CPM23 (GY) FOR AN OPEN

- Disconnect: RH Exterior Mirror C622 (without heated mirrors) or C625 (with heated mirrors)

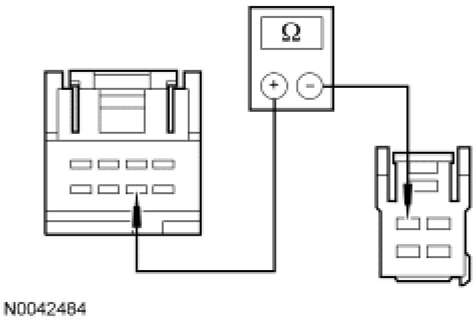


Fig. 7: Checking Circuit CPM23 (GY) For Open (Without Heated Mirror)
Courtesy of FORD MOTOR CO.

NOTE: **Without heated mirror.**

- Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY) harness side and RH exterior mirror C622-2, circuit CPM23 (GY) harness side.

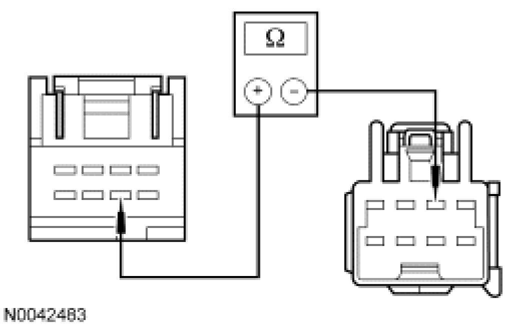


Fig. 8: Checking Circuit CPM23 (GY) For Open (With Heated Mirror)
Courtesy of FORD MOTOR CO.

NOTE: **With heated mirror.**

- Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY)

harness side and RH exterior mirror C625-2, circuit CPM23 (GY) harness side.

- **Is the resistance less than 5 ohms?**

  YES : CHECK the RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness can not be repaired, INSTALL a new RH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new exterior mirror motor. REFER to **Exterior Mirror Motor**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

B4 CHECK THE EXTERIOR MIRROR CONTROL SWITCH

- Key in OFF position.
- Disconnect: Exterior Mirror Control Switch C527
- Carry out the Exterior Mirror Control Switch component test. Refer to COMPONENT TESTING.
- **Did the exterior mirror control switch pass the component test?**

  YES : Go to B5.

  NO : INSTALL a new exterior mirror control switch. REFER to **Exterior Mirror Control Switch**. TEST the system for normal operation.

B5 CHECK CIRCUIT CPM23 (GY) FOR AN OPEN

- Disconnect: LH Exterior Mirror C516 (without heated mirrors) or C517 (with heated mirrors)

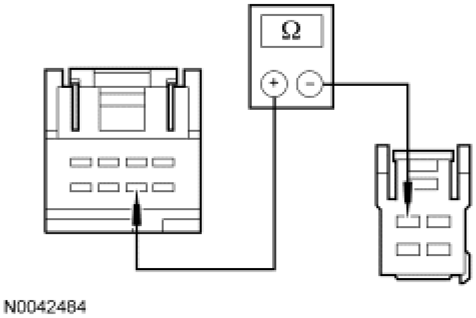


Fig. 9: Checking Circuit CPM23 (GY) For Open (Without Heated Mirror)
Courtesy of FORD MOTOR CO.

NOTE: Without heated mirror.

- Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY) harness side and LH exterior mirror C516-2, circuit CPM23 (GY) harness side.

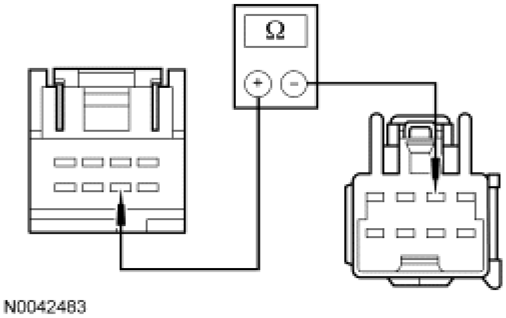


Fig. 10: Checking Circuit CPM23 (GY) For Open (With Heated Mirror)
Courtesy of FORD MOTOR CO.

NOTE: With heated mirror.

- Measure the resistance between exterior mirror control switch C527-6, circuit CPM23 (GY) harness side and LH exterior mirror C517-2, circuit CPM23 (GY) harness side.
- **Is the resistance less than 5 ohms?**

  YES : CHECK the LH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness can not be repaired, INSTALL a new LH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new exterior mirror motor. REFER to **Exterior Mirror Motor**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test C: A Single Mirror Does Not Function With Switch Logic - Non-Memory Mirrors

Refer to **SYSTEM WIRING DIAGRAMS** , Power Mirrors for schematic and connector information.

Normal Operation

Under normal operation, the exterior mirror control switch uses circuits CPM16 (BN/BU), CPM17 (BU/GN), CPM20 (BN/WH), CPM21 (YE/VT) and CPM23 (GY) to control the exterior mirror motor movement. The exterior mirror switch controls the LH exterior mirror motor movement by switching voltage and ground to circuits CPM16 (BN/BU), CPM17 (BU/GN) and CPM23 (GY). The exterior mirror switch controls the RH exterior mirror motor movement by switching voltage and ground to circuits CPM20 (BN/WH), CPM21 (YE/VT) and CPM23 (GY).

Mirror Movement

- When the LH/RH exterior mirror motor receives ground through circuit CPM16 (BN/BU)/CPM20 (BN/WH) and power through circuit CPM23 (GY), the LH/RH exterior mirror motor will operate right.
- When the LH/RH exterior mirror motor receives power through circuit CPM16 (BN/BU)/CPM20 (BN/WH) and ground through circuit CPM23 (GY), the LH/RH exterior mirror motor will operate left.
- When the LH/RH exterior mirror motor receives ground through circuit CPM17 (BU/GN)/CPM21 (YE/VT) and power through circuit CPM23 (GY), the LH/RH exterior mirror motor will operate upward.

- When the LH/RH exterior mirror motor receives power through circuit CPM17 (BU/GN)/CPM21 (YE/VT) and ground through circuit CPM23 (GY), the LH/RH exterior mirror motor will operate downward.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Exterior mirror control switch
- Exterior mirror motor
- Exterior mirror

PINPOINT TEST C: A SINGLE MIRROR DOES NOT FUNCTION WITH SWITCH LOGIC - NON-MEMORY MIRRORS

C1 CHECK THE MIRROR MOVEMENT (RIGHT/LEFT)

- Operate the RH and LH exterior mirrors in the right and left direction using the exterior mirror control switch.
- **Do the exterior mirrors move left and right?**

  YES : Go to C2.

  NO : Go to C3.

C2 CHECK THE MIRROR MOVEMENT (DOWN/UP)

- Operate the RH and LH exterior mirrors in the down and up direction using the exterior mirror control switch.
- **Do the exterior mirrors move up and down?**

  YES : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

  NO : Go to C4.

C3 CHECK THE VOLTAGE TO THE INOPERATIVE MIRROR

- Key in OFF position.
- Disconnect: Inoperative LH Exterior Mirror C516 (without heated mirrors)/C517 (with heated mirrors) or RH Exterior Mirror C622 (without heated mirrors) or C625 (with heated mirrors)

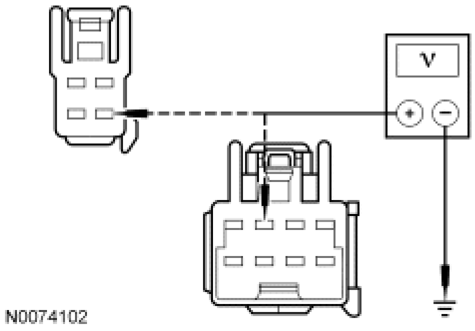


Fig. 11: Checking Voltage To Inoperative Mirror
Courtesy of FORD MOTOR CO.

NOTE: Position the exterior mirror control switch to the LH or RH position.

- While operating the exterior mirror control switch in the LEFT position, measure the voltage between ground and exterior mirror:

  NOTE: Without heated mirrors.

  - (LH) C516-3, circuit CPM16 (BN/BU) harness side.
  - (RH) C622-3, circuit CPM20 (BN/WH) harness side.

  NOTE: With heated mirrors.

  - (LH) C517-3, circuit CPM16 (BN/BU) harness side.
  - (RH) C625-3, circuit CPM20 (BN/WH) harness side.
- **Is the voltage greater than 10 volts?**

  YES : CHECK the RH or LH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness can not be repaired, INSTALL a new RH or LH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new RH or LH exterior mirror motor. REFER to **Exterior Mirror Motor**. TEST the system for normal operation.

  NO : Go to C5.

C4 CHECK THE VOLTAGE TO THE INOPERATIVE MIRROR

- Key in OFF position.
- Disconnect: LH Exterior Mirror C516 (without heated mirrors)/C517 (with heated mirrors) or RH Exterior Mirror C622 (without heated mirrors) or C625 (with heated mirrors)

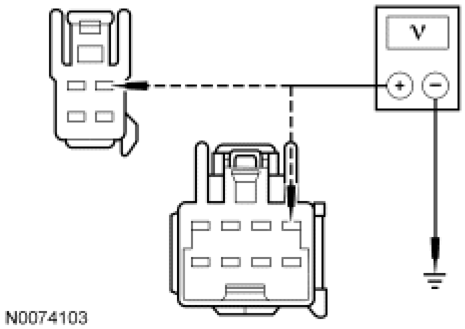


Fig. 12: Checking Voltage To Inoperative Mirror
Courtesy of FORD MOTOR CO.

NOTE: Position the exterior mirror control switch to the LH or RH position.

- While operating the exterior mirror control switch in the DOWN position, measure the voltage between ground and exterior mirror:

NOTE: Without heated mirrors.

- (LH) C516-1, circuit CPM17 (BU/GN) harness side.
- (RH) C622-1, circuit CPM21 (YE/VT) harness side.

NOTE: With heated mirrors.

- (LH) C517-1, circuit CPM17 (BU/GN) harness side.
- (RH) C625-1, circuit CPM21 (YE/VT) harness side.

- **Is the voltage greater than 10 volts?**

  YES : CHECK the RH or LH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness can not be repaired, INSTALL a new RH or LH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new RH or LH exterior mirror motor. REFER to **Exterior Mirror Motor**. TEST the system for normal operation.

  NO : Go to C6.

C5 CHECK CIRCUITS CPM16 (BN/BU) AND CPM20 (BN/WH) FOR AN OPEN

- Disconnect: Exterior Mirror Control Switch C527

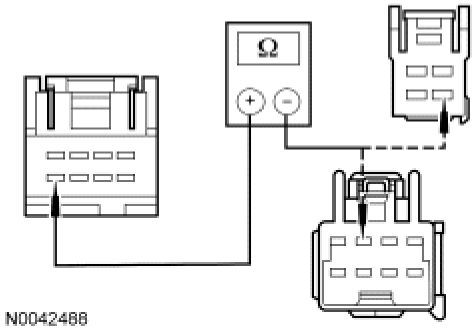


Fig. 13: Checking Circuit CPM16 (BN/BU) And Circuit CPM20 (BN/WH) For Open (Inoperative LH Mirror)
Courtesy of FORD MOTOR CO.

NOTE: Inoperative LH mirror.

- Measure the resistance between exterior mirror control switch C527-8, circuit CPM16 (BN/BU) harness side and LH exterior mirror:
  - (without heated mirror) C516-3, circuit CPM16 (BN/BU) harness side.
  - (with heated mirror) C517-3, circuit CPM16 (BN/BU) harness side.

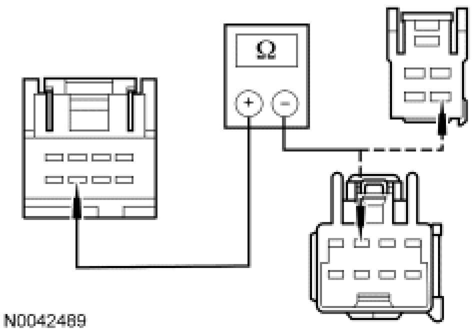


Fig. 14: Checking Circuit CPM16 (BN/BU) And Circuit CPM20 (BN/WH) For Open (Inoperative RH Mirror)
Courtesy of FORD MOTOR CO.

NOTE: Inoperative RH mirror.

- Measure the resistance between exterior mirror control switch C527-7, circuit CPM20 (BN/WH) harness side and RH exterior mirror:
  - (without heated mirror) C622-3, circuit CPM20 (BN/WH) harness side.
  - (with heated mirror) C625-3, circuit CPM20 (BN/WH) harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new exterior mirror control switch. REFER to **Exterior Mirror Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

C6 CHECK CIRCUITS CPM17 (BU/GN) AND CPM21 (YE/VT) FOR AN OPEN

- Disconnect: Exterior Mirror Control Switch C527

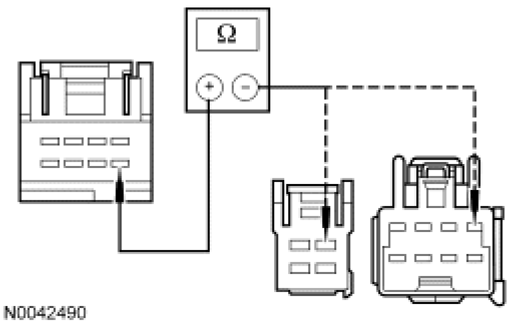


Fig. 15: Checking Circuit CPM17 (BU/GN) And CPM21 (YE/VT) For Open (Inoperative LH Mirror)
Courtesy of FORD MOTOR CO.

NOTE: Inoperative LH mirror.

- Measure the resistance between exterior mirror control switch C527-5, circuit CPM17 (BU/GN) harness side and LH exterior mirror:

- (without heated mirror) C516-1, circuit CPM17 (BU/GN) harness side.
- (with heated mirror) C517-1, circuit CPM17 (BU/GN) harness side.

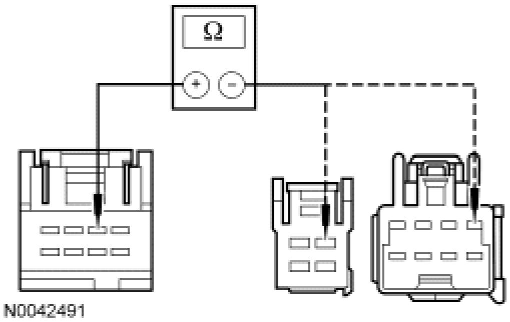


Fig. 16: Checking Circuit CPM17 (BU/GN) And CPM21 (YE/VT) For Open (Inoperative RH Mirror)
Courtesy of FORD MOTOR CO.

NOTE: Inoperative RH mirror.

- Measure the resistance between exterior mirror control switch C527-2, circuit CPM21 (YE/VT) harness side and RH exterior mirror:
  - (without heated mirror) C622-1, circuit CPM21 (YE/VT) harness side.
  - (with heated mirror) C625-1, circuit CPM21 (YE/VT) harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new exterior mirror control switch. REFER to **Exterior Mirror Control Switch**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test D: The Memory Mirror is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** , Power Mirrors for schematic and connector information.

Normal Operation

Under normal operation, the exterior mirror control switch receives power from circuit SBP15 (WH/RD) and ground from circuit GD126 (BK/WH). The exterior mirror control switch uses circuits CPM16 (BN/BU), CPM17 (BU/GN), CPM20 (BN/WH), CPM21 (YE/VT) and CPM23 (GY) to send input signals to the driver door module (DDM). The DDM controls the LH exterior mirror motor movement by supplying the appropriate power and ground to circuits CPM26 (WH), CPM27 (GY/BU), CPM28 (BU/BN) and CPM29 (GN). The DDM communicates with the driver seat module (DSM) through the medium-speed controller area network (MS-CAN) whenever the DDM receives an input signal from the exterior mirror control switch for the RH mirror. The DSM controls the RH exterior mirror motor movement by supplying the appropriate power and ground to circuits CPM31 (YE/GY), CPM32 (WH/BU), CPM33 (WH/VT) and CPM34 (WH/BN).

The memory mirror system uses feedback potentiometers, located in the LH and RH exterior mirrors, in order to track the movement of the LH and RH exterior mirror motors. The DDM supplies the LH exterior mirror

feedback potentiometer reference voltage through circuit LPM30 (GY/VT) and ground through circuit RPM30 (YE). The DSM supplies the RH exterior mirror feedback potentiometer reference voltage through circuit LPM30 (GY/VT) and ground through circuit RPM30 (YE). The DDM receives feedback from the LH exterior mirror feedback potentiometer through left/right circuit VPM35 (YE/BU) and up/down circuit VPM36 (BN/YE). The DSM receives feedback from the RH exterior mirror feedback potentiometer through left/right circuit VPM37 (BU/OG) and up/down circuit VPM38 (BN/GN).

DTC Description	Fault Trigger Conditions
B1234 - Mirror Switch Invalid Code	Short to battery and the switch is activated or short to battery for greater than 2 minutes.
B1667 - Mirror Driver Up/Down Motor Stalled	Incorrect mirror motor position reported to the DDM during On-Demand Self Test.
B1668 - Mirror Driver Right/Left Motor Stalled	Incorrect mirror motor position reported to the DDM during On-Demand Self Test.
B1669 - Mirror Passenger Up/Down Motor Stalled	Incorrect mirror motor position reported to the DSM during On-Demand Self Test.
B1670 - Mirror Passenger Right/Left Motor Stalled	Incorrect mirror motor position reported to the DSM during On-Demand Self Test.
B2223 - Mirror Driver Drive Circuit Failure	Short to ground or battery.
B2224 - Mirror Passenger Drive Circuit Failure	Short to ground or battery.
B2312 - Mirror Passenger Horizontal Feedback Potentiometer Circuit Failure	Open or short to ground.
B2314 - Mirror Passenger Horizontal Feedback Potentiometer Circuit Short to Battery	Short to battery.
B2316 - Mirror Passenger Vertical Feedback Potentiometer Circuit Failure	Open or short to ground.
B2318 - Mirror Passenger Vertical Feedback Potentiometer Circuit Short to Battery	Short to battery.
B2320 - Mirror Driver Horizontal Feedback Potentiometer Circuit Failure	Open or short to ground.
B2322 - Mirror Driver Horizontal Feedback Potentiometer Circuit Short to Battery	Short to battery.
B2324 - Mirror Driver Vertical Feedback Potentiometer Circuit Failure	Open or short to ground.
B2326 - Mirror Driver Vertical Feedback Potentiometer Circuit Short to Battery	Short to battery.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- DDM
- DSM
- Exterior mirror motor

- Exterior mirror
- Exterior mirror control switch

PINPOINT TEST D: THE MEMORY MIRROR IS INOPERATIVE

D1 RETRIEVE THE DTCs FROM DSM AND DDM

- Use the recorded DSM and DDM DTCs from the continuous and on-demand self tests.
- **Are DTCs retrieved?**

  YES : If DTC B1234 - CARRY OUT the exterior mirror control switch component test. Refer to COMPONENT TESTING. If the switch tests OK, go to D11.

  If DTC B1667 or B1668 - If other DTCs are present, diagnose them first. If no other DTCs are present, INSPECT the LH exterior mirror motor for foreign material, damage or a binding condition. If no condition is found, Go to D12.

  If DTC B1669 or B1670 - If other DTCs are present, diagnose them first. If no other DTCs are present, INSPECT the RH exterior mirror motor for foreign material, damage or a binding condition. If no condition is found, Go to D14.

  If DTC B2223, go to D16.

  If DTC B2224, go to D19.

  If DTC B2312, B2316, B2320 or B2324, go to D22.

  If DTC B2314, B2318, B2322 or B2326, go to D26.

  NO : Go to D2.

D2 CHECK THE OPERATION OF THE EXTERIOR MIRRORS FROM THE EXTERIOR MIRROR CONTROL SWITCH

- Operate the mirrors using the exterior mirror control switch.
- **Do the mirrors operate from the exterior mirror control switch?**

  YES : Go to D8.

  NO : Go to D3.

D3 CHECK THE EXTERIOR MIRROR CONTROL SWITCH

- Key in OFF position.
- Disconnect: Exterior Mirror Control Switch C527
- Carry out the Exterior Mirror Control Switch component test. Refer to COMPONENT TESTING.
- **Did the exterior mirror control switch pass the component test?**

  YES : Go to D4.

  NO : INSTALL a new exterior mirror control switch. REFER to **Exterior Mirror Control Switch**. TEST the system for normal operation.

D4 CHECK CIRCUIT SBP15 (WH/RD) FOR VOLTAGE

- Key in ON position.

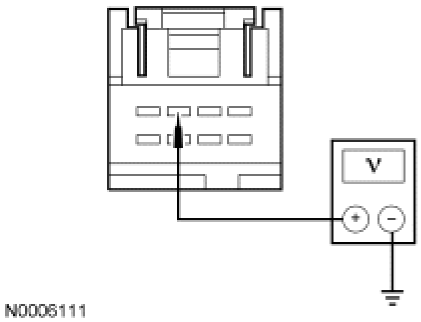


Fig. 17: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between exterior mirror control switch C527-3, circuit SBP15 (WH/RD) harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to D5.

  NO : VERIFY smart junction box (SJB) fuse 20 (7.5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

D5 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

- Key in OFF position.

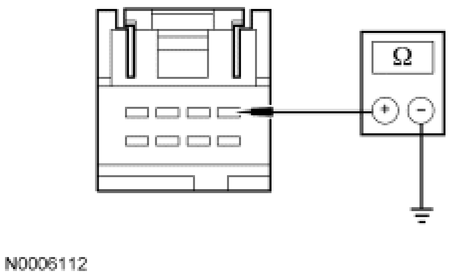


Fig. 18: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between exterior mirror control switch C527-1, circuit GD126 (BK/WH) harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to D6.

  NO : REPAIR the circuit. TEST the system for normal operation.

D6 CHECK CIRCUITS CPM16 (BN/BU), CPM17 (BU/GN), CPM20 (BN/WH), CPM21 (YE/VT) AND CPM23 (GY) FOR A SHORT TO GROUND

- Disconnect: DDM C568B

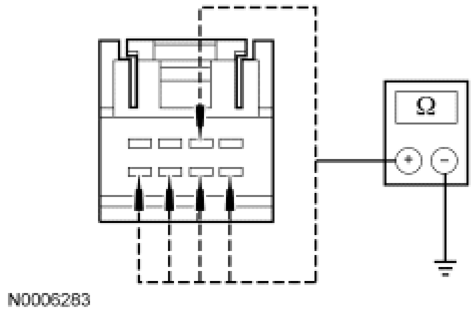


Fig. 19: Checking Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and exterior mirror control switch:
  - C527-2, circuit CPM21 (YE/VT) harness side.
  - C527-5, circuit CPM17 (BU/GN) harness side.
  - C527-6, circuit CPM23 (GY) harness side.
  - C527-7, circuit CPM20 (BN/WH) harness side.
  - C527-8, circuit CPM16 (BN/BU) harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to D7.

  NO : REPAIR the circuit(s). TEST the system for normal operation.

D7 CHECK CIRCUITS CPM16 (BN/BU), CPM17 (BU/GN), CPM20 (BN/WH), CPM21 (YE/VT) AND CPM23 (GY) FOR AN OPEN

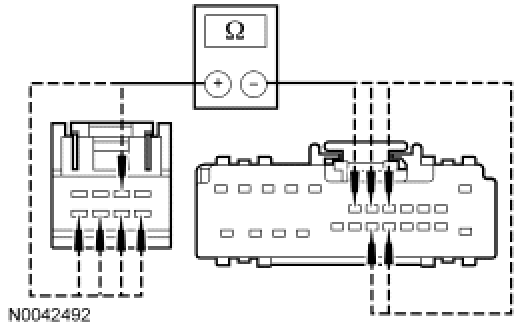


Fig. 20: Checking Circuits CPM21 (YE/VT), CPM17 (BU/GN), CPM20 (BN/WH), CPM16 (BN/BU) And CPM23 (GY) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between exterior mirror control switch:
  - C527-2, circuit CPM21 (YE/VT) harness side and DDM C568B-6, circuit CPM21 (YE/VT) harness side.
  - C527-5, circuit CPM17 (BU/GN) harness side and DDM C568B-17, circuit CPM17 (BU/GN) harness side.
  - C527-6, circuit CPM23 (GY) harness side and DDM C568B-18, circuit CPM23 (GY)

harness side.

- C527-7, circuit CPM20 (BN/WH) harness side and DDM C568B-5, circuit CPM20 (BN/WH) harness side.
- C527-8, circuit CPM16 (BN/BU) harness side and DDM C568B-7, circuit CPM16 (BN/BU) harness side.

- **Are the resistances less than 5 ohms?**

  YES : Go to D29.

  NO : REPAIR the circuit(s). TEST the system for normal operation.

D8 CHECK CIRCUIT RPM30 (YE) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DDM C568A

  NOTE: Inoperative LH mirror.

- Disconnect: DDM C568B

  NOTE: Inoperative LH mirror.

- Disconnect: DSM C3299C

  NOTE: Inoperative RH mirror.

- Disconnect: DSM C3299D

  NOTE: Inoperative RH mirror.

- Key in ON position.

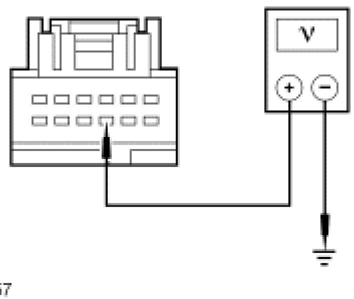


Fig. 21: Checking Circuit RPM30 (YE) For A Short To Voltage
Courtesy of FORD MOTOR CO.

NOTE: Inoperative LH mirror.

- Measure the voltage between DDM C568A-9, circuit RPM30 (YE) harness side and ground.

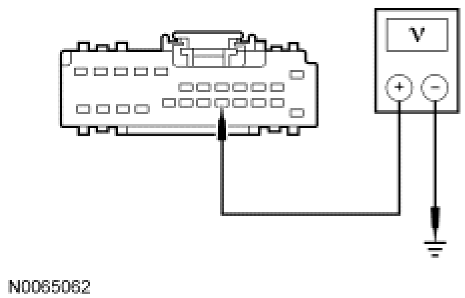


Fig. 22: Measuring Voltage Between DDM C568A-9, Circuit RPM30 (YE) Harness Side & Ground
Courtesy of FORD MOTOR CO.

NOTE: **Inoperative RH mirror.**

- Measure the voltage between DSM C3299C-17, circuit RPM30 (YE) harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to D9.

D9 CHECK CIRCUIT LPM30 (GY/VT) FOR SHORT TO GROUND

- Key in OFF position.
- Disconnect: Inoperative Exterior Mirror C522 (LH) and C626 (RH)

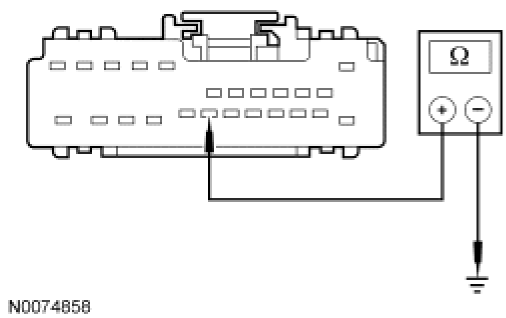


Fig. 23: Checking Circuit LPM30 (GY/VT) For Short To Ground
Courtesy of FORD MOTOR CO.

NOTE: **Inoperative LH mirror.**

- Measure the resistance between DDM C568B-19, circuit LPM30 (GY/VT) harness side and ground.

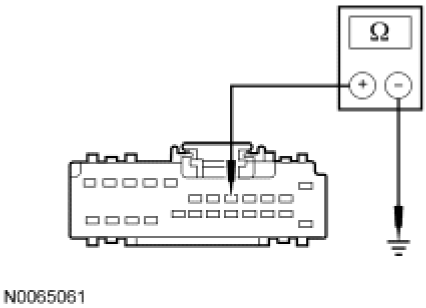


Fig. 24: Measuring Resistance Between DDM C568B-19, Circuit LPM30 (GY/VT) Harness Side & Ground
Courtesy of FORD MOTOR CO.

NOTE: Inoperative RH mirror.

- Measure the resistance between DSM C3299C-5, circuit LPM30 (GY/VT) harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to D10.

  NO : REPAIR the circuit. TEST the system for normal operation.

D10 CHECK CIRCUITS RPM30 (YE) AND LPM30 (GY/VT) FOR AN OPEN

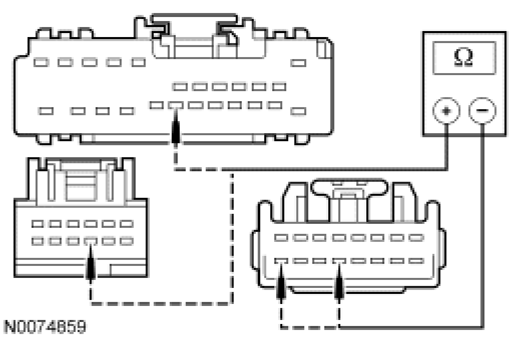


Fig. 25: Checking Circuits RPM30 (YE) & LPM30 (GY/VT) For An Open
Courtesy of FORD MOTOR CO.

NOTE: Inoperative LH mirror.

- Measure the resistance between LH exterior mirror:
  - C522-13, circuit LPM30 (GY/VT) harness side and DDM C568B-19, circuit LPM30 (GY/VT) harness side.
  - C522-16, circuit RPM30 (YE) harness side and DDM C568A-9, circuit RPM30 (YE) harness side.

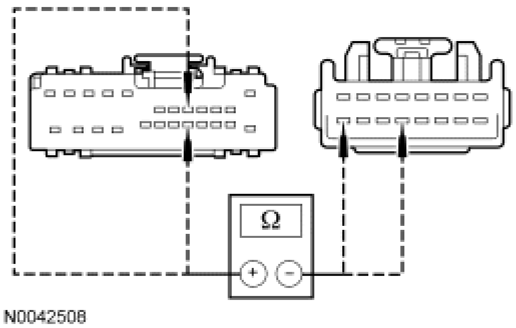


Fig. 26: Checking Feed And Return Circuit For Open (DTC B2312 And B2316)
Courtesy of FORD MOTOR CO.

NOTE: Inoperative RH mirror.

- Measure the resistance between RH exterior mirror:
  - C626-13, circuit LPM30 (GY/VT) harness side and DSM C3299C-5, circuit LPM30 (GY/VT) harness side.
  - C626-16, circuit RPM30 (YE) harness side and DSM C3299C-17, circuit RPM30 (YE) harness side.
- **Are the resistances less than 5 ohms?**

  YES : CHECK the LH or RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motors for open or shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new LH or RH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new LH or RH exterior mirror motor. REFER to **Exterior Mirror Motor**. TEST the system for normal operation.

  NO : REPAIR the circuit(s). TEST the system for normal operation.

D11 CHECK CIRCUITS CPM16 (BN/BU), CPM17 (BU/GN), CPM20 (BN/WH), CPM21 (YE/VT) AND CPM23 (GY) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Exterior Mirror Control Switch C527
- Disconnect: DDM C568B
- Key in ON position.

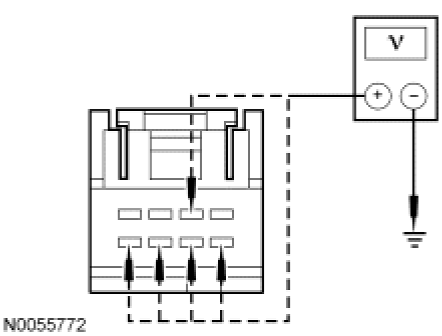


Fig. 27: Checking Circuits For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and exterior mirror control switch:
  - C527-2, circuit CPM21 (YE/VT) harness side.
  - C527-5, circuit CPM17 (BU/GN) harness side.
  - C527-6, circuit CPM23 (GY) harness side.
  - C527-7, circuit CPM20 (BN/WH) harness side.
  - C527-8, circuit CPM16 (BN/BU) harness side.
- **Is any voltage present?**

  YES : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

  NO : Go to D29.

D12 CHECK THE EXTERIOR MIRROR FOR VOLTAGE FROM THE DDM

- Key in OFF position.
- Disconnect: LH Exterior Mirror C522
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DDM DataLogger

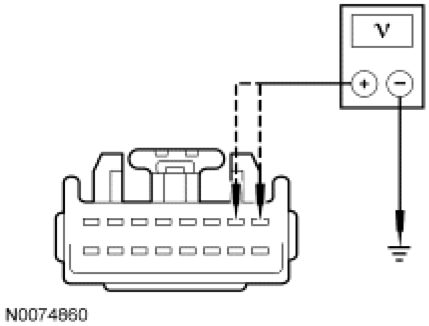


Fig. 28: Checking Exterior Mirror For Voltage From DDM (DTC B1667)
Courtesy of FORD MOTOR CO.

NOTE: DTC B1667.

- Measure the voltage between LH exterior mirror C522-1, circuit CPM29 (GN) harness side and ground while toggling the LH exterior mirror DDM PID DR_UP to On; and between LH exterior mirror C522-2, circuit CPM26 (WH) harness side and ground while toggling the LH exterior mirror DDM PID DR_DOWN to On.

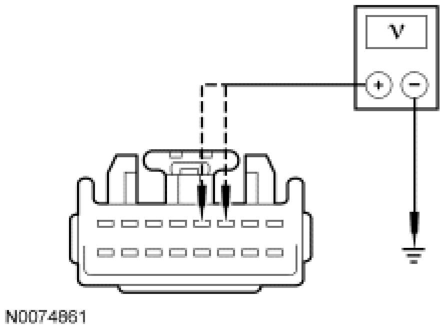


Fig. 29: Checking Exterior Mirror For Voltage From DDM (DTC B1668)
Courtesy of FORD MOTOR CO.

NOTE: DTC B1668.

- Measure the voltage between LH exterior mirror C522-3, circuit CPM27 (GY/BU) harness side and ground while toggling the LH exterior mirror DDM PID DR_LEFT to On; and between LH exterior mirror C522-4, circuit CPM28 (BU/BN) harness side and ground while toggling the LH exterior mirror DDM PID DR_RIGHT to On.
- **Do the voltages momentarily change from 0 volt to greater than 10 volts when the active command is toggled On?**

  YES : CHECK the LH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for shorted and open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new LH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new LH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

  NO : Go to D13.

D13 CHECK CIRCUITS CPM26 (WH), CPM27 (GY/BU), CPM28 (BU/BN) AND CPM29 (GN) FOR AN OPEN

- Key in OFF position.
- Disconnect: DDM C568A

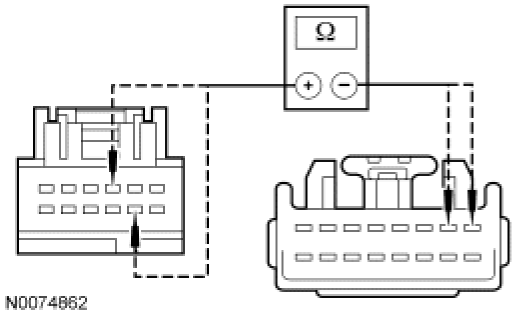


Fig. 30: Checking Circuits CPM26 (WH), CPM27 (GY/BU), CPM28 (BU/BN) & CPM29 (GN) For An Open
Courtesy of FORD MOTOR CO.

NOTE: DTC B1667.

- Measure the resistance between DDM:
  - C568A-8, circuit CPM26 (WH) harness side and LH exterior mirror C522-2, circuit CPM26 (WH) harness side.
  - C568A-3, circuit CPM29 (GN) harness side and LH exterior mirror C522-1, circuit CPM29 (GN) harness side.

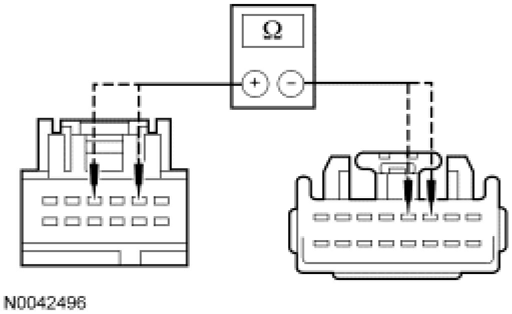


Fig. 31: Checking Circuits CPM26 (WH), CPM29 (GN), CPM28 (BU/BN) And CPM27 (GY/BU) For Open (DTC B1668)
Courtesy of FORD MOTOR CO.

NOTE: DTC B1668.

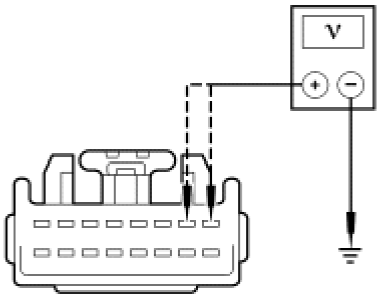
- Measure the resistance between DDM:
  - C568A-2, circuit CPM28 (BU/BN) harness side and LH exterior mirror C522-4, circuit CPM28 (BU/BN) harness side.
  - C568A-4, circuit CPM27 (GY/BU) harness side and LH exterior mirror C522-3, circuit CPM27 (GY/BU) harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to D29.

  NO : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

D14 CHECK THE EXTERIOR MIRROR FOR VOLTAGE FROM THE DSM

- Key in OFF position.
- Disconnect: RH Exterior Mirror C626
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DSM DataLogger

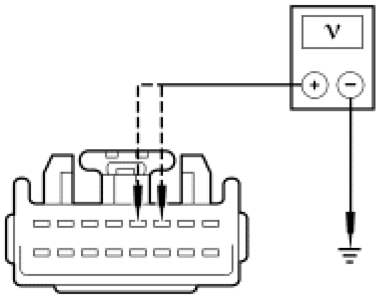


N0074863

Fig. 32: Checking Exterior Mirror For Voltage From DSM (DTC B1669)
Courtesy of FORD MOTOR CO.

NOTE: DTC B1669.

- Measure the voltage between RH exterior mirror C626-1, circuit CPM34 (WH/BU) harness side and ground while toggling the RH exterior mirror DSM PID PR_UP to On; and between RH exterior mirror C626-2, circuit CPM31 (YE/GY) harness side and ground while toggling the RH exterior mirror DSM PID PR_DOWN to On.



N0074864

Fig. 33: Checking Exterior Mirror For Voltage From DSM (DTC B1670)
Courtesy of FORD MOTOR CO.

NOTE: DTC B1670.

- Measure the voltage between RH exterior mirror C626-3, circuit CPM32 (WH/BU) harness side and ground while toggling the RH exterior mirror DSM PID PR_LEFT to On; and between RH exterior mirror C626-4, circuit CPM33 (WH/VT) harness side and ground while toggling the RH exterior mirror DSM PID PR_RIGHT to On.
- **Do the voltages momentarily change from 0 volt to greater than 10 volts when the active command is toggled On?**

  YES : CHECK the RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for shorted and open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new RH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new RH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

NO : Go to D15.

D15 CHECK CIRCUITS CPM31 (YE/GY), CPM32 (WH/BU), CPM33 (WH/VT) AND CPM34 (WH/BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: DSM C3299D

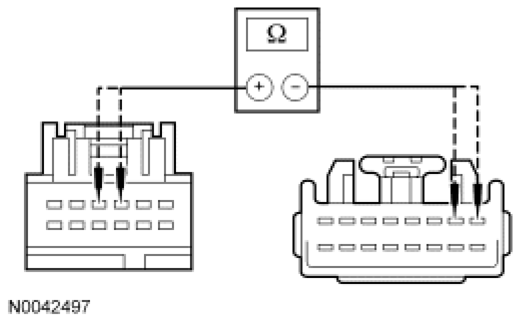


Fig. 34: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: DTC B1669.

- Measure the resistance between DSM:
  - C3299D-3, circuit CPM34 (WH/BN) harness side and RH exterior mirror C626-1, circuit CPM34 (WH/BN) harness side.
  - and RH exterior mirror C626-2, circuit CPM31 (YE/GY) harness side and DSM C3299D-4, circuit CPM31 (YE/GY) harness side.

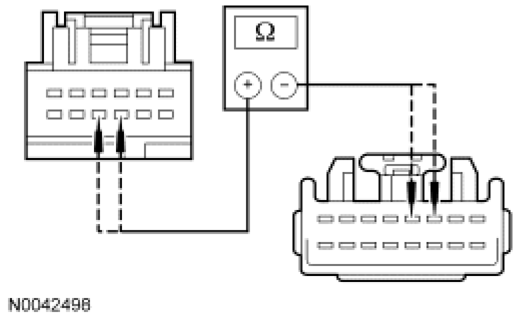


Fig. 35: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: DTC B1670.

- Measure the resistance between DSM:
  - C3299D-10, circuit CPM32 (WH/BU) harness side and RH exterior mirror C626-3, circuit CPM32 (WH/BU) harness side.

- C3299D-9, circuit CPM33 (WH/VT) harness side and RH exterior mirror C626-4, circuit CPM33 (WH/VT) harness side.

- **Are the resistances less than 5 ohms?**

  YES : Go to D28.

  NO : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

D16 CHECK CIRCUITS CPM26 (WH), CPM27 (GY/BU), CPM28 (BU/BN) AND CPM29 (GN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DDM C568A
- Key in ON position.

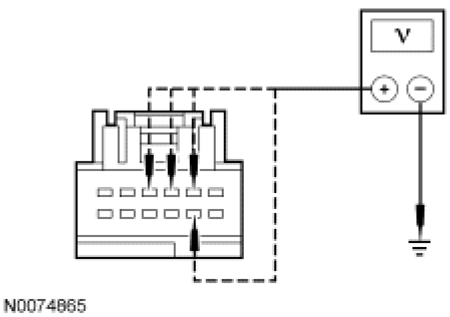


Fig. 36: Checking Circuits CPM26 (WH), CPM27 (GY/BU), CPM28 (BU/BN) & CPM29 (GN) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and DDM:
  - C568A-2, circuit CPM28 (BU/BN) harness side.
  - C568A-3, circuit CPM29 (GN) harness side.
  - C568A-4, circuit CPM27 (GY/BU) harness side.
  - C568A-8, circuit CPM26 (WH) harness side.
- **Is any voltage present?**

  YES : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

  NO : Go to D17.

D17 CHECK CIRCUITS CPM26 (WH), CPM27 (GY/BU), CPM28 (BU/BN) AND CPM29 (GN) FOR A SHORT TO GROUND

- Key in OFF position.

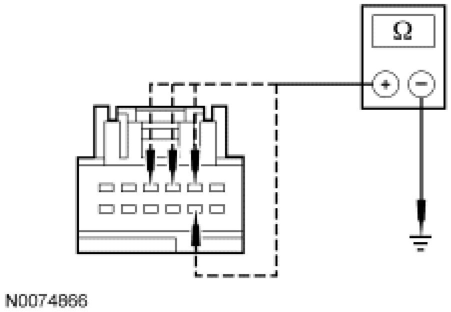


Fig. 37: Checking Circuits CPM26 (WH), CPM27 (GY/BU), CPM28 (BU/BN) & CPM29 (GN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and DDM:
  - C568A-2, circuit CPM28 (BU/BN) harness side.
  - C568A-3, circuit CPM29 (GN) harness side.
  - C568A-4, circuit CPM27 (GY/BU) harness side.
  - C568A-8, circuit CPM26 (WH) harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to D29.

  NO : Go to D18.

D18 CHECK THE LH EXTERIOR MIRROR FOR A SHORT TO GROUND

- Disconnect: LH Exterior Mirror C522

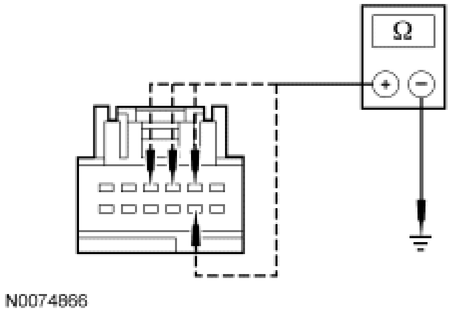


Fig. 38: Checking LH Exterior Mirror For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and DDM:
  - C568A-2, circuit CPM28 (BU/BN) harness side.
  - C568A-3, circuit CPM29 (GN) harness side.
  - C568A-4, circuit CPM27 (GY/BU) harness side.
  - C568A-8, circuit CPM26 (WH) harness side.
- **Are the resistances greater than 10,000 ohms?**

YES : CHECK the LH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new LH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new LH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

NO : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

D19 CHECK CIRCUITS CPM31 (YE/GY), CPM32 (WH/BU), CPM33 (WH/VT) AND CPM34 (WH/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSM C3299D
- Key in ON position.

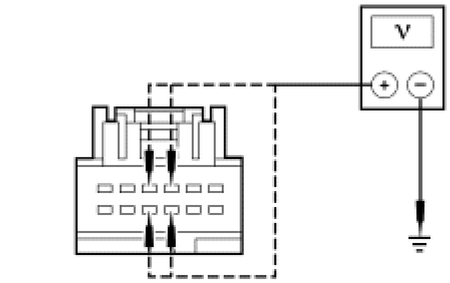


Fig. 39: Checking Circuits CPM31 (YE/GY), CPM32 (WH/BU), CPM33 (WH/VT) & CPM34 (WH/BN) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and DSM:
  - C3299D-3, circuit CPM34 (WH/BN) harness side.
  - C3299D-4, circuit CPM31 (YE/GY) harness side.
  - C3299D-9, circuit CPM33 (WH/VT) harness side.
  - C3299D-10, circuit CPM32 (WH/BU) harness side.
- **Is any voltage present?**

  YES : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

  NO : Go to D20.

D20 CHECK CIRCUITS CPM31 (YE/GY), CPM32 (WH/BU), CPM33 (WH/VT) AND CPM34 (WH/BN) FOR A SHORT TO GROUND

- Key in OFF position.

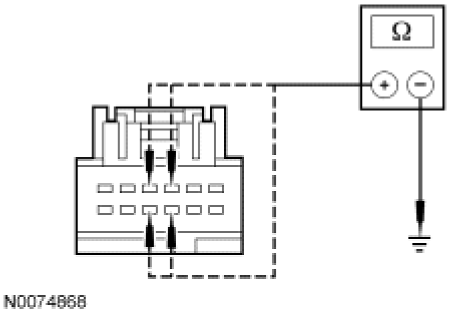


Fig. 40: Checking Circuits CPM31 (YE/GY), CPM32 (WH/BU), CPM33 (WH/VT) & CPM34 (WH/BN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and DSM:
  - C3299D-3, circuit CPM34 (WH/BN) harness side.
  - C3299D-4, circuit CPM31 (YE/GY) harness side.
  - C3299D-9, circuit CPM33 (WH/VT) harness side.
  - C3299D-10, circuit CPM32 (WH/BU) harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to D28.

  NO : Go to D21.

D21 CHECK THE RH EXTERIOR MIRROR FOR A SHORT TO GROUND

- Disconnect: LH Exterior Mirror C626

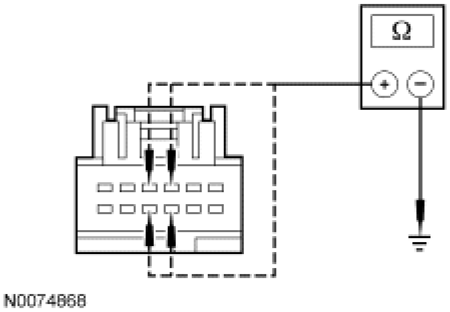


Fig. 41: Checking RH Exterior Mirror For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ground and DSM:
  - C3299D-3, circuit CPM34 (WH/BN) harness side.
  - C3299D-4, circuit CPM31 (YE/GY) harness side.
  - C3299D-9, circuit CPM33 (WH/VT) harness side.
  - C3299D-10, circuit CPM32 (WH/BU) harness side.
- **Are the resistances greater than 10,000 ohms?**

YES : CHECK the RH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new RH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new RH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

NO : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

D22 CHECK THE LH AND RH EXTERIOR MIRRORS

- Key in OFF position.
- Disconnect: DSM C3299D

NOTE: DTC B2312 or B2316.

- Disconnect: DDM C568A

NOTE: DTC B2320 or B2324.

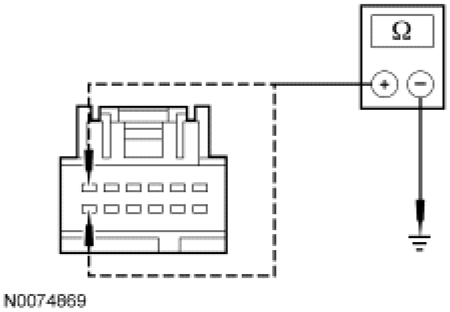


Fig. 42: Checking LH & RH Exterior Mirrors (DTC B2312 or B2316)
Courtesy of FORD MOTOR CO.

NOTE: DTC B2312 or B2316.

- Measure the resistance between ground and DSM:
  - (DTC B2312) C3299D-6, circuit VPM37 (BU/OG) harness side.
  - (DTC B2316)C3299D-12, circuit VPM38 (BN/GN) harness side.

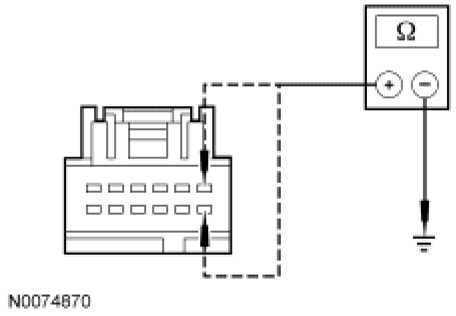


Fig. 43: Checking LH & RH Exterior Mirrors (DTC B2320 or B2324)
Courtesy of FORD MOTOR CO.

NOTE: DTC B2320 or B2324.

- Measure the resistance between ground and DDM:
  - (DTC B2320) C568A-7, circuit VPM35 (YE/BU) harness side.
  - (DTC B2324) C568A-1, circuit VPM36 (BN/YE) harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to D24.

  NO : Go to D23.

D23 CHECK CIRCUITS VPM35 (YE/BU), VPM36 (BN/YE), VPM37 (BU/OG) AND VPM38 (BN/GN) FOR A SHORT TO GROUND

- Disconnect: RH Exterior Mirror C625

NOTE: DTC B2312 or B2316.

- Disconnect: LH Exterior Mirror C522

NOTE: DTC B2320 or B2324.

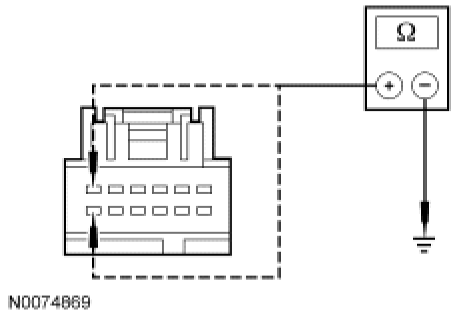


Fig. 44: Checking Circuits VPM35 (YE/BU), VPM36 (BN/YE), VPM37 (BU/OG) & VPM38 (BN/GN) For A Short To Ground (DTC B2312 or B2316)
Courtesy of FORD MOTOR CO.

NOTE: DTC B2312 or B2316.

- Measure the resistance between ground and DSM:
  - (DTC B2312) C3299D-6, circuit VPM37 (BU/OG) harness side.
  - (DTC B2316)C3299D-12, circuit VPM38 (BN/GN) harness side.

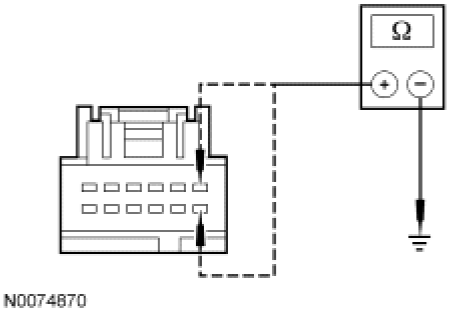


Fig. 45: Checking Circuits VPM35 (YE/BU), VPM36 (BN/YE), VPM37 (BU/OG) & VPM38 (BN/GN) For A Short To Ground (DTC B2320 or B2324)
Courtesy of FORD MOTOR CO.

NOTE: DTC B2320 or B2324.

- Measure the resistance between ground and DDM:
  - (DTC B2320) C568A-7, circuit VPM35 (YE/BU) harness side.
  - (DTC B2324) C568A-1, circuit VPM36 (BN/YE) harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : CHECK the RH or LH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new RH or LH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new RH or LH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

  NO : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

D24 CHECK THE RH AND LH EXTERIOR MIRRORS FOR AN INTERNAL OPEN

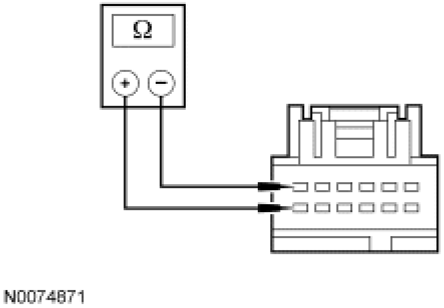
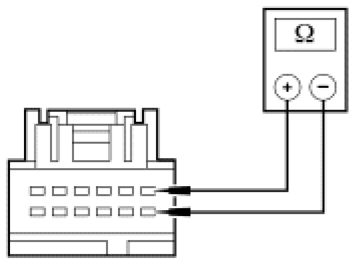


Fig. 46: Checking RH & LH Exterior Mirrors For An Internal Open (DTC B2312 or B2316)
Courtesy of FORD MOTOR CO.

NOTE: **DTC B2312 or B2316.**

- Measure the resistance between DSM C3299D-6, circuit VPM37 (BU/OG) harness side and C3299D-12, circuit VPM38 (BN/GN) harness side.



N0074672

Fig. 47: Checking RH & LH Exterior Mirrors For An Internal Open (DTC B2320 or B2324)
Courtesy of FORD MOTOR CO.

NOTE: **DTC B2320 or B2324.**

- Measure the resistance between DDM C568A-7, circuit VPM35 (YE/BU) harness side and C568A-1, circuit VPM36 (BN/YE) harness side.
- **Is the resistance less than 5 ohms?**

  YES : For DTC B2312 or B2316, go to D28.

  For DTC B2320 or B2324, go to D29.

  NO : Go to D25.

D25 CHECK CIRCUITS VPM35 (YE/BU), VPM36 (BN/YE), VPM37 (BU/OG) AND VPM38 (BN/GN) FOR AN OPEN

- Disconnect: RH Exterior Mirror C626

NOTE: **DTC B2312 or B2316.**

- Disconnect: LH Exterior Mirror C522

NOTE: **DTC B2320 or B2324.**

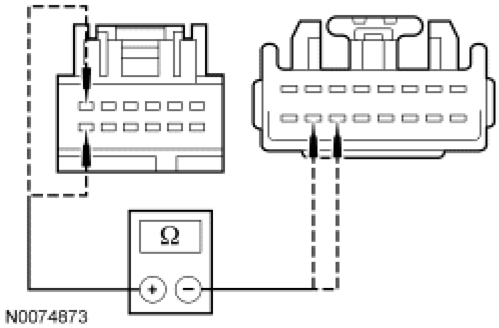


Fig. 48: Checking Circuits VPM35 (YE/BU), VPM36 (BN/YE), VPM37 (BU/OG) & VPM38 (BN/GN) For An Open (DTC B2312 or B2316)
Courtesy of FORD MOTOR CO.

NOTE: DTC B2312 or B2316.

- Measure the resistance between DSM:
  - (DTC B2312) C3299D-6, circuit VPM37 (BU/OG) harness side and C626-15, circuit VPM37 (BU/OG) harness side.
  - (DTC B2316) C3299D-12, circuit VPM38 (BN/GN) harness side and C626-14, circuit VPM38 (BN/GN) harness side.

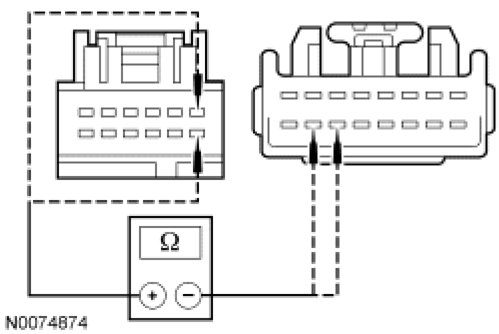


Fig. 49: Checking Circuits VPM35 (YE/BU), VPM36 (BN/YE), VPM37 (BU/OG) & VPM38 (BN/GN) For An Open (DTC B2320 or B2324)
Courtesy of FORD MOTOR CO.

NOTE: DTC B2320 or B2324.

- Measure the resistance between DDM:
  - (DTC B2320) C568A-7, circuit VPM35 (YE/BU) harness side and C522-15, circuit VPM35 (YE/BU) harness side.
  - (DTC B2324) C568A-1, circuit VPM36 (BN/YE) harness side and C522-14, circuit VPM36 (BN/YE) harness side.
- **Is the resistance less than 5 ohms?**

  YES : CHECK the RH or LH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for shorted circuits and damaged or pushed-out pins. If the jumper harness is

not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new RH or LH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new RH or LH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

NO : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

D26 CHECK THE LH AND RH EXTERIOR MIRRORS

- Key in OFF position.
- Disconnect: DSM C3299D

NOTE: DTC B2314 or B2318.

- Disconnect: DDM C568A

NOTE: DTC B2322 or B2326.

- Key in ON position.

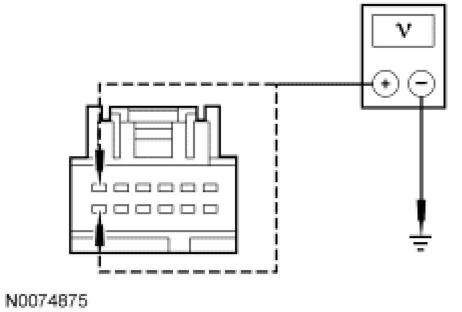


Fig. 50: Checking LH & RH Exterior Mirrors (DTC B2314 Or B2318)
Courtesy of FORD MOTOR CO.

NOTE: DTC B2314 or B2318.

- Measure the voltage between ground and DSM:
  - (DTC B2314) C3299D-6, circuit VPM37 (BU/OG) harness side.
  - (DTC B2318) C3299D-12, circuit VPM38 (BN/GN) harness side.

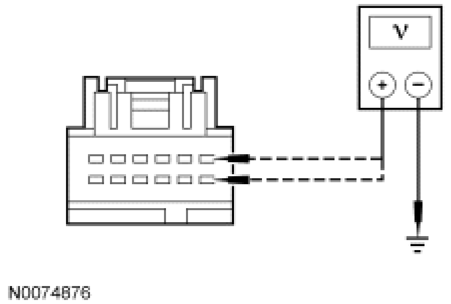


Fig. 51: Checking LH & RH Exterior Mirrors (DTC B2322 or B2326)
Courtesy of FORD MOTOR CO.

NOTE: DTC B2322 or B2326.

- Measure the voltage between ground and DDM:
  - (DTC B2322) C568A-7, circuit VPM35 (YE/BU) harness side.
  - (DTC B2326) C568A-1, circuit VPM36 (BN/YE) harness side.
- **Is any voltage present?**

  YES : Go to D27.

  NO : For DTC B2314 or B2318, go to D28.

  For DTC B2322 or B2326, go to D29.

D27 CHECK THE LH AND RH EXTERIOR MIRRORS

- Key in OFF position.
- Disconnect: RH Exterior Mirror C626

NOTE: DTC B2314 or B2318.

- Disconnect: LH Exterior Mirror C522

NOTE: DTC B2322 or B2326.

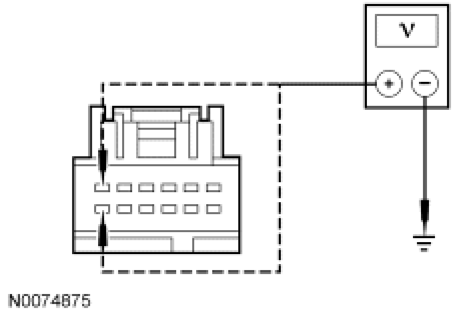


Fig. 52: Checking LH & RH Exterior Mirrors (DTC B2314 or B2318)
Courtesy of FORD MOTOR CO.

NOTE: DTC B2314 or B2318.

- Measure the voltage between ground and DSM:
  - (DTC B2314) C3299D-6, circuit VPM37 (BU/OG) harness side.
  - (DTC B2318) C3299D-12, circuit VPM38 (BN/GN) harness side.

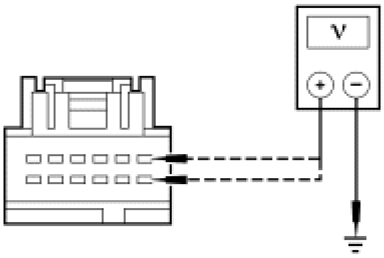


Fig. 53: Checking LH & RH Exterior Mirrors (DTC B2322 or B2326)
Courtesy of FORD MOTOR CO.

NOTE: DTC B2322 or B2326.

- Measure the voltage between ground and DDM:
  - (DTC B2322) C568A-7, circuit VPM35 (YE/BU) harness side.
  - (DTC B2326) C568A-1, circuit VPM36 (BN/YE) harness side.
- **Is any voltage present?**

  YES : REPAIR the circuit(s). CLEAR the DTCs. TEST the system for normal operation.

  NO : CHECK the RH or LH exterior mirror jumper harness between the vehicle harness and the exterior mirror motor for shorted circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new RH or LH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new RH or LH exterior mirror motor. REFER to **Exterior Mirror Motor**. CLEAR the DTCs. TEST the system for normal operation.

D28 CHECK THE DSM FOR CORRECT OPERATION

- Disconnect all DSM connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all DSM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or

corroded connector. CLEAR the DTCs. REPEAT the self-test.

D29 CHECK THE DDM FOR CORRECT OPERATION

- Disconnect all DDM connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all DDM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new DDM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: The Heated Exterior Mirror is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** , Heated Windows for schematic and connector information.

Refer to **SYSTEM WIRING DIAGRAMS** , Power Mirrors for schematic and connector information.

Normal Operation

Under normal operation, the LH and RH exterior mirror glass receives power from SJB fuse 9 (10A) and through circuit CBP16 (BU/OG), when the rear window defrost system is on. Ground is supplied to the LH heated exterior mirror glass through circuit GD126 (BK/WH) and to the RH heated exterior mirror glass through circuit GD139 (BK/YE).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Exterior mirror glass
- Exterior mirror

PINPOINT TEST E: THE HEATED EXTERIOR MIRROR IS INOPERATIVE

E1 CHECK THE OPERATION OF THE REAR WINDOW DEFROST SYSTEM

- Key in ON position.
- Press the rear window defrost switch to the ON position.
- Place a hand on the rear window to verify that the rear window heats up.
- **Does the rear window defrost system operate?**

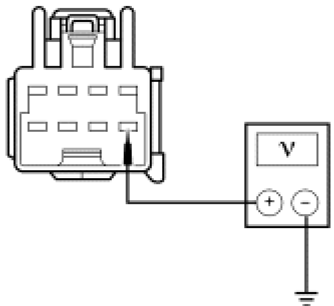
  YES : Go to E2.

  NO : REFER to **GLASS, FRAMES AND MECHANISMS** article to diagnose the rear window

defrost system.

E2 CHECK THE VOLTAGE TO THE EXTERIOR MIRRORS

- Key in OFF position.
- Disconnect: LH Exterior Mirror C517 (without memory mirrors)/C522 (with memory mirrors) or RH Exterior Mirror C625 (without memory mirrors)/C626 (with memory mirrors)
- Key in ON position.
- Press the rear window defrost switch to the ON position.

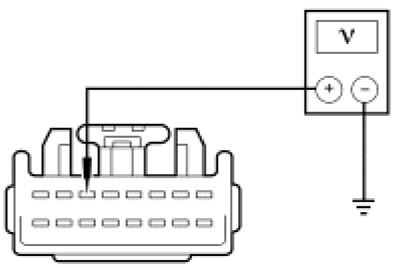


N0042519

Fig. 54: Checking Exterior Mirror For Power (Without Memory Mirrors)
Courtesy of FORD MOTOR CO.

NOTE: Without memory mirrors.

- Measure the voltage between ground and inoperative exterior mirror:
  - (LH) C517-5, circuit CBP16 (BU/OG) harness side.
  - (RH) C625-5, circuit CBP16 (BU/OG) harness side.



N0042518

Fig. 55: Checking Exterior Mirror For Power (With Memory Mirrors)
Courtesy of FORD MOTOR CO.

NOTE: With memory mirrors.

- Measure the voltage between ground and inoperative exterior mirror:
  - (LH) C522-6, circuit CBP16 (BU/OG) harness side.
  - (RH) C626-6, circuit CBP16 (BU/OG) harness side.

- **Is the voltage greater than 10 volts?**

  YES : Go to E3.

  NO : VERIFY the smart junction box (SJB) fuse 9 (10A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

E3 CHECK THE EXTERIOR REAR VIEW MIRROR GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.

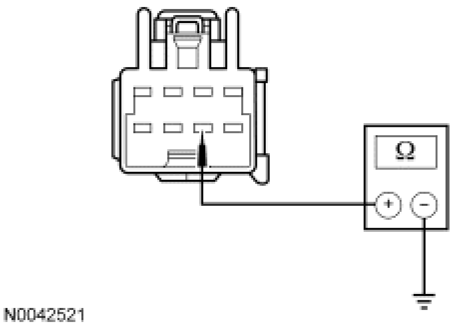


Fig. 56: Checking Exterior Rear View Mirror Ground Circuit For Open (Without Memory Mirrors)
Courtesy of FORD MOTOR CO.

NOTE: Without memory mirrors.

- Measure the resistance between ground and inoperative exterior mirror:
  - (LH) C517-6, circuit GD126 (BK/WH) harness side.
  - (RH) C625-6, circuit GD139 (BK/YE) harness side.

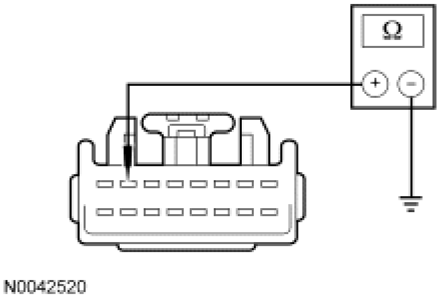


Fig. 57: Checking Exterior Rear View Mirror Ground Circuit For Open (With Memory Mirrors)
Courtesy of FORD MOTOR CO.

NOTE: With memory mirrors.

- Measure the resistance between ground and inoperative exterior mirror:
  - (LH) C522-7, circuit GD126 (BK/WH) harness side.

  - (RH) C626-7, circuit GD139 (BK/YE) harness side.
- **Is the resistance less than 5 ohms?**

  YES : CHECK the LH or RH exterior mirror jumper harness between the vehicle harness and the exterior mirror glass for open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new LH or RH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new LH or RH exterior mirror glass. REFER to **Exterior Mirror Glass**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test F: The Auto-Dimming Mirror Does Not Operate Correctly

Refer to **SYSTEM WIRING DIAGRAMS** , Power Mirrors for schematic and connector information.

Normal Operation

The interior auto-dimming mirror receives power from circuit CBP02 (GN) and ground from circuit GD139 (BK/YE). If equipped with a LH exterior auto-dimming mirror, and the auto-dimming feature is activated, voltage is sent from the interior mirror to the LH exterior mirror though circuit LRD12 (BU/GY). Ground for the LH exterior mirror is provided by the interior mirror through circuit RRD12 (BN). When the vehicle is placed in REVERSE, voltage is sent to the interior mirror through circuit CBP12 (GN/WH) and the interior mirror will turn the dimming feature off. There are 2 photoelectric sensors: one in the front of the interior rear view mirror and one mounted on the glass side of the mirror. If the sensors are blocked, the interior auto-dimming mirror might not work correctly. Always verify both sensors are not physically blocked before attempting to diagnose auto-dimming mirror concerns.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Interior auto-dimming mirror
- LH exterior mirror glass
- LH exterior mirror

PINPOINT TEST F: THE AUTO-DIMMING MIRROR DOES NOT OPERATE CORRECTLY

NOTE:	**If the transmission range (TR) sensor is malfunctioning and the backup lamps are on all the time or do not turn on, the auto-dimming interior mirror will not darken or return to normal view.**

F1 CHECK THE OPERATION OF THE BACKUP LAMPS

- Key in ON position.
- Move the selector lever through the entire range.
- **Do the backup lamps illuminate only in REVERSE?**

  YES : Lincoln only: If the LH exterior mirror only is always dim, REPAIR circuit LRD12

(BU/GY) for a short to voltage. TEST the system for normal operation.

Lincoln only: If the LH exterior mirror only does not dim correctly, go to F10 .

Lincoln only: If the interior mirror only does not dim correctly and the LH exterior mirror does dim correctly, INSTALL a new interior mirror, REFER to **Auto-Dimming Interior Mirror**. TEST the system for normal operation.

Lincoln only: If the LH exterior mirror and interior mirror does not dim correctly, go to F2 .

Ford and Mercury only: If the interior mirror does not operate correctly, go to F2 .

NO : REFER to **EXTERIOR LIGHTING** article to diagnose the backup lamps.

F2 VERIFY THAT THE FORWARD AND REARWARD FACING SENSORS ARE NOT BLOCKED

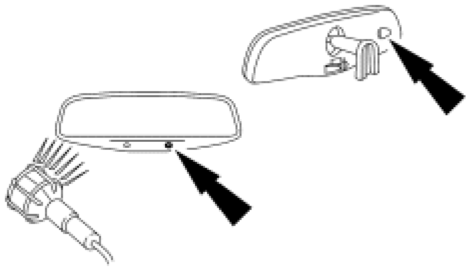
- Visually verify that the forward and rearward facing sensors are not blocked. Sources of blockage can include:
  - stickers, window decals or tags.
  - fold-down screens for TVs or DVD players.
  - non-OEM window tinting.
- **Were either of the sensors blocked?**

  YES : If possible, REMOVE the blockage. TEST the system for normal operation. If the blockage cannot be removed, REVIEW the operation of the interior auto-dimming mirror with the customer.

  NO : Go to F3.

F3 CHECK THE OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - DAYLIGHT CONDITIONS

- Key in ON position.



N0057545

Fig. 58: Checking Operation Of Interior Auto-Dimming Mirror - Daylight Conditions
Courtesy of FORD MOTOR CO.

- Use a bright lamp to simultaneously illuminate the forward-facing sensor and the rearward-facing sensor. The mirror should adjust to a high reflectance mode (mirror will be clear).
- **Does the mirror adjust to the high reflectance (clear) mode?**

  YES : Go to F4.

  NO : INSTALL a new interior mirror. REFER to **Auto-Dimming Interior Mirror**. TEST the system for normal operation.

F4 CHECK THE OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - NIGHT

TIME CONDITIONS WITH GLARE

- Key in ON position.

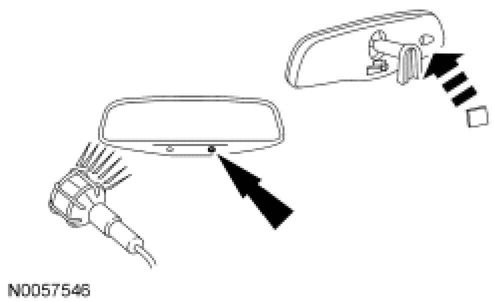


Fig. 59: Checking Operation Of Interior Auto-Dimming Mirror - Night Time Conditions With Glare
Courtesy of FORD MOTOR CO.

- Simulate night time conditions with glare:

  NOTE: Covering the sensor with a finger or hand is not adequate.

  - cover the forward-facing sensor with black electrical tape or other dark material.
  - illuminate the rearward-facing sensor. The mirror should darken to a lower reflectance mode.
- **Did the mirror darken to a lower reflectance (darker) mode?**

  YES : Go to F5.

  NO : Go to F7.

F5 CHECK THE OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - NIGHT TIME CONDITIONS WITHOUT GLARE

- Key in ON position.

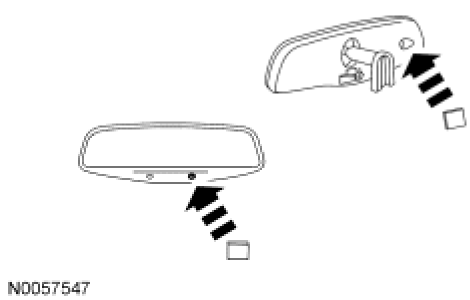


Fig. 60: Checking Operation Of Interior Auto-Dimming Mirror - Night Time Conditions Without Glare
Courtesy of FORD MOTOR CO.

- Simulate night time conditions without glare:

NOTE: Covering the sensor with a finger or hand is not adequate.

- cover the forward-facing sensor with black electrical tape or other dark material.
- cover the rearward-facing sensor. The mirror should adjust to the high reflectance mode.

- **Did the mirror adjust to the high reflectance (clear) mode?**

  YES : Go to F6.

  NO : Go to F7.

F6 CHECK THE OPERATION OF THE INTERIOR AUTO-DIMMING MIRROR - NIGHT TIME CONDITIONS WITH THE VEHICLE IN REVERSE

- Key in ON position.

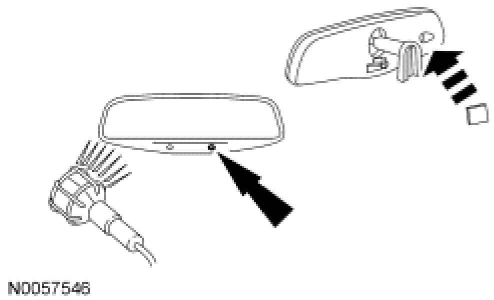


Fig. 61: Checking Operation Of Interior Auto-Dimming Mirror - Night Time Conditions With Glare
Courtesy of FORD MOTOR CO.

- Simulate night time conditions with glare:

NOTE: Covering the sensor with a finger or hand is not adequate.

- cover the forward-facing sensor with black electrical tape or other dark material.
- illuminate the rearward-facing sensor.

- Select REVERSE.
- **Did the mirror adjust to a high reflectance (clear) mode?**

  YES : The system is operating normally at this time. REVIEW operation of the interior auto-dimming mirror feature with the customer.

  NO : Go to F7.

F7 CHECK CIRCUIT CBP02 (GN) FOR VOLTAGE

- Key in OFF position.
- Disconnect: Interior Mirror C911 (without microphone) or C9030 (with microphone)
- Key in ON position.

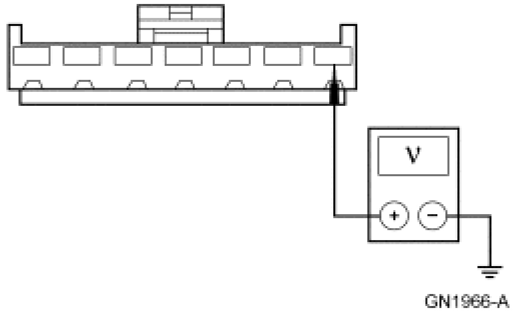


Fig. 62: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

NOTE: Without microphone.

- Measure the voltage between interior mirror C911-1, circuit CBP02 (GN) harness side and ground.

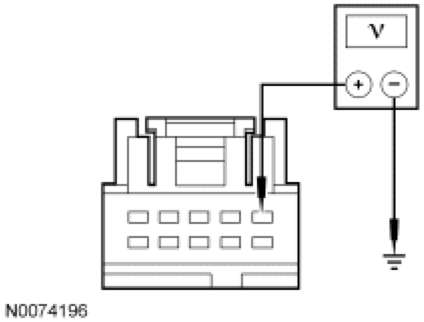


Fig. 63: Measuring Voltage Between Interior Mirror C911-1, Circuit CBP02 (GN) Harness Side & Ground
Courtesy of FORD MOTOR CO.

NOTE: With microphone.

- Measure the voltage between interior mirror C9030-1, circuit CBP02 (GN) harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to F8.

  NO : VERIFY smart junction box (SJB) fuse 12 (7.5A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

F8 CHECK CIRCUIT GD139 (BK/YE) FOR AN OPEN

- Key in OFF position.

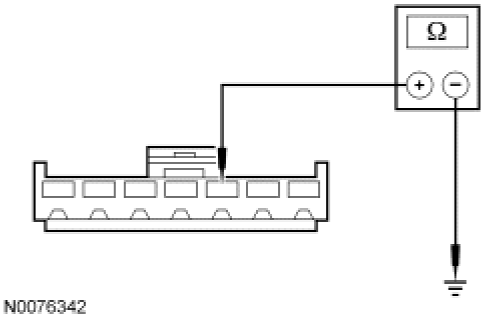


Fig. 64: Checking Circuit GD139 (BK/YE) For An Open
Courtesy of FORD MOTOR CO.

NOTE: Without microphone.

- Measure the resistance between interior mirror C911-3, circuit GD139 (BK/YE) harness side and ground.

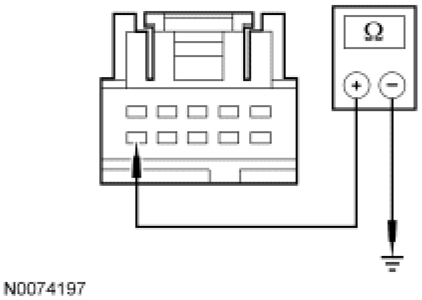


Fig. 65: Measuring Resistance Between Interior Mirror C911-3, Circuit GD139 (BK/YE) Harness Side & Ground
Courtesy of FORD MOTOR CO.

NOTE: With microphone.

- Measure the resistance between interior mirror C9030-10, circuit GD139 (BK/YE) harness side and ground.
- **Is the resistance less than 10 ohms?**

  YES : Go to F9.

  NO : REPAIR the circuit. TEST the system for normal operation.

F9 CHECK CIRCUIT CBP12 (GN/WH) FOR VOLTAGE

- Key in ON position.
- Select REVERSE.

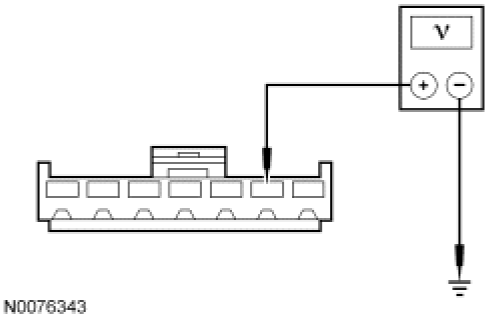


Fig. 66: Checking Circuit CBP12 (GN/WH) For Voltage
Courtesy of FORD MOTOR CO.

NOTE: Without microphone.

- Measure the voltage between interior mirror C911-2, circuit CBP12 (GN/WH) harness side and ground.

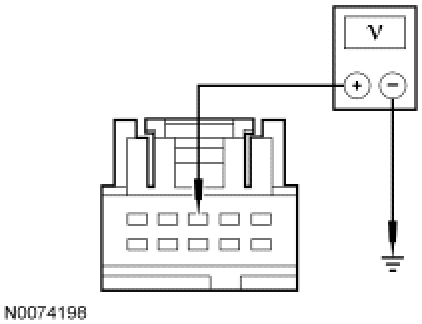


Fig. 67: Measuring Voltage Between Interior Mirror C911-2, Circuit CBP12 (GN/WH) Harness Side & Ground
Courtesy of FORD MOTOR CO.

NOTE: With microphone.

- Measure the voltage between interior mirror C9030-3, circuit CBP12 (GN/WH) harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new interior mirror. REFER to **Auto-Dimming Interior Mirror**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

F10 CHECK CIRCUIT LRD12 (BU/GY) FOR VOLTAGE

- Key in OFF position.
- Disconnect: LH Exterior Mirror C522
- Key in ON position.

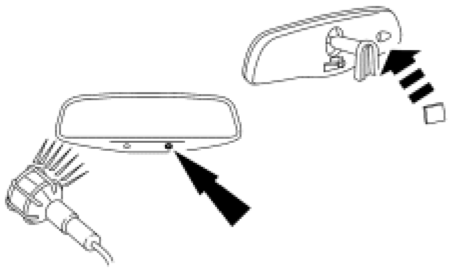


Fig. 68: Checking Operation Of Interior Auto-Dimming Mirror - Night Time Conditions With Glare
Courtesy of FORD MOTOR CO.

- Simulate night time conditions with glare:

NOTE: Covering the sensor with a finger or hand is not adequate.

  - cover the forward-facing sensor with black electrical tape or other dark material.
  - illuminate the rearward-facing sensor. The mirror should darken to a lower reflectance mode.

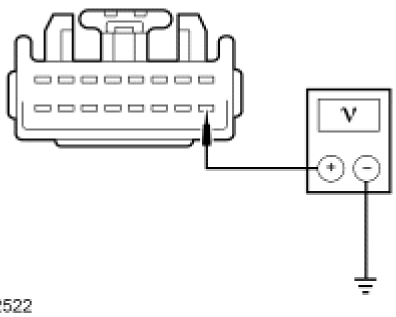


Fig. 69: Checking Circuit LRD12 (BU/GY) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between LH exterior mirror C522-9, circuit LRD12 (BU/GY) harness side and ground.
- **Is the voltage greater than 1 volt?**

  YES : Go to F11.

  NO : Go to F13.

F11 CHECK CIRCUIT RRD12 (BN) FOR GROUND

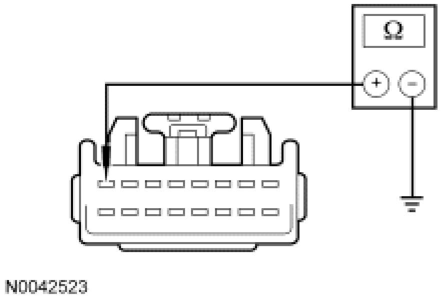


Fig. 70: Checking Circuit RRD12 (BN) For Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between LH exterior mirror C522-8, circuit RRD12 (BN) harness side and ground.
- **Is the resistance less than 15 ohms?**

  YES : CHECK the LH exterior mirror jumper harness between the vehicle harness and the exterior mirror glass for shorted or open circuits and damaged or pushed-out pins. If the jumper harness is not OK, REPAIR the jumper harness. If the jumper harness cannot be repaired, INSTALL a new LH exterior mirror. REFER to **Exterior Mirror**. If the jumper harness is OK, INSTALL a new LH exterior mirror glass. REFER to **Exterior Mirror Glass**. TEST the system for normal operation.

  NO : Go to F12.

F12 CHECK CIRCUIT RRD12 (BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Interior Mirror C911 (without microphone) or C9030 (with microphone)

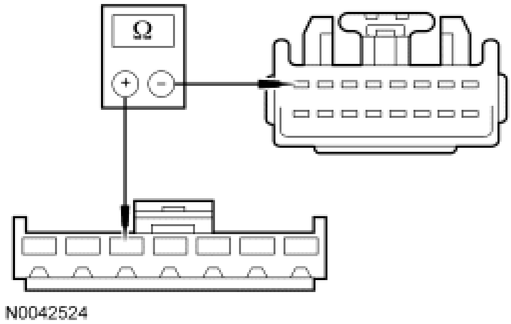


Fig. 71: Checking Circuit RRD12 (BN) For Open
Courtesy of FORD MOTOR CO.

NOTE: Without microphone.

- Measure the resistance between interior mirror C911-5, circuit RRD12 (BN) harness side and LH exterior mirror C522-8, circuit RRD12 (BN) harness side.

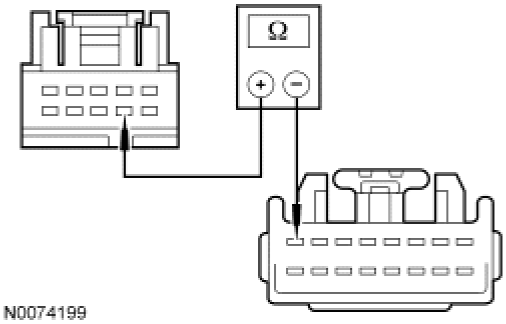


Fig. 72: Measuring Resistance Between Interior Mirror C911-5 & C522-8, Circuit RRD12 (BN) & RRD12 (BN) Harness Side
Courtesy of FORD MOTOR CO.

NOTE: **With microphone.**

- Measure the resistance between interior mirror C9030-7, circuit RRD12 (BN) harness side and LH exterior mirror C522-8, circuit RRD12 (BN) harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL new interior mirror. REFER to **Auto-Dimming Interior Mirror**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

F13 CHECK CIRCUIT LRD12 (BU/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: Interior Mirror C911 (without microphone) or C9030 (with microphone)

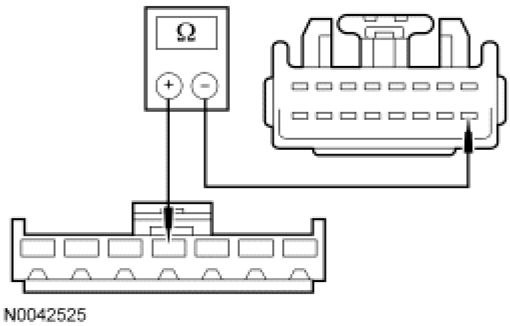


Fig. 73: Checking Circuit LRD12 (BU/GY) For Open
Courtesy of FORD MOTOR CO.

NOTE: **Without microphone.**

- Measure the resistance between LH exterior mirror C522-9, circuit LRD12 (BU/GY) harness side and interior mirror C911-4, circuit LRD12 (BU/GY) harness side.

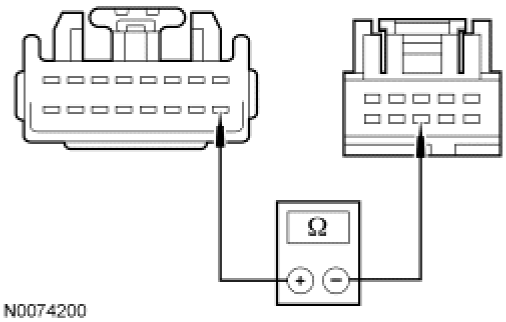


Fig. 74: Measuring Resistance Between LH Exterior Mirror C522-9 & C911-4, Circuit LRD12 (BU/GY) & LRD12 (BU/GY) Harness Side
Courtesy of FORD MOTOR CO.

NOTE: With microphone.

- Measure the resistance between LH exterior mirror C522-9, circuit LRD12 (BU/GY) harness side and interior mirror C9030-8, circuit LRD12 (BU/GY) harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to F14.

  NO : REPAIR the circuit. TEST the system for normal operation.

F14 CHECK CIRCUIT LRD12 (BU/GY) FOR A SHORT TO GROUND

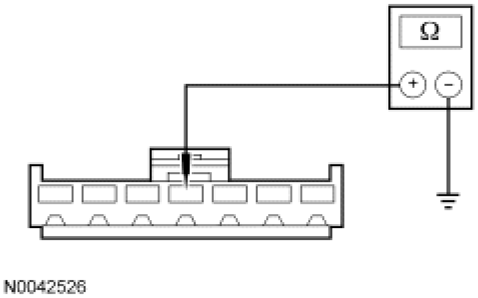


Fig. 75: Measuring Resistance
Courtesy of FORD MOTOR CO.

NOTE: Without microphone.

- Measure the resistance between interior mirror C911-4, circuit LRD12 (BU/GY) harness side and ground.

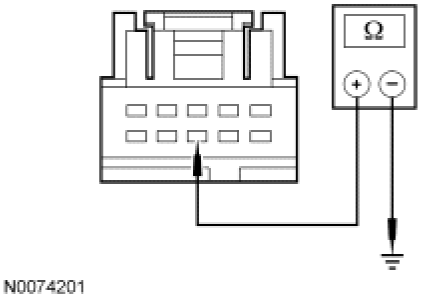


Fig. 76: Measuring Resistance Between Interior Mirror C911-4, Circuit LRD12 (BU/GY) Harness Side & Ground
Courtesy of FORD MOTOR CO.

NOTE: With microphone.

- Measure the resistance between interior mirror C9030-8, circuit LRD12 (BU/GY) harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : INSTALL new interior mirror. REFER to **Auto-Dimming Interior Mirror**. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

REMOVAL AND INSTALLATION

EXTERIOR MIRRORS - EXPLODED VIEW

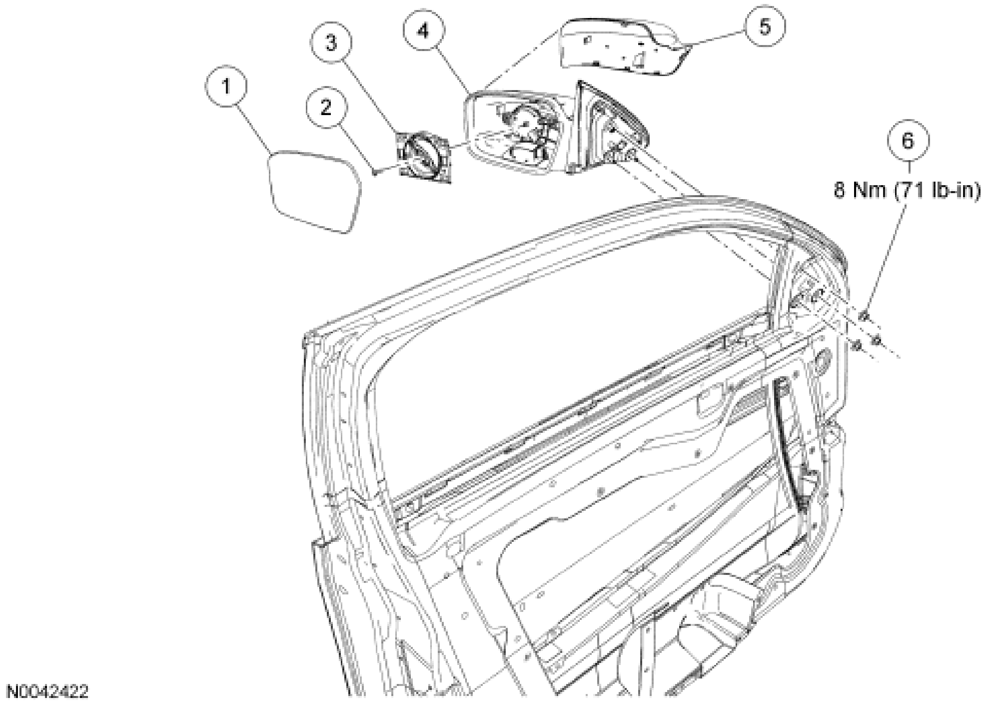


Fig. 77: Exploded View Of Exterior Mirrors With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	17K707	Exterior mirror glass
2	-	Exterior mirror motor screw
3	17D696	Exterior mirror motor
4	17682	Exterior mirror
5	17D742	Exterior mirror cover
6	N621906	Exterior mirror nut (3 required)

1. For additional information, refer to the procedures.

EXTERIOR MIRROR

REMOVAL AND INSTALLATION

1. Remove the front door trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Remove the front door sail panel.
   - If equipped, disconnect the speaker electrical connector.

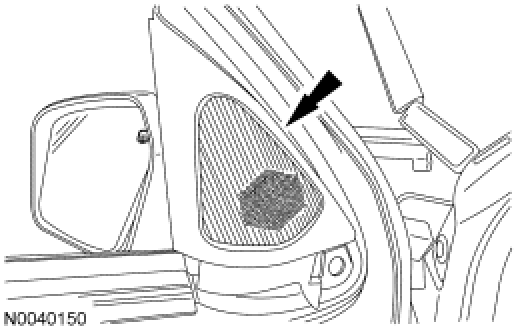


Fig. 78: Locating Front Door Sail Panel
Courtesy of FORD MOTOR CO.

3. Disconnect the exterior mirror electrical connector.

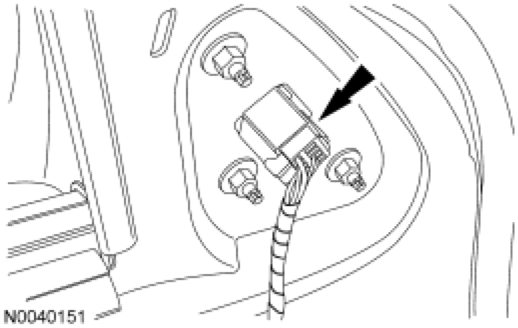


Fig. 79: Locating Exterior Mirror Electrical Connector
Courtesy of FORD MOTOR CO.

4. Remove the 3 exterior mirror nuts and the exterior mirror.
   - To install, tighten to 8 Nm (71 lb-in).

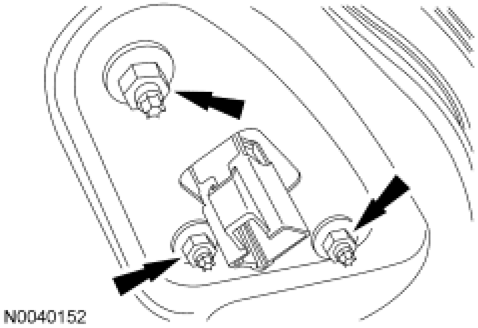


Fig. 80: Locating Exterior Mirror Bolts
Courtesy of FORD MOTOR CO.

5. To install, reverse the removal procedure.

EXTERIOR MIRROR GLASS

REMOVAL

1. Position the exterior mirror glass in the full down position.

WARNING: **Place a shop towel between the hands and the exterior mirror glass for protection in case of glass breakage during mirror service. Failure to follow this instruction may result in serious personal injury.**

2. Pull the upper edge of the exterior mirror glass outward and then upward to release the locking tabs from the exterior mirror motor.

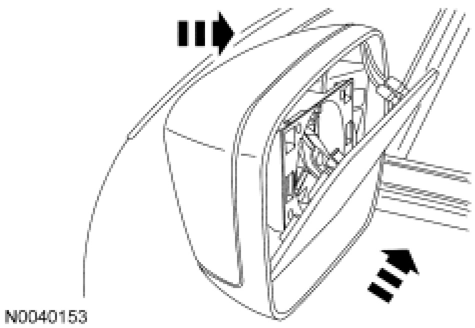


Fig. 81: Pulling Upper Edge Of Exterior Rear View Mirror Glass Outward And Upward
Courtesy of FORD MOTOR CO.

3. If equipped with heated mirrors, disconnect the electrical connectors from the exterior mirror glass.

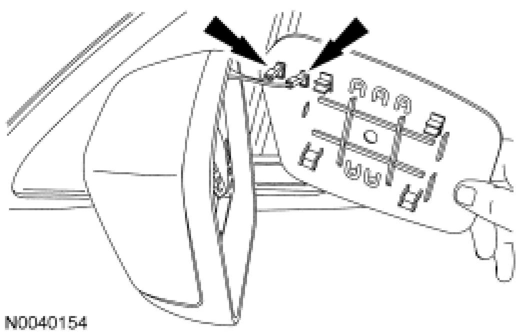


Fig. 82: Locating Electrical Connectors From Exterior Mirror Glass
Courtesy of FORD MOTOR CO.

INSTALLATION

1. If equipped with heated exterior mirrors, connect the electrical connectors to the exterior mirror glass.

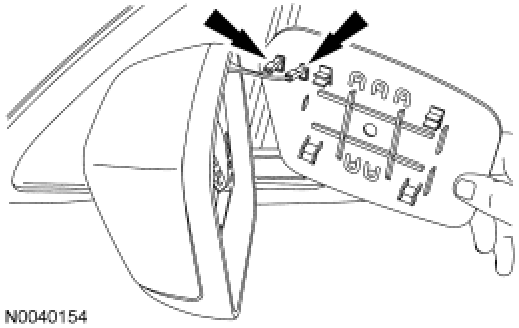


Fig. 83: Locating Electrical Connectors From Exterior Mirror Glass
Courtesy of FORD MOTOR CO.

2. Install the lower exterior mirror glass onto the exterior mirror motor.
3. Position the exterior glass upward.

WARNING: **Place a shop towel between the hands and the exterior mirror glass for protection in case of glass breakage during mirror service. Failure to follow this instruction may result in serious personal injury.**

NOTE: An audible click will be heard during installation.

4. Place a hand against the back of the exterior mirror and a hand flat against the upper exterior mirror glass and press the exterior mirror glass into the upper exterior mirror motor retainers.

EXTERIOR MIRROR MOTOR

1. Remove the exterior mirror glass. For additional information, refer to **Exterior Mirror Glass**.
2. Remove the exterior mirror motor screw.

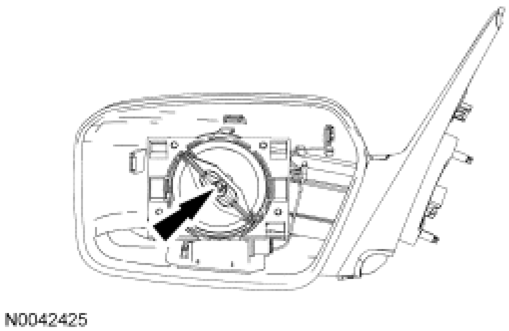


Fig. 84: Locating Screw From Center Of Exterior Rear View Mirror Motor
Courtesy of FORD MOTOR CO.

NOTE: Use a flat-blade screwdriver to remove the exterior mirror motor from the clips.

3. Remove the exterior mirror motor from the 3 mounting clips.
   - Disconnect the electrical connector.

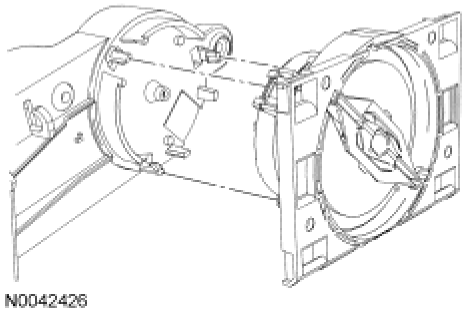


Fig. 85: Identifying Exterior Rear View Mirror Motor From Clips On Bracket
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

EXTERIOR MIRROR COVER

1. Remove the exterior mirror glass. For additional information, refer to **Exterior Mirror Glass**.
2. Depress the 3 tabs and remove the exterior mirror cover.

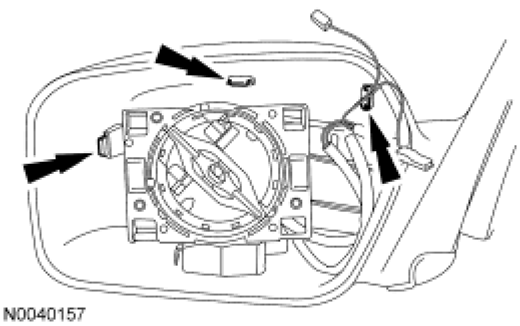


Fig. 86: Locating Exterior Mirror Cover Tabs
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.

EXTERIOR MIRROR CONTROL SWITCH

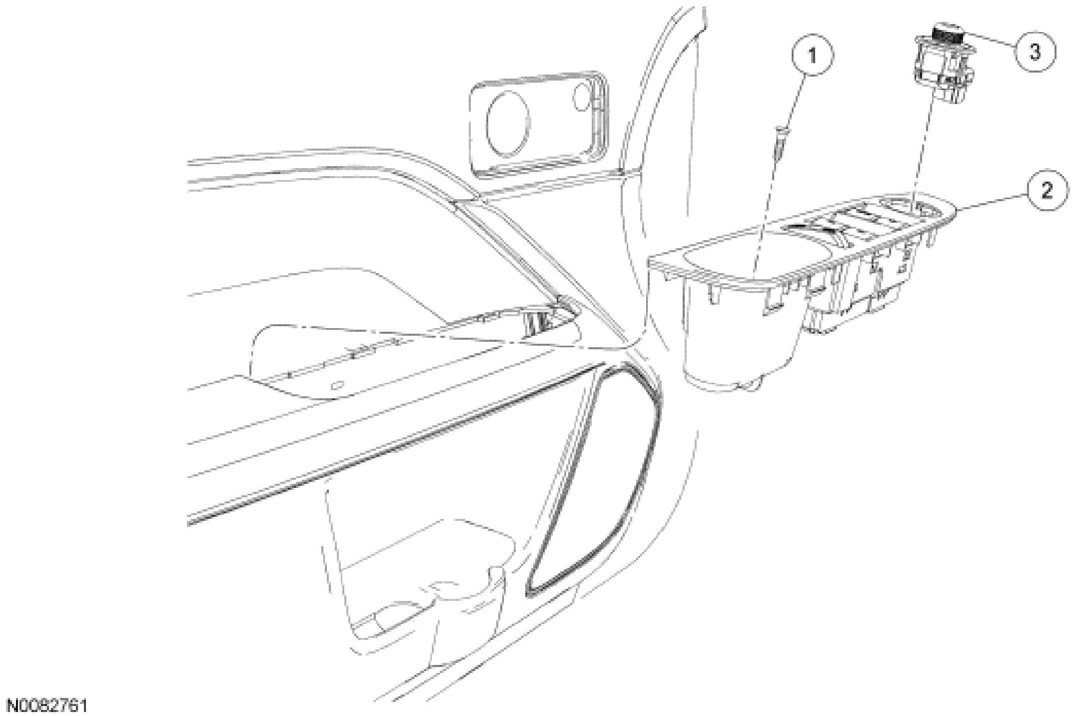


Fig. 87: Exploded View Of Exterior Mirror Control Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Window control switch screw
2	-	Window control switch bezel
3	17B676	Exterior mirror control switch

REMOVAL AND INSTALLATION

1. Remove the window control switch bezel in the following sequence.
    1. Remove the window control switch screw.
    2. Disconnect the electrical connectors.
2. Remove the exterior mirror control switch.
    - Depress the 2 locking tabs.

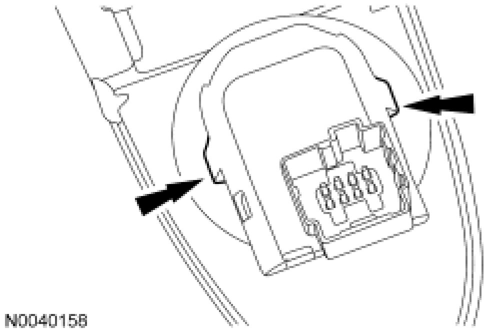
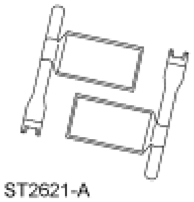


Fig. 88: Locating Exterior Mirror Control Switch Locking Tabs
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.

INTERIOR REAR VIEW MIRROR

Special Tools

Illustration	Tool Name	Tool Number
	Mirror Remover	501-D118
	Installer, Rear View Mirror	501-025 (T94P-17700-AH)

REMOVAL

NOTE: Twisting the interior rear view mirror base from right to left may cause a stress fracture to the windshield.

1. Remove the wire cover (if equipped).
2. Remove the compass by pulling down on the compass rearmost edge (if equipped).
3. Insert the special tool between the mirror mount and windshield bracket from the bottom.

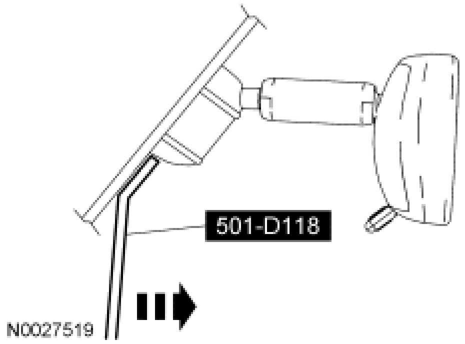


Fig. 89: Inserting Special Tool
Courtesy of FORD MOTOR CO.

4. Release the mirror mount from windshield bracket by pulling the tool away from the windshield.

INSTALLATION

1. Slide the mirror mount over the windshield bracket from the top and adjust the mirror to the upward position.

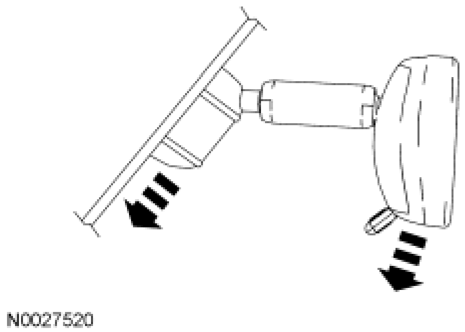


Fig. 90: Installing Mirror Mount Over The Windshield Bracket
Courtesy of FORD MOTOR CO.

2. Using the special tool, press the mirror assembly downward along the windshield until the mount is seated on the windshield bracket.

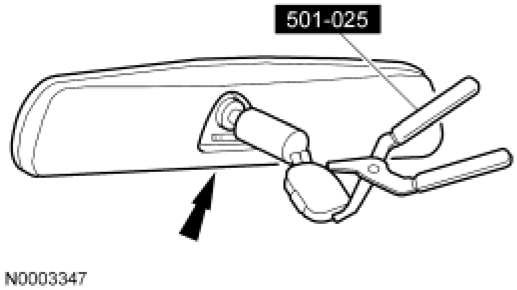
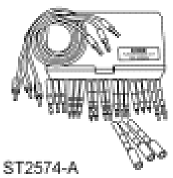


Fig. 91: Locating Mirror Assembly
Courtesy of FORD MOTOR CO.

3. Install compass and wire cover (if equipped).

AUTO-DIMMING INTERIOR MIRROR

Special Tools

Illustration	Tool Name	Tool Number
 ST2574-A	Mirror Remover	501-D118

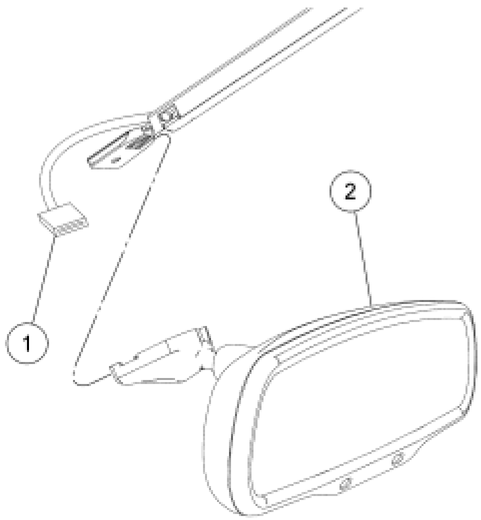


Fig. 92: Exploded View Of Auto-Dimming Interior Mirror
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Interior auto-dimming mirror electrical connector (part of 14A005)
2	17700	Interior auto-dimming mirror

REMOVAL

1. Remove the wire cover.
2. Disconnect the electrical connector.

3. Insert the special tool between the mirror mount and windshield bracket from the top.

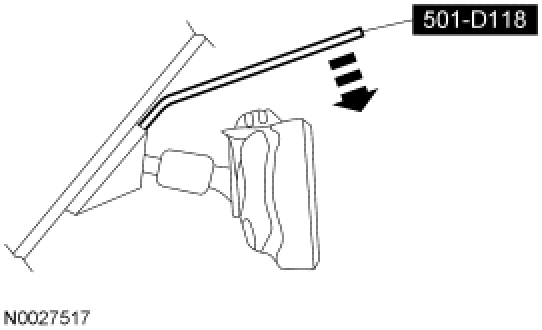


Fig. 93: Inserting Special Tool Between Mirror Mount & Windshield Bracket
Courtesy of FORD MOTOR CO.

NOTE: Twisting the interior rear view mirror base from right to left may cause a stress fracture to the windshield.

4. Release the mirror mount from the windshield bracket by pulling the tool and mirror down and away from the windshield.

INSTALLATION

1. Slide the mirror mount over the windshield bracket from the top and adjust the mirror to the upward position.

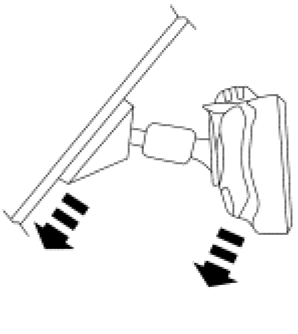


Fig. 94: Sliding Mirror Mount Over Windshield Bracket
Courtesy of FORD MOTOR CO.

2. Quickly press the mirror assembly downward along the windshield until a click is felt. The click indicates the base is engaged to the windshield bracket.
3. Connect the electrical connector and wire cover.
4. If equipped, check the compass zone and calibration. For additional information, refer to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

2008 ENGINE PERFORMANCE

Reference Values - Gasoline Engines

REFERENCE VALUE SYMPTOM CHART

The Reference Value Symptom Chart provides guidance in selecting the appropriate parameter identification (PID) or measured signal related to the fault area. Select a symptom from the symptom chart along with the category number and go to the PID/Measured Signal Chart. For multiple symptoms, select the symptom that is the most evident.

SYMPTOM CHART

Symptom Occurs During	Symptom	Category Number
Startup:	No start/Normal crank Hard start/Long crank Stall after start Diesels/Runs on	1 2 3 4
Idle:	MIL Stalls/Quits Slow Slow return Rolling Fast Rough Misses Backfires	5 6 7 8 9 10 11 12 13
Acceleration:	Stalls/Quits Misses Bucks/Jerks Backfires Hesitation Lack/Loss of power Surge Spark knock Cooling system temperature Poor fuel economy Emissions compliance	6 12 14 13 15 16 17 18 19 20 21
Cruise:	Stalls/Quits Misses Bucks/Jerks	6 12 14

	Backfires Lack/Loss of power Surge Spark knock Cooling system temperature Poor fuel economy Emissions compliance	13 16 17 18 19 20 21
Deceleration:	Stalls/Quits Backfires	6 13
Transmission Operation: (Automatic)	Shift/engagement concerns No overdrive	22 23

REFERENCE VALUE PARAMETER IDENTIFICATION (PID)/MEASURED SIGNAL CHART

The following listing reflects PIDS and/or measured values which may reveal a possible concern within each system shown. Match the category number with the related PID/measured signal and go to the Typical Diagnostic Reference Value Charts.

PID/MEASURED SIGNAL CHART

Category Number	Related PIDS/Measured Signals
5-9-10-17	WAC/ACCR
5-9-10-17	ACCS
5-10-17	ACP
5-10-17	ACP V
5-21	AIR
5-21	AIRF
5-21	AIRM
1-23	APP1
1-23	APP2
1-23	APP3
23	BPP (BOO)
18-19	CHT
18-19	CHT V
1-2-3-5-6-7-11-12-13-14-15-16-17-20-21	CMP
1-2-3-5-6-7-11-12-13-14-15-16-17-20-21	CKP
1-2-3-5-6-7-11-12-13-14-15-16-17-20-21	CMP1/2

10	CPP/PNP
3-5-6-7-9-11-15-16-20-21	DPFEGR
4-18-19-21-22	ECT[a]
4-18-19-21-22	ECT V
3-5-6-7-9-11-15-16-20-21	EGRMC1-4
3-5-6-7-9-11-15-16-20-21	EGRMDSD
3-5-6-7-9-11-15-16-20-21	EGRVR
5-18-19-20-21	EOT
5-18-19-20-21	EOT V
22	EPC/EPC1/EPC2/EPC3
22	EPC V
3-5-6-11-21	EVAPCV
3-5-6-11-21	EVAPPDC
3-5-6-11-21	EVMV
19	FCV 3
20	FLI (H)
20	FLI V
1 thru 21	FP
1 thru 21	FPM or FP M
1 thru 21	FRP
1 thru 21	FRP V
1 thru 21	FRT
5	FTP
1 thru 21	FUELPW1/2
1 thru 21	FUELSYS (OL/CLSD-LP)[a]
22-23	GEAR
5	GENMON
19	HFC (FC3)
1 thru 21	HTR11/12/13/21/22
1 thru 21	IAC
2-3-5-7-8-10-22	IAT[a]
2-3-5-7-8-10-22	IAT2[a]
5-14-15-16-17-20	IMRC
5-14-15-16-17-20	IMRCM
5-14-15-16-17-20	IMTV
6-11-12-14 thru 18-20-21	INJ x F
4-5-16-18-19-20-21	KNOCK 1[a]
4-5-16-18-19-20-21	KNOCK 2[a]
19	LFC (FCI)
1 thru 21	LONGFT1/2[a]

1 thru 23	MAF[a]
1 thru 23	MAP
1 thru 22	MISF
1 thru 21	HO2S11/12/13/21/22
22	OSS
10	PSP
10	PSPT
5	PTO
1 thru 23	RPM[a]
5-14-16-17	SCBC
5-14-16-17	SCIPC
1 thru 21	SHRTFT1/2/11/12/21/22
15-16-18-19-20-21	SPRKADV[a]
22-23	SS1(SSA)/SS2(SSB)/SS3(SSC)/SS4(SSD)
1-23	TACM (-)
1-23	TACM (+)
6-14-16-20	TCC
22	TCIL
22-23	TCS
22-23	TFT
1-23	TP
1-23	TP1 NS
1-23	TP2 PS
1-23	TP V
22-23	TR
22-23	TR 1-4
22-23	TR V
22-23	TR D
22-23	TSS
2-4-5-9-10-11-16-17-18-19-20-21	VCT
2-4-5-9-10-11-16-17-18-19-20-21	VCTDC1/2
1-2-3-5-6-11-12-13-14	VPWR
22-23	VSS

[a] Generic PID

Some signals can only be measured and require the use of a digital multimeter (DMM).

TYPICAL DIAGNOSTIC REFERENCE VALUES

NOTES:

Footnotes are referenced throughout the Typical Diagnostic Reference Value Charts. A letter in parentheses next to a value indicates supplemental information is applicable.

An attempt is made to provide as much information as possible; some vehicles may not display all input and output signals.

The Typical Diagnostic Reference Value Charts do not display fault parameter identifications (PIDs). These are PIDs which indicate a hard fault with the circuit. They display a value of YES or NO and are PIDs ending with the letter F.

Reference values may vary 20% depending on operating conditions, altitude, and other factors. RPM values are axle and tire dependent.

Values are taken at an altitude of approximately Meters 55.7 (600 ft) above sea level.

Refer to the Introduction part, Acronyms and Definitions for technical terms applicable to Ford Motor Company products.

Refer to**PARAMETER IDENTIFICATION (PID)** , for PID descriptions.

For detailed transmission diagnostics, refer to the Workshop article. Transmission signals may be referred to in either alpha or numeric form. For example, 1=A, 2=B, 3=C.

A. A/C on.
B. Cooling fan on (single, low or high speed).
C. Heated oxygen sensors (HO2S) should switch from rich to lean at least once every 3 seconds. HO2S voltage should toggle above and below 0.450 DCV and never be a negative value. Valid HO2S switching occurs only during closed loop fuel control operation.
D. Downstream HO2S(s) stay close to a constant voltage when the catalyst monitor is off (positive value only). When the catalyst monitor is on, the HO2S switches rich to lean above and below 0.450 DCV and never be a negative value. For downstream HO2S(s) (12, 13, 22) greater activity results when the catalyst monitor is active.
E. Brake pedal applied.
F. The electric vapor management valve (VMV) commanded current varies from 0 mA - 1000 mA depending on the PCM command to purge the EVAP system.
G. While pressing the transmission control switch (TCS) or switching to manual drive mode.
H. Value is dependent on fuel tank level. Typical operating range is 15% (empty) to 90% (full).
I. Steering wheel turned.
J. Clutch pedal applied.
K. Value is dependent upon ambient air temperature and may fall outside of range.
L. Value is not useful under this condition.
M. If equipped.

N. Transmission in selected range.
O. May change state under this condition.
P. While pressing switch.
Q. Value may cycle 5-6 times every 5 seconds.
R. Canister vent duty cycles to 100% (close) when EVAP monitor test is running.
S. Refer to Workshop article part 419-01.
T. EGR voltage and duty cycle will vary from 0-VBAT or 0-100% depending on EGR demand.
U. RPM dependent. If signal is 0 Hz at idle, check signal at 900 RPM.
V. Crank position.
W. Value may vary 20% depending on altitude, operating conditions, weather, and other factors.

2.0L 4V FOCUS

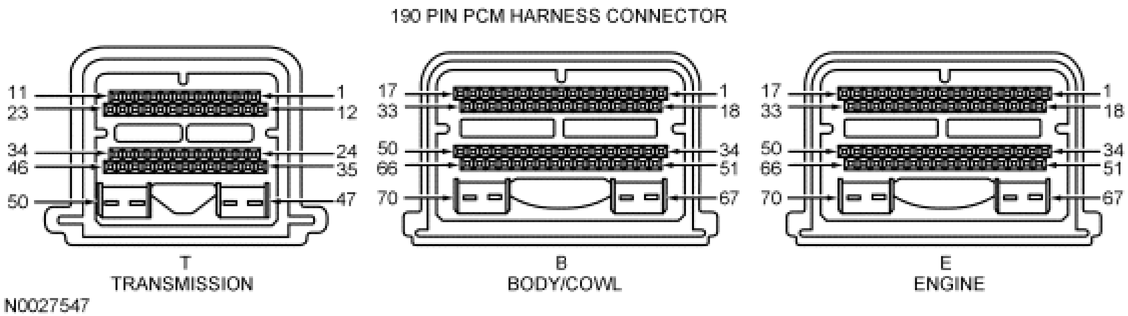


Fig. 1: 190 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
BOO1	B13	OFF	ON (E)	OFF	OFF	ON/OFF
APP1	B28	0.77/15.29	0.77/15.29	1.38/25.49	1.45/28.24	DCV/%
APP2	B29	0.38/7.45	0.38/7.45	0.69/13.73	0.73/14.51	DCV/%
ACP_PRESS	B31	1.56/66.55	1.69/74.53	1.45/59.30	1.39/55.69	DCV/PSI
FPM	B32	0	100	100	100	%
MAF	B40	0	0.6	1.83	1.87	DCV
BOO2	B46	OFF	ON (E)	OFF	OFF	ON/OFF
IAT	B47	1.78/120.2 (K)	1.99/111.2 (K)	2.53/93.2 (K)	2.66/87.8 (K)	DCV/DEG F
FTP	B65	2.6/0	2.6/0	2.6/0	2.6/0	DCV/PSI
O2S11	E11	(L)	switching (C)	switching (C)	switching (C)	DCV

CHT	E15	3.2/224.6	3.56/204.8	0.67/186.8	0.67/186.8	DCV/DEG F
IMRC1M (PZEV)	E25	0.1	0.1	4.98	4.98	DCV
MAP	E40	4.02/14.35 (W)	1.15/4.06 (W)	2.42/8.70 (W)	3.15/11.31 (W)	DCV/PSI
TP1	E44	4.10	4.33	3.90	4.06	DCV
TP2	E45	1.19	0.72	1.60	1.27	DCV
HTRCM11	E52	1.58	1.58	1.65	1.65	AMPS
O2S13 (PZEV)	T7	0.1	(D)	(D)	(D)	DCV
O2S12	T16	(L)	(D)	(D)	(D)	DCV
HTRCM12	T18	676	676	634	634	mA
TFT (A/T)	T19	118 (K)	117 (K)	147 (K)	144 (K)	DEG F
TFTV (A/T)	T19	1.9 (K)	1.9 (K)	1.3 (K)	1.4 (K)	DCV
PSP	T29	OFF	OFF	OFF	OFF	ON/OFF
TCC (A/T)	T30	0	0	0	99.61	%
TSS_SRC (A/T)	T37	0	731	1513	1844	RPM
APP	PID	0	0	19	21	%
APP_ MAXDIFF	PID	0	0	0	-0.06	DEG
BARO	PID	14.5/29.53	14.5/29.53	14.5/29.53	14.5/29.53	PSI/IN HG
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	MODE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.73	1.48	7.79	8.25	DEG
ETC_DSD	PID	7.60	1.45	7.71	8.12	DEG
ETC_TRIM	PID	0	0	0.01	0.02	DEG
GENMON	PID	0	54.9	18.96	22.1	%
LOAD	PID	0 (L)	27	55.29	74.9	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	702	2527	1887	RPM
TP_MAXDIFF	PID	-4	-8	-8	-8	DEG
TR (A/T)	PID	PARK	PARK	OVERDRIVE	OVERDRIVE	MODE
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FP	B19	0/OFF	100/ON	100/ON	100/ON	%/ON-OFF
EVAPCV	B20	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVMV	B55	0/OFF	0/OFF	500-900 (F)/VARYING	500-900 (F)/VARYING	mA/OFF-VARYING

IMRC (PZEV)	E22	ON	ON	OFF	OFF	ON/OFF
HTR11	E52	OFF (O)	ON	ON	ON	ON/OFF
SSA (SS1) (A/T)	T11	OFF	ON	OFF	OFF	ON/OFF
HTR12	T18	OFF (O)	ON	ON	ON	ON/OFF
SSB (SS2) (A/T)	T23	0/OFF	0/OFF	0/OFF	100/ON	%/ON-OFF
HTR13 (PZEV)	T25	OFF (O)	ON	ON	ON	ON/OFF
EGRPCT	PID	0	0.78	43.14	49.02	%
EGR_STEP	PID	0	1	23	26	0-52
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAPSOAK	PID	YES	YES	YES	YES	YES/NO
FUELSYS1	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
GENCMD	PID	0	0 (Q)	0 (Q)	0 (Q)	%
HFC	PID	OFF	ON (B)	OFF	OFF	ON/OFF
LFC	PID	OFF	ON (B)	OFF	OFF	ON/OFF
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LOOP_ CONTRL	PID	OPEN	OPEN	CLOSED	CLOSED	OPEN/ CLOSED
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	9.75	39.75	23.75	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VREF	B52, E63, T70	5	5	5	5	DCV
VPWR	B67/68	VBAT	VBAT	VBAT	VBAT	DCV

2.3L 4V FUSION/MILAN

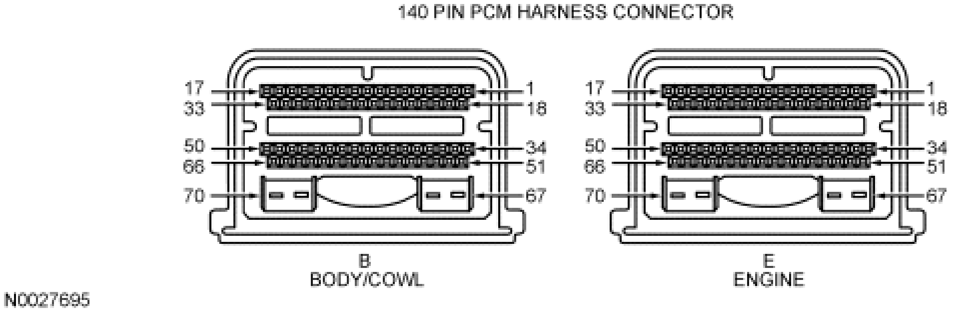


Fig. 2: Identifying 140 Pin PCM Harness Connectors/Terminals
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
APP1	B25	4.1	4.1	3.8	3.8	DCV
APP2	B26	1.5	1.5	1.6	1.7	DCV
APP3	B27	1.0	1	1	1.1	DCV
FPM	B30	OFF	ON	ON	ON	ON/OFF
MAF	B41	0	0.71	1.2	1.28	DCV
IAT	B43	1.6/126 (K)	1.71/122 (K)	3.5/54 (K)	3.43/55 (K)	DCV/DEG F
FTP	B44	2.6/-0.01	2.5/-0.02	2.3/-0.09	2.2/-0.11	DCV/PSI
BOO	B46	OFF	ON (E)	OFF	OFF	ON/OFF
BPA	B47	OFF	ON (E)	OFF	OFF	ON/OFF
AIRM (PZEV)	B50	OFF	OFF	OFF	OFF	ON/OFF
A/CT	B53	95	98.6 (A)	113	113	DEG F
A/CT_V	B53	2.46	2.38	1.98	1.98	DCV
ACP_PRESS	B63	2.4/240	2.43/243	1.65/158	1.68/162	DCV/PSI
O2S12	E3	(L)	(D)	(D)	(D)	DCV
O2S13 (PZEV)	E5	0.1	(D)	(D)	(D)	DCV
HTRCM12	E23	582	582	582	582	mA
GENMON	E26	0	40	25	21.8	%
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
CHT	E41	4.5-1/240-160	3.4/212	3.22/224	3.18/226	DCV/DEG F
KNOCK 1	E49	219	175	264	373	N/A
TP2	E60	1.15/23.14	0.66/13.33	0.93/18.43	2.12/42.35	DCV/%
TP1	E61	4.12/17.26	4.36/12.55	4.22/15.29	3.64/27.06	DCV/%
MAP	E62	4/14.35 (W)	1.15/4.06 (W)	2.66/9.42 (W)	2.87/10.29 (W)	DCV/PSI
IMTV	E64	OFF	ON	ON	ON	ON/OFF
PSP	E65	LOW	HIGH (I)	LOW	LOW	HIGH/LOW
HTRCM11	E69	1.49	1.49	1.49	1.49	AMPS
APP	PID	0	0	10.5	19	%
BARO	PID	14.3/156.2	14.3/156.2	14.3/156.2	14.3/156.2	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.25	1.25	8.43	11.69	DEG
ETC_DSD	PID	6.5	1.28	8.45	11.68	DEG

FLI	PID	36 (H)	36 (H)	40 (H)	36 (H)	%
LOAD	PID	54 (L)	17.6	19.7	22.4	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	797	1717	2434	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
AIR (PZEV)	B1	OFF	OFF	OFF	OFF	ON/OFF
EVMV	B4	0/OFF	450/ VARYING	801/ VARYING	930/ VARYING	mA/OFF-VARYING
FANVAR	B8	0	55	0	0	%
EVAPCV	B61	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
FP	B62	OFF	ON	ON	ON	ON/OFF
WAC/ACCR	B64	OFF	ON	OFF	OFF	ON/OFF
SPARKDUR_2	E11	0	2.06	1.37	781	uS
SPARKDUR_3	E12	0	2.12	1.46	719	uS
GENCMD	E13	3.79	0 (Q)	0 (Q)	0 (Q)	%
SPARKDUR_4	E16	0	2.31	1.21	719	uS
SPARKDUR_1	E17	0	2.25	1.37	656	uS
HTR12	E23	OFF	ON	ON	ON	ON/OFF
HTR13 (PZEV)	E25	ON (O)	ON	ON	ON	ON/OFF
VCTDC	E67	0	0	0	0	%
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
VCTADV	PID	0	0	-0.37	-1.06	DEG
VCTADVERR	PID	0	0	0.37	1.06	DEG
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	4.5	25.75	29.75	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B51/52	VBAT	VBAT	VBAT	VBAT	DCV

3.0L 4V FUSION/MILAN

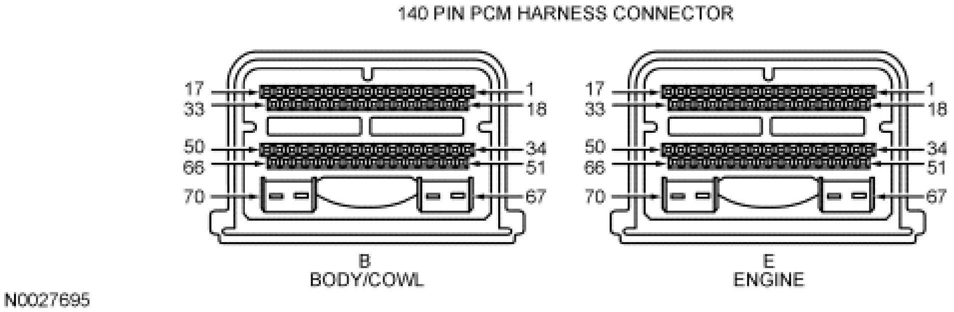


Fig. 3: Identifying 140 Pin PCM Harness Connectors/Terminals
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
APP1	B25	4	4	3.9	3.7	DCV
APP2	B26	1.5	1.5	1.6	1.8	DCV
APP3	B27	1	1	1.1	1.2	DCV
FPM	B30	OFF	ON	ON	ON	ON/OFF
MAF	B41	0	0.68	1.27	1.83	DCV
IAT	B43	1.75/120 (K)	2.02/109 (K)	3.16/64 (K)	3.22/63 (K)	DCV/DEG F
FTP	B44	2.6/-0	2.6/-0	2.57/-0.01	2.5/-0.03	DCV/PSI
BPA	B47	OFF	ON (E)	OFF	OFF	ON/OFF
A/CT	B53	3.1/73.4	3.05/75.2 (A)	4/39	3.92/42	DCV/DEG F
ACP_PRESS	B63	2.36/235	2.39/239	2.24/223	2.12/210	DCV/PSI
PSP	B65	LOW	HIGH (I)	LOW	LOW	HIGH/LOW
O2S12	E3	(L)	(D)	(D)	(D)	DCV
O2S22	E4	0.1	(D)	(D)	(D)	DCV
ECT	E18	0.45/210	0.44/210	0.53/199	0.57/196	DCV/DEG F
HTRCM12	E23	617	617	617	617	mA
HTRCM22	E24	605	605	605	605	mA
GENMON	E26	0	35.16	28.13	25	%
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN

O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
BOO	E46	OFF	ON (E)	OFF	OFF	ON/OFF
KNOCK 1	E49	654	650	1366	1621	N/A
TP2	E60	1.22/24.31	0.74/14.9	0.99/19.61	1.3/25.88	DCV/%
TP1	E61	4.05/18.82	4.29/13.73	4.17/16.47	4/19.61	DCV/%
MAP	E62	4.02/14.35 (W)	1.28/4.49 (W)	2.37/8.55 (W)	1.86/6.67 (W)	DCV/PSI
HTRCM11	E69	1.62	1.62	1.62	1.62	AMPS
HTRCM21	E70	1.58	1.58	1.58	1.58	AMPS
APP	PID	0	0	4	11	%
BARO	PID	14.48/157.4	14.48/157.4	14.48/157.4	14.48/157.4	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	8	2.62	6.45	8.93	DEG
ETC_DSD	PID	7.79	2.62	6.45	9.08	DEG
FLI	PID	73.5 (H)	73 (H)	90 (H)	83 (H)	%
LOAD	PID	65 (L)	17	19	25	%
MISFIRE	PID	NO	NO	NO	NO	ON/OFF
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	766	1600	1700	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
EVMV	B4	0/OFF	0/OFF	480/ VARYING	962/ VARYING	mA/OFF-VARYING
FANVAR	B8	0	38	32	71	%
FP	B62	OFF	ON	ON	ON	ON/OFF
WAC/ACCR	B64	OFF	ON	OFF	OFF	ON/OFF
PCVHC	E2	0	0	0	0	%
SPKDUR_6	E10	0	2.18	2.12	1.15	ms
SPKDUR_5	E11	0	2.06	1.87	1.09	ms
SPKDUR_4	E12	0	2.37	2.15	1.43	ms
GENCMD	E13	3.79	0 (Q)	0 (Q)	0 (Q)	%
SPKDUR_3	E15	0	1.71	2.12	0.875	ms
SPKDUR_2	E16	0	2.28	1.71	1	ms
SPKDUR_1	E17	0	2.4	2	1.46	ms

HTR12	E23	OFF	ON	ON	ON	ON/OFF
HTR22	E24	OFF	ON	ON	ON	ON/OFF
VCTDC	E67	0	0	41.7	39.5	%
VCTDC2	E68	0	0	43.3	33.7	%
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	READY	READY	READY	READY	READY/NOT READY
EVAPCV	PID	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	14	36	40	DEG
VCTADV	PID	0	-0.37	10.8	32	DEG
VCTADV2	PID	0	-1	8	33.7	DEG
VCTADVERR	PID	0	-0.68	0.81	1.12	DEG
VCTADVERR2	PID	0	1	1.56	-0.43	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B51/52	VBAT	VBAT	VBAT	VBAT	DCV

3.5L 4V EDGE/MKX

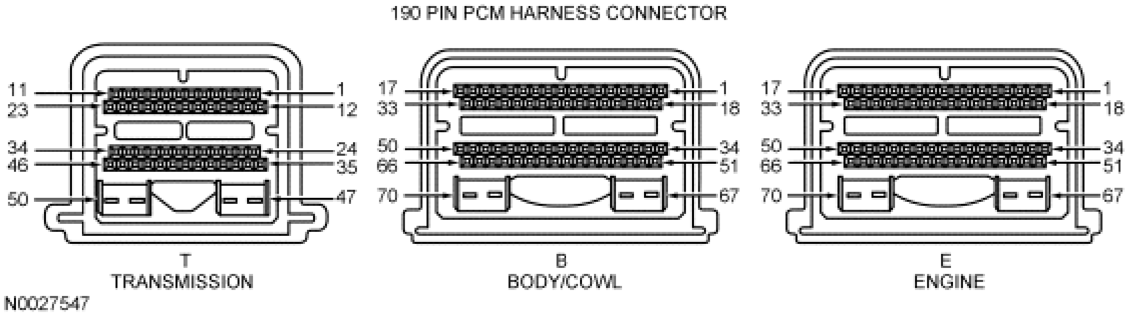


Fig. 4: 190 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
PSP	B17	0.1/LOW	VBAT/HIGH (I)	0.1/LOW	0.1/LOW	DCV/ HIGH-LOW
GENMON	B23	0	41.41	30.47	27.34	%
APP1	B25	3.9	3.9	3.5	3.3	DCV
APP2	B26	1.6	1.7	1.8	2.1	DCV
APP3	B27	1.0	1.0	1.3	1.5	DCV
FPM	B30	OFF	ON	ON	ON	ON/OFF
ACP	B37	0.8/70	0.86/73	0.9/75	1.0/87	DCV/PSI
MAF	B41	0	0.7	1.4	1.5	DCV
MAF SIGRTN	B42	0	0.6-1.9	1-1.6	1.3-2.3	DCV
IAT	B43	80 (K)	50 (K)	37 (K)	34 (K)	DEG F
FTP	B44	2.6/-0.01	2.6/-0.01	2.6/-0.01	2.6/-0.01	DCV/PSI
BOO	B46	VBAT/OFF	0.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
BPA	B47	0.1/OFF	VBAT/ON (E)	0.1/OFF	0.1/OFF	DCV/ON-OFF
FEPS	B55	0.5-0.6	0.5-0.6	0.5-0.6	0.5-0.6	DCV
HO2S12	E23	(L)	(D)	(D)	(D)	DCV
HO2S22	E24	0.1	(D)	(D)	(D)	DCV
HO2S21	E28	0	switching (C)	switching (C)	switching (C)	DCV
HO2S11	E29	(L)	switching (C)	switching (C)	switching (C)	DCV
CHT	E41	3.6/199	3.6/199	3.58/201	3.45/208	DCV/DEG F
CMP2	E44	0	5-7	13-16	20-23	Hz
CMP1	E45	0	5-7	13-16	20-23	Hz
CKP	E47	0	400-500	850-1050	1050-1150	Hz
KNOCK 1	E49	23.99k	25.01k	25.73k	44.51k	N/A
TP2	E60	1.1/25	0.8/15	1.0/19	1.4/27	DCV/%
TP1	E61	4.1/17	4.4/13	4.2/16	4.0/19	DCV/%

ACCS	PID	VBAT/OFF	VBAT/ON (A)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
APP	PID	3.9	0	0	22	%
APP_FLT	PID	NO FAULT	NO FAULT	NO FAULT	NO FAULT	FAULT/NO FAULT
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
ETC_ACT	PID	7.56	1.27	6.22	12.74	DEG
ETC_DSD	PID	7.62	1.31	6.19	12.73	DEG
ETC_TRIM	PID	0.23	0.21	0.24	0.24	DEG
FANVAR_F	PID	NO FAULT	NO FAULT	NO FAULT	NO FAULT	FAULT/NO FAULT
FLI	PID	71 (H)	72 (H)	82 (H)	81 (H)	%
LOAD	PID	51.4 (L)	16.1	35.4	34.7	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
RPM	PID	0	600	1200	1500	RPM
VSS	PID	0	0	30	55	MPH
WAC_F	PID	NO FAULT	NO FAULT	NO FAULT	NO FAULT	FAULT/NO FAULT

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
GENCMD	B22	3.79	0 (Q)	0 (Q)	0 (Q)	%
SMC	B34	0	0	0	0	DCV
CTO	B49	0	0	0	0	Hz
EVMV	B50	0	337	0	847	mA
EVAPCV	B61	0	0	0	0	%
FP	B62	8.3/75	3.6/27	3.6/27	3.8/29	DCV/%
WAC/ACCR	B64	OFF	OFF	OFF	OFF	ON/OFF
HTR12	E1	VBAT/OFF	0.2/ON	0.2/ON	0.2/ON	DCV/ON-OFF
HTR22	E2	VBAT/OFF	0.2/ON	0.2/ON	0.2/ON	DCV/ON-OFF
CD6F (CYL 6)	E10	VBAT	VBAT	VBAT	VBAT	DCV
CD5D (CYL 5)	E11	VBAT	VBAT	VBAT	VBAT	DCV
CD4B (CYL 4)	E12	VBAT	VBAT	VBAT	VBAT	DCV
CD3E (CYL 3)	E15	VBAT	VBAT	VBAT	VBAT	DCV
CD2C (CYL 2)	E16	VBAT	VBAT	VBAT	VBAT	DCV
CD1A (CYL 1)	E17	VBAT	VBAT	VBAT	VBAT	DCV
PCVHC	E33	0	0	0	0	%
TACM (+)	E34	3.7	VBAT	VBAT	VBAT	DCV
TACM (-)	E51	3.7	VBAT	VBAT	VBAT	DCV
VCTADV	E67	0	-.031	-27.56	-30.94	DEG

VCTADV2	E68	0	0	-27.69	-31.06	DEG
HTR11	E69	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
HTR21	E70	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
FANVAR	PID	0	0	0	0	%
FANDC	PID	7.5	7.5	7.5	7.5	%
FP	PID	ON/OFF	ON	ON	ON	ON/OFF
LONGFT1	PID	(L)	(-)20-(+) 20	(-)20-(+) 20	(-)20-(+) 20	%
LONGFT2	PID	(L)	(-)20-(+) 20	(-)20-(+) 20	(-)20-(+) 20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+) 10	(-)10-(+) 10	(-)10-(+) 10	%
SHRTFT2	PID	(L)	(-)10-(+) 10	(-)10-(+) 10	(-)10-(+) 10	%
SPARKADV	PID	10	13.25	44	45.25	DEG
VCTDC	PID	0	0	47.32	80	%
VCTDC2	PID	0	0	46.8	80	%
VCTADVERR	PID	0	0.18	-0.37	-0.18	DEG
VCTADVERR2	PID	0	0.06	-0.43	0	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
ETCVREF	B21/28	5	5	5	5	DCV
VREF	B33/E57	5	5	5	5	DCV
VPWR	B51/52	VBAT	VBAT	VBAT	VBAT	DCV
KAPWR	B54	VBAT	VBAT	VBAT	VBAT	DCV

3.5L 4V MKZ

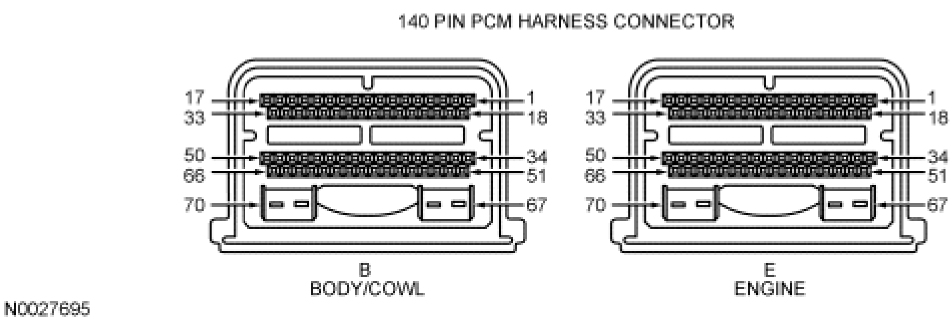


Fig. 5: Identifying 140 Pin PCM Harness Connectors/Terminals
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
APP1	B25	4.1	4.2	3.9	3.7	DCV
APP2	B26	1.6	1.7	1.9	2.1	DCV
APP3	B27	1.0	1.1	1.3	1.5	DCV
FPM	B30	OFF	ON	ON	ON	ON/OFF
MAF	B41	0	0.62	1.06	1.44	DCV
IAT	B43	1.89/114.8 (K)	2.13/104 (K)	3.32/59 (K)	3.37/57.2 (K)	DCV/DEG F
FTP	B44	2.55/-0.01	2.53/-0.02	2.49/-0.03	2.28/-0.08	DCV/PSI
BOO	B46	OFF	ON (E)	OFF	OFF	ON/OFF
BPA	B47	OFF	ON (E)	OFF	OFF	ON/OFF
ACP_PRESS	B63	1.46/47.99	1.48/51.98	1.42/41.99	1.42/41.99	DCV/PSI
PSP	E65	LOW	HIGH (I)	LOW	LOW	HIGH/LOW
O2S12	E3	(L)	(D)	(D)	(D)	DCV
O2S22	E4	(L)	(D)	(D)	(D)	DCV
HTRCM12	E23	582	582	582	582	mA
HTRCM22	E24	613	613	613	613	mA
GENMON	E26	0	50.78	31.25	31.25	%
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
CHT	E41	0.61/192.2	0.64/190.4	0.71/181.4	0.69/183.2	DCV/DEG F
KNOCK 1	E49	26590	27310	32090	40910	N/A
TP2	E60	1.25/25.1	0.85/16.8	0.82/16	1.26/25.1	DCV/%
TP1	E61	4.1/16.9	4.4/12.2	4.3/12.9	4.2/14.9	DCV/%
HTRCM11	E69	1.43	1.43	1.43	1.43	AMPS
HTRCM11	E70	1.49	1.49	1.49	1.49	AMPS
ACCS	PID	OFF	ON (A)	OFF	OFF	ON/OFF
BARO	PID	14.24/155.8	14.24/155.8	14.24/155.8	14.24/155.8	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
APP	PID	0	0	19.5	24.5	%
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.25	1.87	5.68	7.81	DEG
ETC_DSD	PID	7.62	1.94	5.66	7.81	DEG
FLI	PID	13.58 (H)	13.59 (H)	23.15 (H)	28 (H)	%
LOAD	PID	49 (L)	17	21	29	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO

O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	640	1146	1675	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
EVMV	B4	0/OFF	155/ VARYING	553/ VARYING	905/ VARYING	mA/OFF- VARYING
EVAPCV	B61	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
FP	B62	OFF	ON	ON	ON	ON/OFF
WAC/ACCR	B64	OFF	OFF	OFF	OFF	ON/OFF
PCVHC	E2	0	0	0	0	%
SPKDUR_6	E10	0	2.31	1.53	1.56	ms
SPKDUR_5	E11	0	2.12	1.62	1.34	ms
SPKDUR_4	E12	0	2.31	1.87	1.59	ms
GENCMD	E13	3.79	0 (Q)	0 (Q)	0 (Q)	%
SPKDUR_3	E15	0	2.12	1.75	1.5	ms
SPKDUR_2	E16	0	2.5	1.75	1.5	ms
SPKDUR_1	E17	0	2.31	1.78	1.9	ms
HTR12	E23	OFF	ON	ON	ON	ON/OFF
HTR22	E24	OFF	ON	ON	ON	ON/OFF
VCTADV	E67	0	0.5	0.5	-40.44	DEG
VCTADV2	E68	0	0.06	0.12	-40	DEG
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	YES	YES	YES	YES/NO
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
FANDC	PID	7.5	7.5	7.5	7.5	%
FANVAR	PID	0	29	29	0	%
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF

SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	31.25	25.5	47.5	42.5	DEG
STRT_RLY	PID	ENABLED	DISABLED	DISABLED	DISABLED	ENABLED/ DISABLED
VCTADVERR	PID	0	-0.31	-1.56	0.43	DEG
VCTADVERR2	PID	0	-0.31	-2.06	0.12	DEG
VCTDC	PID	0	0	0	80	%
VCTDC2	PID	0	0	0	80	%

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B51/52	VBAT	VBAT	VBAT	VBAT	DCV

3.5L 4V TAURUS/TAURUS X/SABLE

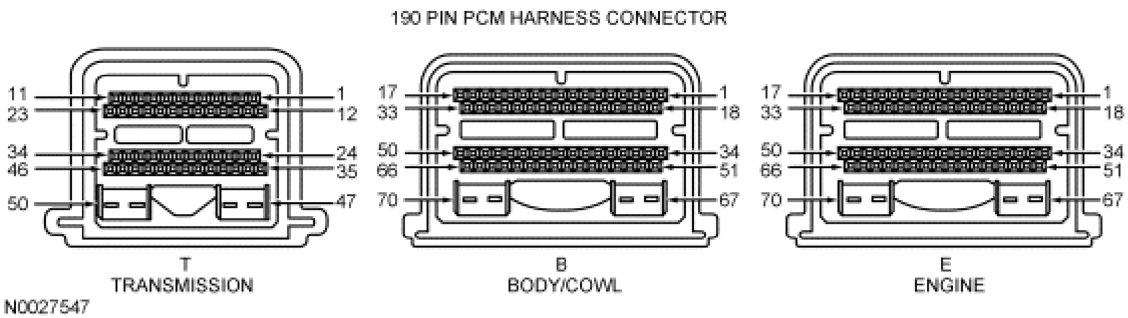


Fig. 6: 190 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
PSP	B17	LOW	HIGH (I)	LOW	LOW	HIGH/LOW
GENMON	B23	0	46.09	22.66	25.78	%
APP1	B25	3.9	3.9	3.5	3.3	DCV
APP2	B26	1.6	1.7	1.8	2.1	DCV
APP3	B27	1.0	1.0	1.3	1.5	DCV
FPM	B30	OFF	ON	ON	ON	ON/OFF
ACP_PRESS	B37	1.34/103.98	1.34/103.98	0.89/47.99	0.93/51.98	DCV/PSI
MAF	B41	0	0.7	1.4	1.5	DCV
IAT	B43	2.1/105.8 (K)	2.1/105.8 (K)	3.9/32 (K)	3.9/32 (K)	DCV/DEG F

FTP	B44	2.6/-0.01	2.6/-0.01	2.6/-0.01	2.6/-0.01	DCV/PSI
BPA	B47	OFF	ON	OFF	OFF	ON/OFF
O2S11_CUR (PZEV)	E18	0	66	16	137	uA
O2S21_CUR (PZEV)	E20	0	4	39	213	uA
O2S12	E23	0.87	0.33	0.78	0.6	DCV
O2S22	E24	0.16	0.21	0.8	0.6	DCV
CHT	E41	0.74/179.6	0.71/181.4	3.86/183.2	3.81/188.6	DCV/DEG F
TP2	E60	1.1/25	0.8/15	1.0/19	1.4/27	DCV/%
TP1	E61	4.1/17	4.4/13	4.2/16	4.0/19	DCV/%
TSS	T15	0	601.3	1130	1519	RPM
ACCS	PID	OFF	ON	OFF	OFF	ON/OFF
APP	PID	0	0	16.5	17	%
B+	PID	12.06	14.06	14.5	14.25	DCV
BARO	PID	149.6/13.26	149.6/13.26	149.6/13.26	149.6/13.26	Hz/PSI
BOO	PID	OFF	ON (E)	OFF	OFF	ON/OFF
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	NO	NO	NO	NO	YES/NO
EONV_RDY	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EQ_RAT11	PID	0	(-)2-(+)2	(-)2-(+)2	(-)2-(+)2	RATIO
EQ_RAT21	PID	0	(-)2-(+)2	(-)2-(+)2	(-)2-(+)2	RATIO
ETC_ACT	PID	7.37	2.95	4.68	23	DEG
ETC_DSD	PID	7.62	2.98	4.74	23.19	DEG
ETC_TRIM	PID	-0.63	-0.61	-0.54	-0.54	DEG
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	5	6	GEAR
INJPWR_M	PID	0.34	13.97	14.19	14.14	DCV
LOAD	PID	51.4 (L)	16.1	35.4	34.7	%
MIL_DIS	PID	0	0	0	0	Miles
MISFIRE	PID	NO	NO	NO	NO	YES/NO
NM	PID	0	0	0	0	COUNT
O2S11_ IMPED (PZEV)	PID	4.94	1.0	0.93	0.97	DCV
O2S21_ IMPED (PZEV)	PID	4.94	1.03	0.98	0.95	DCV
OSS	PID	0	0	1131	1990	RPM
OSS_SRC	PID	0	0	1121	2027	RPM
RPM	PID	0	600	1200	1500	RPM

STRT_RLY	PID	ENABLED	DISABLED	DISABLED	DISABLED	ENABLED/ DISABLED
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
TFT	PID	176	176	192.2	192.2	DEG F
TFTV	PID	0.8	0.81	0.63	0.62	DCV
TORQUE	PID	207	4	18.7	45.42	Nm
TR	PID	P	P	OD	OD	MODE
TR2	PID	OPEN	OPEN	CLOSED	CLOSED	OPEN/ CLOSED
TSS/ISS	PID	0	600.8	1130	1516	RPM
TSS_SRC	PID	0	600.3	1131	1516	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
GENCMD	B22	3.79	0 (Q)	0 (Q)	0 (Q)	%
EVMV	B50	0/OFF	0/OFF	543/ VARYING	289/ VARYING	mA/OFF-VARYING
FP	B62	OFF	ON	ON	ON	ON/OFF
HTR12	E1	OFF	ON	ON	ON	ON/OFF
HTRCM12	E1	609	609	566	566	mA
HTR22	E2	OFF	ON	ON	ON	ON/OFF
HTRCM22	E2	715	715	586	586	mA
PCVHC	E33	0	0	0	0	%
VCTADV	E67	0	-.031	-27.56	-30.94	DEG
VCTADV2	E68	0	0	-27.69	-31.06	DEG
O2S11_HTR (PZEV)	E69	0	36.4	32.12	33.35	%
HTR11 (Non-PZEV)	E69	ON (O)	OFF	ON	ON	ON/OFF
HTRCM11	E69	1.37	1.37	1.39	1.39	Amps
O2S21_HTR (PZEV)	E70	0	39.5	28.29	25.48	%
HTR21 (Non PZEV)	E70	ON (O)	ON	ON	ON	ON/OFF
HTRCM21	E70	1.35	1.35	1.35	1.35	Amps
CAT_EVAL	PID	YES	YES	YES	YES	YES/NO
CLRDIST	PID	40.37	40.37	11.8	10.56	MILES
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT	NOT	NOT	NOT	READY/NOT

		READY	READY	READY	READY	READY
EVAPCV	PID	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVAPSOAK	PID	YES	YES	YES	YES	YES/NO
EVAPSTA	PID	6-MONITOR COMPLETE	6-MONITOR COMPLETE	6-MONITOR COMPLETE	1-VAC STABLE	STATUS
EVAP_EVAL	PID	YES	YES	YES	NO	YES/NO
FANDC	PID	7.5	7.5	7.5	7.5	%
FANVAR	PID	0	0	0	0	%
FTP_H20	PID	-0.03	-0.03	-2.13	-3.38	in H2O
FUELSYST	PID	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
IGN_R/S	PID	ON	ON	ON	ON	ON/OFF
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
O2S_EVAL	PID	YES	YES	YES	YES	YES/NO
O2SHTR_ EVAL	PID	YES	YES	YES	YES	YES/NO
RPMDSD	PID	1120	731.8	1179	608	RPM
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	13.25	44	45.25	DEG
TRIP_CNT	PID	1	1	0	0	COUNT
VCTADVERR	PID	0	0.18	-0.37	-0.18	DEG
VCTADVERR2	PID	0	0.06	-0.43	0	DEG
VCTDC	PID	0	0	47.32	80	%
VCTDC2	PID	0	0	46.8	80	%
VCTSYS	PID	OL	CL	CL	CL	OPEN/ CLOSED LOOP

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B51/52/53	VBAT	VBAT	VBAT	VBAT	DCV
VREF	C64	5	5	5	5	DCV

4.0L MUSTANG

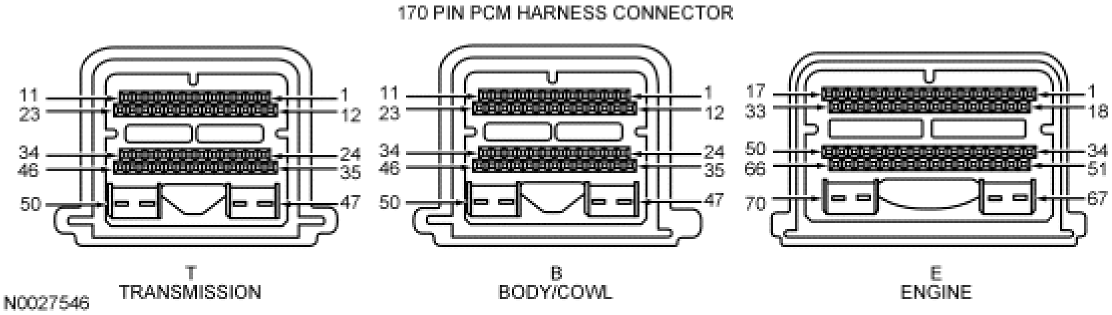


Fig. 7: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0	2.6/0	2.6/0	2.6/0	DCV/PSI
FTP_H2O	B3	0	-0.2	-0.61	-0.34	IN-H2O
APP1	B5	4.1	4.1	3.8	3.8	DCV
ACCS	B15	OFF	OFF	OFF	OFF	ON/OFF
APP2	B17	1.4	1.4	1.65	1.65	DCV
FPM	B21	0	0	0	0	%
ACP_PRESS	B26	0.8/63.98	0.8/63.98	0.8/63.98	0.8/63.98	DCV/PSI
APP3	B28	0.9	0.9	1.1	1.1	DCV
TCS (A/T)	B29	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
CPP-BT	B33	CLOSED	CLOSED	CLOSED	CLOSED	OPEN/ CLOSED
PSP	B34	LOW	LOW	LOW	LOW	HIGH/LOW
BOO	B46	OFF	OFF	OFF	OFF	ON/OFF
BPA	B47	OFF	OFF	OFF	OFF	ON/OFF
GENMON	E5	0	24.22	21.09	21.09	%
ECT	E18	0.56/199.4	0.56/199.4	0.56/199.4	0.56/199.4	DCV/DEG F
FRT	E19	2.7/86 (K)	2.7/86 (K)	3.49/57.2 (K)	3.49/57.2 (K)	DCV/DEG F
DPFEGR	E21	0.25-1.3	0.25-1.3	0.25-4.65	0.25-4.65	DCV
IAT	E22	3/73 (K)	3.1/68 (K)	3.9/32 (K)	4/25 (K)	DCV/DEG F
MAF	E25	0	0.86	1.8	1.9	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.35/53	3.06/45	2.8/39	2.8/39	DCV/PSI

KNOCK 1	E49	16380	177	339	313	N/A
TP2	E60	1.31/26.28	0.92/18.43	1.11/22.35	1.11/22.35	DCV/%
TP1	E61	4.1/17.65	4.29/13.73	4.2/15.69	4.2/15.69	DCV/%
MAP	E62	4.3/-0.29/14.64 (W)	1.05/21.55/3.91 (W)	1.61/17.71/5.8 (W)	2.18/14.16/7.54 (W)	DCV/in Hg/PSI
OSS_SRC	T3	0	0	1256	2275	RPM
ISS (A/T)	T4	0	365-380/ 630-720	595/1080	1070/1640 - 2060	Hz/RPM
TSS (A/T)	T15	0	634	913	1642	RPM
TR 1 (A/T)	T16	0	0	11.5	11.5	DCV
TR 2 (A/T)	T17	0	0	11.5	11.5	DCV
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TR 3 (A/T)	T27	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
TR 4 (A/T)	T28	0	0	11.5	11.5	DCV
TFT (A/T)	T29	2.2/107 (K)	2.1/109 (K)	0.9/172 (K)	0.9/169 (K)	DCV/DEG F
APP	PID	0	0	8.5	10	%
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
BARO	PID	158.1/14.61	158.1/14.61	158.1/14.61	158.1/14.61	Hz/PSI
CPP/PNP	PID	NEUTRAL	DRIVE	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.56	1	4.91	8.53	DEG
ETC_DSD	PID	7.62	0.96	4.88	8.52	DEG
ETC_TRIM	PID	0.18	0.18	0.19	0.18	DEG
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	5	5	GEAR
LOAD	PID	70 (L)	17	16.35	32.32	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	631	1232	1675	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	75/OFF	24/ON	21/ON	24/ON	%/ON-OFF
WAC/ACCR	B14	OFF	OFF	OFF	OFF	ON-OFF
GENCMD	B32	3.79	0 (Q)	0 (Q)	0 (Q)	%

HFC	E4	OFF	OFF	OFF	OFF	ON/OFF
EVMV	E6	0/OFF	0/OFF	331/ VARYING	353/ VARYING	mA/OFF-VARYING
LFC	E7	OFF	OFF	OFF	OFF	ON/OFF
EGRVR	E63	0	0	(T)	(T)	%
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTRCM11	E69	1.15	1.15	1.15	1.15	AMPS
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
HTRCM21	E70	1.11	1.11	1.11	1.11	AMPS
PC1 (A/T)	T11	7/8	9/8	9-9.8/12-22	9-10.7/18-22	DCV/PSI
PC2 (A/T)	T23	8.6	10.7	10.4	10.5	DCV
PC3 (A/T)	T34	5.8	8.1	VBAT	VBAT	DCV
SSA (SS1) (A/T)	T42	0.1/ON	0.1/ON	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
SSB (SS2) (A/T)	T43	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
SSC (SS3) (A/T)	T44	VBAT/OFF	VBAT/OFF	0.35/ON	0.1/ON	DCV/ON-OFF
SSD (SS4) (A/T)	T45	0.1/ON	0.1/ON	0.35/ON	0.1/ON	DCV/ON-OFF
TCC (A/T)	T46	0.2/100	VBAT/0	11.1-VBAT/ 0-45	0.2/95-100	DCV/%
HTR12	T47	ON (O)	ON	ON	ON	ON/OFF
HTRCM12	T47	641	641	641	641	mA
HTR22	T48	ON (O)	ON	ON	ON	ON/OFF
HTRCM22	T48	652	652	652	652	mA
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	READY	READY	READY	READY	READY/NOT READY
EVAPCV	PID	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAPSTA	PID	NOT RUNNING	NOT RUNNING	NOT RUNNING	NOT RUNNING	STATUS
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%

SPARKADV	PID	0-10	17-23	30-40	31-40	DEG
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57	5	5	5	5	DCV

4.6L 3V MUSTANG

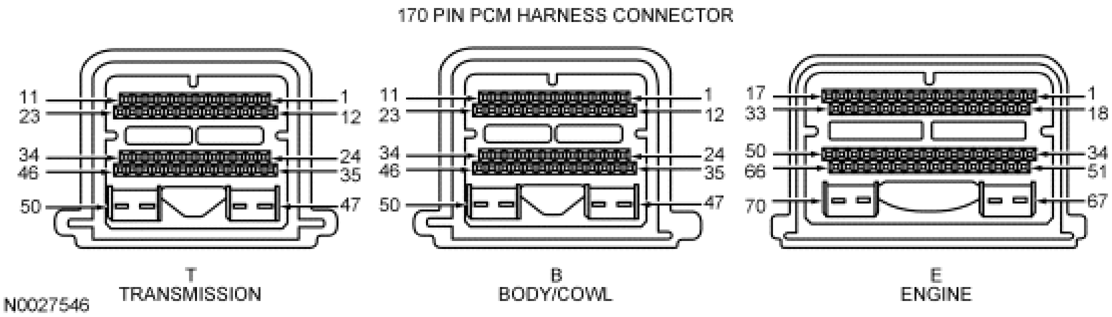


Fig. 8: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.1/-0.13 (M)	2.6/-0.24 (M)	DCV/PSI
FTP_H2O	B3	0.06	0.06	-0.41	-0.37	IN H2O
APP1	B5	4.0	4.0	3.7	3.7	DCV
ACCS	B15	OFF	ON (A)	OFF	OFF	ON/OFF
APP2	B17	1.5	1.5	1.7	1.7	DCV
FPM	B21	100	100	100	100	%
ACP	B26	OPEN	OPEN	OPEN	OPEN	OPEN/ CLOSED
APP3	B28	1.0	1.1	1.3	1.5	DCV
TCS (A/T)	B29	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
GENMON	E5	0	38	36.7	35.9	%
FRT	E19	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	DCV/DEG F
		1.7-3.5/120-50	1.7-3.5/120-50	1.7-4.1/120-32	1.7-4.1/120-32	

IAT	E22	(K)	(K)	(K)	(K)	DCV/DEG F
MAF (A/T)	E25	0	0.88-0.94	0.8-1.5	1.3-1.9	DCV
MAF (M/T)	E25	0	1	1.5	1.3	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
KNOCK 2	E31	0	288	218	292	N/A
FRP	E32	3.35/56	3/39	2.8/40	2.8/39	DCV/PSI
CHT	E41	3.6/199	3.6/199	3.58/201	3.45/208	DCV/DEG F
KNOCK 1	E49	0	235	266	357	N/A
TP2	E60	1.18/23.53	0.66/12.94	0.96/19.22	1.05/20.78	DCV/%
TP1	E61	4.09/18.04	4.35/12.55	4.2/15.69	4.16/16.47	DCV/%
HTRCM11	E69	1.01	1.01	1.03	1.03	AMPS
HTRCM21	E70	1.01	1.01	1.01	1.01	AMPS
OSS (A/T)	T3	0	0	1385	2400	RPM
OSS (M/T)	T3	0	0	1420	2500	RPM
TSS (A/T)	T15	0	680	595	2060	RPM
TR 2 (A/T)	T17	CLOSED	CLOSED	OPEN	OPEN	OPEN/ CLOSED
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TFT (A/T)	T29	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	DCV/DEG F
CPP-BOT (M/T)	T33	NO	YES (J)	NO	NO	YES/NO
HTRCM12	T47	664	664	664	664	mA
HTRCM22	T48	660	660	660	660	mA
APP	PID	0	0	11	18.5	%
BARO	PID	155.8/14.24	155.8/14.24	155.8/14.24	155.8/14.24	Hz/PSI
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
CPP/PNP	PID	NEUTRAL	DRIVE	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ECT_ACT	PID	7.43	1.06	7.45	9.66	DEG
ECT_DSD	PID	7.62	1.04	7.52	9.66	DEG
ECT_TRIM	PID	0.18	0.18	0.25	0.25	DEG
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR (A/T)	PID	1	1	5	5	GEAR
LOAD	PID	59 (L)	16	22	18	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN

O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	660	1200	1450	RPM
TR (A/T)	PID	P	P	OD	OD	MODE
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FP	B12	75/OFF	28/ON	28/ON	28/ON	%/ON-OFF
EVAPCV	B13	0/OFF	0/OFF	0 (R)/OFF	0 (R)/OFF	%/ON-OFF
WAC/ACCR	B14	ON	OFF (A)	ON	ON	ON/OFF
GENCMD	B32	3.79	0 (Q)	0 (Q)	0 (Q)	%
HFC	E4	OFF	ON (B)	OFF	OFF	ON/OFF
EVMV	E6	0/OFF	0/OFF	350/ VARYING	235/ VARYING	mA/OFF-VARYING
LFC	E7	OFF	ON (B)	OFF	OFF	ON/OFF
IMRC	E50	OFF	OFF	OFF	OFF	ON/OFF
VCTDC	E67	0	0	41.7	39.5	%
VCTDC2	E68	0	0	43.3	33.7	%
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
TCC (A/T)	T46	0/OFF	0/OFF	0/OFF	100/ ENGAGED	%/OFF-ENGAGED
HTR12	T47	ON (O)	ON	ON	ON	ON/OFF
HTR22	T48	ON (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	YES	YES	YES/NO
EVAPSTA	PID	NOT RUNNING	NOT RUNNING	NOT RUNNING	NOT RUNNING	STATUS
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
LONGFT1	PID	(L)	(L)	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	-10-0	15-20	29-38	34-41	DEG
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF

VCTADV	PID	0	-0.37	10.8	32	DEG
VCTADV2	PID	0	-1	8	33.7	DEG
VCTADVERR	PID	0	-0.68	0.81	1.12	DEG
VCTADVERR2	PID	0	1	1.56	-0.43	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57	5	5	5	5	DCV

5.4L 4V MUSTANG

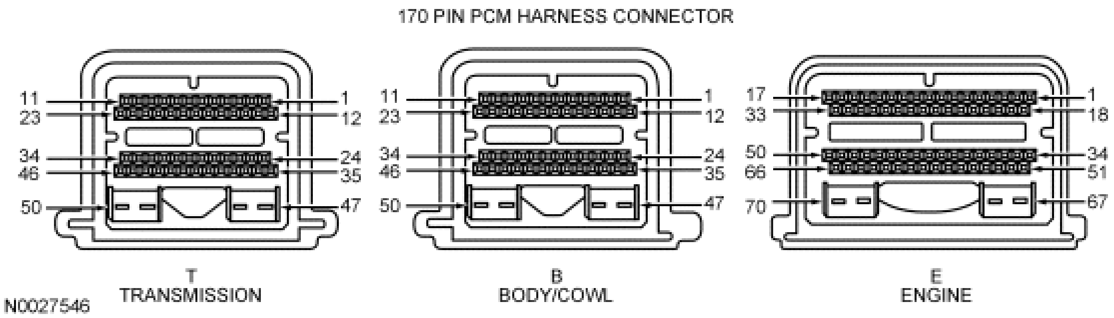


Fig. 9: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.1/-0.13 (M)	2.6/-0.24 (M)	DCV/PSI
APP1	B5	4.0	4.0	3.8	3.6	DCV
APP2	B17	1.5	1.5	1.7	1.7	DCV
APP3	B28	1.0	1.1	1.3	1.5	DCV
CPP-BOT	B33	NO	NO	NO	NO	YES/NO
GENMON	E5	0	34	24	27	%
ACCS	E15	OFF	ON (A)	OFF	OFF	ON/OFF
FRT	E19	1.7/122 (K)	1.8/120 (K)	2.9/79 (K)	2.7/84 (K)	DCV/DEG F
IAT	E22	1.7/158 (K)	1.9/135 (K)	3.8/34 (K)	3.9/30 (K)	DCV/DEG F
MAF	E25	0	0.6	1.1	1.3	DCV
IAT2	E27	1.2/158 (K)	1.3/135 (K)	2.5/93 (K)	2.7/84 (K)	DCV/DEG F
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN

O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	2.6/36	3/44	3/44	3/44	DCV/PSI
CHT	E41	3.6/199	3.6/199	3.58/201	3.45/208	DCV/DEG F
TP2	E60	1.23/24.31	0.74/14.51	0.87/17.26	0.96/19.22	DCV/%
TP1	E61	4.1/17.65	4.35/12.94	4.28/14.12	4.23/14.9	DCV/%
HTRCM11	E69	1.02	1.02	1.02	1.02	AMPS
HTRCM21	E70	1.02	1.02	1.02	1.02	AMPS
OSS_SRC	T3	0	0	1251	2268	RPM
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
HTRCM12	T47	676	676	676	676	mA
HTRCM22	T48	660	660	660	660	mA
APP	PID	0	0	9.5	9.5	%
BARO	PID	14.73/158.9	14.73/158.9	14.73/158.9	14.73/158.9	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.62	1.7	6.5	5.43	DEG
ETC_DSD	PID	7.62	1.57	6.44	5.4	DEG
ETC_TRIM	PID	0.12	0.12	0.12	0.12	DEG
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
LOAD	PID	73 (L)	16	23.7	27.3	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	660-780	1200-1300	1450-1740	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	75/OFF	21.59/ON	21.26/ON	20.94/ON	%/ON-OFF
EVAPCV	B13	OFF	OFF	OFF	OFF	ON/OFF
WAC/ACCR	B14	ON	OFF (A)	ON	ON	ON/OFF
FPM	B21	100.2	100.2	99.71	103.4	%
GENCMD	B32	3.79	0 (Q)	0 (Q)	0 (Q)	%
HFC	E4	OFF	ON (B)	OFF	OFF	ON/OFF
EVMV	E6	0/OFF	327/ VARYING	427/ VARYING	200/ VARYING	mA/OFF- VARYING
LFC	E7	OFF	ON (B)	OFF	OFF	ON/OFF
SPKDUR_8	E9	0	1.78	1.46	1.59	ms

SPKDUR_5	E10	0	1.56	1.37	1.81	ms
SPKDUR_2	E11	0	1.75	1.43	1.46	ms
SPKDUR_3	E12	0	1.84	1.62	1.53	ms
SPKDUR_4	E14	0	1.78	1.59	1.62	ms
SPKDUR_6	E15	0	1.56	1.65	1.56	ms
SPKDUR_7	E16	0	1.96	1.62	1.43	ms
SPKDUR_1	E17	0	1.9	1.75	1.43	ms
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
HTR12	T47	ON (O)	ON	ON	ON	ON/OFF
HTR22	T48	ON (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(L)	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	14.7	34.7	31	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57	5	5	5	5	DCV

4.6L 2V CROWN VICTORIA/GRAND MARQUIS

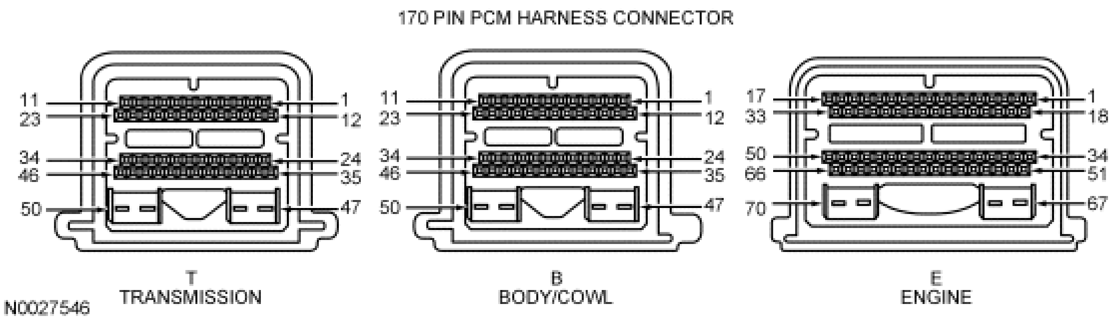


Fig. 10: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.6/0 (M)	1.4/-0.3 (M)	DCV/PSI
APP1	B5	4.0	4.0	3.8	3.6	DCV
BPP/BOO	B8	OFF	OFF	OFF	OFF	ON/OFF
ACCS	B15	OFF	OFF	OFF	OFF	ON/OFF
APP2	B17	1.5	1.5	1.7	1.7	DCV
ACP	B26	1.64/157	1.64/157	1.27/117	1.27/117	DCV/PSI
APP3	B28	1.0	1.1	1.3	1.5	DCV
TCS	B29	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
GENMON	E5	0	46	34	27	%
FRT	E19	3.4/62 (K)	3.4/64 (K)	3.2/68 (K)	3.3/66 (K)	DCV/DEG F
DPFEGR	E21	0.25-1.3	0.25-1.3	0.25-4.65	0.25-4.65	DCV
IAT	E22	1.9/115 (K)	2.6/86 (K)	3.2/63 (K)	3.2/61 (K)	DCV/DEG F
MAF	E25	0	0.9	1.97	1.94	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.35/50	3/43	2.8/39	2.8/39	DCV/PSI
CHT	E41	3.64/190.4	3.7/188.6	3.76/186.8	3.76/186.8	DCV/DEG F
KNOCK 1	E48	0	235	266	357	N/A
TP2	E60	1.2	0.7	0.90	1.2	DCV
TP1	E61	4.1	4.4	4.1	4.1	DCV
MAP	E62	4.39/0/14.79	1.25/69/4.49	2.27/46/7.83	2.06/51/7.1	DCV/kPa/PSI
OSS_SRC	T3	0	0	1385-1420	2400-2500	RPM
TSS	T15	0	624	737	1339	RPM

TR2	T17	CLOSED	CLOSED	OPEN	OPEN	OPEN/ CLOSED
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TFT	T29	1.4/142 (K)	1.4/140 (K)	0.8/176 (K)	0.8/179 (K)	DCV/DEG F
APP	PID	0	0	6	10.5	%
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
BARO	PID	159.3/14.79	159.3/14.79	159.3/14.79	159.3/14.79	Hz/PSI
BPA	PID	OFF	OFF	OFF	OFF	ON/OFF
CPP/PNP	PID	NEUTRAL	DRIVE	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.87	1.62	6.22	12.74	DEG
ETC_DSD	PID	7.85	1.65	6.19	12.73	DEG
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	58 (L)	15	19	14	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	638	1065	1330	RPM
TR	T16	P	P	OD	OD	MODE
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
PATSENABL	B2	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
FP	B12	75/OFF	17/ON	28/ON	28/ON	%/ON-OFF
WAC/ACCR	B14	ON	OFF (A)	ON	ON	ON/OFF
EGRVR	E63	0	0	(T)	(T)	%
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTRCM11	E69	1.1	1.1	1.1	1.1	Amps
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
HTRCM21	E70	1.04	1.04	1.04	1.04	Amps
TCC	T46	0/OFF	0/OFF	0/OFF	100/ ENGAGED	%/OFF- ENGAGED
HTR12	T47	ON (O)	ON	ON	ON	ON/OFF
HTRCM12	T47	629	629	629	629	mA
HTR22	T48	ON (O)	ON	ON	ON	ON/OFF
HTRCM22	T48	629	629	629	629	mA

EGR_EVAL	PID	YES	YES	NO	NO	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020F	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPCV	PID	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAPSTA	PID	NOT RUNNING	NOT RUNNING	NOT RUNNING	NOT RUNNING	STATUS
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
EVMV	PID	0/OFF	VARYING	VARYING	VARYING	mA/OFF-VARYING
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
GENCMD	PID	3.79	0 (Q)	0 (Q)	0 (Q)	%
LONGFT1	PID	(L)	(L)	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	17.7	20	37	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57	5	5	5	5	DCV

4.6L 2V TOWN CAR

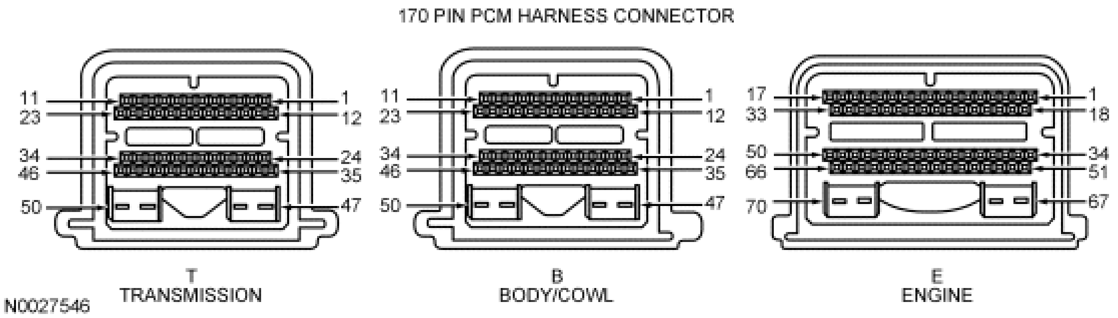


Fig. 11: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.6/0 (M)	1.4/-0.3 (M)	DCV/PSI
APP1	B5	4.0	4.0	3.8	3.6	DCV
SMR	B7	VBAT (V)	0	0	0	DCV
BPP	B8	VBAT/OFF	0.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
BPS	B9	0.1/OFF	VBAT/ON (E)	0.1/OFF	0.1/OFF	DCV/ON-OFF
ACCS	B15	0.1/OFF	VBAT/ON (A)	0.1/OFF	0.1/OFF	DCV/ON-OFF
APP2	B17	1.5	1.5	1.7	1.7	DCV
FPM	B21	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACP	B26	1.3/80	1.4/75	1.3/80	1.3/80	DCV/PSI
APP3	B28	1.0	1.1	1.3	1.5	DCV
TCS	B29	0.1/OFF	VBAT/ON (G)	0.1/OFF	0.1/OFF	DCV/ON-OFF
PSP	B34	0.1/LOW	VBAT/HIGH (I)	0.1/LOW	0.1/LOW	DCV/ HIGH-LOW
PATS IN	B42	VBAT	VBAT	VBAT	VBAT	DCV
FEPS	B44	0.1	0.1	0.1	0.1	DCV
GENMON	E5	0	39.8	30	24	%
FRT	E19	2.6/90 (K)	3.2/ 70 (K)	3.1/72 (K)	3.2/70 (K)	DCV/DEG F
DPFEGR	E21	0.25-1.3	0.25-1.3	0.25-4.65	0.25-4.65	DCV
IAT	E22	2.74/81 (K)	2.9/73 (K)	4/27 (K)	3.9/30 (K)	DCV/DEG F
MAF	E25	0	0.9	1	1.5	DCV
HO2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV
HO2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV
FRP	E32	3.35/50	3/43	2.8/39	2.8/39	DCV/PSI
CHT	E41	3.54/194	3.54/194	3.72/188.6	3.65/190.4	DCV/DEG F
CMP1	E45	0	5-7	10-12	12-16	Hz
CKP	E47	0	390-450	650-760	980-1020	Hz
KNOCK 1	E48	0	235	266	357	N/A
TP2	E60	1.2	0.7	0.90	1.2	DCV
TP1	E61	4.1	4.4	4.1	4.1	DCV
MAP	E62	4.3/14.5 (W)	1.2/4.5 (W)	1.2/4.4 (W)	1.7/5.8 (W)	DCV/PSI
OSS_SRC	T3	0	0	1201	2236	RPM
TSS	T15	0	623	825	1569	Hz/RPM
TR 1	T16	0	0	11.5	11.5	DCV
TR 2	T17	0	0	11.5	11.5	DCV
HO2S12	T24	(L)	(D)	(D)	(D)	DCV
HO2S22	T25	0.1	(D)	(D)	(D)	DCV
TR3A	T27	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE

TR 4	T28	0	0	11.5	11.5	DCV
TFT	T29	1.5/135 (K)	1.5/136 (K)	1.2/154 (K)	1.2/156 (K)	DCV/DEG F
CPP/PNP	PID	NEUTRAL	DRIVE	DRIVE	DRIVE	NEUTRAL/ DRIVE
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
FRT	PID	2.5/93 (K)	2.6/90 (K)	3.1/72 (K)	3.1/72 (K)	DCV/DEG F
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	14 (L)	14	17	19	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
RPM	PID	0	660-780	1200-1300	1450-1740	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
PATSTRT	B2	0	0	0	0	DCV
FP	B12	3.7/75	1.3/28	1.3/28	1.3/28	DCV/%
CANV	B13	VBAT/0	VBAT/0	VBAT/0 (R)	VBAT/0 (R)	DCV/%
PATS OUT	B31	10.5	VBAT (A)	VBAT	VBAT	DCV
WAC/ACCR	B14	0.1/ON	VBAT/OFF (A)	0.1/ON	0.1/ON	DCV/ON-OFF
GENCMD	B32	3.79	0 (Q)	0 (Q)	0 (Q)	%
PCVHC	E3	0.1/ON	0.1/ON	VBAT/OFF	0.1/ON	DCV/ON-OFF
EVAPPDC	E6	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
VFC	E7	0-100	0-100	0-100	0-100	%
CDH (CYL 8)	E9	VBAT	VBAT	VBAT	1.3/28	DCV
CDF (CYL 5)	E10	VBAT	VBAT	VBAT	VBAT	DCV
CDD (CYL 2)	E11	VBAT	VBAT	VBAT	VBAT	DCV
CDB (CYL 3)	E12	VBAT	VBAT	VBAT	VBAT	DCV
CDG (CYL 4)	E14	VBAT	VBAT	VBAT	VBAT	DCV
CDE (CYL 6)	E15	VBAT	VBAT	VBAT	VBAT	DCV
CDC (CYL 7)	E16	VBAT	VBAT	VBAT	VBAT	DCV
CDA (CYL 1)	E17	VBAT	VBAT	VBAT	VBAT	DCV
TACM (+)	E34	3.7	VBAT	VBAT	VBAT	DCV
TACM (-)	E51	3.7	VBAT	VBAT	VBAT	DCV
EGRVR	E63	VBAT/0	VBAT/0	(T)	(T)	DCV/%
HTR11	E69	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
HTR21	E70	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
EPC	T11	7.9/20	9.5/20	9.3/22	9.5/22	DCV/PSI
SSA (SS1)	T42	0.1/ON	0.1/ON	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
SSB (SS2)	T43	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/ON-OFF

TCC	T46	0.1/100	VBAT/0	VBAT/0	0.2/95-100	DCV/%
HTR12	T47	0.2/ON (O)	0.2/ON	0.2/ON	0.2/ON	DCV/ON-OFF
HTR22	T48	0.2/ON (O)	0.2/ON	0.2/ON	0.2/ON	DCV/ON-OFF
LONGFT1	PID	(L)	(L)	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	17.5	32.7	37.7	DEG
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57	5	5	5	5	DCV
KAPWR	B45	VBAT	VBAT	VBAT	VBAT	DCV
ETCVREF	E66	5	5	5	5	DCV

2.3L 4V ESCAPE/MARINER

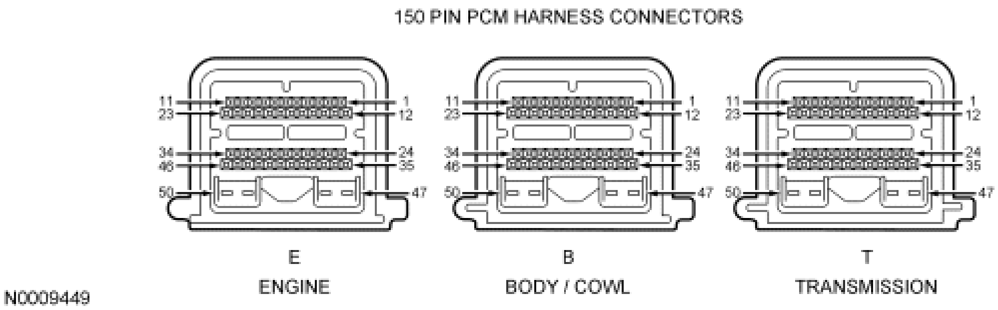


Fig. 12: Identifying 150 Pin PCM Harness Connectors/Terminals
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
BOO	B8	OFF	ON (E)	OFF	OFF	ON/OFF
FTP	B9	2.6/0	2.6/0	2.5/-0.03	2.15/-0.12	DCV/PSI
FTP_H2O	B9	-0.13	-0.13	-0.86	-3.27	in-Hg
ACCS	B15	OFF	ON (A)	OFF	OFF	ON/OFF
IAT	B20	111/1.96 (K)	104/2.16 (K)	3.15/66 (K)	3.18/64 (K)	DCV/DEG F

TCS (A/T)	B27	0.1/OFF	VBAT/ON (G)	0.1/OFF	0.1/OFF	DCV/ON-OFF
MAF (A/T)	B32	0	0.9	1.4	2.5	DCV
MAF (M/T)	B32	0	1-1.08	1-1.7	1.2-2.5	DCV
GENMON	E16	0	37.5	15.63	15.63	%
TP	E19	0.53-1.27	0.53-1.27	1-1.3	1.1-2	DCV
MAP	E23	4/14.3 (W)	1.2/4.2 (W)	1.1/4.1 (W)	3.3/11.9 (W)	DCV/PSI
FRT	E28	2.5/93 (K)	2.6/90 (K)	3.1/72 (K)	3.1/72 (K)	DCV/DEG F
O2S11	E30	(L)	switching (C)	switching (C)	switching (C)	DCV
CHT	E33	3.4/210	3.4/212	3.4/212	3.2/225	DCV/DEG F
FRP	E37	1.3/14	3.7/39	3.7/39	3.7/39	DCV/PSI
VSS (M/T)	T3	0	0	30	55	MPH
OSS (A/T)	T4	0	0	67-400	120/7300	RPM
TSS (A/T)	T15	0	686	1547	1995	RPM
O2S12	T24	(L)	(D)	(D)	(D)	DCV
TRS (A/T)	T27	4.4/PARK	4.4/PARK	2.1/OD	2.1/OD	DCV/MODE
CPP (M/T)	T27	0/ON	0/ON	12/OFF	12/OFF	DCV/ON-OFF
TFT (A/T)	T29	1.2/154 (K)	1.1/156 (K)	1.4/140 (K)	1.4/142 (K)	DCV/DEG F
ACP	PID	OPEN (OK)	OPEN (OK)	OPEN (OK)	OPEN (OK)	OPEN/ CLOSED
B+	PID	13	14.3	14.19	14.19	DCV
BARO	PID	157.7	157.7	157.7	155.8	Hz
CHT_COLD	PID	80.6	75.2	82.4	80.6	DEG F
CHT_HOT	PID	237.2	231.8	240.8	239	DEG F
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
EVMV	PID	0	0	36	741	mA
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR (A/T)	PID	1	1	3	4	GEAR
HTRCM11	PID	1.46	1.46	1.53	1.53	Amps
HTRCM12	PID	750	750	852	852	mA
LOAD (A/T)	PID	54 (L)	17.4	19.2	24.7	%
LOAD (M/T)	PID	(L)	10-20	19-30	30-48	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
RPM	PID	0	680	1877	2252	RPM
PSP	PID	LOW	HIGH (I)	LOW	LOW	HIGH/LOW
TPCT	PID	0.85	0.84	0.85	0.85	DCV
VSS	PID	0	0	30	55	MPH

	PCM	Measured/PID Values				

Actuators/Outputs	Pin/PID only	KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	Units Measured/PID
FP	B12	75	18	19.5	19.8	%
WAC/ACCR	B25	VBAT/OFF	1.5/ON	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
EVMV	B34	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
HFC	B38	VBAT/OFF	0.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
LFC	B39	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
GENCMD	E7	3.79	0 (Q)	0 (Q)	0 (Q)	%
IAC	E39	VBAT/6.89	10.1/37.37	8.2/60 (L)	7.6/64 (L)	DCV/%
HTR11	E49	OFF	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
EPC (A/T)	T11	7.5/0	8.4/0	9-10/25-37	10.3-11.2/42-51	DCV/PSI
SSC (SS3) (A/T)	T23	VBAT/OFF	VBAT/OFF	8.8/OFF	8.8/OFF	DCV/ON-OFF
SSA (SS1) (A/T)	T42	VBAT/OFF	VBAT/OFF	VBAT/OFF	0.1/ON	DCV/ON-OFF
SSB (SS2) (A/T)	T43	0.1/ON (O)	0.1/ON	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
TCC (A/T)	T46	VBAT/0	VBAT/0	VBAT/0	0.2/100	DCV/%
HTR12	T47	0.2/ON (O)	0.2/ON	0.2/ON	0.2/ON	DCV/ON-OFF
CAT_EVAL	PID	NO	NO	NO	NO	YES/NO
EVAPCV	PID	OFF/0	OFF/0	OFF/0 (R)	OFF/0 (R)	ON-OFF/%
EVAPSOAK	PID	YES	YES	YES	YES	YES/NO
FAN	PID	OFF	OFF	OFF	OFF	ON/OFF
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FRP_DSD	PID	39.15	39.15	39.15	39.15	PSI
FUELSYST	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
IMTV	PID	OFF	ON	ON	ON	ON/OFF
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MFC	PID	OFF	OFF	OFF	OFF	ON/OFF
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
RPMDSD	PID	848	672	672	672	RPM
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV (A/T)	PID	10	14-20	36-44	30-40	DEG
SPARKADV (M/T)	PID	0	15	46	45	DEG
STRT_RLY	PID	ENABLED	DISABLED	DISABLED	DISABLED	ENABLED/ DISABLED
TCIL (A/T)	PID	OFF	OFF	OFF	OFF	ON/OFF
TPCT	PID	0.85	0.84	0.85	0.85	DCV
TQ_CNTRL	PID	NONE	NONE	NONE	NONE	_

		Measured/PID Values				

Other	PCM Pin/PID only	KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	Units Measured/PID
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV

3.0L 4V ESCAPE/MARINER

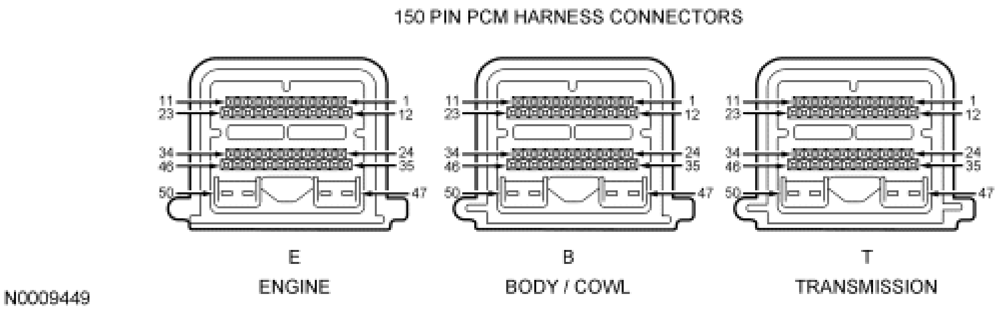


Fig. 13: Identifying 150 Pin PCM Harness Connectors/Terminals
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
PSP	B3	0.1/LOW	VBAT/HIGH (I)	0.1/LOW	0.1/LOW	DCV/ HIGH-LOW
BOO	B8	0.1/OFF	VBAT/ON (E)	0.1/OFF	0.1/OFF	DCV/ON-OFF
FTP	B9	2.6/57	2.6/48	2.6/65	2.6/36	DCV/kPa
ACCS	B15	0.1/OFF	VBAT/ON (A)	0.1/OFF	0.1/OFF	DCV/ON-OFF
IAT	B20	1.58/125.6 (K)	1.74/120.2 (K)	3.6/48.2 (K)	3.64/46.4 (K)	DCV/DEG F
ACP	B26	1.3/80	1.4/75	1.3/80	1.3/80	DCV/%
MAF	B32	0	0.80-1.03	0.7-1.5	1.3-2	DCV
GENMON	E16	0	31.25	18.75	25	%
ECT	E21	0.5-2.7/210-110	0.5-2.7/210-110	0.5-2.7/210-110	0.5-2.7/210-110	DCV/DEG F
MAP	E23	4 (W)	1-1.4 (W)	1.5-2.1 (W)	1.9-2.3 (W)	DCV
O2S21	E26	0	switching (C)	switching (C)	switching (C)	DCV
EGRVR	E27	VBAT/0	VBAT/0	(T)	(T)	DCV/%
FRT	E28	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	DCV/DEG F
O2S11	E30	(L)	switching (C)	switching (C)	switching (C)	DCV
FRP	E37	3.7/39	3.7/39	3.7/39	3.8/40	DCV/PSI
DPFEGR	E44	0.25-1.3	0.25-1.3	0.25-4.65	0.25-4.65	DCV
OSS	T4	0	0	67/1360	120/2466	Hz/RPM

TSS	T15	0	45-50/ 700-770	90-100/ 1350-1450	110-120/ 1700-1800	Hz/RPM
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TR	T27	PARK	PARK	OD	OD	MODE
TFT	T29	0.4-2/220-125 (K)	0.4-2/220-125 (K)	0.4-2.4/220-125 (K)	0.4-2/220-125 (K)	DCV/DEG F
B+	PID	12.63	14.63	14.5	14.44	DCV
BARO	PID	157.7/14.48	157.7/14.48	157.7/14.24	155.8/14.24	Hz/PSI
CAT_EVAL	PID	YES	YES	YES	YES	YES/NO
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	3	4	GEAR
HTRCM11	PID	1.09	1.09	1.09	1.09	Amps
HTRCM12	PID	680	680	680	680	mA
HTRCM21	PID	1.11	1.11	1.11	1.11	Amps
HTRCM22	PID	660	660	660	660	mA
LOAD	PID	(L)	10-20	19-30	30-48	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
RPM	PID	0	705-820	1200-1500	1600-1800	RPM
TPCT	PID	0.85	0.85	0.85	0.85	DCV
TSS_ISS	PID	0	761.5	1356	1765	RPM
TSS_SRC	PID	0	761.8	1354	1768	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	8.3/75	3.6/27	3.6/27	3.8/29	DCV/%
WAC/ACCR	B25	VBAT/OFF	1.5/ON	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
EVMV	B34	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
HFC	B38	OFF	ON	OFF	OFF	ON/OFF
LFC	B39	OFF	ON (B)	OFF	OFF	ON/OFF
GENCMD	E7	3.79	0 (Q)	0 (Q)	0 (Q)	%
IAC	E39	0	32-40	30-55	50-79	%
HTR21	E48	ON (O)	ON	ON	ON	ON/OFF
HTR11	E49	ON	ON	ON	ON	ON/OFF
TCC	T46	0/ON	0/ON	0/ON	100/ON	%/ON-OFF
HTR12	T47	ON	ON	ON	ON	ON/OFF
HTR22	T48	ON	ON	ON	ON	ON/OFF
CAT_EVAL	PID	YES	YES	YES	YES	YES/NO

EVAPCV	0/OFF	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVAPSOAK	PID	YES	YES	YES	YES	YES/NO
FAN	PID	OFF	OFF	OFF	OFF	ON/OFF
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FRP_DSD	PID	39.15	39.15	39.15	39.15	PSI
FTP_H2O	PID	-0.13	-0.13	-0.86	-3.27	in H2O
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
RPMDSD	PID	1120	763	672	672	RPM
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0-10	5-20	36-44	30-40	DEG
STRT_RLY	PID	ENABLED	DISABLED	DISABLED	DISABLED	ENABLED/ DISABLED
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
TQ_CNTRL	PID	NONE	NONE	NONE	NONE	_

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV

2.3L RANGER

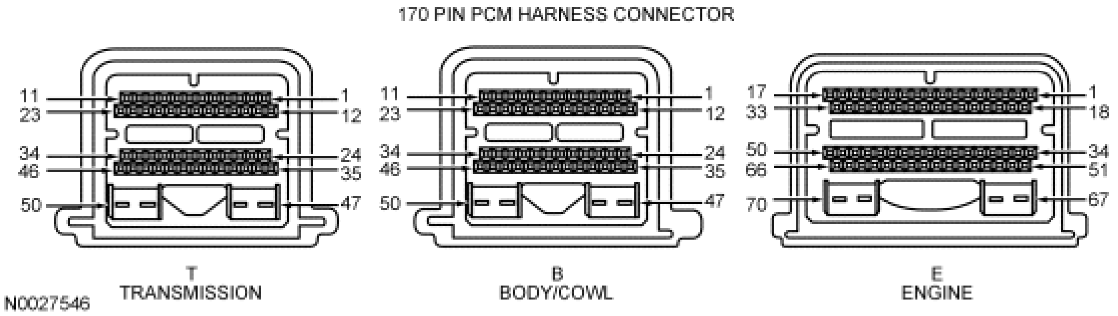


Fig. 14: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6	2.6	2.6	2.6	DCV
FTP_H2O	B3	0	0	0	0	IN H20
ACCS	B15	OFF	ON (A)	OFF	OFF	ON/OFF
FPM	B21	OFF	ON	ON	ON	ON/OFF
TCS	B29	0.1/OFF	VBAT/ON (G)	0.1/OFF	0.1/OFF	DCV/ON-OFF
CPP/PNP	B33	NEUTRAL	NEUTRAL	DRIVE	DRIVE	MODE
PSP	B34	LOW	HIGH(I)	LOW	LOW	HIGH/LOW
FEPS	B44	0.1	0.1	0.1	0.1	DCV
IAT	E22	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG F
MAF	E25	0	0.7-0.9	1.2-1.6	1.6-2.1	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV
CHT	E41	0.67 or 3.7/194 - 230	0.67 or 3.7/194 - 230	0.67 or 3.7/194 - 230	0.67 or 3.7/194 - 230	DCV/DEG F
KNOCK 1	E49	0	0	0	0	N/A
TP	E61	0.53-1.27	0.53-1.27	0.8-1.1	1.2-1.7	DCV
MAP	E62	3.99/14.21/28.9	0.95/3.33/6.79	1.58/5.91/11.22	2.01/6.81/13.87	DCV/PSI/IN HG
HTRCM11	E69	531	531	531	531	mA
OSS	T3	0	0	1250-1290	2100-2400	RPM
TSS	T15	0	320-360/ 630-670	500-713/ 1100-1300	845-985/ 1700-1800	Hz/RPM
TR 1	T16	0	0	VBAT	VBAT	DCV
TR 2	T17	0	0	VBAT	VBAT	DCV
O2S12	T24	(L)	(D)	(D)	(D)	DCV
TR3 V/TR3	T27	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
TR 4	T28	0	0	VBAT	VBAT	DCV
TFT	T29	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	DCV/DEG F
HTRCM12	T47	977	977	977	977	mA
BARO	PID	156.2/14.3	156.2/14.3	156.2/14.3	156.2/14.3	Hz/PSI
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	NO	NO	NO	NO	YES/NO
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	17-28	19-26	30-40	%
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	750	1300	1780	RPM

VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FP	B12	OFF	ON	ON	ON	ON/OFF
EVAPCV	B13	0 (R)/OFF	0 (R)/OFF	0 (R)/OFF	0 (R)/OFF	%/ON-OFF
WAC/ACCR	B14	OFF	ON (A)	OFF	OFF	ON/OFF
EVMV	E6	0/OFF	0/OFF	500-900 (F)/VARYING	500-900 (F)/VARYING	mA/OFF-VARYING
IAC	E33	0	35	35-41 (L)	57-68 (L)	%
HTR11	E69	OFF (O)	ON	ON	ON	ON/OFF
EPC	T11	6.0	8.0	10.0	10.0	DCV
SSA (SS1)	T42	0.1/ON	0.1/ON	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
SSB (SS2)	T43	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
SSC (SS3)	T44	VBAT/OFF	VBAT/OFF	VBAT/OFF	0.1/ON	DCV/ON-OFF
SSD (SS4)	T45	0.1/ON	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
TCC	T46	VBAT/0	VBAT/0	VBAT/0	0.2/100	DCV/%
HTR12	T47	OFF (O)	ON	ON	ON	ON/OFF
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
EGR_EVAL	PID	YES	YES	NO	NO	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	20-25	30-35	30-35	DEG
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/B36	VBAT	VBAT	VBAT	VBAT	DCV

VREF	E57	5	5	5	5	DCV

3.0L RANGER

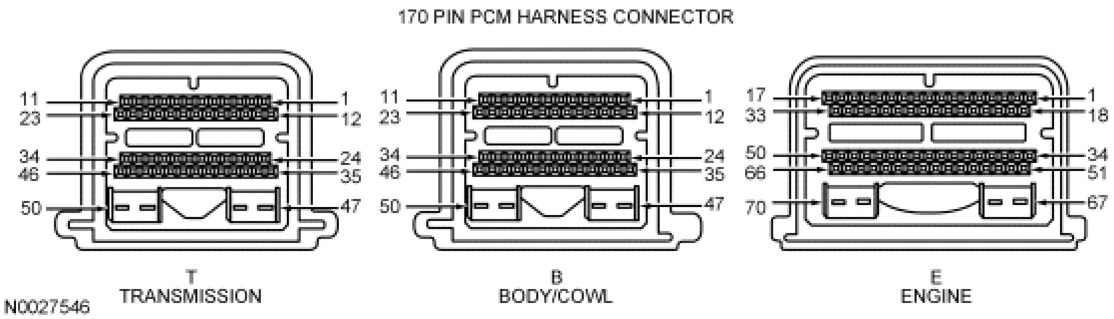


Fig. 15: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0	2.6/0	2.6/0	2.6/0	DCV/PSI
ACCS	B15	OFF	ON (A)	OFF	OFF	ON/OFF
FPM	B21	OFF	ON	ON	ON	ON/OFF
TCS	B29	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
CPP/PNP	B33	NEUTRAL	NEUTRAL	DRIVE	DRIVE	MODE
ECT	E18	0.4-1/200-160	0.4-1/200-160	0.4-1/200-160	0.4-1/200-160	DCV/DEG F
DPFEGR	E21	0.25-1.30	0.25-1.30	0.25-4.65	0.25-4.65	DCV
IAT	E22	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG F
MAF	E25	0	0.7-0.9	1.2-1.6	1.6-2.1	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
KNOCK 1	E49	0	0	0	0	N/A
TP	E61	0.53-1.27/CT	0.53-1.27/CT	0.8-1.1/PT	1.2-1.7/PT	DCV/MODE
HTRCM11	E69	539	539	539	539	mA
HTRCM21	E70	504	504	504	504	mA
OSS	T3	0	0	1250-1290	2100-2400	RPM
TSS	T15	0	630-670	1100-1300	1700-1800	RPM
						OPEN/

TR 2	T17	CLOSED	CLOSED	OPEN	OPEN	CLOSED
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TFT	T29	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	DCV/DEG F
HTRCM12	T47	969	969	969	969	mA
HTRCM22	T48	965	965	965	965	mA
BARO	PID	13.87/153.5	13.87/153.5	13.87/153.5	13.87/153.5	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	YES	NO	NO	NO	YES/NO
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	17-28	19-26	30-40	%
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	750	1300-1350	1780	RPM
TR	PID	P	P	OD	OD	MODE
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	OFF	ON	ON	ON	ON/OFF
EVAPCV	B13	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
WAC/ACCR	B14	OFF	ON (A)	OFF	OFF	ON/OFF
PCVHC	E3	0	0	0	0	%
EVMV	E6	0	0	500-900 (F)/VARYING	500-900 (F)/VARYING	mA/OFF-VARYING
IAC	E33	0	35	35-41 (L)	57-68 (L)	%
EGRVR	E63	0	0	(T)	(T)	%
HTR11	E69	OFF (O)	ON	ON	ON	ON/OFF
HTR21	E70	OFF (O)	ON	ON	ON	ON/OFF
TCC	T46	0/OFF	0/OFF	0/OFF	100/ ENGAGED	%/OFF-ENGAGED
HTR12	T47	OFF (O)	ON	ON	ON	ON/OFF
HTR22	T48	OFF (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
		NOT	NOT			READY/NOT

EVAP020R	PID	READY	READY	NOT READY	NOT READY	READY
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+) 20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+) 20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	0	(-)10-(+) 10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	0	(-)10-(+) 10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	20-25	30-35	30-35	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VPWR	B35/B36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/T40	5	5	5	5	DCV

4.0L RANGER

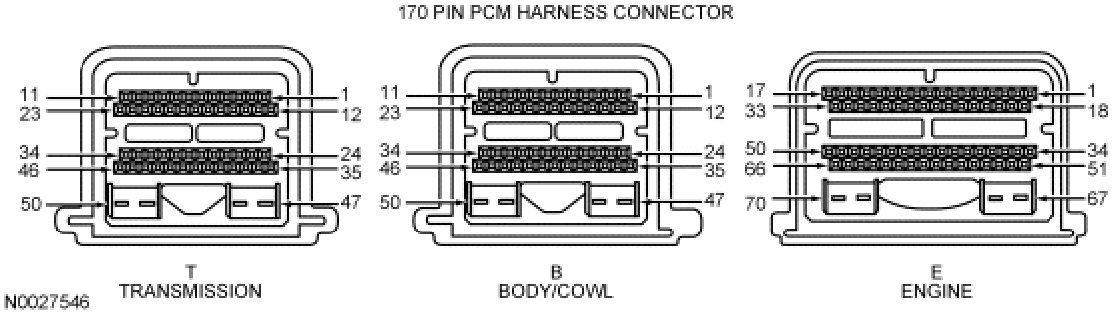


Fig. 16: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FTP	B3	2.6/0	2.6/0	2.6/0	2.6/0	DCV/PSI
FTP_H2O	B3	0	0	0	0	H2O
BOO	B8	OFF	OFF	OFF	OFF	ON/OFF
FPM	B21	OFF	ON	ON	ON	ON/OFF

TCS	B29	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
CPP/PNP	B33	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
ECT	E18	0.4-1/200-160	0.4-1/200-160	0.4-1/200-160	0.4-1/200-160	DCV/DEG F
DPFEGR	E21	0.25-1.30	0.25-1.30	0.25-4.65	0.25-4.65	DCV
IAT	E22	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG F
MAF	E25	0	0.7-0.9	1.2-1.6	1.6-2.1	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
KNOCK 1	E49	16380	196	173	212	N/A
TP	E61	1.05/CT	1.05/CT	1.21/PT	1.29/PT	DCV/CT/ PT/WOT
OSS	T3	0	0	1261	2294	RPM
TSS	T15	0	775	926	1716	RPM
TR2	T17	CLOSED	CLOSED	OPEN	OPEN	OPEN/ CLOSED
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TFT	T29	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	DCV/DEG F
ACCS	PID	OFF	ON (A)	OFF	OFF	ON/OFF
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
BARO	PID	155.1/14.18	155.1/14.18	155.1/14.18	155.1/14.18	Hz/PSI
DECHOKE	PID	YES	NO	NO	NO	YES/NO
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	17-28	19-26	30-40	%
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	750	1300-1350	1780	RPM
TORQUE	PID	238.7	10.85	8.13	179	Nm
TPCT	PID	1.05	1.05	1.05	1.05	DCV
TR	PID	P	P	OD	OD	MODE
TSS/ISS	PID	0	750	990	1720	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FP	B12	OFF	ON	ON	ON	ON/OFF
PCVHC	E3	0	0	0	0	%
EVMV	E6	0	0	500-900 (F)	500-900 (F)	mA
IAC	E33	0	35	35-41 (L)	57-68 (L)	%
EGRVR	E63	0	0	(T)	(T)	%
HTR11	E69	OFF (O)	ON	ON	ON	ON/OFF
HTRCM11	E69	539	539	535	535	mA
HTR21	E70	OFF (O)	ON	ON	ON	ON/OFF
HTRCM21	E70	504	504	500	500	mA
TCC	T46	0/OFF	0/OFF	0/OFF	100/ ENGAGED	%/OFF-ENGAGED
HTR12	T47	OFF (O)	ON	ON	ON	ON/OFF
HTRCM12	T47	938	938	906	906	mA
HTR22	T48	OFF (O)	ON	ON	ON	ON/OFF
HTRCM22	T48	922	922	945	945	mA
EGR_EVAL	PID	NO	NO	NO	NO	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPCV	PID	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVAPSOAK	PID	YES	YES	NO	NO	YES/NO
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	20-25	30-35	30-35	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/B36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/T40	5	5	5	5	DCV

4.0L EXPLORER/EXPLORER SPORT TRAC/MOUNTAINEER

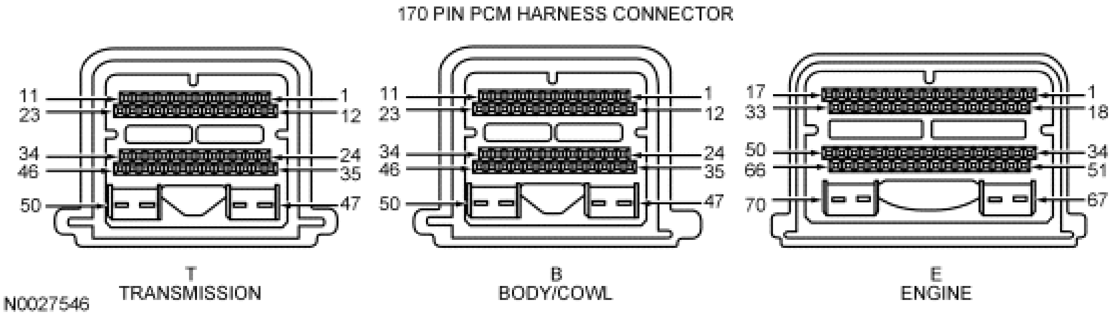


Fig. 17: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.61/0	2.61/0	2.19/-0.11	2.62/0	DCV/PSI
APP1	B5	4.0	4.0	3.4-4.0	2.9-4.0	DCV
BOO	B8	OFF	ON (E)	OFF	OFF	ON/OFF
ACCS	B15	OFF	ON (A)	OFF	OFF	ON/OFF
ACDS1	B16	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE/ DISABLED
APP2	B17	1.4	1.5	1.5-1.9	1.5-2.4	DCV
ACP_PRESS	B18	117.97	101.97	81.98	83.98	PSI
APP3	B28	0.9	0.9	0.9-1.3	0.9-1.8	DCV
TCS	B29	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
ECT	E18	0.4-1/200-160	0.4-1/200-160	0.4-1/200-160	0.4-1/200-160	DCV/DEG F
FRT	E19	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	DCV/DEG F
DPFEGR	E21	0.25-1.30	0.25-1.30	0.25-4.65	0.25-4.65	DCV
IAT	E22	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG F
FANSS	E24	0	300-500	300-550	300-500	RPM
MAF	E25	0	0.7-0.9	1.2-1.8	1.6-2.1	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.4/55	2.8/40	2.8/40	2.8/38	DCV/PSI

KNOCK 1	E49	8.19k	132	127	121	N/A
TP2	E60	1.23/24.31	0.75/14.9	0.85/16.86	1.43/28.63	DCV/%
TP1	E61	4.05/18.82	4.29.13.73	4.24/14.9	3.96/20.39	DCV/%
MAP	E62	4.3/14.5 (W)	1.21/4.49 (W)	2.14/7.54 (W)	2.83/9.71 (W)	DCV/PSI
HTRCM11	E69	523	523	523	523	mA
HTRCM21	E70	477	477	477	477	mA
OSS_SRC	T3	0	0	1250-1330	2100-2400	RPM
TSS	T15	0	630-670	1100-1310	1700-1800	RPM
TR 2	T17	CLOSED	CLOSED	OPEN	OPEN	DCV
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TFT	T29	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	DCV/DEG F
HTRCM12	T47	852	852	852	852	mA
HTRCM22	T48	887	887	887	887	mA
ACDS2	PID	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE/ DISABLED
APP	PID	0	0	15.5	23.5	%
BARO	PID	14.54/157.7	14.54/157.7	14.54/157.7	14.54/157.7	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.39	1.5	5.14	12.15	DEG
ETC_DSD	PID	7.62	1.42	5.12	12.22	DEG
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	15-28	19-26	30-40	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	750-820	1300-1520	1600-1780	RPM
TR	PID	P	P	OD	OD	MODE
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FP	B12	75/OFF	20.44/ON	20.65/ON	23.04/ON	%/ON-OFF
EVAPCV	B13	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
WAC/ACCR	B14	OFF	ON (A)	OFF	OFF	ON/OFF
GENCMD (ILINE)	B22	0	8.62	8.75	8.81	DCV
PCVHC	E3	0	0	0	0	%

EVMV	E6	0/OFF	0/OFF	500-900 (F)/VARYING	500-900 (F)/VARYING	mA/OFF-VARYING
FANVAR	E7	0	0/100	13	10	%
EGRVR	E63	0	0	(T)	(T)	%
HTR11	E69	OFF (O)	ON	ON	ON	ON/OFF
HTR21	E70	OFF (O)	ON	ON	ON	ON/OFF
TCC	T46	0/OFF	0/OFF	0/OFF	100/ON	%/ON-OFF
HTR12	T47	OFF (O)	ON	ON	ON	ON/OFF
HTR22	T48	OFF (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	13-25	26-35	21-35	DEG
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VPWR	B35/B36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57	5	5	5	5	DCV

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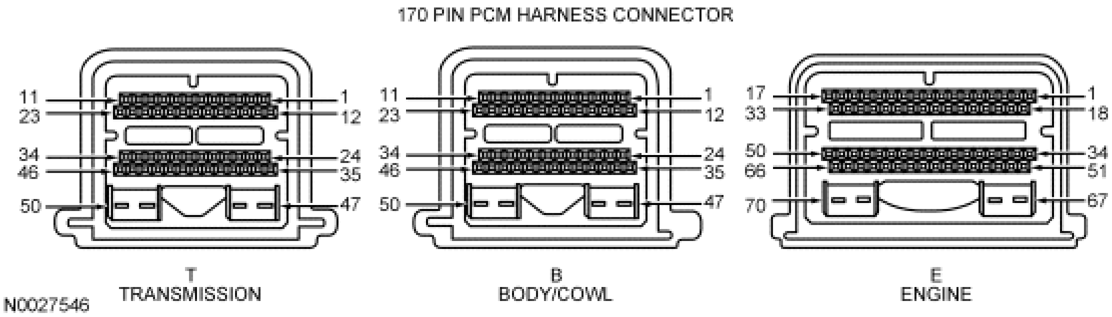

Fig. 18: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0	2.6/0	1.98/-0.16	2.05/-0.14	DCV/PSI
APP1	B5	4.0	4.0	3.4-4.0	2.9-4.0	DCV
ACCS	B15	OFF	ON (A)	OFF	OFF	ON/OFF
ACDS1	B16	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE/ DISABLE
APP2	B17	1.4	1.4	1.4-1.9	1.4-2.4	DCV
ACP_PRESS	B18	101.97	105.98	87.98	87.98	PSI
APP3	B28	0.9	0.9	0.9-1.3	0.9-1.8	DCV
TCS	B29	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
FRT	E19	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	0.5-3/210-110 (K)	DCV/DEG F
IAT	E22	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG F
FANSS	E24	0	300-1040	300-500	300-500	RPM
MAF	E25	0	0.7-0.9	1.2-1.7	1.5-2.4	DCV
EOT	E27	0.5-3/210-110	0.5-3/210-110	0.5-3/210-110	0.5-3/210-110	DCV/DEG F
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.0/50	2.8/40	2.8/39	2.8/39	DCV/PSI
CHT	E41	0.6-3.7/194 (K)	0.6-3.7/194 (K)	0.6-3.7/194 (K)	0.6-3.7/194 (K)	DCV/DEG F
TP2	E60	1.27/25.1	0.72/14.51	0.76/14.9	3.96/78.82	DCV/%
TP1	E61	4.03/19.22	4.3/13.73	4.28/14.12	2.71/45.88	DCV/%

HTRCM11	E69	512	512	512	512	mA
HTRCM21	E70	512	512	512	512	mA
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
HTRCM12	T47	863	863	863	863	mA
HTRCM22	T48	863	863	863	863	mA
ACDS2	PID	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE/ DISABLE
APP	PID	0	0	7	13	%
BARO	PID	14.48/157.4	14.48/157.4	14.48/157.4	14.48/157.4	PSI/BARO
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.98	1.43	4.37	5	DEG
ETC_DSD	PID	7.6	1.37	4.24	4.77	DEG
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	16-23	15-20	25-37	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	630-850	1400-1465	1500-1726	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	75/OFF	22.03/ON	19.89/ON	19.5/ON	%/ON-OFF
EVAPCV	B13	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
WAC/ACCR	B14	OFF	ON (A)	OFF	OFF	ON/OFF
GENCMD (ILINE)	B22	0	8.68	8.81	8.81	DCV
EVMV	E6	0/OFF	0/OFF	500-900 (F)/VARYING	500-900 (F)/VARYING	mA/OFF-VARYING
SPKDUR_8	E9	0	1.71	1.65	1.53	mS
SPKDUR_5	E10	0	1.62	1.65	1.59	mS
SPKDUR_2	E11	0	1.71	1.68	1.21	mS
SPKDUR_3	E12	0	1.84	1.78	1.43	mS
SPKDUR_4	E14	0	1.71	1.71	1.4	mS
SPKDUR_6	E15	0	1.65	1.68	1.5	mS
SPKDUR_7	E16	0	1.65	1.59	1.53	mS
SPKDUR_1	E17	0	1.68	1.62	1.21	mS
IMRC	E50	OFF	OFF	OFF	OFF	ON/OFF

VCTDC	E67	0	0	47.49	48.31	DEG
VCTDC2	E68	0	0	41.94	47	DEG
HTR11	E69	OFF (O)	ON	ON	ON	ON/OFF
HTR21	E70	OFF (O)	ON	ON	ON	ON/OFF
HTR12	T47	OFF (O)	ON	ON	ON	ON/OFF
HTR22	T48	OFF (O)	ON	ON	ON	ON/OFF
CHTIL	PID	OFF	OFF	OFF	OFF	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0-10	9-16	30-35	28-35	DEG
VCTADV	PID	0	-0.37	40.06	47.5	DEG
VCTADV2	PID	0	-1	41.94	49.63	DEG
VCTADVERR	PID	0	0.37	1.06	0.75	DEG
VCTADVERR2	PID	0	1	-0.75	-1.25	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/B36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57/T40	5	5	5	5	DCV

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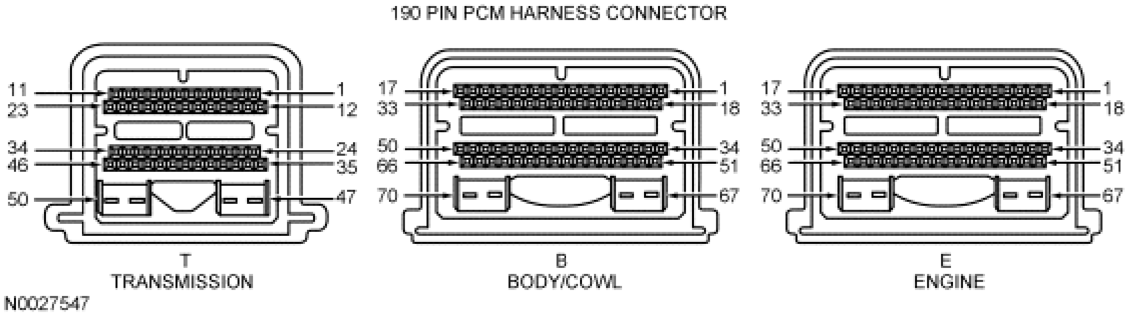

Fig. 19: 190 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
ACCS	B19	0.1/OFF	VBAT/ON (A)	0.1/OFF	0.1/OFF	DCV/ON-OFF
GENMON	B23	0	28.13	16.41	21.88	%
APP1	B25	3.9	4	3.9	3.7	DCV
APP2	B26	1.5	1.5	1.9	1.7	DCV
APP3	B27	1	1	1.3	1.2	DCV
PATS IN	B37	VBAT	VBAT	VBAT	VBAT	DCV
CPP-BT	B39	NO	NO	NO	NO	YES/NO
FTP	B44	2.6/0	2.6/0	2.6/0	2.6/0	DCV/PSI
TCS (A/T)	B45	0.1/OFF	VBAT/ON (G)	0.1/OFF	0.1/OFF	DCV/ON-OFF
BPP	B46	VBAT/OFF	VBAT/ON (E)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
BPS	B47	0.1/OFF	VBAT/ON (E)	0.1/OFF	0.1/OFF	DCV/ON-OFF
FEPS	B55	0.5-0.6	0.5-0.6	0.5-0.6	0.5-0.6	DCV
FRT	E19	80.6 (K)	84.2 (K)	53.6 (K)	57.2(K)	DEG F
DPFEGR	E21	0.25-1.3	0.25-1.3	0.25-4.65	0.25-4.65	DCV
IAT	E22	1.58/125.6 (K)	1.74/120.2 (K)	3.6/48.2 (K)	3.64/46.4 (K)	DCV/DEG F
MAF	E25	0	0.86	0.93	1.6	DCV
HO2S21	E28	0	switching (C)	switching (C)	switching (C)	DCV
HO2S11	E29	(L)	switching (C)	switching (C)	switching (C)	DCV
FRP	E32	3.7/39	3.8/40	3.7/39	3.8/40	DCV/PSI
CHT	E41	0.63/190	0.66/188	3.71/194	3.7/194	DCV/DEG F

IMRCM	E43	NO FAULT	NO FAULT	NO FAULT	NO FAULT	FAULT/NO FAULT
CMP	E45	0	6	11	15	Hz
CKP	E47	0	475	800	1100	Hz
KNOCK 1	E49	16	25	18	29	N/A
TP2	E60	1.31	1	1.27	1.66	DCV
TP1	E61	4	4.1	4	3.8	DCV
MAP	E62	4.2/14.21 (W)	1.24/4.49 (W)	1.27/4.49 (W)	2/7.25 (W)	DCV/PSI
OSS (A/T)	T14	0	0	500-524/ 1250-1310	960-1020/ 2400-2550	Hz/RPM
OSS (M/T)	T14	0	0	1133	2151	RPM
TSS (A/T)	T15	0	320-360/ 630-670	500-713/ 1100-1300	845-985/ 1700-1800	Hz/RPM
TR1 (A/T)	T17	0	0	11.5	11.5	DCV
TR2 (A/T)	T18	0	0	11.5	11.5	DCV
TR3 V/TR (A/T)	T19	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
TFT (A/T)	T20	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	0.5-2/210-110 (K)	DCV/DEG
HO2S22	T21	0.1	(D)	(D)	(D)	DCV
HO2S12	T22	(L)	(D)	(D)	(D)	DCV
TR4 (A/T)	T32	0	0	11.5	11.5	DCV
APP	PID	0	0	1.5	8	%
CPP/PNP	PID	ON	ON	OFF	OFF	ON/OFF
FLI	PID	98.2 (H)	98.2 (H)	100 (H)	100 (H)	%
GEAR (A/T)	PID	1	1	3	4	GEAR
VSS	PID	0	0	30	55	MPH
LOAD	PID	61.89 (L)	15.38	23.54	28.42	%
MISFIRE	PID	NO	NO	OFF	OFF	ON/OFF
RPM	PID	0	1018	1138	1721	RPM

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
WAC/ACCR	B18	VBAT/OFF	0.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
GENCMD	B22	3.79	0 (Q)	0 (Q)	0 (Q)	%
PATSTRT/SMC	B34	0	0	0	0	DCV
PAT IL	B35	0	0	0	0	DCV
PATS OUT	B36	10.5	VBAT (A)	VBAT	VBAT	DCV
EVAPCV	B61	VBAT/OFF	VBAT/OFF	VBAT/OFF (R)	VBAT/OFF (R)	DCV/ON-OFF
FP	B62	VBAT/OFF	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF

VSO	B63	0	0	55	125	Hz
PCVHC	E3	0	0	100	100	%
CDB (CYL 3 and 4)	E12	VBAT	VBAT	VBAT	VBAT	DCV
CDC (CYL 2 and 6)	E16	VBAT	VBAT	VBAT	VBAT	DCV
CDA (CYL 1 and 5)	E17	VBAT	VBAT	VBAT	VBAT	DCV
TACM (+)	E34	3.7	VBAT	VBAT	VBAT	DCV
IMRC	E50	VBAT/OFF	VBAT/OFF	VBAT/OFF	0/ON	DCV/ON-OFF
TACM (-)	E51	3.7	VBAT	VBAT	VBAT	DCV
EGRVR	E63	0	0	(T)	48.43 (T)	%
EVAPPDC	E65	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
HTR11	E69	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
HTR21	E70	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
HTR12	T1	0.2/ON (O)	0.2/ON	0.2/ON	0.2/ON	DCV/ON-OFF
HTR22	T12	0.2/ON (O)	0.2/ON	0.2/ON	0.2/ON	DCV/ON-OFF
TCC (A/T)	T36	0.2/100	VBAT/0	0.2-VBAT/ 0-100	0.2/90-100	DCV/%
SSB (SS2) (A/T)	T37	VBAT/OFF	VBAT/OFF	0.1/ON	0.1/ON	DCV/ON-OFF
SSA (SS1) (A/T)	T38	0.1/ON	0.1/ON	VBAT/OFF	0.1/ON	DCV/ON-OFF
EPC (A/T)	T39	7.7/15-20	8.8-10.2/15-20	10.3-10.6/ 35-40	10.6/45	DCV/PSI
CHTFM	PID	NO FAULT	NO FAULT	NO FAULT	NO FAULT	FAULT/NO FAULT
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
OTS_STAT (A/T)	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0.5	19.25	14.5	37.75	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
ETCVREF	B21/B28/E66	5	5	5	5	DCV
BVREF	B29/E57	5	5	5	5	DCV
VPWR	B51/52/53	VBAT	VBAT	VBAT	VBAT	DCV
KAPWR	B54	VBAT	VBAT	VBAT	VBAT	DCV

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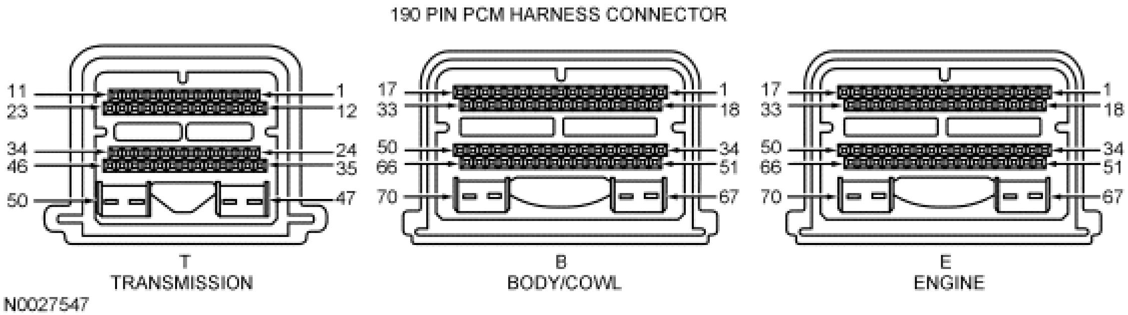


Fig. 20: 190 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
ACCS	B19	OFF	ON (A)	OFF	OFF	ON/OFF
GENMON	B23	0	28.13	21.88	20.31	%
APP1	B25	4.0	4.0	3.9	3.7	DCV
APP2	B26	1.5	1.5	1.6	1.75	DCV
APP3	B27	1	1	1	1.2	DCV
4WDMCS	B32	8.8 (2HIGH)	9.6 (4LOW)	6.6 (4HIGH)	9.5 (2HIGH)	DCV
FTP	B44	2.59/0	2.53/-0.02	2.58/0	2.56/-0.01	DCV/PSI
TCS	B45	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED-NOT DEPRESSED
BPP/BOO	B46	OFF	ON (E)	OFF	OFF	ON/OFF
DPFEGR	E21	0.25-1.3	0.25-1.3	0.25-4.65	0.25-4.65	DCV
IAT	E22	1.69/122 (K)	1.77/118(K)	3.07/68 (K)	3.08/68 (K)	DCV/DEG F
PSP	E24	4.99/1499.3	4.99/1499.3	4.99/1499.3	4.99/1499.3	DCV/PSI
MAF	E25	0	0.64	1.47	1.5	DCV
O2S21	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S11	E29	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.59/55	2.8/40	2.8/40	2.8/40	DCV/PSI
CHT	E41	0.6/194	0.6/194	0.61/192	0.61/192	DCV/DEG F
KNOCK 1	E49	24290	20470	27570	55580	N/A
TP2	E60	1.29/25.49	0.89/17.65	1.39/27.45	1.53/30.59	DCV
TP1	E61	4.1/17.65	4.31/13.33	4.06/18.43	3.98/20	DCV
MAP	E62	4.34/14.64 (W)	1.24/4.49 (W)	2.13/7.54 (W)	2.19/7.68 (W)	DCV/PSI
OSS	T14	0	0	1220	2361	RPM

TSS	T15	0	649	863	1637	RPM
TR2	T18	CLOSED	CLOSED	OPEN	OPEN	OPEN/ CLOSED
TFT	T20	0.98/165.2 (K)	0.88/172.4 (K)	1.21/153 (K)	1.13/158 (K)	DCV/DEG F
O2S22	T21	(L)	switching (D)	switching (D)	switching (D)	DCV
O2S12	T22	(L)	switching (D)	switching (D)	switching (D)	DCV
APP	PID	0	0	2	10.5	%
BARO	PID	14.48/157.4	14.48/157.4	14.48/157.4	14.48/157.4	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.37	2.25	5.06	11.02	DEG
ETC_DSD	PID	7.62	2.19	5.08	11.06	DEG
ETC_TRIM	PID	0.23	0.23	0.22	0.22	DEG
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	65.78 (L)	15.83	15.55	27.35	%
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	655	975	1650	RPM
TR	PID	P	P	OD	OD	MODE

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
WAC/ACCR	B18	OFF	ON (A)	OFF	OFF	ON/OFF
GENCMD	B22	3.79	0 (Q)	0 (Q)	0 (Q)	%
EVMV	B50	0/OFF	405/ VARYING	356/ VARYING	405/ VARYING	mA/OFF-VARYING
EVAPCV	B61	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
FP	B62	75/OFF	19.66/ON	22.02/ON	20.34/ON	%/ON-OFF
SPKDUR_8	E9	0	1.65	1.68	1.03	ms
SPKDUR_5	E10	0	1.5	1.37	1.15	ms
SPKDUR_2	E11	0	1.71	1.43	1.31	ms
SPKDUR_3	E12	0	1.37	1.56	1.31	ms
SPKDUR_4	E14	0	1.75	1.37	1.09	ms
SPKDUR_6	E15	0	1.75	1.43	1.25	ms
SPKDUR_7	E16	0	1.75	1.59	0.906	ms
SPKDUR_1	E17	0	1.68	1.12	1.25	ms
EGRVR	E63	0	0	36.25 (T)	77.8 (T)	%
HTR11	E69	OFF (O)	ON	ON	ON	ON/OFF
HTR21	E70	OFF (O)	ON	ON	ON	ON/OFF
HTR12	T1	OFF (O)	ON	ON	ON	ON/OFF

HTR22	T12	OFF (O)	ON	ON	ON	ON/OFF
TCC	T36	0/OFF	0/OFF	0/OFF	100/ ENGAGED	%/OFF- ENGAGED
4WDC	T49	0.5	0.2	0.2	0.2	DCV
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	YES	YES	NO	NO	YES/NO
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
OTS_STAT (A/T)	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	0.5	28	35.75	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
BVREF	B29/E57	5	5	5	5	DCV
VPWR	B51/52/53	VBAT	VBAT	VBAT	VBAT	DCV

5.4L 3V F-150/MARK LT

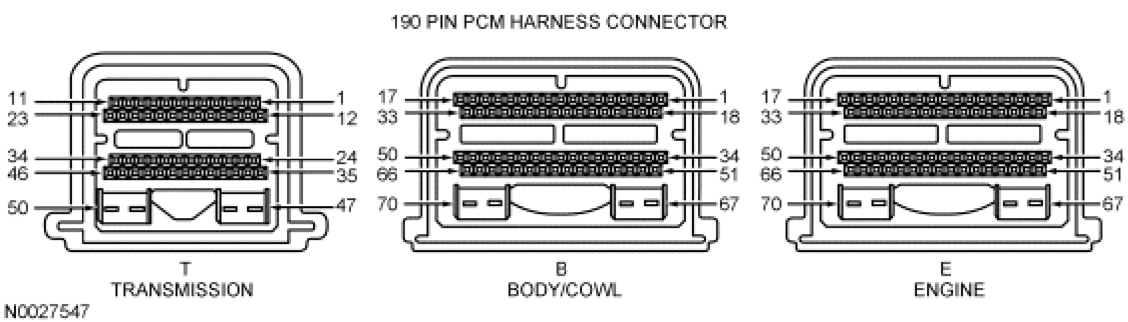


Fig. 21: 190 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
ACCS	B19	OFF	ON (A)	OFF	OFF	ON/OFF
GENMON	B23	0	34.36	21.88	20.31	%
APP1	B25	4.0	4.0	3.7	3.6	DCV
APP2	B26	1.5	1.5	1.7	1.8	DCV
APP3	B27	0.9	0.9	1.16	1.22	DCV
4WDMCS	B32	9.5 (2HIGH)	4.5 (4LOW)	6.6 (4HIGH)	9.5 (2HIGH)	DCV
FTP	B44	2.6/-0.01	2.6/-0.01	2.3/-0.09	2.7/-0.09	DCV/PSI
TCS	B45	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
BPP/BOO	B46	OFF	ON (E)	OFF	OFF	ON/OFF
BPA	B47	OFF	ON (E)	OFF	OFF	ON/OFF
FRT	E19	2.7/86 (K)	2.7/86 (K)	3.5/57 (K)	3.5/61 (K)	DCV/DEG F
IAT	E22	1.6/126 (K)	1.7/120 (K)	3.6/48 (K)	3.6/46 (K)	DCV/DEG F
PSP	E24	4.99/1499.3	4.99/1499.3	4.99/1499.3	4.99/1499.3	DCV/PSI
MAF	E25	0	0.72	1.25	1.75	DCV
O2S21	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S11	E29	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
KNOCK 2	E31	65.54k	170	183	234	N/A
FRP	E32	2.9/41.4	2.7/38.6	2.7/39	2.7/39.3	DCV/PSI
CHT	E41	3.6/201	3.5/204	3.5/201	3.5/207	DCV/DEG F
KNOCK 1	E49	175	178	205	254	N/A
TP2	E60	1.31/26.28	0.83/16.47	1.21/23.92	1.61/32.16	DCV/%
TP1	E61	4.08/18.04	4.32/13.33	4.14/17.65	3.93/21.18	DCV/%
HTRCM11	E69	516	516	516	516	mA
HTRCM21	E70	539	539	539	539	mA
HTRCM12	T1	500	500	500	500	mA
4WDP1 (ESOF)	T6	VBAT	VBAT	VBAT	VBAT	DCV
4WDP2 (ESOF)	T7	VBAT	VBAT	VBAT	VBAT	DCV
4WDMP1 (MSOF)	T7	0	0	0	0	DCV
4WDP3 (ESOF)	T8	VBAT	VBAT	VBAT	VBAT	DCV
4WDMP2 (MSOF)	T8	0	0	0	0	DCV
4WDP4 (ESOF)	T9	VBAT	VBAT	VBAT	VBAT	DCV
HTRCM22	T1	520	520	520	520	mA
OSS	T14	0	0	1162	2150	RPM

TSS	T15	0	724	823	1514	RPM
TCSS/VSS	T16	0	0	0	0	MPH
TR2	T18	CLOSED	CLOSED	OPEN	OPEN	OPEN/ CLOSED
TFT	T20	1.86/118 (K)	1.87/118 (K)	1.41/142 (K)	1.38/144 (K)	DCV/DEG F
O2S22	T21	(L)	switching (D)	switching (D)	switching (D)	DCV
O2S12	T22	(L)	switching (D)	switching (D)	switching (D)	DCV
APP	PID	0	0	9	16.5	%
BARO	PID	14.67/158.5	14.67/158.5	14.67/158.5	14.67/158.5	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.62	1.02	3.5	8.06	DEG
ETC_DSD	PID	7.62	0.96	3.62	8.09	DEG
ETC_TRIM	PID	-0.43	-0.43	-0.43	-0.43	DEG
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	62 (L)	14.5	21.4	32	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	655	1230	1500	RPM
TR	PID	P	P	OD	OD	MODE
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
WAC/ACCR	B18	OFF	ON (A)	OFF	OFF	ON/OFF
GENCMD	B22	6.08	0 (Q)	0 (Q)	0 (Q)	%
EVAPCV	B61	0/OFF	0/OFF	0 (R)/OFF	0 (R)/OFF	%/ON-OFF
FP	B62	75/OFF	18.81/ON	19.45/ON	21.39/ON	DCV/%
4WDMCS	B32	9.5 (2HIGH)	4.5 (4LOW)	6.6 (4HIGH)	9.5 (2HIGH)	DCV
EVMV	C50	0/OFF	0/OFF	472 (F)/VARIES	760 (F)/VARIES	mA/OFF-VARIES
SPKDUR_8	E9	0	1.75	1.62	0.688	ms
SPKDUR_5	E10	0	1.84	1.59	0.688	ms
SPKDUR_2	E11	0	1.68	1.12	0.750	ms
SPKDUR_3	E12	0	1.68	1.37	0.750	ms
SPKDUR_4	E14	0	1.81	1.25	0.688	ms
SPKDUR_6	E15	0	1.84	1.71	0.938	ms
SPKDUR_7	E16	0	1.75	1.18	0.688	ms
SPKDUR_1	E17	0	1.75	1	0.906	ms

IMRC	E50	OFF	OFF	OFF	OFF	ON/OFF
VCTDC	E67	0	0	46.88	43.95	%
VCTDC2	E68	0	0	45.88	44.25	%
HTR11	E69	OFF (O)	ON	ON	ON	ON/OFF
HTR21	E70	OFF (O)	ON	ON	ON	ON/OFF
HTR12	T1	OFF (O)	ON	ON	ON	ON/OFF
HTR22	T12	OFF (O)	ON	ON	ON	ON/OFF
TCC	T36	0/OFF	0/OFF	0/OFF	100/ ENGAGED	%/OFF- ENGAGED
4WDC (ESOF)	T49	0.5	0.2	0.2	0.2	DCV
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/ NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
OTS_STAT (A/T)	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	15.75	34	35.75	DEG
VCTADV	PID	0	0.62	50.69	49.56	DEG
VCTADV2	PID	0	0.5	50.75	50.38	DEG
VCTADVERR	PID	0	-0.62	0.68	-1.25	DEG
VCTADVERR2	PID	0	-0.5	-1.68	-0.5	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VREF	B29/E57	5	5	5	5	DCV
VPWR	B51/52/53	VBAT	VBAT	VBAT	VBAT	DCV

4.6L 2V E-SERIES

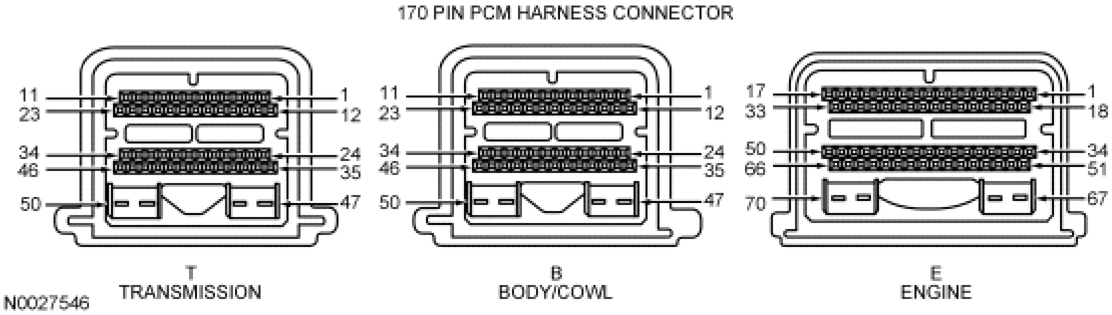


Fig. 22: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0	2.6/0	2.6/0	2.6/0	DCV/PSI
APP1	B5	4.1	4.1	3.8	3.6	DCV
BPP/BOO	B8	OFF	ON (E)	OFF	OFF	ON/OFF
APP2	B17	1.64	1.7	1.7	1.9	DCV
TCS	B27	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
APP3	B28	1	1	1.2	1.3	DCV
ACCS	E4	OFF	ON (A)	OFF	OFF	ON/OFF
FRT	E19	2.02/109.4	2/111.2	2.45/96.8	2.5/93.2	DCV/DEG F
DPFEGR	E21	0.25-1.3	0.25-1.3	0.25-4.65	0.25-4.65	DCV
IAT	E22	2.9/75 (K)	3.1/66 (K)	3.6/50 (K)	3.6/50 (K)	DCV/DEG F
MAF	E25	0	0.78	.8	1.5	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.2/47	2.8/40	2.8/40	2.8/40	DCV/PSI
CHT	E41	0.6/190	0.64/190	0.61/192	0.61/192	DCV/DEG F
KNOCK 1	E49	4095	56	87	116	N/A
TP2	E60	1.25/24.71	0.9/18.04	1.1/21.96	1.54/29.8	DCV/%
TP1	E61	4.08/18.04	4.26/14.51	4.16/16.47	3.94/20.78	DCV/%
MAP	E62	4.3/14.5 (W)	1.2/4.35 (W)	1.3/4.78 (W)	2.7/9.13 (W)	DCV/PSI
BPA	E65	OFF	ON (E)	OFF	OFF	ON/OFF
HTRCM11	E69	1.49	1.49	1.49	1.49	AMPS
HTRCM21	E70	1.57	1.57	1.57	1.57	AMPS
OSS_SRC	T3	0	0	1207	2298	RPM

TSS	T15	0	744	866	1610	RPM
TR	T16	P	P	OD	OD	MODE
TR2	T17	CLOSED	CLOSED	OPEN	OPEN	OPEN/ CLOSED
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0.1	(D)	(D)	(D)	DCV
TFT	T29	2.3/102 (K)	2.6/93 (K)	1.7/124 (K)	1.65/129 (K)	DCV/DEG F
HTRCM12	T47	961	961	961	961	mA
HTRCM22	T48	945	945	945	945	mA
APP	PID	0	0	5.5	13.5	%
BARO	PID	14.36/156.6	14.36/156.6	14.36/156.6	14.36/156.6	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.75	2.87	5.18	10.92	DEG
ETC_DSD	PID	7.62	2.51	5.15	10.92	DEG
ETC_TRIM	PID	0.23	0.23	0.23	0.23	DEG
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	59 (L)	18	16	28	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	728	1315	1597	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VSO	B1	0	0	65	125	Hz
FP	B12	75/OFF	20/ON	21/ON	22/ON	%/ON-OFF
EVAPCV	B13	0/OFF	0/OFF	0/OFF (R)	0/OFF (R)	%/ON-OFF
EVMV	E1	0/OFF	0/OFF	0/OFF	20/VARYING	mA/OFF-VARYING
PCVHC	E2	0	0	0	0	%
WAC/ACCR	E3	OFF	ON (A)	OFF	OFF	ON/OFF
EGRVR	E63	0	0	33 (T)	53 (T)	%
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
TCC	T46	0/OFF	0/OFF	0/OFF	100/ ENGAGED	%/OFF-ENGAGED

HTR12	T47	ON (O)	ON	ON	ON	ON/OFF
HTR22	T48	ON (O)	ON	ON	ON	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	YES	YES	YES	YES	YES/NO
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	11.75	27.5	41	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40/E57	5	5	5	5	DCV

5.4L 2V E-SERIES

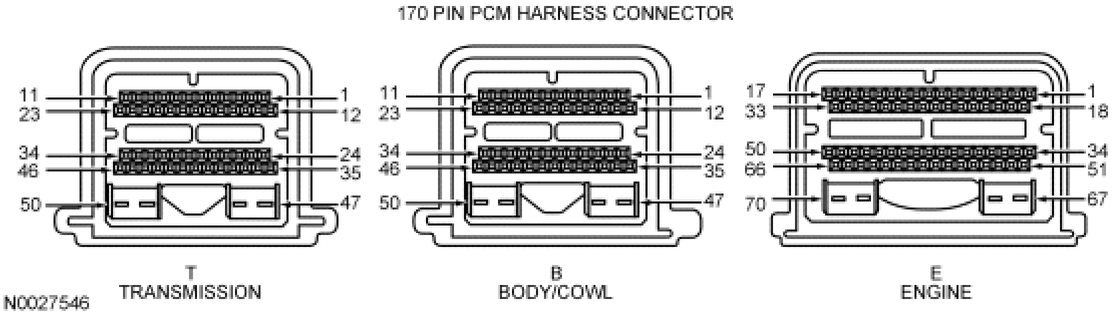


Fig. 23: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.1/-0.13 (M)	2.6/-0.24 (M)	DCV/PSI
APP1	B5	4.1	4	3.9	3.7	DCV
PTOIR V (5R110W)	B7	VBAT	VBAT	VBAT	VBAT	DCV
BPP/BOO	B8	OFF	ON (E)	OFF	OFF	ON/OFF
APP2	B17	1.4	1.4	1.6	1.8	DCV
PTO (5R110W)	B26	OFF	OFF	OFF	OFF	ON/OFF
TCS	B27	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
APP3	B28	1	0.9	1	3.7	DCV
ACCS	E4	OFF	ON (A)	OFF	OFF	ON/OFF
FRT	E19	3.4/62 (K)	3.4/64 (K)	3.2/68 (K)	3.3/66 (K)	DCV/DEG F
IAT	E22	3.5/52 (K)	3.6/48 (K)	4/27 (K)	4/23 (K)	DCV/DEG F
MAF	E25	0	0.71	1	1.7	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.5/52	2.8/40	2.8/40	2.7/39	DCV/PSI
CHT	E41	0.61/192	0.67/187	3.7/195	3.6/197	DCV/DEG F
KNOCK 1	E49	4.09k	54	62	110	N/A
TP2	E60	1.23/24.31	0.79/15.69	1.12/22.35	1.33/26.28	DCV/%
TP1	E61	4.06/18.43	4.28/14.12	4.12/17.26	4.01/19.61	DCV/%
BPA	E65	OFF	ON (E)	OFF	OFF	ON/OFF
HTRCM11	E69	1.53	1.53	1.53	1.53	AMPS
HTRCM21	E70	1.57	1.57	1.57	1.57	AMPS
OSS_SRC	T3	0	0	1157	2264	RPM
TSS	T15	0	931	831	1600	RPM
TR2 (4R75E)	T17	CLOSED	CLOSED	OPEN	OPEN	OPEN/ CLOSED
TR-P (5R110W)	T19	P	P	OD	OD	MODE
O2S12	T24	(L) (M)	(D) (M)	(D) (M)	(D) (M)	DCV
O2S22	T25	0 (M)	(D) (M)	(D) (M)	(D) (M)	DCV
TFT	T29	2.9/82 (K)	3/77 (K)	2.3/100 (K)	2.2/104 (K)	DCV/DEG F
HTRCM12	T47	898	898	898	898	mA
HTRCM22	T48	906	906	906	906	mA
APP	PID	0	0	14.5	16	%
BARO	PID	14.48/157.4	14.48/157.4	14.48/157.4	14.48/157.4	PSI/HZ

B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.47	2.1	12.19	12.48	DEG
ETC_DSD	PID	7.62	2.06	12.29	12.61	DEG
ETC_TRIM	PID	-0.33	-0.35	-0.3	-0.3	DEG
FLI	PID	40 (H)	41(H)	43 (H)	48 (H)	%
GEAR (4R75E)	PID	1	1	4	4	GEAR
GEAR (5R110W)	PID	1	1	5	6	GEAR
LOAD	PID	71 (L)	15	18	32	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	720	1100	1600	RPM
TR (4R75E)	PID	P	P	OD	OD	MODE
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	75/OFF	20/ON	20/ON	23/ON	%/ON-OFF
EVAPCV	B13	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
EVMV	E1	0/OFF	0/OFF	626/ VARYING	839/ VARYING	mA/OFF-VARYING
WAC/ACCR	E3	OFF	ON (A)	OFF	OFF	ON/OFF
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
TCC (4R75E)	T46	0/OFF	0/OFF	0/OFF	39.29/ ENGAGED	%/OFF-ENGAGED
HTR12	T47	ON (M) (O)	ON (M)	ON (M)	ON (M)	ON/OFF
HTR22	T48	ON (M) (O)	ON (M)	ON (M)	ON (M)	ON/OFF
TSPC (5R110W)	T49	VBAT	VBAT	VBAT	VBAT	DCV
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO

LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	8.75	27	29.75	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	E57	5	5	5	5	DCV

6.8L 2V E-SERIES

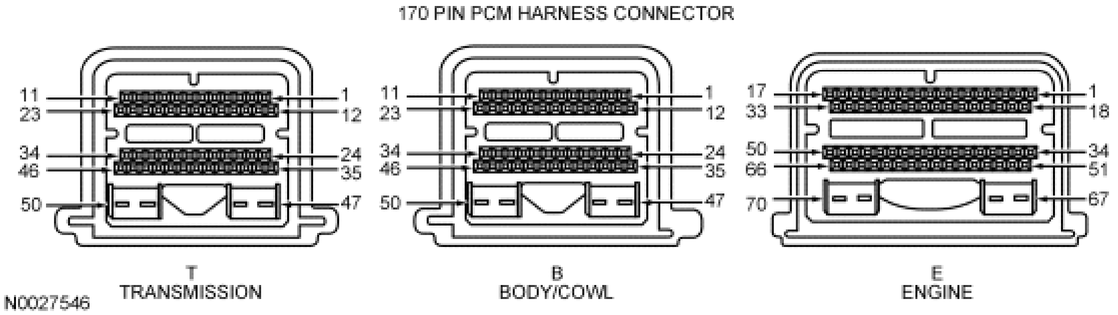


Fig. 24: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.6/0 (M)	1.4/-0.3 (M)	DCV/PSI
APP1	B5	4	4	3.8	3.7	DCV
PTOIR V	B7	0.0	0.0	0.0	0.0	DCV
BOO	B8	OFF	ON (E)	OFF	OFF	ON/OFF
PTOLOAD	B9	NO	NO	NO	NO	YES/NO
O2S13	B14	0 (M)	switching (C) (M)	switching (C) (M)	switching (C) (M)	DCV
APP2	B17	1.4	1.4	1.7	1.7	DCV
PTO	B26	OFF	OFF	OFF	OFF	ON/OFF

TCS	B27	NOT DEPRESSED	DEPRESSED (G)	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
APP3	B28	0.9	0.9	1.2	1.2	DCV
ACCS	E4	OFF	ON (A)	OFF	OFF	ON/OFF
FRT	E19	2.6/90 (K)	3.2/ 70 (K)	3.1/72 (K)	3.2/70 (K)	DCV/DEG F
IAT	E22	2.74/81 (K)	2.9/73 (K)	4/27 (K)	3.9/30 (K)	DCV/DEG F
MAF	E25	0	1	1.3	1.8	DCV
O2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
FRP	E32	3.3/49	4.2/65	4.2/65	4.2/65	DCV/PSI
CHT	E41	0.7/188	0.6/187	0.7/188	0.6/188	DCV/DEG F
TP2	E60	1.16/23.14	0.69/13.73	1.16/23.14	1.1/21.96	DCV/%
TP1	E61	4.09/18.04	4.32/13.33	4.09/18.04	4.12/17.26	DCV/%
BPA	E65	OFF	ON (E)	OFF	OFF	ON/OFF
HTRCM11	E69	1.59	1.59	1.59	1.59	AMPS
HTRCM21	E70	1.54	1.54	1.54	1.54	AMPS
OSS	T3	0	0	1317	2503	RPM
TSS	T15	0	769	894	1761	RPM
O2S12	T24	(L) (M)	(D) (M)	(D) (M)	(D) (M)	DCV
O2S22	T25	0 (M)	(D) (M)	(D) (M)	(D) (M)	DCV
TFT	T29	1.5/135 (K)	1.5/136 (K)	1.2/154 (K)	1.2/156 (K)	DCV/DEG F
HTRCM12	T47	969	969	969	969	mA
HTRCM22	T48	957	957	957	957	mA
APP	PID	0	0	5.5	12.5	%
BARO	PID	14.92/160	14.92/160	14.92/160	14.92/160	PSI/HZ
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.54	1.62	4.85	8.47	DEG
ETC_DSD	PID	8	1.6	4.84	8.51	DEG
ETC_TRIM	PID	0.22	0.22	0.22	0.22	DEG
GEAR	PID	1	1	6	6	GEAR
LOAD	PID	40 (L)	40	20	27	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
RPM	PID	0	670	1026	1828	RPM
VSS	PID	0	0	30	55	MPH

	PCM	Measured/PID Values				

Actuators/Outputs	Pin/PID only	KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	Units Measured/PID
FP	B12	75/OFF	26/ON	26/ON	27/ON	%/ON-OFF
EVAPCV	B13	0/OFF (M)	0/OFF (M)	0/OFF (M) (R)	0/OFF (M) (R)	%/ON-OFF
HTR13	B38	ON (M) (O)	ON (M)	ON (M)	ON (M)	ON/OFF
PTOIL	B42	OFF	OFF	OFF	OFF	ON/OFF
TCIL	B43	OFF	OFF	OFF	OFF	ON/OFF
EVMV	E1	0/OFF	0/OFF	697/ VARYING	758/ VARYING	mA/OFF-VARYING
PCVHC	E2	0	0	0	0	%
WAC/ACCR	E3	OFF	ON	OFF	OFF	ON/OFF
HTR11	E69	ON (O)	ON	ON	ON	ON/OFF
HTR21	E70	ON (O)	ON	ON	ON	ON/OFF
HTR12	T47	ON (M) (O)	ON (M)	ON (M)	ON (M)	ON/OFF
HTR22	T48	ON (M) (O)	ON (M)	ON (M)	ON (M)	ON/OFF
CHTIL	PID	OFF	OFF	OFF	OFF	ON/OFF
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAP020R	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAPSOAK	PID	NO	NO	NO	NO	YES/NO
EVAP_EVAL	PID	NO	NO	NO	NO	YES/NO
LONGFT1	PID	(L)	(-)20-(+) 20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+) 20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+) 10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+) 10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	13.5	33.5	26-34	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV

VREF	E57	5	5	5	5	DCV

5.4L 3V EXPEDITION/NAVIGATOR

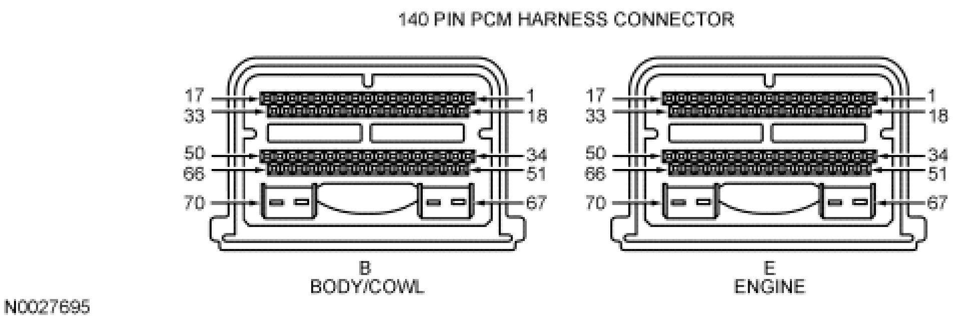


Fig. 25: Identifying 140 Pin PCM Harness Connectors/Terminals
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
GENMON	B23	0	25.78	22.66	4.68	%
APP1	B25	4.0	4.0	3.7	3.4	DCV
APP2	B26	1.5	1.5	1.7	2.0	DCV
APP3	B27	0.9	0.9	1.1	1.4	DCV
O2S12	B39	(L)	(D)	(D)	(D)	DCV
O2S22	B40	(L)	(D)	(D)	(D)	DCV
MAF	B41	0	0.77	1.56	1.75	DCV
IAT	B43	2.43/93.2 (K)	2.72/82.4 (K)	3.85/33.8 (K)	3.85/33.8 (K)	DCV/DEG F
FTP	B44	2.6/0	2.6/0	2.6/0	2.6/0	DCV/PSI
FTP_H2O	B44	0	0	-0.24	-1.86	in-Hg
BOO	B46	OFF	OFF	OFF	OFF	ON/OFF
BPA	B47	OFF	OFF	OFF	OFF	ON/OFF
O2S21	E28	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
O2S11	E29	(L)	switching (C)	switching (C)	switching (C)	DCV/ RICH-LEAN
KNOCK 2	E31	0	283	322	396	N/A
CHT	E41	0.57/196	0.56/198	3.63/194	3.5/204	DCV/DEG F
KNOCK 1	E49	0	174	323	413	N/A
TP2	E60	25.1/1.26	14.9/0.74	18.82/0.92	26.7/1.34	%/DCV
TP1	E61	18/4	12.9/4.3	14.9/4.2	22/3.9	%/DCV
ACCS	PID	OFF	OFF	OFF	OFF	ON/OFF

APP	PID	0	0	11	15	%
B+	PID	VBAT	VBAT	VBAT	VBAT	DCV
BARO	PID	160.4/14.97	160.4/14.97	160.4/14.97	160.4/14.97	Hz/PSI
CPP/PNP	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
DECHOKE	PID	YES	NO	NO	NO	YES/NO
ETC_ACT	PID	7.56	1.39	6.65	7.75	DEG
ETC_DSD	PID	7.62	1.34	5.65	7.66	DEG
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	5	6	GEAR
LOAD	PID	61.9 (L)	14.3	20.5	38.2	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
O2BANK1	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
O2BANK2	PID	VARIES	VARIES	VARIES	VARIES	RICH/LEAN
TCS	PID	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	NOT DEPRESSED	DEPRESSED/ NOT DEPRESSED
RPM	PID	0	695	1516	1497	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
HTR12	B10	OFF	ON	ON	ON	ON/OFF
HTRCM12	B10	895	895	895	895	mA
HTR22	B11	OFF	ON	ON	ON	ON/OFF
HTRCM22	B11	887	887	887	887	mA
WAC/ACCR	B18	OFF	OFF	OFF	OFF	ON/OFF
GENCMD	B22	6.08	57.54 (Q)	57.67 (Q)	57.65 (Q)	%
PTO	B26	OFF	OFF	OFF	OFF	ON/OFF
EVMV	B50	0/OFF	0/OFF	192/ VARYING	633/ VARYING	mA/OFF-VARYING
EVAPCV	B61	0/OFF	0/OFF	0/OFF	0/OFF	%/ON-OFF
FP	B62	0/OFF	100/ON	100/ON	100/ON	%/ON-OFF
IMRC	E50	OFF	OFF	OFF	OFF	ON/OFF
HTR11	E69	OFF	ON	ON	ON	ON/OFF
HTRCM11	E69	512	512	512	512	mA
HTR21	E70	OFF	ON	ON	ON	ON/OFF
HTRCM21	E70	527	527	527	527	mA
CHT_F	PID	NO FAULT	NO FAULT	NO FAULT	NO FAULT	FAULT/NO FAULT

EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAPSOAK	PID	NO	NO	YES	YES	YES/NO
EVAPSTA	PID	NOT RUNNING	NOT RUNNING	NOT RUNNING	NOT RUNNING	STATUS
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
FUELSYS	PID	OPEN LOOP	CLOSED LOOP	CLOSED LOOP	CLOSED LOOP	OPEN/ CLOSED LOOP
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
PATSENABL	PID	ENABLED	ENABLED	ENABLED	ENABLED	ENABLED/ DISABLED
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	14.8	34	36	DEG
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
VCTADV	PID	0	-0.31	35	56.56	DEG
VCTADV2	PID	0	0.62	32.63	55.94	DEG
VCTADVERR	PID	0	0.31	-1.31	-1.56	DEG
VCTADVERR2	PID	0	-0.62	0.06	-0.95	DEG
VCTDC	PID	0	0	39.69	38.85	%
VCTDC2	PID	0	0	41.39	40.34	%

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
VREF	E57	5	5	5	5	DCV
VPWR	B51/52/53	VBAT	VBAT	VBAT	VBAT	DCV

5.4L 3V F-SUPER DUTY

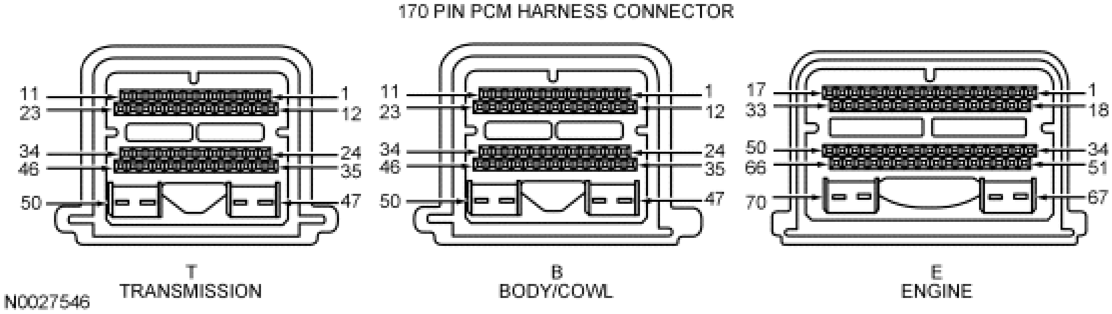


Fig. 26: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
SMC_MON	B2	OFF	OFF	OFF	OFF	ON/OFF
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.3/-0.07 (M)	2.1/-0.13 (M)	DCV/PSI
FTP_H2O	B3	2.6/0 (M)	2.6/0 (M)	2.3/-0.07 (M)	2.1/-0.13 (M)	DCV/PSI
APP1	B5	4.1	4.1	3.9	3.4	DCV
PTOIR_V	B7	VBAT	VBAT	VBAT	VBAT	DCV
BOO	B8	VBAT/OFF	0.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
APP2	B17	1.5	1.5	1.8	2.0	DCV
FPM	B21	0.1-VBAT	0.1-VBAT	0.1-VBAT	0.1-VBAT	DCV
PTO	B26	OFF	OFF	OFF	OFF	ON/OFF
TCS (A/T)	B27	0.1/NOT DEPRESSED	VBAT/ DEPRESSED (G)	0.1/NOT DEPRESSED	0.1/NOT DEPRESSED	DCV/ DEPRESSED-NOT DEPRESSED
APP3	B28	0.9	0.9	1.20	1.4	DCV
TCSS/VSS	B29	0	0	30	55	MPH
CPP/PNP (M/T)	B34	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
BPA	B65	OFF	OFF	OFF	OFF	ON/OFF
WAC/ACCR	E3	OFF	OFF	OFF	OFF	ON/OFF
ACCS	E4	OFF	OFF	OFF	OFF	ON/OFF
SPKDUR_8	E9	0	1.7	1.3	1.1	ms
SPKDUR_5	E10	0	1.1	1.1	1.2	ms
SPKDUR_2	E11	0	1.6	1.5	1.3	ms
SPKDUR_3	E12	0	1.8	1.2	1.2	ms
SPKDUR_4	E14	0	1.6	1.4	1.6	ms
SPKDUR_6	E15	0	1.7	1.1	1.2	ms
SPKDUR_7	E16	0	1.7	1.2	1.0	ms
SPKDUR_1	E17	0	1.6	1.3	1.4	ms
FRT	E19	2.5/93 (K)	2.6/90 (K)	3.1/72 (K)	3.1/72 (K)	DCV/DEG F
IAT	E22	2.6/86 (K)	2.9/73 (K)	3.7/43 (K)	3.7/41 (K)	DCV/DEG F
MAF (A/T)	E25	0	0.8	1.45	1.77	DCV
MAF (M/T)	E25	0	0.83-0.91	1-1.6	1.7-2.4	DCV
KNOCK 2	E31	0	65	74	141	N/A
FRP	E32	3.5/53	2.8/40	2.8/40	2.7/39	DCV/PSI

CHT	E41	3.6/188	3.6/201	3.6/201	3.4/210	DCV/DEG F
HTRCM12	E47	844	844	844	844	mA
HTRCM22	E48	871	871	871	871	mA
KNOCK 1	E49	0	72	78	141	N/A
IMRC1M	E50	5.0	5.0	5.0	0	DCV
TP2	E60	1.2/27	0.7/17	1.1/25/21	1.7	DCV/%
TP1	E61	4.1/13	4.3/18	4.1/17	3.8/15	DCV/%
HTRCM21	E70	1.33	1.33	1.33	1.33	mA
OSS (A/T)	T3	0	0	1185	2224	RPM
O2S12	T24	(L)	(D)	(D)	(D)	DCV
O2S22	T25	0	(D)	(D)	(D)	DCV
TFT (A/T)	T29	1.5/136 (K)	1.5/136 (K)	1.2/154 (K)	1.4/156 (K)	DCV/DEG F
ACP	PID	OPEN (OK)	OPEN (OK)	OPEN (OK)	OPEN (OK)	OPEN/ CLOSED
APP	PID	NO PEDAL	NO PEDAL	NO PEDAL	NO PEDAL	YES/NO PEDAL
BARO	PID	156	156	159	157	Hz
CAT_EVAL	PID	YES	YES	YES	YES	YES/NO
CHTIL	PID	OFF	OFF	OFF	OFF	ON/OFF
CPP/PNP (A/T)	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
EGR_EVAL	PID	YES	YES	YES	YES	YES/NO
EONV_RDY	PID	NOT READY	NOT READY	NOT READY	NOT READY	READY/NOT READY
EVAP_EVAL	PID	YES	YES	YES	YES	YES/NO
EVAP020C	PID	NO	NO	NO	NO	YES/NO
EVAP020D	PID	ALLOW	ALLOW	ALLOW	ALLOW	ALLOW/ DISALLOW
EVAPSOAK	PID	NO	YES	YES	YES	YES/NO
FCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
FLI	PID	89 (H)	88 (H)	85 (H)	95 (H)	%
FUELSYS	PID	OPEN LOOP	OPEN LOOP	OPEN LOOP	OPEN LOOP	OPEN/ CLOSED LOOP
LOAD	PID	61	15	23	29	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
MP_LRN	PID	YES	YES	YES	YES	YES/NO
O2S_EVAL	PID	YES	YES	YES	YES	YES/NO
PTOLOAD	PID	NO	NO	NO	NO	YES/NO
RPM	PID	0	722	1288	1565	RPM
VCTADVERR	PID	0	-0.56°	-5.12°	-0.93°	DEG
VCTADVERR2	PID	O	-1.06°	-2.56°	-0.50°	DEG

VCTSYS	PID	OL	CL	CL	CL	OPEN/ CLOSED
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
FP	B12	75/ON	20.4/ON	22.58/ON	24.67/ON	%/ON-OFF
EVAPCV	B13	0%/OFF	0%/OFF	0%/OFF (R)	0%/OFF (R)	%/ON-OFF
PTOIL	B42	OFF	OFF	OFF	OFF	ON/OFF
PCVHC	E2	0	0	0	0	%
WAC/ACCR	E3	0.1/OFF	VBAT/ON (A)	0.1/OFF	0.1/OFF	DCV/ON-OFF
IMRC	E50	OFF	OFF	OFF	OFF	ON/OFF
VCTDC	E67	0	0	42	43.1	DCV
VCTDC2	E68	0	0	39.8	39.3	DCV
HTRCM11	PID	1.33	1.33	1.33	1.33	mA
HTRCM12	PID	844	844	844	844	mA
HTRCM21	PID	1.33	1.33	1.33	1.33	mA
HTRCM22	PID	871	871	871	871	mA
TCIL	PID	OFF	OFF	OFF	OFF	ON/OFF
VCTADV	PID	0	0.56	44.69	-0.37	DEG
VCTADV2	PID	0	1.06	45.19	0.68	DEG
O2SHTR_ EVAL	PID	YES	YES	YES	YES	YES/NO
ETC_DSD	PID	7.62	1.36	2.61	8.26	DEG
FRP_DSD	PID	49.99	40	40	40	PSI
RPM_DSD	PID	640	640	624	624	RPM
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	12.25	37	37.2	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
APPVREF	B4/16	5	5	5	5	DCV
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
BVREF	E57	5	5	5	5	DCV

TPVREF	E66	5	5	5	5	DCV

6.8L 3V F-SUPER DUTY

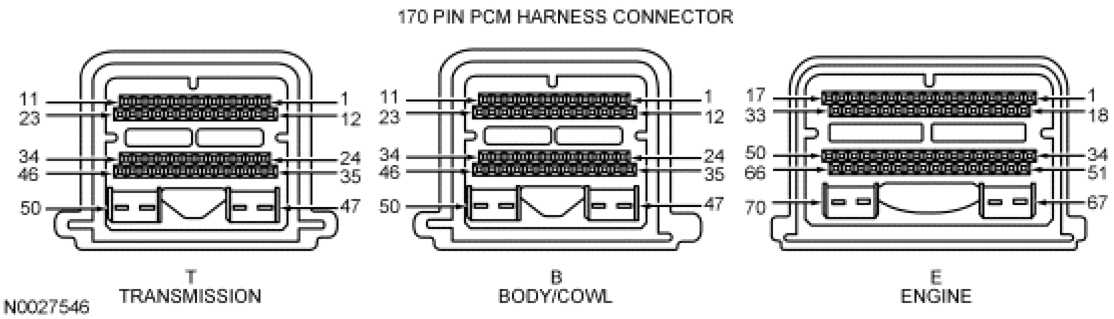


Fig. 27: 170 Pin PCM Harness Connector
Courtesy of FORD MOTOR CO.

TYPICAL DIAGNOSTIC REFERENCE VALUES

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
FTP	B3	2.6/0 (M)	2.6/0 (M)	2.6/0 (M)	1.6/-0.26 (M)	DCV/PSI
APP1	B5	4	4	3.9	3.7	DCV
PTOIR V	B7	0.02	0.02	0.02	0	DCV
BOO	B8	VBAT/OFF	0.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
PTO LOAD	B9	NO	NO	NO	NO	YES/NO
HO2S13	B14	0 (M)	(D) (M)	(D) (M)	(D) (M)	DCV
APP2	B17	1.5	1.5	1.6	1.8	DCV
FPM	B21	0.1-VBAT	0.1-VBAT	0.1-VBAT	0.1-VBAT	DCV
PTO	B26	OFF	OFF	OFF	OFF	ON/OFF
TCS (A/T)	B27	0.1/OFF	VBAT/ON (G)	0.1/OFF	0.1/OFF	DCV/ON-OFF
APP3	B28	1	1.1	1.3	1.5	DCV
VSS	B29	0	0	30	55	MPH
CPP BT (M/T)	B34	OPEN	OPEN	OPEN	OPEN	OPEN/ CLOSED
ACCS	E4	0.1/OFF	VBAT/ON (A)	0.1/OFF	0.1/OFF	DCV/ON-OFF
FRT	E19	2.5/97 (K)	2.5/93 (K)	2.9/79 (K)	3/79 (K)	DCV/DEG F
IAT	E22	2.9/73 (K)	3.3/59 (K)	3.7/45 (K)	3.7/43 (K)	DCV/DEG F
MAF (A/T)	E25	0	1.1	1.2	2.1	DCV
MAF (M/T)	E25	0	1.1	1.2	2.1	DCV
HO2S11	E28	(L)	switching (C)	switching (C)	switching (C)	DCV

HO2S21	E29	0	switching (C)	switching (C)	switching (C)	DCV
KNOCK 2	E31	32770	206	245	303	N/A
FRP	E32	3.5/53	3.7/39	3.7/39	2.7/39	DCV/PSI
CHT	E41	0.61/192.2	0.6/194	3.58/201.2	3.56/204.8	DCV/DEG F
CMP	E45	0	6.5-10	10-13	13-16	Hz
CKP	E47	0	420-520	800-1050	1100-1300	Hz
KNOCK 1	E49	32770	205	212	319	N/A
TP2	E60	1.3	0.9	1	1.4	DCV
TP1	E61	4.1	4.3	4.2	4	DCV
BPA	E65	0.1/OFF	VBAT/ON (E)	0.1/OFF	0.1/OFF	DCV/ON-OFF
OSS	T3	0	0	1194	2278	RPM
ISS	T4	0	782	860	1623	RPM
TSS	T15	0	782	860	1623	RPM
HO2S12	T24	(L) (M)	(D) (M)	(D) (M)	(D) (M)	DCV
HO2S22	T25	0 (M)	(D) (M)	(D) (M)	(D) (M)	DCV
TFT (A/T)	T29	1.6/132 (K)	1.5/136 (K)	1.1/154 (K)	1.1/158 (K)	DCV/DEG F
CPP/PNP (A/T)	PID	NEUTRAL	NEUTRAL	DRIVE	DRIVE	NEUTRAL/ DRIVE
GEAR (A/T)	PID	1	1	6	6	GEAR
LOAD	PID	63 (L)	18	17	35	%
MISFIRE	PID	NO	NO	NO	NO	YES/NO
RPM	PID	0	654	1127	1618	RPM
VSS	PID	0	0	30	55	MPH

Actuators/Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	48 KM/H (30 MPH)	89 KM/H (55 MPH)	
VSO	B1	0	0	65	125	Hz
SMC	B2	0	0	0	0	DCV
FP	B12	75	20	20.8	21.3	%
EVAPCV	B13	VBAT/0 (M)	VBAT/0 (M)	VBAT/0 (M) (R)	VBAT/0 (M) (R)	DCV/%
CTO	B25	0	55-65	110-130	140-175	Hz
PTOIL	B42	OFF	OFF	OFF	OFF	ON/OFF
TCIL (A/T)	B43	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
EVAPPDC	E1	0	0/0	0/0	0/0	Hz/%
PCVHC	E2	0 (M)	0 (M)	0 (M)	0 (M)	%
WAC/ACCR	E3	VBAT/OFF	0.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/ON-OFF
CDD (CYL 10)	E8	VBAT	VBAT	VBAT	VBAT	DCV
CDH (CYL 8)	E9	VBAT	VBAT	VBAT	VBAT	DCV
CDC (CYL 5)	E10	VBAT	VBAT	VBAT	VBAT	DCV

CDE (CYL 2)	E11	VBAT	VBAT	VBAT	VBAT	DCV
CDG (CYL 3)	E12	VBAT	VBAT	VBAT	VBAT	DCV
CDJ (CYL 9)	E13	VBAT	VBAT	VBAT	VBAT	DCV
CDI (CYL 4)	E14	VBAT	VBAT	VBAT	VBAT	DCV
CDB (CYL 6)	E15	VBAT	VBAT	VBAT	VBAT	DCV
CDF (CYL 7)	E16	VBAT	VBAT	VBAT	VBAT	DCV
CDA (CYL 1)	E17	VBAT	VBAT	VBAT	VBAT	DCV
TACM (+)	E34	3.7	VBAT	VBAT	VBAT	DCV
TACM (-)	E51	3.7	VBAT	VBAT	VBAT	DCV
IMTV	E64	0	0	0	VBAT	DCV
HTR11	E69	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
HTR21	E70	0.1/ON (O)	0.1/ON	0.1/ON	0.1/ON	DCV/ON-OFF
HTR12	T47	0.2/ON (M) (O)	0.2/ON (M)	0.2/ON (M)	0.2/ON (M)	DCV/ON-OFF
HTR22	T48	0.2/ON (M) (O)	0.2/ON (M)	0.2/ON (M)	0.2/ON (M)	DCV/ON-OFF
CHTIL	PID	OFF	OFF	OFF	OFF	ON/OFF
LONGFT1	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(L)	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	ON/OFF
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	10	13.75	29.5	27.25	DEG

Other	**PCM Pin/PID only**	**Measured/PID Values**				**Units Measured/PID**
		KOEO	**Hot Idle**	**48 KM/H (30 MPH)**	**89 KM/H (55 MPH)**	
APVREF	B4/16	5	5	5	5	DCV
VPWR	B35/36	VBAT	VBAT	VBAT	VBAT	DCV
KAPWR	B45	VBAT	VBAT	VBAT	VBAT	DCV
BVREF	E57	5	5	5	5	DCV
TPVREF	E66	5	5	5	5	DCV
VBPWR	T39	VBAT	VBAT	VBAT	VBAT	DCV

2008 ACCESSORIES & BODY, CAB

Remote Convenience - Fusion, Milan & MKZ

DESCRIPTION AND OPERATION

UNIVERSAL TRANSMITTER

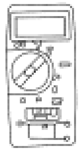
The universal transmitter is an integral part of the LH sun visor and provides a convenient way to substitute up to 3 hand-held transmitters with a single built-in device. The universal transmitter can learn the radio frequency codes of most current transmitters. The universal transmitter:

- operates garage doors, gates and home/office lighting and security systems.
- learns and transmits the radio frequency of up to 3 hand-held transmitters from any of the systems mentioned above.
- is powered by the vehicle battery and charging system.

DIAGNOSTIC TESTS

UNIVERSAL TRANSMITTER

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Universal transmitter • Receiver unit	• Smart junction box (SJB) fuse 3 (15A) • Wiring, terminals or connectors

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom. Go to **Symptom Chart**.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The universal transmitter is inoperative	• Fuse • Wiring, terminals or connectors • Universal transmitter • Receiver unit	• Go to **Pinpoint Test A**.

Pinpoint Tests

Pinpoint Test A: The Universal Transmitter is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Interior Lamps for schematic and connector information.

Normal Operation

The universal transmitter receives voltage on circuit CLN09 (YE/GN) and is grounded through circuit GD139 (BK/YE).

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Receiver unit
- Universal transmitter

PINPOINT TEST A: THE UNIVERSAL TRANSMITTER IS INOPERATIVE

A1 CHECK THE UNIVERSAL TRANSMITTER

- Check the illumination of the universal transmitter by pressing one of the buttons.
- **Does the red indicator on the universal transmitter illuminate?**

  YES : Go to A2.

  NO : Go to A3.

A2 PROGRAM A HAND-HELD TRANSMITTER INTO A UNIVERSAL TRANSMITTER

- Program the universal transmitter. Refer to **Universal Transmitter Programming**.
- **Does the universal transmitter program successfully?**

  YES : The universal transmitter is OK. VERIFY the receiver operates correctly.

  NO : INSTALL a new LH sun visor assembly. TEST the system for normal operation.

A3 CHECK CIRCUIT CLN09 (YE/GN) FOR VOLTAGE

- Disconnect: LH Vanity Mirror Lamp C907

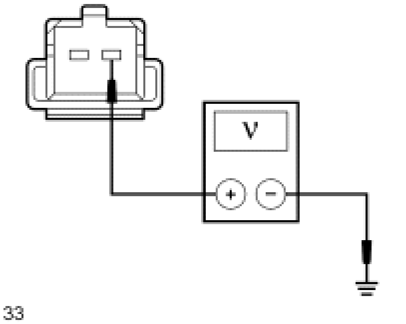


Fig. 1: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the LH vanity mirror lamp C907-1, circuit CLN09 (YE/GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A4.

  NO : VERIFY the smart junction box (SJB) fuse 3 (15A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

A4 CHECK CIRCUIT GD139 (BK/YE) FOR AN OPEN

- Key in OFF position.

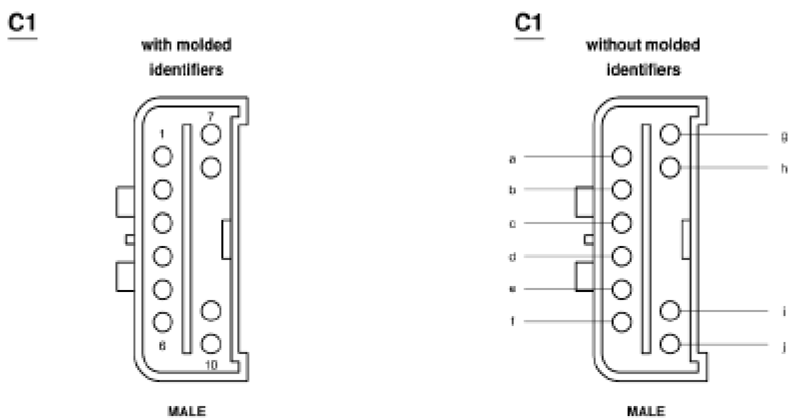


Fig. 2: Checking Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the LH vanity mirror lamp C907-2, circuit GD139 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new LH sun visor assembly. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

GENERAL PROCEDURES

UNIVERSAL TRANSMITTER PROGRAMMING

NOTE: A new battery in the hand-held transmitter may allow quicker and easier training due to a more accurate transmission of the radio frequency signal.

1. Verify the hand-held transmitter is operative.
2. Turn the key to the ON position.
3. Prepare for programming the universal transmitter by erasing all 3 channels by holding down the 2 outside buttons until the red light begins to flash (20-30 seconds). Release both buttons.
4. Select 1 of the 3 universal transmitter buttons to be used for programming.
5. Hold the end of the hand-held transmitter 25-76 mm (1-3 in) away from the front surface of the universal transmitter so that the universal transmitter red light can still be seen.

   NOTE: During programming, the hand-held transmitter may automatically stop transmitting after 2 seconds, which may not be long enough to program the universal transmitter. If programming with this type of hand-held transmitter, continue to hold the button on the universal transmitter while pressing and releasing the hand-held transmitter button every 2 seconds.

6. At the same time, press the hand-held transmitter button and the desired button on the universal transmitter until the red light on the universal transmitter flashes first slowly, and then rapidly. Release both buttons when the rapid flashing begins.
7. Firmly press and hold for 5 seconds, then release the just-trained universal transmitter button up to 2 separate times to activate the door. If after 2 separate times, the door still does not activate, press and hold the just-trained universal transmitter button and observe the indicator light.
   - If the indicator light stays on constantly, programming is complete and the device should activate when the universal transmitter button is pressed and released.
   - If the indicator light blinks rapidly for 2 seconds and then turns to a constant light, follow the Training a Garage Door Opener Equipped With "Rolling Codes" procedure to complete the programming of a rolling code equipped device.

Training a Garage Door Opener Equipped With "Rolling Codes"

1. At the garage door opener receiver (motor-head unit) in the garage, locate the "learn" or "smart" button. This can usually be found where the hanging antenna wire is attached to the motor-head unit.
2. Firmly press and release the "learn" or "smart" button. (The name and color of the button may vary by manufacturer.) There are 30 seconds to initiate step 3.
3. Return to the vehicle and firmly press, hold for 2 seconds and release the programmed universal transmitter button. Repeat the press/hold/release sequence a second time, and depending on the brand of the garage door opener (or other rolling code equipped device), repeat this sequence a third time to complete the programming process.

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Roof Opening Panel - Fusion, Milan & MKZ

SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Front edge of roof panel to roof opening panel	-1.5-0 mm (-0.059-0 in)
Rear edge of roof panel to roof opening panel	0-1.5 mm (0-0.059 in)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Passenger assist handle cover bolts	5	-	44
Roof opening panel air deflector screws	1	-	9
Roof opening panel frame bolts	12	9	-
Roof opening panel glass screws	6	-	53
Roof opening panel motor screws	4	-	35

DESCRIPTION AND OPERATION

ROOF OPENING PANEL

The roof opening panel consists of the following:

- Concertina blinds
- Air deflector
- Trough assembly
- Roof opening panel glass
- Roof opening panel motor
- Roof opening panel module
- Roof opening panel shield
- Roof opening panel switch
- Roof opening panel drain hoses

The roof opening panel is an electronically operated panel that can be opened or closed by pressing a switch located on the overhead console. It also has one-touch open, one-touch close, one-touch vent open and one-touch vent close features.

When the roof opening panel is in the fully CLOSED position, pressing the roof opening panel control switch rearward to the second detent and then releasing it will activate the one-touch open feature. Pressing the roof opening panel control switch in either direction with the roof opening panel moving will cancel the one-touch open operation.

With the roof opening panel glass in any OPEN position except VENT, rocking the roof opening panel control switch forward and then releasing it will activate the one-touch close feature. Pressing the roof opening panel control switch in either direction with the roof opening panel moving will cancel the one-touch close operation and the motion will immediately stop. Near the end of the forward travel, the rear portion of the roof opening panel glass moves upward on 2 lifter arms. This allows a weather-tight seal when the roof opening panel glass is closed.

If an obstacle contacts the leading edge of the roof opening panel glass during one-touch close operation, the roof opening panel glass will reverse direction and open to approximately the mid position and stop. The operator cannot stop this open motion once it has begun.

If an obstacle contacts the rear edge of the roof opening panel glass during one-touch vent close operation, the roof opening panel glass will reverse direction to the vent OPEN position.

When the roof opening panel glass is in the fully CLOSED position, pressing the roof opening panel control switch forward and then releasing it will activate the one-touch vent feature. Pressing the roof opening panel control switch in either direction with the roof opening panel moving will cancel the one-touch vent operation. There is a one-touch vent close feature.

Global Open - MKZ Only

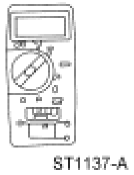
NOTE: The smart junction box (SJB) may also be identified as the generic electronic module (GEM).

The SJB sends a signal on the global open circuit, to both front door window motors and the roof opening panel motor, to open the windows based on a signal received from the remote keyless entry (RKE) transmitter. If the accessory delay relay is active, the global open feature will not operate.

DIAGNOSTIC TESTS

ROOF OPENING PANEL

Special Tools

Illustration	Tool Name	Tool Number
	73III Automotive Meter	105-R0057 or equivalent

Principles of Operation

Roof Opening Panel - The roof opening panel assembly uses an integrated motor and module to operate the roof opening panel. The roof opening panel motor and module are installed new as an assembly. The roof opening panel is an electronically operated glass panel that can be opened, closed or tilted by the roof opening panel switch. Actuating the switch in either a forward or rearward motion supplies a ground to the roof opening panel motor/module. The roof opening panel has one-touch open and one-touch close features that are activated when the switch is momentarily pressed to the double detent OPEN or CLOSE position. These functions are controlled by the roof opening panel motor/module.

The roof opening panel motor must be initialized whenever the roof opening panel motor has been removed from the roof opening panel system, the roof opening panel assembly has been removed from the vehicle, a new roof opening panel motor has been installed or a new roof opening panel assembly has been installed.

Global Open - MKZ only

NOTE: The smart junction box (SJB) may also be identified as the generic electronic module (GEM).

When the unlock button of the remote keyless entry (RKE) transmitter is held for 2 seconds the global open activates. The SJB sends a signal to activate the one-touch open operation of the roof opening panel. The global open feature does not operate if the delay accessory is active.

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Roof opening panel • Roof opening panel frame • Roof opening panel drain hoses • Roof opening panel lifter assemblies • Roof opening panel trough • Roof opening panel air deflector assembly • Roof opening panel seal • Roof opening panel shield	• Battery junction box (BJB) fuse 33 (20A) • Smart junction box (SJB) fuse 12 (7.5A) • Circuitry • Accessory delay relay • Roof opening panel motor and module assembly • Roof opening panel switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. If the concern is not visually evident, determine the symptom. Go to **Symptom Chart - Roof Opening Panel** or Go to **Symptom Chart - Noise, Vibration and Harshness (NVH)**.

Symptom Chart - Roof Opening Panel

Symptom Chart - Roof Opening Panel

Condition	Possible Sources	Action
• The roof opening panel leaks	• Roof opening panel adjustment • Front rail seal • Drain tube attachment points • Roof opening panel water trough and seal • Roof opening panel drain hose • Roof opening panel weatherstrip/seals • Mechanism mistimed	• Go to **Pinpoint Test B**.
• The roof opening panel does not open or close	• Roof opening panel adjustment • Fuse(s) • Circuitry • Roof opening panel switch • Roof opening panel motor/module assembly • Roof opening panel lifter assemblies • Roof opening panel motor not initialized	• Go to **Pinpoint Test E**.
• The one-touch open feature is inoperative	• Roof opening panel motor not initialized • Roof opening panel motor/module • Roof opening panel control switch • Circuitry	• INITIALIZE the roof opening panel motor/module. REFER to **Roof Opening Panel Motor Initialization**. If concern is still present after initialization, INSTALL a new roof opening panel motor/module. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Motor**. TEST the system for normal operation. Go to

		Pinpoint Test E.
• The global open function is inoperative/does not operate correctly	• Circuitry • Roof opening panel motor • Smart junction box (SJB) • Remote keyless entry (RKE) transmitters • Roof opening panel not initialized	• Go to **Pinpoint Test F**.
• The roof opening panel does not seat in flush position from any position	• Incorrect roof opening panel adjustment • Mechanism mistimed	• REFER to **Roof Opening Panel Alignment**.
• Roof opening panel reverses during operation	• Mechanism mistimed	• REFER to **Timing Adjustment**.
	• Roof opening panel not initialized	• REFER to **Roof Opening Panel Motor Initialization**.
	• Roof opening panel adjustment • Concertina blind broken or loose • Foreign material in guide	• REFER to **Roof Opening Panel Alignment**.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: **Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.**

Symptom Chart - Noise, Vibration and Harshness (NVH)

Condition	Possible Sources	Action
• The roof opening panel has excessive wind noise	• Incorrect adjustment • Roof opening panel weatherstrip/seals • Mechanism mistimed	• Go to **Pinpoint Test A**.
	• Roof opening panel • Roof opening panel tracks • Roof opening panel air deflector	

	assembly	
• The roof opening panel rattles	• Roof opening panel trough • Roof opening panel lifter assemblies • Roof opening panel water trough guide • Headliner • Motor pad • Rear side brackets	• Go to **Pinpoint Test C**.
• The roof opening panel is noisy during operation	• Roof opening panel • Roof opening panel tracks • Roof opening panel lifter assemblies • Roof opening panel adjustment • Roof opening panel motor/module assembly	• Go to **Pinpoint Test D**.

Pinpoint Tests

Pinpoint Test A: The Roof Opening Panel Has Excessive Wind Noise

Normal Operation

When the roof opening panel glass is completely closed, it is flush with the roof panel.

This pinpoint test is intended to diagnose the following:

- Incorrect roof opening panel alignment
- Poorly fitting roof opening panel seal/weatherstrip
- Incorrect installation of the roof opening panel and motor/module
- Incorrect curvature of the air deflector

PINPOINT TEST A: THE ROOF OPENING PANEL HAS EXCESSIVE WIND NOISE

A1 VERIFY ROOF OPENING PANEL NOISE

- Road test the vehicle with the roof opening panel in the CLOSED and OPEN positions.
- **Is the wind noise present only in the OPEN position?**

  YES : Go to A4.

  NO : Go to A2.

A2 CHECK THE ROOF OPENING PANEL WEATHERSTRIP

NOTE:	**Make sure the weatherstrip is secured to the glass, not cut, cracked, pinched, loose or obstructed in CLOSED, VENT and OPEN positions.**

- Check the roof opening panel weatherstrip.

- **Is the roof opening panel weatherstrip OK?**

  YES : Go to A3.

  NO : INSTALL a new roof opening panel weatherstrip. REFER to **Roof Opening Panel - Exploded View**. TEST the system for normal operation.

A3 CHECK ROOF OPENING PANEL ALIGNMENT

- Check the roof opening panel alignment.
- **Is the alignment OK?**

  YES : CHECK for correct installation of the roof opening panel and motor/module. REFER to **Roof Opening Panel - Exploded View**,**Roof Opening Panel Frame** and **Roof Opening Panel Motor**. TEST the system for normal operation.

  NO : ALIGN the roof opening panel. REFER to **Roof Opening Panel Alignment**. TEST the system for normal operation.

A4 CHECK THE AIR DEFLECTOR

- Make sure the air deflector is securely attached.
- **Is the air deflector OK?**

  YES : PARTIALLY close the roof opening panel until the noise is eliminated. If the noise is eliminated, INFORM the customer that changing glass location will eliminate the wind noise. If the wind noise is not eliminated, INSTALL a new air deflector. TEST the system for normal operation.

  NO : INSTALL new air deflector assembly. REFER to **Roof Opening Panel - Exploded View** and **Air Deflector**. TEST the system for normal operation.

Pinpoint Test B: The Roof Opening Panel Leaks

Normal Operation

When the roof opening panel glass is completely closed, it is flush with the roof panel.

This pinpoint test is intended to diagnose the following:

- Incorrect roof opening panel adjustments
- Damaged roof opening panel drain hoses
- Damaged roof opening panel seal/weatherstrip
- Damaged roof opening panel frame
- Incorrect position of the roof opening panel glass

PINPOINT TEST B: THE ROOF OPENING PANEL LEAKS

B1 CHECK THE ALIGNMENT OF THE ROOF OPENING PANEL

NOTE:	**Make sure the roof opening panel weatherstrip is not cracked or loose.**

- Check the roof opening panel weatherstrip.

- **Does the roof opening panel seal correctly?**

  YES : Go to B2.

  NO : ALIGN the roof opening panel. REFER to **Roof Opening Panel Alignment**. TEST the system for normal operation.

B2 CHECK THE ROOF OPENING PANEL DRAIN HOSES

> **NOTE: Make sure the roof opening panel drain hoses are not cracked, slit, pinched or obstructed.**

- Check the 4 roof opening panel drain hoses for correct operation.
- **Are the roof opening panel drain hoses OK?**

  YES : Go to B3.

  NO : REPAIR or INSTALL a new roof opening panel drain hose(s). TEST the system for normal operation.

B3 CHECK THE ROOF OPENING PANEL DRAIN HOSE ATTACHMENT POINTS

> **NOTE: Make sure the roof opening panel drain hose attachment points are not damaged or obstructed.**

- Check the roof opening panel drain hose attachment points for correct attachment.
- **Are the roof opening panel drain hose attachment points OK?**

  YES : Go to B4.

  NO : REPAIR or INSTALL a new roof opening panel frame. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Frame**. TEST the system for normal operation.

B4 CHECK THE ROOF OPENING PANEL REAR TROUGH CONDITION

- Check the roof opening panel rear trough for damage.
- **Is the roof opening panel trough OK?**

  YES : Go to B5.

  NO : REPAIR or INSTALL a new roof opening rear trough. REFER to **Roof Opening Panel - Exploded View**, **Roof Opening Panel Frame** and **Trough Assembly**. TEST the system for normal operation.

B5 CHECK THE CONDITION OF THE ROOF OPENING GLASS PANEL

- Check the roof opening panel frame for damage that may cause the roof opening panel glass seal to seat incorrectly.
- **Is the roof opening panel frame OK?**

  YES : INSTALL a new roof opening panel glass. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Glass**. TEST the system for normal operation.

  NO : REPAIR or INSTALL a new roof opening panel frame. REFER to **Roof Opening Panel - Exploded View** **Roof Opening Panel Frame**. TEST the system for normal operation.

Pinpoint Test C: The Roof Opening Panel Rattles

Normal Operation

When the roof opening panel glass is completely closed, it is flush with the roof panel. All components should be secured correctly.

This pinpoint test is intended to diagnose the following:

- Roof opening panel
- Roof opening panel air deflector assembly
- Roof opening panel trough
- Roof opening panel lifter assemblies
- Headliner
- Roof opening panel motor/module pad
- Roof opening panel frame

PINPOINT TEST C: THE ROOF OPENING PANEL RATTLES

C1 CHECK THE ROOF OPENING PANEL WEATHERSTRIP

NOTE:	**Make sure the weatherstrip is secured to the glass, not cut, cracked, pinched, loose or obstructed in CLOSED, VENT and OPEN positions.**

- Check the roof opening panel weatherstrip.
- **Is the roof opening panel weatherstrip OK?**

YES : Go to C2.

NO : INSTALL a new roof opening panel weatherstrip. REFER to **Roof Opening Panel - Exploded View**. TEST the system for normal operation.

C2 CHECK THE ROOF OPENING PANEL TIGHTNESS

- Manually push up and fore/aft.
- **Is the roof opening panel loose?**

YES : ALIGN the roof opening panel. REFER to **Roof Opening Panel Alignment**. TEST the system for normal operation.

NO : Go to C3.

C3 CHECK THE ROOF OPENING PANEL TRACKS

- Open the roof opening panel.
- Check the roof opening panel tracks for obstructions and damage.
- **Are the roof opening panel tracks OK?**

YES : Go to C4.

NO : REMOVE all the roof opening panel track obstructions and REPAIR the roof opening panel tracks. If the roof opening panel tracks cannot be repaired, INSTALL a new roof opening panel frame. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Frame**. TEST the system for normal operation.

C4 CHECK THE ROOF OPENING PANEL TROUGH AND TROUGH GUIDES

- Check the water roof opening panel trough and trough guides for any loose obstructions.
- **Are the roof opening panel trough and trough guides installed securely and free from obstructions?**

  YES : Go to C5.

  NO : REMOVE all obstructions from the roof opening panel trough guides and install securely. INSTALL a new roof opening panel frame if the trough guides are damaged. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Frame**. TEST the system for normal operation.

C5 CHECK THE ROOF OPENING PANEL SHIELD (SUNSHADE)

- Check the roof opening panel shield for correct installation.
- **Is the roof opening panel shield installed correctly?**

  YES : Go to C6.

  NO : INSTALL the roof opening panel shield correctly. REFER to **Roof Opening Panel Shield**. TEST the system for normal operation.

C6 CHECK THE ROOF OPENING PANEL AIR DEFLECTOR ASSEMBLY

- Check the roof opening panel air deflector assembly for obstructions and damage.
- **Is the roof opening panel air deflector assembly OK?**

  YES : Go to C7.

  NO : REMOVE all obstructions and REPAIR or INSTALL a new roof opening panel air deflector assembly. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Frame**. TEST the system for normal operation.

C7 CHECK THE ROOF OPENING PANEL GLASS

- Verify the roof opening panel glass is free from obstructions and damage, and is securely fastened.
- **Is the roof opening panel glass OK?**

  YES : Go to C8.

  NO : REPAIR or INSTALL a new roof opening panel glass. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Glass**. TEST the system for normal operation.

C8 CHECK THE ROOF OPENING PANEL LIFTER ASSEMBLIES

- Verify the roof opening panel lifter assemblies are free from obstructions and damage.
- **Are the roof opening panel lifter assemblies OK?**

  YES : Go to C9.

  NO : REMOVE all obstructions from the roof opening panel lifter assemblies and REPAIR any damage. If the roof opening panel lifter assemblies cannot be repaired, INSTALL a new roof opening panel frame. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Frame**. TEST the system for normal operation.

C9 CHECK ROOF OPENING PANEL FRAME INSTALLATION

- Check all roof opening fasteners for correct torque and verify correct installation of the roof opening panel frame. Refer to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Frame**.

- **Is the roof opening panel correctly installed and tightened to specification?**

  YES : Go to C10.

  NO : TIGHTEN the loose fasteners or REINSTALL the roof opening panel frame. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Frame** in this section. TEST the system for normal operation.

C10 CHECK THE ROOF OPENING PANEL FRAME FOR RATTLES

- Check the roof opening panel frame assembly for any loose parts or for any condition that will cause rattles.
- **Is there a condition that will cause rattles?**

  YES : INSTALL a suitable sound damper material to correct the condition. If the rattle still persists, INSTALL a new roof opening panel frame. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Frame**. TEST the system for normal operation.

  NO : INSTALL a new roof opening panel frame. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Frame**. TEST the system for normal operation.

Pinpoint Test D: The Roof Opening Panel is Noisy During Operation

Normal Operation

The roof opening panel operates smoothly while opening and closing.

This pinpoint test is intended to diagnose the following:

- Obstructed or damaged roof opening panel
- Obstructed or damaged roof opening panel lifter assemblies
- Incorrect roof opening panel adjustment
- Noisy roof opening panel motor/module assembly

PINPOINT TEST D: THE ROOF OPENING PANEL IS NOISY DURING OPERATION

D1 CHECK THE ROOF OPENING PANEL FOR OBSTRUCTIONS OR DAMAGE

- Check the roof opening panel for any obstructions and damage.
- **Are there any obstructions and/or damage?**

  YES : REMOVE all obstructions. REPAIR any damage. If the damage cannot be repaired, INSTALL a new roof opening panel frame. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Frame**. TEST the system for normal operation.

  NO : Go to D2.

D2 CHECK THE ROOF OPENING PANEL OPERATION

- Check the roof opening panel during operation.
- **Is the roof opening panel loose or incorrectly aligned?**

  YES : ALIGN the roof opening panel. REFER to **Roof Opening Panel Alignment**. TEST the system for normal operation.

  NO : Go to D3.

D3 CHECK THE ROOF OPENING PANEL TRACKS

- Open the roof.
- Check the roof opening panel tracks for obstructions and damage.
- **Are the roof opening panel tracks OK?**

  YES : Go to D4.

  NO : REMOVE all obstructions and REPAIR any damage. If the roof opening panel tracks cannot be repaired, INSTALL a new roof opening panel frame. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Frame**. TEST the system for normal operation.

D4 CHECK THE ROOF OPENING PANEL SHIELD

- Check the roof opening panel shield for correct movement.
- **Is the roof opening panel shield moving correctly?**

  YES : Go to D5.

  NO : REMOVE and REINSTALL the roof opening panel shield. REFER to **Roof Opening Panel Shield**. TEST the system for normal operation.

D5 CHECK THE ROOF OPENING PANEL LIFTER ASSEMBLIES

- Check the roof opening panel lifter assemblies for obstructions and damage.
- **Are the roof opening panel lifter assemblies OK?**

  YES : Go to D6.

  NO : REMOVE all obstructions and REPAIR any damage. If the roof opening panel lifter assemblies cannot be repaired, INSTALL a new roof opening panel frame. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Frame**. TEST the system for normal operation.

D6 CHECK THE ROOF OPENING PANEL MOTOR/MODULE

- Remove the roof opening panel motor/module and leave the electrical connector connected.
- Operate the roof opening panel to the full OPEN and CLOSED position.
- **Does the motor/module make excessive noise?**

  YES : INSTALL a new roof opening panel motor/module. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Motor**. TEST the system for normal operation.

  NO : REINSTALL the roof opening panel motor/module. TEST the system for normal operation. If the roof opening panel is still noisy, INSTALL a new roof opening panel frame. REFER to **Roof Opening Panel - Exploded View** and **Roof Opening Panel Frame**. If the roof opening panel is no longer noisy, the system is operating correctly. The concern may have been caused by an incorrectly installed roof opening panel motor.

Pinpoint Test E: The Roof Opening Panel Does Not Open or Close

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Roof Opening Panel for schematic and connector information.

The roof opening panel motor must be initialized whenever the roof opening panel motor has been removed from the roof opening panel system, the roof opening panel assembly has been removed from the vehicle, a new

roof opening panel motor has been installed or a new roof opening panel assembly has been installed. Refer to **Roof Opening Panel Motor Initialization**.

Normal Operation

The roof opening panel uses an integrated motor and module to operate the roof opening panel. A new roof opening panel motor/module is installed as an assembly.

The roof opening panel motor/module receives voltage from the accessory delay relay through circuit CBP02 (GN) when the key is in the ACC or RUN position and voltage at all times through circuit SBB33 (RD). Ground is supplied to the motor/module through circuit GD139 (BK/YE). The roof opening panel motor/module provides ground to the roof opening panel switch through circuit CPR39 (VT/WH). When the roof opening panel switch is pressed to the CLOSED position, a ground signal is sent to the roof opening panel motor/module through circuit CPR40 (YE/OG), which causes the roof opening panel to close. When the roof opening panel switch is pressed to the OPEN position, a ground signal is sent to the roof opening panel motor/module through circuit CPR31 (VT/BN), which causes the roof opening panel to open.

One-touch open and one-touch close features are enabled when the motor/module receives a ground input from the roof opening panel switch through circuit CPR38 (WH/BU).

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Inoperative roof opening panel switch
- Inoperative roof opening panel motor/module assembly
- Inoperative accessory delay relay
- Roof opening panel motor not initialized

PINPOINT TEST E: THE ROOF OPENING PANEL DOES NOT OPEN OR CLOSE

E1 CHECK THE ROOF OPENING PANEL OPERATION

- Key in ON position.
- Attempt to operate the roof opening panel to the vent position.
- **Does the roof opening panel operate to the vent position?**

  YES : Go to E2.

  NO : Go to E3.

E2 CHECK THE MOTOR/MODULE FOR INITIALIZATION

- Carry out the roof opening panel motor initialization procedure. Refer to **Roof Opening Panel Motor Initialization**.
- **Is the concern still present?**

  YES : Go to E3.

  NO : The system is operating normally at this time. The roof opening panel motor was not initialized.

E3 CHECK THE POWER WINDOWS

- Key in ON position.
- Verify the power windows operate.
- **Do the power windows operate?**

  YES : Go to E4.

  NO : REFER to **GLASS, FRAMES AND MECHANISMS** article to diagnose the accessory delay relay circuit.

E4 CHECK THE ROOF OPENING PANEL SWITCH

- Key in OFF position.
- Disconnect: Roof Opening Panel Switch C912
- Carry out the roof opening panel switch component test. Refer to COMPONENT TESTING.
- **Is the roof opening panel switch OK?**

  YES : Go to E5.

  NO : INSTALL a new roof opening panel switch. REFER to **Roof Opening Panel Control Switch**. TEST the system for normal operation.

E5 CHECK VOLTAGE TO THE ROOF OPENING PANEL MOTOR/MODULE - CIRCUITS CBP02 (GN) AND SBB33 (RD)

- Key in OFF position.
- Disconnect: Roof Opening Panel Motor/Module C921
- Key in ON position.

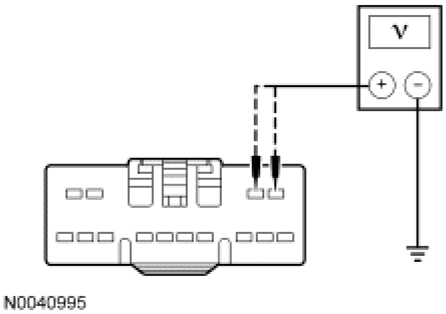


Fig. 1: Checking Voltage To Roof Opening Panel Motor/Module - Circuit CBP02 (GN) And SBB33 (RD)
Courtesy of FORD MOTOR CO.

- Measure the voltage between roof opening panel motor/module C921-2, circuit CBP02 (GN) and C921-1, circuit SBB33 (RD), harness side and ground.
- **Are the voltages greater than 10 volts, but less than 16 volts?**

  YES : Go to E6.

  NO : VERIFY smart junction box (SJB) fuse 12 (7.5A) and battery junction box (BJB) fuse 33 (20A) are OK. If OK, REPAIR the circuit. TEST the system for normal operation.

E6 CHECK THE ROOF OPENING PANEL GROUND - CIRCUIT GD139 (BK/YE)

- Key in OFF position.

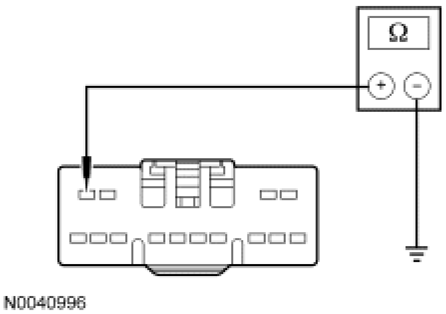


Fig. 2: Checking Roof Opening Panel Ground - Circuit GD139 (BK/YE)
Courtesy of FORD MOTOR CO.

- Measure the resistance between roof opening panel motor/module C921-4, circuit GD139 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to E7.

  NO : REPAIR the circuit. TEST the system for normal operation.

E7 CHECK CIRCUIT CPR39 (VT/WH) FOR AN OPEN

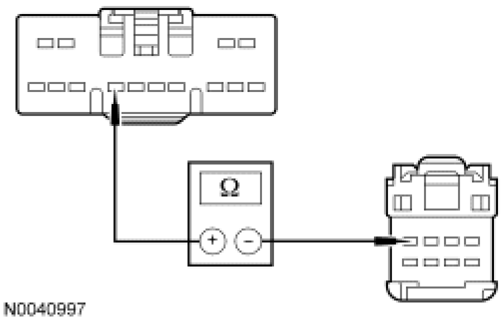


Fig. 3: Checking Circuit CPR39 (VT/WH) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between overhead console C912-4, circuit CPR39 (VT/WH), and roof opening panel motor/module C921-11, circuit CPR39 (VT/WH) harness side.
- **Is the resistance less than 5 ohms?**

  YES : CHECK the overhead console jumper harness for loose pins, an open or a short in circuit CPR39 (VT/WH) between the roof opening panel switch socket and overhead console C912-4. If the overhead console jumper harness is not OK, INSTALL a new overhead console jumper harness and TEST the system for normal operation. If the overhead console jumper harness is OK, go to E8.

  NO : REPAIR the circuit. TEST the system for normal operation.

E8 CHECK CIRCUIT CPR40 (YE/OG) FOR AN OPEN

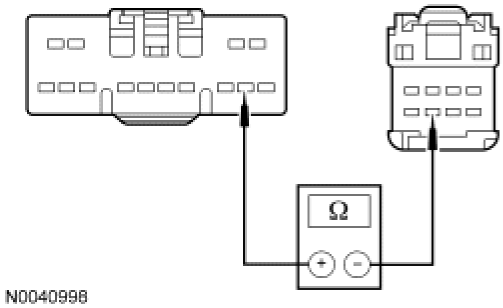


Fig. 4: Checking Circuit CPR40 (YE/OG) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between overhead console C912-7, circuit CPR40 (YE/OG), and roof opening panel motor/module C921-6, circuit CPR40 (YE/OG) harness side.
- **Is the resistance less than 5 ohms?**

  YES : CHECK the overhead console jumper harness for loose pins, an open or a short in circuit CPR40 (YE/OG) between the roof opening panel switch socket and overhead console C912-7. If the overhead console jumper harness is not OK, INSTALL a new overhead console jumper harness and TEST the system for normal operation. If the overhead console jumper harness is OK, go to E9.

  NO : REPAIR the circuit. TEST the system for normal operation.

E9 CHECK CIRCUIT CPR31 (VT/BN) FOR AN OPEN

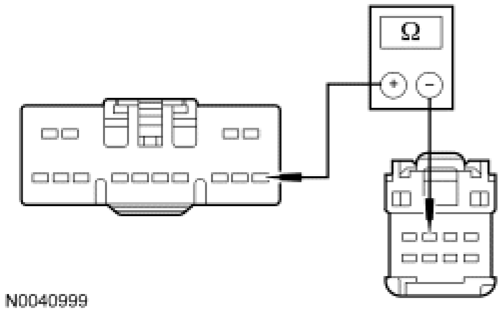


Fig. 5: Checking Circuit CPR31 (VT/BN) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between overhead console C912-3, circuit CPR31 (VT/BN), and roof opening panel motor/module C921-5, circuit CPR31 (VT/BN) harness side.
- **Is the resistance less than 5 ohms?**

  YES : CHECK the overhead console jumper harness for loose pins, an open or a short in circuit CPR31 (VT/BN) between the roof opening panel switch socket and overhead console C912-3. If the overhead console jumper harness is not OK, INSTALL a new overhead console jumper harness, and TEST the system for normal operation. If the overhead console jumper harness is OK, go to E10.

  NO : REPAIR the circuit. TEST the system for normal operation.

E10 CHECK CIRCUIT CPR38 (WH/BU) FOR AN OPEN

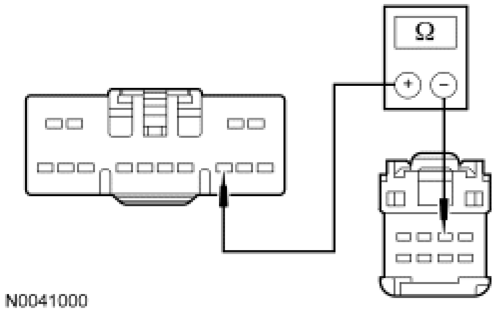


Fig. 6: Checking Circuit CPR38 (BU/BK) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between overhead console C912-2, circuit CPR38 (WH/BU), and roof opening panel motor/module C921-7, circuit CPR38 (WH/BU) harness side.
- **Is the resistance less than 5 ohms?**

  YES : CHECK the overhead console jumper harness for loose pins, an open or a short in circuit CPR38 (WH/BU) between the roof opening panel switch socket and overhead console C912-2. If the overhead console jumper harness is not OK, INSTALL a new overhead console jumper harness and TEST the system for normal operation. If the overhead console jumper harness is OK, go to E11.

  NO : REPAIR the circuit. TEST the system for normal operation.

E11 CHECK THE ROOF OPENING PANEL MOTOR/MODULE FOR CORRECT OPERATION

- Disconnect all roof opening panel motor/module connectors.
- Check for:
  - corrosion.
  - bent or pushed-out pins.
- Connect all roof opening panel motor/module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new roof opening panel motor/module. REFER to **Roof Opening Panel Motor**. TEST the system for normal operation.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test F: The Global Open Function is Inoperative/Does Not Operate Correctly

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Roof Opening Panel for schematic and connector information.

Normal Operation

When the global open feature is activated the smart junction box (SJB) sends a signal through circuit CPW01 (BN/BU) to the roof opening panel motor. The global open feature does not function when the delayed accessory is active.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Roof opening panel motor
- SJB
- Remote keyless entry (RKE) transmitters
- Roof opening panel not initialized

PINPOINT TEST F: THE GLOBAL OPEN FUNCTION IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

NOTE: **One-touch open must be operational for the global open function to operate correctly. Make sure the one-touch open is operational before proceeding with this diagnostic.**

F1 VERIFY THE POWER WINDOWS ARE OPERATIONAL

- Operate the power windows using the global open procedure.
- **Do the power windows operate correctly?**

  YES : Go to F2.

  NO : REFER to **GLASS, FRAMES AND MECHANISMS** article to diagnose the inoperative windows.

F2 CHECK CIRCUIT CPW01 (BN/BU) FOR AN OPEN

- Disconnect: Roof Opening Panel Motor C921
- Disconnect: SJB C2280c

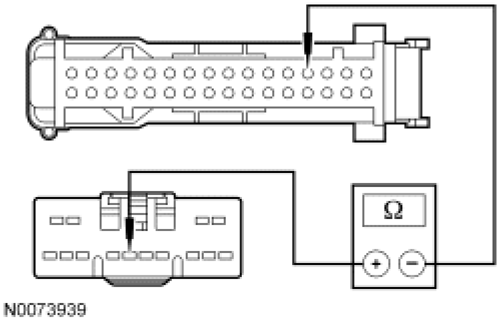


Fig. 7: Checking Circuit CPW01 (BN/BU) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between roof opening panel motor C921-10, circuit CPW01 (BN/BU), harness side and the C2280c-29, circuit CPW01 (BN/BU) harness side.
- **Is the resistance less than 5 ohms?**

YES : INSTALL a new roof opening panel motor. REFER to **Roof Opening Panel Motor**. INITIALIZE the roof opening panel motor. REFER to **Roof Opening Panel Motor Initialization** TEST the system for normal operation.

NO : REPAIR the circuit. INITIALIZE the roof opening panel motor. REFER to **Roof Opening Panel Motor Initialization**. TEST the system for normal operation.

GENERAL PROCEDURES

ROOF OPENING PANEL ALIGNMENT

1. Open the roof opening panel to the VENT position.
2. Loosen the 4 roof opening panel glass screws.
    - To access the glass screws, unclip the top portion of the concertina blind and position aside as shown.

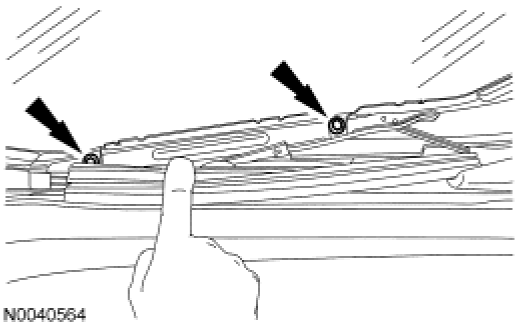


Fig. 8: Locating Roof Opening Panel Glass Screws
Courtesy of FORD MOTOR CO.

3. Close the roof opening panel glass.

NOTE: **The correct position of the roof opening panel glass to the roof panel should be -1.50 mm to 0 mm (-0.059 to 0 in) at the front edge and 0 mm to 1.5 mm (0 to 0.059 in) at the rear edge of the roof panel.**

Make sure the roof opening panel is centered in the roof opening.

4. Adjust the roof opening panel glass.

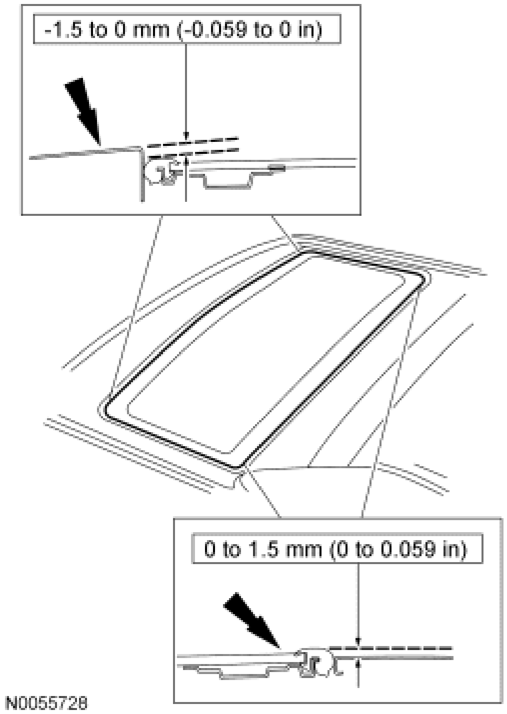


Fig. 9: Identifying Roof Opening Panel Glass Gap
Courtesy of FORD MOTOR CO.

5. Tighten the 4 roof opening panel glass screws to 6 N.m (53 lb-in).

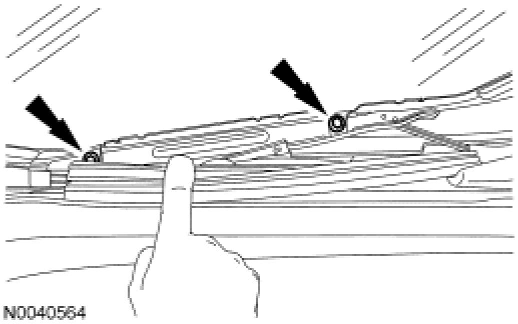


Fig. 10: Locating Roof Opening Panel Glass Screws
Courtesy of FORD MOTOR CO.

6. Open the roof opening panel to the VENT position.
7. Reattach the concertina blind making sure that it is fully seated on the 3 clips in roof panel glass.

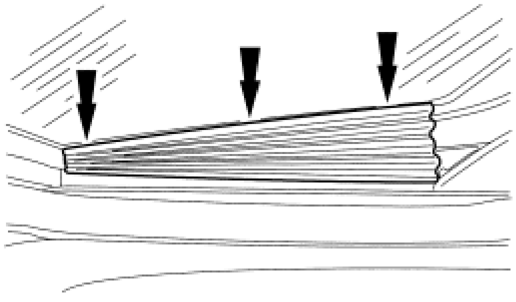


Fig. 11: Locating Roof Panel Glass Clips
Courtesy of FORD MOTOR CO.

ROOF OPENING PANEL MOTOR INITIALIZATION

WARNING: **Keep objects and body parts clear of the glass panel when carrying out the initialization procedure. During the initialization procedure, the glass panel closes with high force and cannot detect objects in its path. Failure to follow this instruction may result in serious personal injury.**

NOTE: A new roof opening panel motor must be initialized after installation. It will only move toward the VENT position until initialized.

NOTE: The roof opening panel motor initialization procedure must be done when repairs are carried out on any part of the roof opening panel system, including: any time the roof opening panel motor has been removed from the roof opening panel assembly, a new roof opening panel motor has been installed or when a new roof opening panel assembly has been installed.

1. Turn the ignition to the RUN position.
2. For a new roof opening panel motor, press and hold the roof opening panel control switch forward until the roof opening panel glass moves to the full VENT position.

   NOTE: Make sure the front door is open during this step.

3. Cycle the ignition from ON to OFF and then back to ON.
4. Within 5 seconds:
   - press and release the roof opening panel control switch forward.
   - press and hold the roof opening panel control switch forward.
5. Continue holding roof opening panel control switch forward for 5 seconds after the roof opening panel motor stops moving to confirm this position to the roof opening panel motor.

   NOTE: Only complete open and close motions count towards the cycle count. If the roof opening panel reverses during closing operations, perform the cycles with the roof opening panel control switch continuously held

during the closing motions.

6. Release the roof opening panel switch and test the system for normal operation by checking the one-touch open, one-touch close, one-touch vent and close operations. Five complete cycles must be carried out for the roof opening panel motor to be correctly initialized.
    - If roof opening panel does not operate correctly, repeat Steps 2 through 6.

TIMING ADJUSTMENT

NOTE: **Anytime a roof opening panel motor is removed, the cables/mechanisms can experience free-play movement. It is important that the cables do not move. They are timed to be parallel with each other. If one or both are moved in either direction, they must be re-timed.**

1. Remove the roof opening panel glass. For additional information, refer to **Roof Opening Panel Glass**.
2. Remove the roof opening panel motor. For additional information, refer to **Roof Opening Panel Motor**.
3. Using a flat-blade screwdriver, push on the back of the drive slide until it contacts the timing screw. Repeat on other side.

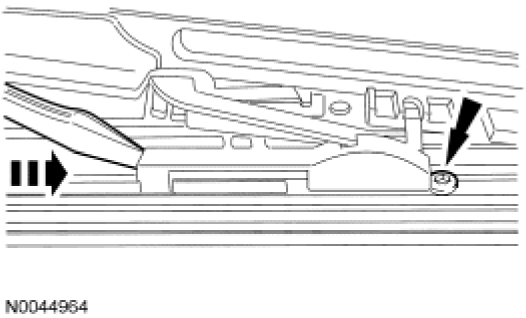


Fig. 12: Pushing On Back Of Drive Slide Until It Contacts Timing Screw Using A Flat-Blade Screwdriver
Courtesy of FORD MOTOR CO.

4. Reinstall the roof opening panel motor but do not carry out the roof opening panel motor initialization. For additional information, refer to **Roof Opening Panel Motor**.
5. Reinstall the roof opening panel glass. For additional information, refer to **Roof Opening Panel Glass**.
6. Operate the roof opening panel to the full VENT position and hold for 6 seconds.
7. Initialize the roof opening panel motor. For additional information, refer to **Roof Opening Panel Motor Initialization**.

REMOVAL AND INSTALLATION

ROOF OPENING PANEL - EXPLODED VIEW

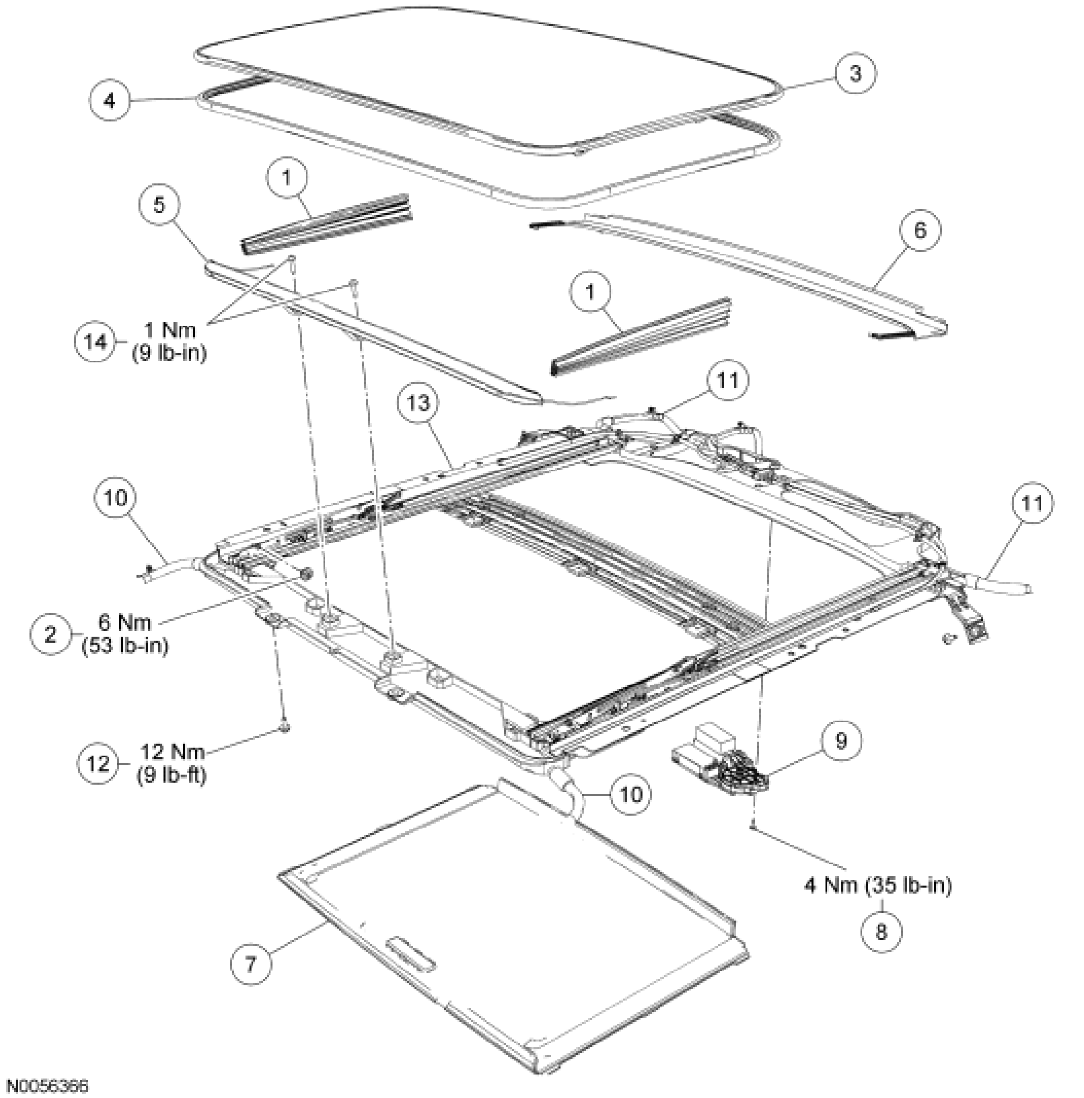


Fig. 13: Exploded View Of Roof Opening Panel With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	500A66	Concertina blinds (2 required)
2	-	Roof opening panel glass screw (4 required)
3	54500A18	Roof opening panel glass
4	5451884	Roof opening panel glass seal
5	54500A26	Roof opening panel air deflector
6	7854022	Roof opening panel trough
7	54519A02	Roof opening panel shield
8	-	Roof opening panel motor screw (3 required)

9	15B689	Roof opening panel motor
10	502C52A	Front drain hoses
11	502C52B	Rear drain hoses
12	-	Roof opening panel frame bolt (8 required)
13	54502C22	Roof opening panel frame
14	-	Air deflector screws

1. For additional information, refer to the individual procedures.

ROOF OPENING PANEL GLASS

1. Open the roof opening panel to the VENT position.
2. Remove the 4 roof opening panel glass screws.
   - To access the glass screws, unclip the top portion of the concertina blind and position aside as shown.
   - To install, tighten to 6 N.m (53 lb-in).

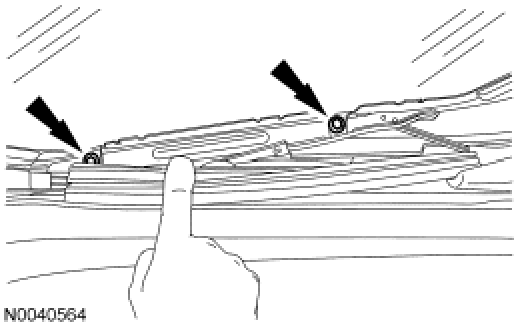


Fig. 14: Locating Roof Opening Panel Glass Screws
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.
   - Verify that the roof opening panel is centered and aligned before tightening the screws. For additional information, refer to **Roof Opening Panel Alignment**.
   - Initialize the roof opening panel motor. For additional information, refer to **Roof Opening Panel Motor Initialization**.

ROOF OPENING PANEL SHIELD

REMOVAL AND INSTALLATION

1. Remove the roof opening panel glass. For additional information, refer to **Roof Opening Panel Glass**.
2. Remove the trough assembly. For additional information, refer to **Trough Assembly**.
3. Slide the roof opening panel shield forward halfway.

4. Disengage the roof opening panel shield guide feet.
    - Lift the front portion of the roof opening panel shield upward at center until able to disengage one of the front guide feet.

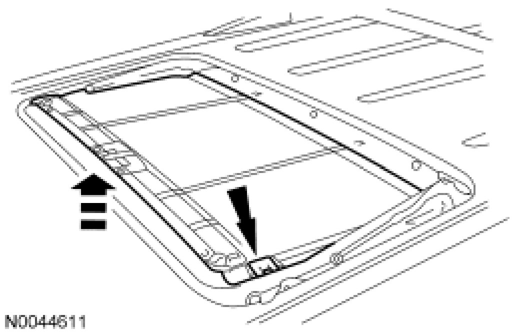


Fig. 15: Disengaging Roof Opening Panel Shield Guide Feet
Courtesy of FORD MOTOR CO.

5. With one of the guide feet released, carefully rotate the roof opening panel in a clockwise manner to disengage the remaining guide feet.

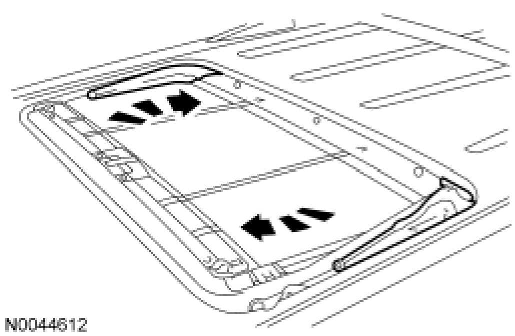


Fig. 16: Rotating Roof Opening Panel In Clockwise
Courtesy of FORD MOTOR CO.

6. To install, reverse the removal procedure.
    - Initialize the roof opening panel motor. For additional information, refer to **Roof Opening Panel Motor Initialization**.

ROOF OPENING PANEL MOTOR

REMOVAL AND INSTALLATION

NOTE: Anytime a roof opening panel motor is removed, the cables/mechanisms can experience free-play movement. It is important that the cables do not move. They are timed to be parallel with each other. If one or both are moved in either direction, they must be retimed.

1. Close the roof opening panel glass.

2. Open the 4 passenger assist handle covers.
    - Remove the bolts and remove the handles.
        - To install, tighten to 5 Nm (44 lb-in).
3. Remove the A-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
4. Remove the B-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
5. Remove the C-pillar trim panels. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
6. Remove the overhead console.
    - Disconnect the electrical connector.
7. If equipped, disconnect the automatic-dimming rear view mirror electrical connector.
8. Remove the sun visors and the sun visor clips.
    - If equipped, disconnect the electrical connectors.
9. Remove the 2 headliner pushpins at the rear.
10. Remove the interior lamp.
    - Disconnect the electrical connector.
11. Position the headliner forward to gain access to the roof opening panel motor.
12. Remove the 3 roof opening panel motor screws and the roof opening panel motor.
    - Disconnect the electrical connector.
    - To install, tighten to 4 N.m (35 lb-in).

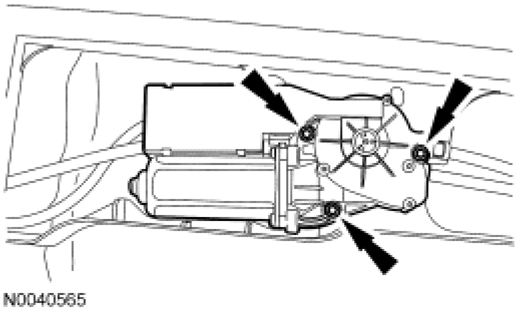


Fig. 17: Removing Roof Opening Panel Motor Screws
Courtesy of FORD MOTOR CO.

13. To install, reverse the removal procedure.
    - Initialize the roof opening panel motor. For additional information, refer to **Roof Opening Panel Motor Initialization**.

AIR DEFLECTOR

REMOVAL AND INSTALLATION

1. Position the roof opening panel glass to the full OPEN position.
2. Disengage the front portion of the roof opening panel air deflector. Remove the 2 screws.
    - To install, tighten to 1 Nm (9 lb-in).

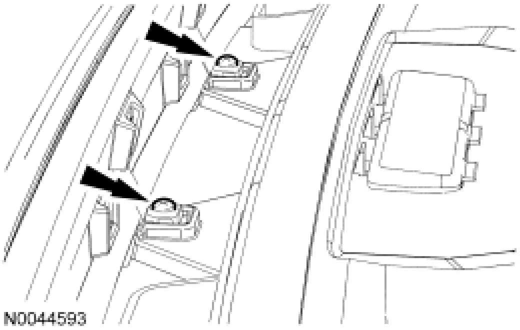


Fig. 18: Locating Roof Opening Panel Air Deflector Screws
Courtesy of FORD MOTOR CO.

3. Lift upward and pull to unlock the spring on each side to remove the air deflector assembly.
4. To install, reverse the removal procedure.
    - Initialize the roof opening panel motor. For additional information, refer to **Roof Opening Panel Motor Initialization**.

ROOF OPENING PANEL FRAME

REMOVAL AND INSTALLATION

1. Remove the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Disconnect the 4 roof opening panel drain hoses.
3. Disconnect the electrical connector.
4. Remove the 8 roof opening panel frame bolts and remove the roof opening panel frame.
    - To install tighten to 12 N.m (9 lb-ft).
5. To install, reverse the removal procedure.
    - Initialize the roof opening panel motor. For additional information, refer to **Roof Opening Panel Motor Initialization**.

TROUGH ASSEMBLY

REMOVAL AND INSTALLATION

1. Remove the roof opening panel glass. For additional information, refer to **Roof Opening Panel Glass**.
2. Remove the trough assembly.
    - Pull the trough assembly arms outward to release the trough assembly guide arm pins from the roof opening panel frame to remove.

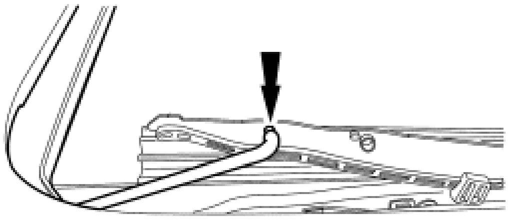


Fig. 19: Locating Trough Assembly Arm Pins
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.
   - Initialize the roof opening panel motor. For additional information, refer to **Roof Opening Panel Motor Initialization**.

ROOF OPENING PANEL CONTROL SWITCH

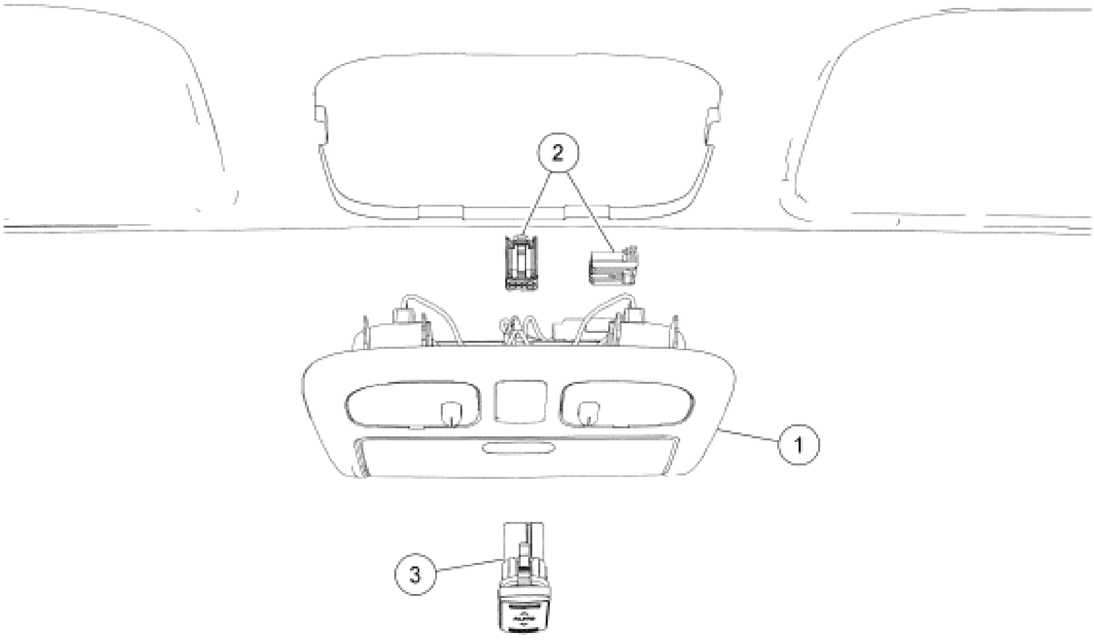


Fig. 20: Exploded View Of Roof Opening Panel Control Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	54519A70	Overhead console
2	-	Overhead console electrical connectors
3	15B69	Roof opening panel control switch

REMOVAL AND INSTALLATION

1. Open the storage compartment cover and remove the 2 screws.

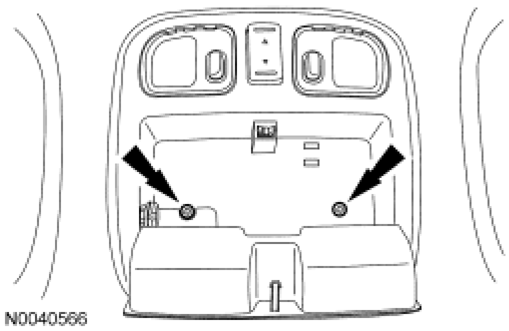


Fig. 21: Locating Storage Compartment Cover Screws
Courtesy of FORD MOTOR CO.

2. Disconnect the overhead console electrical connectors.
3. Disengage the clips and remove the switch from the overhead console.

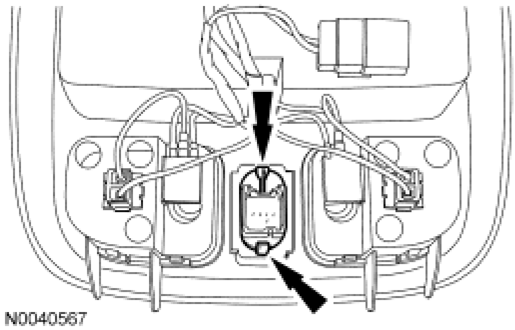


Fig. 22: Locating Overhead Console Electrical Connectors Pin And Switch
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

2008 RESTRAINTS

Safety Belt System - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Motorcraft Professional Strength Carpet and Upholstery Cleaner ZC-54	-	-

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Center safety belt anchor bolt	48	35	-
Center safety belt retractor bolt	40	30	-
Child safety seat tether anchor bolt	28	21	-
Front safety belt buckle bolt	40	30	-
Rear outboard safety belt anchor bolt	48	35	-
Rear outboard safety belt retractor bolt	40	30	-
Rear safety belt buckle bolt	48	35	-
Safety belt anchor bolt	40	30	-
Safety belt retractor and pretensioner bolt (lower)	40	30	-
Safety belt retractor and pretensioner bolt (upper)	10	-	89
Safety belt retractor and pretensioner D-ring bolt	40	30	-
Safety belt shoulder height adjuster bolt	40	30	-

DESCRIPTION AND OPERATION

SAFETY BELT SYSTEM

WARNING: **After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:**

- **Retractors**
- **Buckles**
- **Belt tension sensor (BTS) (if equipped)**
- **Front safety belt buckle support assemblies (slide bar) (if equipped)**

- **Safety belt shoulder belt height adjusters (if equipped)**
- **Child safety seat tether bracket assemblies**
- **Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)**

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

When installing any new active occupant restraint components, use only the replacement parts specified in the Ford Customer Service Division Master Parts Catalog.

The active restraint system consists of the following:

- Front safety belt shoulder height adjusters
- Front row safety belt buckles attached to the inboard side of the seats
- Front row safety belt retractors and pretensioners located behind the lower B-pillar trim panels
- Rear center safety belt retractor, attached to the parcel shelf sheet metal and safety belt buckle assembly, attached to the floor pan under the rear seat cushion
- Rear dual safety belt buckle assembly, attached to the floor pan under the seat cushion
- LATCH at rear outboard seating positions, attached below the rear seat cushion
- Child safety seat tether anchors are attached to the parcel shelf sheet metal for all 3 rear seating positions

Safety Belt, Lap/Shoulder

While the vehicle is in motion, the combination lap and shoulder belt adjusts to the occupant's movement. However, if the vehicle brakes hard, corners hard or if the vehicle receives an impact of 8 km/h (5 mph) or more, the lap and shoulder belt locks and helps reduce the occupant's forward movement.

Safety Belt Retractor and Pretensioner

The safety belt retractor and pretensioner is a pyrotechnic device that removes excess webbing from the safety belt when deployed. The pretensioner works in conjunction with the front air bag system. When the front air bags deploy, the pretensioners deploy, causing the retractor to move downward, removing excess webbing from

the lap and shoulder safety belts.

If the vehicle is involved in a collision that results in deployment of the front air bags and safety belt pretensioners, a new driver and passenger seat belt system (including safety belt buckle and pretensioners, safety belt retractors and height adjusters) must be installed.

For safety belt retractor pretensioner diagnostic information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

For safety belt retractor pretensioner disposal information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Dual Locking Mode Retractors

NOTE: When installing a dual locking mode retractor, the retractor should be checked to make sure it is not in the automatic locking retractor (ALR) mode after installation in the stowed position.

All continuous-loop, 3-point retractor systems, except the driver position, are equipped with the dual locking mode system.

The emergency locking retractor (ELR) mode will allow the occupant freedom of movement, locking tight only on hard braking, hard cornering or an impact of approximately 8 km/h (5 mph). The ELR mode helps to reduce the forward movement of the driver and passengers. The ELR mode is continuously in operation at all seating positions.

The ALR portion of this system does not allow the occupant freedom of movement. The ALR mode is used when locking a child seat in an outboard seating position or when a tight belt fit is desired. The ALR mode is automatically engaged when the webbing is fully extracted from the retractor and then allowed to retract. As the webbing is retracted back onto the spool, an audible clicking sound is made indicating the retractor is in ALR mode and the webbing will not pull back out of the retractor. To disengage the ALR mode, let the webbing retract back onto the spool. The ALR mode is disengaged when the webbing is free to move out and back into the retractor.

The automatic locking mode must be used when installing a child safety seat in the front or rear passenger seating positions where dual locking mode retractors are provided.

Energy Management Retractor

This vehicle has a safety belt system with an energy management feature at the front seating positions to help further reduce the risk of injury in the event of a head-on collision.

The energy management retractor feature is designed to pay out webbing in a controlled manner. This feature is designed to help reduce the belt force acting on an occupant's chest.

Safety Belt Extension

In certain cases, the safety belt may be too short even when it is fully extended. Additional length can be added

to the belt length by using a safety belt extension. Safety belt extensions are available through the dealership parts department at no cost. Safety belt extensions are only available with black webbing. Two extension assemblies are available for the front and rear seating positions.

Use only extensions manufactured by the same supplier as the safety belt. Manufacturer identification is located at the end of the webbing on the label. Also, use the safety belt extension only if the safety belt is too short for you when fully extended. Do not use the extension to change the fit of the shoulder belt across the torso.

Child Safety Seat Tether Anchors

The child safety seat tether anchors are attached to the parcel shelf sheet metal.

Lower Anchors and Tethers for Children (LATCH)

The LATCH system is a standardized and uniform attachment system for installing child safety seats in passenger vehicles. LATCH-equipped child safety seats have lower attachments that connect to the vehicle portion of the LATCH system.

The vehicle portion of the system consists of attachment points (6-mm wires) at outboard second row seating positions. The attachment points protrude from the bite line between the seat cushion and seat backrest.

If a child safety seat was in use during a collision, inspect the vehicle portion of the system for damage. If any of the attachment points (6-mm wires) are damaged, a new one must be installed.

The child safety seat tether anchors and LATCH system is a structural member of the seat frame and floor pan beneath the rear seat cushion.

Safety Belt Warning System

The safety belt warning indicator illuminates and a chime sounds to remind the occupants to fasten their safety belts.

The conditions of operation for the safety belt warning indicator and chime are as follows:

- If the driver safety belt is not buckled before the ignition switch is turned to the ON position, the safety belt warning indicator illuminates for 1-2 minutes and the warning chime sounds for 4-8 seconds.
- If the driver safety belt is buckled while the warning indicator is illuminated and the reminder chime is sounding, the safety belt warning indicator and warning chime will turn off.
- If the driver safety belt is buckled before the ignition switch is turned to ON, the safety belt warning indicator and reminder chime will remain off.

Belt-Minder®

The Belt-Minder® feature is a supplemental warning to the safety belt warning function. This feature provides additional reminders by intermittently sounding a chime and illuminating the safety belt warning indicator, in the instrument cluster (IC), when the driver and front passenger safety belt is unbuckled.

The Belt-Minder® feature uses information from the front passenger sensing system to determine if a front seat passenger is present and therefore potentially in need of a warning. To avoid activating the Belt-Minder® feature for objects placed in the front passenger seat, warnings will only be given to front seat occupants over a certain weight, as determined by the front passenger sensing system.

Both the driver and passenger safety belt usages are monitored and either may activate the Belt-Minder® feature. The warnings are the same for the driver and the front passenger. If the Belt-Minder® warnings have expired (warnings for approximately 5 minutes) for one occupant (driver or front passenger), the other occupant can still activate the Belt-Minder® feature.

When the Belt-Minder® feature is activated, the safety belt warning indicator illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belts are buckled.

The Belt-Minder® feature uses 2 different warning chimes. During the first minute of activation, the warning chime will sound once every second. The remaining warning chimes will sound twice every second while the system is activated.

To activate or deactivate the Belt-Minder® feature, refer to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article or the Owner's Literature.

If...	Then...
The driver or front passenger safety belt is not buckled before the vehicle has reached at least 5 km/h (3 mph) and 1-2 minutes have elapsed since the ignition switch has been turned to ON...	The Belt-Minder® feature is activated - the safety belt warning indicator illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until safety belts are buckled.
The driver or front passenger safety belt becomes unbuckled for approximately one minute while the vehicle is traveling at least 5 km (3 mph) and more than 1-2 minutes have elapsed since the ignition switch has been turned to ON.	The Belt-Minder® feature is activated-the safety belt warning indicator illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belts are buckled.
The driver and front passenger safety belts are buckled before the ignition switch is turned to the ON position or less than 1-2 minutes have elapsed since the ignition switch has been turned ON.	The Belt-Minder® feature will not activate.

DIAGNOSTIC TESTS

SAFETY BELT SYSTEM

Inspection and Verification

1. Verify the customer's concern by operating the active restraint system to duplicate the condition.
2. Inspect to determine if any of the following mechanical or electrical concerns apply:

VISUAL INSPECTION CHART

Mechanical	Electrical
• Safety belt webbing integrity • Safety belt buckle and tongue assembly • Safety belt retractor	• Wiring, terminal or connector • Safety belt warning indicator lamp burned out • High-speed controller area network (HS-CAN) network concern

3. If the inspection reveals an obvious concern(s) that can be readily identified, service as required. With the exception of removing a twist from the safety belt webbing, do not attempt to repair a component of the safety belt system; new components must be installed.
4. If the concern remains after the inspection, determine the symptom. Go to **Symptom Chart**.
5. To check the active restraint system for correct operation, carry out the appropriate Functional Test(s).

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The safety belt warning indicator lamp does not operate	• Burned-out lamp/LED • Circuitry • Instrument cluster (IC) • Restraints control module (RCM)	• If the air bag warning indicator is illuminated, REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. If the air bag warning indicator is not illuminated, REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
• The safety belt warning chime does not operate	• Safety belt switch • IC module • RCM • Circuitry	• If the air bag warning indicator is illuminated, REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. If the air bag warning indicator is not illuminated, REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
• Excessive pressure on the occupant during normal wear, the webbing cannot be extracted, excessive slack in webbing does	• Front safety belt retractor and tongue • Rear safety belt retractor and tongue	• CARRY OUT the component **Functional Test - Buckle and Tongue**. INSTALL a new retractor if necessary.

not retract		
• The Belt-Minder® feature is inoperative	• Belt-Minder® feature is deactivated • Circuitry	• REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article or the Seating and Safety Restraints section of the Owner's Literature to activate the Belt-Minder® feature. If the Belt-Minder® is activated, REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article to diagnose.

Component Test

Carry out the appropriate Functional Test(s) as determined in Inspection and Verification.

Functional Test - Buckle and Tongue

The safety belt buckle and tongue assembly must operate freely during the latching and unlatching function. Fasten the safety belt by inserting the tongue (male portion) into the buckle (female portion).

1. Verify the following during the latching sequence:
   - Tongue insertion is not hindered by excessive effort.
   - A "click" is heard when the buckle latches the tongue.
2. Verify the system integrity by forcefully pulling on the belt webbing.
3. Unlatch the belt by fully depressing the buckle release button and allow the belt to release and retract.
4. Verify the following during the unlatching process:
   - Push-button depression does not require excessive effort.
   - Tongue can be removed easily from the buckle.
   - Repeat the above steps 3 times.
5. If the inspection reveals an obvious concern(s) that can be readily identified, service as required. Do not attempt to carry out any repair on the buckle and tongue assembly. If a concern exists with either component, a new safety belt buckle and safety belt retractor assembly must be installed.

Functional Test - Retractor

The safety belt retractor assembly must be freely operational for extraction and retraction of the safety belt webbing between full extension and in-vehicle stowed positions.

1. Extract and retract the safety belt between the full extension and stowed positions.
2. Verify the retractor operates without excessive effort or binding.
3. Install a new safety belt retractor and buckle if no obvious concerns are noticed and the complaint has

been verified.

Functional Test - System Road Test Inspection

NOTE: If the RH or second and third rear safety belts are to be tested, the assistance of a passenger is required.

1. Fasten the safety belts and proceed to a safe area.
2. Attain a speed of 8 km/h (5 mph).

WARNING: The driver and passenger must be prepared to brace themselves in the event the safety belt retractor does not lock. Failure to follow this instruction may result in serious personal injury.

3. Test the safety belts.
   1. Grasp the shoulder harness and prepare to lean forward.

      WARNING: Apply maximum brake force only on dry concrete or equivalent hard surface, NEVER on wet pavement or gravel. Failure to follow this instruction may result in serious personal injury.

      WARNING: The driver and passenger must be prepared to brace themselves in the event the safety belt retractor does not lock. Failure to follow this instruction may result in serious personal injury.

      NOTE: Do not jerk on the safety belt webbing when carrying out this test. Lean forward slightly when the brake application is made.

   2. Make a maximum brake application without a skid.
4. The safety belts should lock up with minimum webbing extension.
5. If there is a lockup of both shoulder straps, the safety belt assemblies are functioning correctly. Should either or both retractors fail to lock up at the 8 km/h (5 mph) speed, repeat the test at a constant 24 km/h (15 mph) speed. (This test must be carried out with a RH front or rear passenger if the RH front or rear safety belts are to be tested.)

NOTE: Before installing a new safety belt assembly, inspect the mounting area for damage and distortion. If the retractor of a new safety belt assembly has been bolted into a damaged or distorted mounting area, the retractor may be warped and may not function. If this is the case, remove the retractor, return the vehicle structure to its original production configuration and install a new safety belt assembly.

6. If any retractors do not lock up at the 24 km/h (15 mph) test, return the vehicle for service of malfunctioning safety belts.

Functional Test - Automatic Locking Retractor (ALR)

WARNING: **After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:**

- **Retractors**
- **Buckles**
- **Belt tension sensor (BTS) (if equipped)**
- **Front safety belt buckle support assemblies (slide bar) (if equipped)**
- **Safety belt shoulder belt height adjusters (if equipped)**
- **Child safety seat tether bracket assemblies**
- **Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)**

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Position the seat back into the full up position.
2. Position the height adjuster (if equipped) in the full down or up position.
3. Latch the seat belt buckle and tongue assembly.
4. Pull the shoulder belt out until the automatic locking retractor (ALR) feature is activated.
5. Release the shoulder belt and allow it to retract until it stops.
6. Pull on the shoulder belt to check that the belt has remained in the ALR mode. If the belt is not locked, install a new safety belt assembly.
7. Unlatch the safety belt tongue from the buckle and allow the safety belt to retract to its stowed position.
8. Pull the shoulder belt to verify the retractor assembly has converted automatically out of the ALR mode. If the shoulder belt remains locked in the stowed position, install a new safety belt retractor assembly.

GENERAL PROCEDURES

SAFETY BELT CLEANING

Material

Item	Specification
Motorcraft Professional Strength Carpet and Upholstery Cleaner ZC-54	-

WARNING: **Do not bleach or re-dye the safety belt webbing, as the webbing may weaken. Failure to follow this instruction may increase the risk of serious personal injury or death in a crash.**

1. Clean the safety belt webbing only with the recommended carpet and upholstery cleaner. Follow the instructions provided with the cleaning solution.

SAFETY BELT MAINTENANCE

WARNING: **After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:**

- **Retractors**
- **Buckles**
- **Belt tension sensor (BTS) (if equipped)**
- **Front safety belt buckle support assemblies (slide bar) (if equipped)**
- **Safety belt shoulder belt height adjusters (if equipped)**
- **Child safety seat tether bracket assemblies**
- **Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)**

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

NOTE: **The safety belt assemblies should be periodically inspected to make sure that**

they have not become damaged and that they remain in correct operating condition, particularly if they have been subjected to severe stress.

NOTE: **Before installing a new safety belt assembly, the safety belt attaching areas must be inspected for damage and distortion. If the attaching points are damaged and distorted, the sheet metal must be worked back to its original shape and structural integrity.**

1. Carry out all applicable Functional Tests for the component(s). For additional information, refer to the appropriate Functional Test procedure in **Safety Belt System**. Install the new safety belt(s) as directed.

SAFETY BELT PROCEDURE AFTER A COLLISION

WARNING: **After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:**

- **Retractors**
- **Buckles**
- **Belt tension sensor (BTS) (if equipped)**
- **Front safety belt buckle support assemblies (slide bar) (if equipped)**
- **Safety belt shoulder belt height adjusters (if equipped)**
- **Child safety seat tether bracket assemblies**
- **Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)**

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Before installing a new safety belt assembly, the safety belt attaching areas must be inspected for damage and distortion. If the attaching points are damaged and distorted, the sheet metal must be worked back to its original shape and structural integrity.
2. Install the new safety belt(s). For additional information, refer to the appropriate procedure. Carry out all

applicable Functional Tests for the component(s). For additional information, refer to the appropriate Functional Test procedure in **Safety Belt System**.

SAFETY BELT SHOULDER HEIGHT ADJUSTER WITH STRIPPED WELD NUTS

1. Remove the B-pillar trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Use the half-inch drill with integral stop to drill out the damaged threads in the upper pillar structure.

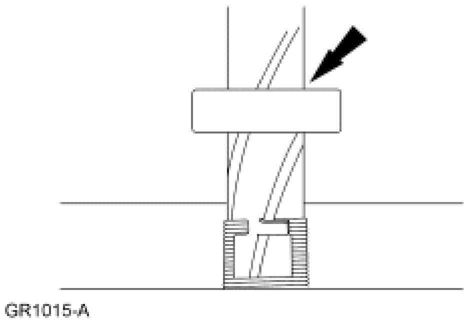


Fig. 1: Drilling Out Damaged Threads
Courtesy of FORD MOTOR CO.

NOTE: After each rotation, back off tap slightly to remove new cuttings and be sure to blow out any chips before proceeding.

3. Apply a suitable lubricant to the M14 x 1.5 tap with integral stop and tap new threads.

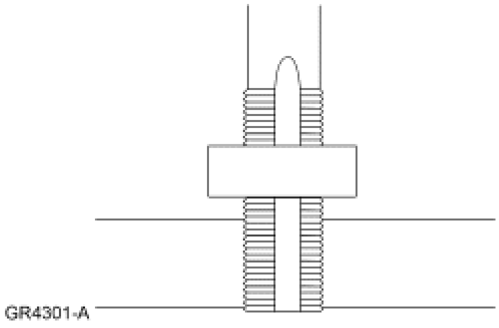


Fig. 2: Tapping New Threads
Courtesy of FORD MOTOR CO.

4. Use a threaded insert and screw it into the retapped hole until it is slightly below the surface.

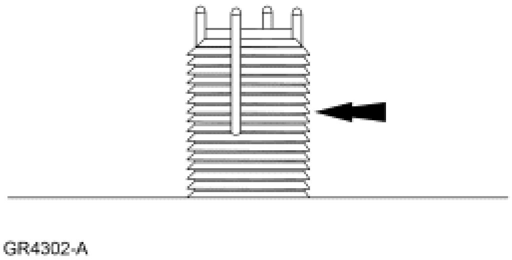


Fig. 3: Threaded Insert
Courtesy of FORD MOTOR CO.

5. Use a hammer to lightly tap the installation tool several times to seat the insert keys.

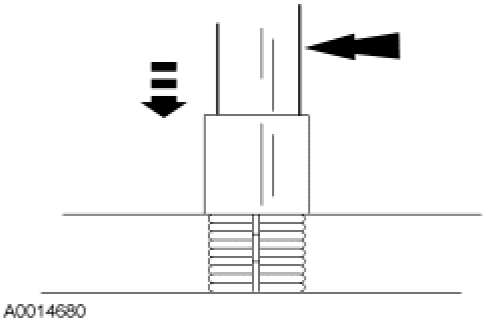


Fig. 4: Tapping Installation Tool To Seat Insert Keys
Courtesy of FORD MOTOR CO.

6. If the bolt(s) on the height adjuster is not stripped, reinstall the original safety belt shoulder height adjuster. If the bolt(s) is stripped, install a new safety belt shoulder height adjuster. For additional information, refer to the appropriate height adjuster procedure.

SAFETY BELT TONGUE ROTATED ON BELT

1. Fold the safety belt as indicated.

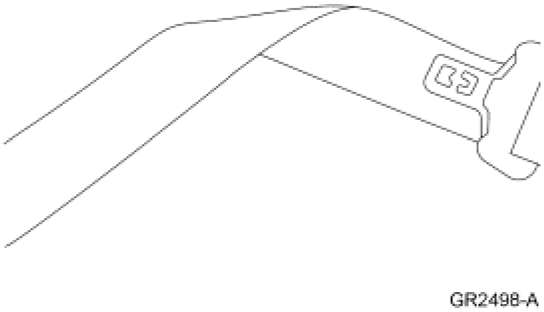


Fig. 5: Folding Safety Belt
Courtesy of FORD MOTOR CO.

2. Pull the safety belt tongue over the fold in the safety belt.

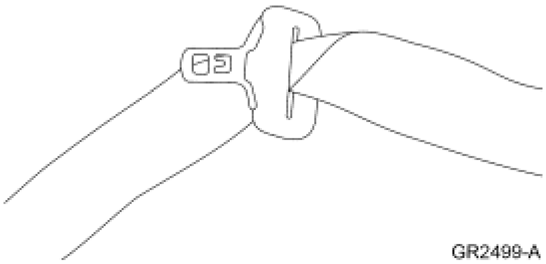


Fig. 6: Pulling Safety Belt Tongue Over Fold In Safety Belt
Courtesy of FORD MOTOR CO.

REMOVAL AND INSTALLATION

SAFETY BELT RETRACTOR AND PRETENSIONER

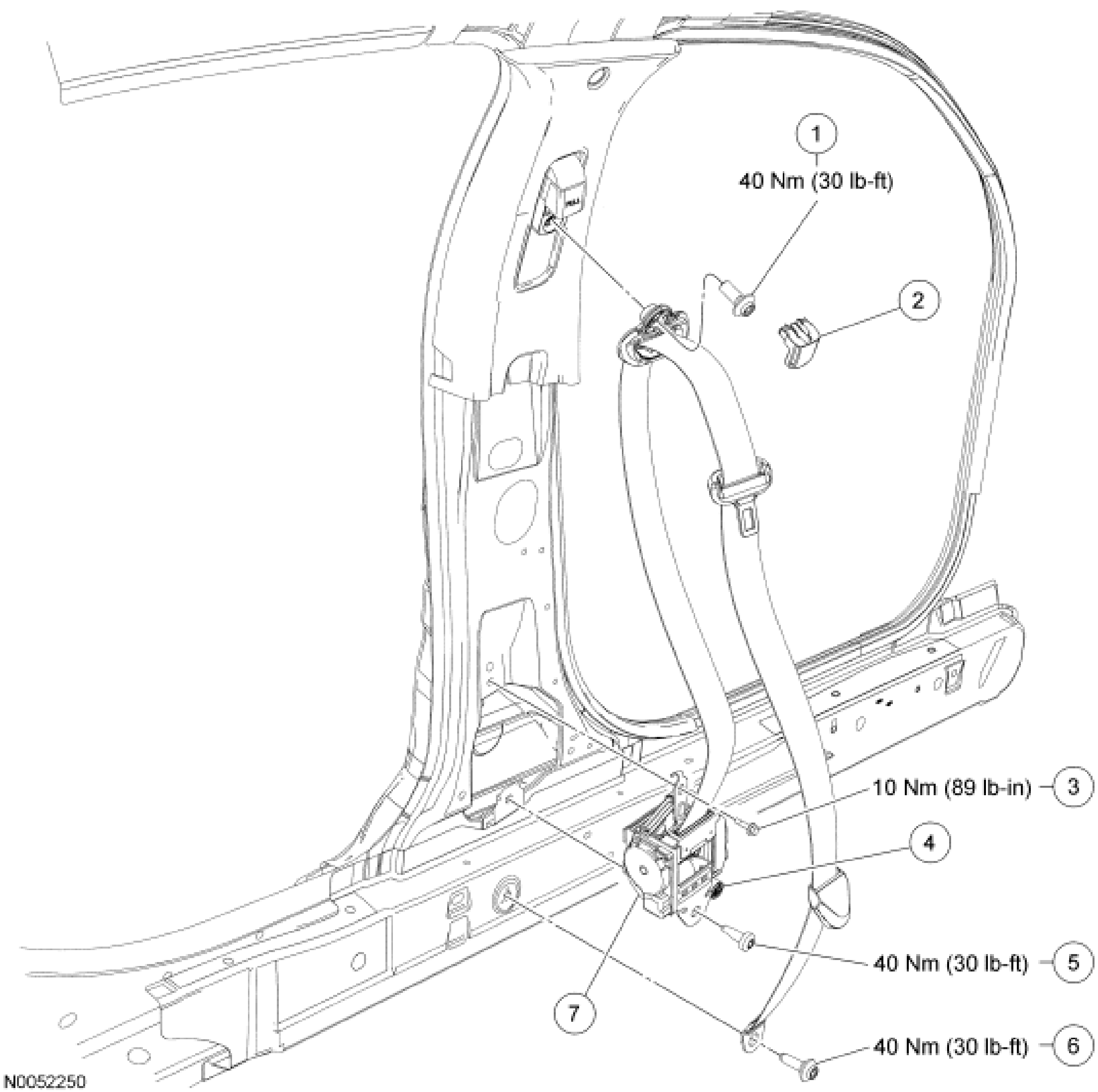


Fig. 7: Exploded View Of Safety Belt Retractor & Pretensioner With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Bolt, D-ring (part of 611B09 LH/ 611B08 RH)
2	60262	Cover, D-ring
3	W505253	Bolt, safety belt retractor (upper)
4	-	Electrical connector
5	W700883	Bolt, safety belt retractor and pretensioner (lower)
6	-	Bolt, safety belt retractor anchor (part of 611B08 RH/ 611B09 LH)
7	611B08 RH/ 611B09 LH	Safety belt retractor and pretensioner

REMOVAL AND INSTALLATION

WARNING: **After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:**

- **Retractors**
- **Buckles**
- **Belt tension sensor (BTS) (if equipped)**
- **Front safety belt buckle support assemblies (slide bar) (if equipped)**
- **Safety belt shoulder belt height adjusters (if equipped)**
- **Child safety seat tether bracket assemblies**
- **Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)**

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: LH shown, RH similar.

All front retractors

NOTE: If equipped with power seats, position the passenger seat track downward to access the safety belt retractor anchor bolt.

1. Position the seat to the most forward position.
2. Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NOTE: Inspect the D-ring cover for damage. If the cover is damaged or does not remain attached, install a new D-ring cover.

3. Remove the D-ring cover.
4. Remove the bolt and D-ring.
   - To install, tighten to 40 Nm (30 lb-ft).
5. Remove the lower B-pillar trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

   RH front retractor

6. Remove the safety belt retractor anchor cover from the side of the seat.

   All front retractors

7. Remove the bolt and safety belt retractor anchor.
   - To install, tighten to 40 Nm (30 lb-ft).
8. Disconnect the electrical connector.
9. Remove the upper bolt.
   - To install, tighten to 10 Nm (89 lb-in).
10. Remove the lower bolt and safety belt retractor and pretensioner.
    - To install, tighten to 40 Nm (30 lb-ft).

NOTE: Make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.

NOTE: When installing a dual locking mode retractor, the retractor should be checked to make sure it is not in the automatic locking retractor (ALR) mode after installation in the stowed position.

11. To install, reverse the removal procedure.
12. Repower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

13. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in **Safety Belt System**.

SAFETY BELT RETRACTOR - REAR, CENTER

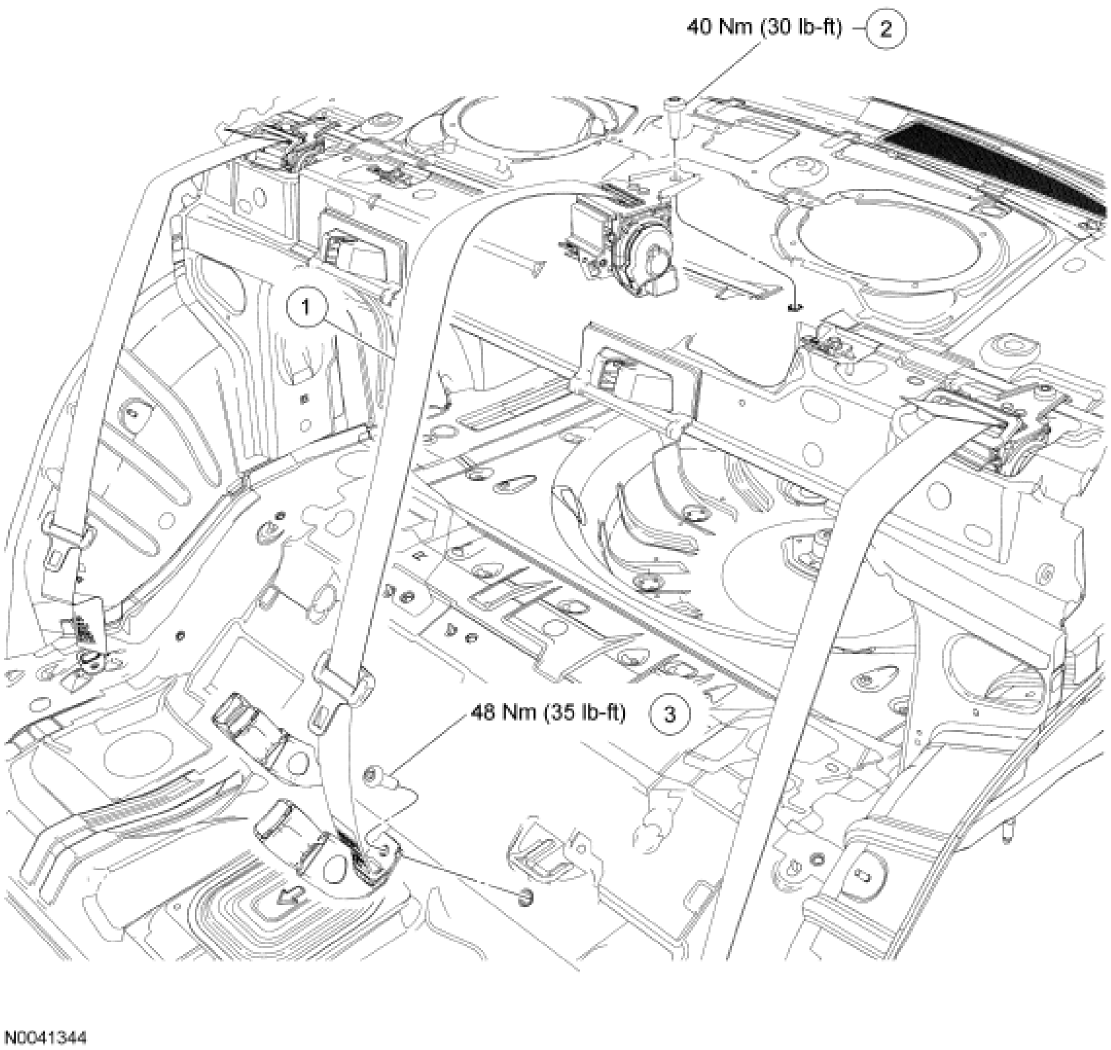


Fig. 8: Exploded View Of Rear Center Safety Belt Retractor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	611B66	Rear center safety belt retractor
2	W700883	Bolt, safety belt retractor
3	-	Bolt (part of 611B66)

REMOVAL AND INSTALLATION

WARNING: **After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:**

- **Retractors**
- **Buckles**
- **Belt tension sensor (BTS) (if equipped)**
- **Front safety belt buckle support assemblies (slide bar) (if equipped)**
- **Safety belt shoulder belt height adjusters (if equipped)**
- **Child safety seat tether bracket assemblies**
- **Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)**

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Remove the rear seat cushion. For additional information, refer to **SEATING** article.
2. Remove the bolt and safety belt retractor anchor.
   - To install, tighten to 48 Nm (35 lb-ft).
3. Remove the parcel shelf. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
4. Remove the bolt and center safety belt retractor.
   - To install, tighten to 40 Nm (30 lb-ft).

NOTE: **Make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.**

NOTE: **When installing a dual locking mode retractor, the retractor should be checked to make sure it is not in the automatic locking retractor (ALR) mode after installation in the stowed position.**

5. To install, reverse the removal procedure.

6. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in **Safety Belt System**.

SAFETY BELT RETRACTOR - REAR, OUTBOARD

NOTE: **LH shown, RH similar.**

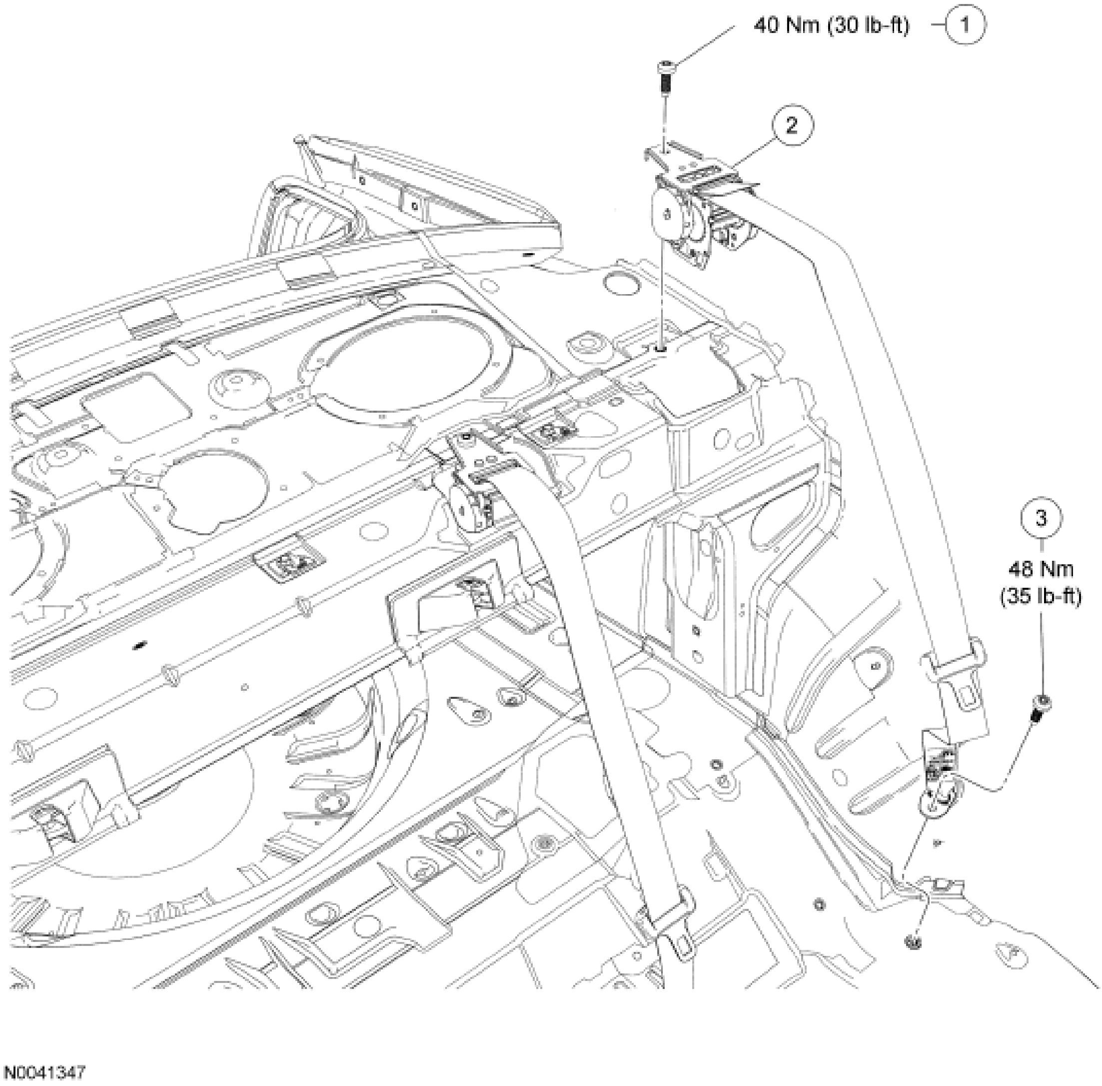


Fig. 9: Exploded View Of Rear Outboard Safety Belt Retractor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Bolt (part of 611B68)
2	611B68	Safety belt retractor assembly
3	-	Bolt (part of 611B68)

REMOVAL AND INSTALLATION

WARNING: **After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:**

- **Retractors**
- **Buckles**
- **Belt tension sensor (BTS) (if equipped)**
- **Front safety belt buckle support assemblies (slide bar) (if equipped)**
- **Safety belt shoulder belt height adjusters (if equipped)**
- **Child safety seat tether bracket assemblies**
- **Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)**

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Remove the rear seat cushion. For additional information, refer to **SEATING** article.
2. Remove the rear seat bolster. For additional information, refer to **SEATING** article.
3. Remove the parcel shelf. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
4. Remove the bolt and safety belt retractor anchor.
   - To install, tighten to 48 Nm (35 lb-ft).
5. Remove the bolt and safety belt retractor.
   - To install, tighten to 40 Nm (30 lb-ft).

NOTE: **Make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.**

NOTE: **When installing a dual locking mode retractor, the retractor should be**

checked to make sure it is not in the automatic locking retractor (ALR) mode after installation in the stowed position.

NOTE: **During installation, the web loop position of the safety belt anchor must face outboard of the vehicle.**

6. To install, reverse the removal procedure.
7. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in **Safety Belt System**.

SAFETY BELT SHOULDER HEIGHT ADJUSTER

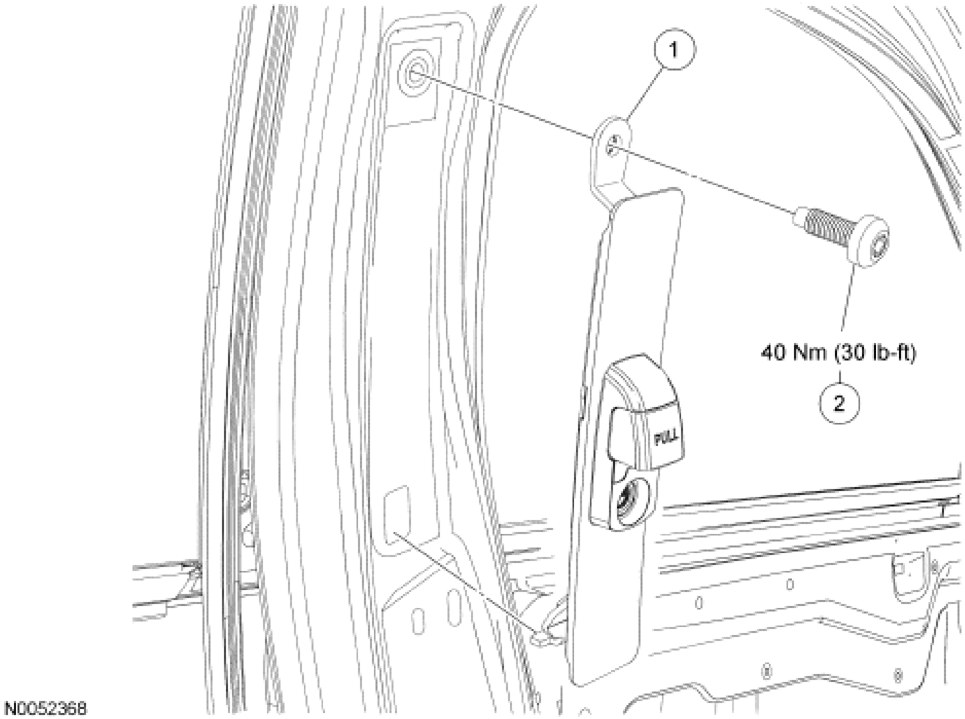


Fig. 10: Exploded View Of Safety Belt Shoulder Height Adjuster With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	602B82	Safety belt shoulder height adjuster
2	-	Bolt (part of 602B82)

REMOVAL AND INSTALLATION

WARNING: **After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:**

- **Retractors**
- **Buckles**
- **Belt tension sensor (BTS) (if equipped)**
- **Front safety belt buckle support assemblies (slide bar) (if equipped)**
- **Safety belt shoulder belt height adjusters (if equipped)**
- **Child safety seat tether bracket assemblies**
- **Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)**

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Remove the upper B-pillar trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Position the safety belt shoulder height adjuster down and remove the bolt.
   - To install, tighten to 40 Nm (30 lb-ft).

NOTE: **When installing the safety belt shoulder height adjuster, the lower T-tab must be engaged into the body prior to installing the bolt.**

3. Remove the safety belt shoulder height adjuster.
   1. Rotate the safety belt shoulder height adjuster downward to release the lower tab.
   2. Remove the safety belt shoulder height adjuster.

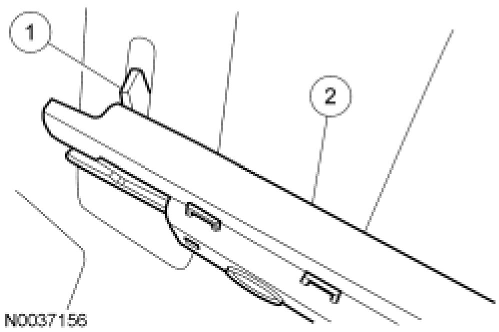


Fig. 11: Safety Belt Shoulder Height Adjuster & Tab
Courtesy of FORD MOTOR CO.

NOTE:	**Make sure the safety belt webbing is not twisted and the safety belts and buckles are accessible to the occupants.**

4. To install, reverse the removal procedure.
5. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in **Safety Belt System**.

SAFETY BELT BUCKLE - FRONT

NOTE:	**LH shown, RH similar.**

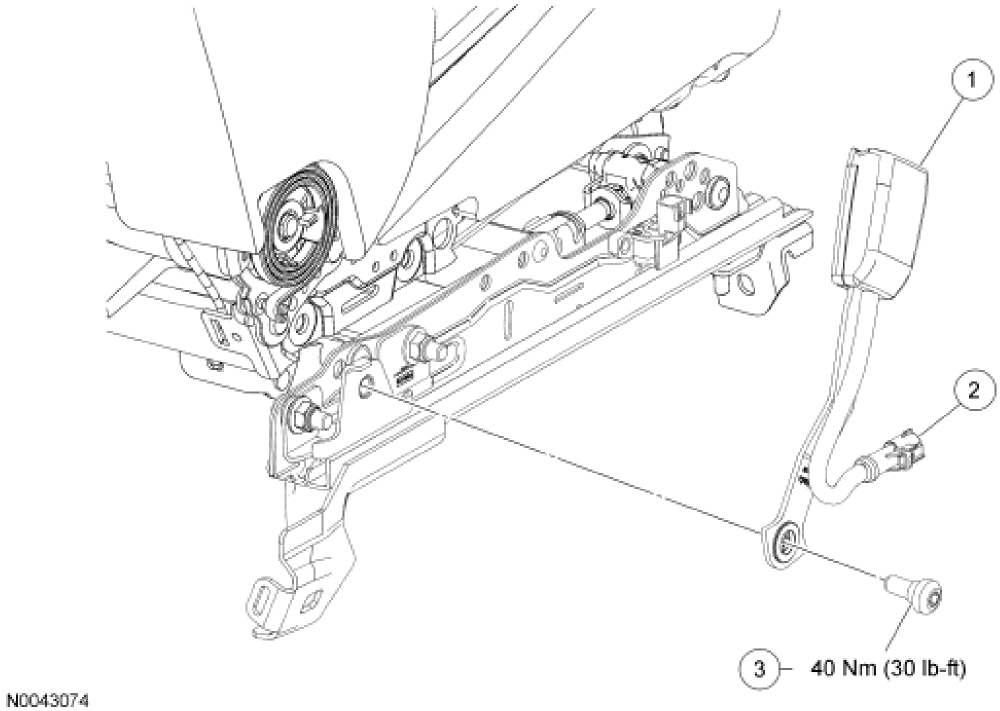


Fig. 12: Exploded View Of Front Safety Belt Buckle With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	61203 LH/ 61202 RH	Safety belt buckle
2	-	Electrical connector
3	-	Bolt (part of 61203 LH/ 61202 RH)

REMOVAL AND INSTALLATION

WARNING: **After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:**

- **Retractors**
- **Buckles**
- **Belt tension sensor (BTS) (if equipped)**
- **Front safety belt buckle support assemblies (slide bar) (if equipped)**
- **Safety belt shoulder belt height adjusters (if equipped)**
- **Child safety seat tether bracket assemblies**
- **Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)**

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the seat. For additional information, refer to **SEATING** article.

2. Disconnect the electrical connector.
    - Release the retainer on the side of the seat cushion cover to remove the wire for the safety belt buckle switch.
3. Remove the bolt.
    - To install, tighten to 40 Nm (30 lb-ft).
4. Remove the safety belt buckle through the opening in the seat cushion cover.
5. To install, reverse the removal procedure.
    - Make sure that the safety belt buckle is routed through the seat cushion cover.
6. Install the seat. **If the passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **SEATING** article.

    Passenger seat

7. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test and prove out the SRS. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

    All seats

8. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in **Safety Belt System**.

SAFETY BELT BUCKLE - REAR

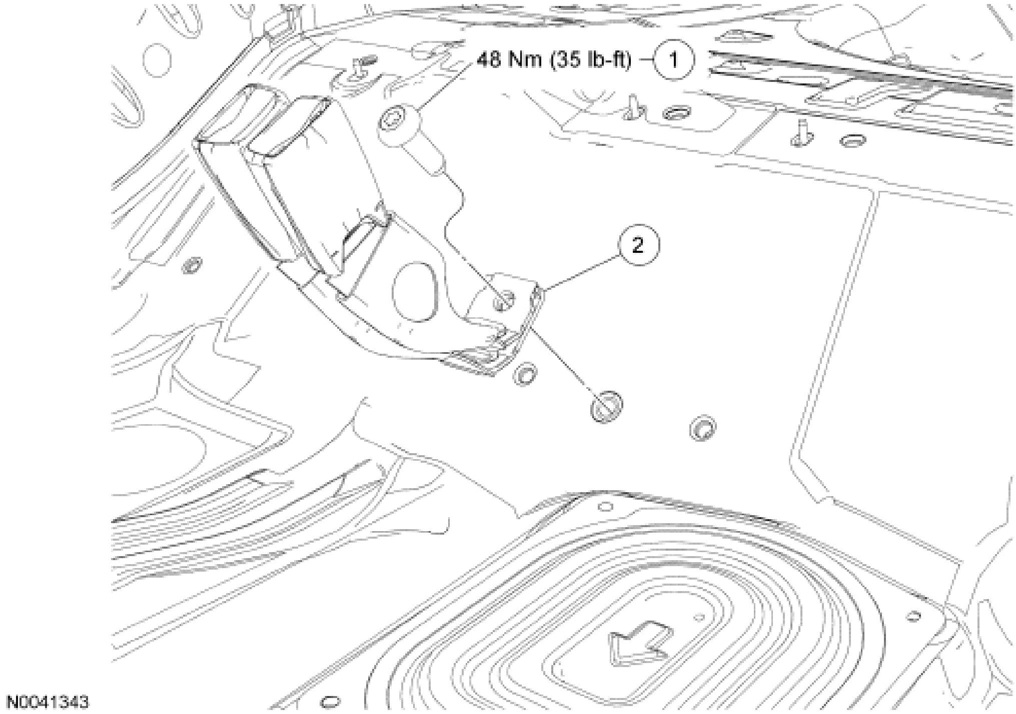


Fig. 13: Exploded View Of Rear Safety Belt Buckle With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Bolt (part of 60044)
2	60044	RH and center safety belt buckle assembly

REMOVAL AND INSTALLATION

WARNING: **After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:**

- **Retractors**
- **Buckles**
- **Belt tension sensor (BTS) (if equipped)**
- **Front safety belt buckle support assemblies (slide bar) (if equipped)**
- **Safety belt shoulder belt height adjusters (if equipped)**
- **Child safety seat tether bracket assemblies**
- **Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)**

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

NOTE: **The LH safety belt buckle is a part of the center safety belt retractor assembly and is not serviced separately. To remove the LH safety belt buckle, refer to Safety Belt Retractor - Rear, Center.**

1. Remove the rear seat cushion. For additional information, refer to **SEATING** article.
2. Remove the bolt and dual safety belt buckle assembly.
   - To install, tighten to 48 Nm (35 lb-ft).

NOTE: **Make sure the safety belt webbing is not twisted and the safety belts and**

buckles are accessible to the occupants.

NOTE: **The anti-rotation tab of the safety belt anchor buckle assembly must be correctly aligned before tightening fastener for correct installation.**

3. To install, reverse the removal procedure.
4. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in **Safety Belt System**.

CHILD SAFETY SEAT TETHER ANCHOR

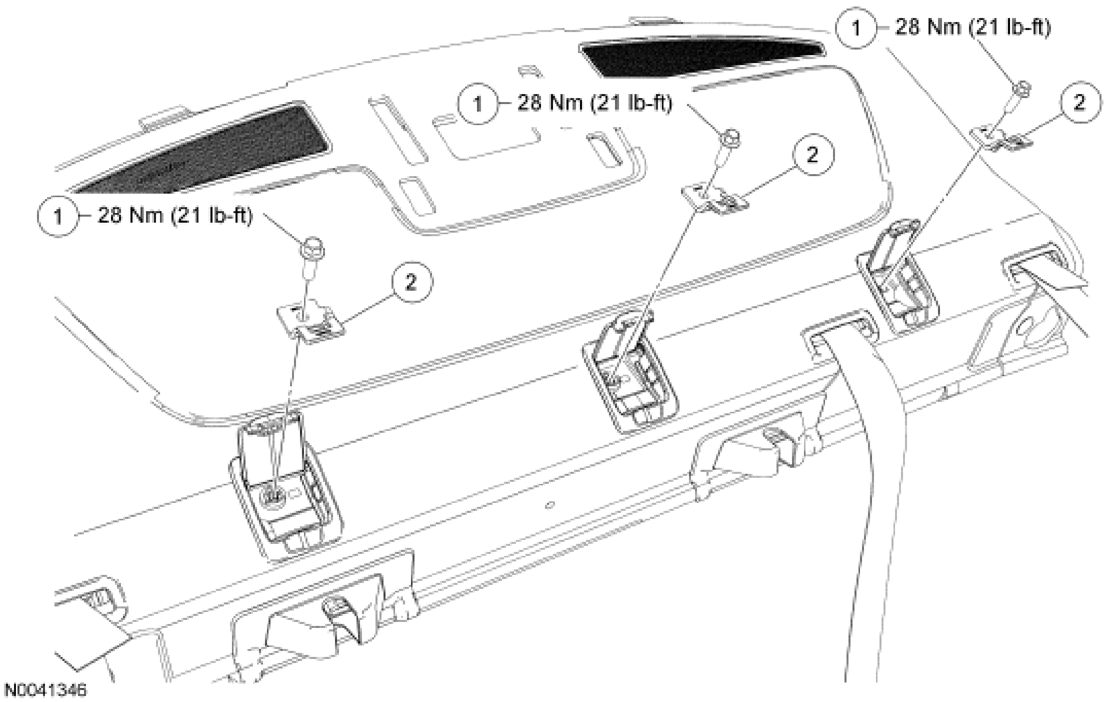


Fig. 14: Exploded View Of Child Safety Seat Tether Anchor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Bolts (part of 613D26)
2	613D26	Safety seat tether anchors

REMOVAL AND INSTALLATION

WARNING: **After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:**

- **Retractors**

- **Buckles**
- **Belt tension sensor (BTS) (if equipped)**
- **Front safety belt buckle support assemblies (slide bar) (if equipped)**
- **Safety belt shoulder belt height adjusters (if equipped)**
- **Child safety seat tether bracket assemblies**
- **Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)**

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion of this section, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Open the cover and remove the bolt and child safety seat tether anchor.
   - To install, tighten to 28 Nm (21 lb-ft).

   WARNING: **Always tighten the child safety seat tether anchor/bolt to specification. Failure to follow this instruction may result in the child's safety seat being incorrectly secured, which increases the risk of serious personal injury or death to the child in a sudden stop or crash.**

2. To install, reverse the removal procedure.
3. Check the active restraint system for correct operation. For additional information, refer to the appropriate Functional Test procedure in **Safety Belt System**.

2008 ACCESSORIES & BODY, CAB

Seating - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Front Seat			
Cushion thermo-electric device (TED) assembly nuts	6	-	53
Power recliner motor bolt	6	-	53
Power seat track horizontal drive unit bolts	28	21	-
Recliner-to-backrest frame bolts	55	41	-
Recliner-to-cushion frame bolts	55	41	-
Safety belt anchor bracket nuts	36	27	-
Safety belt buckle bolt	40	30	-
Safety belt buckle bracket nuts	36	27	-
Safety belt retractor belt anchor bolt	40	30	-
Seat position sensor bolt	6	-	53
Seat riser bolts	25	18	-
Seat-to-floor bolts[a]	-	-	-
Seat track-to-cushion frame nuts	36	27	-
Seat track-to-occupant classification sensor (OCS) rail bolts	25	18	-
Side air bag bracket-to-backrest frame nuts	6	-	53
Side air bag module bolt	10	-	89
Rear Seat			
Armrest pivot bolts	10	-	89
Armrest-to-backrest bolts	10	-	89
Backrest latch release handle bracket nuts	9	-	80
Backrest latch nuts	48	35	-
Backrest latch striker nuts	6	-	53
Backrest pivot-to-floor bolts	47	35	-
Backrest-to-pivot bolts	10	-	89
Side bolster bolt	11	8	-

[a] Refer to procedure.

DESCRIPTION AND OPERATION

SEATS

Front Seats

The front seats can be equipped with the following systems:

- Two-way manual seat track
- Four-way manual seat track
- Six-way power seat track
- Manual recline
- Power recline
- Backrest, without fold-flat
- Backrest with fold-flat (optional, passenger only)
- Heated seats
- Heated/cooled climate controlled seats (MKZ only)
- Memory driver seat (MKZ only)
- Manual lumbar
- Power lumbar
- Adjustable head restraints
- Seat side air bags
- Occupant classification sensor (OCS) system on passenger seat

Driver Seat Module (DSM) - Memory Seat

The power driver seat, exterior mirrors and adjustable pedal positions are controlled by the driver seat module (DSM) only when the vehicle is equipped with the programmable/recall memory option. The DSM is located on the driver seat track.

This system allows automatic positioning of the driver power bucket seat, exterior power mirrors and adjustable pedals to 2 programmable positions. Memory positions can be stored at any time. A memory recall can be initiated only if the vehicle is in PARK or NEUTRAL and the ignition switch is not in START. A memory recall in progress will not be affected by moving the ignition switch to START or by moving the selector lever out of PARK or NEUTRAL. For information on programming memory positions or recalling stored memory position, refer to **Memory Position Programming**.

Easy Entry/Easy Exit

The memory driver seat easy entry/exit feature moves the seat slightly rearward for easier exit from the vehicle and returns the seat forward after entry. The easy entry/easy exit feature can be enabled/disabled using selections on the message center. Refer to Driver Controls in the Owner's Literature for additional instructions for using the message center.

Heated Seats

This system allows independent seat electrical heating of each front seat on demand.

The serviceable components of the system are:

- the seat heater mats located in the seat cushion and backrest.
- the dual heated seat module located on the passenger seat track.
- the heated seat switches, located on the HVAC module.

Climate Controlled Seats

The climate control seat system is able to heat and cool the front seats. Each climate controlled seat is operated by push-buttons on the HVAC module located on the instrument panel. Each front seat temperature is then monitored and controlled by the dual climate controlled seat module (DCSM) located on the passenger front seat track.

The climate controlled seat system contains the following serviceable components:

- HVAC module
- DCSM
- Thermo-electric device (TED) and blower assembly within each front seat cushion and backrest
- Air filter (attached to each TED and blower assembly)
- Cushion and backrest manifolds
- Cushion and backrest foam pads
- Cushion and backrest trim covers

Manual Lumbar

The manual front seat backrest lumbar is adjusted by a knob mounted on the side of the seat cushion side shield.

Power Lumbar

The driver seat has an electro-mechanical backrest pad adjuster. The lumbar switch adjustment is on the side of the seat cushion side shield and is part of the seat control switch.

Manual Recline

The manual recline can be adjusted by a handle mounted on the outboard side of the cushion side shield.

Front Seats Without Backrest Fold-Flat

Manual recliners on seats that do not fold-flat are only serviceable by installing a new backrest frame assembly.

Passenger Seats With Backrest Fold-Flat

Front passenger seats can come with a backrest that folds flat, when option with manual recline. The recliners on this backrest will recline the backrest back or fold the backrest forward. Pull up on the recliner handle allowing the backrest to recline forward. When the backrest reclines fully forward, if the recliner handle is held up, the backrest will continue to fold forward until it reaches the fold-flat position. Manual recliners on seats

that fold-flat are serviced separately from the backrest frame assembly.

Power Recline

The driver seat has an electro-mechanical backrest adjuster. The backrest adjustment switch is located on the side of the seat cushion side shield and is part of the seat control switch.

Power recliners are only serviceable by installing a new backrest frame assembly. However, the recliner motor can be serviced separately.

Seat Side Air Bags

The driver and passenger seat side air bags are attached to the seat backrest frame. If a seat side air bag deployment has occurred or for more information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Occupant Classification Sensor (OCS) System

The occupant classification sensor (OCS) system is standard equipment on all front passenger seats. For diagnosing or servicing the OCS system, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Rear Seats

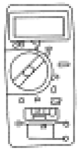
These seats are a 60/40 split folding backrest. The 60 percent has a fold down armrest and may be equipped with cup holders. Each backrest is held in place at the top with its own latch attached to the package tray sheet metal and a striker attached to each backrest frame. The rear seat backrest latch release handles are located in the luggage compartment.

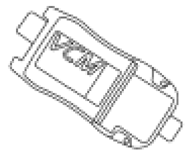
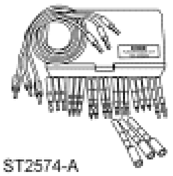
The cushion foam pad for an all wheel drive (AWD) vehicle is different than that for a front wheel drive (FWD) vehicle. The center tunnel is higher on an AWD vehicle, creating the need for a shorter cushion foam pad. Make sure when installing a new cushion foam pad, the correct part is being installed.

DIAGNOSTIC TESTS

SEATS

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	Fluke 73III Automotive Meter	105-R0057 or equivalent
	Vehicle Communication Module (VCM) and Integrated Diagnostic	software with appropriate hardware, or equivalent scan tool

 ST2834-A	System (IDS)	
 ST2574-A	Flex Probe Kit	105-R025C or equivalent

Medium-Speed Controller Area Network (MS-CAN)

This vehicle utilizes a communication system called a medium-speed controller area network (MS-CAN). When diagnosing the memory seat or climate controlled seat, use a Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool with the latest software update with the capability of communicating over the MS-CAN bus.

Principles of Operation

Driver and Passenger Power Seats Without Memory

The 10-way power seat control feature moves the seat in 10 possible directions: the seat can be moved forward or backward and the front and back of the cushion can be moved up and down independently. The backrest of the seat can be moved forward and backward, and the lumbar can be moved IN and OUT. All 10 positions are controlled by one switch. The power seat feature operates independent of the ignition switch position.

The 8-way power seat control feature moves the seat in 8 possible directions. It is like the 10-way power seat, less power lumbar.

The 6-way power seat control feature moves the seat in 6 possible directions. It is like the 10-way power seat, less power lumbar and recline.

The power seat motors are hardwired to the seat control switch. The circuits are normally at ground through the seat control switch. An individual circuit is switched to voltage when a specific adjustment position is selected.

Power Driver Seat With Memory

NOTE: Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.

NOTE: A memory recall in progress does not prohibit the initiation of another memory recall; the most recently requested memory recall will be executed.

The driver power memory seat is controlled by the driver seat module (DSM). The memory seat feature allows

the driver to program a personalized seat position that can be recalled using the memory switch or a remote keyless entry (RKE) transmitter. There are 2 memory settings possible. The exterior mirror positions are also stored and recalled with the driver memory seat positions.

The driver seat control switch provides voltage to the DSM when activated. The NEUTRAL position of the driver seat control switch position is a ground state through the seat control switch contacts. A voltage input causes the DSM to power the appropriate motor until the input is removed. Ground is the normal state of the motor circuits through the DSM and is not switched to control the motors. The DSM internally switches the appropriate circuit from ground to voltage for operating the motors.

As the seat is adjusted, the DSM constantly monitors the motor position sensors to record the current seat position. The DSM will remove voltage from the motor upon termination of the seat control switch input or if the DSM does not see movement from the motor by monitoring the position sensor.

The DSM communicates DTCs and other information using the MS-CAN communication bus. It should be noted for diagnostics that because CAN bus communication is more robust and reliable than other methods, it may be possible to have limited module communication with one of the CAN bus circuits disconnected or shorted to ground. Refer to **MODULE COMMUNICATIONS NETWORK** article for information concerning MS-CAN bus communication.

For information on programming memory positions or recalling a stored memory position, refer to **Memory Position Programming**. For information on remote keyless entry transmitter programming, refer to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.

The DSM is located under the driver seat. To install a new DSM, refer to **MULTIFUNCTION ELECTRONIC MODULES** article. Programmable module installation (PMI) must be carried out when installing a new DSM. Refer to **MODULE CONFIGURATION** article.

This part only diagnoses concerns specific to the memory seat. To diagnose a memory exterior mirror concern, refer to **REAR VIEW MIRRORS** article.

Easy Exit/Easy Entry

The easy entry/exit feature is a function of the driver seat module (DSM) that moves the driver seat backwards about 2 in (50.8 mm) when the ignition key is removed from the ignition switch. The DSM receives a key out command over the MS-CAN communication network and powers the driver seat rearward. This function will not operate if the seat is less than the 51 mm (2 in) travel distance to the end of the track or the function has been disabled. The DSM will also cancel this operation if a valid input command is received from the driver seat control switch, memory SET switch or exterior mirror control switch.

The DSM will record the current seat position before powering the seat for an easy exit function. This recorded position will be used to return the seat to this position on the easy entry operation. During easy entry operation, the seat is returned to the position previous to the easy exit operation. Easy entry operation will be cancelled if a valid input command from the seat control switch, memory SET switch or exterior mirror control switch is received by the DSM.

The easy entry/exit feature can be enabled/disabled using a scan tool. When enabled, the feature becomes a user accessible item on the message center allowing the user to turn the feature on and off. Refer to the Owner's

Literature or **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article for information on the message center.

Heated Seats

Vehicles equipped with front heated seats are equipped with a single-heated seat module to control both front heated seats. The heated seat module is located on the passenger seat track. The HVAC module includes both driver and passenger heated seat control buttons and indicators. The heated seat system will function independently of the vehicle's climate control system. A momentary ground signal is transmitted to the heated seat module when a heated seat switch button on the HVAC module is depressed and ignition switched voltage is supplied. Upon receiving each control signal to an input circuit, the heated seat module will decrease one setting (the sequence is HI, LOW, OFF, HI, etc.). When a heated seat is set to HI, both LED indicators above that heated seat's control button will illuminate. When a heated seat is set to LOW, only one LED indicator above that switch will illuminate. When activated, the heated seat module supplies voltage to the selected seat's heater circuit. Each seat's cushion heater mat and backrest heater mat is connector in a series circuit to the heated seat module and powered by the output circuit for that seat and ground. The heated seat module monitors inputs from a temperature sensor, located in each seat's cushion heater mat and maintains seat temperature by regulating current flow to the heater circuits. The heated seat module will remain ON until the heated seat switch button is depressed to cycle the heated seat module OFF. If ignition voltage is switched OFF, the heated seat module will enter an OFF state.

Climate Controlled Seat System

NOTE: **Avoid applying voltage directly to a thermo-electric device (TED) for testing its operation. Doing so may cause damage to the TED.**

NOTE: **When installing a new dual climate controlled seat module (DCSM), it is necessary to carry out programmable module installation (PMI). Refer to MODULE CONFIGURATION article.**

Both the driver and front passenger climate controlled seats are independently controlled electronically by the DCSM mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E.

If one of the BJB fuses open, both seats will remain operational because the voltage supply circuits are internally connected in the DCSM.

Both climate controlled seats operate independently. If a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module. If the system shuts down due to a DTC fault, cycling the ignition OFF and then ON again will reset the DCSM to function until the DTC resets.

The 4 switches (identified with seat icons) on the HVAC module activate each seat system setting and illuminate LEDs above each switch to indicate the operating mode, 3 LEDs for HIGH, 2 LEDs for MED or 1

LED for LOW. The push-buttons with the blue seat icon operate the seat cooling mode and the push-buttons with the red seat icon operate the seat heating mode. The climate controlled seat system is not equipped with auto-mode.

Each driver and front passenger seat cushion and backrest is equipped with a thermo-electric device (TED) and blower motor assembly. Applying voltage polarity to the TED in one direction, causes it to heat. Applying voltage polarity in the opposite direction causes the TED to cool. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the incoming air depending on the control switch settings. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once activated, the DCSM maintains the heating/cooling modes until deactivated.

The temperature differences between the individual heated and cooled settings is minimal. For example, it is difficult to distinguish between LOW COOL and MEDIUM COOL settings. Measuring seat temperature at different settings is possible by monitoring the DCSM PIDs using the scan tool.

The HVAC module communicates climate controlled seat commands to the DCSM using the medium-speed controller area network (MS-CAN) communication bus. The MS-CAN bus is connected to the data link connector (DLC) for diagnostic use. No direct connection exists between the DCSM and HVAC module for the climate controlled seat switches. The climate controlled seats can be commanded using the diagnostic tool to verify both module communication on the MS-CAN bus and operation of the DCSM. This method may be useful for isolating a control switch concern. It should also be noted that because CAN bus communication is more robust and reliable than other methods, it may be possible to have limited module communication with one of the CAN bus circuits disconnected or shorted to ground. Refer to **MODULE COMMUNICATIONS NETWORK** article for additional information concerning CAN bus communication.

Heating Characteristics

NOTE: The presence of overtemperature faults (DTCs B2729, B2730, B272A and B272B) can be induced by incorrect operation of the climate controlled seat system after an initial HEAT setting has been attained. If a HEAT setting is repeatedly turned OFF and ON in an attempt to increase the seat temperature, an overtemperature condition can result and the DTCs will be set.

- In HEAT mode, the TED circuits of a given seat are wired in parallel internally in the DCSM.
- The climate controlled seat system draws approximately 24 amperes, with both seats heating, until reaching the set point and then the system operates at a reduced amperage to maintain the climate setting.
- In HEAT mode, the TED can add up to 40°C-60°C (72°F-108°F) to the ambient air temperature entering the system.
- There are 3 manual settings based on the LEDs above each seat heat switch button on the HVAC module. The first setting is HIGH (3 LEDs), the second setting is MED (2 LEDs), the third is LOW (1 LED) then OFF (no LEDs).
- In the LOW setting, the DCSM is set to maintain TED temperature at approximately 46°C (115°F).
- In the HIGH setting, the DCSM is set to maintain TED temperature at 65°C (149°F).
- When heating, the DCSM will vary the speed of the fans and the TED duty cycle in order to reach and maintain the temperature determined by the switch setting.

- Seat heating has a maximum operating duration of 15 minutes.

Climate Controlled Seat Heat State	Initial Temperature	Final Temperature
HIGH	90°C (194°F)	65°C (149°F)
MED	80°C (176°F)	60°C (140°F)
LOW	75°C (167°F)	46°C (115°F)

Cooling Characteristics

- In cool mode, the TED circuits of a given seat are wired in series internally in the DCSM.
- The climate controlled seat system draws approximately 7 amps when in cool mode on high setting.
- In cool mode, the TED can remove up to 8°C (14°F) from the ambient air temperature entering the system.
- There are 3 manual settings based on the LEDs above each seat cool switch button on the HVAC module. The first setting is HIGH (3 LEDs), the second setting is MED (2 LEDs) and the third is LOW (1 LED) then OFF (no LEDs).
- When cooling, the DCSM maintains constant speed of the fans and constant TED supply voltage (duty cycle) in open loop cool mode.
- Seat cooling has a maximum operating duration of 30 minutes.

Climate Controlled Seat Cool State	TED Voltage	TED Supply Duty Cycle
HIGH	Vbat	100%
MED	Vbat	75%
LOW	Vbat	50%

The climate controlled seat system is deactivated by one of the following actions:

- Selecting the HVAC module setting to manual OFF.
- Turning the vehicle OFF.

If the temperature at one of the TEDs falls below 5°C (41°F), the DCSM will shut down the TEDs and initiate system recovery mode. If the temperature continues to drop below 2°C (36°F), the DCSM will shut down the fans in the affected seat.

Climate Controlled Seat System Recovery Mode

NOTE: The presence of overtemperature faults (DTCs B2729, B2730, B272A and B272B) can be induced by incorrect operation of the climate controlled seat system after an initial heat setting has been attained. If a heat setting is repeatedly turned OFF and ON in an attempt to increase the seat temperature or repeatedly toggled between heat and cool modes, an overtemperature condition can result and the DTCs will be set.

If the temperature at one of the TEDs rises above 110°C (230°F) in the heat mode or 65°C (149°F) in the cool mode for more than 4 seconds, the DCSM will record an overtemperature DTC, remove voltage from the TEDs and go into recovery mode (blower only) for 30 seconds to cool down the TEDs. The same will occur if a temperature difference of 60°C (108°F) or greater is seen between the backrest and cushion TEDs on either front seat. The DCSM will continue to monitor the TEDs while in recovery mode. If the temperature of the TEDs does not drop to 105°C (221°F) in the heat mode or 60°C (140°F) in the cool mode after 30 seconds, the system will continue to cool the TEDs in recovery mode for up to 5 minutes. If the TEDs cool down at anytime after 30 seconds, but before 5 minutes (checked at 4-second intervals), the system will operate as normal. An overtemperature DTC will still be recorded even if the system recovers and is operating normally. Recovery mode is more likely to occur during extreme cabin temperatures with significant seat back sunload. If the system does not recover within 30 seconds in heat mode or within 5 minutes in cool mode, the DCSM will disable that seat (fault mode) and remain off until the ignition is cycled. Also, if the DCSM detects temperature differential fault twice during the same ignition cycle, it will shutdown. When a fault causes a shutdown, the climate controlled seat indicators will turn off for the affected seat and that seat will not be operational until the next key cycle.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical and electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical

• Switch(es)
• Seat tracks obstructed or damaged
• Lumbar assembly
	• Battery junction box (BJB) fuse(s):
	  ○ 11 (20A Fusion and Milan) (30A MKZ) (heated seats or passenger climate controlled seat)
	  ○ 12 (30A) (driver climate controlled seat)
	  ○ 15 (10A) (driver memory seat)
	  ○ 31 (30A) (passenger power seat)
	  ○ 32 (30A) (driver power seat or driver memory seat)
	• Smart junction box (SJB) fuse 28 (10A)

damaged • Recliner assembly damaged (backrest frame) • Thermo-electric device (TED) assembly filter dirty (cushion or backrest)	(heated seats) • Wiring harness • Loose or corroded connections • Seat control switch(es) • Power seat motor (seat track) • Memory seat position switch • Seat cushion heater • Seat backrest heater • Heated seat module • Lumbar control switch • Power lumbar motor • TED assembly (cushion or backrest) • Power recliner motor • Driver seat module (DSM) • Driver door module (DDM) • HVAC module • Dual climate controlled seat module (DCSM)

NOTE: The smart junction box (SJB) may also be identified as the generic electronic module (GEM).

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is with the power seat (non-memory seat) or heated seat and the cause is not visually evident, verify the symptom and Go to **Symptom Chart**.

NOTE: Make sure to use the latest scan tool software release.

5. If the concern is with the memory seat or climate controlled seat and the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

6. If the scan tool does not communicate with the VCM:

- check the VCM connection to the vehicle.
- check the scan tool connection to the VCM.
- refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.

7. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
8. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
9. Clear the continuous DTCs and carry out the self-test diagnostics for the DSM, DDM, DCSM.
10. If the DTCs retrieved are related to the concern, go to Driver Seat Module (DSM) DTC Chart, Dual Climate Controlled Seat Module (DCSM) DTC Chart or Driver Door Module (DDM) DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
11. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

Driver Seat Module (DSM) DTC Chart

DRIVER SEAT MODULE (DSM) DTC CHART

DTC	Description	Retrieved	Action
B1342	ECU Is Faulted	On-Demand and Continuous	INSTALL a new driver seat module (DSM) and carry out PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.
B1663	Seat Driver Front Up/Down Motor Stalled	On-Demand	If the motor does not operate, go to **Pinpoint Test J**. If motor operates, go to **Pinpoint Test K**.
B1664	Seat Driver Rear Up/Down Motor Stalled	On-Demand	If the motor does not operate, go to **Pinpoint Test J**. If motor operates, go to **Pinpoint Test K**.
B1665	Seat Driver Forward/Backward Motor Stalled	On-Demand	If the motor does not operate, go to **Pinpoint Test J**. If motor operates, go to **Pinpoint Test K**.
B1666	Seat Driver Recline Motor Stalled	On-Demand	If the motor does not operate, go to **Pinpoint Test J**. If motor operates, go to **Pinpoint Test K**.
B1703	Seat Driver Recline Forward Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J**.
B1707	Seat Driver Recline Rearward Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J**.

B1711	Seat Driver Front Up Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J**.
B1715	Seat Driver Front Down Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J**.
B1719	Seat Driver Forward Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J**.
B1723	Seat Driver Rearward Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J**.
B1727	Seat Driver Rear Up Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J**.
B1731	Seat Driver Rear Down Switch Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test J**.
B1952	Seat Rear Up/Down Position Feedback Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test K**.
B1953	Seat Rear Up/Down Position Feedback Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K**.
B1956	Seat Front Up/Down Position Feedback Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test K**.
B1957	Seat Front Up/Down Position Feedback Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K**.
B1960	Seat Recline Forward/Backward Position Feedback Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test K**.
B1961	Seat Recline Forward/Backward Position Feedback Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K**.
B1964	Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Battery	On-Demand and Continuous	Go to **Pinpoint Test K**.
B1965	Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K**.
B2143	Non Volatile Memory Failure (EEPROM)	Continuous	CARRY OUT PMI on the DSM. REFER to **MODULE CONFIGURATION** article. CLEAR DTCs. CYCLE the ignition and RETEST the system. If DTC B2143 is retrieved again, INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.
B2477	Module Configuration Failure	Continuous	**NOTE:** **This DTC indicates PMI has not been done to a newly installed module or configuration data has been lost.**

			Presence of this DTC alone does not prevent basic seat operation from the seat control switch. CARRY OUT PMI on the DSM. REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. If PMI is successful, the DTC will not be present.
U2050	No Application Present	Continuous	INSTALL a new DSM and CARRY OUT PMI. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. REPEAT the self-test.
All Other DTCs	-	On-Demand and Continuous	REFER to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.

Driver Door Module (DDM) DTC Chart

DRIVER DOOR MODULE (DDM) DTC CHART

DTC	Description	Retrieved	Action
B1530	Memory Set Switch Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K**.
B1534	Memory 1 Switch Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K**.
B1538	Memory 2 Switch Circuit Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K**.
B2084	Memory SET Indicator Short to Ground	On-Demand and Continuous	Go to **Pinpoint Test K**.
All Other DTCs	-	On-Demand and Continuous	REFER to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.

Dual Climate Controlled Seat Module (DCSM) DTC Chart

DUAL CLIMATE CONTROLLED SEAT MODULE (DCSM) DTC CHART

DTC	Description	Retrieved	Action
B103B	Thermo-electric Driver Overcurrent Low	On-Demand and Continuous	Go to **Pinpoint Test S**.
B103C	Thermo-electric Driver Open Load	On-Demand and Continuous	Go to **Pinpoint Test T**.
B103D	Blower Driver Overtemperature	On-Demand and Continuous	Go to **Pinpoint Test U**.
B1111	Driver Thermo-electric Device Control Overtemperature Fault	On-Demand and Continuous	Go to **Pinpoint Test S**.

B1113	Passenger Thermo-electric Device Control Overtemperature Fault	On-Demand and Continuous	Go to **Pinpoint Test V**.
B111B	Passenger Thermo-electric Driver Overcurrent Low	On-Demand and Continuous	Go to **Pinpoint Test V**.
B111C	Passenger Thermo-electric Driver Open Load	On-Demand and Continuous	Go to **Pinpoint Test W**.
B111D	Passenger Blower Driver Overtemperature	On-Demand and Continuous	Go to **Pinpoint Test X**.
B1342	ECU is Faulted	On-Demand and Continuous	CLEAR the DTC. CARRY OUT the self-test. If the DTC does not clear or is retrieved again, INSTALL a new dual climate controlled seat module (DCSM) and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**.
B19A1	Passenger Seat Cushion Blower Speed Short to Battery	On-Demand and Continuous	DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT passenger seat side air bag module C313. CONNECT the battery ground cable. DISCONNECT DCSM C3305c and passenger seat cushion TED C3303. With the ignition switch ON, MEASURE the voltage between C3305c-3, circuit VHS23 (BN/BU), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CLEAR the DTC. CARRY OUT the self-test. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B19A2	Passenger Seat Back Blower Speed Short to Battery	On-Demand and Continuous	DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT passenger seat side air bag module C313. CONNECT the battery ground cable.

			DISCONNECT DCSM C3305c and passenger seat backrest TED C3311. With the ignition switch ON, MEASURE the voltage between C3305c-4, circuit VHS21 (BU/WH), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CLEAR the DTC. CARRY OUT the self-test. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B19A3	Driver Seat Cushion Blower Speed Short to Battery	On-Demand and Continuous	DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT passenger seat side air bag module C313. DISCONNECT driver seat side air bag module C327. CONNECT the battery ground cable. DISCONNECT DCSM C3305c and driver seat cushion TED C3300. With the ignition switch ON, MEASURE the voltage between C3305c-11, circuit VHS18 (BN/GN), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CLEAR the DTC. CARRY OUT the self-test. CONNECT passenger seat side air bag module C313. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B19A4	Driver Seat Back Blower Speed Short to Battery	On-Demand and Continuous	DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT

			passenger seat side air bag module C313. DISCONNECT driver seat side air bag module C327. CONNECT the battery ground cable. DISCONNECT DCSM C3305c and driver seat backrest TED C3310. With the ignition switch ON, MEASURE the voltage between C3305c-12, circuit VHS16 (BU/GN), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CLEAR the DTC. CARRY OUT the self-test. CONNECT passenger seat side air bag module C313. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B19A5	Passenger Seat Cushion Blower Speed Short to Ground	On-Demand and Continuous	DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT passenger seat side air bag module C313. CONNECT the battery ground cable. DISCONNECT DCSM C3305c and passenger seat cushion TED C3303. MEASURE the resistance between C3305c-3, circuit VHS23 (BN/BU), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CLEAR the DTC. CARRY OUT the self-test. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B19A6	Passenger Seat Back Blower Speed Short to Ground	On-Demand and Continuous	DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT**

			SYSTEM article. DISCONNECT passenger seat side air bag module C313. CONNECT the battery ground cable. DISCONNECT DCSM C3305c and passenger seat backrest TED C3311. MEASURE the resistance between C3305c-4, circuit VHS21 (BU/WH), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CLEAR the DTC. CARRY OUT the self-test. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B19A7	Driver Seat Cushion Blower Speed Short to Ground	On-Demand and Continuous	DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT passenger seat side air bag module C313. DISCONNECT driver seat side air bag module C327. CONNECT the battery ground cable. DISCONNECT DCSM C3305c and driver seat cushion TED C3300. MEASURE the resistance between C3305c-11, circuit VHS18 (BN/GN), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CLEAR the DTC. CARRY OUT the self-test. CONNECT passenger seat side air bag module C313. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B19A8	Driver Seat Back Blower Speed	On-Demand and	DEPOWER the SRS. REFER to

	Short to Ground	Continuous	**SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT passenger seat side air bag module C313. DISCONNECT driver seat side air bag module C327. CONNECT the battery ground cable. DISCONNECT DCSM C3305c and driver seat backrest TED C3310. MEASURE the resistance between C3305c-12, circuit VHS16 (BU/GN), harness side and ground. REPAIR the short to voltage as needed. If OK, INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. CLEAR the DTC. CARRY OUT the self-test. CONNECT passenger seat side air bag module C313. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
B2477	Module Configuration Failure	On-Demand and Continuous	**NOTE:** **This DTC indicates PMI has not been done to a newly installed module or configuration data has been lost.** CARRY OUT PMI on the DCSM. REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. If PMI is successful, the DTC will not be present.
B2486	Climate Control Seat Module Voltage Out of Range	On-Demand and Continuous	REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to diagnose the incorrect charging system voltage symptom.
B2729	Cushion Over-Temp Detected (Driver)	On-Demand and Continuous	Go to **Pinpoint Test Y**.
B272A	Passenger Cushion Over-Temp Detected	On-Demand and Continuous	Go to **Pinpoint Test Z**.
B272B	Passenger Back Over-Temp Detected	On-Demand and Continuous	Go to **Pinpoint Test AA**.

B272C	Driver Differential Temperature Fault	On-Demand and Continuous	Go to **Pinpoint Test AB**.
B272D	Passenger Differential Temperature Fault	On-Demand and Continuous	Go to **Pinpoint Test AC**.
B272E	Driver Ignition Run/Blower Circuit Short to Ground (this DTC sets for an open or short to voltage)	On-Demand and Continuous	Go to **Pinpoint Test AD**.
B272F	Passenger Ignition Run/Blower Circuit Short to Ground (this DTC sets for an open or short to voltage)	On-Demand and Continuous	Go to **Pinpoint Test AE**.
B2730	Back Over-Temp Detected (Driver)	On-Demand and Continuous	Go to **Pinpoint Test AF**.
U2050	No Application Present	Continuous	INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test.
All Other DTCs	-	On-Demand and Continuous	REFER to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the driver seat module (DSM)	• Fuse • Circuitry • DSM	• DEPOWER the supplemental restraint system (SRS). REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT driver seat side air bag C327. CONNECT the battery ground cable. REFER to **BATTERY, MOUNTING AND CABLES** article. • CHECK DSM C3299a pin 2, circuit SBB32 (VT/RD) and C3299c pin 1, circuit SBB15 (WH/RD) for greater than 10 volts; REPAIR as needed. CHECK DSM C3299a pin 1, circuit GD126 (BK/WH) and C3299c pin 13, circuit GD126 (BK/WH) for less than 5 ohms to ground; REPAIR as needed. If OK, REFER to

		MODULE COMMUNICATIONS NETWORK article. • DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
• No communication with the module - unable to carry out self-test with the DSM	• Circuitry • DSM	• REFER to **MODULE COMMUNICATIONS NETWORK** article.
• No communication with the dual climate controlled seat module (DCSM)	• Fuse • Circuitry • DCSM	• DEPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT passenger seat side air bag module C313. CONNECT the battery ground cable. REFER to **BATTERY, MOUNTING AND CABLES** article. DISCONNECT and CHECK DCSM C3305a-E, circuit SBB11 (BU/RD), harness side and DCSM C3305a-F, circuit SBB12 (GN/RD), harness side for greater than 10 volts and DCSM C3305a-M, circuit GD139 (BK/YE), harness side for less than 5 ohms to ground and REPAIR as needed. If OK, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the medium-speed controller area network (MS-CAN) communication bus concern. Once the repair is complete, DISCONNECT the battery ground cable. CONNECT the passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
• The power seat is inoperative - driver, with power recliner	• Fuse • Circuitry • Front seat control switch	• Go to **Pinpoint Test A**.
• The power seat is inoperative - driver, without power	• Fuse • Circuitry	• Go to **Pinpoint Test B**.

recliner	• Front seat control switch	
• The power seat is inoperative - passenger	• Fuse • Circuitry • Front seat control switch	• Go to **Pinpoint Test C**.
• The power seat moves but is loose	• Fastening hardware • Seat track	• Go to **Pinpoint Test D**.
• The power seat moves but is noisy	• Seat track	• Go to **Pinpoint Test E**.
• The power seat does not make full travel	• Seat track obstructed • Seat track	• Go to **Pinpoint Test F**.
• The power seat does not move horizontally/vertically/recline - driver	• Circuitry • Front seat motors • Front seat control switch	• Go to **Pinpoint Test G**.
• The power seat does not move horizontally/vertically - driver	• Circuitry • Front seat motors • Front seat control switch	• Go to **Pinpoint Test H**.
• The power seat does not move horizontally/vertically/recline - passenger	• Circuitry • Front seat motors • Front seat control switch	• Go to **Pinpoint Test I**.
• The memory seat is inoperative/does not operate correctly - does not operate horizontally/vertically/recline	• Circuitry • Seat control switch • DSM	• Go to **Pinpoint Test J**.
• The memory seat does not operate correctly - does not operate using the memory SET switch	• Circuitry • Memory SET switch • DSM	• Go to **Pinpoint Test K**.
• The memory seat does not operate correctly - the seat moves in one second intervals	• Circuitry • DSM	• REFER to the Driver Seat Module (DSM) DTC Chart.
• The memory seat does not operate correctly - the seat	• Circuitry • Memory SET	• REFER to the Driver Seat Module (DSM) DTC Chart.

does not move to the correct memory position	switch • DSM • Seat track	
• The memory seat does not operate correctly - does not operate using the remote transmitter	• Circuitry • DSM • Keyless entry transmitter	• VERIFY the RKE transmitter is operating correctly and is associated to a memory position. REFER to Owner's Literature or **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article for information on associating a RKE transmitter. RUN the DSM Self-Test and REFER to the Driver Seat Module (DSM) DTC Chart to diagnose any DTCs retrieved.
• Easy exit/easy entry is inoperative/does not operate correctly	• Circuitry • Key in ignition switch • Instrument cluster (IC) module • DSM	• Go to **Pinpoint Test L**.
• The power lumbar is inoperative - driver	• Circuitry • Seat control switch • Power lumbar motor assembly	• Go to **Pinpoint Test M**.
• The power lumbar is inoperative - passenger	• Circuitry • Seat control switch • Power lumbar motor assembly	• Go to **Pinpoint Test N**.
• The heated seat is inoperative - driver	• Fuse • Circuitry • Heated seat switch • Seat cushion heater mat • Seat backrest heater mat • Heated seat module	• Go to **Pinpoint Test O**.
• The heated seat is inoperative - passenger	• Fuse • Circuitry • Heated seat switch • Seat cushion heater	• Go to **Pinpoint Test P**.

	mat • Seat backrest heater mat • Heated seat module	
• The heated seat is inoperative - driver seat does heat but the heated seat indicator does not illuminate when pressed	• Wiring, terminals or connectors • HVAC module • Heated seat module	• Go to **Pinpoint Test Q**.
• The heated seat is inoperative - passenger seat does heat but the heated seat indicator does not illuminate when pressed	• Wiring, terminals or connectors • HVAC module • Heated seat module	• Go to **Pinpoint Test R**.
• All climate controlled seats are inoperative	• Fuse • Circuitry • MS-CAN communication fault • DCSM • HVAC module	• VERIFY battery junction box (BJB) fuse 11 (30A) and 12 (30A) are OK. If OK, CARRY OUT the Data Links Diagnostics test using a scan tool and verify network communication of the HVAC and DCSM. REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose a module communication or network concern. If OK, CARRY OUT the DCSM self-test and retrieve any DTCs. If any DTC is present, REFER to the Dual Climate Controlled Seat Module (DCSM) DTC Chart. CHECK the climate control system for correct operation. REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article for diagnosis of the HVAC or climate control system. If OK, INSTALL a new dual climate controlled seat module (DCSM) and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**.
• A single climate controlled seat is inoperative - switch indicators may or may not illuminate	• Circuitry • HVAC module • DCSM	**NOTE:** **If a fault occurs setting a DTC specific to only one climate controlled seat, the DCSM will disable only the affected seat**

		outputs and allow the other seat to remain operational. CHECK for DTCs specific to the affected climate controlled seat and, if a DTC is present, REFER to the Dual Climate Controlled Seat Module (DCSM) DTC Chart. **NOTE:** **The DCSM receives battery voltage to C3305a pins E and F. Pin F is used by the module for driver seat system operation and pin E is used for the passenger seat system operation. It may be possible for voltage to be missing from one pin location and cause only one climate controlled seat to become inoperative.** • Go to **Pinpoint Test AG**.

Pinpoint Tests

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.

Refer to Inspection and Verification, Driver Seat Module (DSM) DTC Chart, Driver Door Module (DDM) DTC Chart, Dual Climate Controlled Seat Module (DCSM) DTC Chart and the Symptom Chart for direction to the appropriate pinpoint test.

Pinpoint Test A: The Power Seat is Inoperative - Driver, With Power Recliner

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Seats for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBB32 (VT/RD) and is supplied ground on circuit GD126 (BK/WH). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor or power recline motor to move the seat or backrest. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor or power recline motor, which moves the seat or backrest in the opposite direction. There are 3 power seat track motors that combine to move

the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). There is an additional motor in the power recline mechanism to move the seat backrest forward and rearward. If a new seat track motor needs to be installed, it is necessary to install an entire power seat track. The power recline motor is serviced separately.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Seat control switch

PINPOINT TEST A: THE POWER SEAT IS INOPERATIVE - DRIVER, WITH POWER RECLINER

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

A1 CHECK CIRCUIT SBB32 (VT/GN) FOR VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: Driver Seat Control Switch C360

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Measure the voltage between driver seat control switch C360-5, circuit SBB32 (VT/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A2.

  NO : VERIFY battery junction box (BJB) fuse 32 (30A) is OK. If BJB fuse 32 (30A) is OK, REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

A2 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

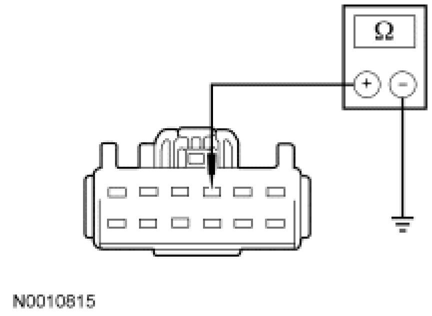


Fig. 1: Checking Circuit GD126 (BK/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C360-3, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new driver seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test B: The Power Seat is Inoperative - Driver, Without Power Recliner

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Seats for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBB32 (VT/RD) and is supplied ground on circuit GD126 (BK/WH). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new seat track motor needs to be installed, it is necessary to install an entire power seat track.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors

- Seat control switch

PINPOINT TEST B: THE POWER SEAT IS INOPERATIVE - DRIVER, WITHOUT POWER RECLINER

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

B1 CHECK CIRCUIT SBB32 (VT/RD) FOR VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: Driver Seat Control Switch C369

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

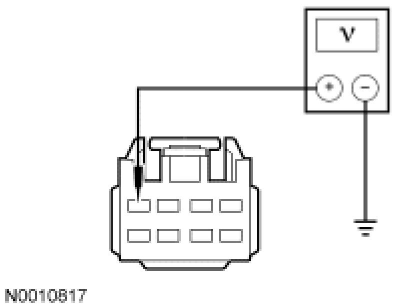


Fig. 2: Checking Circuit SBB32 (VT/RD) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat control switch C369-4, circuit SBB32 (VT/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to B2.

  NO : VERIFY battery junction box (BJB) fuse 32 (30A) is OK. If BJB fuse 32 (30A) is OK, REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

B2 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

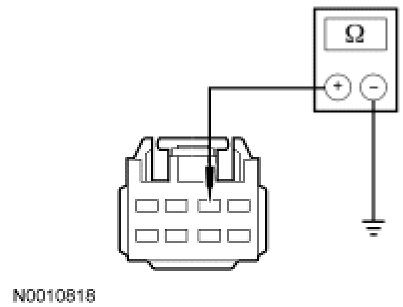


Fig. 3: Checking Circuit GD126 (BK/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C369-2, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new driver seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test C: The Power Seat is Inoperative - Passenger

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Seats for schematic and connector information.

Normal Operation

The passenger seat control switch is powered by battery voltage on circuit SBB31 (WH/RD) and is supplied ground on circuit GD139 (BK/YE). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new seat track motor needs to be installed, it is necessary to install an entire power seat track.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Seat control switch

PINPOINT TEST C: THE POWER SEAT IS INOPERATIVE - PASSENGER

NOTE:	**The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

C1 CHECK CIRCUIT SBB31 (WH/RD) FOR VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: Passenger Seat Control Switch C3190

WARNING:	**Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

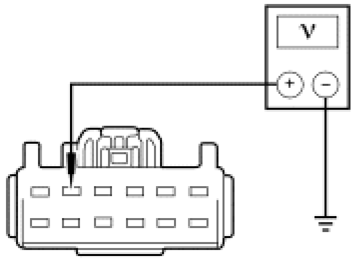


Fig. 4: Checking Circuit SBB31 (WH/RD) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat control switch C3190-5, circuit SBB31 (WH/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

YES : Go to C2.

NO : VERIFY battery junction box (BJB) fuse 31 (30A) is OK. If BJB fuse 31 (30A) is OK, REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

C2 CHECK CIRCUIT GD139 (BK/YE) FOR AN OPEN

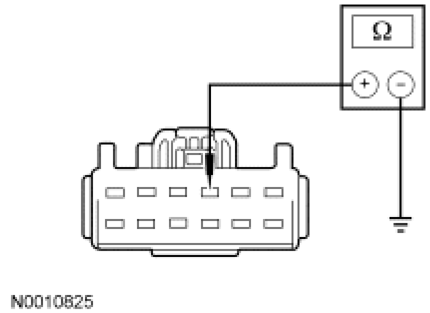


Fig. 5: Checking Circuit GD139 (BK/YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3190-3, circuit GD139 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new passenger seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test D: The Power Seat Moves But is Loose

Normal Operation

The power seat movement should be smooth and the seat cushion should not rock during or after operation.

This pinpoint test is intended to diagnose the following:

- Loose fastening hardware
- Seat track

PINPOINT TEST D: THE POWER SEAT MOVES BUT IS LOOSE

D1 CHECK THE FASTENING HARDWARE

- Inspect for loose fastening hardware on the affected seat.
- **Is the fastening hardware loose?**

  YES : TIGHTEN all fastening hardware to specification. TEST the system for normal operation.

  NO : IDENTIFY the cause and REPAIR as necessary. TEST the system for normal operation.

Pinpoint Test E: The Power Seat Moves But is Noisy

Normal Operation

The power seat should move quietly during operation. Some noise is acceptable.

This pinpoint test is intended to diagnose the following:

- Seat track
- Seat track component
- Object obstructing seat movement

PINPOINT TEST E: THE POWER SEAT MOVES BUT IS NOISY

E1 CHECK THE TRACK ALIGNMENT

- Check the alignment of the track to the floor and the track to the seat.
- **Is the track out of alignment?**

  YES : ALIGN the track to the seat and the floor. TEST the system for normal operation.

  NO : IDENTIFY the cause and REPAIR as necessary. TEST the system for normal operation.

Pinpoint Test F: The Power Seat Does Not Make Full Travel

Normal Operation

The power seat should travel fully horizontal (forward/rearward) and vertical (front up/down and rear up/down).

This pinpoint test is intended to diagnose the following:

- Obstruction
- Seat track

PINPOINT TEST F: THE POWER SEAT DOES NOT MAKE FULL TRAVEL

NOTE:	**The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of**

faults before releasing the vehicle to the customer.

F1 CHECK FOR AN OBSTRUCTION IN THE SEAT TRACK

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Remove the affected seat. Refer to **Seat - Front**.
- **Are there any obstructions in the track?**

  YES : REMOVE the obstruction(s).

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

  NO : IDENTIFY the cause and REPAIR as necessary.

  REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

Pinpoint Test G: The Power Seat Does Not Move Horizontally/Vertically/Recline - Driver

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Seats for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBB32 (VT/RD) and is supplied ground on circuit GD126 (BK/WH). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor or power recline motor to move the seat or backrest. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor or power recline motor, which moves the seat or backrest in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). There is an additional motor in the power recline mechanism to move the seat backrest forward and rearward. If a new seat track motor needs to be installed, it is necessary to install an entire power seat track. The power recline motor is serviced separately.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Seat control switch
- Seat track
- Seat recliner motor

PINPOINT TEST G: THE POWER SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY/RECLINE - DRIVER

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

G1 CHECK THE HORIZONTAL MOTOR FOR CORRECT OPERATION

- Operate the driver power seat forward and rearward.
- **Will the seat move horizontally?**

  YES : Go to G2.

  NO : Go to G3.

G2 CHECK THE RECLINER MOTOR FOR CORRECT OPERATION

- Recline the driver backrest forward and rearward.
- **Will the seat backrest recline forward and rearward?**

  YES : Go to G6.

  NO : Go to G13.

G3 CHECK VOLTAGE TO THE DRIVER SEAT HORIZONTAL MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: Driver Seat Motor C357

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

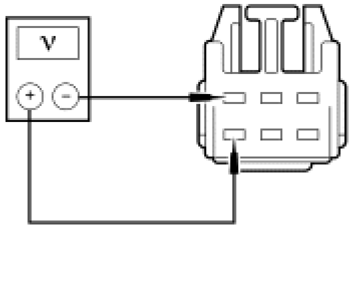


Fig. 6: Checking Voltage To Driver Seat Horizontal Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat motor C357-6, circuit CPS28 (GN), harness side and C357-3, circuit CPS23 (GN/VT), harness side, while operating the seat control switch horizontal adjust forward and rearward.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to G4.

G4 CHECK CIRCUIT CPS28 (GN) FOR AN OPEN AND SHORT TO GROUND

- Disconnect: Driver Seat Control Switch C360

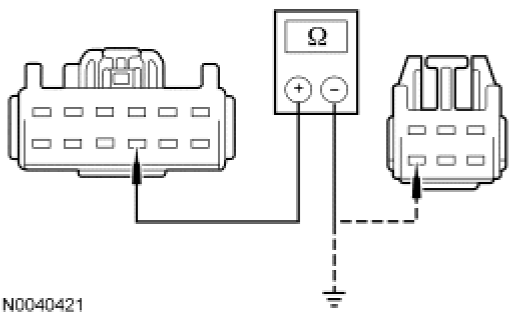


Fig. 7: Checking Circuit CPS28 (GN) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C360-9, circuit CPS28 (GN), harness side and driver seat motor C357-6, circuit CPS28 (GN), harness side; and between driver seat control switch C360-9, circuit CPS28 (GN), harness side and ground.
- **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**

  YES : Go to G5.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

G5 CHECK CIRCUIT CPS23 (GN/VT) FOR AN OPEN AND SHORT TO GROUND

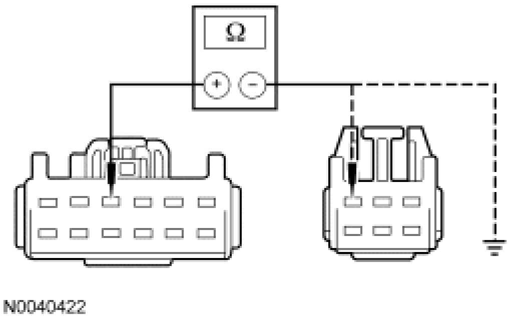


Fig. 8: Checking Circuit CPS23 (GN/VT) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C360-4, circuit CPS23 (GN/VT), harness side and driver seat motor C357-3, circuit CPS23 (GN/VT), harness side; and between driver seat control switch C360-4, circuit CPS23 (GN/VT), harness side and ground.
- **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**

  YES : INSTALL a new driver seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

G6 DETERMINE THE SEAT HEIGHT ADJUST FAILURE

- Operate the front and rear seat height adjustments.
- **Does the seat front and rear height adjust up and down?**

  YES : If only front height adjust operates, go to G7.

  If only rear height adjust operates, go to G10.

  NO : INSTALL a new driver seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

G7 CHECK THE VOLTAGE TO THE DRIVER SEAT REAR HEIGHT MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

- Disconnect the driver seat side air bag C327.
- Disconnect: Driver Seat Motor C357

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

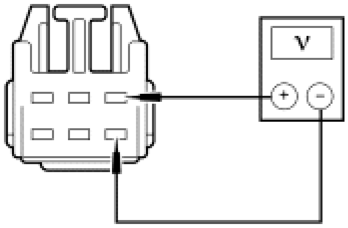


Fig. 9: Checking Voltage To Driver Seat Rear Height Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat motor C357-1, circuit CPS27 (BU/BN), harness side and C357-4, circuit CPS26 (YE/BU), harness side, while operating the seat control switch rear height adjust up and down.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to G8.

G8 CHECK CIRCUIT CPS27 (BU/BN) FOR AN OPEN AND SHORT TO GROUND

- Disconnect: Driver Seat Control Switch C360

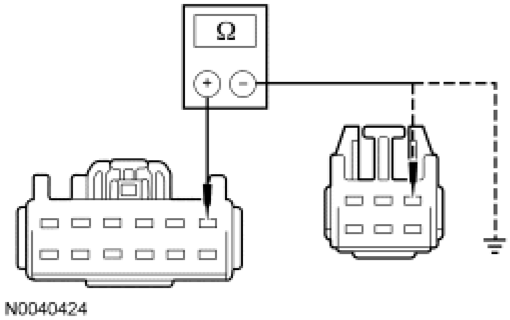


Fig. 10: Checking Circuit CPS27 (BU/BN) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C360-1, circuit CPS27 (BU/BN), harness side and driver seat motor C357-1, circuit CPS27 (BU/BN), harness side; and between driver seat control switch C360-1, circuit CPS27 (BU/BN), harness side and ground.
- **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**

  YES : Go to G9.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

G9 CHECK CIRCUIT CPS26 (YE/BU) FOR AN OPEN AND SHORT TO GROUND

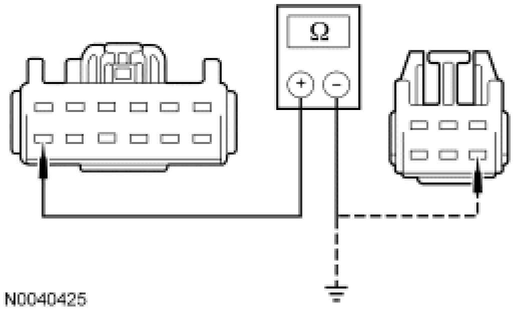


Fig. 11: Checking Circuit CPS26 (YE/BU) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C360-12, circuit CPS26 (YE/BU), harness side and driver seat motor C357-4, circuit CPS26 (YE/BU), harness side; and between driver seat control switch C360-12, circuit CPS26 (YE/BU), harness side and ground.
- **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**

  YES : INSTALL a new driver seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

G10 CHECK VOLTAGE TO THE DRIVER SEAT FRONT HEIGHT MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: Driver Seat Motor C357

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

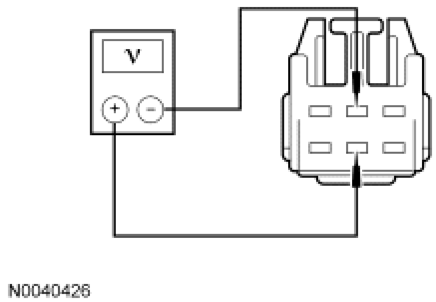


Fig. 12: Checking Voltage To Driver Seat Front Height Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat motor C357-2, circuit CPS25 (WH/VT), harness side and C357-5, circuit CPS24 (GY), harness side, while operating the seat control switch front height adjust up and down.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to G11.

G11 CHECK CIRCUIT CPS25 (WH/VT) FOR AN OPEN AND SHORT TO GROUND

- Disconnect: Driver Seat Control Switch C360

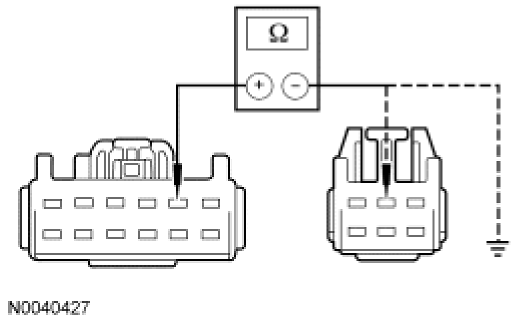


Fig. 13: Checking Circuit CPS25 (WH/VT) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C360-2, circuit CPS25 (WH/VT), harness side and driver seat motor C357-2, circuit CPS25 (WH/VT), harness side; and between driver seat control switch C360-2, circuit CPS25 (WH/VT), harness side and ground.
- **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**

YES : Go to G12.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

G12 CHECK CIRCUIT CPS24 (GY) FOR AN OPEN AND A SHORT TO GROUND

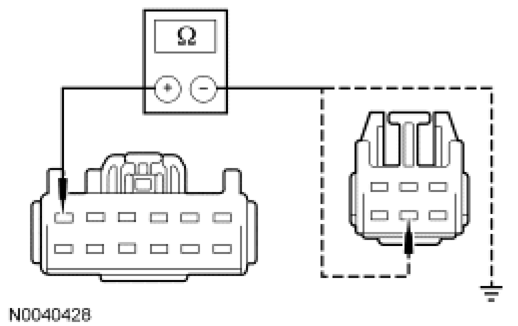


Fig. 14: Checking Circuit CPS24 (GY) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C360-6, circuit CPS24 (GY) harness side, and driver seat motor C357-5, circuit CPS24 (GY), harness side; and between driver seat control switch C360-6, circuit CPS24 (GY), harness side and ground.

- **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**

  YES : INSTALL a new driver seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

G13 CHECK VOLTAGE TO THE DRIVER SEAT RECLINER MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: Driver Seat Recliner Motor C3187

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

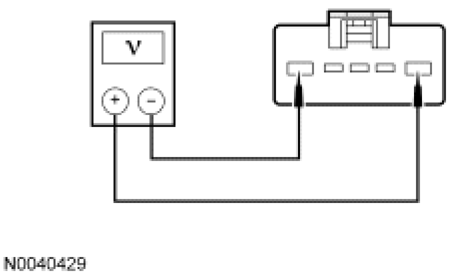


Fig. 15: Checking Voltage To Driver Seat Recliner Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat recliner motor C3187-1, circuit CPS29 (WH/BN), harness side and C3187-5, circuit CPS30 (VT/BN), harness side, while operating the seat control switch recline adjust forward and rearward.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions**

and 0 volts in the rest position?

YES : INSTALL a new driver seat recliner motor. REFER to **Seat Recliner Motor**. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to G14.

G14 CHECK CIRCUIT CPS29 (WH/BN) FOR AN OPEN AND SHORT TO GROUND

- Disconnect: Driver Seat Control Switch C360

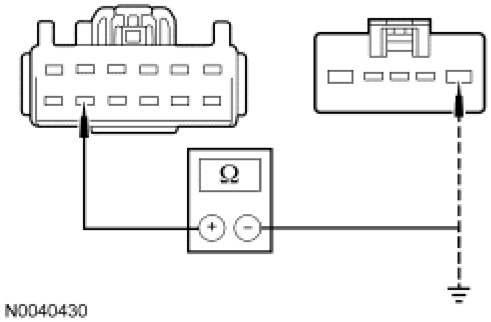


Fig. 16: Checking Circuit CPS29 (WH/BN) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C360-11, circuit CPS29 (WH/BN), harness side and driver seat recliner motor C3187-1, circuit CPS29 (WH/BN), harness side; and between driver seat control switch C360-11, circuit CPS29 (WH/BN), harness side and ground.
- **Is the resistance less than 5 ohms between the driver seat recliner motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**

YES : Go to G15.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

G15 CHECK CIRCUIT CPS30 (VT/BN) FOR AN OPEN AND SHORT TO GROUND

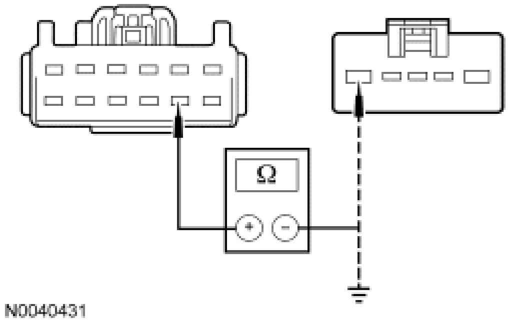


Fig. 17: Checking Circuit CPS30 (VT/BN) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C360-8, circuit CPS30 (VT/BN) harness side, and driver seat recliner motor C3187-5, circuit CPS30 (VT/BN), harness side; and between driver seat control switch C360-8, circuit CPS30 (VT/BN), harness side and ground.
- **Is the resistance less than 5 ohms between the driver seat recliner motor and the driver seat control switch; and greater than 10,000 ohms between the seat control switch and ground?**

  YES : INSTALL a new driver seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test H: The Power Seat Does Not Move Horizontally/Vertically - Driver

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Seats for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBB32 (VT/RD) and is supplied ground on circuit GD126 (BK/WH). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor to move the seat. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor, which moves the seat in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). If a new motor needs to be installed, it is necessary to install an entire power seat track.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Seat control switch
- Seat track

PINPOINT TEST H: THE POWER SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY - DRIVER

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

H1 CHECK THE HORIZONTAL MOTOR FOR CORRECT OPERATION

- Operate the driver power seat forward and rearward.
- **Will the seat move horizontally?**

  YES : Go to H5.

  NO : Go to H2.

H2 CHECK VOLTAGE TO THE DRIVER SEAT HORIZONTAL MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: Driver Seat Motor C357

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

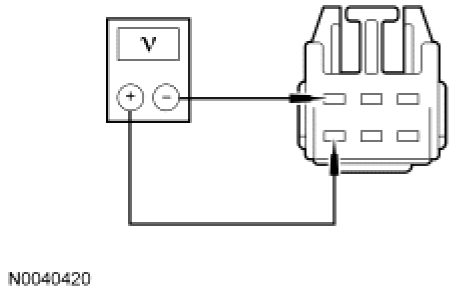


Fig. 18: Checking Voltage To Driver Seat Horizontal Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat motor C357-6, circuit CPS23 (GN/VT), harness side and C357-3, circuit CPS22 (BN), harness side, while operating the seat control switch horizontal adjust forward and rearward.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to H3.

H3 CHECK CIRCUIT CPS22 (BN) FOR AN OPEN AND SHORT TO GROUND

- Disconnect: Driver Seat Control Switch C369

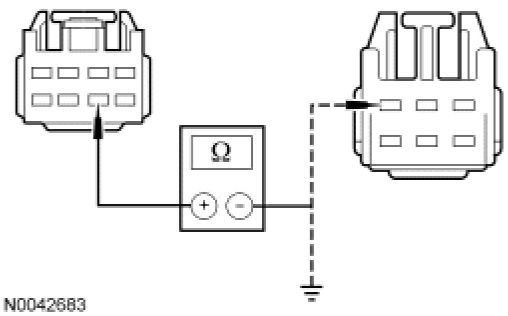


Fig. 19: Checking Circuit CPS22 (BN) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C369-6, circuit CPS22 (BN), harness side and driver seat motor C357-3, circuit CPS22 (BN), harness side; and between driver seat control switch C369-6, circuit CPS22 (BN), harness side and ground.
- **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**

  YES : Go to H4.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

H4 CHECK CIRCUIT CPS23 (GN/VT) FOR AN OPEN AND SHORT TO GROUND

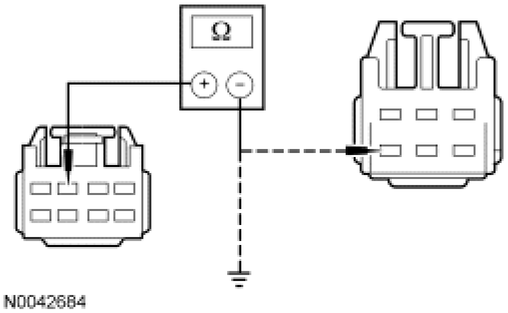


Fig. 20: Checking Circuit CPS23 (GN/VT) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C369-3, circuit CPS23 (GN/VT), harness side and driver seat motor C357-6, circuit CPS23 (GN/VT), harness side; and between driver seat control switch C369-3, circuit CPS23 (GN/VT), harness side and ground.
- **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**

  YES : INSTALL a new driver seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

H5 DETERMINE THE SEAT HEIGHT ADJUST FAILURE

- Operate the front and rear seat height adjustments.
- **Does the seat front and rear height adjust up and down?**

  YES : If only front height adjust operates, go to H6.

  If only rear height adjust operates, go to H9.

  NO : INSTALL a new driver seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

H6 CHECK VOLTAGE TO THE DRIVER SEAT REAR HEIGHT MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

- Disconnect the driver seat side air bag C327.
- Disconnect: Driver Seat Motor C357

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

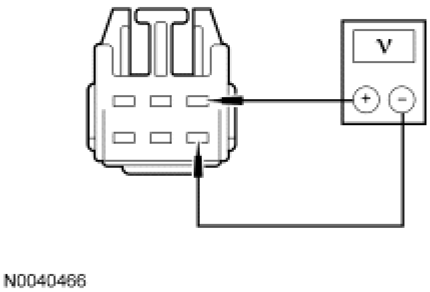


Fig. 21: Checking Voltage To Driver Seat Rear Height Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat motor C357-1, circuit CPS27 (BU/BN), harness side and C357-4, circuit CPS26 (YE/BU), harness side, while operating the seat control switch rear height adjust up and down.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to H7.

H7 CHECK CIRCUIT CPS27 (BU/BN) FOR AN OPEN AND SHORT TO GROUND

- Disconnect: Driver Seat Control Switch C369

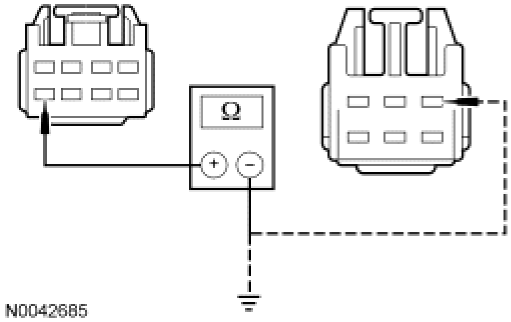


Fig. 22: Checking Circuit CPS27 (BU/BN) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C369-8, circuit CPS27 (BU/BN), harness side and driver seat motor C357-1, circuit CPS27 (BU/BN), harness side; and between driver seat control switch C369-8, circuit CPS27 (BU/BN), harness side and ground.
- **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**

  YES : Go to H8.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

H8 CHECK CIRCUIT CPS26 (YE/BU) FOR AN OPEN AND SHORT TO GROUND

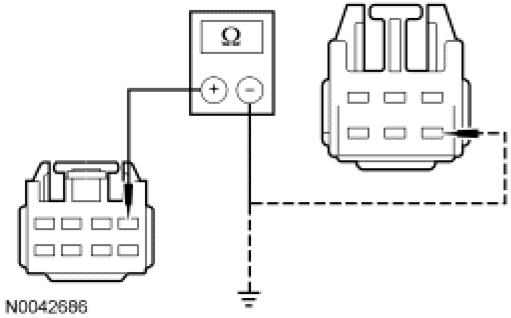


Fig. 23: Checking Circuit CPS26 (YE/BU) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C369-1, circuit CPS26 (YE/BU), harness side and driver seat motor C357-4, circuit CPS26 (YE/BU), harness side; and between driver seat control switch C369-1, circuit CPS26 (YE/BU), harness side and ground.
- **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**

  YES : INSTALL a new driver seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

H9 CHECK VOLTAGE TO THE DRIVER SEAT FRONT HEIGHT MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: Driver Seat Motor C357

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

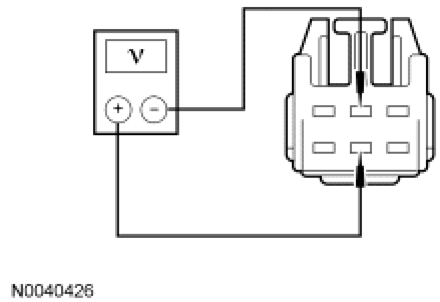


Fig. 24: Checking Voltage To Driver Seat Front Height Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat motor C357-2, circuit CPS25 (WH/VT), harness side and C357-5, circuit CPS24 (GY), harness side, while operating the seat control switch front height adjust up and down.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to H10.

H10 CHECK CIRCUIT CPS25 (WH/VT) FOR AN OPEN AND SHORT TO GROUND

- Disconnect: Driver Seat Control Switch C369

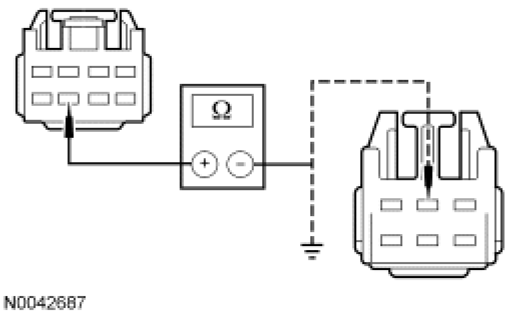


Fig. 25: Checking Circuit CPS25 (WH/VT) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C369-7, circuit CPS25 (WH/VT), harness side and driver seat motor C357-2, circuit CPS25 (WH/VT), harness side; and between driver seat control switch C369-7, circuit CPS25 (WH/VT), harness side and ground.
- **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**

  YES : Go to H11.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

H11 CHECK CIRCUIT CPS24 (GY) FOR AN OPEN

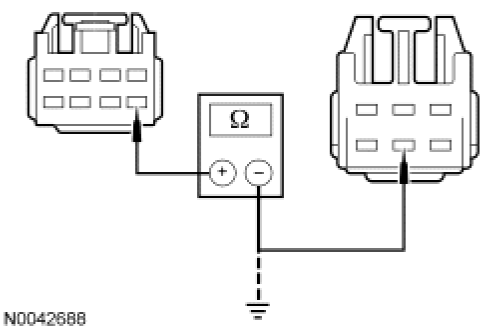


Fig. 26: Checking Circuit CPS24 (GY) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat control switch C369-5, circuit CPS24 (GY) harness side, and driver seat motor C357-5, circuit CPS24 (GY), harness side; and between driver seat control switch C3069-5, circuit CPS24 (GY), harness side and ground.

- **Is the resistance less than 5 ohms between the driver seat motor and the driver seat control switch; and greater than 10,000 ohms between the driver seat control switch and ground?**

  YES : INSTALL a new driver seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test I: The Power Seat Does Not Move Horizontally/Vertically/Recline - Passenger

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Seats for schematic and connector information.

Normal Operation

The passenger seat control switch is powered by battery voltage on circuit SBB31 (WH/RD) and is supplied ground on circuit GD139 (BK/YE). When pressed, the seat control switch supplies that voltage and ground to a power seat track motor or power recline motor to move the seat or backrest. When pressed in the opposite direction, the seat control switch reverses the polarity to that same power seat track motor or power recline motor, which moves the seat or backrest in the opposite direction. There are 3 power seat track motors that combine to move the seat cushion horizontally (forward/rearward) and vertically (front up/down and rear up/down). There is an additional motor in the power recline mechanism to move the seat backrest forward and rearward. If a new seat track motor needs to be installed, it is necessary to install an entire power seat track. The power recline motor is serviced separately.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Seat control switch
- Seat track
- Seat recliner motor

PINPOINT TEST I: THE POWER SEAT DOES NOT MOVE HORIZONTALLY/VERTICALLY/RECLINE - PASSENGER

NOTE:	**The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

I1 CHECK THE HORIZONTAL MOTOR FOR CORRECT OPERATION

- Operate the passenger power seat forward and rearward.
- **Will the seat move horizontally?**

  YES : Go to I2.

  NO : Go to I3.

I2 CHECK THE RECLINER MOTOR FOR CORRECT OPERATION

- Recline the passenger backrest forward and rearward.
- **Will the seat backrest recline forward and rearward?**

  YES : Go to I6.

  NO : Go to I13.

I3 CHECK VOLTAGE TO THE PASSENGER SEAT HORIZONTAL MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: Passenger Seat Motor C3015

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

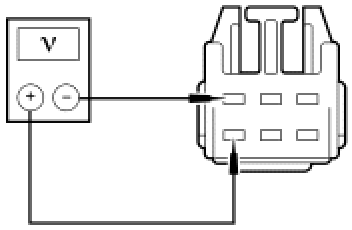


Fig. 27: Checking Voltage To Driver Seat Horizontal Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat motor C3015-6, circuit CPS38 (GN/BU), harness side and C3015-3, circuit CPS33 (WH), harness side, while operating the seat control switch horizontal adjust forward and rearward.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

YES : INSTALL a new passenger seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to I4.

I4 CHECK CIRCUIT CPS38 (GN/BU) FOR AN OPEN AND SHORT TO GROUND

- Disconnect: Passenger Seat Control Switch C3190

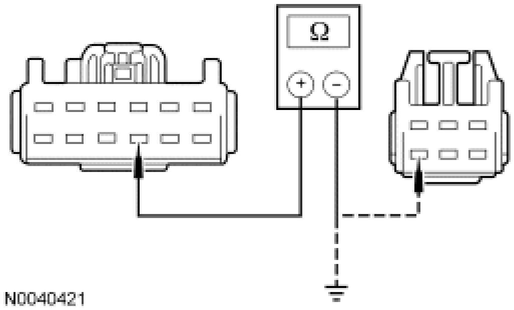


Fig. 28: Checking Circuit CPS28 (GN) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3190-9, circuit CPS38 (GN/BU), harness side and passenger seat motor C3015-6, circuit CPS38 (GN/BU), harness side; and between passenger seat control switch C3190-9, circuit CPS38 (GN/BU), harness side and ground.
- **Is the resistance less than 5 ohms between the passenger seat motor and the passenger seat control switch; and greater than 10,000 ohms between the passenger seat control switch and ground?**

YES : Go to I5.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

I5 CHECK CIRCUIT CPS33 (WH) FOR AN OPEN AND SHORT TO GROUND

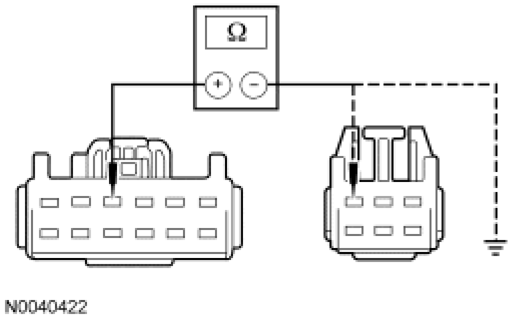


Fig. 29: Checking Circuit CPS23 (GN/VT) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3190-4, circuit CPS33 (WH), harness side and passenger seat motor C3015-3, circuit CPS33 (WH), harness side; and between passenger seat control switch C3190-4, circuit CPS33 (WH), harness side and ground.
- **Is the resistance less than 5 ohms between the passenger seat motor and the passenger seat control switch; and greater than 10,000 ohms between the passenger seat control switch and ground?**

  YES : INSTALL a new passenger seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

I6 DETERMINE THE SEAT HEIGHT ADJUST FAILURE

- Operate the front and rear seat height adjustments.
- **Does the seat front and rear height adjust up and down?**

  YES : If only front height adjust operates, go to I7.

  If only rear height adjust operates, go to I10.

  NO : INSTALL a new passenger seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

I7 CHECK VOLTAGE TO THE PASSENGER SEAT REAR HEIGHT MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in

the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

- Disconnect the passenger seat side air bag C313.
- Disconnect: Passenger Seat Motor C3015

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

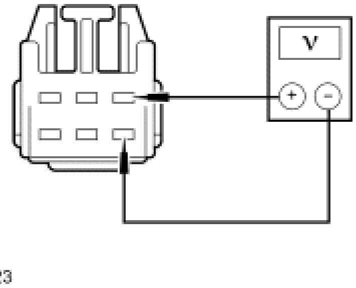


Fig. 30: Checking Voltage To Driver Seat Rear Height Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat motor C3015-1, circuit CPS37 (WH/BU), harness side and C3015-4, circuit CPS36 (YE/GY), harness side, while operating the seat control switch rear height adjust up and down.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new passenger seat track assembly. REFER to **Seat Track**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to I8.

I8 CHECK CIRCUIT CPS37 (WH/BU) FOR AN OPEN AND SHORT TO GROUND

- Disconnect: Passenger Seat Control Switch C3190

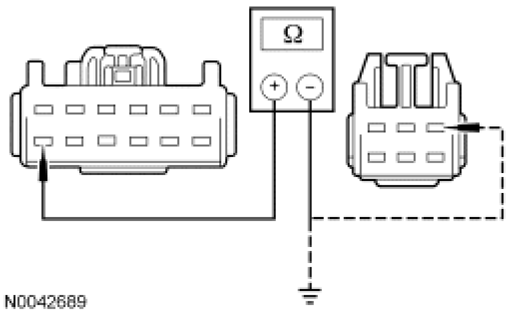


Fig. 31: Checking Circuit CPS37 (WH/BU) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3190-12, circuit CPS37 (WH/BU), harness side and passenger seat motor C3015-1, circuit CPS37 (WH/BU), harness side; and between passenger seat control switch C3190-12, circuit CPS37 (WH/BU), harness side and ground.
- **Is the resistance less than 5 ohms between the passenger seat motor and the passenger seat control switch; and greater than 10,000 ohms between the passenger seat control switch and ground?**

  YES : Go to I9.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

I9 CHECK CIRCUIT CPS36 (YE/GY) FOR AN OPEN AND SHORT TO GROUND

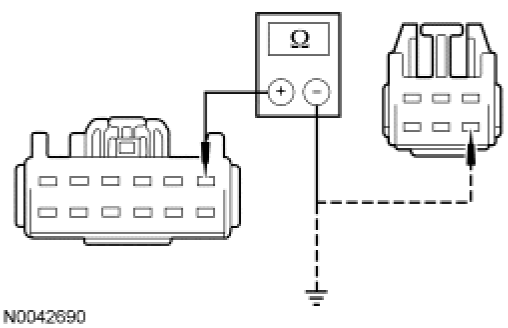


Fig. 32: Checking Circuit CPS36 (YE/GY) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3190-1, circuit CPS36 (YE/GY), harness side and passenger seat motor C3015-4, circuit CPS36 (YE/GY), harness side; and between passenger seat control switch C3190-4, circuit CPS36 (YE/GY), harness side and ground.
- **Is the resistance less than 5 ohms between the passenger seat motor and the passenger seat control switch; and greater than 10,000 ohms between the passenger seat control switch and ground?**

YES : INSTALL a new passenger seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

I10 CHECK VOLTAGE TO THE PASSENGER SEAT FRONT HEIGHT MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: Passenger Seat Motor C3015

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

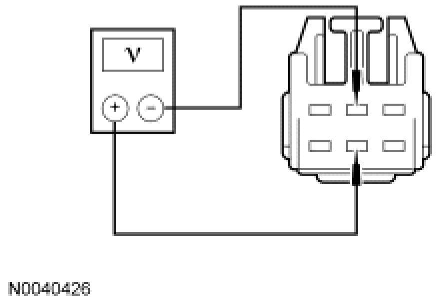


Fig. 33: Checking Voltage To Driver Seat Front Height Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat motor C3015-2, circuit CPS35 (VT/GN), harness side and C3015-5, circuit CPS34 (GY/BU), while operating the seat control switch front height adjust up and down.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new passenger seat track assembly. REFER to **Seat Track**. TEST the system

for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to I11.

I11 CHECK CIRCUIT CPS35 (VT/GN) FOR AN OPEN AND SHORT TO GROUND

- Disconnect: Passenger Seat Control Switch C3190

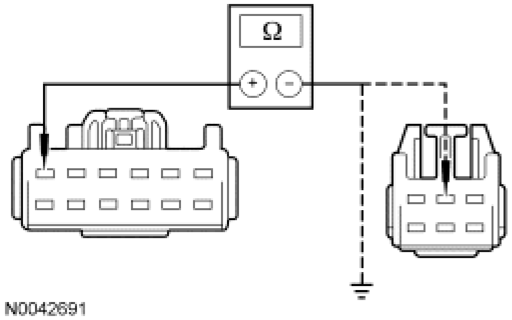


Fig. 34: Checking Circuit CPS35 (VT/GN) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3190-6, circuit CPS35 (VT/GN), harness side and passenger seat motor C3015-2, circuit CPS35 (VT/GN), harness side; and between passenger seat control switch C3190-6, circuit CPS35 (VT/GN), harness side and ground.
- **Is the resistance less than 5 ohms between the passenger seat motor and the passenger seat control switch; and greater than 10,000 ohms between the passenger seat control switch and ground?**

YES : Go to I12.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

I12 CHECK CIRCUIT CPS34 (GY/BU) FOR AN OPEN

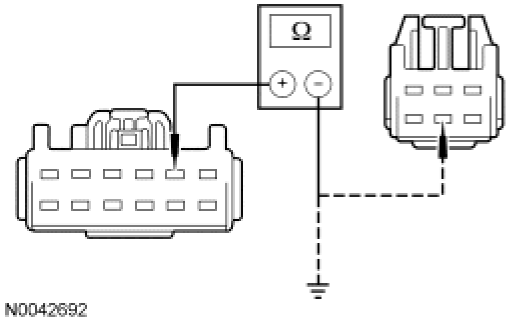


Fig. 35: Checking Circuit CPS34 (GY/BU) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3190-2, circuit CPS34 (GY/BU) harness side, and passenger seat motor C3015-5, circuit CPS34 (GY/BU), harness side; and between passenger seat control switch C3190-2, circuit CPS34 (GY/BU), harness side and ground.
- **Is the resistance less than 5 ohms between the passenger seat motor and the passenger seat control switch; and greater than 10,000 ohms between the passenger seat control switch and ground?**

  YES : INSTALL a new passenger seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

I13 CHECK VOLTAGE TO THE PASSENGER SEAT RECLINER MOTOR

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: Passenger Seat Recliner Motor C3189

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

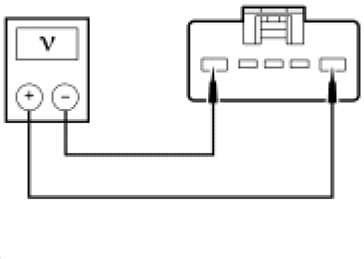


Fig. 36: Checking Voltage To Driver Seat Recliner Motor

Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger seat recliner motor C3189-1, circuit CPS39 (GY/YE), harness side and C3189-5, circuit CPS40 (VT/GY), harness side, while operating the seat control switch recline adjust forward and rearward.
- **Is the voltage greater than 10 volts when the seat control switch is operated in both directions and 0 volts in the rest position?**

  YES : INSTALL a new passenger seat recliner motor. REFER to **Seat Recliner Motor**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to I14.

I14 CHECK CIRCUIT CPS39 (GY/YE) FOR AN OPEN AND SHORT TO GROUND

- Disconnect: Passenger Seat Control Switch C3190

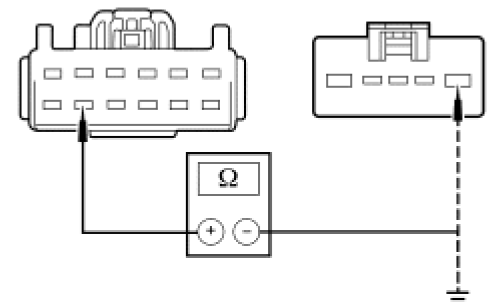


Fig. 37: Checking Circuit CPS29 (WH/BN) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

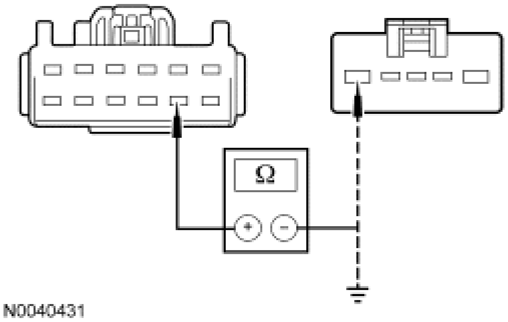
- Measure the resistance between passenger seat control switch C3190-11, circuit CPS39 (GY/YE), harness side and passenger seat recliner motor C3189-1, circuit CPS39 (GY/YE), harness side; and between passenger seat control switch C3190-11, circuit CPS39 (GY/YE), harness side and ground.
- **Is the resistance less than 5 ohms between the passenger seat recliner motor and the passenger seat control switch; and greater than 10,000 ohms between the passenger seat control switch and ground?**

  YES : Go to I15.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

I15 CHECK CIRCUIT CPS40 (VT/GY) FOR AN OPEN AND SHORT TO GROUND



N0040431

Fig. 38: Checking Circuit CPS30 (VT/BN) For Open And Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat control switch C3190-8, circuit CPS40 (VT/GY) harness side, and passenger seat recliner motor C3189-5, circuit CPS40 (VT/GY), harness side; and between passenger seat control switch C3190-8, circuit CPS40 (VT/GY), harness side and ground.
- **Is the resistance less than 5 ohms between the passenger seat recliner motor and the passenger seat control switch; and greater than 10,000 ohms between the seat control switch and ground?**

  YES : INSTALL a new passenger seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test J: The Memory Seat is Inoperative/Does Not Operate Correctly - Does Not Operate Horizontally/Vertically/Recline

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Memory Seats for schematic and connector information.

Refer to COMPONENT TESTING.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBB15 (WH/RD) and is supplied ground on circuit GD126 (BK/WH). When pressed, the seat control switch supplies the voltage and ground to the applicable driver seat module (DSM) inputs. The DSM then supplies voltage and ground to the appropriate power seat track motor or power recline motor based on the inputs received from the seat control switch. When pressed in the opposite direction, the seat control switch reverses the polarity to the DSM inputs, and the DSM likewise reverses polarity of the appropriate power seat track motor or power recliner motor circuits causing the seat or backrest to move in the opposite direction. There are 3 power seat track motors that combine to move the seat horizontally (forward/rearward) and vertically (front up/down and rear up/down). The seat backrest power

recliner mechanism uses a single motor to move the seat backrest forward and rearward.

Battery voltage is also supplied to DSM on circuits SBB15 (WH/RD) and SBB32 (VT/RD). Ground is supplied to the DSM on circuit GD126 (BK/WH).

Each motor, in the memory power seat track and power recliner mechanism contains a Hall-effect position sensor. The DSM supplies a signal feed circuit to each position sensor and a shared reference signal return circuit. Each position sensor sends a signal voltage back to the DSM used to monitor the position of the power seat and seat backrest. The DSM uses this information to return the seat to a stored pre-programmed position when pressing the memory seat position switch or a remote entry transmitter. The memory seat position switch is hard-wired to the driver door module (DDM) and communicates memory SET commands to the DSM via medium-speed controller area network (MS-CAN). For information on programming memory positions or recalling a stored memory position, refer to **Memory Position Programming**.

The following pinpoint test diagnoses a memory seat that does not operate in one or more directions when using the seat control switch. If the memory seat moves in all directions using the seat control switch, go to **Pinpoint Test K**.

DTC Description	Fault Trigger Conditions
• B1342 - ECU is Faulted	If a programming error is detected, the DTC is set.
• B1663 - Seat Driver Front Up/Down Motor Stalled • B1664 - Seat Driver Rear Up/Down Motor Stalled • B1665 - Seat Driver Forward/Backward Motor Stalled	During self-test, the driver seat module (DSM) attempts to operate the appropriate seat track motor and uses the motor's position sensor to monitor movement. If no motor movement is sensed, the DTC is set. The DSM will retry motor operation on the next activation of the seat control switch. If no movement continues to be monitored after 250 milliseconds, the DSM disables the output.
• B1666 - Seat Driver Recline Motor Stalled	During self-test, the DSM attempts to operate the recliner motor and uses the recliner motor position sensor to monitor movement. If no motor movement is sensed, the DTC is set. The DSM will retry motor operation on the next activation of the seat control switch. If no motor movement is still monitored after 250 milliseconds, the DSM disables the output.
• B1703 - Seat Driver Recline Forward Switch Circuit Short to	If voltage is sensed on the switch input circuit during the DSM Self-

Battery • B1707 - Seat Driver Recline Rearward Switch Circuit Short to Battery	Test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.
• B1711 - Seat Driver Front Up Switch Circuit Short to Battery • B1715 - Seat Driver Front Down Switch Circuit Short to Battery	If voltage is sensed on the switch input circuit during the DSM Self-Test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.
• B1719 - Seat Driver Forward Switch Circuit Short to Battery • B1723 - Seat Driver Rearward Switch Circuit Short to Battery	If voltage is sensed on the switch input circuit during the DSM Self-Test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.
• B1727 - Seat Driver Rear Up Switch Circuit Short to Battery • B1731 - Seat Driver Rear Down Switch Circuit Short to Battery	If voltage is sensed on the switch input circuit during the DSM Self-Test, the DTC is set. If voltage is sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Seat control switch
- Seat track
- Seat recliner motor
- DSM

PINPOINT TEST J: THE MEMORY SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - DOES NOT OPERATE HORIZONTALLY/VERTICALLY/RECLINE

NOTE:	**The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.

J1 CHECK DSM GEAR SELECTED (TRANS GEAR) PID

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM

  NOTE: D6_PRK applies to both park and overdrive.

- Operate the transmission gear selector in all positions while monitoring the following DSM PID TRANS GEAR states:
  - D6_PRK
  - REV
  - NTRL
  - D6_PRK
  - DRIVE1
- **Do the PID states agree with the selected positions?**

  YES : Go to J2.

  NO : To diagnose a transmission gear selector (PRNDL) status concern, REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article or **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.

J2 CHECK DSM IGNITION SWITCH STATUS (IGN_SW) PID

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM
- Cycle the ignition switch in all positions while monitoring the following DSM IGN_SW PID states:
  - Off
  - Accessory
  - Run
  - Start
- **Do the PID states agree with the selected positions?**

  YES : Go to J3.

  NO : To diagnose an ignition switch status concern, REFER to **STEERING COLUMN SWITCHES** article.

J3 RETRIEVE THE DTCs

- Operate the memory seat and memory exterior mirrors in all directions through the full range of travel.

- Place the memory seat and memory exterior mirrors in central travel positions.
- Enter the following diagnostic mode on the diagnostic tool: Self-Test/DSM/Retrieve DTCs
- **Are any DTCs retrieved?**

  YES : If DTCs B1663, B1664, B1665 and B1666 are all retrieved, go to J12.

  If DTC B1663, go to J22.

  If DTC B1664, go to J25.

  If DTC B1665, go to J28.

  If DTC B1666, go to J31.

  If DTC B1703, go to J5.

  If DTC B1707, go to J5.

  If DTC B1711, go to J5.

  If DTC B1715, go to J5.

  If DTC B1719, go to J5.

  If DTC B1723, go to J5.

  If DTC B1727, go to J5.

  If DTC B1731, go to J5.

  If DTC B1342, INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CARRY OUT programmable module installation (PMI). REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to J4.

J4 CHECK DSM SEAT CONTROL SWITCH PIDs

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM
- Monitor the following DSM seat control switch PIDs while activating the seat control switch in all positions:
  - Driver Power Seat Front Up/Down Switch (SFNT_SW)
  - Driver Power Seat Forward/Backward Switch (SFWD_SW)
  - Driver Power Seat Rear Up/Down Switch (SREARSW)
  - Driver Power Seat Recline Switch Status (SRCL_SW)
- **Do the PID states agree with the switch positions?**

  YES : Go to J11.

NO : VERIFY battery junction box (BJB) fuse 15 (10A) is OK.

If BJB fuse 15 (10A) fails while operating the seat control switch, DISCONNECT the seat control switch C3297 and Go to J9.

If BJB fuse 15 (10A) is OK, go to J5.

J5 CHECK THE SEAT CONTROL SWITCH

- Key in OFF position.
- Remove the seat control switch. Refer to **Seat Control Switch**.
- Check the seat control switch. Refer to COMPONENT TESTING.
- **Is the seat control switch OK?**

  YES : Go to J6.

  NO : INSTALL a new seat control switch. REFER to **Seat Control Switch**. REPEAT the self-test. CLEAR the DTCs.

J6 CHECK CIRCUIT SBB15 (WH/RD) FOR VOLTAGE TO THE SEAT CONTROL SWITCH

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Measure the voltage between seat control switch C3297-5, circuit SBB15 (WH/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to J7.

  NO : VERIFY BJB fuse 15 (10A) is OK. If BJB fuse 15 (10A) is OK, REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J7 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

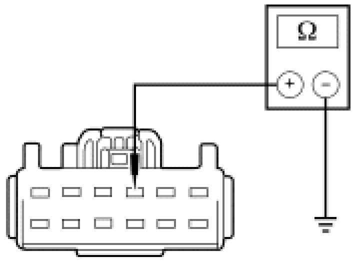


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Fig. 39: Checking Circuit GD126 (BK/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C3297-3, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to J8.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J8 CHECK THE SEAT CONTROL SWITCH TO DRIVER SEAT MODULE CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect: DSM C3299b
- Key in ON position.

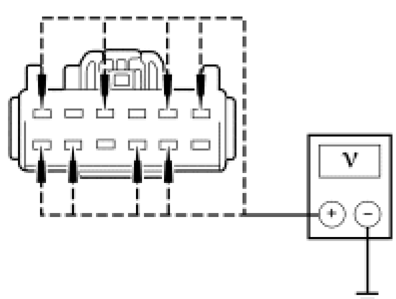

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Fig. 40: Checking Seat Control Switch To Driver Seat Module Circuits For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the following seat control switch pins, harness side and ground.

Connector-Pin	Circuit
	CPS06

C3297-9	(GN/WH)
C3297-4	CPS01 (GN/BU)
C3297-2	CPS03 (VT/GY)
C3297-6	CPS02 (GY/YE)
C3297-11	CPS07 (GY/BN)
C3297-8	CPS08 (VT/OG)
C3297-12	CPS04 (YE/OG)
C3297-1	CPS05 (BU/WH)

- **Is any voltage present?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to J9.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J9 CHECK THE SEAT CONTROL SWITCH TO DRIVER SEAT MODULE CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: Seat Control Switch C3297

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

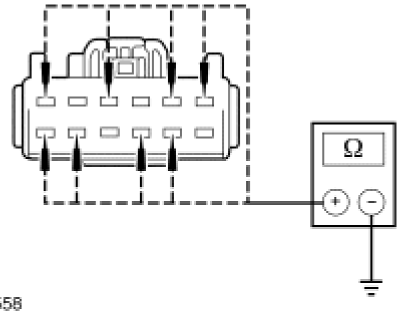


Fig. 41: Checking Seat Control Switch To Driver Seat Module Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the following seat control switch pins, harness side and ground.

Connector-Pin	Circuit
C3297-9	CPS06 (GN/WH)
C3297-4	CPS01 (GN/BU)
C3297-2	CPS03 (VT/GY)
C3297-6	CPS02 (GY/YE)
C3297-11	CPS07 (GY/BN)
C3297-8	CPS08 (VT/OG)
C3297-12	CPS04 (YE/OG)
C3297-1	CPS05 (BU/WH)

- **Are the resistances greater than 10,000 ohms?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J10.

J10 CHECK THE SEAT CONTROL SWITCH TO DSM CIRCUITS FOR AN OPEN

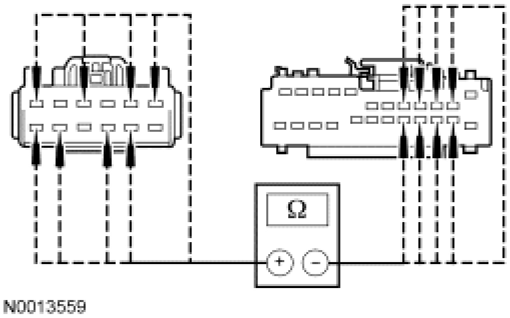


Fig. 42: Checking Seat Control Switch To DSM Circuits For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the following seat control switch pins, harness side and DSM pins, harness side.

Seat Control Switch Connector-Pin	Circuit	DSM Connector-Pin
C3297-9	CPS06 (GN/WH)	C3299b-15
C3297-4	CPS01 (GN/BU)	C3299b-3
C3297-2	CPS03 (VT/GY)	C3299b-14
C3297-6	CPS02 (GY/YE)	C3299b-2
C3297-11	CPS07 (GY/BN)	C3299b-17
C3297-8	CPS08 (VT/OG)	C3299b-5
C3297-12	CPS04 (YE/OG)	C3299b-4
C3297-1	CPS05 (BU/WH)	C3299b-16

- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CARRY OUT PMI. REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J11 CHECK THE POWER SEAT TRACK OPERATION USING DSM SEAT TRACK MOTOR PIDs

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM
- Toggle the following DSM active commands ON and OFF while monitoring the seat movement:
    - Front Motor Up (FRONT_UP)
    - Front Motor Down (FRONT_DWN)
    - Rear Motor Up (REAR_UP)
    - Rear Motor Down (REAR_DWN)
    - Horizontal Motor Forward (HORZ_FWD)
    - Horizontal Motor Backward (HORZ_BWD)
    - Recline Motor Backward (RECL_BWD)
    - Recline Motor Forward (RECL_FWD)
- **Does the driver seat operate correctly?**

  YES : INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CARRY OUT PMI. REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If no seat movement, go to J12.

  If no front vertical seat movement, go to J22.

  If no rear vertical seat movement, go to J25.

  If no horizontal seat movement, go to J28.

  If no recline seat movement, go to J31.

J12 CHECK DSM CIRCUIT SBB32 (VT/RD) FOR VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: DSM C3299a

WARNING: **Make sure no one is in the vehicle and there is nothing**

blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

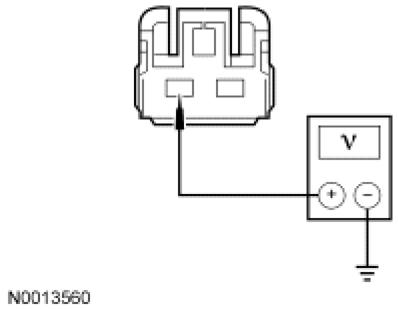


Fig. 43: Checking DSM Circuit SBB32 (VT/RD) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299a-2, circuit SBB32 (VT/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to J13.

  NO : VERIFY BJB fuse 32 (30A) is OK. If OK, REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J13 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

- Disconnect: DSM C3299c

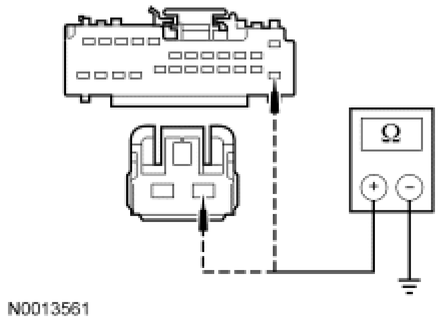


Fig. 44: Checking Circuit GD126 (BK/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299a-1, circuit GD126 (BK/WH), harness side and

ground; and between DSM C3299c-13, circuit GD126 (BK/WH), harness side and ground.

- **Is the resistance less than 5 ohms?**

  YES : Go to J14.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J14 CHECK CIRCUITS CPS24 (GY) AND CPS25 (WH/VT) FOR A SHORT TO GROUND

- Disconnect: DSM C3299b

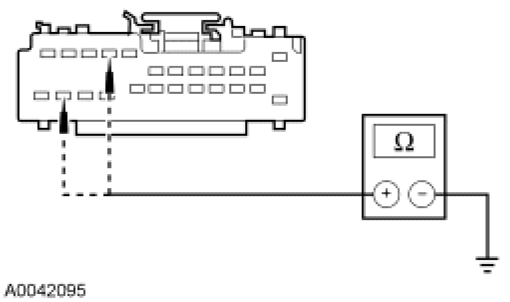


Fig. 45: Checking Circuits CPS24 (GY) & CPS25 (WH/VT) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-9, circuit CPS25 (WH/VT), harness side and ground; and between DSM C3299b-23, circuit CPS24 (GY), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to J16.

  NO : Go to J15.

J15 CHECK THE FRONT HEIGHT POWER SEAT MOTOR CIRCUITS CPS25 (WH/VT) AND CPS24 (GY) FOR A SHORT TO GROUND

- Disconnect: Power Seat Motor C357

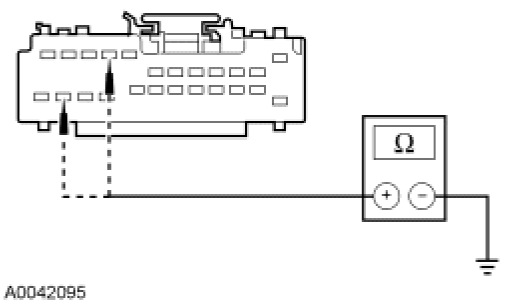


Fig. 46: Checking Front Height Power Seat Motor Circuits CPS25 (WH/VT) & CPS24 (GY) For A Short To Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-9, circuit CPS25 (WH/VT), harness side and ground; and between DSM C3299b-23, circuit CPS24 (GY), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J16 CHECK CIRCUITS CPS27 (BU/BN) AND CPS26 (YE/BU) FOR A SHORT TO GROUND

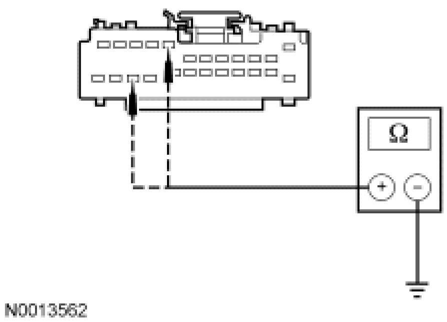


Fig. 47: Checking Circuits CPS27 (BU/BN) & CPS26 (YE/BU) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-8, circuit CPS27 (BU/BN), harness side and ground; and between DSM C3299b-22, circuit CPS26 (YE/BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to J18.

  NO : Go to J17.

J17 CHECK THE REAR HEIGHT POWER SEAT MOTOR CIRCUITS CPS27 (BU/BN) AND CPS26 (YE/BU) FOR A SHORT TO GROUND

- Disconnect: Power Seat Motor C357

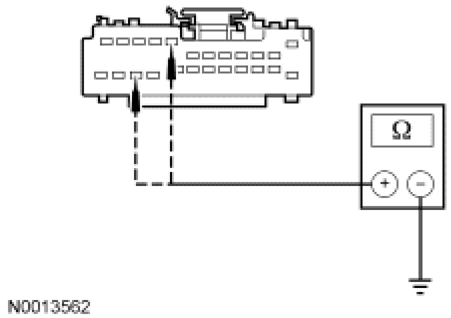


Fig. 48: Checking Rear Height Power Seat Motor Circuits CPS27 (BU/BN) & CPS26 (YE/BU) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-8, circuit CPS27 (BU/BN), harness side and ground; and between DSM C3299b-22, circuit CPS26 (YE/BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J18 CHECK CIRCUITS CPS23 (GN/VT) AND CPS22 (BN) FOR A SHORT TO GROUND

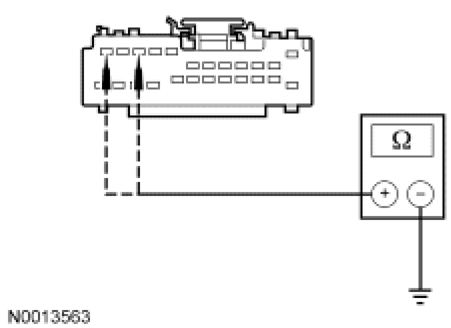


Fig. 49: Checking Circuits CPS23 (GN/VT) & CPS22 (BN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-10, circuit CPS23 (GN/VT), harness side and ground; and between DSM C3299b-12, circuit CPS22 (BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to J20.

NO : Go to J19.

J19 CHECK THE HORIZONTAL POWER SEAT MOTOR CIRCUITS CPS23 (GN/VT) AND CPS22 (BN) FOR A SHORT TO GROUND

- Disconnect: Power Seat Motor C357

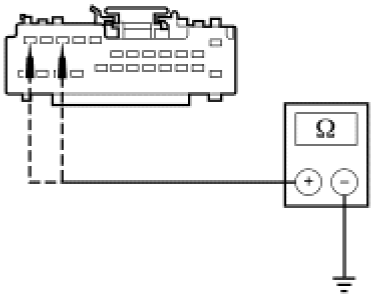


Fig. 50: Checking Horizontal Power Seat Motor Circuits CPS23 (GN/VT) & CPS22 (BN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-10, circuit CPS23 (GN/VT), harness side and ground; and between DSM C3299b-12, circuit CPS22 (BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J20 CHECK CIRCUITS CPS29 (WH/BN) AND CPS30 (VT/BN) FOR A SHORT TO GROUND

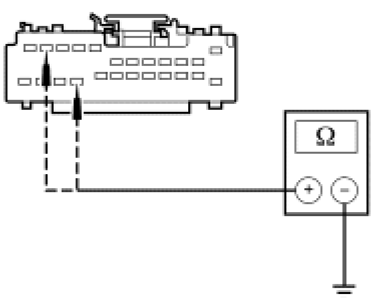


Fig. 51: Checking Circuits CPS29 (WH/BN) & CPS30 (VT/BN) For A Short To Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-11, circuit CPS29 (WH/BN), harness side and ground; and between DSM C3299b-21, circuit CPS30 (VT/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CARRY OUT PMI. REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J21.

J21 CHECK THE DRIVER POWER SEAT RECLINER MOTOR CIRCUITS CPS29 (WH/BN) AND CPS30 (VT/BN) FOR A SHORT TO GROUND

- Disconnect: Driver Power Seat Recliner Motor C3187

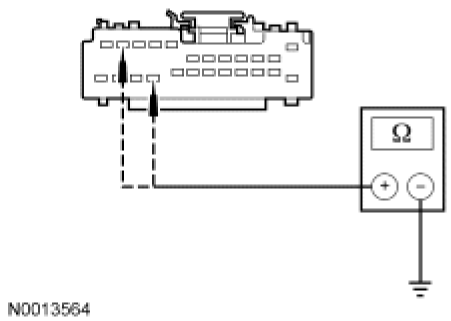


Fig. 52: Checking Driver Power Seat Recliner Motor Circuits CPS29 (WH/BN) & CPS30 (VT/BN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-11, circuit CPS29 (WH/BN), harness side and ground; and between DSM C3299b-21, circuit CPS30 (VT/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new driver seat recliner motor. REFER to **Seat Recliner Motor**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J22 CHECK FOR VOLTAGE AT THE FRONT HEIGHT MOTOR USING DSM SEAT TRACK

MOTOR PIDs

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: Power Seat Motor C357

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM
  - Front Motor Up (FRONT_UP)
  - Front Motor Down (FRONT_DWN)

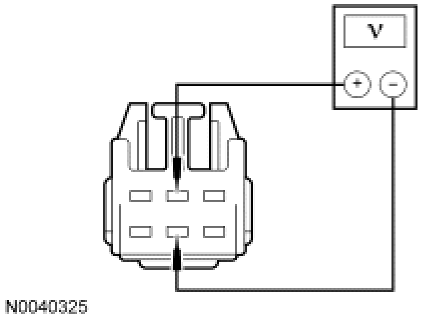


Fig. 53: Checking Front Height Power Seat Motor For Correct Operation
Courtesy of FORD MOTOR CO.

- Measure the voltage between power seat motor C357-2, circuit CPS25 (WH/VT) and C357-5, circuit CPS24 (GY), harness side while toggling DSM active commands FRONT MOTOR UP and FRONT MOTOR DOWN, ON and OFF.
- **Is the voltage greater than 10 volts when command ON in both directions and no voltage present when commanded OFF?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J23.

J23 CHECK CIRCUITS CPS25 (WH/VT) AND CPS24 (GY) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSM C3299b
- Key in ON position.

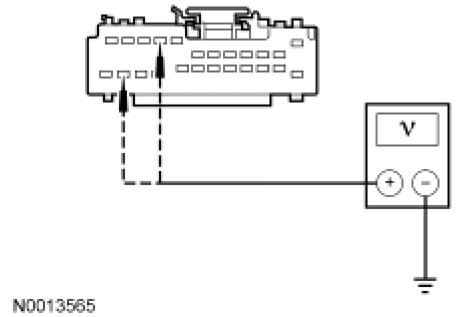


Fig. 54: Checking Circuits CPS25 (WH/VT) & CPS24 (GY) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299b-9, circuit CPS25 (WH/VT), harness side and ground; and between DSM C3299b-23, circuit CPS24 (GY), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J24.

J24 CHECK CIRCUITS CPS25 (WH/VT) AND CPS24 (GY) FOR AN OPEN

- Key in OFF position.

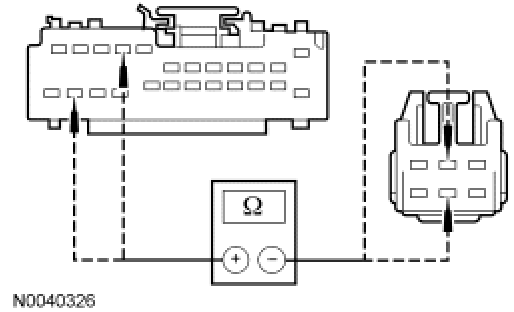


Fig. 55: Checking Circuits CPS25 (WH/VT) & CPS24 (GY) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-9, circuit CPS25 (WH/VT), harness side and power seat motor C357-2, circuit CPS25 (WH/VT), harness side; and between DSM C3299b-23, circuit CPS24 (GY), harness side and power seat motor C357-5, circuit CPS24 (GY), harness side.

- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CARRY OUT PMI. REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J25 CHECK FOR VOLTAGE AT THE REAR HEIGHT MOTOR USING DSM SEAT TRACK MOTOR PIDs

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: Power Seat Motor C357

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM
  - Rear Motor Up (REAR_UP)
  - Rear Motor Down (REAR_DWN)

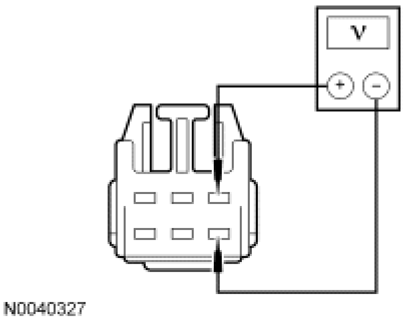


Fig. 56: Checking Rear Height Motor For Correct Operation
Courtesy of FORD MOTOR CO.

- Measure the voltage between power seat motor C357-1, circuit CPS27 (BU/BN), harness side and C357-4, circuit CPS26 (YE/BU), harness side while toggling DSM active commands REAR MOTOR UP and REAR MOTOR DOWN, ON and OFF.
- **Is the voltage greater than 10 volts when command ON in both directions and no voltage present when commanded OFF?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J26.

J26 CHECK CIRCUITS CPS27 (BU/BN) AND CPS26 (YE/BU) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSM C3299b
- Key in ON position.

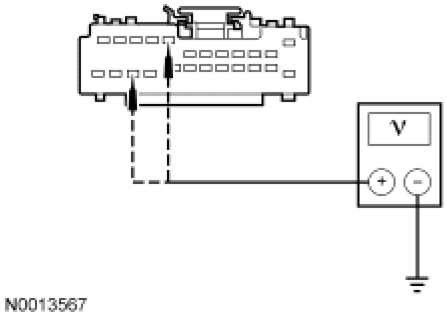


Fig. 57: Checking Circuits CPS27 (BU/BN) & CPS26 (YE/BU) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299b-8, circuit CPS27 (BU/BN), harness side and ground; and between DSM C3299b-22, circuit CPS26 (YE/BU), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J27.

J27 CHECK CIRCUITS CPS27 (BU/BN) AND CPS26 (YE/BU) FOR AN OPEN

- Key in OFF position.

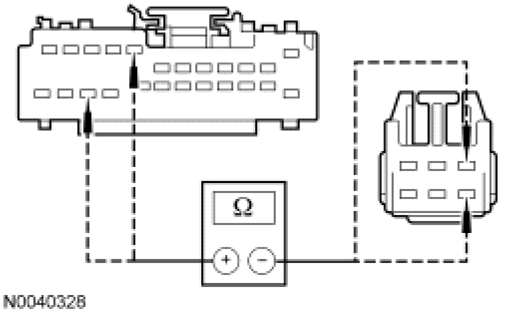


Fig. 58: Checking Circuits CPS27 (BU/BN) & CPS26 (YE/BU) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-8, circuit CPS27 (BU/BN), harness side and power seat motor C357-1, circuit CPS27 (BU/BN), harness side; and between DSM C3299b-22, circuit CPS26 (YE/BU), harness side and rear height power seat motor C357-4, circuit CPS26 (YE/BU), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CARRY OUT PMI. REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs. DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J28 CHECK FOR VOLTAGE AT THE HORIZONTAL MOTOR USING DSM SEAT TRACK MOTOR PIDs

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: Power Seat Motor C357

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM
  - Horizontal Motor Forward (HORZ_FWD)

- Horizontal Motor Backward (HORZ_BWD)

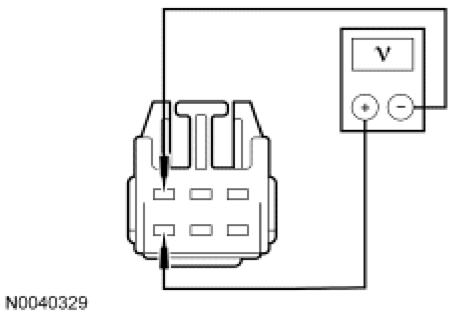


Fig. 59: Checking Horizontal Motor For Correct Operation
Courtesy of FORD MOTOR CO.

- Measure the voltage between power seat motor C357-3, circuit CPS22 (BN) and C357-6, circuit CPS23 (GN/VT), harness side while toggling DSM active commands HORIZONTAL MOTOR FORWARD and HORIZONTAL MOTOR BACKWARD, ON and OFF.
- **Is the voltage greater than 10 volts when command ON in both directions and no voltage present when commanded OFF?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J29.

J29 CHECK CIRCUITS CPS22 (BN) AND CPS23 (GN/VT) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSM C3299b
- Key in ON position.

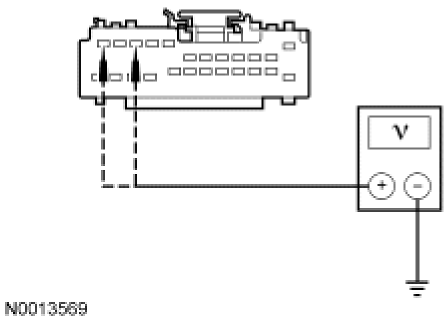


Fig. 60: Checking Circuits CPS22 (BN) & CPS23 (GN/VT) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299b-10, circuit CPS23 (GN/VT), harness side and ground;

and between DSM C3299b-12, circuit CPS22 (BN), harness side and ground.

- **Is any voltage present?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J30.

J30 CHECK CIRCUITS CPS23 (GN/VT) AND CPS22 (BN) FOR AN OPEN

- Key in OFF position.

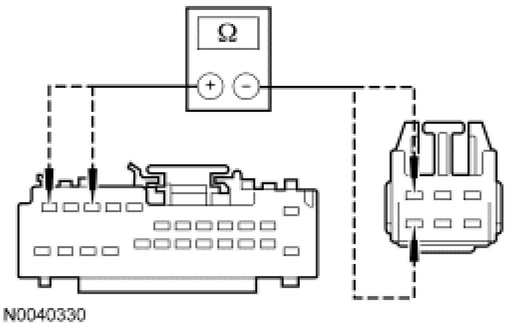


Fig. 61: Checking Circuits CPS23 (GN/VT) & CPS22 (BN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-10, circuit CPS23 (GN/VT), harness side and power seat motor C357-6, circuit CPS23 (GN/VT), harness side; and between DSM C3299b-12, circuit CPS22 (BN), harness side and horizontal power seat motor C357-3, circuit CPS22 (BN), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CARRY OUT PMI. REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

J31 CHECK FOR VOLTAGE AT THE RECLINER MOTOR USING DSM SEAT TRACK MOTOR PIDs

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

- Disconnect the driver seat side air bag C327.
- Disconnect: Driver Seat Power Recliner Motor C3187

WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM
  - Recline Motor Forward (RECL_FWD)
  - Recline Motor Backward (RECL_BWD)

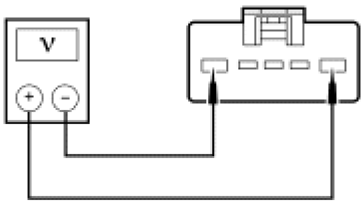


Fig. 62: Checking Driver Seat Power Recliner Motor For Correct Operation
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat power recliner motor C3187-1, circuit CPS29 (WH/BN) and C3187-5, circuit CPS30 (VT/BN), harness side while toggling DSM active commands RECLINE MOTOR FORWARD and RECLINE MOTOR BACKWARD, ON and OFF.
- **Is the voltage greater than 10 volts when command ON in both directions and no voltage present when commanded OFF?**

  YES : INSTALL a new driver seat recliner motor. REFER to **Seat Recliner Motor**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J32.

J32 CHECK CIRCUITS CPS29 (WH/BN) AND CPS30 (VT/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSM C3299b
- Key in ON position.

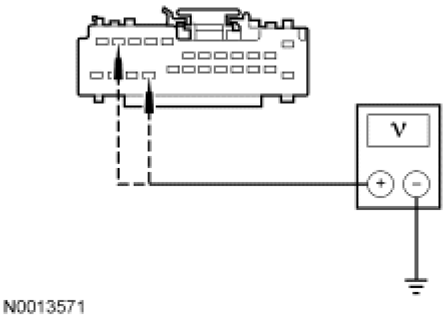


Fig. 63: Checking Circuits CPS29 (WH/BN) & CPS30 (VT/BN) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DSM C3299b-11, circuit CPS29 (WH/BN), harness side and ground; and between DSM C3299b-21, circuit CPS30 (VT/BN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to J33.

J33 CHECK CIRCUITS CPS29 (WH/BN) AND CPS30 (VT/BN) FOR AN OPEN

- Key in OFF position.

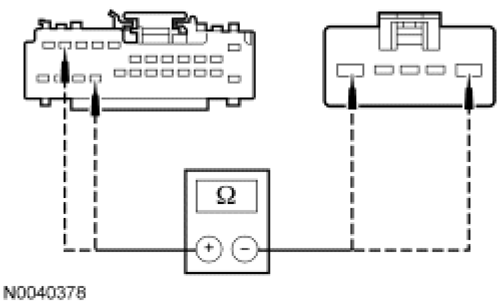


Fig. 64: Checking Circuits CPS29 (WH/BN) & CPS30 (VT/BN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DSM C3299b-11, circuit CPS29 (WH/BN), harness side and recliner power seat motor C3187-1, circuit CPS29 (WH/BN), harness side; and between DSM C3229b-21, circuit CPS30 (VT/BN), harness side and recliner power seat motor C3187-5, circuit CPS30 (VT/BN), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CARRY OUT PMI. REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test K: The Memory Seat Does Not Operate Correctly - Does Not Operate Using the Memory SET Switch

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Memory Seats for schematic and connector information.

Normal Operation

The driver seat control switch is powered by battery voltage on circuit SBB15 (VT/RD) and is supplied ground on circuit GD126 (BK/WH). When pressed, the seat control switch supplies the voltage and ground to the applicable driver seat module (DSM) inputs. The DSM then supplies voltage and ground to the appropriate power seat track motor or power recline motor based on the inputs received from the seat control switch. When pressed in the opposite direction, the seat control switch reverses the polarity to the DSM inputs, and the DSM likewise reverses polarity of the appropriate power seat track motor or power recliner motor circuits causing the seat or backrest to move in the opposite direction. There are 3 power seat track motors that combine to move the seat horizontally (forward/rearward) and vertically (front up/down and rear up/down). The seat backrest power recliner mechanism uses a single motor to move the seat backrest forward and rearward.

Battery voltage is also supplied to the DSM on circuit SBB15 (WH/RD) and SBB32 (VT/RD). Ground is supplied to the DSM on circuit GD126 (BK/WH).

Each motor, in the memory power seat track and power recliner mechanism contains a Hall-effect position sensor. The DSM supplies a signal feed circuit to each position sensor and a shared reference signal return circuit. Each position sensor sends a signal voltage back to the DSM used to monitor the position of the power seat and seat backrest. The DSM uses this information to return the seat to a stored pre-programmed position when pressing the memory SET switch or a remote entry transmitter. The memory SET switch is hard-wired to the driver door module (DDM) and communicates memory SET commands to the DSM via medium-speed controller area network (MS-CAN). For information on programming memory positions or recalling a stored memory position, refer to **Memory Position Programming**.

The following pinpoint test diagnoses a memory seat that does not operate correctly using the memory SET switch. If the memory seat does not move in all directions using the seat control switch, go to **Pinpoint Test J**.

DTC Description	Fault Trigger Conditions
• B1342 - ECU is Faulted	If a programming error is detected, the DTC is set.
• B1530 - Memory SET Switch Circuit Short to Ground	If a short to ground is sensed on the switch input circuit during the DSM Self-Test, the DTC is set. If activity

- B1534 - Memory 1 Switch Circuit Short to Ground - B1538 - Memory 2 Switch Circuit Short to Ground	is sensed on the input circuit for greater than 2 minutes, the DTC is set as continuous. With the DTC set, any input signal on the circuit is ignored.
- B1663 - Seat Driver Front Up/Down Motor Stalled - B1664 - Seat Driver Rear Up/Down Motor Stalled - B1665 - Seat Driver Forward/Backward Motor Stalled	During self-test the driver seat module (DSM) attempts to operate the appropriate seat track motor and uses the motor's position sensor to monitor movement. If no motor movement is sensed, the DTC is set. The DSM will retry motor operation on the next activation of the seat control switch. If no movement continues to be monitored after 250 milliseconds, the DSM disables the output.
B1666 - Seat Driver Recline Motor Stalled	During self-test the DSM attempts to operate the recliner motor and uses the recliner motor position sensor to monitor movement. If no motor movement is sensed, the DTC is set. The DSM will retry motor operation on the next activation of the seat control switch. If no motor movement is still monitored after 250 milliseconds, the DSM disables the output.
- B1952 - Seat Rear Up/Down Position Feedback Circuit Short to Battery - B1956 - Seat Front Up/Down Position Feedback Circuit Short to Battery - B1960 - Seat Recline Forward/Backward Position Feedback Circuit Short to Battery - B1964 - Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Battery	If a short to voltage or an open condition is present on the affected motor's position sensor (Hall effect) feedback circuit, the DTC is set. After a DTC is set, a memory recall is not possible but the seat control switch can operate the associated motor in one-second increments.
- B1953 - Seat Rear Up/Down Position Feedback Circuit Short to Ground - B1957 - Seat Front Up/Down Position Feedback Circuit Short to Ground - B1961 - Seat Recline Forward/Backward Position Feedback Circuit Short to Ground - B1965 - Seat Horizontal Forward/Rearward Position Feedback Circuit Short to Ground	If a short to ground condition is present on the affected motor's position sensor (Hall effect) feedback circuit, the DTC is set. After a DTC is set, a memory recall is not possible but the seat control switch can operate the associated motor in one-second increments.
	If a short to ground or open

• B2084 - Memory SET Indicator Short to Ground	condition is present on the memory SET switch indicator output circuit, the DTC is set.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Memory SET switch
- Remote entry transmitter
- Seat track
- Seat recliner motor
- DSM

PINPOINT TEST K: THE MEMORY SEAT DOES NOT OPERATE CORRECTLY - DOES NOT OPERATE USING THE MEMORY SET SWITCH

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

NOTE: **Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.**

K1 CHECK DSM GEAR SELECTED (TRANS GEAR) PID

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM

  NOTE: **D6_PRK applies to both park and overdrive.**

  Operate the transmission gear selector in all positions while monitoring the following DSM PID TRANS GEAR states:

  - D6_PRK
  - REV
  - NTRL
  - D6_PRK
  - DRIVE1
- **Do the PID states agree with the selected positions?**

YES : Go to K2.

NO : To diagnose a transmission gear selector (PRNDL) status concern, REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article or **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.

K2 CHECK DSM IGNITION SWITCH STATUS (IGN_SW) PID

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM

  Cycle the ignition switch in all positions while monitoring the following DSM IGN_SW PID states:

  - Off
  - Accessory
  - Run
  - Start
- **Do the PID states agree with the selected positions?**

  YES : Go to K3.

  NO : To diagnose an ignition switch status concern, REFER to **STEERING COLUMN SWITCHES** article.

K3 RETRIEVE THE DTCs

NOTE: During the DDM Self-Test, document when the memory SET LED illuminates and turns off.

- Using the switches, attempt to operate the memory seat and memory exterior mirrors in all directions through the full range of travel.
- Place the memory seat and memory exterior mirrors in central travel positions.
- Enter the following diagnostic mode on the diagnostic tool: Self-Test/DSM/Retrieve DTCs
- Enter the following diagnostic mode on the diagnostic tool: Self-Test/DDM/Retrieve DTCs
- **Are any DSM or DDM DTCs retrieved or does the memory SET LED fail to illuminate during the DDM Self-Test?**

  YES : If the memory SET LED fails to illuminate during the DDM Self-Test, go to K5.

  If one or all of the following DDM DTCs are retrieved; B1530, B1534, B1538 and B2084, go to K5.

  If DTCs B1952, B1956, B1960 and B1964 are all retrieved, go to K10.

  If DTCs B1953, B1957, B1961 and B1965 are all retrieved, go to K10.

  If DTC B1663, go to K11.

  If DTC B1664, go to K14.

  If DTC B1665, go to K17.

If DTC B1666, go to K20.

If DTC B1952, go to K14.

If DTC B1953, go to K15.

If DTC B1956, go to K11.

If DTC B1957, go to K12.

If DTC B1960, go to K20.

If DTC B1961, go to K21.

If DTC B1964, go to K17.

If DTC B1965, go to K18.

If DTC B1342, INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CARRY OUT programmable module installation (PMI). REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. CLEAR the DTCs.

NO : Go to K4.

K4 CHECK DDM MEMORY SET SWITCH STATUS (MEMORY_SW) PID STATES

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DDM
- While activating the memory switch SET, recall 1 and recall 2 buttons, monitor the DDM MEMORY_SW PID states:
  - Inactive
  - Set
  - Memory 1
  - Memory 2
- **Do the PID states agree with the switch button positions?**

  YES : Go to K10.

  NO : Go to K5.

K5 CHECK THE MEMORY SET SWITCH

- Key in OFF position.
- Disconnect: Memory SET Switch C503

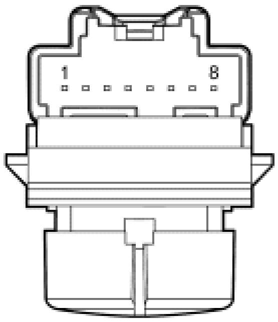


Fig. 65: Checking Memory Set Switch
Courtesy of FORD MOTOR CO.

- Use the following table and illustration to check the memory SET switch. Measure the resistance between the memory SET switch pins, component side, while pressing the indicated switch buttons and compare the results to the table.

Switch Button	Pins	Ohms
Memory Switch 1	7 and 2	Less than 5
Memory Switch 2	7 and 6	Less than 5
Memory SET Switch	7 and 5	Less than 5

NOTE: Refer to multi-meter user's article for testing diodes.

- Use the following table and preceding illustration. Using the diode testing meter function, connect the meter leads to the memory SET switch pins, component side. Measure the voltages and compare the results to the table, to check the switch LED indicator.

Positive Lead	Negative Lead	Volts
Pin 1	Pin 7	Greater than 0.3
Pin 7	Pin 1	OL

- **Is the memory SET switch OK?**

  YES : Go to K6.

  NO : INSTALL a new memory SET switch. REFER to **Memory Set Switch**. REPEAT the self-

test. CLEAR the DTCs.

K6 CHECK GROUND CIRCUIT GD126 (BK/WH) TO THE MEMORY SET SWITCH

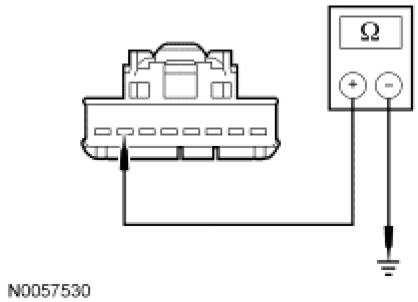


Fig. 66: Measuring Resistance Between Memory SET Switch C503-7, Circuit GD133 (BK) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between memory SET switch C503-7, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to K7.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

K7 CHECK CIRCUITS CPS14 (GY/VT), CPS15 (VT/WH), CPS16 (YE) AND CPS55 (YE) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: DSM C568a
- Disconnect: DSM C568b
- Key in ON position.

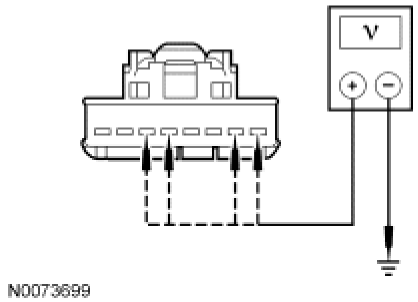


Fig. 67: Checking Circuits CPS14 (GY/VT), CPS15 (VT/WH), CPS16 (YE) & CPS55 (YE) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the following memory SET switch pins, harness side and ground:

Connector - Pin	Circuit
C503-1	CPS55 (YE)
C503-2	CPS15 (VT/WH)
C503-5	CPS14 (GY/VT)
C503-6	CPS16 (YE)

- **Is any voltage present?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to K8.

K8 CHECK CIRCUITS CPS14 (GY/VT), CPS15 (VT/WH), CPS16 (YE) AND CPS55 (YE) FOR A SHORT TO GROUND

- Key in OFF position.

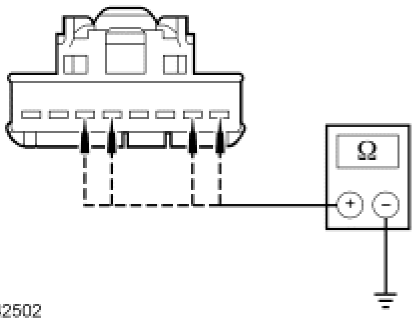


Fig. 68: Check Circuits CPS15 (VT/WH), CPS16 (YE), CPS14 (GY/VT) And CPS55 (YE) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the following memory SET switch pins, harness side and ground:

Connector - Pin	Circuit
C503-1	CPS55 (YE)
C503-2	CPS15 (VT/WH)
C503-5	CPS14 (GY/VT)
C503-6	CPS16 (YE)

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to K9.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

K9 CHECK CIRCUITS CPS14 (GY/VT), CPS15 (VT/WH), CPS16 (YE) AND CPS55 (YE) FOR AN OPEN

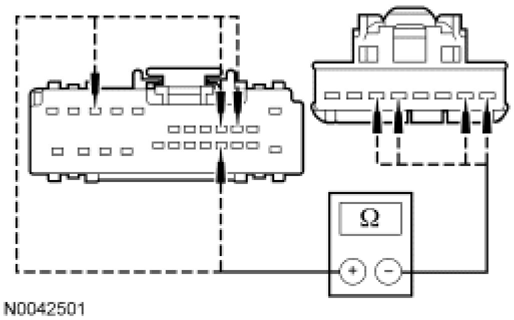


Fig. 69: Checking Circuits CPS15 (VT/WH), CPS16 (YE), CPS14 (GY/VT) And CPS55 (YE) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the following memory SET switch pins and DDM pins:

Memory SET switch connector	Circuit	DDM connector
C503-2	CPS15 (VT/WH)	C568b-4
C503-5	CPS14 (GY/VT)	C568b-3
C503-6	CPS16 (YE)	C568b-16
C503-1	CPS55 (YE)	C568a-10

- **Are the resistances less than 5 ohms?**

  YES : Go to K10.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

K10 CHECK DSM SENSOR PIDs

- Place the seat in a central position, using the seat control switch.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DSM

NOTE: **If the DSM detects a fault while carrying out this step, the associated motor may operate in one-second intervals.**

- Using the switch, operate the memory seat in all directions through the full range of travel while monitoring the following DSM PIDs:
  - Driver Power Seat Front Up/Down Sense (SFNT_MT)
  - Driver Power Seat Forward/Backward Sense (SFWD_MT)
  - Driver Power Seat Rear Up/Down Sense (SREARMT)
  - Driver Power Seat Recline Sense (SRCL_MT)
- **Does each PID indicate the sensor is operational throughout each motor's full range of travel?**

  YES : INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CARRY OUT PMI. REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. CLEAR the DTCs.

  NO : If the PID indicates driver seat front vertical position sensor is not present, go to K11.

  If the PID indicates driver seat rear vertical position sensor is not present, go to K14.

  If the PID indicates driver seat horizontal position sensor is not present, go to K17.

  If the PID indicates driver seat recline position sensor is not present, go to K20.

K11 CHECK CIRCUITS VPS10 (BU/GN) AND RPS13 (GN/OG) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: DSM C3299b
- Disconnect: Memory Seat Position Sensor C358

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Key in ON position.

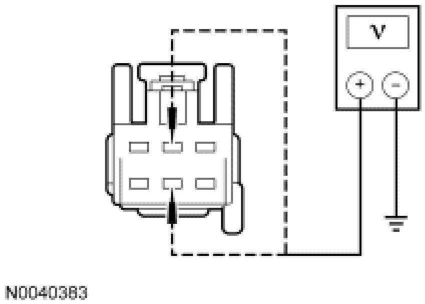


Fig. 70: Checking Circuits VPS10 (BU/GN) And RPS13 (GN/OG) For Short To Power
Courtesy of FORD MOTOR CO.

- Measure the voltage between memory seat position sensor C358-2, circuit VPS10 (BU/GN), harness side and ground; and between memory seat position sensor 358-5, circuit RPS13 (GN/OG), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to K12.

K12 CHECK CIRCUITS VPS10 (BU/GN) AND RPS13 (GN/OG) FOR A SHORT TO GROUND

- Key in OFF position.

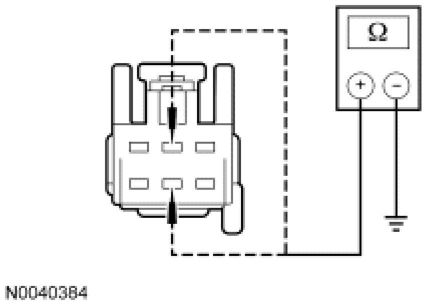


Fig. 71: Checking Circuits VPS10 (BU/GN) And RPS13 (GN/OG) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between memory seat position sensor C358-2, circuit VPS10 (BU/GN), harness side and ground; and between memory seat position sensor 358-5, circuit RPS13 (GN/OG), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to K13.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K13 CHECK CIRCUITS VPS10 (BU/GN) AND RPS13 (GN/OG) FOR AN OPEN

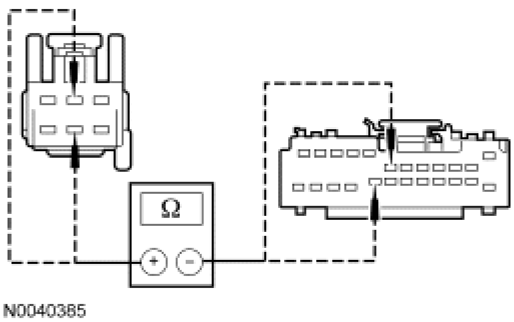


Fig. 72: Checking Circuits VPS10 (BU/GN) And RPS13 (GN/OG) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between memory seat position sensor C358-2, circuit VPS10 (BU/GN), harness side and DSM C3299b-7, circuit VPS10 (BU/GN), harness side; and between memory seat position sensor 358-5, circuit RPS13 (GN/OG), harness side and DSM C3299b-20, circuit RPS13 (GN/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K14 CHECK CIRCUITS VPS11 (GN/BN) AND RPS13 (GN/OG) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: DSM C3299b
- Disconnect: Memory Seat Position Sensor C358

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may**

result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

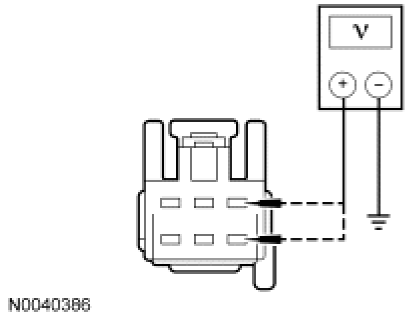


Fig. 73: Checking Circuits VPS11 (GN/BN) And RPS13 (GN/OG) For Short To Power
Courtesy of FORD MOTOR CO.

- Measure the voltage between memory seat position sensor C358-1, circuit VPS11 (GN/BN), harness side and ground; and between driver seat position sensor C358-4, circuit RPS13 (GN/OG), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to K15.

K15 CHECK CIRCUITS VPS11 (GN/BN) AND RPS13 (GN/OG) FOR A SHORT TO GROUND

- Key in OFF position.

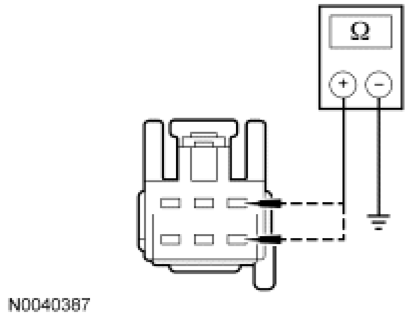


Fig. 74: Checking Circuits VPS11 (GN/BN) And RPS13 (GN/OG) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between memory seat position sensor C358-1, circuit VPS11 (GN/BN), harness side and ground; and between memory seat position sensor C358-4, circuit RPS13

(GN/OG), harness side and ground.

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to K16.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K16 CHECK CIRCUITS VPS11 (GN/BN) AND RPS13 (GN/OG) AND FOR AN OPEN

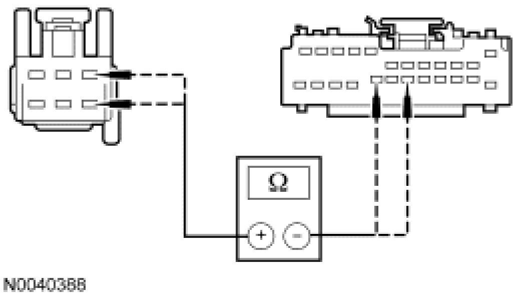


Fig. 75: Checking Circuits VPS11 (GN/BN) And RPS13 (GN/OG) And For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between memory position sensor C358-1, circuit VPS11 (GN/BN), harness side and DSM C3299b-18, circuit VPS11 (GN/BN), harness side; and between memory seat position sensor C358-4, circuit RPS13 (GN/OG), harness side and DSM C3299b-20, circuit RPS13 (GN/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit(s) in question. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K17 CHECK CIRCUITS VPS09 (BN/BU) AND RPS13 (GN/OG) AND FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.

- Disconnect: DSM C3299b
- Disconnect: Memory Seat Position Sensor C358

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Key in ON position.

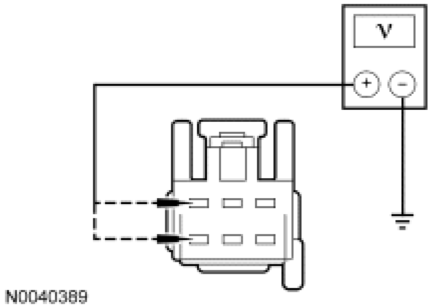


Fig. 76: Checking Circuits VPS09 (BN/BU) And RPS13 (GN/OG) And For Short To Power
Courtesy of FORD MOTOR CO.

- Measure the voltage between memory seat position sensor C358-3, circuit VPS09 (BN/BU), harness side and ground; and between memory seat position sensor C358-6, circuit RPS13 (GN/OG), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to K18.

K18 CHECK CIRCUITS VPS09 (BN/BU) AND RPS13 (GN/OG) FOR A SHORT TO GROUND

- Key in OFF position.

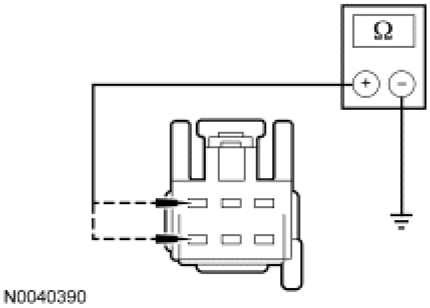


Fig. 77: Checking Circuits VPS09 (BN/BU) And RPS13 (GN/OG) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between memory seat position sensor C358-3, circuit VPS09 (BN/BU), harness side and ground; and between memory seat position sensor C358-6, circuit RPS13 (GN/OG), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to K19.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K19 CHECK CIRCUITS VPS09 (BN/BU) AND RPS13 (GN/OG) FOR AN OPEN

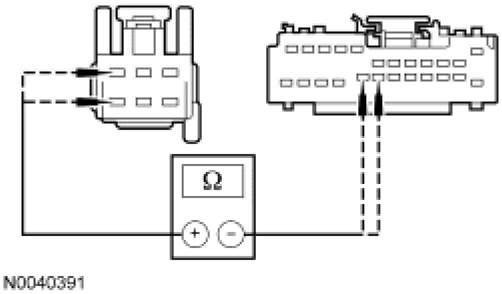


Fig. 78: Checking Circuits VPS09 (BN/BU) And RPS13 (GN/OG) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between memory seat position sensor C358-3, circuit VPS09 (BN/BU), harness side and DSM C3299b-19, circuit VPS09 (BN/BU), harness side; and between memory seat position sensor C358-6, circuit RPS13 (GN/OG), harness side and DSM C3299b-20, circuit RPS13 (GN/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new driver seat track assembly. REFER to **Seat Track**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K20 CHECK CIRCUITS RPS13 (GN/OG) AND LPS12 (VT/RD) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: DSM C3299b
- Disconnect: Driver Seat Recliner Motor C3187

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

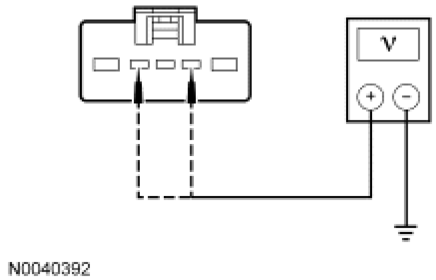


Fig. 79: Checking Circuits RPS13 (GN/OG) & LPS12 (VT/RD) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat recliner motor C3187-2, circuit RPS13 (GN/OG), harness side and ground; and between driver seat recliner motor C3187-4, circuit LPS12 (VT/RD), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to K21.

K21 CHECK CIRCUITS RPS13 (GN/OG) AND LPS12 (VT/RD) FOR A SHORT TO GROUND

- Key in OFF position.

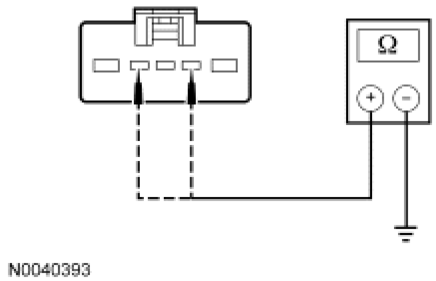


Fig. 80: Checking Circuits RPS13 (GN/OG) & LPS12 (VT/RD) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat recliner motor C3187-2, circuit RPS13 (GN/OG), harness side and ground; and between driver seat recliner motor C3187-4, circuit LPS12 (VT/RD), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to K22.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

K22 CHECK CIRCUITS RPS13 (GN/OG) AND LPS12 (VT/RD) FOR AN OPEN

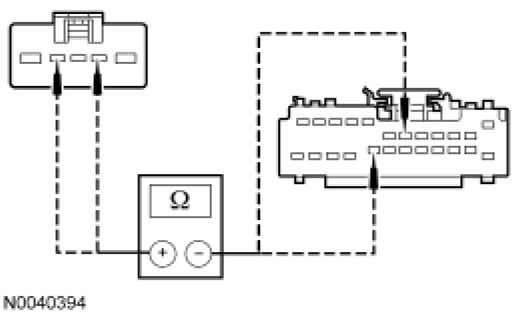


Fig. 81: Checking Circuits RPS13 (GN/OG) And LPS12 (VT/RD) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat recliner motor C3187-2, circuit RPS13 (GN/OG), harness side and DSM C3299b-20, circuit RPS13 (GN/OG), harness side; and between driver seat recliner motor C3187-4, circuit LPS12 (VT/RD), harness side and DSM C3299b-6, circuit LPS12 (VT/RD), harness side.

- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new driver seat recliner motor. REFER to **Seat Recliner Motor**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test L: Easy Exit/Easy Entry is Inoperative/Does Not Operate Correctly

Normal Operation

The driver seat module (DSM) receives a key out command over the medium-speed controller area network (MS-CAN) and powers the driver seat rearward about 50.8 mm (2 in).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Key-in-ignition warning switch
- Instrument cluster (IC) module
- DSM

PINPOINT TEST L: EASY EXIT/EASY ENTRY IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

L1 CHECK THE DRIVER POWER SEAT OPERATION

- Key in ON position.
- Check the message center to verify the easy entry/exit feature is enabled.
  - The easy entry/exit feature can be enabled/disabled using a scan tool in module programming. When enabled, the feature becomes a user accessible item on the message center allowing the user to turn the feature on and off. Refer to the Owner's Literature or **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article for information on the message center.
- Using the seat control switch, verify the driver power seat operates fully forward and rearward.
- Verify the driver power seat operates forward and rearward.
- **Does the power seat operate forward and rearward correctly?**

  YES : Go to L2.

  NO : REFER to the Symptom Chart for diagnosis of inoperative driver power seat horizontal movement.

L2 CHECK THE EASY EXIT OPERATION

- Position the driver seat at least 50.8 mm (2 in) from the rear stop point.

- Key in OFF position.
- Remove the key from the ignition switch.
- **Does the driver power seat move rearward approximately 50.8 mm (2 in)?**

  YES : Go to L5.

  NO : Go to L3.

L3 CHECK THE INSTRUMENT CLUSTER MODULE IGNITION KEY IN/OUT (IGN_KEY) PID STATES

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/Instrument Cluster (IC) Module
- Monitor the instrument cluster module IGN_KEY PID states with the ignition key in and with the key removed.
- **Does the instrument cluster module PID states agree with the switch positions?**

  YES : Go to L4.

  NO : To diagnose the key-in-ignition warning switch fault, REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

L4 CHECK FOR DTCs FROM THE DSM

- Enter the following diagnostic mode on the diagnostic tool: Self-Test/DSM/Retrieve DTCs
- **Are any DSM DTCs present?**

  YES : REFER to the Driver Seat Module (DSM) DTC Chart for DSM DTC diagnosis.

  NO : INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CARRY OUT programmable module installation (PMI). REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. CLEAR the DTCs.

L5 CHECK THE EASY ENTRY OPERATION

- Insert the ignition key.
- **Does the driver power seat move forward approximately 50.8 mm (2 in)?**

  YES : The system is operating correctly at this time. RETEST the system for intermittent operation. If no fault is found, INSTRUCT the customer on the correct operation of the system.

  NO : INSTALL a new DSM. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CARRY OUT PMI. REFER to **MODULE CONFIGURATION** article. REPEAT the self-test. CLEAR the DTCs.

Pinpoint Test M: The Power Lumbar is Inoperative - Driver

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Memory Seats for schematic and connector information.

Normal Operation

The seat control switch is powered by battery voltage on circuit SBB15 (WH/RD) and is supplied ground on

circuit GD126 (BK/WH). When the knob of the seat control switch is pressed, voltage and ground are supplied to the power lumbar motor. When pressing the lumbar knob in the opposite direction, the lumbar control switch reverses the polarity to the power lumbar motor, which moves the lumbar mechanism in the opposite direction.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Lumbar control switch
- Lumbar motor

PINPOINT TEST M: THE POWER LUMBAR IS INOPERATIVE - DRIVER

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

M1 CHECK CIRCUIT SBB15 (WH/RD) FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag C327.
- Disconnect: Seat Control Switch C3297

WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Measure the voltage between seat control switch C3297-5, circuit SBB15 (WH/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to M2.

  NO : VERIFY battery junction box (BJB) fuse 15 (10A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

M2 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN

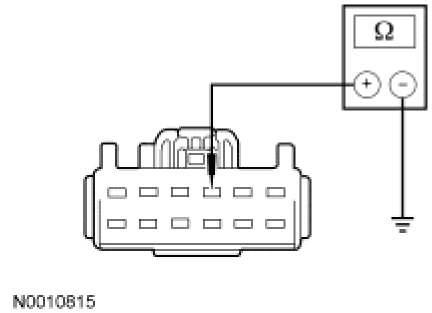


Fig. 82: Checking Circuit GD126 (BK/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C3297-3, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to M3.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

M3 CHECK THE LUMBAR MOTOR

- Connect: Seat Control Switch C3297
- Disconnect: Power Lumbar Motor C3215

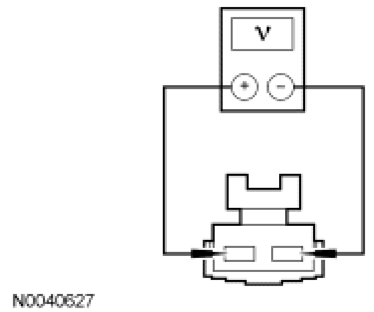


Fig. 83: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- For power seat, measure the voltage between power lumbar motor C3215-1, circuit CPS18 (BN/GN), harness side and power lumbar motor C3215-2, circuit CPS19 (GY/VT), harness side.
- Operate the seat control switch in both directions.
- **Is the voltage greater than 10 volts in both directions?**

  YES : INSTALL a new power lumbar assembly. REFER to **Lumbar Assembly**. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : Go to M4.

M4 CHECK CIRCUITS CPS19 (GY/VT) AND CPS18 (BN/GN) FOR A SHORT TO GROUND

- Disconnect: Seat Control Switch C3297

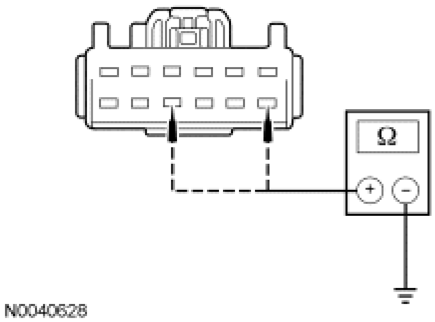


Fig. 84: Checking Circuits CPS19 (GY/VT) & CPS18 (BN/GN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C3297-7, circuit CPS18 (BN/GN), harness side and ground; and between seat control switch C3297-10, circuit CPS19 (GY/VT), harness side and ground.
- **Are the resistances greater than 10,000 ohms.**

YES : Go to M5.

NO : REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

M5 CHECK CIRCUITS CPS19 (GY/VT), CPS18 (GN/RD) AND CPS18 (BN/GN) FOR AN OPEN

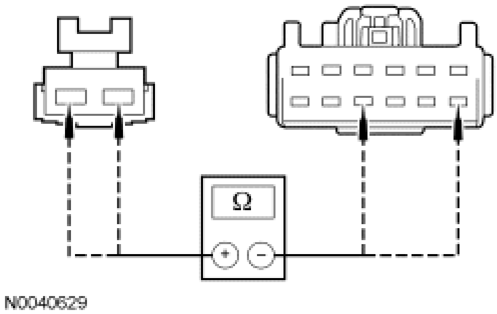


Fig. 85: Checking Circuits CPS19 (GY/VT), CPS18 (GN/RD) & CPS18 (BN/GN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C3297-7, circuit CPS18 (BN/GN), harness side and power lumbar motor C3215-1, circuit CPS18 (BN/GN), harness side; and between seat control switch C3297-10, circuit CPS19 (GY/VT), harness side and power lumbar motor C3215-2, circuit CPS19 (GY/VT), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test N: The Power Lumbar is Inoperative - Passenger

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Seats for schematic and connector information.

Normal Operation

The seat control switch is powered by battery voltage on circuit SBP31 (WH/RD) and is supplied ground on circuit GD139 (BK/YE). When the knob of the seat control switch is pressed, voltage and ground are supplied to the power lumbar motor. When pressing the lumbar knob in the opposite direction, the lumbar control switch reverses the polarity to the power lumbar motor, which moves the lumbar mechanism in the opposite direction.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Lumbar control switch
- Lumbar motor

PINPOINT TEST N: THE POWER LUMBAR IS INOPERATIVE - PASSENGER

NOTE:	**The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**
NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

N1 CHECK CIRCUIT SBB31 (WH/RD) FOR AN OPEN

- Key in OFF position.

- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: Seat Control Switch C3190

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Measure the voltage between seat control switch C3190-5 , circuit SBB31 (WH/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to N2.

  NO : VERIFY battery junction box (BJB) fuse 31 (30A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

N2 CHECK CIRCUIT GD139 (BK/YE) FOR AN OPEN

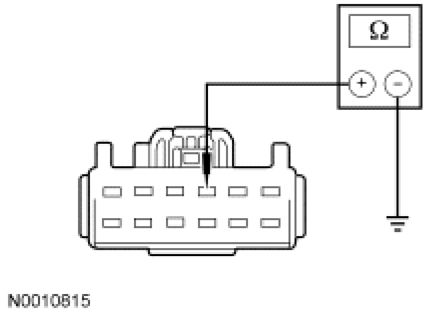


Fig. 86: Checking Circuit GD139 (BK/YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C3190-3, circuit GD139 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to N3.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

N3 CHECK THE LUMBAR MOTOR

- Connect: Seat Control Switch C3190
- Disconnect: Power Lumbar Motor C3216

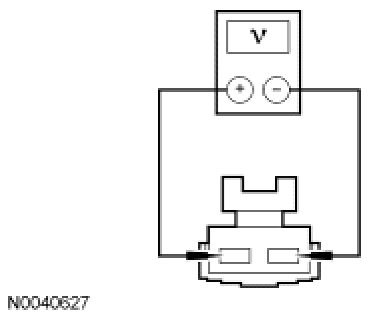


Fig. 87: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- For power seat, measure the voltage between power lumbar motor C3216-1, circuit CPS20 (VT), harness side and power lumbar motor C3216-2, circuit CPS21 (WH/OG), harness side.
- Operate the seat control switch in both directions.
- **Is the voltage greater than 10 volts in both directions?**

  YES : INSTALL a new power lumbar assembly. REFER to **Lumbar Assembly**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to N4.

N4 CHECK CIRCUITS CPS20 (VT) AND CPS21 (YE/BK) FOR A SHORT TO GROUND

- Disconnect: Seat Control Switch C3190

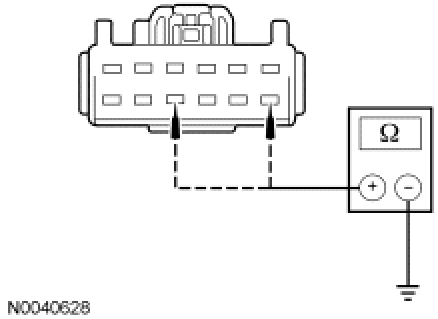


Fig. 88: Checking Circuits CPS20 (VT) & CPS21 (YE/BK) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C3190-7, circuit CPS20 (VT), harness side and ground; and between seat control switch C3190-10, circuit CPS21 (WH/OG), harness side and

ground.

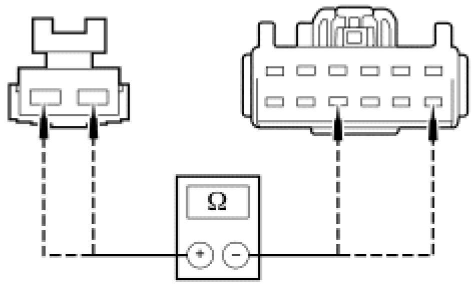
- **Are the resistances greater than 10,000 ohms.**

  YES : Go to N5.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

N5 CHECK CIRCUITS CPS20 (VT), CPS20 (WH/OG) AND CPS21 (YE/BK) FOR AN OPEN



N0040629

Fig. 89: Checking Circuits CPS20 (VT), CPS20 (WH/OG) & CPS21 (YE/BK) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between seat control switch C3190-7, circuit CPS20 (VT), harness side and power lumbar motor C3215-1, circuit CPS20 (WH/OG), harness side; and between seat control switch C3190-10, circuit CPS21 (YE/BK), harness side and power lumbar motor C3215-2, circuit CPS21 (YE/BK), harness side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new seat control switch. REFER to **Seat Control Switch**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test O: The Heated Seat is Inoperative - Driver

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

The heated seat module receives ignition voltage on circuit CBP19 (BN/WH), battery voltage on circuit SBB11 (BU/RD) and is supplied ground on circuit GD139 (BK/YE). When ignition switched voltage is supplied and the driver heated seat button on the HVAC module is pressed, a momentary ground signal is sent to the heated seat module on circuit CHS29 (WH/BU) to command the system ON or OFF. Upon receiving a signal, the heated seat module will decrease one setting (the sequence is HI, LO, OFF, HI, etc.). The heated seat module supplies voltage to the cushion and backrest heater mats on circuit CHS02 (YE/BU). Ground to the heater mats is provided on circuit GD126 (BK/WH). The cushion and backrest heater mats are connected in series and operate together. Temperature is maintained by the heated seat module using a sensor contained within the cushion heater mat. The heated seat module supplies a reference voltage to the temperature sensor on circuit RHS05 (YE/VT) and monitors the signal from the temperature sensor on circuit VHS26 (VT) for controlling current flow to the heater mats. The heated seat module is designed to remain ON, heating the seat and maintaining temperature until switched OFF.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Heater mat
- Heated seat module
- HVAC module

PINPOINT TEST O: THE HEATED SEAT IS INOPERATIVE - DRIVER

NOTE:	**The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

O1 CHECK CIRCUIT SBB11 (BU/RD) FOR VOLTAGE TO THE HEATED SEAT MODULE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag module C327.
- Disconnect the passenger seat side air bag module C313.
- Disconnect: Heated Seat Module C3304

WARNING:	**Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

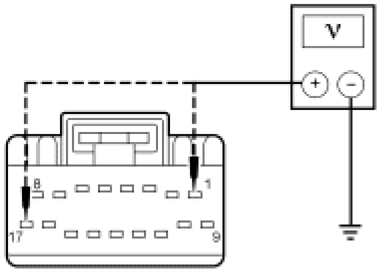


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Fig. 90: Checking Circuit SBB11 (BU/RD) For Voltage To Heated Seat Module
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C3304-1, circuit SBB11 (BU/RD) harness side and ground and C3304-17, circuit SBB11 (BU/RD) harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to O2.

  NO : VERIFY battery junction box (BJB) fuse 11 (20A Fusion and Milan) (30A MKZ) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

O2 CHECK CIRCUIT CBP19 (BN/WH) FOR VOLTAGE TO THE HEATED SEAT MODULE

- Key in ON position.

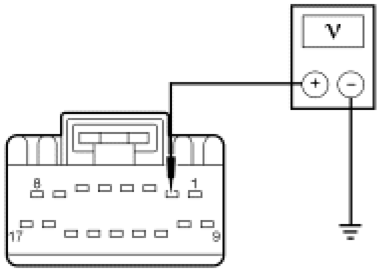

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Fig. 91: Checking Circuit CBP19 (BN/WH) For Voltage To Heated Seat Module
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C3304-2, circuit CBP19 (BN/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to O3.

  NO : VERIFY smart junction box (SJB) fuse 28 (10A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

O3 CHECK HEATED SEAT MODULE GROUND CIRCUIT GD139 (BK/YE) FOR AN OPEN

- Key in OFF position.

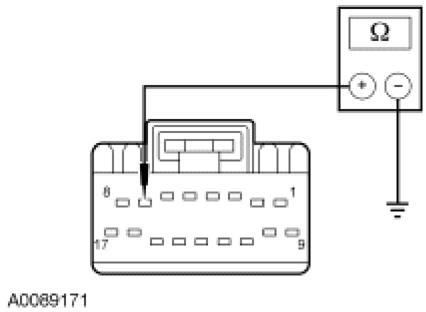


Fig. 92: Checking Heated Seat Module Ground Circuit GD139 (BK/YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3304-7, circuit GD139 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to O4.

  NO : REPAIR circuit GD139 (BK/YE). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

O4 CHECK CIRCUIT CHS02 (YE/BU) FOR SHORT TO VOLTAGE

- Disconnect: Driver Seat Cushion Heater C364
- Key in ON position.

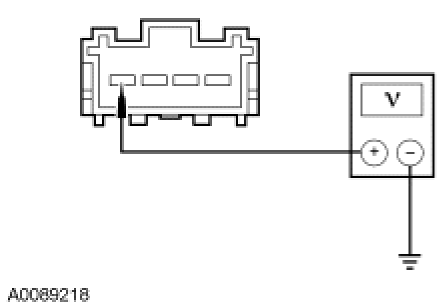


Fig. 93: Checking Circuit CHS02 (YE/BU) For Short To Voltage - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the voltage between driver seat cushion heater C3298-1, circuit CHS02 (YE/BU), harness side and ground.

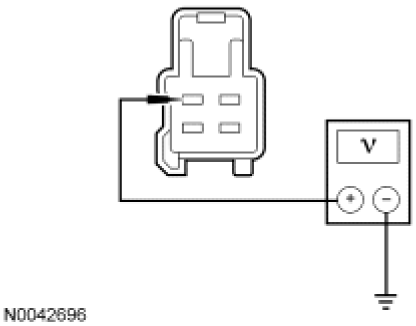


Fig. 94: Checking Circuit CHS02 (YE/BU) For Short To Voltage - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the voltage between driver seat cushion heater C364-1, circuit CHS02 (YE/BU), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR circuit CHS02 (YE/BU). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to O5.

O5 CHECK CIRCUIT CHS02 (YE/BU) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.

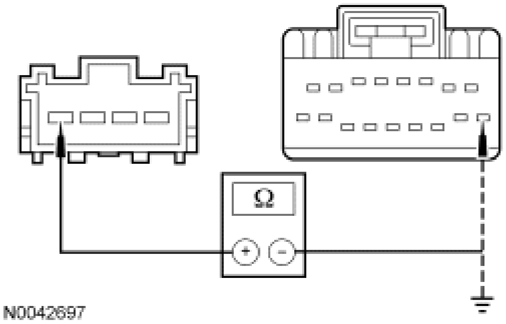


Fig. 95: Checking Circuit CHS02 (YE/BU) For Open Or Short To Ground - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between driver seat cushion heater C3298-1, circuit CHS02 (YE/BU), harness side and ground; and between C3298-1, circuit CHS02 (YE/BU), harness side and heated seat module C3304-9, circuit CHS02 (YE/BU) harness side.

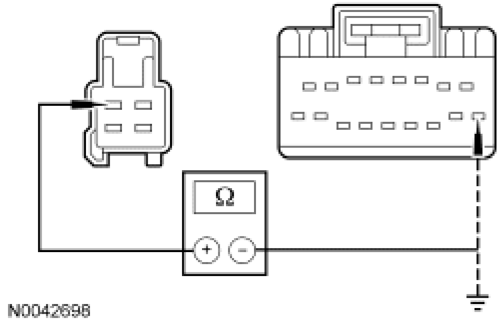


Fig. 96: Checking Circuit CHS02 (YE/BU) For Open Or Short To Ground - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the resistance between driver seat cushion heater C364-1, circuit CHS02 (YE/BU), harness side and ground; and between C364-1, circuit CHS02 (YE/BU), harness side and heated seat module C3304-9, circuit CHS02 (YE/BU) harness side.
- **Is the resistance greater than 10,000 ohms between the driver seat cushion heater and ground and less than 5 ohms between the driver seat cushion heater and the heated seat module?**

  YES : Go to O6.

  NO : REPAIR circuit CHS02 (YE/BU). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

O6 CHECK CIRCUIT CHS11 (VT/GN) FOR A SHORT TO VOLTAGE

- Disconnect: Driver Seat Backrest Heater C365
- Key in ON position.

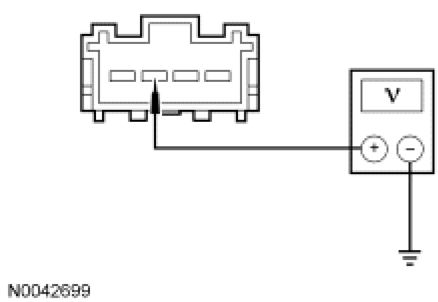


Fig. 97: Checking Circuit CHS11 (VT/GN) For A Short To Voltage - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the voltage between driver seat cushion heater C3298-2, circuit CHS11 (VT/GN), harness side and ground.

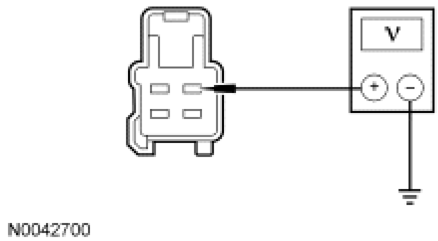


Fig. 98: Checking Circuit CHS11 (VT/GN) For A Short To Voltage - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the voltage between driver seat cushion heater C364-2, circuit CHS11 (VT/GN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR circuit CHS11 (VT/GN). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to O7.

O7 CHECK CIRCUIT CHS11 (VT/GN) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.

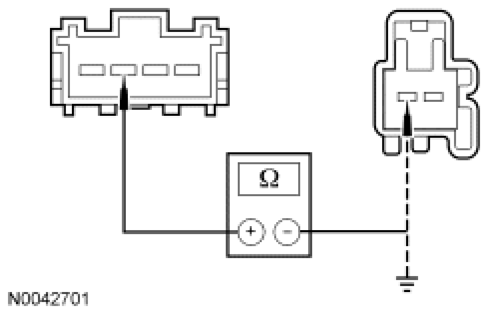
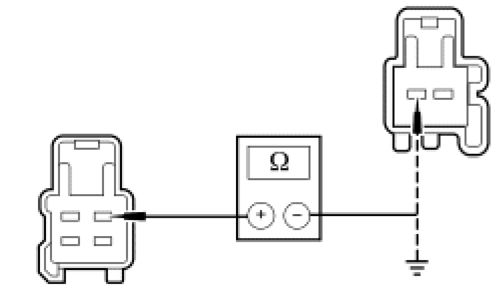


Fig. 99: Checking Circuit CHS11 (VT/GN) For An Open Or Short To Ground - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between driver seat cushion heater C3298-2, circuit CHS11 (VT/GN), harness side and ground; and between C3298-2, circuit CHS11 (VT/GN), harness side and driver seat backrest heater C365-1, circuit CHS11 (VT/GN) harness side.



N0042702

Fig. 100: Checking Circuit CHS11 (VT/GN) For An Open Or Short To Ground - Fusion & Milan
Courtesy of FORD MOTOR CO.

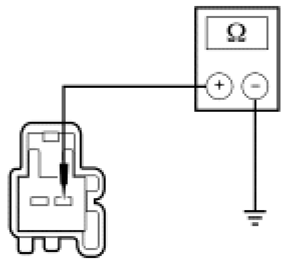
- For Fusion and Milan, measure the resistance between driver seat cushion heater C364-2, circuit CHS11 (VT/GN), harness side and ground; and between C364-2, circuit CHS11 (VT/GN), harness side and driver seat backrest heater C365-1, circuit CHS11 (VT/GN) harness side.
- **Is the resistance greater than 10,000 ohms between the driver seat cushion heater and ground and less than 5 ohms between the driver seat cushion heater and driver seat backrest heater?**

  YES : Go to O8.

  NO : REPAIR circuit CHS11 (VT/GN). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

O8 CHECK CIRCUIT GD126 (BK/WH) FOR AN OPEN



N0040603

Fig. 101: Checking Circuit GD126 (BK/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat backrest heater C365-2, circuit GD126 (BK/WH), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to O9.

  NO : REPAIR circuit GD126 (BK/WH). TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

O9 CHECK CUSHION HEATER FOR SHORT TO GROUND OR AN OPEN

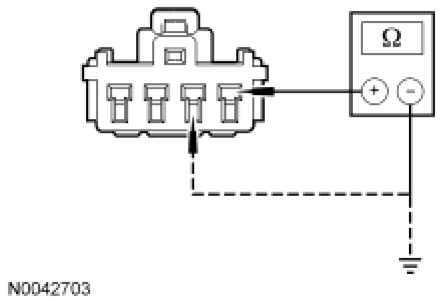


Fig. 102: Checking Cushion Heater For Short To Ground Or Open - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between driver seat cushion heater C3298 pin 1, circuit CHS02 (YE/BU), component side and C3298 pin 2, circuit CHS11 (VT/GN), component side; and between C3298 pin 1, circuit CHS02 (YE/BU), component side and ground.

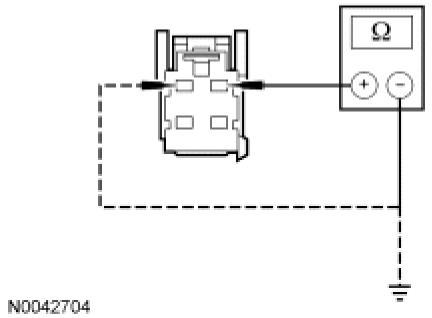


Fig. 103: Checking Cushion Heater For Short To Ground Or Open - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the resistance between driver seat cushion heater C364 pin 1, circuit CHS02 (YE/BU), component side and C364 pin 2, circuit CHS11 (VT/GN), component side; and between C364 pin 1, circuit CHS02 (YE/BU), component side and ground.
- **Is the resistance greater than 1.6 ohms and less than 10 ohms between driver seat cushion heater pin 1 and pin 2; and greater than 10,000 ohms between driver seat cushion heater pin 1 and ground?**

  YES : Go to O10.

  NO : INSTALL a new driver seat cushion heater. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to

SUPPLEMENTAL RESTRAINT SYSTEM article.

O10 CHECK THE SEAT BACKREST HEATER FOR AN OPEN

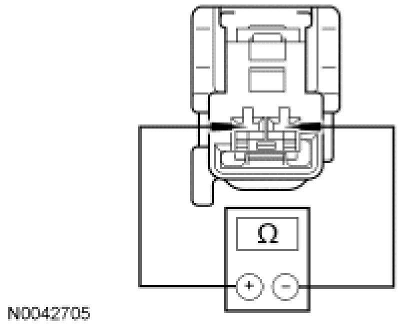


Fig. 104: Checking Seat Backrest Heater
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat backrest heater C365 pin 1, circuit CHS11 (VT/GN), component side and C365 pin 2, circuit GD126 (BK/WH), component side.
- **Is the resistance between 0.6 and 0.9 ohm?**

  YES : Go to O11.

  NO : INSTALL a new driver seat backrest heater. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

O11 CHECK THE HEATED SEAT TEMPERATURE SENSOR AND CIRCUITS FOR A SHORT TO VOLTAGE

- Key in ON position.

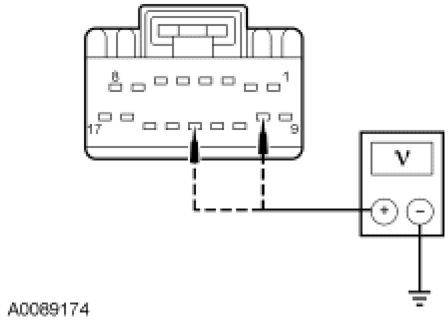


Fig. 105: Checking Heated Seat Temperature Sensor And Circuits For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C3304-13, circuit RHS05 (YE/VT), harness side and ground and between C3304-10, circuit VHS26 (VT), harness side and ground.

- **Is any voltage present?**

  YES : REPAIR the affected circuit RHS05 (YE/VT) or VHS26 (VT). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to O12.

O12 CHECK THE HEATED SEAT TEMPERATURE SENSOR AND CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.

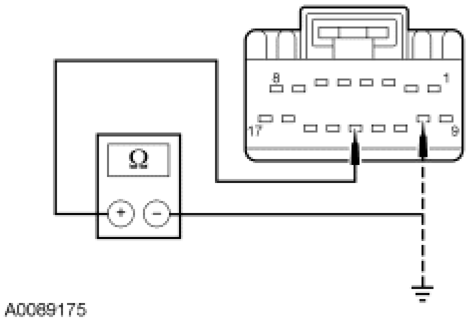


Fig. 106: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3304-13, circuit RHS05 (YE/VT), harness side and C3304-10, circuit VHS26 (VT), harness side; and between heated seat module C3304-13, circuit RHS05 (YE/VT), harness side and ground.
- **Is the resistance less than 300,000 ohms and greater than 50 ohms between heated seat module pin 13 and pin 10 and greater than 10,000 ohms between heated seat module pin 13 and ground?**

  YES : Go to O15.

  NO : Go to O13.

O13 CHECK CIRCUIT RHS05 (YE/VT) FOR AN OPEN OR SHORT TO GROUND

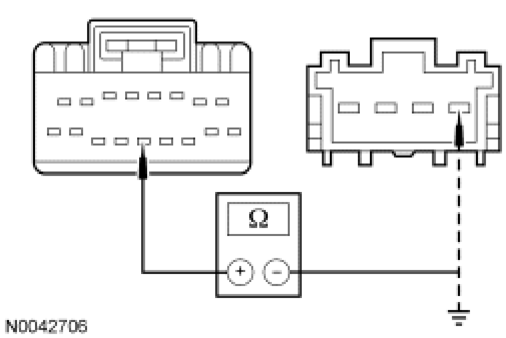


Fig. 107: Checking Circuit RHS05 (YE/VT) For Open Or Short To Ground - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between heated seat module C3304-13, circuit RHS05 (YE/VT), harness side and the driver seat cushion heater C3298-4, circuit RHS05 (YE/VT), harness side; and between heated seat module C3304-13, circuit RHS05 (YE/VT), harness side and ground.

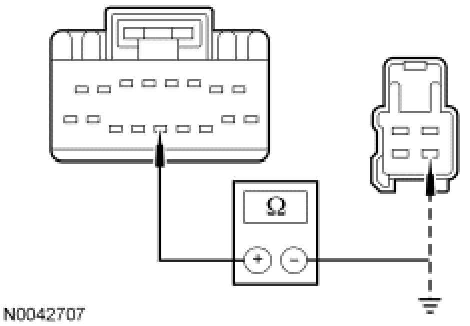


Fig. 108: Checking Circuit RHS05 (YE/VT) For Open Or Short To Ground - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the resistance between heated seat module C3304-13, circuit RHS05 (YE/VT), harness side and the driver seat cushion heater C364-4, circuit RHS05 (YE/VT), harness side; and between heated seat module C3304-13, circuit RHS05 (YE/VT), harness side and ground.
- **Is the resistance less than 5 ohms between the heated seat module and the driver seat cushion heater and greater than 10,000 ohms between the heated seat module and ground?**

YES : Go to O14.

NO : REPAIR circuit RHS05 (YE/VT). TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

O14 CHECK CIRCUIT VHS26 (VT) FOR AN OPEN OR SHORT TO GROUND

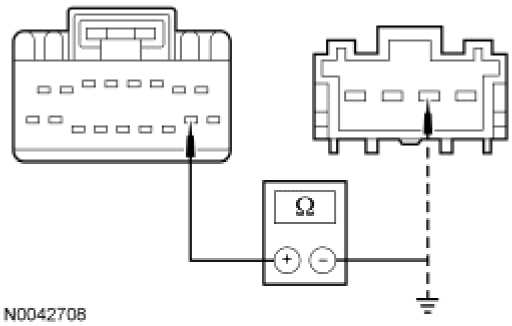


Fig. 109: Checking Circuit VHS26 (VT) For Open Or Short To Ground - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between heated seat module C3304-10, circuit VHS26 (VT), harness side and driver seat cushion heater C3298-3, circuit VHS26 (VT), harness side; and between heated seat module C3304-10, circuit VHS26 (VT), harness side and ground.

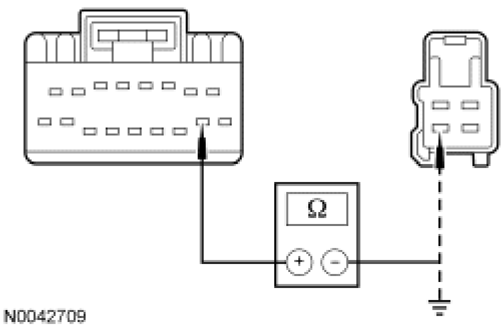


Fig. 110: Checking Circuit VHS26 (VT) For Open Or Short To Ground - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the resistance between heated seat module C3304-10, circuit VHS26 (VT), harness side and driver seat cushion heater C364-3, circuit VHS26 (VT), harness side; and between heated seat module C3304-10, circuit VHS26 (VT), harness side and ground.
- **Is the resistance less than 5 ohms between the heated seat module and the driver seat cushion heater and greater than 10,000 ohms between the heated seat module and ground?**

  YES : INSTALL a new driver seat cushion heater. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR circuit VHS26 (VT). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

O15 CHECK CIRCUIT CHS29 (WH/BU) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: HVAC Module C2356b (MKZ) or C228b (Fusion and Milan)
- Key in ON position.

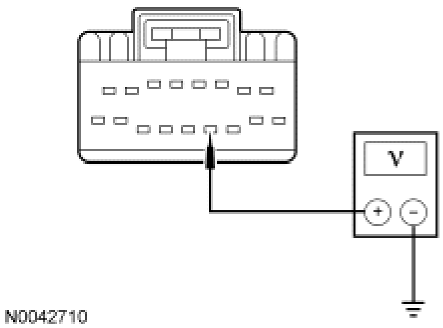


Fig. 111: Checking Circuit CHS29 (WH/BU) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C3304-12, circuit CHS29 (WH/BU), harness side and ground.
- **Is the voltage less than 0.2 volt?**

  YES : Go to O16.

  NO : REPAIR circuit CHS29 (WH/BU). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

O16 CHECK CIRCUIT CHS29 (WH/BU) FOR A SHORT TO GROUND

- Key in OFF position.

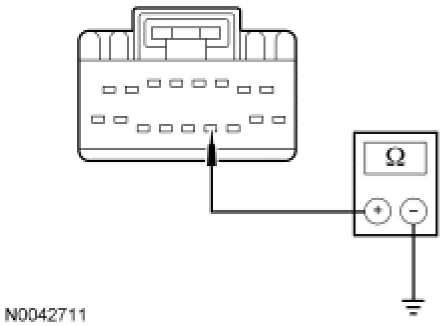


Fig. 112: Checking Circuit CHS29 (WH/BU) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3304-12, circuit CHS29 (WH/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to O17.

  NO : REPAIR circuit CHS29 (WH/BU). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327.

CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

O17 CHECK CIRCUIT CHS29 (WH/BU) FOR AN OPEN

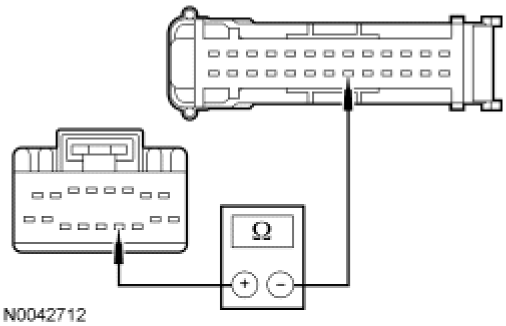


Fig. 113: Checking Circuit CHS29 (WH/BU) For An Open
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between heated seat module C3304-12, circuit CHS29 (WH/BU), harness side and HVAC module C2356b-6, circuit CHS29 (WH/BU), harness side.

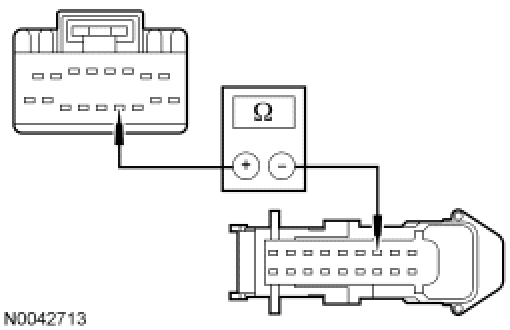


Fig. 114: Checking Circuit CHS29 (WH/BU) For Open - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the resistance between heated seat module C3304-12, circuit CHS29 (WH/BU), harness side and HVAC module C228b-7, circuit CHS29 (WH/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to O18.

  NO : REPAIR circuit CHS29 (WH/BU). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

O18 CHECK THE HVAC MODULE OUTPUT

- Connect: HVAC Module C2356b (MKZ) or C228b (Fusion and Milan)

- Connect: Heated Seat Module C3304
- Key in ON position.

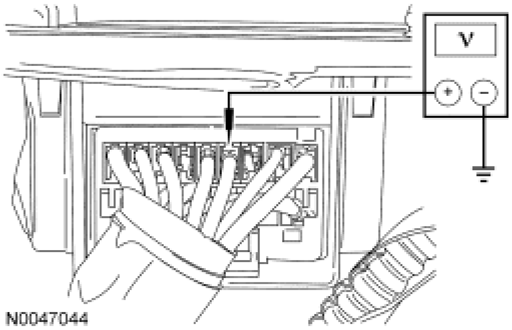


Fig. 115: Checking HVAC Module Output
Courtesy of FORD MOTOR CO.

NOTE:	**The following measurement must be taken by back-probing the heated seat module C3304.**

NOTE:	**The voltage on circuit CHS29 (WH/BU) should drop momentarily when the driver heated seat control button is pressed.**

- Measure the voltage between heated seat module C3304-12, circuit CHS29 (WH/BU), harness side and ground by back-probing heated seat module connector. Press the driver heated seat control button on the HVAC module and note the voltage.
- **Is the voltage greater than 10 volts before pressing the driver heated seat control button, then momentarily drops when the heated seat control button is pressed?**

  YES : INSTALL a new heated seat module. REFER to **Heated Seat Module**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the voltage is greater than 10 volts but did not drop when the driver heated seat button was pressed, INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  If the voltage is less than 10 volts, INSTALL a new heated seat module. REFER to **Heated Seat Module**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test P: The Heated Seat is Inoperative - Passenger

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

The heated seat module receives ignition voltage on circuit CBP19 (BN/WH), battery voltage on circuit SBB11 (BU/RD) and is supplied ground on circuit GD139 (BK/YE). When ignition switched voltage is supplied and the passenger heated seat button on the HVAC module is pressed, a momentary ground signal is sent to the heated seat module on circuit CHS30 (GN/YE) to command the system ON or OFF. Upon receiving a signal, the heated seat module will decrease one setting (the sequence is HI, LO, OFF, HI, etc.). The heated seat module supplies voltage to the cushion and backrest heater mats on circuit CHS07 (GY/BU). Ground to the heater mats is provided on circuit GD139 (BK/YE). The cushion and backrest heater mats are connected in series and operate together. Temperature is maintained by the heated seat module using a sensor contained within the cushion heater mat. The heated seat module supplies a reference voltage to the temperature sensor on circuit RHS05 (YE/VT) and monitors the signal from the temperature sensor on circuit VHS27 (WH/OG) for controlling current flow to the heater mats. The heated seat module is designed to remain ON, heating the seat and maintaining temperature until switched OFF.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Heater mat
- Heated seat module
- HVAC module

PINPOINT TEST P: THE HEATED SEAT IS INOPERATIVE - PASSENGER

NOTE:	**The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

P1 CHECK CIRCUIT SBB11 (BU/RD) FOR VOLTAGE TO THE HEATED SEAT MODULE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: Heated Seat Module C3304

WARNING:	**Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may**

result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

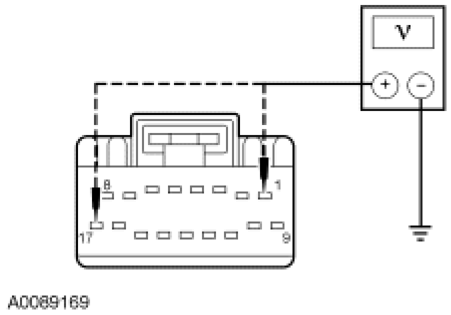


Fig. 116: Checking Circuit SBB11 (BU/RD) For Voltage To Heated Seat Module
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C3304-1, circuit SBB11 (BU/RD) harness side and ground and C3304-17, circuit SBB11 (BU/RD) harness side and ground.
- **Are the voltages greater than 10 volts?**

  YES : Go to P2.

  NO : VERIFY battery junction box (BJB) fuse 11 (20A Fusion and Milan) (30A MKZ) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P2 CHECK CIRCUIT CBP19 (BN/WH) FOR VOLTAGE TO THE HEATED SEAT MODULE

- Key in ON position.

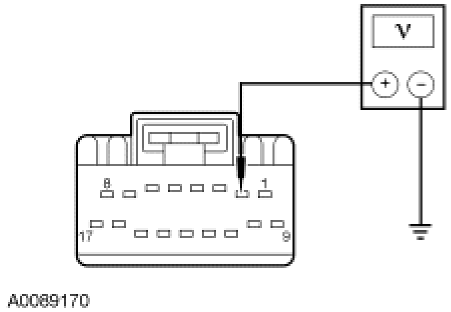


Fig. 117: Checking Circuit CBP19 (BN/WH) For Voltage To Heated Seat Module
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C3304-2, circuit CBP19 (BN/WH), harness side and ground.

- **Is the voltage greater than 10 volts?**

  YES : Go to P3.

  NO : VERIFY smart junction box (SJB) fuse 28 (10A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P3 CHECK HEATED SEAT MODULE GROUND CIRCUIT GD139 (BK/YE) FOR AN OPEN

- Key in OFF position.

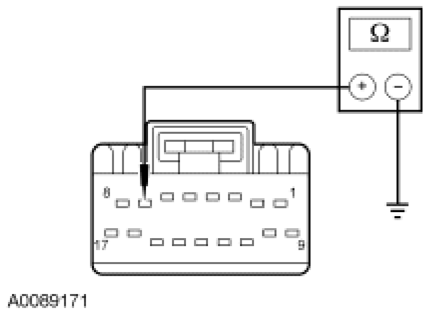


Fig. 118: Checking Heated Seat Module Ground Circuit GD139 (BK/YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3304-7, circuit GD139 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to P4.

  NO : REPAIR circuit GD139 (BK/YE). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P4 CHECK CIRCUIT CHS07 (GY/BU) FOR A SHORT TO VOLTAGE

- Disconnect: Passenger Seat Cushion Heater C334/C3320
- Key in ON position.

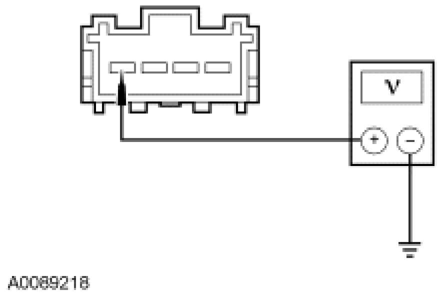


Fig. 119: Checking Circuit CHS07 (GY/BU) For A Short To Voltage - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the voltage between passenger seat cushion heater C3320-1, circuit CHS07 (GY/BU), harness side and ground.

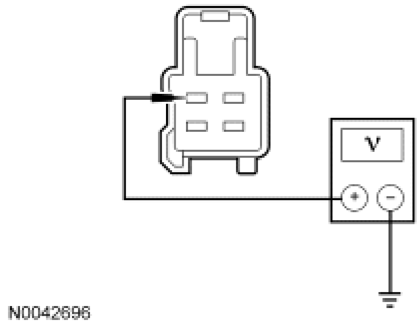


Fig. 120: Checking Circuit CHS07 (GY/BU) For A Short To Voltage - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the voltage between passenger seat cushion heater C334-1, circuit CHS07 (GY/BU), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR circuit CHS07 (GY/BU). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to P5.

P5 CHECK CIRCUIT CHS07 (GY/BU) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.

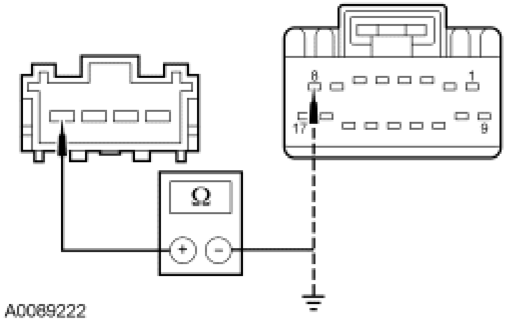


Fig. 121: Checking Circuit CHS07 (GY/BU) For An Open Or Short To Ground - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between passenger seat cushion heater C3320-1, circuit CHS07 (GY/BU), harness side and ground; and between C3320-1, circuit CHS07 (GY/BU), harness side and heated seat module C3304-8, circuit CHS07 (GY/BU) harness side.

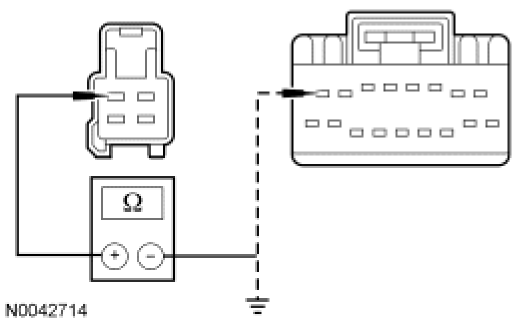


Fig. 122: Checking Circuit CHS07 (GY/BU) For An Open Or Short To Ground - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the resistance between passenger seat cushion heater C334-1, circuit CHS07 (GY/BU), harness side and ground; and between C334-1, circuit CHS07 (GY/BU), harness side and heated seat module C3304-8, circuit CHS07 (GY/BU) harness side.
- **Is the resistance greater than 10,000 ohms between the passenger seat cushion heater and ground and less than 5 ohms between the passenger seat cushion heater and the heated seat module?**

  YES : Go to P6.

  NO : REPAIR circuit CHS07 (GY/BU). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P6 CHECK CIRCUIT CHS12 (YE/GN) FOR A SHORT TO VOLTAGE

- Disconnect: Passenger Seat Backrest Heater C335
- Key in ON position.

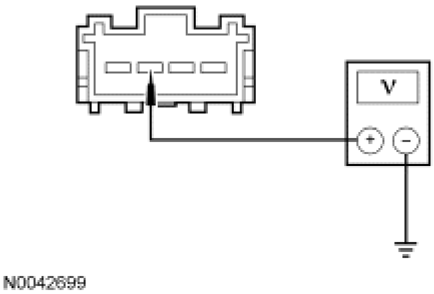


Fig. 123: Checking Circuit CHS12 (YE/GN) For A Short To Voltage - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the voltage between passenger seat cushion heater C3320-2, circuit CHS12 (YE/GN), harness side and ground.

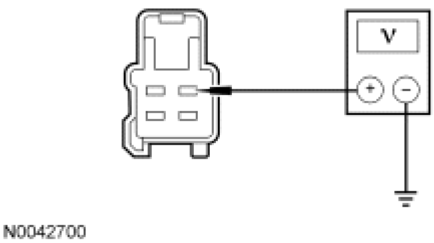


Fig. 124: Checking Circuit CHS12 (YE/GN) For A Short To Voltage - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the voltage between passenger seat cushion heater C334-2, circuit CHS12 (YE/GN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR circuit CHS12 (YE/GN). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to P7.

P7 CHECK CIRCUIT CHS12 (YE/GN) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.

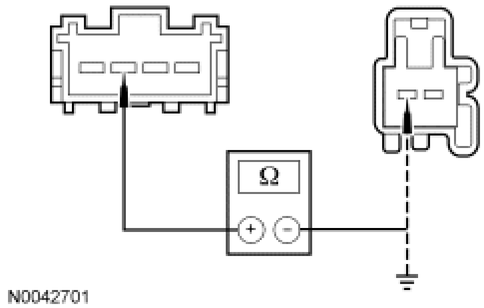


Fig. 125: Checking Circuit CHS12 (YE/GN) For An Open Or Short To Ground - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between passenger seat cushion heater C3320-2, circuit CHS12 (YE/GN), harness side and ground; and between C3320-2, circuit CHS12 (YE/GN), harness side and passenger seat backrest heater C335-1, circuit CHS12 (YE/GN) harness side.

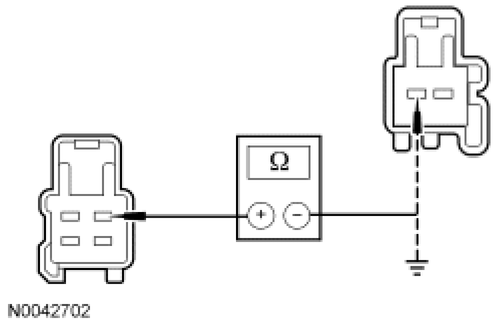


Fig. 126: Checking Circuit CHS12 (YE/GN) For An Open Or Short To Ground - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the resistance between passenger seat cushion heater C334-2, circuit CHS12 (YE/GN), harness side and ground; and between C334-2, circuit CHS12 (YE/GN), harness side and passenger seat backrest heater C335-1, circuit CHS12 (YE/GN) harness side.
- **Is the resistance greater than 10,000 ohms between the passenger seat cushion heater and ground and less than 5 ohms between the passenger seat cushion heater and passenger seat backrest heater?**

  YES : Go to P8.

  NO : REPAIR circuit CHS12 (YE/GN). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P8 CHECK CIRCUIT GD139 (BK/YE) FOR AN OPEN

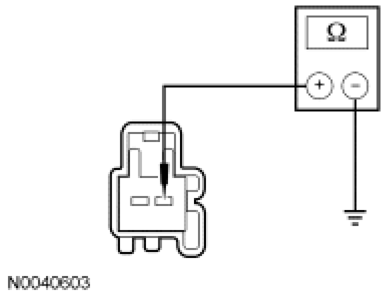


Fig. 127: Checking Circuit GD139 (BK/YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat backrest heater C335-2, circuit GD139 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to P9.

  NO : REPAIR circuit GD139 (BK/YE). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P9 CHECK CUSHION HEATER FOR A SHORT TO GROUND OR AN OPEN

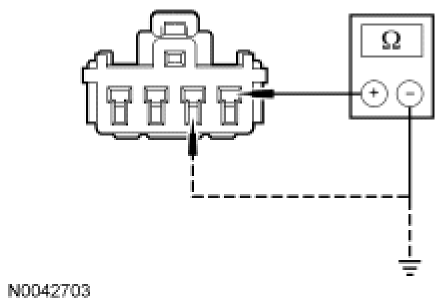


Fig. 128: Checking Cushion Heater For Short To Ground Or Open - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between passenger cushion heater C3320 pin 1, circuit CHS07 (GY/BU), component side and C3320 pin 2, circuit CHS12 (YE/GN), component side; and between C334 pin 1, circuit CHS07 (GY/BU), component side and ground.

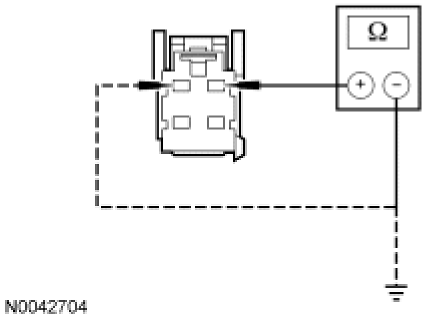


Fig. 129: Checking Cushion Heater For Short To Ground Or Open - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the resistance between passenger seat cushion heater C334 pin 1, circuit CHS07 (GY/BU), component side and C334 pin 2, circuit CHS12 (YE/GN), component side; and between C334 pin 1, circuit CHS07 (GY/BU), component side and ground.
- **Is the resistance greater than 1.6 ohms and less than 10 ohms between the passenger seat cushion heater pin 1 and pin 2 and greater than 10,000 ohms between the passenger seat cushion heater pin 1 and ground?**

  YES : Go to P10.

  NO : INSTALL a new passenger seat cushion heater. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P10 CHECK THE SEAT BACKREST HEATER FOR AN OPEN

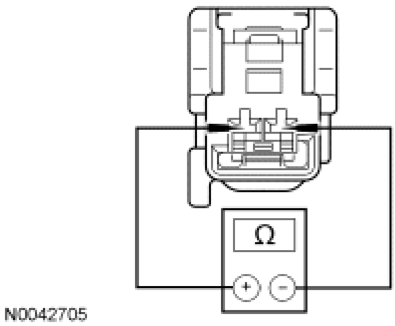


Fig. 130: Checking Seat Backrest Heater
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger seat backrest heater C335 pin 1, circuit CHS12 (YE/GN), component side and C335 pin 2, circuit GD139 (BK/YE), component side.
- **Is the resistance between 0.6 and 0.9 ohm?**

  YES : Go to P11.

  NO : INSTALL a new driver seat backrest heater. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P11 CHECK THE HEATED SEAT TEMPERATURE SENSOR AND CIRCUITS FOR A SHORT TO VOLTAGE

- Key in ON position.

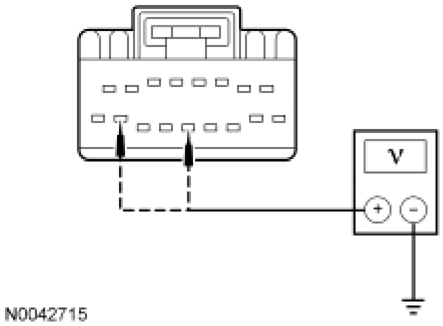


Fig. 131: Checking Heated Seat Temperature Sensor And Circuits For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between heated seat module C3304-13, circuit RHS05 (YE/VT), harness side and ground and between C3304-16, circuit VHS27 (WH/OG), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the affected circuit RHS05 (YE/VT) or VHS27 (WH/OG). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to P12.

P12 CHECK THE HEATED SEAT TEMPERATURE SENSOR AND CIRCUITS FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.

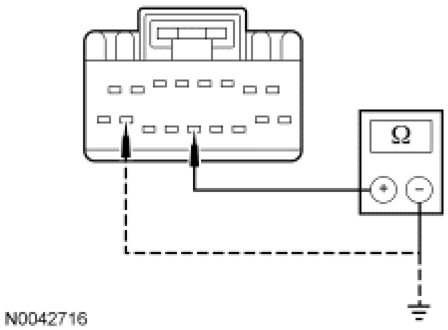


Fig. 132: Checking Heated Seat Temperature Sensor And Circuits For Open Or Short To Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between heated seat module C3304-13, circuit RHS05 (YE/VT), harness side and C3304-16, circuit VHS27 (WH/OG), harness side; and between heated seat module C3304-13, circuit RHS05 (YE/VT), harness side and ground.
- **Is the resistance less than 300,000 ohms and greater than 50 ohms between heated seat module pin 13 and pin 16 and greater than 10,000 ohms between heated seat module pin 13 and ground?**

  YES : Go to P15.

  NO : Go to P13.

P13 CHECK CIRCUIT RHS05 (YE/VT) FOR AN OPEN OR SHORT TO GROUND

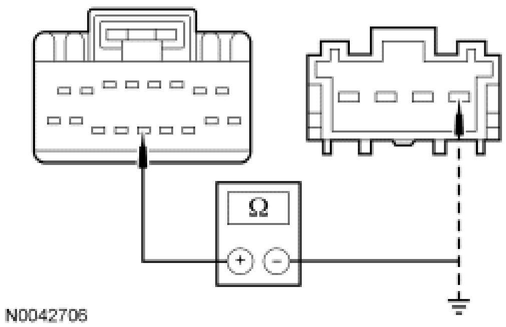


Fig. 133: Checking Circuit RHS05 (YE/VT) For Open Or Short To Ground - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between heated seat module C3304-13, circuit RHS05 (YE/VT), harness side and the passenger seat cushion heater C3320-4, circuit RHS05 (YE/VT), harness side; and between heated seat module C3304-13, circuit RHS05 (YE/VT), harness side and ground.

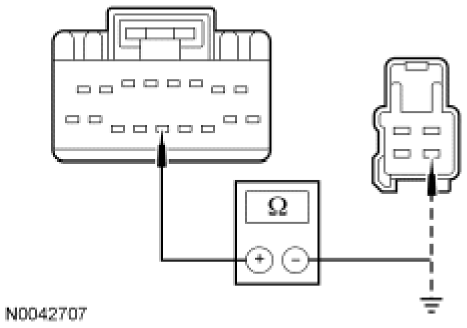


Fig. 134: Checking Circuit RHS05 (YE/VT) For Open Or Short To Ground - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the resistance between heated seat module C3304-13, circuit RHS05 (YE/VT), harness side and the passenger seat cushion heater C334-4, circuit RHS05 (YE/VT), harness side; and between heated seat module C3304-13, circuit RHS05 (YE/VT), harness side and ground.

- **Is the resistance less than 5 ohms between the heated seat module and passenger seat cushion heater and greater than 10,000 ohms between the heated seat module and ground?**

  YES : Go to P14.

  NO : REPAIR circuit RHS05 (YE/VT). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P14 CHECK CIRCUIT VHS27 (WH/OG) FOR AN OPEN OR SHORT TO GROUND

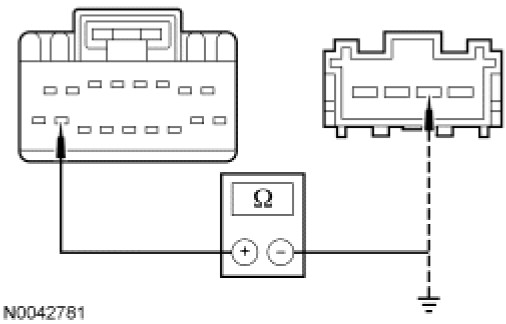


Fig. 135: Checking Circuit VHS27 (WH/OG) For Open Or Short To Ground - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between heated seat module C3304-16, circuit VHS27 (WH/OG), harness side and passenger seat cushion heater C3320-3, circuit VHS27 (WH/OG), harness side; and between heated seat module C3304-16, circuit VHS27 (WH/OG), harness side and ground.

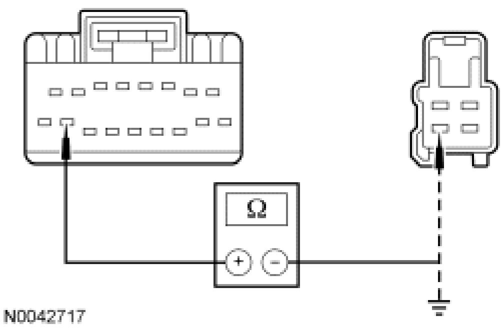


Fig. 136: Checking Circuit VHS27 (WH/OG) For Open Or Short To Ground - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the resistance between heated seat module C3304-16, circuit VHS27 (WH/OG), harness side and passenger seat cushion heater C334-3, circuit VHS27 (WH/OG), harness side; and between heated seat module C3304-16, circuit VHS27 (WH/OG), harness side and ground.
- **Is the resistance less than 5 ohms between the heated seat module and passenger seat cushion heater and greater than 10,000 ohms between the heated seat module and ground?**

YES : INSTALL a new passenger seat cushion heater. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : REPAIR circuit VHS27 (WH/OG). TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P15 CHECK CIRCUIT CHS30 (GY/YE) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: HVAC Module C2356b (MKZ) or C228b (Fusion and Milan)
- Key in ON position.

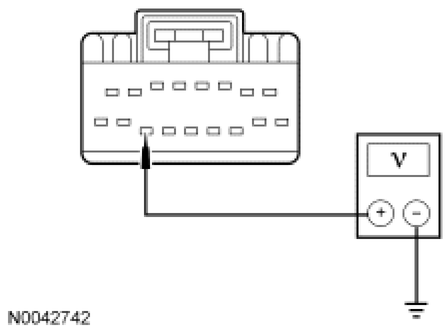


Fig. 137: Checking Circuit CHS30 (GY/YE) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between passenger heated seat module C3304-15, circuit CHS30 (GY/YE), harness side and ground.
- **Is the voltage less than 0.2 volt?**

YES : Go to P16.

NO : REPAIR circuit CHS30 (GY/YE). TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P16 CHECK CIRCUIT CHS30 (GY/YE) FOR A SHORT TO GROUND

- Key in OFF position.

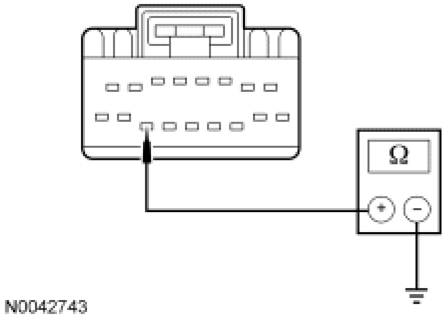


Fig. 138: Checking Circuit CHS30 (GY/YE) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger heated seat module C3304-15, circuit CHS30 (GY/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to P17.

  NO : REPAIR circuit CHS30 (GY/YE). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P17 CHECK CIRCUIT CHS30 (GY/YE) FOR AN OPEN

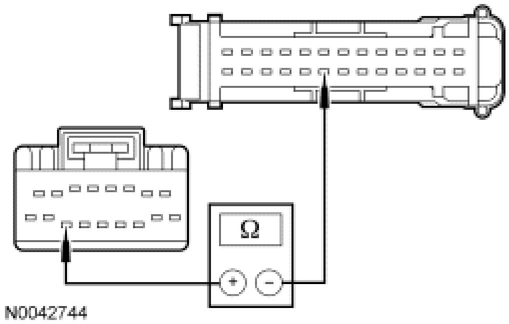


Fig. 139: Checking Circuit CHS30 (GY/YE) For Open - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between passenger heated seat module C3304-15, circuit CHS30 (GY/YE), harness side and HVAC module C2356b-19, circuit CHS30 (GY/YE), harness side.

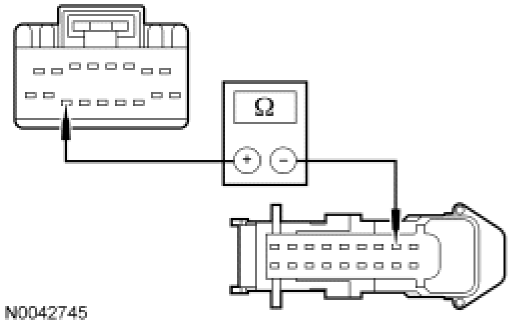


Fig. 140: Checking Circuit CHS30 (GY/YE) For Open - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the resistance between passenger heated seat module C3304-15, circuit CHS30 (GY/YE), harness side and HVAC module C228b-8, circuit CHS30 (GY/YE), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to P18.

  NO : REPAIR circuit CHS30 (GY/YE). TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

P18 CHECK THE HVAC MODULE OUTPUT

- Connect: HVAC Module C2356b (MKZ) or C228b (Fusion and Milan)
- Connect: Heated Seat Module C3304
- Key in ON position.

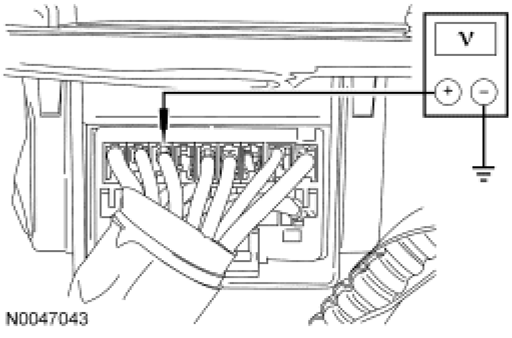


Fig. 141: Checking HVAC Module Output
Courtesy of FORD MOTOR CO.

NOTE:	**The following measurement must be taken by back-probing the heated seat module C3304.**

NOTE:	**The voltage on circuit CHS30 (GY/YE) should drop momentarily when**

the passenger heated seat control button is pressed.

- Measure the voltage between passenger heated seat module C3304-15, circuit CHS30 (GY/YE), harness side and ground by back-probing heated seat module connector. Press the passenger heated seat control button on the HVAC module and note the voltage.
- **Is the voltage greater than 10 volts before pressing the passenger heated seat control button, then momentarily drops when the heated seat control button is pressed?**

  YES : INSTALL a new heated seat module. REFER to **Heated Seat Module**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the voltage is greater than 10 volts but did not drop when the passenger heated seat button was pressed, INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  If the voltage is less than 10 volts, INSTALL a new heated seat module. REFER to **Heated Seat Module**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test Q: The Heated Seat is Inoperative - Driver Seat Does Heat But the Heated Seat Indicator Does Not Illuminate When Pressed

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Upon receiving a signal from the HVAC module, the heated seat module will decrease one setting (the sequence is HI, LO, OFF, HI, etc.). When the driver heated seat is set to HI, both LED indicators above the driver heated seat control button will illuminate. When the driver heated seat is set to LO, only the left LED on the driver heated seat indicator will illuminate. When the driver heated seat is set to OFF, neither driver heated seat LED will illuminate.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Heated seat module
- HVAC module

PINPOINT TEST Q: THE HEATED SEAT IS INOPERATIVE - DRIVER SEAT DOES HEAT BUT THE HEATED SEAT INDICATOR DOES NOT ILLUMINATE WHEN PRESSED

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

Q1 CHECK CIRCUITS CHS04 (YE/GY) AND CHS13 (VT/BN) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag module C327.
- Disconnect the passenger seat side air bag module C313.
- Disconnect: HVAC Module C2356b (MKZ) or C228b (Fusion and Milan)
- Disconnect: Heated Seat Module C3304

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

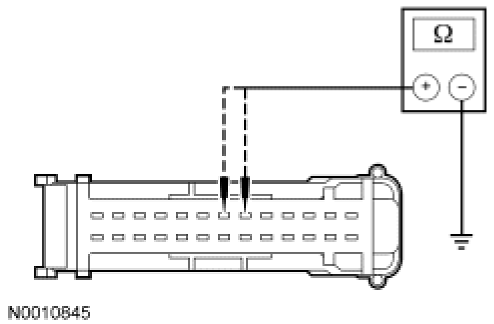


Fig. 142: Checking Circuits CHS04 (YE/GY) And CHS13 (VT/BN) For Short To Ground - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between HVAC module C2356b-7, circuit CHS04 (YE/GY), harness side and ground; and between HVAC module C2356b-8, circuit CHS13 (VT/BN), harness side and ground.

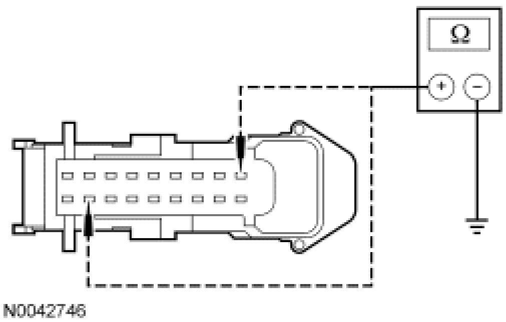


Fig. 143: Checking Circuits CHS04 (YE/GY) And CHS13 (VT/BN) For Short To Ground - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the resistance between HVAC module C228b-11, circuit CHS04 (YE/GY), harness side and ground; and between HVAC module C228b-9, circuit CHS13 (VT/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to Q2.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Q2 CHECK CIRCUITS CHS04 (YE/GY) AND CHS13 (VT/BN) FOR AN OPEN

- Key in ON position.

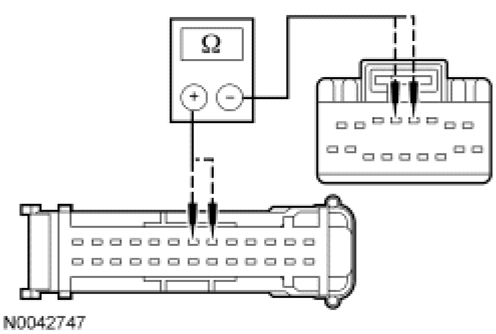


Fig. 144: Checking Circuits CHS04 (YE/GY) And CHS13 (VT/BN) For Open - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between HVAC module C2356b-7, circuit CHS04 (YE/GY), harness side and heated seat module C3304-5, circuit CHS04 (YE/GY), harness side; and between HVAC module C2356b-8, circuit CHS13 (VT/BN), harness side and heated seat module C3304-4, circuit CHS13 (VT/BN), harness side.

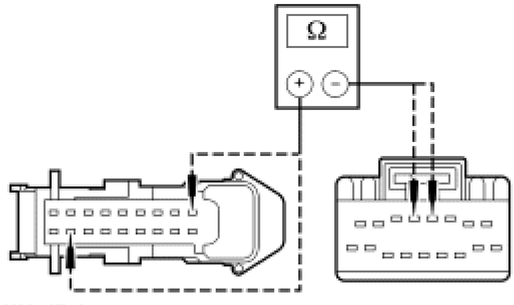


Fig. 145: Checking Circuits CHS04 (YE/GY) And CHS13 (VT/BN) For Open - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the resistance between HVAC module C228b-11, circuit CHS04 (YE/GY), harness side and heated seat module C3304-5, circuit CHS04 (YE/GY), harness side; and between HVAC module C228b-9, circuit CHS13 (VT/BN), harness side and heated seat module C3304-4, circuit CHS13 (VT/BN), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to Q3.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Q3 CHECK THE HEATED SEAT MODULE HI INDICATOR ON THE HVAC MODULE

- Connect: HVAC Module C2356b (MKZ) or C228b (Fusion and Milan)
- Key in ON position.

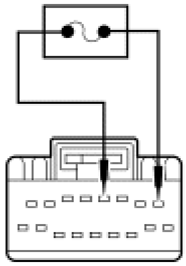


Fig. 146: Checking Heated Seat Module HI Indicator On EATC Module
Courtesy of FORD MOTOR CO.

- Connect a fused jumper lead between heated seat module C3304-4, circuit CHS13 (VT/BN), harness side and C3304-1, circuit SBB11 (BU/RD), harness side.
- **Do both driver heated seat indicator LEDs illuminate on the HVAC module?**

YES : Go to Q4.

NO : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Q4 CHECK THE HEATED SEAT MODULE LOW INDICATOR ON THE HVAC MODULE

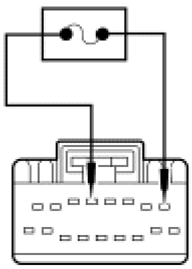


Fig. 147: Checking Heated Seat Module Low Indicator On EATC Module
Courtesy of FORD MOTOR CO.

- Connect a fused jumper lead between heated seat module C3304-5, circuit CHS04 (YE/GY), harness side and C3304-1, circuit SBB11 (BU/RD), harness side.
- **Does only the left driver heated seat indicator LED illuminate on the HVAC module?**

  YES : INSTALL a new heated seat module. REFER to **Heated Seat Module**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test R: The Heated Seat is Inoperative - Passenger Seat Does Heat But the Heated Seat Indicator Does Not Illuminate When Pressed

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Upon receiving a signal from the HVAC module, the heated seat module will decrease one setting (the sequence is HI, LO, OFF, HI, etc.). When the passenger heated seat is set to HI, both LED indicators above the passenger heated seat control button will illuminate. When the passenger heated seat is set to LO, only the left LED on the passenger heated seat indicator will illuminate. When the passenger heated seat is set to OFF, neither passenger heated seat LED will illuminate.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Heated seat module
- HVAC module

PINPOINT TEST R: THE HEATED SEAT IS INOPERATIVE - PASSENGER SEAT DOES HEAT BUT THE HEATED SEAT INDICATOR DOES NOT ILLUMINATE WHEN PRESSED

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

R1 CHECK CIRCUITS CHS09 (GY) AND CHS14 (GN) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: HVAC Module C2356b (MKZ) or C228b (Fusion and Milan)
- Disconnect: Heated Seat Module C3304

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

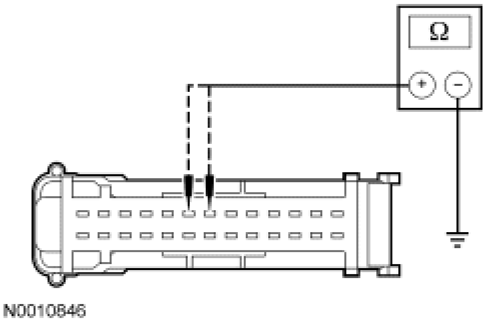


Fig. 148: Checking Circuits CHS09 (GY) And CHS14 (GN) For Short To Ground - MKZ
Courtesy of FORD MOTOR CO.

- For MKZ, measure the resistance between HVAC module C2356b-20, circuit CHS09 (GY), harness side and ground; and between HVAC module C2356b-21, circuit CHS14 (GN), harness side and ground.

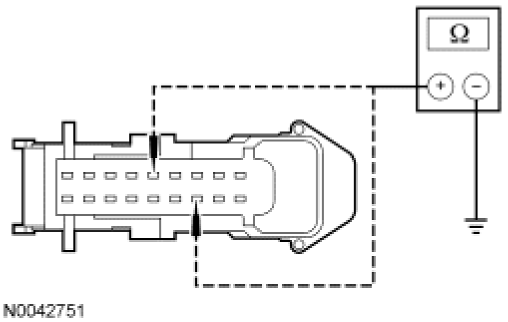


Fig. 149: Checking Circuits CHS09 (GY) And CHS14 (GN) For Short To Ground - Fusion & Milan
Courtesy of FORD MOTOR CO.

- For Fusion and Milan, measure the resistance between HVAC module C228b-5, circuit CHS09 (GY), harness side and ground; and between HVAC module C228b-16, circuit CHS14 (GN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to R2.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

R2 CHECK CIRCUITS CHS09 (GY) AND CHS14 (GN) FOR AN OPEN

- Key in ON position.

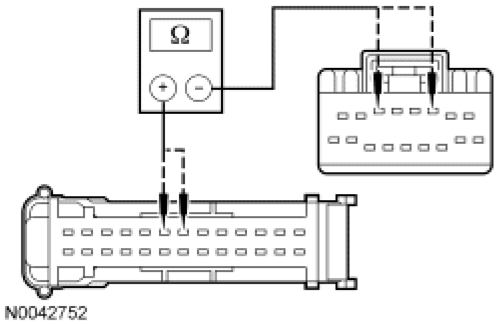


Fig. 150: Checking Circuits CHS09 (GY) And CHS14 (GN) For Open (1 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module C2356b-20, circuit CHS09 (GY), harness side and heated seat module C3304-3, circuit CHS09 (GY), harness side; and between HVAC module C2356b-21, circuit CHS14 (GN), harness side and heated seat module C3304-6, circuit CHS14 (GN), harness side.

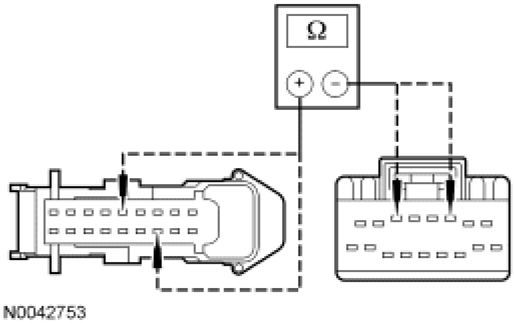


Fig. 151: Checking Circuits CHS09 (GY) And CHS14 (GN) For Open (2 Of 2)
Courtesy of FORD MOTOR CO.

- Measure the resistance between HVAC module C228b-5, circuit CHS09 (GY), harness side and heated seat module C3304-3, circuit CHS09 (GY), harness side; and between HVAC module C228b-16, circuit CHS14 (GN), harness side and heated seat module C3304-6, circuit CHS14 (GN), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to R3.

  NO : REPAIR the affected circuit. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

R3 CHECK THE HEATED SEAT MODULE HI INDICATOR ON THE HVAC MODULE

- Connect: HVAC Module C2356b (MKZ) or C228b (Fusion and Milan)
- Key in ON position.

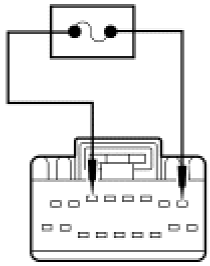


Fig. 152: Checking Heated Seat Module HI Indicator On EATC Module
Courtesy of FORD MOTOR CO.

- Connect a fused jumper lead between heated seat module C3304-6, circuit CHS14 (GN), harness side and C3304-1, circuit SBB11 (BU/RD), harness side.
- **Do both passenger heated seat indicator LEDs illuminate on the HVAC module?**

  YES : Go to R4.

  NO : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

R4 CHECK THE HEATED SEAT MODULE LOW INDICATOR ON THE HVAC MODULE

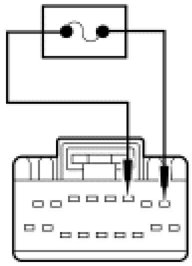


Fig. 153: Checking Heated Seat Module Low Indicator On EATC Module
Courtesy of FORD MOTOR CO.

- Connect a fused jumper lead between passenger heated seat module C3304-3, circuit CHS09 (GY), harness side and C3304-1, circuit SBB11 (BU/RD), harness side.
- **Does only the left passenger heated seat indicator LED illuminate on the HVAC module?**

  YES : INSTALL a new heated seat module. REFER to **Heated Seat Module**. TEST the system for normal operation.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. TEST the system for normal operation.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test S: DTC B103B/B1111 - Thermo-Electric Driver Overcurrent Low/Driver Thermo-Electric Device Control Overtemperature Fault

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B103B Thermo-Electric Driver Overcurrent Low - If DCSM outputs to the driver seat backrest or cushion TED (circuit pins G, H, J or K at the DCSM connector) or any components within these circuit loops are shorted to ground or a TED resistance of less than 0.9 ohm is sensed, the DCSM will shut down the driver seat system and set this DTC.
- DTC B1111 Driver Thermo-Electric Device Control Overtemperature Fault - If the DCSM TED driver integrated circuit temperature exceeds 175°C (347°F), the DCSM will shut down the driver seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- TED assembly

- DCSM

PINPOINT TEST S: DTC B103B/B1111 - THERMO-ELECTRIC DRIVER OVERCURRENT LOW/DRIVER THERMO-ELECTRIC DEVICE CONTROL OVERTEMPERATURE FAULT

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

S1 CHECK THE TED CIRCUITS FOR SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag module C327.
- Disconnect the passenger seat side air bag module C313.
- Disconnect: DCSM C3305a

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Measure the resistance between the following DCSM pins, harness side and ground.

Connector-Pin	Circuit
C3305a-G	CHS02 (YE/BU)
C3305a-H	RHS02 (BU/OG)
C3305a-J	CHS01 (GY/VT)
C3305a-K	RHS01 (WH/VT)

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to S2.

  NO : If the resistances of C3305a-G, circuit CHS02 (YE/BU) and/or C3305a-H, circuit RHS02 (BU/OG) to ground were **not** greater than 10,000 ohms to ground, go to S6.

If resistances of C3305a-J, circuit CHS01 (GY/VT) and/or C3305a-K, circuit RHS01 (WH/VT) to ground were **not** greater than 10,000 ohms to ground, go to S7.

S2 CHECK THE TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between the following DCSM pins, harness side and ground.

Connector-Pin	Circuit
C3305a-G	CHS02 (YE/BU)
C3305a-H	RHS02 (BU/OG)
C3305a-J	CHS01 (GY/VT)
C3305a-K	RHS01 (WH/VT)

- **Are the voltages less than 1 volt?**

  YES : Go to S3.

  NO : If the voltages measured at C3305a-G and/or C3305a-H were **not** less than 1 volt, go to S8.

  If voltages measured at C3305a-J and/or C3305a-K were **not** less than 1 volt, go to S9.

S3 CHECK THE TED RESISTANCE

- Key in OFF position.

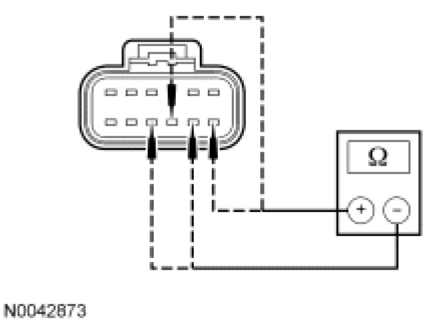


Fig. 154: Checking TED Resistance
Courtesy of FORD MOTOR CO.

NOTE: **Make sure the thermo-electric devices (TEDs) are at room temperature and there is no air blowing across the TEDs. Do not handle a TED when measuring resistance. These conditions can cause incorrect readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between DCSM C3305a-G, circuit CHS02 (YE/BU), harness side and DCSM C3305a-H, circuit RHS02 (BU/OG), harness side; and between DCSM C3305a-J, circuit CHS01 (GY/VT), harness side and C3305a-K, circuit RHS01 (WH/VT), harness die and ground.
- **Are the resistances between 0.9 and 10 ohms?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the resistance between DCSM C3305a-G and C3305a-H was **not** between 0.9 and 10 ohms, go to S5.

  If the resistance between DCSM C3305a-J and C3305a-K was **not** between 0.9 and 10 ohms, go to S4.

S4 CHECK THE RESISTANCE OF THE BACKREST TED

- Disconnect: Backrest TED C3310

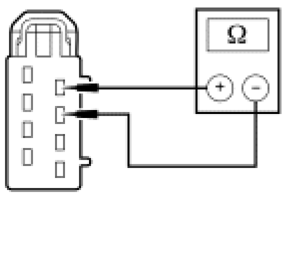


Fig. 155: Checking Resistance Of Backrest TED
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3310 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327.

CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S5 CHECK THE RESISTANCE OF THE CUSHION TED

- Disconnect: Cushion TED C3300

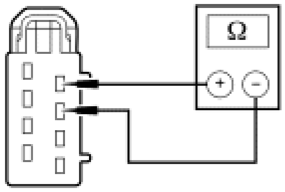


Fig. 156: Checking Resistance Of Cushion TED
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED C3300 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S6 CHECK THE CUSHION TED CIRCUITS FOR SHORT TO GROUND

- Disconnect: Cushion TED C3300

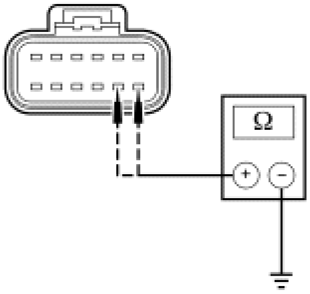


Fig. 157: Checking Cushion TED Circuits For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305a-G, circuit CHS02 (YE/BU), harness side and ground and between C3305a-H, circuit RHS02 (BU/OG), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S7 CHECK THE BACKREST TED CIRCUITS FOR SHORT TO GROUND

- Disconnect: Backrest TED C3310

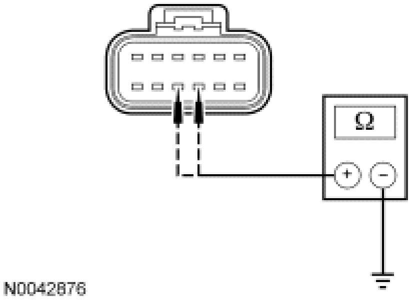


Fig. 158: Checking Backrest TED Circuits For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305a-J, circuit CHS01 (GY/VT), harness side and ground and between C3305a-K, circuit RHS01 (WH/VT), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S8 CHECK THE CUSHION TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Cushion TED C3300
- Key in ON position.

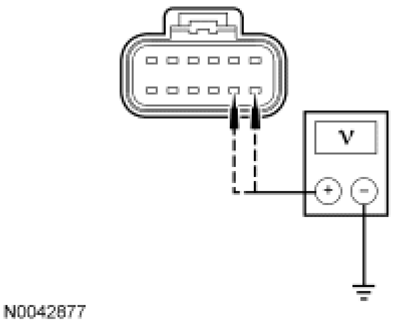


Fig. 159: Checking Cushion TED Circuits For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305a-G, circuit CHS02 (YE/BU), harness side and ground and between C3305a-H, circuit RHS02 (BU/OG), harness side and ground.
- **Are the voltages less than 1 volt?**

  YES : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

S9 CHECK THE BACKREST TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Backrest TED C3310
- Key in ON position.

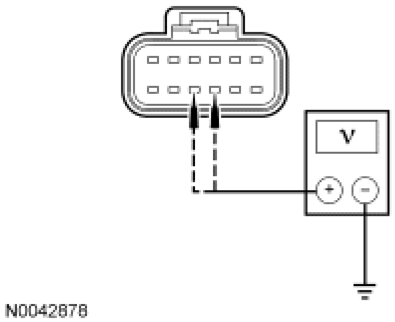


Fig. 160: Checking Backrest TED Circuits For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305a-J, circuit CHS01 (GY/VT), harness side and ground and between C3305a-K, circuit RHS01 (WH/VT), harness side and ground.
- **Are the voltages less than 1 volt?**

  YES : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test T: DTC B103C - Thermo-Electric Driver Open Load

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B103C Thermo-Electric Driver Open Load - If DCSM outputs to the driver seat backrest or cushion TED (circuit pins G, H, J or K at the DCSM connector) or any components within these circuit loops are open, disconnected or a TED resistance greater than 90K ohms is sensed, the DCSM continues normal operation and sets this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- TED assembly
- DCSM

PINPOINT TEST T: DTC B103C - THERMO-ELECTRIC DRIVER OPEN LOAD

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

T1 CHECK THE TED CIRCUITS FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag module C327.
- Disconnect the passenger seat side air bag module C313.
- Disconnect: DCSM C3305a
- Disconnect: Cushion TED C3300
- Disconnect: Backrest TED C3310

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Measure the resistance of the following circuits.

DCSM Connector-Pin	Circuit	TED Connector-Pin
C3305a-G	CHS02 (YE/BU)	C3300-1
C3305a-H	RHS02 (BU/OG)	C3300-3
C3305a-J	CHS01 (GY/VT)	C3310-1
C3305a-K	RHS01 (WH/VT) (VT/BK)	C3310-3

- **Are the resistances less than 5 ohms?**

  YES : Go to T2.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

T2 CHECK THE TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between the following DCSM pins, harness side and ground.

Connector-Pin	Circuit
C3305a-G	CHS02 (YE/BU)
C3305a-H	RHS02 (BU/OG)
C3305a-J	CHS01 (GY/VT)
C3305a-K	RHS01 (WH/VT)

- **Is any voltage present?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to

SUPPLEMENTAL RESTRAINT SYSTEM article.

NO : Go to T3.

T3 CHECK THE RESISTANCE OF THE TEDS

- Key in OFF position.

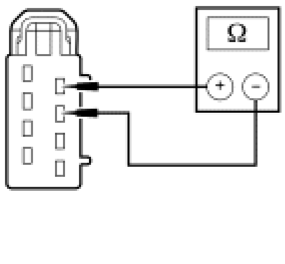


Fig. 161: Checking Resistance Of TED
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3310 pin 1 and pin 3, component side and between cushion TED C3310 pin 1 and pin 3, component side.
- **Are the resistances between 0.9 and 10 ohms?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the resistance of the backrest TED was **not** between 0.9 and 10 ohms, INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  If the resistance of the cushion TED was **not** between 0.9 and 10 ohms, INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test U: DTC B103D - Blower Driver Overtemperature

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B103D Blower Driver Overtemperature - If the DCSM outputs to the driver seat blower or any components within these circuit loops are shorted to ground or cause an excessive current draw, the DCSM will overheat, shut down the driver seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- TED assembly
- DCSM

PINPOINT TEST U: DTC B103D - BLOWER DRIVER OVERTEMPERATURE

NOTE:	**The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

U1 CHECK THE BLOWER CIRCUIT FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag module C327.

- Disconnect the passenger seat side air bag module C313.
- Disconnect: DCSM C3305c
- Disconnect: Cushion TED C3300
- Disconnect: Backrest TED C3310

> WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

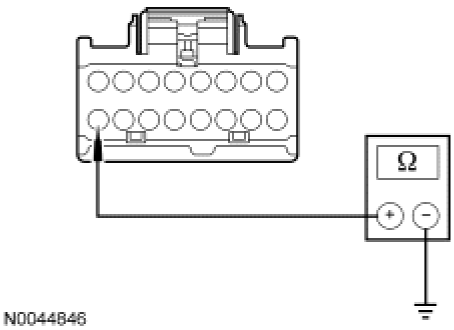


Fig. 162: Checking Blower Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-16, circuit CHS03 (GN/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to U2.

  NO : REPAIR the affected circuit. REPEAT the self-test.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

U2 CHECK FOR A SHORT BETWEEN BLOWER CIRCUITS RHS03 (GY/OG) AND CHS03 (GN/BN)

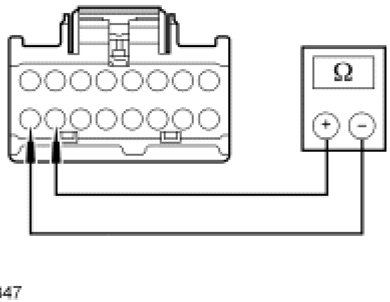


Fig. 163: Checking For A Short Between Blower Circuits RHS03 (GY/OG) & CHS03 (GN/BN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-15, circuit RHS03 (GY/OG), harness side and C3305c-16, circuit CHS03 (GN/BN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to U3.

  NO : REPAIR the affected circuits. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

U3 CHECK THE BLOWER RESISTANCE

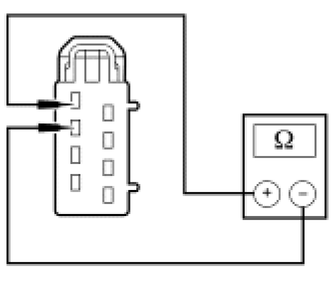


Fig. 164: Checking Blower Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3300 pin 2 and pin 4, component side and between backrest TED C3310 pin 2 and pin 4, component side.

- **Are the resistances between 6K ohms and 9K ohms?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the resistance of the cushion TED was **not** between 6,000 and 9,000 ohms, INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  If the resistance of the backrest TED was **not** between 6,000 and 9,000 ohms, INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test V: DTC B1113/B111B - Passenger Thermo-Electric Device Control Overtemperature Fault/Passenger Thermo-Electric Driver Overcurrent Low

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible

algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B1113 Passenger Thermo-Electric Device Control Overtemperature Fault - If the DCSM TED driver integrated circuit temperature exceeds 175°C (347°F), the DCSM will shut down the passenger seat system and set this DTC.
- DTC B111B Passenger Thermo-Electric Driver Overcurrent Low - If DCSM outputs to the passenger seat backrest or cushion TED (circuit pins A, B, C or D at the DCSM connector) or any components within these circuit loops are shorted to ground or a TED resistance of less than 0.9 ohms is sensed, the DCSM will shut down the passenger seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- TED assembly
- DCSM

PINPOINT TEST V: DTC B1113/B111B - PASSENGER THERMO-ELECTRIC DEVICE CONTROL OVERTEMPERATURE FAULT/PASSENGER THERMO-ELECTRIC DRIVER OVERCURRENT LOW

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

V1 CHECK THE TED CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: DCSM C3305a

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Measure the resistance between the following DCSM pins, harness side and ground.

Connector-Pin	Circuit

C3305a-A	CHS07 (GY/BU)
C3305a-B	RHS07 (BU)
C3305a-C	CHS06 (BU/BN)
C3305a-D	RHS06 (WH)

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to V2.

  NO : If the resistances of C3305a-A and/or C3305a-B to ground were **not** greater than 10,000 ohms to ground, go to V6.

  If resistances of C3305a-C and/or C3305a-D to ground were **not** greater than 10,000 ohms to ground, go to V7.

V2 CHECK THE TED CIRCUITS FOR A SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between the following DCSM pins, harness side and ground.

Connector-Pin	Circuit
C3305a-A	CHS07 (GY/BU)
C3305a-B	RHS07 (BU)
C3305a-C	CHS06 (BU/BN)
C3305a-D	RHS06 (WH)

- **Are the voltages less than 1 volt?**

  YES : Go to V3.

  NO : If the voltages measured at C3305a-A and/or C3305a-B were **not** less than 1 volt, go to V8.

  If voltages measured at C3305a-C and/or C3305a-D were **not** less than 1 volt, go to V9.

V3 CHECK THE TED RESISTANCE

- Key in OFF position.

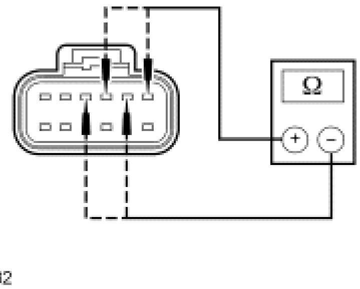


Fig. 165: Checking TED Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**Make sure the thermo-electric devices (TEDs) are at room temperature and there is no air blowing across the TEDs. Do not handle a TED when measuring resistance. These conditions can cause incorrect readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between DCSM C3305a-A, circuit CHS07 (GY/BU), harness side and DCSM C3305a-B, circuit RHS07 (BU), harness side; and between DCSM C3305a-C, circuit CHS06 (BU/BN), harness side and C3305a-D, circuit RHS06 (WH), harness die and ground.
- **Are the resistances between 0.9 and 10 ohms?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

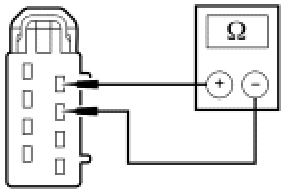
  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the resistance between DCSM C3305a-A and C3305a-B was **not** between 0.9 and 10 ohms, go to V5.

  If the resistance between DCSM C3305a-C and C3305a-D was **not** between 0.9 and 10 ohms, go to V4.

V4 CHECK THE RESISTANCE OF THE BACKREST TED

- Disconnect: Backrest TED C3311



N0042874

Fig. 166: Checking Resistance Of Backrest TED
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3311 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

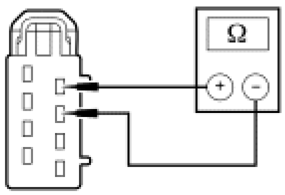
  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

V5 CHECK THE RESISTANCE OF THE CUSHION TED

- Disconnect: Cushion TED C3303



N0042874

Fig. 167: Checking Resistance Of Cushion TED
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED C3303 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

V6 CHECK THE CUSHION TED CIRCUITS FOR A SHORT TO GROUND

- Disconnect: Cushion TED C3303

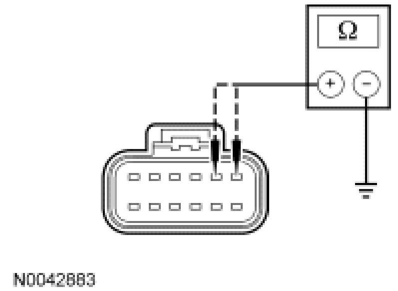


Fig. 168: Checking Cushion TED Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305a-A, circuit CHS07 (GY/BU), harness side and ground and between C3305a-B, circuit RHS07 (BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

V7 CHECK THE BACKREST TED CIRCUITS FOR A SHORT TO GROUND

- Disconnect: Backrest TED C3311

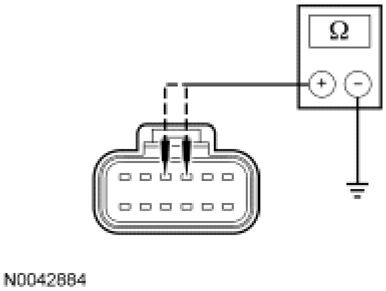


Fig. 169: Checking Backrest TED Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305a-C, circuit CHS06 (BU/BN), harness side and ground and between C3305a-D, circuit RHS06 (WH), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

V8 CHECK THE CUSHION TED CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Cushion TED C3303
- Key in ON position.

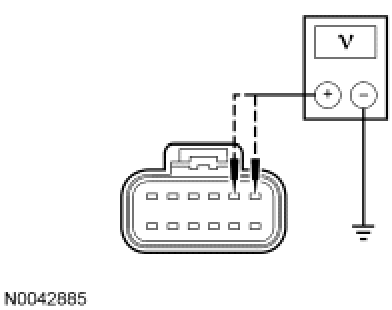


Fig. 170: Checking Cushion TED Circuits For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305a-A, circuit CHS07 (GY/BU), harness side and ground

and between C3305a-B, circuit RHS07 (BU), harness side and ground.

- **Are the voltages less than 1 volt?**

  YES : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

V9 CHECK THE BACKREST TED CIRCUITS FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Backrest TED C3311
- Key in ON position.

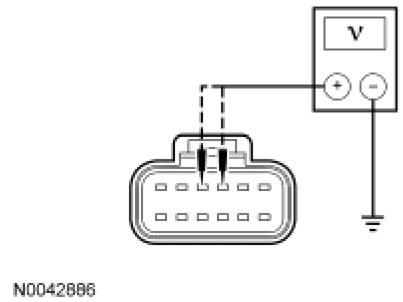


Fig. 171: Checking Backrest TED Circuits For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305a-C, circuit CHS06 (BU/BN), harness side and ground and between C3305a-D, circuit RHS06 (WH), harness side and ground.
- **Is any voltage present?**

  YES : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test W: DTC B111C - Passenger Thermo-Electric Driver Open Load

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B111C Passenger Thermo-Electric Driver Open Load - If DCSM outputs to the passenger seat backrest or cushion TED (circuit pins A, B, C or D at the DCSM connector) or any components within these circuit loops are open, disconnected or a TED resistance greater than 90K ohms is sensed, the DCSM continues normal operation and sets this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- TED assembly
- DCSM

PINPOINT TEST W: DTC B111C - PASSENGER THERMO-ELECTRIC DRIVER OPEN LOAD

NOTE:	**The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**
NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

W1 CHECK THE TED CIRCUITS FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: DCSM C3305a
- Disconnect: Cushion TED C3303
- Disconnect: Backrest TED C3311

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Measure the resistance of the following circuits.

DCSM Connector-Pin	Circuit	TED Connector-Pin
C3305a-A	CHS07 (GY/BU)	C3303-1
C3305a-B	RHS07 (BU)	C3303-3
C3305a-C	CHS06 (BU/BN)	C3311-1
C3305a-D	RHS06 (WH) (GN/BK)	C3311-3

- **Are the resistances less than 5 ohms?**

  YES : Go to W2.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

W2 CHECK THE TED CIRCUITS FOR SHORT TO VOLTAGE

- Key in ON position.
- Measure the voltage between the following DCSM pins, harness side and ground.

Connector-Pin	Circuit

C3305a-A	CHS07 (GY/BU)
C3305a-B	RHS07 (BU)
C3305a-C	CHS06 (BU/BN)
C3305a-D	RHS06 (WH)

- **Is any voltage present?**

  YES : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to W3.

W3 CHECK THE RESISTANCE OF THE TEDS

- Key in OFF position.

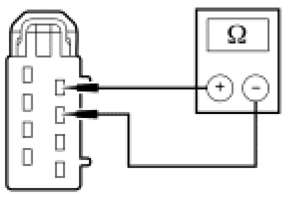


Fig. 172: Checking Resistance Of TED
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3311 pin 1 and pin 3, component side and between cushion TED C3311 pin 1 and pin 3, component side.
- **Are the resistances between 0.9 and 10 ohms?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the resistance of the backrest TED was **not** between 0.9 and 10 ohms, INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

If the resistance of the cushion TED was **not** between 0.9 and 10 ohms, INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test X: DTC B111D - Passenger Blower Driver Overtemperature

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B111D Passenger Blower Driver Overtemperature - If the DCSM outputs to the passenger seat blower or any components within these circuit loops are shorted to ground or cause an excessive current draw, the DCSM will overheat, shut down the passenger seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- TED assembly
- DCSM

PINPOINT TEST X: DTC B111D - PASSENGER BLOWER DRIVER OVERTEMPERATURE

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

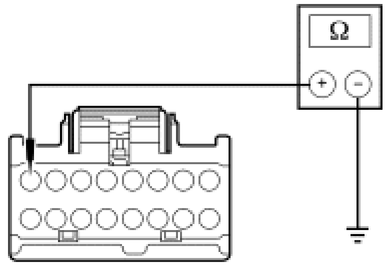
NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

X1 CHECK THE BLOWER CIRCUIT FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: DCSM C3305c
- Disconnect: Cushion TED C3303
- Disconnect: Backrest TED C3311

WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.



N0044848

Fig. 173: Checking Blower Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-8, circuit CHS08 (BN/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to X2.

  NO : REPAIR the affected circuit. REPEAT the self-test.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

X2 CHECK FOR A SHORT BETWEEN BLOWER CIRCUITS RHS08 (VT/WH) AND CHS08 (BN/YE)

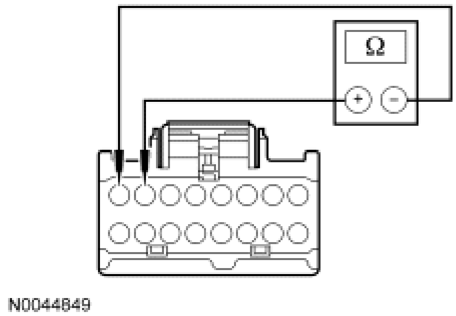


Fig. 174: Checking For A Short Between Blower Circuits RHS08 (VT/WH) & CHS08 (BN/YE)
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-7, circuit RHS08 (VT/WH), harness side and C3305c-8, circuit CHS08 (BN/YE), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to X3.

  NO : REPAIR the affected circuits. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

X3 CHECK THE BLOWER RESISTANCE

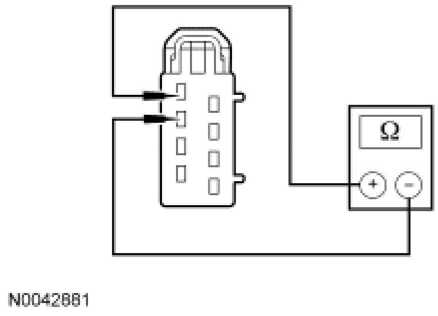


Fig. 175: Checking Blower Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3303 pin 2 and pin 4, component side and between backrest TED C3311 pin 2 and pin 4, component side.
- **Are the resistances between 6K ohms and 9K ohms?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  NO : If the resistance of the cushion TED was **not** between 6,000 and 9,000 ohms, INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  If the resistance of the backrest TED was **not** between 6,000 and 9,000 ohms, INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test Y: DTC B2729 - Driver Cushion Over-Temp Detected

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B2729 Cushion Over-Temp Detected - In the heating mode, if the driver seat cushion TED

temperature exceeds 85°C (185°F) for more than 34 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the driver seat system and set this DTC.

- DTC B2729 Cushion Over-Temp Detected - In the cooling mode, if the driver seat cushion TED temperature exceeds 70°C (158°F) for more than 34 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the driver seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Restricted cushion TED filter
- Crushed or restricted cushion foam pad
- Crushed or restricted climate controlled seat manifold
- Cushion TED assembly
- DCSM

PINPOINT TEST Y: DTC B2729 - DRIVER CUSHION OVER-TEMP DETECTED

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

Y1 CHECK THE DCSM FOR DTCs

- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: Self-Test/DCSM Retrieve DTCs
- **Was DTC B2729 retrieved during the self-test?**

  YES : Go to Y2.

  NO : Go to Y4.

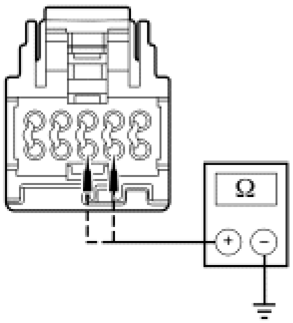
Y2 CHECK THE TED THERMISTOR CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag module C327.
- Disconnect the passenger seat side air bag module C313.
- Disconnect: DCSM C3305b
- Disconnect: Cushion TED C3300

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental**

deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.



N0042889

Fig. 176: Checking TED Thermistor Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

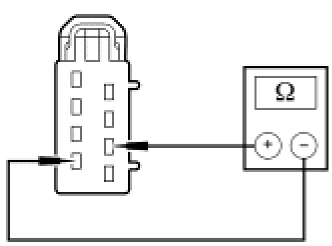
- Measure the resistance between DCSM C3305b-7, circuit VHS26 (VT), harness side and ground and between DCSM C3305b-8, circuit RHS05 (YE/VT), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to Y3.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Y3 CHECK THE TED THERMISTOR



N0042890

Fig. 177: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED C3300 pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance

0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : REPAIR the affected open circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Y4 CONFIRM THE FAULT

- Verify with the customer that the concern is the seat shuts OFF in heat mode.

NOTE: **A crushed seat cushion foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault.**

- Attempt to recreate the fault. Start the vehicle and set the driver seat to high heat for at least 15 minutes.
- **Is the customer concern with the seat shutting OFF in heat mode or was the fault recreated?**

  YES : Go to Y5.

  NO : Fault not present. Fault may have been set due to a past failure or incorrect use of the climate controlled seat system by repeated switching between HEAT and COOL modes. REPEAT the self-test. CLEAR the DTCs.

Y5 CHECK OPERATION OF THE SEAT

- Key in ON position.

- With the engine running, set both front seats to high cool (3 LEDs illuminated on HVAC module).
- Compare the airflow from the driver seat cushion and compare it to the airflow from the passenger seat cushion.
- **Is the airflow exhausting from the driver seat cushion comparable to the airflow exhausting from the passenger seat cushion?**

  YES : Go to Y14.

  NO : Go to Y6.

Y6 CHECK THE CUSHION BLOWER FOR AN OBSTRUCTION OR RESTRICTED FILTER

- Key in OFF position.
- Inspect the blower of the cushion TED assembly for an obstruction or for a restricted filter.
- **Is the blower obstructed or the filter restricted?**

  YES : REMOVE the obstruction or INSTALL a new filter. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to Y7.

Y7 CHECK THE CUSHION FAN OPERATION

- Key in ON position.
- With the engine running, set both front seats to high cool (3 LEDs illuminated on HVAC module).
- Inspect the cushion blower for operation.
- **Does the cushion blower operate?**

  YES : Go to Y14.

  NO : Go to Y8.

Y8 CHECK THE BLOWER SPEED CONTROL CIRCUIT FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag module C327.
- Disconnect the passenger seat side air bag module C313.
- Disconnect: DCSM C3305c
- Disconnect: Cushion TED C3300

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

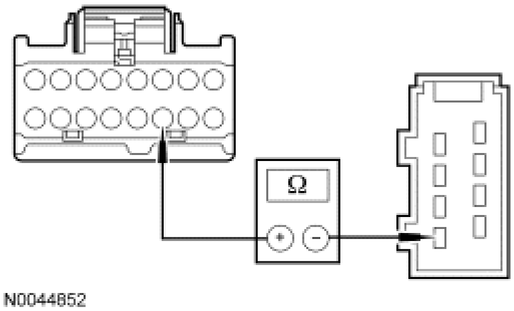


Fig. 178: Checking Blower Speed Control Circuit For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-11, circuit VHS18 (BN/GN), harness side and cushion TED C3300-7, circuit VHS18 (BN/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to Y9.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Y9 CHECK BLOWER CIRCUIT RHS03 (GY/OG) FOR A SHORT TO VOLTAGE

- Key in ON position.

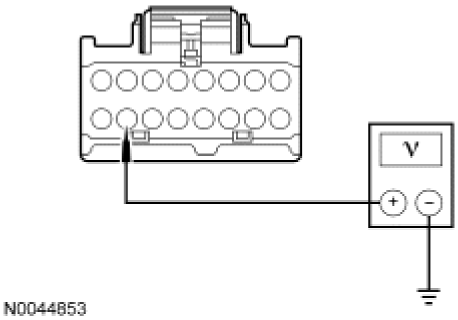


Fig. 179: Checking Blower Circuit RHS03 (GY/OG) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305c-15, circuit RHS03 (GY/OG), harness side and ground.
- **Is voltage greater than 1 volt?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to

SUPPLEMENTAL RESTRAINT SYSTEM article.

NO : Go to Y10.

Y10 CHECK BLOWER CIRCUIT CHS03 (GN/BN) FOR A SHORT TO GROUND

- Key in OFF position.

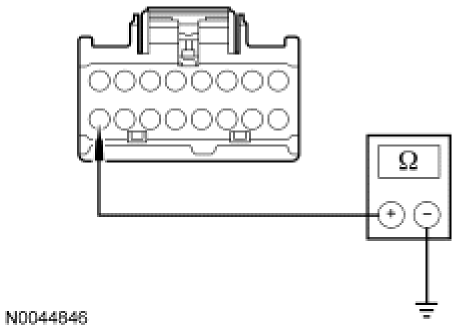


Fig. 180: Checking Blower Circuit CHS03 (GN/BN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-16, circuit CHS03 (GN/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to Y11.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Y11 CHECK BLOWER CIRCUITS CHS03 (GN/BN) AND RHS03 (GY/OG) FOR AN OPEN

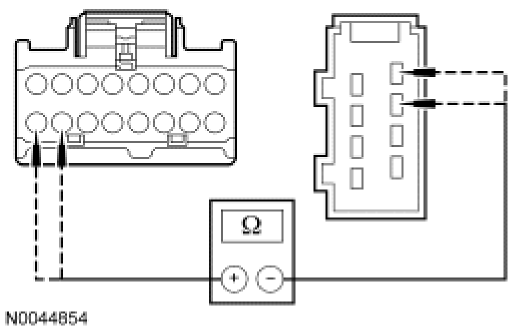


Fig. 181: Checking Blower Circuits CHS03 (GN/BN) & RHS03 (GY/OG) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-16, circuit CHS03 (GN/BN), harness side and cushion TED C3300-2, circuit CHS03 (GN/BN), harness side; and between DCSM C3305c-15,

circuit RHS03 (GY/OG), harness side and cushion TED C3300-4, circuit RHS03 (GY/OG), harness side.

- **Are the resistances less than 5 ohms?**

  YES : Go to Y12.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Y12 CHECK THE BLOWER RESISTANCE

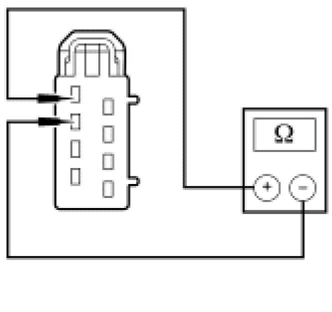


Fig. 182: Checking Blower Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3300 pin 2 and pin 4, component side.
- **Is the resistance between 6K ohms and 9K ohms?**

  YES : Go to Y13.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Y13 CHECK THE BLOWER SPEED CONTROL RESISTANCE

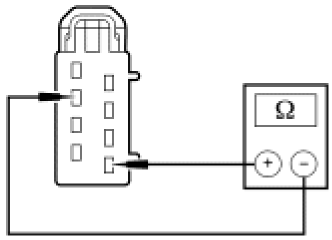


Fig. 183: Checking Blower Speed Control Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3300 pin 7 and pin 4, component side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : Go to Y14.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Y14 CHECK THE TED INSTALLATION AND FOR CRUSHED SEAT CUSHION

- Remove the seat. Refer to **Seat - Front**.
- Remove the seat cushion trim cover. Refer to **Seat Cushion Cover - Front**.
- Inspect the seat cushion for the following:
  - Is the TED correctly installed?
  - Is the seat cushion foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?
- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : CORRECTLY install the cushion TED or INSTALL a new seat cushion foam pad and/or climate controlled seat manifold. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test Z: DTC B272A - Passenger Cushion Over-Temp Detected

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B272A Passenger Cushion Over-Temp Detected - In the cooling mode, if the passenger seat cushion TED temperature exceeds 70°C (158°F) for more than 34 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the passenger seat system and set this DTC.
- DTC B272A Passenger Cushion Over-Temp Detected - In the heating mode, if the passenger seat cushion TED temperature exceeds 85°C (185°F) for more than 34 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the passenger seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Restricted cushion TED filter

- Crushed or restricted cushion foam pad
- Crushed or restricted climate controlled seat manifold
- Cushion TED assembly
- DCSM

PINPOINT TEST Z: DTC B272A - PASSENGER CUSHION OVER-TEMP DETECTED

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

Z1 CHECK THE DCSM FOR DTCs

- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: Self-Test/DCSM Retrieve DTCs
- **Was DTC B272A retrieved during the self-test?**

  YES : Go to Z2.

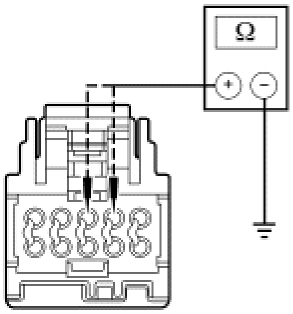
  NO : Go to Z4.

Z2 CHECK THE TED THERMISTOR CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: DCSM C3305b
- Disconnect: Cushion TED C3303

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.



N0042894

Fig. 184: Checking TED Thermistor Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

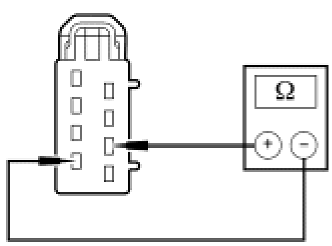
- Measure the resistance between DCSM C3305b-2, circuit VHS27 (WH/OG), harness side and ground and between DCSM C3305b-3, circuit RHS10 (BU/OG), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to Z3.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Z3 CHECK THE TED THERMISTOR



N0042890

Fig. 185: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED C3303 pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140

	ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : REPAIR the affected open circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Z4 CONFIRM THE FAULT

- Verify with the customer that the concern is the seat shuts OFF in heat mode.

NOTE: A crushed seat cushion foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault.

- Attempt to recreate the fault. Start the vehicle and set the passenger seat to high heat for at least 15 minutes.
- **Is the customer concern with the seat shutting OFF in heat mode or was the fault recreated?**

  YES : Go to Z5.

  NO : Fault not present. Fault may have been set due to a past failure or incorrect use of the climate controlled seat system by repeated switching between HEAT and COOL modes. REPEAT the self-test. CLEAR the DTCs.

Z5 CHECK OPERATION OF THE SEAT

- Key in ON position.
- With the engine running, set both front seats to high cool (3 LEDs illuminated on HVAC module).
- Compare the airflow from the passenger seat cushion and compare it to the airflow from the driver seat cushion.
- **Is the airflow exhausting from the passenger seat cushion comparable to the airflow exhausting from the driver seat cushion?**

  YES : Go to Z14.

NO : Go to Z6.

Z6 CHECK THE CUSHION BLOWER FOR AN OBSTRUCTION OR RESTRICTED FILTER

- Key in OFF position.
- Inspect the blower of the cushion TED assembly for an obstruction or for a restricted filter.
- **Is the blower obstructed or the filter restricted?**

  YES : REMOVE the obstruction or INSTALL a new filter. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to Z7.

Z7 CHECK THE CUSHION FAN OPERATION

- Key in ON position.
- With the engine running, set both front seats to high cool (3 LEDs illuminated on HVAC module).
- Inspect the cushion blower for operation.
- **Does the cushion blower operate?**

  YES : Go to Z14.

  NO : Go to Z8.

Z8 CHECK THE BLOWER SPEED CONTROL CIRCUIT FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: DCSM C3305c
- Disconnect: Cushion TED C3303

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

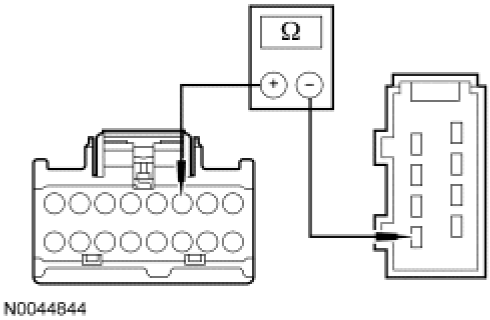


Fig. 186: Checking Circuit For Open

Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-3, circuit VHS23 (BN/BU), harness side and cushion TED C3303-7, circuit VHS23 (BN/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to Z9.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Z9 CHECK BLOWER CIRCUIT RHS08 (VT/WH) FOR A SHORT TO VOLTAGE

- Key in ON position.

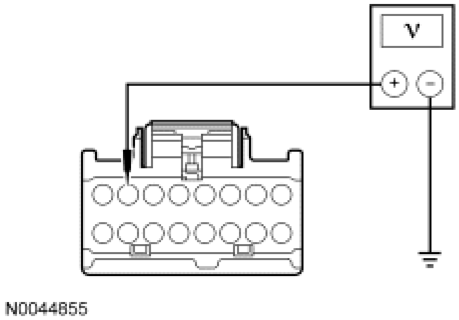


Fig. 187: Checking Blower Circuit RHS08 (VT/WH) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305c-7, circuit RHS08 (VT/WH), harness side and ground.
- **Is voltage greater than 1 volt?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to Z10.

Z10 CHECK BLOWER CIRCUIT CHS08 (BN/YE) FOR A SHORT TO GROUND

- Key in OFF position.

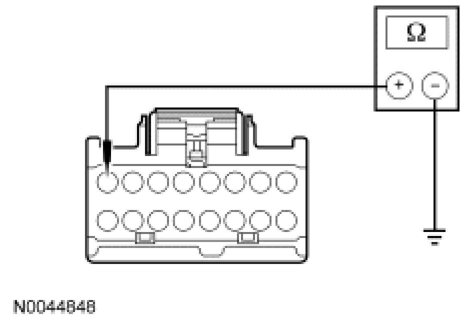


Fig. 188: Checking Blower CircuitCHS08 (BN/YE) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-8, circuit CHS08 (BN/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to Z11.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Z11 CHECK BLOWER CIRCUITS CHS08 (BN/YE) AND RHS08 (VT/WH) FOR AN OPEN

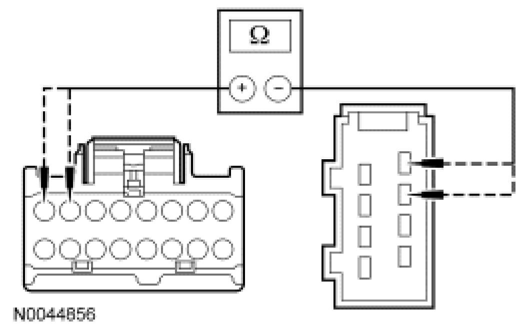


Fig. 189: Checking Blower Circuits CHS08 (BN/YE) & RHS08 (VT/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-8, circuit CHS08 (BN/YE), harness side and cushion TED C3303-2, circuit CHS08 (BN/YE), harness side; and between DCSM C3305c-7, circuit RHS08 (VT/WH), harness side and cushion TED C3311-4, circuit RHS08 (VT/WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to Z12.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Z12 CHECK THE BLOWER RESISTANCE

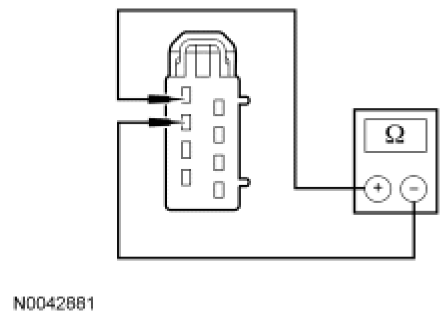


Fig. 190: Checking Blower Resistance
Courtesy of FORD MOTOR CO.

NOTE: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between cushion TED C3303 pin 2 and pin 4, component side.
- **Is the resistance between 6K ohms and 9K ohms?**

YES : Go to Z13.

NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Z13 CHECK THE BLOWER SPEED CONTROL RESISTANCE

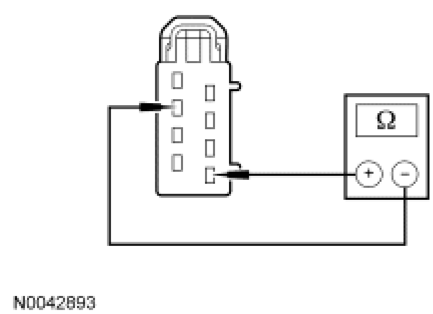


Fig. 191: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

NOTE: The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between cushion TED C3303 pin 7 and pin 4, component side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : Go to Z14.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Z14 CHECK THE TED INSTALLATION AND FOR CRUSHED SEAT CUSHION

- Key in OFF position.
- Remove the seat. Refer to **Seat - Front**.
- Remove the seat cushion trim cover. Refer to **Seat Cushion Cover - Front**.
- Inspect the seat cushion for the following:
  - Is the TED correctly installed?
  - Is the seat cushion foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?
- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : CORRECTLY install the cushion TED or INSTALL a new seat cushion foam pad and/or climate controlled seat manifold. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AA: DTC B272B - Passenger Back Over-Temp Detected

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B272B Passenger Back Over-Temp Detected - In the cooling mode, if the passenger seat backrest TED temperature exceeds 70°C (158°F) for more than 34 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the passenger seat system and set this DTC.
- DTC B272B Passenger Back Over-Temp Detected - In the heating mode, if the passenger seat backrest TED temperature exceeds 85°C (185°F) for more than 34 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the passenger seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Restricted backrest TED filter
- Crushed or restricted backrest foam pad
- Crushed or restricted climate controlled seat manifold
- Backrest TED assembly
- DCSM

PINPOINT TEST AA: DTC B272B - PASSENGER BACK OVER-TEMP DETECTED

NOTE:	**The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

AA1 CHECK THE DCSM FOR DTCs

- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: Self-Test/DCSM Retrieve DTCs
- **Was DTC B2730 retrieved during the self-test?**

  YES : Go to AA2.

  NO : Go to AA4.

AA2 CHECK THE TED THERMISTOR CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: DCSM C3305b
- Disconnect: Backrest TED C3311

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

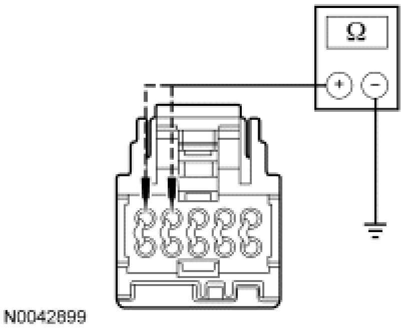


Fig. 192: Checking TED Thermistor Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305b-4, circuit VHS36 (YE/BU), harness side and ground and between DCSM C3305b-5, circuit RHS20 (GN/BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AA3.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AA3 CHECK THE TED THERMISTOR

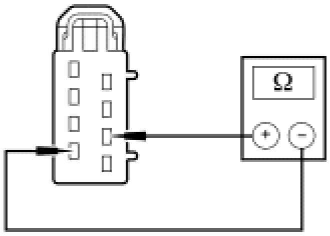


Fig. 193: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3311 pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : REPAIR the affected open circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AA4 CONFIRM THE FAULT

- Verify with the customer that the concern is the seat shuts OFF in heat mode.

NOTE: **A crushed seat backrest foam pad or a crushed climate controlled**

seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault.

- Attempt to recreate the fault. Start the vehicle and set the front passenger seat to high heat for at least 15 minutes.
- **Is the customer concern with the seat shutting OFF in heat mode or was the fault recreated?**

  YES : Go to AA5.

  NO : Fault not present. Fault may have been set due to a past failure or incorrect use of the climate controlled seat system by repeated switching between HEAT and COOL modes. REPEAT the self-test. CLEAR the DTCs.

AA5 CHECK OPERATION OF THE SEAT

- Key in ON position.
- With the engine running, set both front seats to high cool (3 LEDs illuminated on HVAC module).
- Compare the airflow from the front passenger seat backrest and compare it to the airflow from the driver seat backrest.
- **Is the airflow exhausting from the front passenger seat backrest comparable to the airflow exhausting from the driver seat backrest?**

  YES : Go to AA14.

  NO : Go to AA6.

AA6 CHECK THE BACKREST BLOWER FOR AN OBSTRUCTION OR RESTRICTED FILTER

- Key in OFF position.
- Inspect the blower of the backrest TED assembly for an obstruction or for a restricted filter.
- **Is the blower obstructed or the filter restricted?**

  YES : REMOVE the obstruction or INSTALL a new filter. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AA7.

AA7 CHECK THE BACKREST FAN OPERATION

- Key in ON position.
- With the engine running, set both front seats to high cool (3 LEDs illuminated on HVAC module).
- Inspect the backrest blower for operation.
- **Does the backrest blower operate?**

  YES : Go to AA14.

  NO : Go to AA8.

AA8 CHECK THE BLOWER SPEED CONTROL CIRCUIT FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.

- Disconnect: DCSM C3305c
- Disconnect: Backrest TED C3311

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

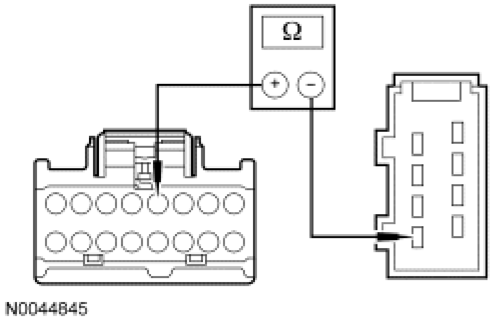


Fig. 194: Checking Blower Speed Control Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-4, circuit VHS21 (BU/WH), harness side and backrest TED C3310-7, circuit VHS21 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to AA9.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AA9 CHECK BLOWER CIRCUIT RHS08 (VT/WH) FOR A SHORT TO VOLTAGE

- Key in ON position.

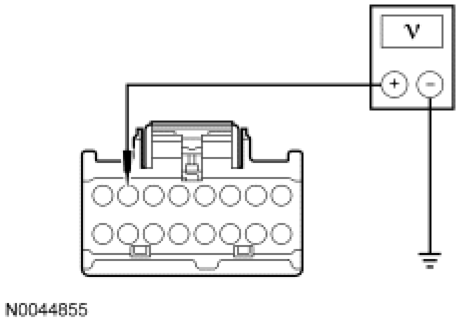


Fig. 195: Checking Blower Circuit RHS08 (VT/WH) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305c-7, circuit RHS08 (VT/WH), harness side and ground.
- **Is voltage greater than 1 volt?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AA10.

AA10 CHECK BLOWER CIRCUIT CHS08 (BN/YE) FOR A SHORT TO GROUND

- Key in OFF position.

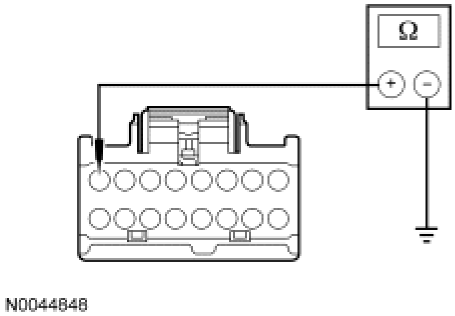


Fig. 196: Checking Blower Circuit CHS08 (BN/YE) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-8, circuit CHS08 (BN/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AA11.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AA11 CHECK BLOWER CIRCUITS CHS08 (BN/YE) AND RHS08 (VT/WH) FOR AN OPEN

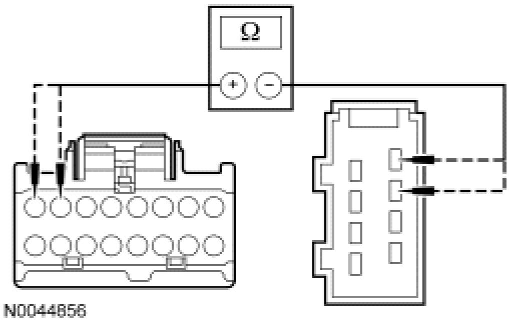


Fig. 197: Checking Blower Circuits CHS08 (BN/YE) & RHS08 (VT/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-8, circuit CHS08 (BN/YE), harness side and backrest TED C3311-2, circuit CHS08 (GY/RD), harness side; and between DCSM C3305c-7, circuit RHS08 (VT/WH), harness side and backrest TED C3311-4, circuit RHS08 (VT/WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to AA12.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AA12 CHECK THE BLOWER RESISTANCE

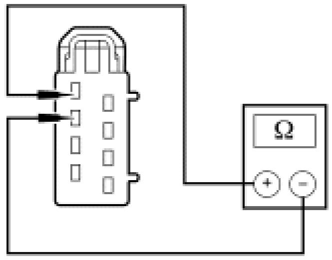


Fig. 198: Checking Blower Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between backrest TED C3311 pin 2 and pin 4, component side.
- **Is the resistance between 6K ohms and 9K ohms?**

YES : Go to AA13.

NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AA13 CHECK THE BLOWER SPEED CONTROL RESISTANCE

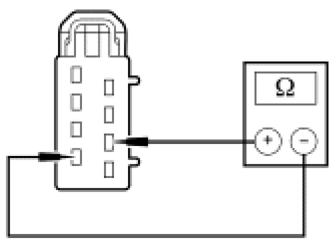


Fig. 199: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between backrest TED C3311 pin 7 and pin 4, component side.
- **Is the resistance between 290K ohms and 420K ohms?**

YES : Go to AA14.

NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AA14 CHECK THE TED INSTALLATION AND FOR CRUSHED SEAT BACKREST

- Key in OFF position.
- Remove the seat. Refer to **Seat - Front**.
- Remove the seat backrest trim cover. Refer to **Seat Backrest Cover - Front, Without Fold Flat**.
- Inspect the seat backrest for the following:
  - Is the TED correctly installed?
  - Is the seat backrest foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?

- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : CORRECTLY install the backrest TED or INSTALL a new seat backrest foam pad and/or climate controlled seat manifold. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AB: DTC B272C - Driver Differential Temperature Fault

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

A differential fault occurs when the cushion and backrest TEDs on an affected seat are reporting very different temperatures to the DCSM. This may result from an airflow restriction or a circuit fault of either TED area. If a TED and manifold is clear of obstruction and is operational, the other TED and circuitry on the seat should be checked. It is important to note that a TED with a higher temperature may be operating correctly and not the

area of concern. The other TED may be indicating a much lower temperature, causing the DTC to set.

- DTC B272C Driver Differential Temperature Fault - If there is a temperature differential between the driver backrest and cushion TED of 60°C (108°F) or more for more than 4 seconds, the TED is disconnected or the duct is blocked, this DTC will set. When this happens the first time in a key cycle, the DCSM puts the driver seat system into recovery mode (see principles of operation). If the system is able to recover, it will function normally. If the system is able to recover and it occurs a second time in the same key cycle, the DCSM will shut down the driver seat system.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Restricted cushion or backrest TED filter
- Crushed or restricted cushion or backrest foam pad
- Crushed or restricted cushion or backrest climate controlled seat manifold
- Cushion or backrest TED assembly
- DCSM

PINPOINT TEST AB: DTC B272C - DRIVER DIFFERENTIAL TEMPERATURE FAULT

NOTE:	**The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

AB1 CHECK THE DCSM FOR DTCs

- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: Self-Test/DCSM Retrieve DTCs
- **Was DTC B2729 or B2730 retrieved during the self-test or as a continuous DTC?**

  YES : For DTC B2729, go to **Pinpoint Test Y**. For DTC B2730, go to **Pinpoint Test AD**.

  NO : Go to AB2.

AB2 MONITOR THE DCSM TED TEMPERATURE PIDs

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DCSM
  - Passenger Cushion Thermal Electric Device (TED) Temperature (PCSHTMP)
  - Passenger Back TED Temperature (PBKTMP)
  - Seat cushion thermal electric device temperature (CSHTEMP)
  - Seat back thermal electric device temperature (BK_TEMP)

NOTE:	**Make sure the temperature of the climate controlled seats has stabilized before monitoring the PIDs. Not allowing stabilization can cause incorrect readings and lead to incorrect identification of**

components that are not faulty.

- Monitor the TED temperature PIDs with the climate controlled seats OFF. Compare the PID values of the driver seat to those of the front passenger seat, this can help identify if there is a concern with the driver seat cushion or backrest PID value readings.
- **Are both driver seat TED temperature PIDs within 10°C (18°F) of the ambient temperature?**

  YES : Go to AB3.

  NO : If the driver seat cushion PID varies 10°C (18°F) or more from ambient temperature, go to AB16.

  If the driver seat backrest PID varies 10°C (18°F) or more from ambient temperature, go to AB32.

AB3 CONFIRM THE FAULT IS IN THE SEAT CUSHION OR THE BACKREST

- Key in OFF position.
- Key in ON position.

NOTE: A crushed seat cushion foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault.

NOTE: If the seat shuts down before a 15 minute heat cycle has timed-out, carry out the DCSM self-test and go to the Dual Climate Controlled Seat Module (DCSM) DTC Chart to continue diagnostics.

- After cycling the ignition switch and with the engine running, set the driver seat to high heat (3 LEDs illuminated on HVAC module). Allow the seat to heat for at least 15 minutes while monitoring the TED temperature PIDs of the driver seat. If necessary, when the seat times-out after 15 minutes, set the driver seat to high heat once again.
- **Do the driver seat cushion TED and backrest TED PIDs vary more than 60°C (108°F) from each other?**

  YES : If the driver seat cushion PID is 60°C (108°F) hotter than the backrest PID, go to AB5.

  If the driver seat backrest PID is 60°C (108°F) hotter than the cushion PID, go to AB20.

  NO : Go to AB4.

AB4 CHECK THE TEDs COOLING PERFORMANCE

- Check the TEDs cooling performance on the affected seat. Refer to Component Test - Thermo-electric Device (TED) Cooling Performance.
- **Did the TEDs pass the component test?**

  YES : The DTC may have been set by extreme cabin temperatures or excessive sunload on the seat causing the system to enter recovery mode. Occupant size and weight characteristics can also be a factor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If a concern cannot be found or duplicated, RETURN the vehicle to the customer.

NO : CHECK the affected seat cushion or backrest for correct installation of the climate controlled seat components (TED, manifold, plenum, air ducts and foam pad). CHECK for airflow restrictions (TED inlets and outlets, TED-to-manifold or plenum connections, filters and ducts) and REPAIR as needed. CHECK for an intermittent wiring fault. REPAIR as needed. REPEAT the self-test. CLEAR the DTCs.

AB5 CHECK THE TED INSTALLATION AND FOR A CRUSHED SEAT CUSHION

- Key in OFF position.
- Remove the seat. Refer to **Seat - Front**.
- Remove the seat cushion trim cover. Refer to **Seat Cushion Cover - Front**.
- Inspect the seat cushion for the following:
  - Is the cushion blower obstructed?
  - Is the blower filter restricted or plugged?
  - Is the TED correctly installed?
  - Is the seat cushion foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?
- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

  YES : Go to AB6.

  NO : CORRECTLY install the cushion TED or INSTALL a new seat cushion foam pad and/or climate controlled seat manifold. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB6 CHECK THE BACKREST TED- CIRCUIT FOR SHORT TO VOLTAGE

- Key in OFF position.
- Position the driver seat in the vehicle and connect the seat-to-floor connectors.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag module C327.
- Disconnect the passenger seat side air bag module C313.
- Disconnect: DCSM C3305a

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Key in ON position.

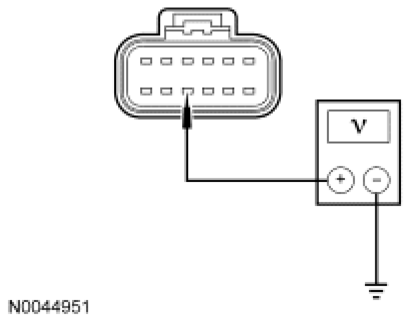


Fig. 200: Checking Backrest TED- Circuit For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305a-K, circuit RHS01 (WH/VT), harness side and ground.
- **Is the voltage less than 0.5 volt?**

  YES : Go to AB7.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB7 CHECK THE BACKREST TED+ CIRCUIT FOR SHORT TO GROUND

- Key in OFF position.

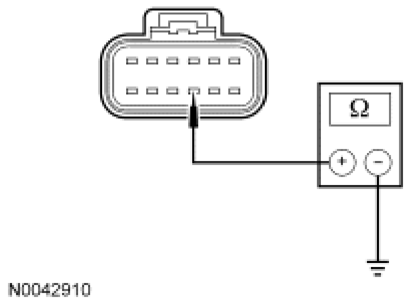


Fig. 201: Checking Backrest TED+ Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305a-J, circuit CHS01 (GY/VT), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AB8.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327.

CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB8 CHECK RESISTANCE OF THE BACKREST TED AND WIRING

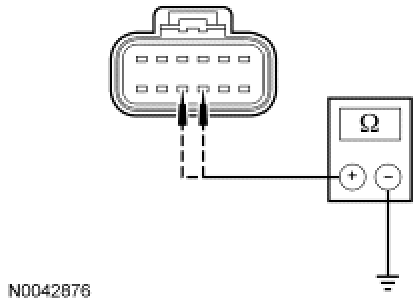


Fig. 202: Checking Resistance Of Backrest TED And Wiring
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305a-J, circuit CHS01 (GY/VT), harness side and DCSM C3305a-K, circuit RHS01 (WH/VT), harness side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : Go to AB10.

  NO : Go to AB9.

AB9 CHECK RESISTANCE OF THE BACKREST TED

- Disconnect: Backrest TED C3310

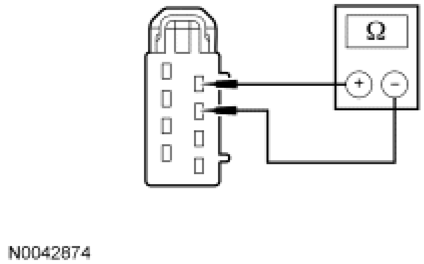


Fig. 203: Checking Resistance Of Backrest TED
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3310 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB10 CHECK BLOWER CIRCUIT CHS03 (GN/BN) AND SPEED CONTROL CIRCUIT VHS18 (BN/GN) FOR A SHORT TO VOLTAGE

- Disconnect: DCSM C3305c
- Key in ON position.

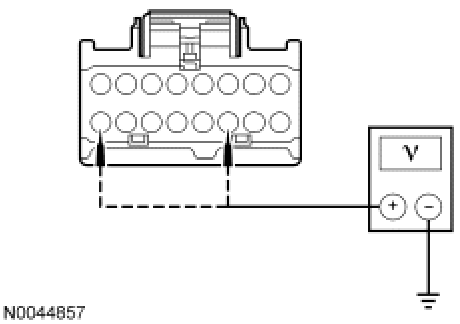


Fig. 204: Checking Blower Circuit CHS03 (GN/BN) & Speed Control Circuit VHS18 (BN/GN) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305c-16, circuit CHS03 (GN/BN), harness side and ground and between DCSM C3305c-11, circuit VHS18 (BN/GN), harness side and ground.
- **Are the voltages less than 1 volt?**

  YES : Go to AB11.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB11 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.

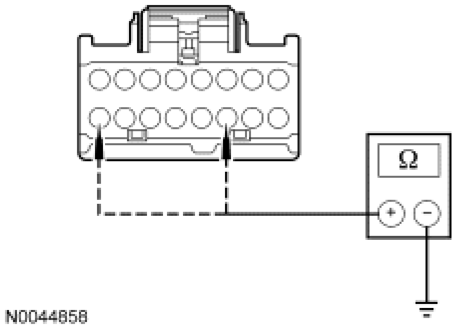


Fig. 205: Checking Blower & Speed Control Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-16, circuit CHS03 (GN/BN), harness side and ground and between DCSM C3305c-11, circuit VHS18 (BN/GN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AB12.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB12 CHECK THE BLOWER AND WIRING

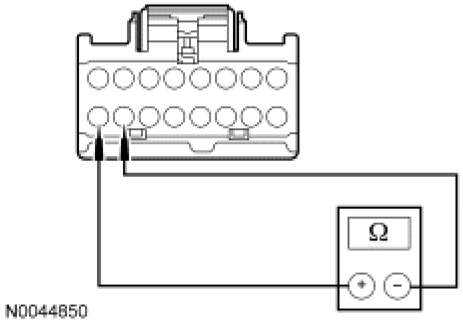


Fig. 206: Checking Blower & Wiring
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to DCSM C3305c-16, circuit CHS03 (GN/BN) and the negative lead to DCSM C3305c-15, circuit RHS03 (GY/OG) when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between DCSM C3305c-16, circuit CHS03 (GN/BN), harness side and DCSM C3305c-15, circuit RHS03 (GY/OG), harness side.

- **Is the resistance between 6K ohms and 9K ohms?**

  YES : Go to AB14.

  NO : Go to AB13.

AB13 CHECK THE BLOWER

- Disconnect: Cushion TED C3300

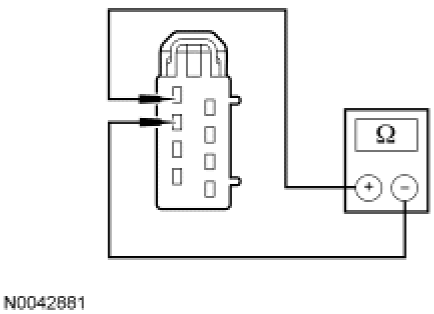


Fig. 207: Checking Blower Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3300 pin 2 and pin 4, component side.
- **Is the resistance between 6K ohms and 9K ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB14 CHECK THE BLOWER SPEED CONTROL AND CIRCUIT

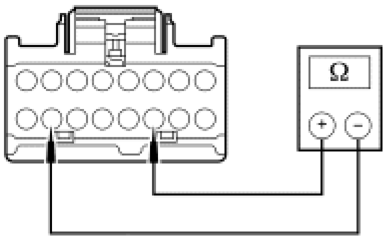


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Fig. 208: Checking Blower Speed Control And Circuit
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to C3305c-11, circuit VHS18 (BN/GN), harness side and the negative lead to C3305c-15, circuit RHS03 (GY/OG), harness side when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between DCSM C3305c-11, circuit VHS18 (BN/GN) harness side and DCSM C3305c-15, circuit RHS03 (GY/OG), harness side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : Go to AB16.

  NO : Go to AB15.

AB15 CHECK THE BLOWER SPEED CONTROL

- Disconnect: Cushion TED C3300

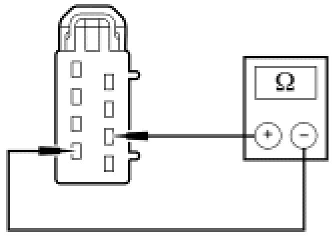

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Fig. 209: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3300 pin 7 and pin 4, component side.

- **Is the resistance between 290K ohms and 420K ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB16 CHECK THE THERMISTOR CIRCUIT FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag module C327.
- Disconnect the passenger seat side air bag module C313.
- Disconnect: DCSM C3305b

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Key in ON position.

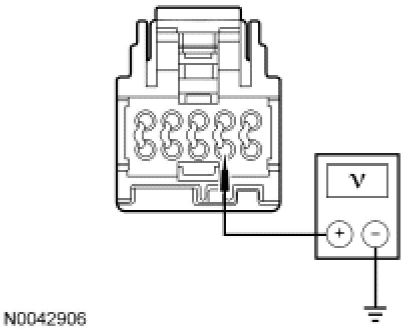

Fig. 210: Checking Thermistor Circuit For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305b-7, circuit VHS26 (VT), harness side and ground.

- **Is the voltage less than 0.5 volt?**

  YES : Go to AB17.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB17 CHECK THE THERMISTOR CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.

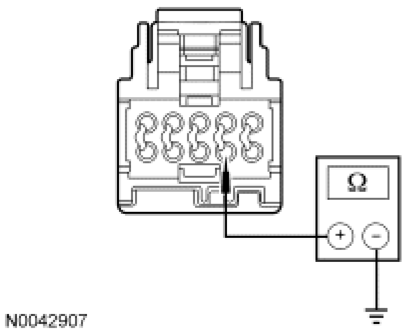

Fig. 211: Checking Thermistor Circuit For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305b-7, circuit VHS26 (VT), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AB18.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB18 CHECK THE THERMISTOR AND WIRING

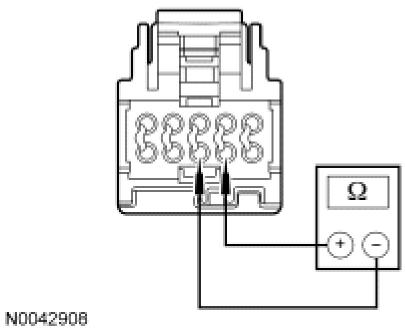

Fig. 212: Checking Thermistor & Wiring

Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305b-7, circuit VHS26 (VT), harness side and DCSM C3305b-8, circuit RHS05 (YE/VT), harness side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AB19.

AB19 CHECK THE THERMISTOR

- Disconnect: Cushion TED C3300

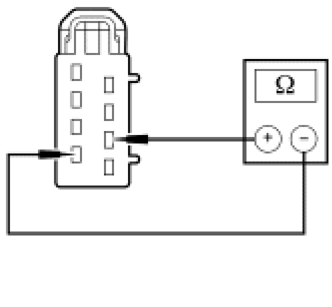

Fig. 213: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB20 CHECK THE TED INSTALLATION AND FOR A CRUSHED SEAT BACKREST

- Key in OFF position.
- Remove the seat. Refer to **Seat - Front**.
- Remove the seat backrest trim cover. Refer to **Seat Backrest Cover - Front, Without Fold Flat**.
- Inspect the seat backrest for the following:
  - Is the backrest blower obstructed?
  - Is the blower filter restricted or plugged?
  - Is the TED correctly installed?
  - Is the seat backrest foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?
- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

YES : Go to AB21.

NO : CORRECTLY install the backrest TED or INSTALL a new seat backrest foam pad and/or climate controlled seat manifold. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB21 CHECK CUSHION TED CIRCUIT RHS02 (BU/OG) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Position the driver seat in the vehicle and connect the seat-to-floor connectors.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag module C327.
- Disconnect the passenger seat side air bag module C313.
- Disconnect: DCSM C3305a

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Key in ON position.

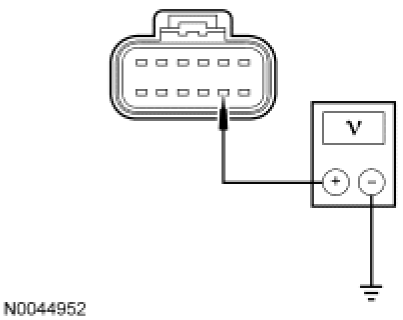

Fig. 214: Checking Cushion TED Circuit RHS02 (BU/OG) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305a-H, circuit RHS02 (BU/OG), harness side and ground.
- **Is the voltage less than 0.5 volt?**

YES : Go to AB22.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327.

CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB22 CHECK THE CUSHION TED+ CIRCUIT FOR SHORT TO GROUND

- Key in OFF position.

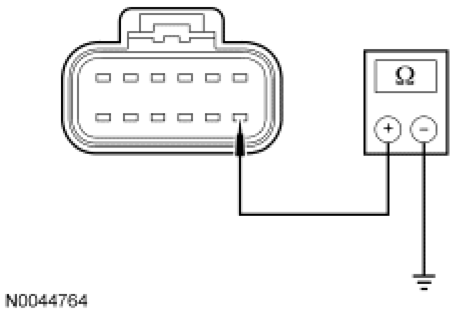

Fig. 215: Checking Cushion TED+ Circuit For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305a-G, circuit CHS02 (YE/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AB23.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB23 CHECK THE RESISTANCE OF THE CUSHION TED AND WIRING

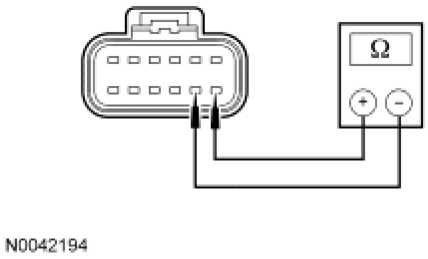

Fig. 216: Checking Resistance Of Cushion TED & Wiring
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305a-G circuit CHS02 (YE/BU), harness side and DCSM C3305a-H, circuit RHS02 (BU/OG), harness side.

- **Is the resistance between 0.9 and 10 ohms?**

  YES : Go to AB25.

  NO : Go to AB24.

AB24 CHECK THE RESISTANCE OF THE CUSHION TED

- Disconnect: Cushion TED C3300

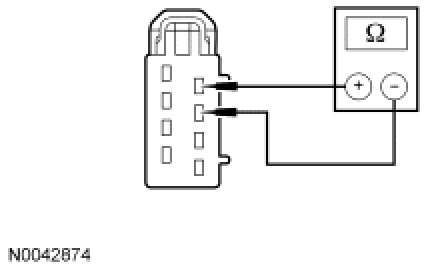

Fig. 217: Checking Resistance Of Cushion TED
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED C3300 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB25 CHECK BLOWER CIRCUIT CHS03 (GN/BN) AND SPEED CONTROL CIRCUIT VHS16 (BU/GN) FOR A SHORT TO VOLTAGE

- Disconnect: DCSM C3305c
- Key in ON position.

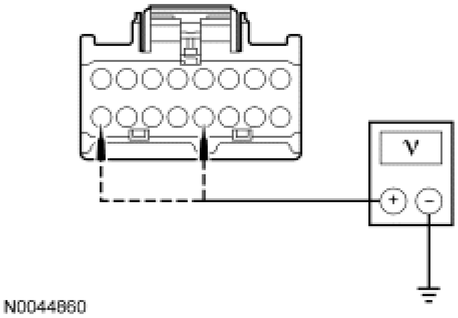

Fig. 218: Checking Blower Circuit CHS03 (GN/BN) & Speed Control Circuit VHS16 (BU/GN) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305c-16, circuit CHS03 (GN/BN), harness side and ground and between DCSM C3305c-12, circuit VHS16 (BU/GN), harness side and ground.
- **Are the voltages less than 1 volt?**

  YES : Go to AB26.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB26 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.

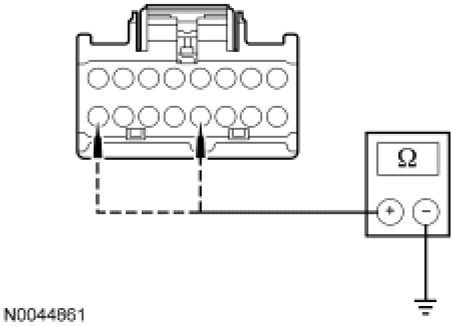

Fig. 219: Checking Blower And Speed Control Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-16, circuit CHS03 (GN/BN), harness side and ground and between DCSM C3305c-12, circuit VHS16 (BU/GN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AB27.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB27 CHECK THE BLOWER AND WIRING

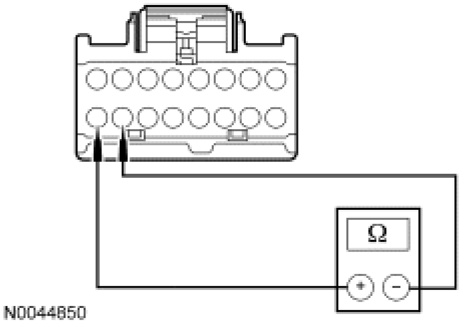

Fig. 220: Checking Blower & Wiring
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to DCSM C3305c-16, circuit CHS03 (GN/BN) and the negative lead to DCSM C3305c-15, circuit RHS03 (GY/OG) when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between DCSM C3305c-16, circuit CHS03 (GN/BN), harness side and DCSM C3305c-15, circuit RHS03 (GY/OG), harness side.
- **Is the resistance between 6K ohms and 9K ohms?**

  YES : Go to AB29.

  NO : Go to AB28.

AB28 CHECK THE BLOWER

- Disconnect: Backrest TED C3310

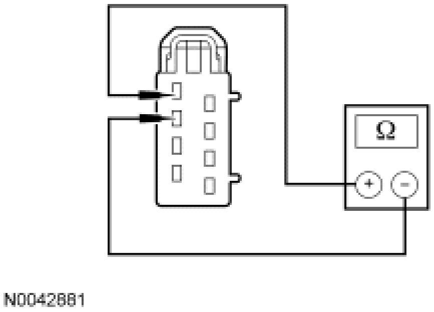

Fig. 221: Checking Blower Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between backrest TED C3310 pin 2 and pin 4, component side.
- **Is the resistance between 6K ohms and 9K ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB29 CHECK THE BLOWER SPEED CONTROL AND CIRCUIT

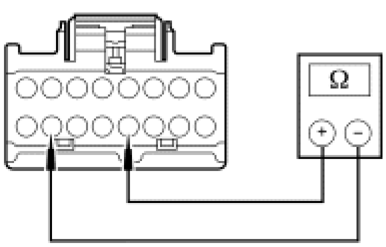

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Fig. 222: Checking Blower Speed Control And Circuit
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to C3305c-12, circuit VHS16 (BU/GN), harness side and the negative lead to C3305c-15, circuit RHS03 (GY/OG), harness side when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between DCSM C3305c-12, circuit VHS16 (BU/GN) harness side and DCSM C3305c-15, circuit RHS03 (GY/OG), harness side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : Go to AB31.

  NO : Go to AB30.

AB30 CHECK THE BLOWER SPEED CONTROL

- Disconnect: Backrest TED C3310

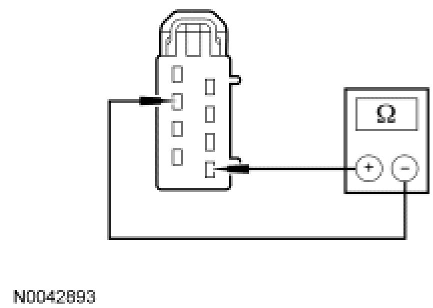


Fig. 223: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between backrest TED C3310 pin 7 and pin 4, component side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB31 CHECK THE THERMISTOR CIRCUIT FOR A SHORT TO VOLTAGE

- Disconnect: DCSM C3305b
- Key in ON position.

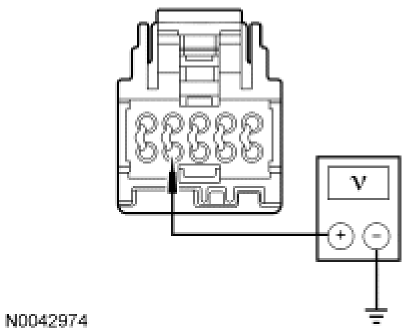


Fig. 224: Checking Thermistor Circuit For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305b-9, circuit VHS35 (VT/OG), harness side and ground.
- **Is the voltage less than 0.5 volt?**

  YES : Go to AB32.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB32 CHECK THE THERMISTOR CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag module C327.
- Disconnect the passenger seat side air bag module C313.
- Disconnect: DCSM C3305b

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

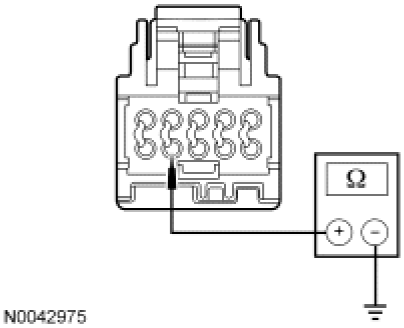


Fig. 225: Checking Thermistor Circuit For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305b-9, circuit VHS35 (VT/OG), harness side and ground.
- **Is the resistance greater than 10,000 volts?**

  YES : Go to AB33.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AB33 CHECK THE THERMISTOR AND WIRING

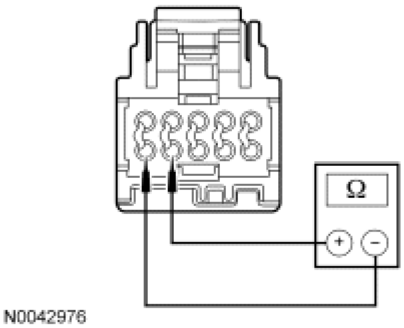


Fig. 226: Checking Thermistor & Wiring
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305b-9, circuit VHS35 (VT/OG), harness side and DCSM C3305b-10, circuit RHS15 (GY/BN), harness side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms

10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AB34.

AB34 CHECK THE THERMISTOR

- Disconnect: Backrest TED C3310

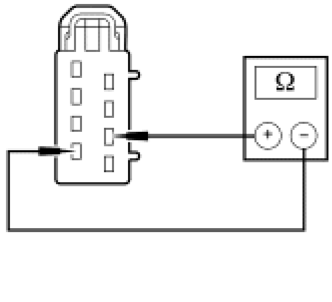


Fig. 227: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms

20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AC: DTC B272D - Passenger Differential Temperature Fault

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible

algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

A differential fault occurs when the cushion and backrest TEDs on an affected seat are reporting very different temperatures to the DCSM. This may result from an airflow restriction or a circuit fault of either TED area. If a TED and manifold is clear of obstruction and is operational, the other TED and circuitry on the seat should be checked. It is important to note that a TED with a higher temperature may be operating correctly and not the area of concern. The other TED may be indicating a much lower temperature, causing the DTC to set.

- DTC B272D Passenger Differential Temperature Fault - If there is a temperature differential between the passenger backrest and cushion TED of 60°C (108°F) or more for more than 4 seconds, the TED is disconnected or the duct is blocked, this DTC will set. When this happens the first time in a key cycle, the DCSM puts the passenger seat system into recovery mode (see principles of operation). If the system is able to recover, it will function normally. If the system is able to recover and it occurs a second time in the same key cycle, the DCSM will shut down the passenger seat system.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Restricted cushion or backrest TED filter
- Crushed or restricted cushion or backrest foam pad
- Crushed or restricted cushion or backrest climate controlled seat manifold
- Cushion or backrest TED assembly
- DCSM

PINPOINT TEST AC: DTC B272D - PASSENGER DIFFERENTIAL TEMPERATURE FAULT

NOTE:	**The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE:	**The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

AC1 CHECK THE DCSM FOR DTCs

- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: Self-Test/DCSM Retrieve DTCs
- **Was DTC B272A or B272B retrieved during the self-test or as a continuous DTC?**

  YES : For DTC B272A, go to **Pinpoint Test Z**. For DTC B272B, go to **Pinpoint Test AA**.

  NO : Go to AC2.

AC2 MONITOR THE DCSM TED TEMPERATURE PIDs

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DCSM
  - Passenger cushion thermal electric device (TED) temperature (PCSHTMP)
  - Passenger back TED temperature (PBKTMP)

- Seat cushion thermal electric device temperature (CSHTEMP)
- Seat back thermal electric device temperature (BK_TEMP)

NOTE: Make sure the temperature of the climate controlled seats has stabilized before monitoring the PIDs. Not allowing stabilization can cause incorrect readings and lead to incorrect identification of components that are not faulty.

- Monitor the TED temperature PIDs with the climate controlled seats OFF. Compare the PIDs of the front passenger seat to those of the driver seat, this can help identify if there is a concern with the front passenger seat cushion or backrest PID readings.
- **Are both front passenger seat TED temperature PIDs within 10°C (18°F) of the ambient temperature?**

  YES : Go to AC3.

  NO : If the front passenger seat cushion PID varies 10°C (18°F) or more from ambient temperature, go to AC16.

  If the front passenger seat backrest PID varies 10°C (18°F) or more from ambient temperature, go to AC32.

AC3 CONFIRM THE FAULT IS IN THE SEAT CUSHION OR THE BACKREST

- Key in OFF position.
- Key in ON position.

NOTE: A crushed seat cushion foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault.

NOTE: If the seat shuts down before a 15-minute heat cycle has timed-out, carry out the DCSM self-test and go to the Dual Climate Controlled Seat Module (DCSM) DTC Chart to continue diagnostics.

- After cycling the ignition switch and with the engine running, set the driver seat to high heat (3 LEDs illuminated on HVAC module). Allow the seat to heat for at least 15 minutes while monitoring the TED temperature PIDs of the driver seat. If necessary, when the seat times-out after 15 minutes, set the driver seat to high heat once again.
- **Do the driver seat cushion TED and backrest TED PIDs vary more than 60°C (108°F) from each other?**

  YES : If the front passenger seat cushion PID is 60°C (108°F) hotter than the backrest PID, go to AC5.

  If the front passenger seat backrest PID is 60°C (108°F) hotter than the cushion PID, go to AC20.

NO : Go to AC4.

AC4 CHECK THE TEDs COOLING PERFORMANCE

- Check the TEDs cooling performance on the affected seat. Refer to Component Test - Thermo-electric Device (TED) Cooling Performance.
- **Did the TEDs pass the component test?**

  YES : The DTC may have been set by extreme cabin temperatures or excessive sunload on the seat causing the system to enter recovery mode. Occupant size and weight characteristics can also be a factor. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation. If a concern cannot be found or duplicated, RETURN the vehicle to the customer.

  NO : CHECK the affected seat cushion or backrest for correct installation of the climate controlled seat components (TED, manifold, plenum, air ducts and foam pad). CHECK for airflow restrictions (TED inlets and outlets, TED-to-manifold or plenum connections, filters and ducts) and REPAIR as needed. CHECK for an intermittent wiring fault. REPAIR as needed. REPEAT the self-test. CLEAR the DTCs.

AC5 CHECK THE TED INSTALLATION AND FOR A CRUSHED SEAT CUSHION

- Key in OFF position.
- Remove the seat. Refer to **Seat - Front**.
- Remove the seat cushion trim cover. Refer to **Seat Cushion Cover - Front**.
- Inspect the seat cushion for the following:
  - Is the cushion blower obstructed?
  - Is the blower filter restricted or plugged?
  - Is the TED correctly installed?
  - Is the seat cushion foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?
- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

  YES : Go to AC6.

  NO : CORRECTLY install the cushion TED or INSTALL a new seat cushion foam pad and/or climate controlled seat manifold. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC6 CHECK THE BACKREST TED- CIRCUIT FOR SHORT TO VOLTAGE

- Key in OFF position.
- Position the front passenger seat in the vehicle and connect the seat-to-floor connectors.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: DCSM C3305a

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Key in ON position.

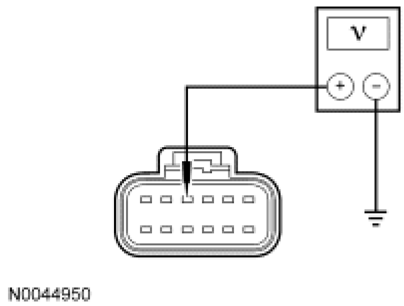


Fig. 228: Checking Backrest TED- Circuit For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305a-D, circuit RHS06 (WH), harness side and ground.
- **Is the voltage less than 0.5 volt?**

  YES : Go to AC7.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC7 CHECK BACKREST TED CIRCUIT CHS06 (BU/BN) FOR SHORT TO GROUND

- Key in OFF position.

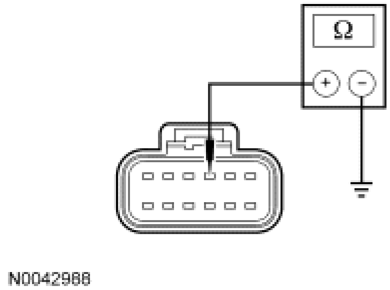


Fig. 229: Checking Backrest TED Circuit CHS06 (BU/BN) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305a-C, circuit CHS06 (BU/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AC8.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC8 CHECK RESISTANCE OF THE BACKREST TED AND WIRING

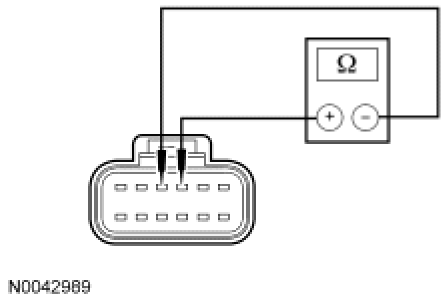


Fig. 230: Checking Resistance Of Backrest TED And Wiring
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305a-C, circuit CHS06 (BU/BN), harness side and DCSM C3305a-D, circuit RHS06 (WH), harness side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : Go to AC10.

  NO : Go to AC9.

AC9 CHECK RESISTANCE OF THE BACKREST TED

- Disconnect: Backrest TED C3311

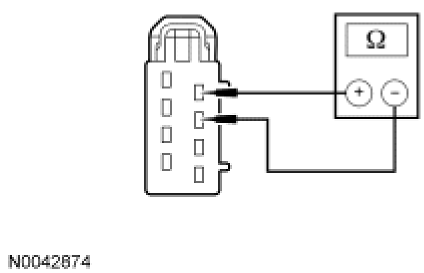


Fig. 231: Checking Resistance Of Backrest TED
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3311 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC10 CHECK BLOWER CIRCUIT CHS08 (BN/YE) AND SPEED CONTROL CIRCUIT VHS23 (BN/BU) FOR A SHORT TO VOLTAGE

- Disconnect: DCSM C3305c
- Key in ON position.

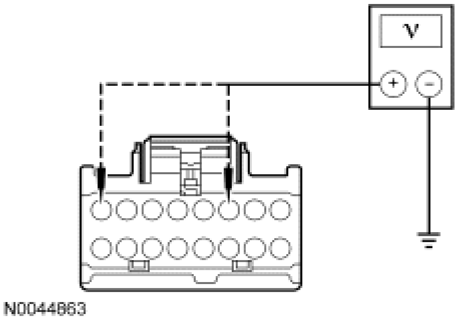


Fig. 232: Checking Blower Circuit CHS08 (BN/YE) & Speed Control Circuit VHS23 (BN/BU) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305c-8, circuit CHS08 (BN/YE), harness side and ground and between DCSM C3305c-3, circuit VHS23 (BN/BU), harness side and ground.
- **Are the voltages less than one volt?**

  YES : Go to AC11.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC11 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.

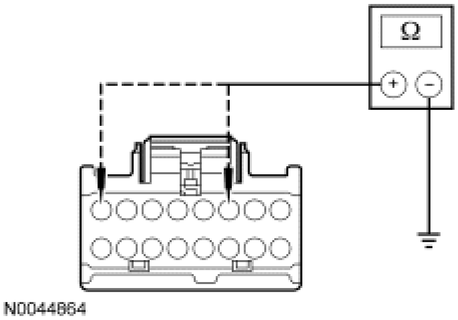


Fig. 233: Checking Blower And Speed Control Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-8, circuit CHS08 (BN/YE), harness side and ground and between DCSM C3305c-3, circuit VHS23 (BN/BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AC12.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC12 CHECK THE BLOWER AND WIRING

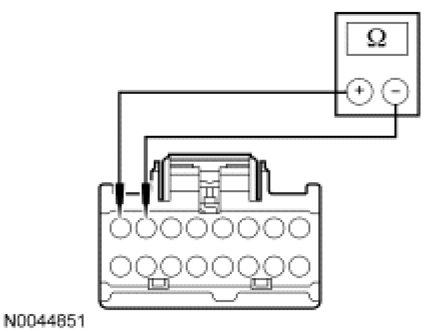


Fig. 234: Checking Blower & Wiring
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to DCSM C3305c-8, circuit CHS08 (BN/YE) and the negative lead to DCSM C3305c-7, circuit RHS08 (VT/WH) when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between DCSM C3305c-8, circuit CHS08 (BN/YE), harness side and DCSM C3305c-7, circuit RHS08 (VT/WH), harness side.
- **Is the resistance between 6K ohms and 9K ohms?**

YES : Go to AC14.

NO : Go to AC13.

AC13 CHECK THE BLOWER

- Disconnect: Cushion TED C3303

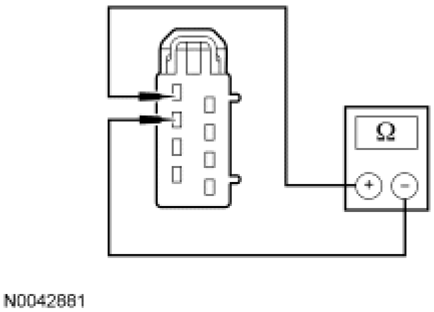


Fig. 235: Checking Blower Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3303 pin 2 and pin 4, component side.
- **Is the resistance between 6K ohms and 9K ohms?**

YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC14 CHECK THE BLOWER SPEED CONTROL AND CIRCUIT

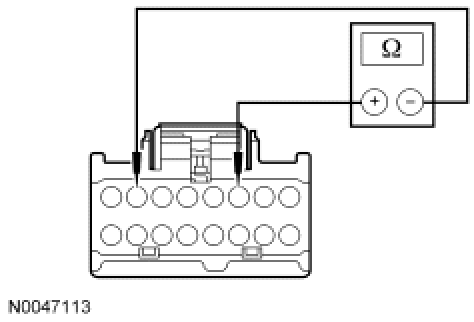


Fig. 236: Checking Blower Speed Control And Circuit
Courtesy of FORD MOTOR CO.

NOTE: The ohmmeter must be connected with the positive lead to C3305c-3, circuit VHS23 (BN/BU), harness side and the negative lead to C3305c-7, circuit RHS08 (VT/WH), harness side when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between DCSM C3305c-3, circuit VHS23 (BN/BU) harness side and DCSM C3305c-7, circuit RHS08 (VT/WH), harness side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : Go to AC16.

  NO : Go to AC15.

AC15 CHECK THE BLOWER SPEED CONTROL

- Disconnect: Cushion TED C3303

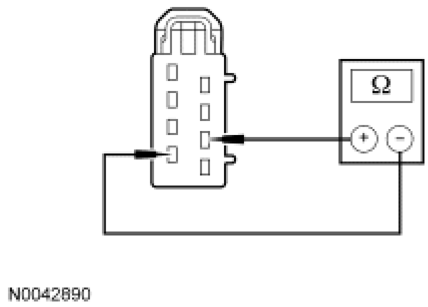


Fig. 237: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

NOTE: The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between cushion TED C3303 pin 7 and pin 4, component side.

- **Is the resistance between 290K ohms and 420K ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC16 CHECK THE THERMISTOR CIRCUIT FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: DCSM C3305b

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Key in ON position.

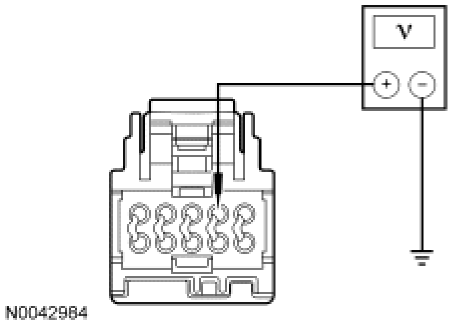


Fig. 238: Checking Thermistor Circuit For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305b-2, circuit VHS27 (WH/OG), harness side and ground.
- **Is the voltage less than 0.5 volt?**

  YES : Go to AC17.

NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC17 CHECK THE THERMISTOR CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.

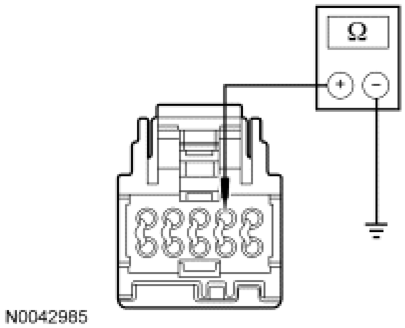


Fig. 239: Checking Thermistor Circuit For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305b-2, circuit VHS27 (WH/OG), harness side and ground.
- **Is the resistance greater than 10,000 volts?**

  YES : Go to AC18.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC18 CHECK THE THERMISTOR AND WIRING

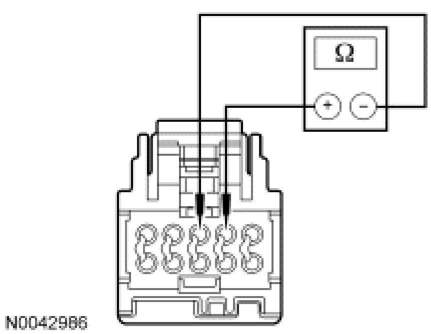


Fig. 240: Checking Thermistor & Wiring
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305b-2, circuit VHS27 (WH/OG), harness side and

DCSM C3305b-3, circuit RHS10 (BU/OG), harness side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AC19.

AC19 CHECK THE THERMISTOR

- Disconnect: Cushion TED C3303

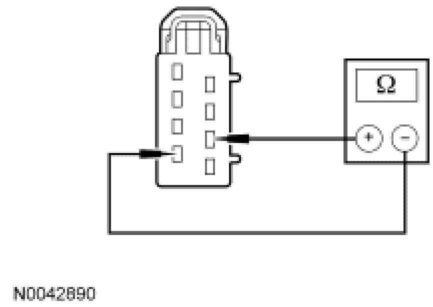


Fig. 241: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC20 CHECK THE TED INSTALLATION AND FOR A CRUSHED SEAT BACKREST

- Key in OFF position.
- Remove the seat. Refer to **Seat - Front**.
- Remove the seat backrest trim cover. Refer to **Seat Backrest Cover - Front, Without Fold Flat**.
- Inspect the seat backrest for the following:
  - Is the backrest blower obstructed?
  - Is the blower filter restricted or plugged?
  - Is the TED correctly installed?
  - Is the seat backrest foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?
- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

  YES : Go to AC21.

  NO : CORRECTLY install the backrest TED or INSTALL a new seat backrest foam pad and/or climate controlled seat manifold. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. REPOWER the SRS. REFER to **SUPPLEMENTAL**

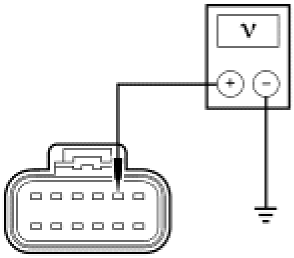
RESTRAINT SYSTEM article.

AC21 CHECK CUSHION TED CIRCUIT RHS07 (BU) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Position the front passenger seat in the vehicle and connect the seat-to-floor connectors.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: DCSM C3305a

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Key in ON position.



N0044870

Fig. 242: Checking Cushion TED Circuit RHS07 (BU) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305a-B, circuit RHS07 (BU), harness side and ground.
- **Is the voltage less than 0.5 volt?**

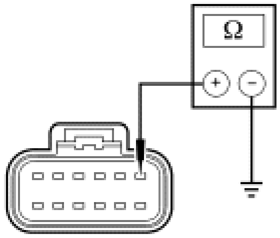
  YES : Go to AC22.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC22 CHECK CUSHION TED CIRCUIT CHS07 (GY/BU) FOR A SHORT TO GROUND

- Key in OFF position.



N0042978

Fig. 243: Checking Cushion TED Circuit CHS07 (GY/BU) For A Short To Ground
Courtesy of FORD MOTOR CO.

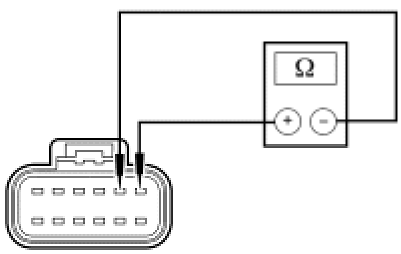
- Measure the resistance between DCSM C3305a-A, circuit CHS07 (GY/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AC23.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC23 CHECK THE RESISTANCE OF THE CUSHION TED AND WIRING



N0042979

Fig. 244: Checking Resistance Of Cushion TED And Wiring
Courtesy of FORD MOTOR CO.

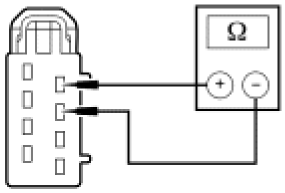
- Measure the resistance between DCSM C3305a-A circuit CHS07 (GY/BU), harness side and DCSM C3305a-B, circuit RHS07 (BU), harness side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : Go to AC25.

  NO : Go to AC24.

AC24 CHECK THE RESISTANCE OF THE CUSHION TED

- Disconnect: Cushion TED C3303



N0042874

Fig. 245: Checking Resistance Of Cushion TED
Courtesy of FORD MOTOR CO.

- Measure the resistance between cushion TED C3303 pin 1 and pin 3, component side.
- **Is the resistance between 0.9 and 10 ohms?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

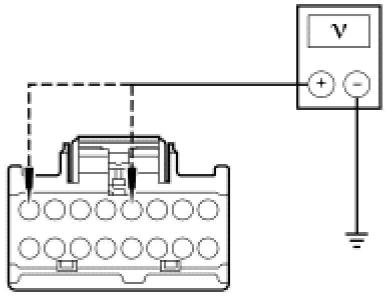
  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC25 CHECK BLOWER CIRCUIT CHS08 (BN/YE) AND SPEED CONTROL CIRCUIT VHS21 (BU/WH) FOR A SHORT TO VOLTAGE

- Disconnect: DCSM C3305c
- Key in ON position.



N0044866

Fig. 246: Checking Blower Circuit CHS08 (BN/YE) & Speed Control Circuit VHS21 (BU/WH) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305c-8, circuit CHS08 (BN/YE), harness side and ground and between DCSM C3305c-4, circuit VHS21 (BU/WH), harness side and ground.

- **Are the voltages less than one volt?**

  YES : Go to AC26.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC26 CHECK THE BLOWER AND SPEED CONTROL CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.

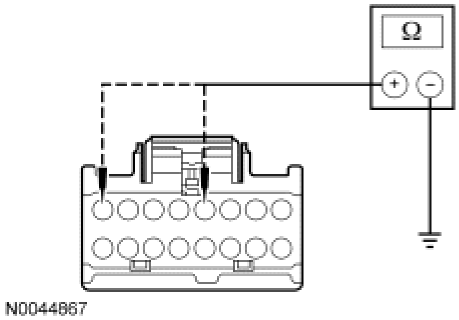


Fig. 247: Checking Blower & Speed Control Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-8, circuit CHS08 (BN/YE), harness side and ground and between DCSM C3305c-4, circuit VHS21 (BU/WH), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AC27.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC27 CHECK THE BLOWER AND WIRING

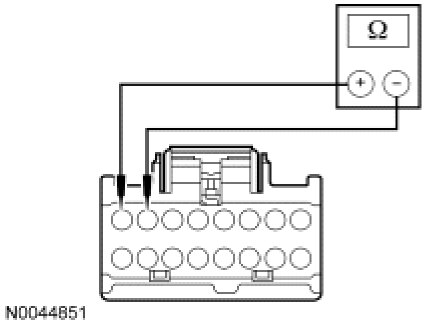


Fig. 248: Checking Blower & Wiring

Courtesy of FORD MOTOR CO.

NOTE: The ohmmeter must be connected with the positive lead to DCSM C3305c-8, circuit CHS08 (BN/YE) and the negative lead to DCSM C3305c-7, circuit RHS08 (VT/WH) when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between DCSM C3305c-8, circuit CHS08 (BN/YE), harness side and DCSM C3305c-7, circuit RHS08 (VT/WH), harness side.
- **Is the resistance between 6K ohms and 9K ohms?**

  YES : Go to AC29.

  NO : Go to AC28.

AC28 CHECK THE BLOWER

- Disconnect: Backrest TED C3311

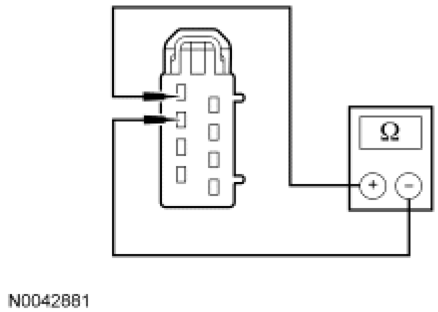


Fig. 249: Checking Blower Resistance
Courtesy of FORD MOTOR CO.

NOTE: The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between backrest TED C3311 pin 2 and pin 4, component side.
- **Is the resistance between 6K ohms and 9K ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313.

REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC29 CHECK THE BLOWER SPEED CONTROL AND CIRCUIT

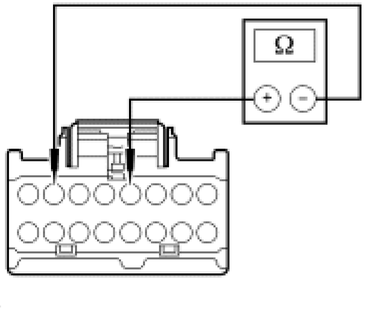


Fig. 250: Checking Blower Speed Control And Circuit
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to C3305c-4, circuit VHS21 (BU/WH), harness side and the negative lead to C3305c-7, circuit RHS08 (VT/WH), harness side when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between DCSM C3305c-4, circuit VHS21 (BU/WH) harness side and DCSM C3305c-7, circuit RHS08 (VT/WH), harness side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : Go to AC31.

  NO : Go to AC30.

AC30 CHECK THE BLOWER SPEED CONTROL

- Disconnect: Backrest TED C3311

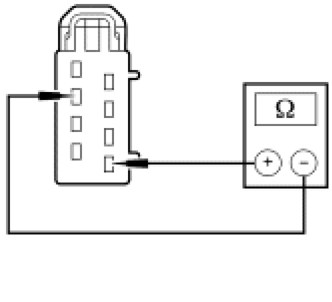


Fig. 251: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads**

incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.

- Measure the resistance between backrest TED C3311 pin 7 and pin 4, component side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC31 CHECK THE THERMISTOR CIRCUIT FOR A SHORT TO VOLTAGE

- Disconnect: DCSM C3305b
- Key in ON position.

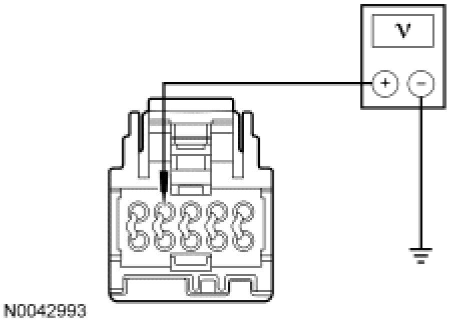


Fig. 252: Checking Thermistor Circuit For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305b-4, circuit VHS36 (YE/BU), harness side and ground.
- **Is the voltage less than 0.5 volt?**

  YES : Go to AC32.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC32 CHECK THE THERMISTOR CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

- Disconnect the passenger seat side air bag C313.

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

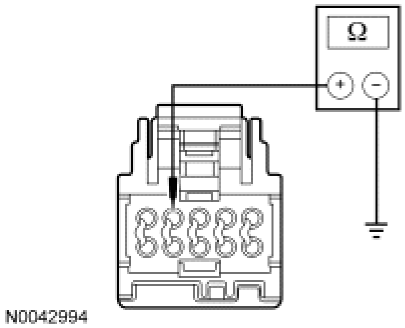


Fig. 253: Checking Thermistor Circuit For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305b-4, circuit VHS36 (YE/BU), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AC33.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AC33 CHECK THE THERMISTOR AND WIRING

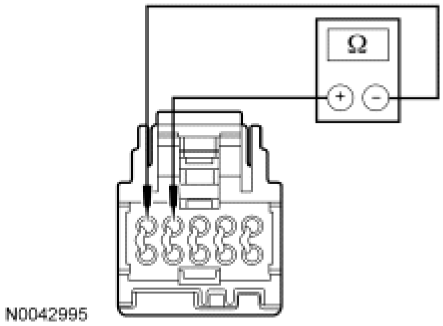


Fig. 254: Checking Thermistor & Wiring
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305b-4, circuit VHS36 (YE/BU), harness side and DCSM C3305b-5, circuit RHS20 (GN/BU), harness side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : INSTALL a new DCSM and CARRY OUT PMI. REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AC34.

AC34 CHECK THE THERMISTOR

- Disconnect: Backrest TED C3311

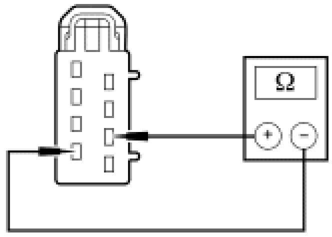


Fig. 255: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : REPAIR the affected circuit(s). REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AD: DTC B272E - Driver Ignition Run/Blower Circuit Short to Ground

NOTE: This DTC sets for an open or short to voltage. See DTC setting description below.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault

occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- HVAC module
- Backrest or cushion TED
- DCSM

PINPOINT TEST AD: DTC B272E - DRIVER IGNITION RUN/BLOWER CIRCUIT SHORT TO GROUND

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

AD1 CHECK DCSM CLIMATE-CONTROLLED SEAT HEAT COMMAND (TED_HEAT_D) PID

- Access the cushion and backrest TEDs and remove the filters to watch the TED fans.
- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DCSM PID TED_HEAT_D

  NOTE: **The DCSM active command TED_HEAT_D is limited to 15 seconds in the ON state.**

- Operate the climate controlled seat using the active command while monitoring the cushion and backrest TEDs for fan movement.
- **Did both fans turn on?**

  YES : CARRY OUT the network test. If DTCs are retrieved from the HVAC module, REFER to the DTC Chart in the Diagnosis and Testing portion of **MULTIFUNCTION ELECTRONIC MODULES** article. If no DTCs are retrieved, CARRY OUT the HVAC Module Cold Boot Process in the Diagnosis and Testing portion of **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

NO : Go to AD2.

AD2 CHECK FOR AN INTERMITTENT CONNECTION AT THE DCSM

- Key in OFF position.
- Disconnect: DCSM C3305c
- Connect: DCSM C3305c
- With the engine running and using the switches on the HVAC module, turn the driver climate controlled seat system on while monitoring the cushion and backrest fans for movement.
  - If there is fan movement, run the driver climate controlled seat system for 2 minutes.
- **Did the climate controlled seat operate correctly?**

  YES : The fault is intermittent. CHECK for causes of the intermittent fault at C3305c and REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AD3.

AD3 CHECK FOR AN INTERMITTENT CONNECTION AT THE CUSHION TED

- Key in OFF position.
- Disconnect: Cushion TED C3300
- Connect: Cushion TED C3300
- With the engine running and using the switches on the HVAC module, turn the driver climate controlled seat system on while monitoring the cushion and backrest fans for movement.
  - If there is fan movement, run the driver climate controlled seat system for 2 minutes.
- **Did the climate controlled seat operate correctly?**

  YES : The fault is intermittent. CHECK for causes of the intermittent fault at C3300 and REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AD4.

AD4 CHECK FOR AN INTERMITTENT CONNECTION AT THE BACKREST TED

- Key in OFF position.
- Disconnect: Backrest TED C3310
- Connect: Backrest TED C3310
- With the engine running and using the switches on the HVAC module, turn the driver climate controlled seat system on while monitoring the cushion and backrest fans for movement.
  - If there is fan movement, run the driver climate controlled seat system for 2 minutes.
- **Did the climate controlled seat operate correctly?**

  YES : The fault is intermittent. CHECK for causes of the intermittent fault at C3310 and REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AD5.

AD5 CHECK BLOWER CIRCUIT CHS03 (GN/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag module C327.

- Disconnect the passenger seat side air bag module C313.
- Disconnect: DCSM C3305c
- Disconnect: Cushion TED C3300
- Disconnect: Backrest TED C3310

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Key in ON position.

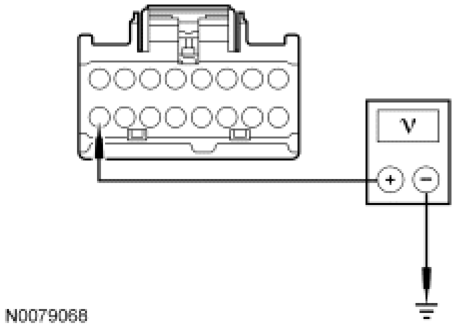


Fig. 256: Checking Blower Circuit CHS03 (GN/BN) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305c-16, circuit CHS03 (GN/BN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AD6.

AD6 CHECK CUSHION TED BLOWER CIRCUITS CHS03 (GN/BN) AND RHS03 (GY/OG) FOR AN OPEN

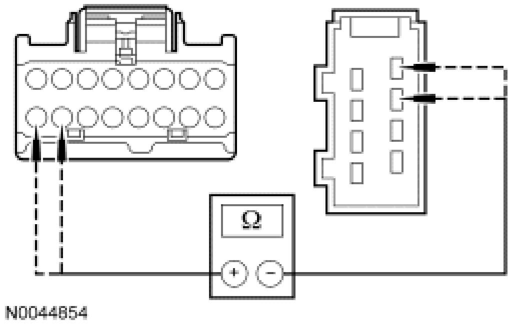


Fig. 257: Checking Cushion TED Blower Circuits CHS03 (GN/BN) & RHS03 (GY/OG) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-16, circuit CHS03 (GN/BN), harness side and cushion TED C3300-2, circuit CHS03 (GN/BN), harness side; and between DCSM C3305c-15, circuit RHS03 (GY/OG), harness side and cushion TED C3300-4, circuit RHS03 (GY/OG), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to AD7.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AD7 CHECK BACKREST TED BLOWER CIRCUITS CHS03 (GN/BN) AND RHS03 (GY/OG) FOR AN OPEN

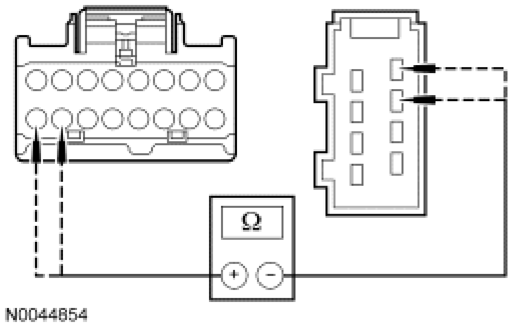


Fig. 258: Checking Backrest TED Blower Circuits CHS03 (GN/BN) & RHS03 (GY/OG) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-16, circuit CHS03 (GN/BN), harness side and backrest TED C3310-2, circuit CHS03 (GN/BN), harness side; and between DCSM C3305c-15, circuit RHS03 (GY/OG), harness side and cushion TED C3310-4, circuit RHS03 (GY/OG), harness side.

- **Are the resistances less than 5 ohms?**

  YES : Go to AD8.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AD8 CHECK BLOWER RESISTANCE

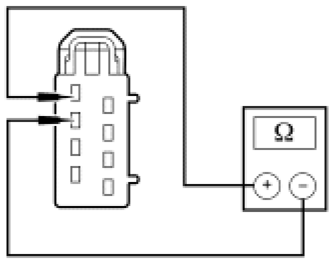


Fig. 259: Checking Blower Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3300 pin 2 and pin 4, component side and between backrest TED C3310 pin 2 and pin 4, component side.
- **Are the resistances between 6,000 ohms and 9,000 ohms?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the resistance of the cushion TED was **not** between 6,000 and 9,000 ohms, INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  If the resistance of the backrest TED was **not** between 6,000 and 9,000 ohms, INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AE: DTC B272F - Passenger Ignition Run/Blower Circuit Short to Ground

NOTE: This DTC sets for an open or short to voltage. See DTC setting description below.

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- HVAC module
- Backrest or cushion TED
- DCSM

PINPOINT TEST AE: DTC B272F - PASSENGER IGNITION RUN/BLOWER CIRCUIT SHORT TO GROUND

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

AE1 CHECK DCSM PASSENGER TED HEAT MODE (TED_HEAT_P) PID

- Access the cushion and backrest TEDs and remove the filters to watch the TED fans.
- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DCSM PID TED_HEAT_P

NOTE: The DCSM active command TED_HEAT_P is limited to 15 seconds in the ON state.

- Operate the climate controlled seat using the active command while monitoring the cushion and backrest TEDs for fan movement.
- **Did both fans turn on?**

  YES : CARRY OUT the network test. If DTCs are retrieved from the HVAC module, REFER to the DTC Chart in the Diagnosis and Testing portion of **MULTIFUNCTION ELECTRONIC MODULES** article. If no DTCs are retrieved, CARRY OUT the HVAC Module Cold Boot Process in the Diagnosis and Testing portion of **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article.

  NO : Go to AE2.

AE2 CHECK FOR AN INTERMITTENT CONNECTION AT THE DCSM

- Key in OFF position.
- Disconnect: DCSM C3305c
- Connect: DCSM C3305c
- With the engine running and using the switches on the HVAC module, turn the passenger climate controlled seat system on while monitoring the cushion and backrest fans for movement.
  - If there is fan movement, run the passenger climate controlled seat system for 2 minutes.
- **Did the climate controlled seat operate correctly?**

  YES : The fault is intermittent. CHECK for causes of the intermittent fault at C3305c and REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AE3.

AE3 CHECK FOR AN INTERMITTENT CONNECTION AT THE CUSHION TED

- Key in OFF position.
- Disconnect: Cushion TED C3303
- Connect: Cushion TED C3303
- With the engine running and using the switches on the HVAC module, turn the passenger climate controlled seat system on while monitoring the cushion and backrest fans for movement.
  - If there is fan movement, run the passenger climate controlled seat system for 2 minutes.
- **Did the climate controlled seat operate correctly?**

  YES : The fault is intermittent. CHECK for causes of the intermittent fault at C3303 and REPAIR

the circuit. REPEAT the self-test. CLEAR the DTCs.

NO : Go to AE4.

AE4 CHECK FOR AN INTERMITTENT CONNECTION AT THE BACKREST TED

- Key in OFF position.
- Disconnect: Backrest TED C3311
- Connect: Backrest TED C3311
- With the engine running and using the switches on the HVAC module, turn the passenger climate controlled seat system on while monitoring the cushion and backrest fans for movement.
  - If there is fan movement, run the passenger climate controlled seat system for 2 minutes.
- **Did the climate controlled seat operate correctly?**

  YES : The fault is intermittent. CHECK for causes of the intermittent fault at C3311 and REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AE5.

AE5 CHECK BLOWER CIRCUIT CHS08 (BN/YE) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the passenger seat side air bag C313.
- Disconnect: DCSM C3305c
- Disconnect: Cushion TED C3303
- Disconnect: Backrest TED C3311

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.
- Key in ON position.

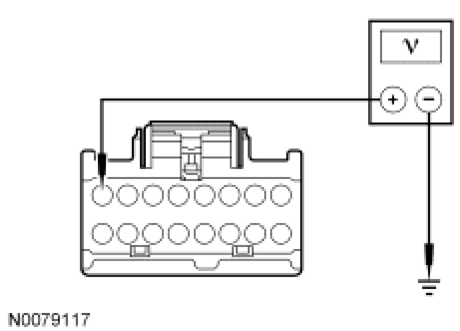


Fig. 260: Checking Blower Circuit CHS08 (BN/YE) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305c-8, circuit CHS08 (BN/YE), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : Go to AE6.

AE6 CHECK CUSHION TED BLOWER CIRCUITS CHS08 (BN/YE) AND RHS08 (VT/WH) FOR AN OPEN

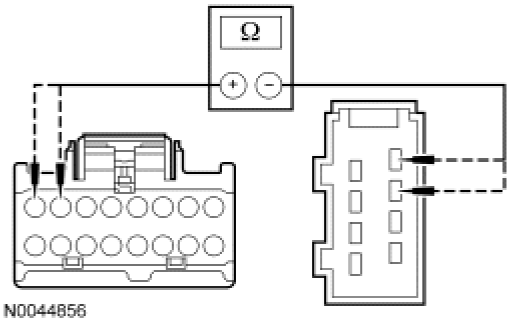


Fig. 261: Checking Cushion TED Blower Circuits CHS08 (BN/YE) & RHS08 (VT/WH) For An Open
Courtesy of FORD MOTOR CO.

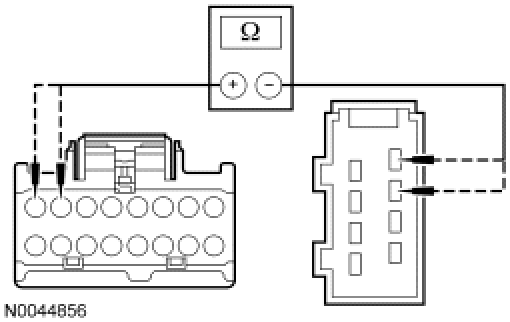
- Measure the resistance between DCSM C3305c-8, circuit CHS08 (BN/YE), harness side and cushion TED C3303-2, circuit CHS08 (BN/YE), harness side; and between DCSM C3305c-7, circuit RHS08 (VT/WH), harness side and cushion TED C3303-4, circuit RHS08 (VT/WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to AE7.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AE7 CHECK BACKREST TED BLOWER CIRCUITS CHS08 (BN/YE)/CHS08 (GY/RD) AND RHS08 (VT/WH) FOR AN OPEN



N0044856

Fig. 262: Checking Backrest TED Blower Circuits CHS08 (BN/YE)/CHS08 (GY/RD) & RHS08 (VT/WH) For An Open
Courtesy of FORD MOTOR CO.

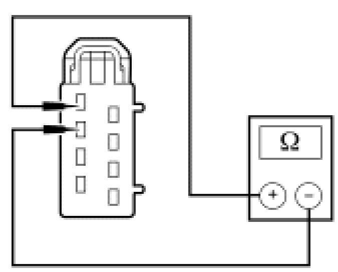
- Measure the resistance between DCSM C3305c-8, circuit CHS08 (BN/YE), harness side and backrest TED C3311-2, circuit CHS08 (GY/RD), harness side; and between DCSM C3305c-7, circuit RHS08 (VT/WH), harness side and backrest TED C3311-4, circuit RHS08 (VT/WH), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to AE8.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AE8 CHECK BLOWER RESISTANCE



N0042881

Fig. 263: Checking Blower Resistance
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between cushion TED C3303 pin 2 and pin 4, component side and between backrest TED C3311 pin 2 and pin 4, component side.

- **Are the resistances between 6,000 ohms and 9,000 ohms?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : If the resistance of the cushion TED was **not** between 6,000 and 9,000 ohms, INSTALL a new cushion TED. REFER to **Seat Cushion Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  If the resistance of the backrest TED was **not** between 6,000 and 9,000 ohms, INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AF: DTC B2730 - Back Over-Temp Detected (Driver)

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

- DTC B2730 Back Over-Temp Detected (Driver) - In the cooling mode, if the driver seat backrest TED temperature exceeds 70°C (158°F) for more than 34 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the driver seat system and set this DTC.
- DTC B2730 Back Over-Temp Detected (Driver) - In the heating mode, if the driver seat backrest TED temperature exceeds 85°C (185°F) for more than 34 seconds, the TED is disconnected or the duct is blocked, the DCSM will shut down the driver seat system and set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Restricted backrest TED filter
- Crushed or restricted backrest foam pad
- Crushed or restricted climate controlled seat manifold
- Backrest TED assembly
- DCSM

PINPOINT TEST AF: DTC B2730 - BACK OVER-TEMP DETECTED (DRIVER)

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

AF1 CHECK THE DCSM FOR DTCs

- Connect the diagnostic tool.
- Enter the following diagnostic mode on the diagnostic tool: Self-Test/DCSM Retrieve DTCs
- **Was DTC B2730 retrieved during the self-test?**

  YES : Go to AF2.

  NO : Go to AF4.

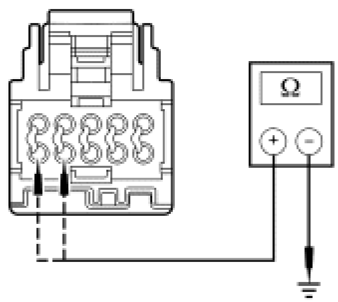
AF2 CHECK THE TED THERMISTOR CIRCUITS FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag module C327.
- Disconnect the passenger seat side air bag module C313.
- Disconnect: DCSM C3305b
- Disconnect: Backrest TED C3310

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may**

result in serious personal injury in the event of an accidental deployment.

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.



N0065349

Fig. 264: Checking TED Thermistor Circuits For A Short To Ground
Courtesy of FORD MOTOR CO.

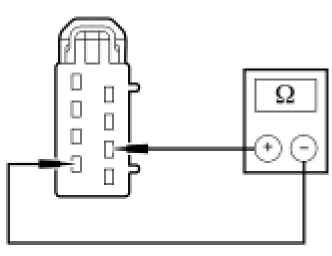
- Measure the resistance between DCSM C3305b-9, circuit VHS35 (VT/OG), harness side and ground; and between DCSM C3305b-10, circuit RHS15 (GY/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to AF3.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AF3 CHECK THE TED THERMISTOR



N0042890

Fig. 265: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

- Measure the resistance between backrest TED C3310 pin 5 and pin 8, component side. Note the ambient temperature and refer to the following table.

Temperature	Resistance
0-10°C (32-50°F)	2,782-1,663 ohms
10-20°C (50-68°F)	1,837-1,140 ohms
20-30°C (68-86°F)	1,260-806 ohms
30-40°C (86-104°F)	893-570 ohms
40-50°C (104-122°F)	630-428 ohms

- **Is the resistance within the limits indicated?**

  YES : REPAIR the affected open circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AF4 CONFIRM THE FAULT

- Verify with the customer that the concern is the seat shuts OFF in heat mode.

NOTE: **A crushed seat backrest foam pad or a crushed climate controlled seat manifold may be the cause of the fault. It may be necessary to sit on the seat or place something of reasonable size and weight on the seat to recreate the fault.**

- Attempt to recreate the fault. Start the vehicle and set the driver seat to high heat for at least 15 minutes.
- **Is the customer concern with the seat shutting OFF in heat mode or was the fault recreated?**

  YES : Go to AF5.

  NO : Fault not present. Fault may have been set due to a past failure or incorrect use of the climate controlled seat system by repeated switching between HEAT and COOL modes. REPEAT the self-test. CLEAR the DTCs.

AF5 CHECK OPERATION OF THE SEAT

- Key in ON position.
- With the engine running, set both front seats to high cool (3 LEDs illuminated on HVAC module).
- Compare the airflow from the driver seat backrest and compare it to the airflow from the passenger seat backrest.
- **Is the airflow exhausting from the driver seat backrest comparable to the airflow exhausting from the passenger seat backrest?**

  YES : Go to AF14.

  NO : Go to AF6.

AF6 CHECK THE BACKREST BLOWER FOR AN OBSTRUCTION OR RESTRICTED FILTER

- Key in OFF position.
- Inspect the blower of the backrest TED assembly for an obstruction or for a restricted filter.
- **Is the blower obstructed or the filter restricted?**

  YES : REMOVE the obstruction or INSTALL a new filter. REPEAT the self-test. CLEAR the DTCs.

  NO : Go to AF7.

AF7 CHECK THE BACKREST FAN OPERATION

- Key in ON position.
- With the engine running, set both front seats to high cool (3 LEDs illuminated on HVAC module).
- Inspect the backrest blower for operation.
- **Does the backrest blower operate?**

  YES : Go to AF14.

  NO : Go to AF8.

AF8 CHECK THE BLOWER SPEED CONTROL CIRCUIT FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect the driver seat side air bag module C327.
- Disconnect the passenger seat side air bag module C313.
- Disconnect: DCSM C3305c
- Disconnect: Backrest TED C3310

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Connect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

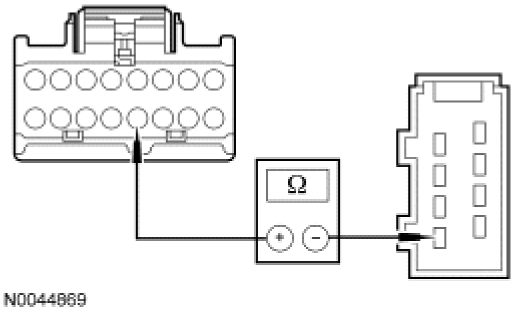


Fig. 266: Checking Blower Speed Control Circuit For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-12, circuit VHS16 (BU/GN), harness side and backrest TED C3310-7, circuit VHS16 (BU/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to AF9.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AF9 CHECK BLOWER CIRCUIT RHS03 (GY/OG) FOR A SHORT TO VOLTAGE

- Key in ON position.

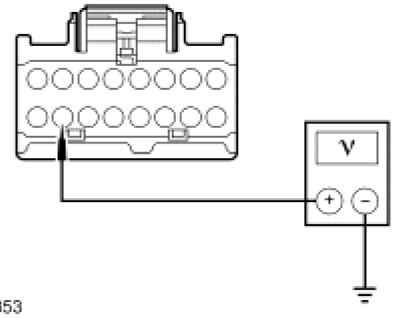


Fig. 267: Checking Blower Circuit RHS03 (GY/OG) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between DCSM C3305c-15, circuit RHS03 (GY/OG), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to

SUPPLEMENTAL RESTRAINT SYSTEM article.

NO : Go to AF10.

AF10 CHECK BLOWER CIRCUIT CHS03 (GN/BN) FOR A SHORT TO GROUND

- Key in OFF position.

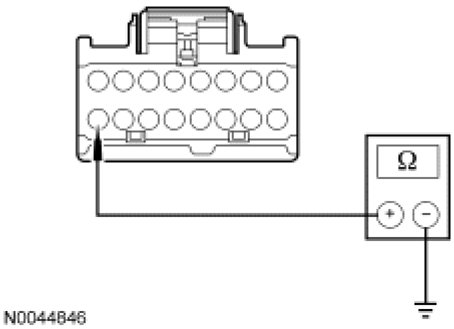


Fig. 268: Checking Blower Circuit CHS03 (GN/BN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-16, circuit CHS03 (GN/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to AF11.

  NO : REPAIR the circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AF11 CHECK BLOWER CIRCUITS CHS03 (GN/BN) AND RHS03 (GY/OG) FOR AN OPEN

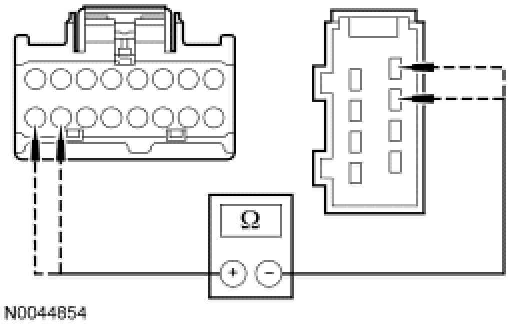


Fig. 269: Checking Blower Circuits CHS03 (GN/BN) & RHS03 (GY/OG) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between DCSM C3305c-16, circuit CHS03 (GN/BN), harness side and backrest TED C3310-2, circuit CHS03 (GN/BN), harness side; and between DCSM C3305c-15,

circuit RHS03 (GY/OG), harness side and backrest TED C3310-4, circuit RHS03 (GY/OG), harness side.

- **Are the resistances less than 5 ohms?**

  YES : Go to AF12.

  NO : REPAIR the affected circuit. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AF12 CHECK THE BLOWER RESISTANCE

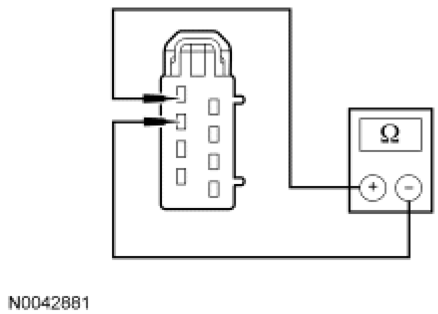


Fig. 270: Checking Blower Resistance
Courtesy of FORD MOTOR CO.

NOTE: **The ohmmeter must be connected with the positive lead to pin 2 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between backrest TED C3310 pin 2 and pin 4, component side.
- **Is the resistance between 6K ohms and 9K ohms?**

  YES : Go to AF13.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AF13 CHECK THE BLOWER SPEED CONTROL RESISTANCE

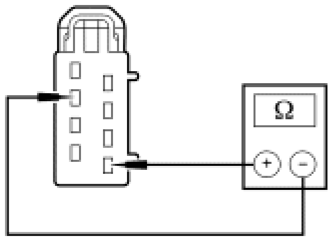


Fig. 271: Checking Blower Speed Control
Courtesy of FORD MOTOR CO.

NOTE:	**The ohmmeter must be connected with the positive lead to pin 7 and the negative lead to pin 4 when measuring. Ohmmeter leads incorrectly connected will result in false readings and lead to incorrect identification of components that are not faulty.**

- Measure the resistance between backrest TED C3310 pin 7 and pin 4, component side.
- **Is the resistance between 290K ohms and 420K ohms?**

  YES : Go to AF14.

  NO : INSTALL a new backrest TED. REFER to **Seat Backrest Thermo-Electric Device**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

AF14 CHECK THE TED INSTALLATION AND FOR CRUSHED SEAT BACKREST

- Remove the seat. Refer to **Seat - Front**.
- Remove the seat backrest trim cover. Refer to **Seat Backrest Cover - Front, Without Fold Flat**.
- Inspect the seat backrest for the following:
  - Is the TED correctly installed?
  - Is the seat backrest foam pad crushed or restricted?
  - Is the climate controlled seat manifold crushed or restricted?
- **Is the TED correctly installed and are there no signs of damage to the foam pad and manifold?**

  YES : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

  DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NO : CORRECTLY install the backrest TED or INSTALL a new seat backrest foam pad and/or climate controlled seat manifold. REPEAT the self-test. CLEAR the DTCs.

DISCONNECT the battery ground cable. CONNECT driver seat side air bag module C327. CONNECT passenger seat side air bag module C313. REPOWER the SRS. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Pinpoint Test AG: A Single Climate Controlled Seat is Inoperative - Switch Indicators May or May Not Illuminate

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Climate Controlled Seats for schematic and connector information.

Normal Operation

Both the driver and front passenger climate controlled seats are independently controlled electronically by the dual climate controlled seat module (DCSM) mounted to the bottom of the passenger seat cushion. The climate controlled seat system only operates with the engine running, however, if using a scan tool to command the DCSM, diagnostic testing can be carried out with the ignition switch key ON engine OFF (KOEO). The system receives voltage from battery junction box (BJB) fuse 12 (30A) supplying battery voltage on circuit SBB12 (GN/RD) into DCSM C3305a pin F. The system also receives voltage from BJB fuse 11 (30A) supplying battery voltage on circuit SBB11 (BU/RD) into DCSM C3305a pin E. If voltage is disconnected from either pin E or F of DCSM C3305a with the voltage connection remaining on the other circuit, both seats will remain operational because the voltage supply circuits are connected internally in the DCSM. However, if a fault occurs setting a DTC specific to either climate controlled seat, only the affected seat will be disabled by the module and the other will remain operational.

Each driver and front passenger seat cushion is equipped with a thermo-electric device (TED) assembly that includes a seat blower (fan motor, serviced as an assembly with the TED). Similarly, each driver and front passenger seat backrest is also equipped with its own TED assembly with blower. Cabin air is drawn through the blower and distributed to each of the TED modules located in the seat cushion and backrest. The TEDs then heat or cool the air. The air is then directed into the foam pad and manifold where it is distributed along the surface of the cushion and backrest of the seat. Once the system is activated, the DCSM uses a set of flexible algorithms to control the heating/cooling modes and the blower speed dependent on the HVAC module seat switch settings.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Medium-speed controller area network (MS-CAN)
- HVAC module
- DCSM

PINPOINT TEST AG: A SINGLE CLIMATE CONTROLLED SEAT IS INOPERATIVE - SWITCH INDICATORS MAY OR MAY NOT ILLUMINATE

NOTE:	**The air bag warning indicator illuminates when the correct restraints control**

module (RCM) fuse is removed and the ignition switch is ON.

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

AG1 CHECK OPERATION OF BOTH CLIMATE CONTROLLED SEATS AND VERIFY THE SYMPTOM

- Check the operation of both climate controlled seats and verify the symptom.
- **Is only a single climate controlled seat inoperative?**

  YES : Go to AG2.

  NO : If both seats are inoperative Go to **Symptom Chart**.

AG2 CHECK FOR DCSM AND HVAC DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self-Test/DCSM Retrieve DTCs
- Enter the following diagnostic mode on the diagnostic tool: Self-Test/HVAC Retrieve DTCs
- **Were any DTCs retrieved during the self-tests?**

  YES : For DCSM DTCs, go to the Dual Climate Controlled Seat Module (DCSM) DTC Chart.

  For HVAC DTCs, REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** article to diagnose the HVAC module fault.

  NO : Go to AG3.

AG3 CHECK OPERATION OF THE DCSM USING PIDs

NOTE: **The purpose of this step is to verify the DCSM is able to receive and process inbound command messages from the communication bus and demonstrate if the DCSM is operational. This indicates the HVAC module may not be sending the commands correctly.**

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DCSM

  Driver Seat

  - Seat cushion thermal electric device temperature (CSHTEMP)
  - Seat back thermal electric device temperature (BK_TEMP)
  - Climate-controlled seat heat command (TED_HEAT_D)

  Front Passenger Seat

  - Passenger Cushion Thermal Electric Device (TED) Temperature (PCSHTMP)
  - Passenger Back TED Temperature (PBKTMP)
  - Passenger TED Heat Mode (TED_HEAT_P)

NOTE: The DCSM active commands TED_HEAT_D (driver seat) and TED_HEAT_P (passenger seat) are limited to 15 seconds in the ON state, then turn OFF.

- Operate the affected climate controlled seat using the active command while monitoring the appropriate PIDs for that seat.
  - When the command is in process the TED temperature PIDs on the affected seat should momentarily increase. If no temperature increase is noted, remove the cushion blower filter and repeat the active command while physically monitoring the cushion blower for fan movement.
- **Do the PID states or cushion blower movement indicate climate controlled seat operation when using the active command?**

  YES : Go to AG4.

  NO : INSTALL a new DCSM and CARRY OUT programmable module installation (PMI). REFER to **Dual Climate Controlled Seat Module (DCSM)**. REPEAT the self-test. CLEAR the DTCs.

AG4 USE THE HVAC SWITCH AND MONITOR THE DCSM PID FOR A RESPONSE

- Enter the following diagnostic mode on the diagnostic tool: DataLogger/DCSM
  - Driver State Seat Mode (DCCSMOD) (driver seat)
  - Passenger State Seat Mode (PCCSMOD) (passenger seat)
- Key in START position.

NOTE: Operation of the climate controlled seats repeatedly ON and OFF or repeatedly switching between heat and cool modes may cause DCSM DTCs to set, disabling one or both seat system and may require DTCs to be cleared before seat operation may continue. It is recommended to allow time between modes for seat temperatures to return toward ambient temperatures before continuing.

- Attempt to operate the affected climate controlled seat in all modes using the appropriate switch on the HVAC while monitoring the DCSM PID DCCSMOD (driver seat) or PCCSMOD (passenger seat).
- **Do all the PID states match the climate controlled seat settings selected on the HVAC module?**

  YES : If the fault is intermittent, CHECK for causes of the intermittent fault. INSPECT the connectors, terminals and wiring. ATTEMPT to recreate the fault by flexing the wire harness and operating the system. CHECK the electrical connectors for corrosion, poor pin contact or pushed-out pins. REPAIR any intermittent concerns found and TIGHTEN any loose DCSM connector pins. REPEAT the self-test. CLEAR the DTCs.

  NO : INSTALL a new HVAC module. REFER to **CLIMATE CONTROL** article. REPEAT the self-test. CLEAR the DTCs.

Component Test

Component Testing - Thermo-electric Device (TED) Cooling Performance

NOTE: This test is intended to check the cooling mode performance of an operational climate controlled seat backrest or cushion thermo-electric device (TED) and verify it is cooling inlet air at the TED (ambient cabin air) between 6-8°C (10-14° F).

NOTE: Make sure the vehicle is out of direct sunlight and is in an area with a stable air temperature when testing the climate controlled seat system.

NOTE: For correct temperature measurements, the seat being tested should be occupied.

1. Enter DataLogger and monitor the following DCSM PIDs:
    - CSHTEMP (Seat cushion thermal electric device temperature)
    - BK_TEMP (Seat back thermal electric device temperature)
    - PCSHTMP (Passenger Cushion Thermal Electric Device [TED] Temperature)
    - PBKTMP (Passenger Back TED Temperature)
    - DCCSMOD (Driver State Seat Mode)
    - PCCSMOD (Passenger State Seat Mode)
2. Any initial PID value of greater than 205°C (401°F) or less than 2°C (36°F) indicates a system hardware failure. Do not proceed with this test. Go to **Symptom Chart** or Dual Climate Controlled Seat Module (DCSM) DTC Chart for diagnosis.

    NOTE: Typical backrest and cushion TED shown, others similar.

3. Gain access to the seat backrest and cushion TEDs and use a suitable thermo-couple temperature measuring device to monitor the air inlet temperature.
    - Access the backrest TED.
        - Release the backrest trim cover J-clips at the sides and bottom.
        - Pull out at the bottom and detach the 2 lower hard back panel pin-type retainers.
        - Position the backrest trim cover out of the way.
    - Place the temperature probe near each TEDs air filter.

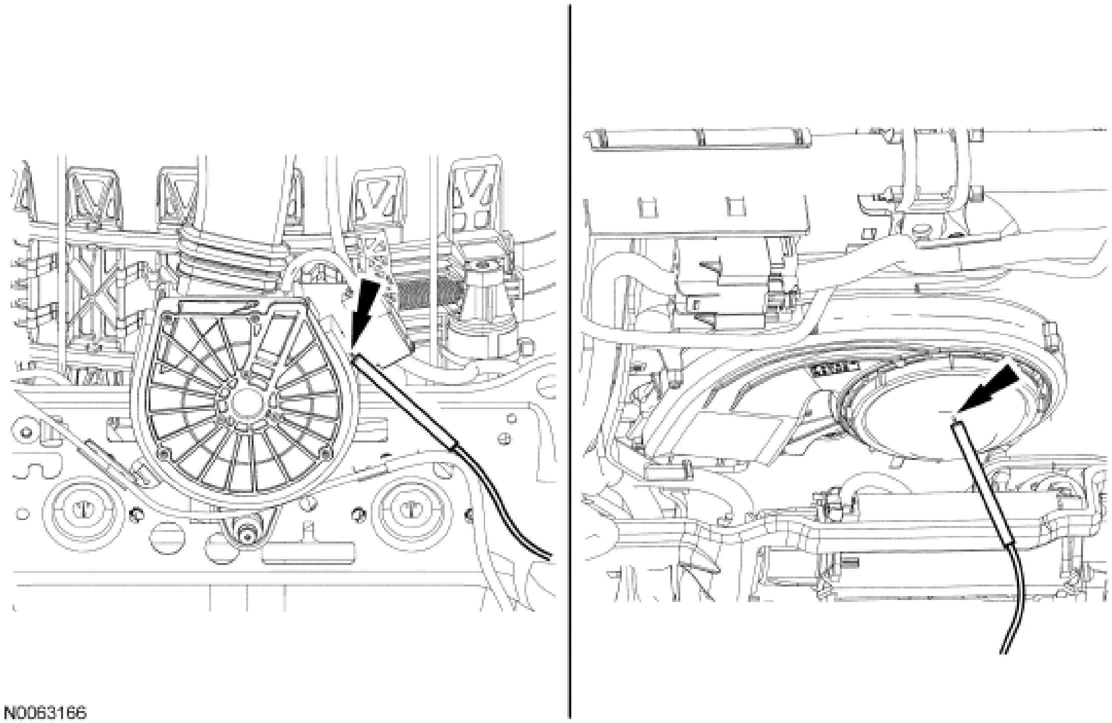


Fig. 272: Using Scan Tool To Measure Cushion TED PID Temperature
Courtesy of FORD MOTOR CO.

NOTE: The engine must be running to operate the climate controlled seat system and carry out this test.

4. Operate system in high cool mode and measure the temperature at the cushion TED filter using the thermo-couple device.
    - Obtain and record the air inlet temperature at the TED.
5. Use a scan tool to measure the cushion TED PID temperature and record the value.
    - Monitor the MODE PID and verify the system is operating. If during testing the PID value changes to Blower Only state, the system has entered into recovery mode and voltage to the TEDs is disabled. If this occurs, the seat has failed the test. Do not continue. Return to the diagnostic routine.
6. Subtract the cushion TED PID temperature from the cushion air inlet temperature and record the temperature difference value.
7. Continue to operate the system in high cool mode and use the thermo-couple device to measure the temperature at the backrest TED filter.
    - Obtain and record the air inlet temperature at the TED.
        - Secure the temperature probe at the backrest TED air filter and close the backrest trim cover before measuring.
8. Use a scan tool to measure the backrest TED PID temperature and record the value.
    - Monitor the MODE PID and verify the system is operating. If during testing the PID value changes to Blower Only state, the system has entered into recovery mode and voltage to the TEDs is

disabled. If this occurs, the seat has failed the test. Do not continue. Return to the diagnostic routine.

9. Subtract the backrest TED PID temperature from the backrest air inlet temperature and record the value.
10. Compare the cushion and backrest calculated temperature values. Both values should be between 6°-8°C (10.8°-14.4°F) and approximately equal (±1°C [±1.8°F]).
11. If the calculated temperature values are not within these specifications, check the climate controlled seat components for air duct or filter restrictions, blockages, duct or electrical disconnections and for incorrect assembly. Repair as needed. If OK, carry out the DCSM self-test and if any DTC is retrieved, go to Dual Climate Controlled Seat Module (DCSM) DTC Chart for diagnostic direction. Return to the diagnostic routine.

GENERAL PROCEDURES

MEMORY POSITION PROGRAMMING

Programming Memory Positions

NOTE: Memory positions can be stored at any time.

NOTE: Verify good battery condition before diagnosing the memory seat system. Poor battery condition may interfere with memory seat operation, even if vehicle starting is possible.

NOTE: To program the Remote Keyless Entry (RKE) transmitter, refer to HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS article.

1. To set memory position(s) move the memory driver seat, memory exterior mirrors (if equipped), memory adjustable pedals (if equipped) and memory tilt steering column (if equipped) to the preferred position using the appropriate switch(es).

NOTE: Once the memory SET switch button is pressed, there is a 5-second time limit to input a memory position. If a memory position input is not received within the time limit, the operation is aborted and the memory SET switch LED (if equipped) is turned OFF.

NOTE: If one of the following other inputs is received during the time limit, the operation is aborted and the memory SET switch LED (if equipped) is turned OFF:

- **Driver seat control switch**
- **Memory SET switch button**
- **Adjustable pedal control switch (if equipped)**
- **Exterior mirror control switch (if equipped)**
- **Power tilt steering column switch (if equipped)**

2. Press the memory SET switch button, activating the memory SET switch LED (if equipped).
3. Within 5 seconds (before the LED goes out) (if equipped), press memory SET switch button 1 or 2.
4. Repeat Steps 1 through 3 to initiate another memory position setting.

Recalling a Stored Memory Position

NOTE: **A memory recall can be initiated only if the vehicle is in PARK or NEUTRAL gear and the ignition switch is not in START. A memory recall in progress will not be affected by moving the ignition switch to START or by moving the gearshift lever out of PARK or NEUTRAL.**

NOTE: **Input from the driver seat control switch, memory SET switch, adjustable pedal control switch (if equipped), exterior mirror control switch (if equipped) or power tilt steering column switch (if equipped) during a memory recall will abort the memory recall.**

1. The driver can recall the desired memory driver seat, memory exterior mirror (if equipped), memory adjustable pedal (if equipped) and memory tilt steering column (if equipped) positions by depressing either memory SET switch button 1 or 2. Depressing memory SET switch button 1 will initiate a recall of the positions stored for Memory 1. Depressing memory SET switch button 2 will initiate a recall of the positions stored for Memory 2.

REMOVAL AND INSTALLATION

SEAT - FRONT

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

NOTE: **Passenger seat shown, driver seat similar.**

NOTE: **The seat track-to-floor bolts must be tightened in the sequence described in this procedure.**

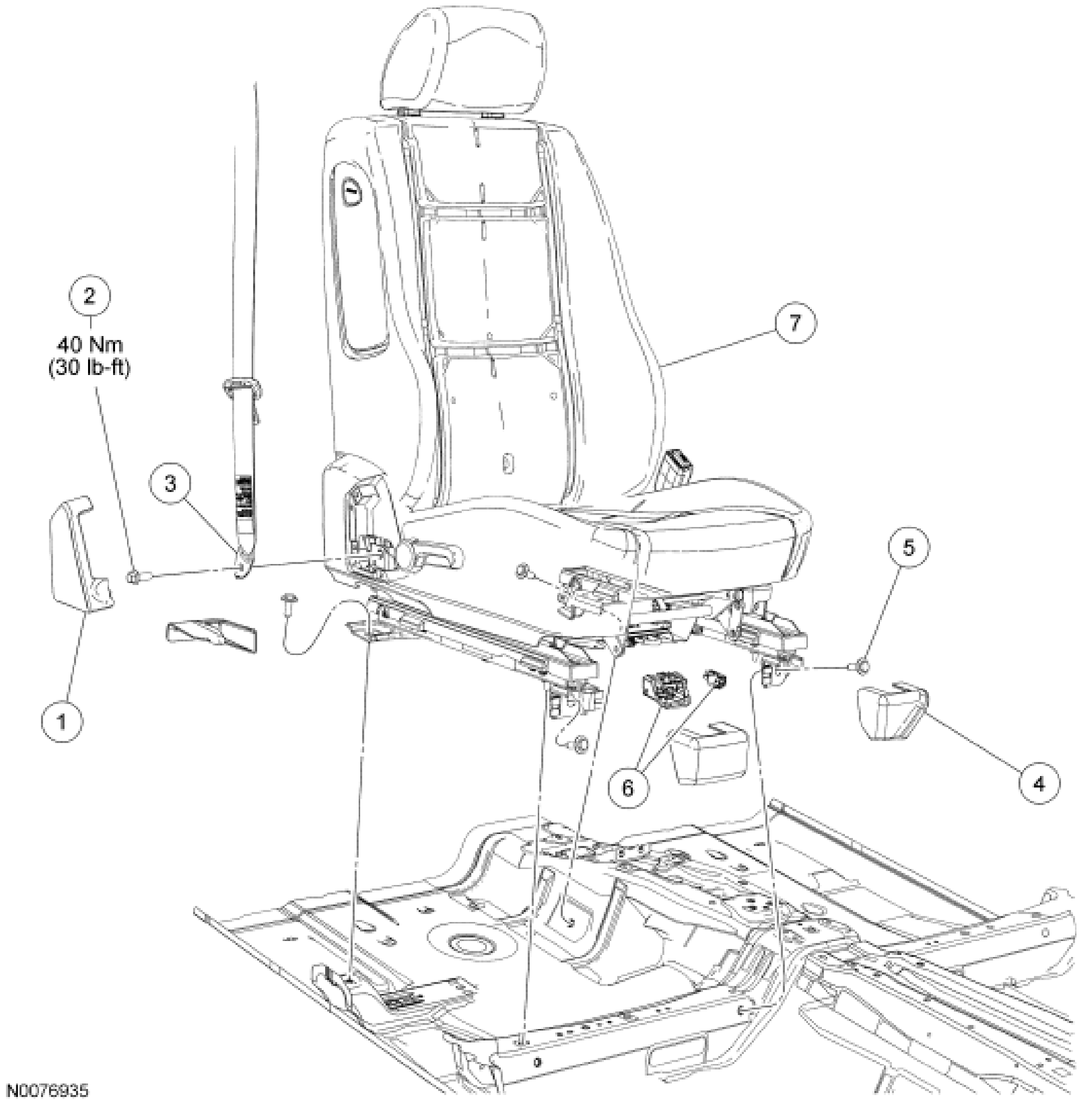


Fig. 273: Exploded View Of Front Seat With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	621A44	Safety belt retractor belt anchor bolt cover (part of 62184) (passenger only)
2	W505274	Safety belt retractor belt anchor bolt (passenger only)
3	-	Safety belt retractor belt anchor (part of 611B08) (passenger only)
4	-	Seat-to-floor bolt cover (4 required)
5	W707858	Seat-to-floor bolt (4 required)
6	-	Electrical connectors (part of 14A698)
7	-	Front seat assembly

REMOVAL

WARNING: Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTE: The air bag warning lamp illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

Seats without fold-flat backrest

1. Remove the head restraint.
    1. Using an appropriate tool, push in the hole while lifting up and release the head restraint from the head restraint guide.
    2. Push in on the head restraint guide release tab and remove the head restraint.

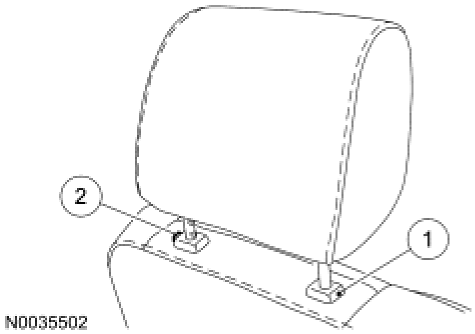


Fig. 274: Identifying Head Restraint Guide Release Tabs
Courtesy of FORD MOTOR CO.

Seats with fold-flat backrest

2. Fold the seat backrest down to the fold-flat position.

Passenger seat

3. Remove the safety belt retractor belt anchor bolt cover from the cushion side shield to access the safety belt anchor bolt.
    - If equipped with power seats, position the passenger seat track downward to access the safety belt retractor anchor bolt.
4. Remove the bolt and separate the safety belt anchor from the seat.

All seats

5. Position the seat to gain access to all 4 seat-to-floor bolts.
    - If equipped with power seats, fully raise the seat to aid seat service.
6. Depower the SRS. For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
7. Remove the 4 seat track-to-floor bolt covers and bolts.
8. Lift the seat to disengage to 2 locator pins from the floor and tip the seat to access the electrical connectors.

WARNING: **Use care when handling the front passenger seat and track assembly. Dropping the assembly, placing excessive weight on or sitting on a front passenger seat that is not secured in the vehicle may result in damaged seat components. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.**

9. Disconnect the seat harness electrical connectors and remove the seat.
    - If equipped, slide and disengage the side air bag module electrical connector locking clip, release the tab and disconnect the side air bag module electrical connector.

CAUTION: **Use care when disconnecting the seat harness electrical connector. Excessive force on the assurance lever can break the connector mounting.**

- Disconnect the seat harness electrical connector.
    - Release the locking tab and rotate the assurance lever fully to disengage the seat harness electrical connector.
    - Slightly tip the connector away and disconnect.

INSTALLATION

WARNING: **Make sure the front passenger seat is correctly installed and fastened to the vehicle. Do not force the alignment to the floorpan mounting holes. If the seat does not align to the floorpan mounting holes, repair the seat or floorpan as needed. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increase the risk of serious personal injury or death in a crash.**

WARNING: **After any crash, inspect the front passenger seat-to-floorpan mounting area for deformation and restore to its original condition, if deformed. Correct alignment of the occupant classification sensor (OCS) rails to the seat and floorpan is critical for correct OCS system operation. Incorrect operation of the OCS system increases the risk of serious personal injury**

or death in a crash.

Manual seats

1. Align both seat track rails to be flush with the rear edge of the seat track base to synchronize.

   All seats

2. Position the seat in the vehicle.
3. Tip the seat and connect the electrical connectors.
   - Connect the seat harness electrical connector.
     - Make sure the electrical connector assurance lever is in the fully released position.
     - Tip the body harness connector into the seat connector and partially insert.
     - Rotate the assurance lever while pushing the connectors together until the handle is locked.
   - If equipped, connect the side air bag module electrical connector, then slide and engage the side air bag electrical connector locking clip.
4. Align the 2 forward seat mounting locators to the guide holes in the floor and position the seat in place.
5. Install the seat-to-floor bolts by hand and tighten in the following sequence.
   1. Tighten to 47 Nm (35 lb-ft).
   2. Tighten to 47 Nm (35 lb-ft).
   3. Tighten to 47 Nm (35 lb-ft).
   4. Tighten to 47 Nm (35 lb-ft).

Fig. 275: Identifying Seat-To-Floor Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

6. Install the 4 seat-to-floor bolt covers.
   - Make sure the safety belts and buckles are accessible to the occupants after installation.
7. Repower the SRS. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to Supplemental Restraint System (SRS) Depowering and Repowering in the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Seats without fold-flat backrest

8. Install the head restraint.

Passenger seat

NOTE: If equipped with power seats, position the passenger seat track downward for safety belt retractor belt anchor and bolt installation.

9. Position the safety belt retractor belt anchor to the seat and install the bolt.
   - Tighten to 40 Nm (30 lb-ft).
10. Install the safety belt retractor belt anchor bolt cover.
    - Make sure the safety belts and buckles are accessible to the occupants after installation.
    - Make sure the safety belt retractor operates without excessive effort or binding.
11. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT - EXPLODED VIEW, FRONT

NOTE: Driver backrest shown, passenger backrest similar.

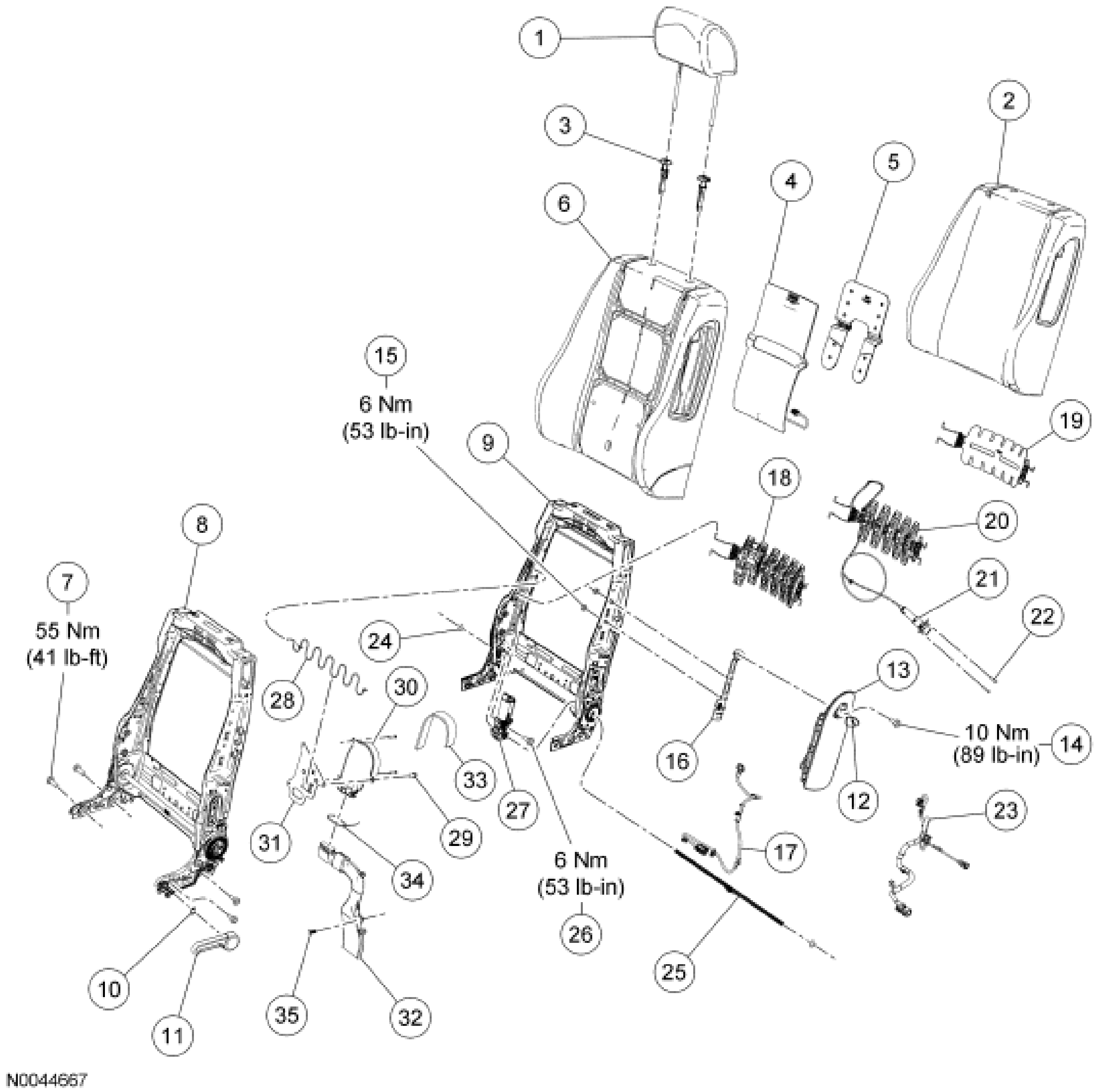


Fig. 276: Exploded View Of Front Seat Backrest, Without Fold-Flat With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	611A08	Head restraint
2	64417	Backrest trim cover
3	610A16	Head restraint guide (2 required)
4	14D696	Backrest heater mat (if equipped)
5	19N550	Backrest manifold, climate controlled seat (if equipped)
6	64811	Backrest foam pad
7	W500632	Backrest-to-cushion bolt (4 required)
8	61018	Backrest frame (with manual recliner) (if equipped)
9	608A15	Backrest frame (with power recliner) (if equipped)
10	-	Spring clip, recliner handle (part of 61199) (if equipped)

11	61199	Handle, recliner (if equipped)
12	-	Cover, side air bag module bolt (part of 611D11) (if equipped)
13	611D11	Side air bag module (if equipped)
14	N605892	Bolt, side air bag module (if equipped)
15	N620480	Nut, side air bag bracket (2 required) (if equipped)
16	611D79	Side air bag bracket (if equipped)
17	14K155	Wiring harness, side air bag (if equipped)
18	65500	Lumbar assembly, power (if equipped)
19	64842	Lumbar assembly, static (if equipped)
20	65500	Lumbar assembly, manual (if equipped)
21	610C01	Manual lumbar control (if equipped)
22	-	Rivet, manual lumbar control (2 required) (if equipped)
23	14C693	Wiring harness, power seat backrest (if equipped)
24	-	Pal nut, recliner torque shaft (2 required)
25	613A68	Recliner torque shaft
26	W790022	Bolt, recliner motor (if equipped)
27	14547	Recliner motor (if equipped)
28	64646	Upper support spring
29	-	Rivet, climate controlled seat TED (3 required) (if equipped)
30	19N550	TED assembly (if equipped)
31	18D583	Bracket, TED assembly (if equipped)
32	18D507	Exhaust duct, climate controlled seat TED assembly (if equipped)
33	-	Filter, climate controlled seat TED assembly (if equipped)
34	-	Tie strap
35	W790002	Pin-type retainer

NOTE: Optional backrest on passenger seat only.

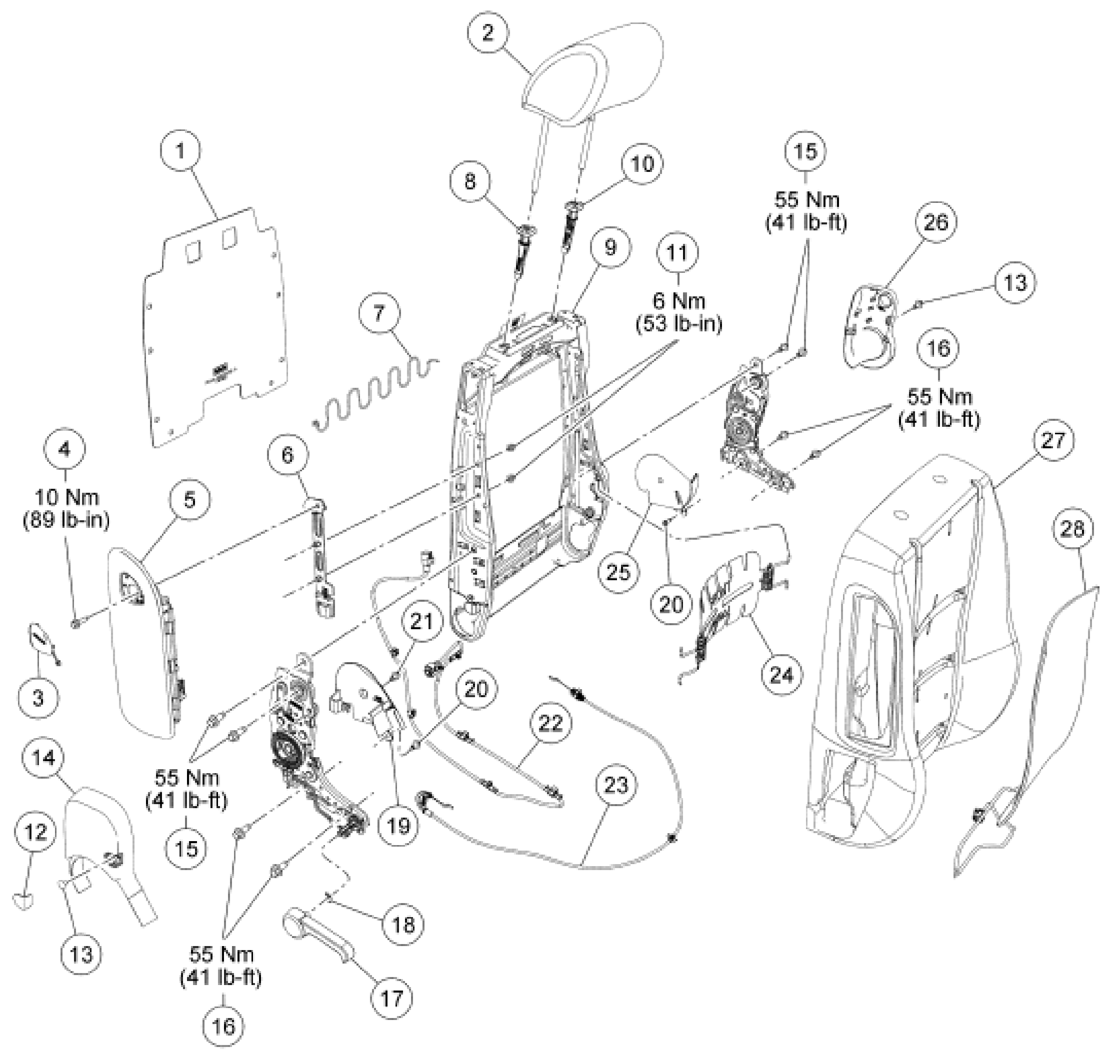


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Fig. 277: Exploded View Of Front Seat Backrest With Torque Specifications - With Fold Flat
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	60770	Hard back panel
2	611A08	Head restraint
3	-	Cover, side air bag module bolt (part of 611D10) (if equipped)
4	N605892	Bolt, side air bag module (if equipped)
5	611D10	Side air bag module (if equipped)
6	611D78	Side air bag bracket (if equipped)
7	64646	Upper support spring
8	610A18	Head restraint guide
9	60136	Backrest frame

10	610A16	Head restraint guide
11	N620480	Nuts, side air bag bracket (2 required) (if equipped)
12	-	RH recliner outboard cover retainer cover
13	W790016	Recliner outboard cover retainer (2 required)
14	63174	RH recliner outboard cover
15	W500632	Recliner-to-backrest frame bolts (4 required)
16	W500632	Recliner-to-cushion frame bolts (4 required)
17	61198	Handle, recliner (if equipped)
18	-	Spring clip, recliner handle (part of 61198) (if equipped)
19	63174	RH recliner inboard cover
20	W790016	Pin-type retainer (2 required)
21	W790016	Screw (2 required)
22	14K155	Wiring harness, side air bag (if equipped)
23	62648	Recliner cable
24	64842	Lumbar assembly, static
25	63175	LH recliner inboard cover
26	63175	LH recliner outboard cover
27	64810/-	Backrest foam pad/backrest trim cover
28	14D696	Backrest heater mat (if equipped)

NOTE: Power seat track shown, manual seat track similar.

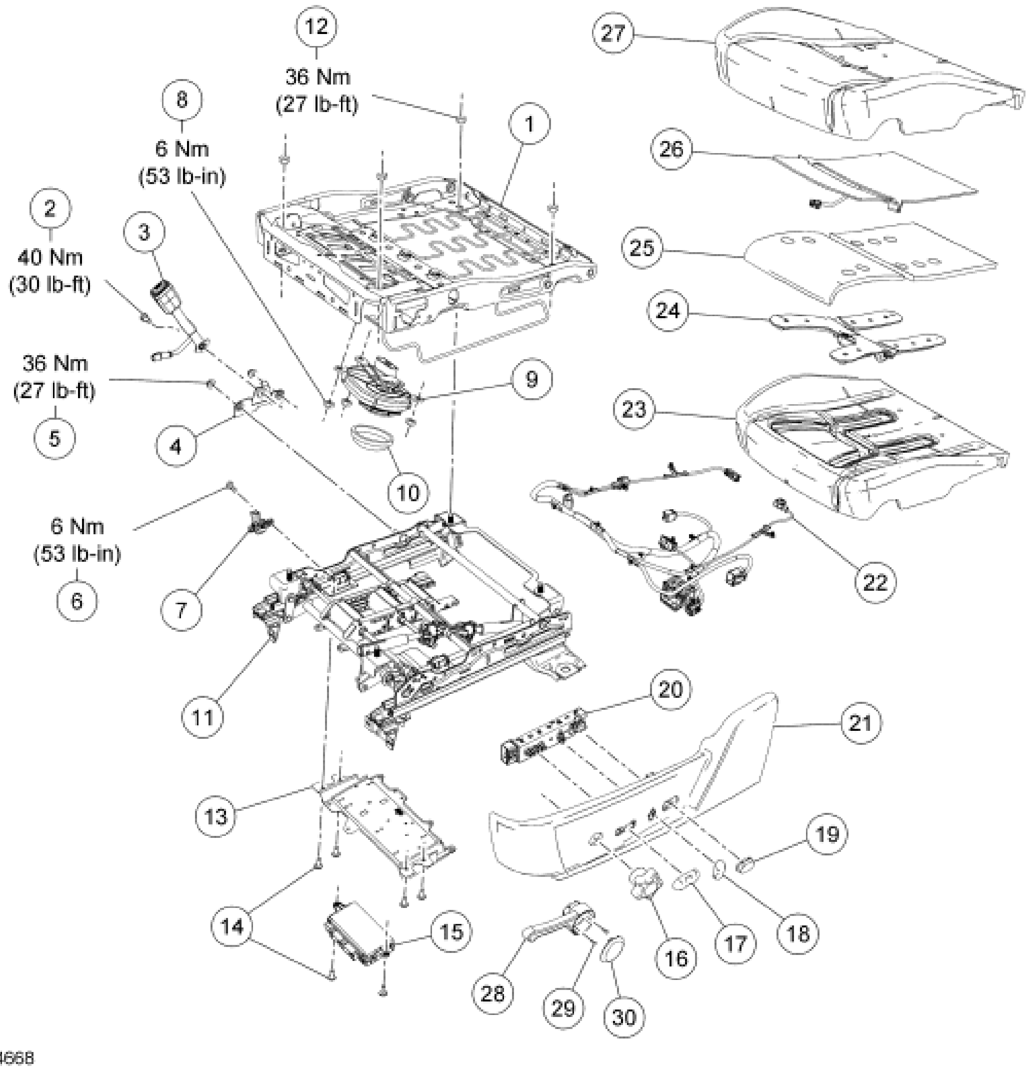

Fig. 278: Exploded View Of Driver Seat Cushion With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	63101	Cushion frame
2	-	Bolt, safety belt buckle (part of 61203)
3	61203	Safety belt buckle
4	-	Safety belt buckle bracket
5	W520113	Nut, safety belt buckle bracket-to-seat track (2 required)
6	W505256-S	Bolt, seat position sensor (part of 61203) (driver only)
7	14B416	Seat position sensor (driver only)
8	N620480	Nut, climate controlled seat thermo-electric device (TED) (3 required) (if equipped)
9	19N550	Cushion TED, climate controlled seat (if equipped)

10	19E880	Cushion TED filter (if equipped)
11	61711	Seat track
12	W520113	Seat track-to-cushion frame nuts (4 required)
13	610E34	Electrical bracket
14	-	Pop rivets (4 required)
15	14C708	Driver seat module (DSM) (if equipped)
16	62622	Manual lumbar control knob (if equipped)
17	14711	Seat control switch knob (if equipped)
18	14711	Power recline switch knob (if equipped)
19	14711	Power lumbar switch knob (if equipped)
20	14A701	Seat control switch (if equipped)
21	62187	Cushion side shield
22	14A699	Driver seat wire harness
23	632A23	Cushion foam pad
24	19N550	Manifold, climate controlled seat (if equipped)
25	632A23	Cushion insert (if equipped)
26	14D696	Cushion heater mat (if equipped)
27	62900	Cushion trim cover
28	61753	Manual height adjust handle (if equipped)
29	W711217	Screw, manual height adjust handle (if equipped)
30	62768	Cover, manual height adjust handle (if equipped)

NOTE: **Power seat track shown, manual seat track similar.**

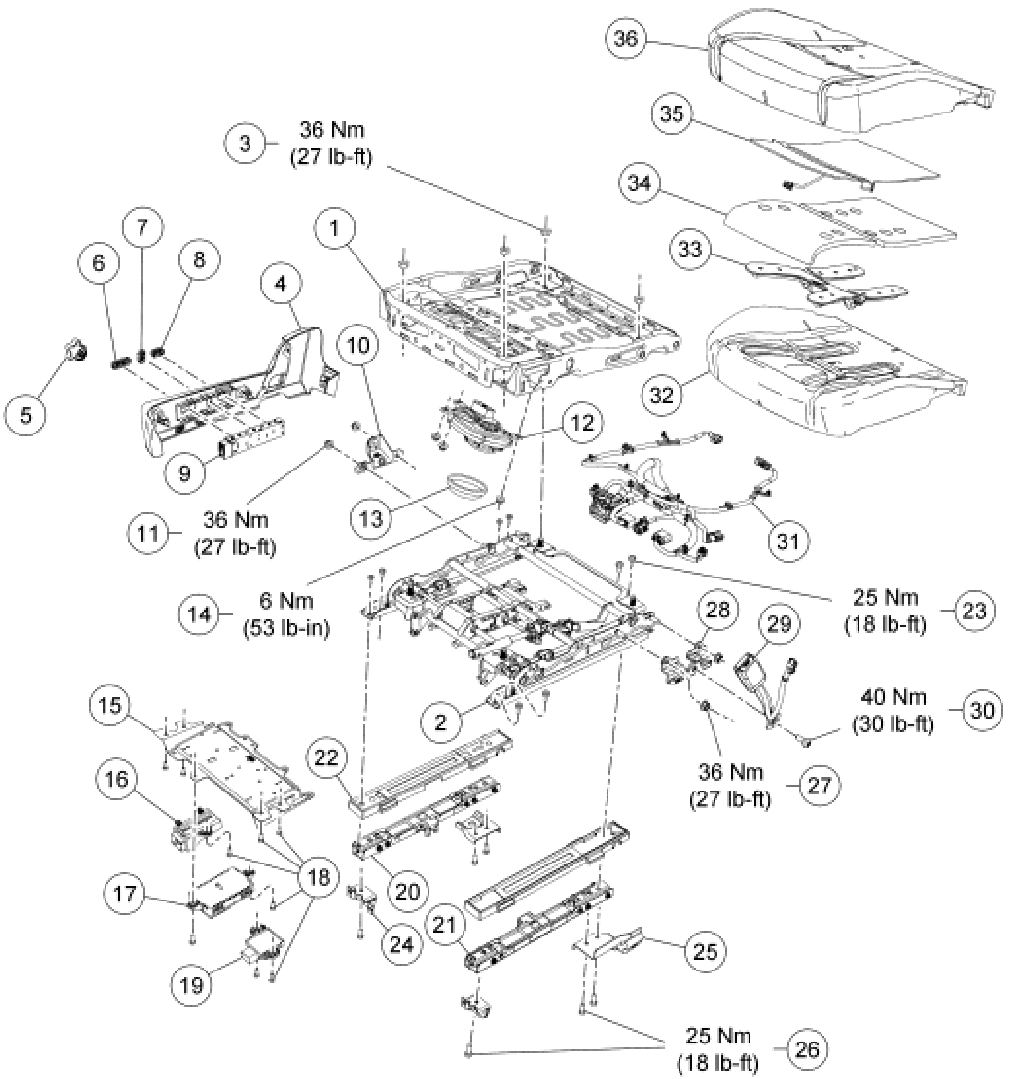

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Fig. 279: Exploded View Of Passenger Seat Cushion With Torque Specifications
Courtesy of FORD MOTOR CO.

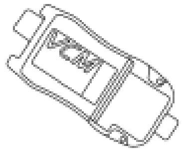
Item	Part Number	Description
1	63100	Cushion frame
2	61710	Seat track
3	W520113	Seat track-to cushion frame nuts (4 required)
4	62186	Cushion side shield
5	62622	Manual lumbar control knob (if equipped)
6	14711	Seat control switch knob (if equipped)
7	14711	Power recline switch knob (if equipped)
8	14711	Power lumbar switch knob (if equipped)
9	14A701	Seat control switch (if equipped)
10	-	Safety belt anchor bracket

11	W520113	Nut, safety belt anchor bracket (2 required)
12	19N550	Cushion thermo-electric device (TED), climate controlled seat (if equipped)
13	19E880	Cushion TED filter (if equipped)
14	N620480	Nut, cushion TED (3 required) (if equipped)
15	610E34	Electrical bracket
16	14C724	Heated seat module (if equipped)
17	14C724	Dual climate controlled seat module (DCSM) (if equipped)
18	31134/31147	Pop rivets (quantity varies with seat option)
19	14B422	Occupant classification system module (OCSM)
20	61708	OCS rail, outboard
21	61709	OCS rail, inboard
22	62126/62127	OCS rail shield (2 required)
23	W712479	OCS rail-to-seat track bolts (8 required)
24	61912/61913	Seat riser, front (2 required)
25	61912/61913	Seat riser, rear (2 required)
26	-	Bolts, seat riser-to-seat track (6 required)
27	W520113	Nut, safety belt buckle bracket (2 required)
28	-	Safety belt buckle bracket
29	61202	Safety belt buckle
30	-	Bolt, safety belt buckle (part of 61202)
31	14A698	Passenger seat wire harness
32	632A22	Cushion foam pad
33	19N550	Cushion manifold, climate controlled seat (if equipped)
34	-	Cushion insert (if equipped)
35	14D698	Cushion heater mat (if equipped)
36	62900	Cushion trim cover

1. For additional information, refer to the procedures.

SEAT BACKREST - FRONT, WITHOUT FOLD FLAT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: The air bag warning lamp illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Driver seat shown, passenger seat similar.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the manual height adjust handle, if equipped.
   - Remove the height adjust handle cover.
   - Remove the 2 screws and height adjust handle.
3. Remove the spring clip and manual recliner handle, if equipped.
4. Remove the manual lumbar control knob, if equipped.
   - Adjust the manual lumbar to the full relaxed position.
   - Pull outward and remove the manual lumbar knob.
5. Detach and position aside the cushion side shield.
   - Pull the side shield away from the seat cushion at the front edge and release the forward and side retainers.
   - Pull the side shield rearward to release the rear retainer and position the cushion side shield aside.
     - Return any detached retainers to the side shield.
     - For installation, position the rear retainer clip on the cushion side shield through the hole in the backrest trim cover flap before attaching to the rear edge of the seat.
6. Release the cushion trim cover hook-and-loop strips from the rear corners of the cushion, release the J-clip and detach the push pin to gain access to the backrest recliner to cushion bolts.
7. Release the trim cover hook-and-loop strap from around the safety belt buckle assembly.

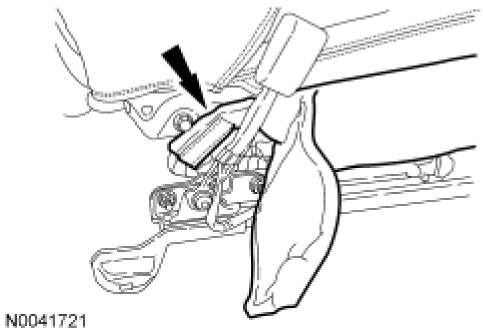


Fig. 280: Locating Trim Cover Hook And Loop Strap
Courtesy of FORD MOTOR CO.

8. Release the 2 trim cover J-clips from the rear of the cushion frame and disconnect the side air bag wiring harness electrical connector.
9. Detach the side air bag wiring harness electrical connector pin-type retainer from the cushion frame.

NOTE: **Electrical connectors vary with power seat options.**

10. Disconnect the backrest power feed electrical connector(s) and route out the wire harness.
    - Release the wire harness retainers.

Seat with manual lumbar

11. Remove the 2 rivets and separate the manual lumbar control from the cushion frame.
12. Detach the lumbar control from the cable and remove.
    - Detach any cable retainers from the cushion frame.
        - Note the manual lumbar cable routing for installation.

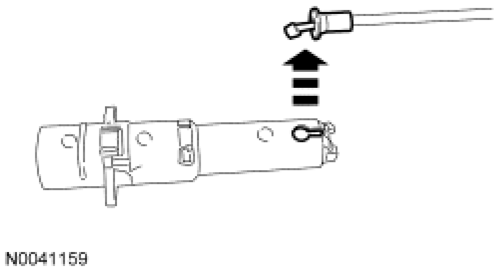


Fig. 281: Removing Cable From Lumbar Control
Courtesy of FORD MOTOR CO.

All seats

13. Remove the 4 recliner-to-cushion frame bolts and remove the backrest assembly.
    - Route out the wire harness(es) and manual lumbar cable, if equipped.

    - Note routing for installation.
  - To install, tighten to 55 Nm (41 lb-ft).

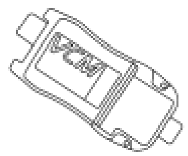
14. To install, reverse the removal procedure.
15. Install the front seat and repower the SRS. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

    Passenger seat

16. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT BACKREST - FRONT, WITH FOLD FLAT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: **The air bag warning lamp illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

NOTE: **Only the front passenger seat can come equipped with optional fold-flat backrest.**

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the spring clip and manual recliner handle.
3. Remove the cushion side shield in the following sequence.

   1. Pull out on the side and rear of the cushion side shield, releasing the retainers.
   2. Separate the wire harness pin-type retainers from the cushion side shield.
   3. Remove the cushion side shield.
4. Remove the RH recliner outboard cover retainer cover.
5. Pull the head of the RH recliner outboard cover retainer up to release, then remove the retainer.

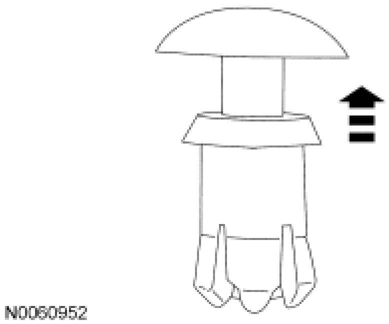


Fig. 282: Pulling Head Of Recliner Outboard Cover Retainer Up To Release
Courtesy of FORD MOTOR CO.

6. Remove the RH recliner outboard cover in the following sequence.
   1. Pull out on the RH recliner outboard cover at the front and rear to release the cover retainers and at the bottom, pull the cover away from the recliner.
   2. Slide the RH recliner outboard cover back to separate from the recliner.
7. Route out the side air bag wire harness and remove the RH recliner outboard cover.

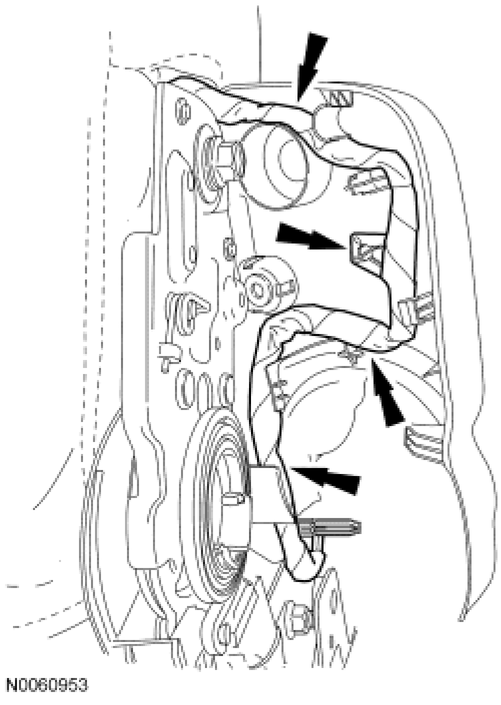


Fig. 283: Locating RH Recliner Outboard Cover
Courtesy of FORD MOTOR CO.

8. Separate the cable at the RH recliner in the following sequence.
    1. Release the cable housing from the RH recliner.
    2. Separate the cable from the RH recliner.
9. Pull the head of the LH recliner outboard cover retainer up to release, then remove the retainer.

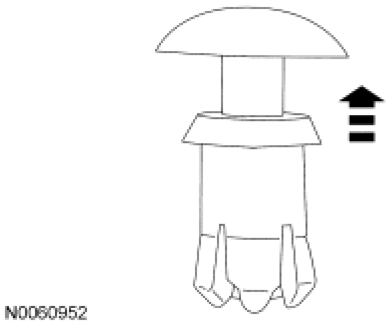


Fig. 284: Pulling Head Of Recliner Outboard Cover Retainer Up To Release
Courtesy of FORD MOTOR CO.

10. Remove the LH recliner outboard cover in the following sequence.
    1. Pull out on the LH recliner outboard cover at the front and rear to release the cover retainers and at the bottom, pull the cover away from the recliner.
    2. Slide the LH recliner outboard cover back to separate from the recliner.
        - If not equipped with heated seats, remove the LH recliner outboard cover.

Seats with heat

11. Route out the heated seat wire harness and remove the LH recliner outboard cover.

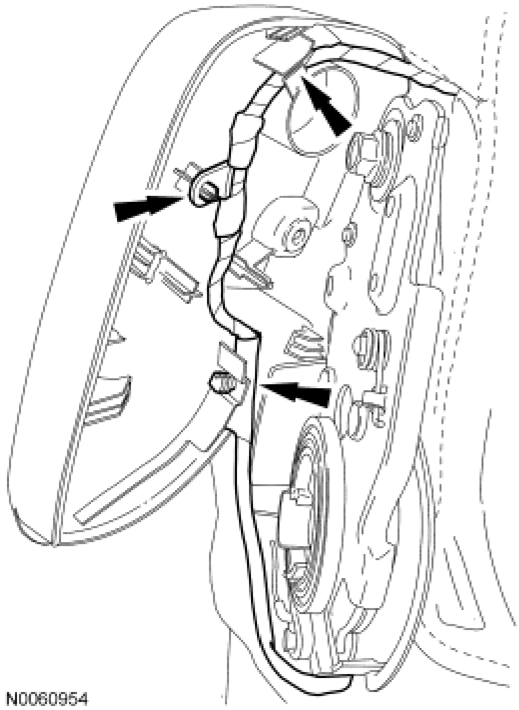


Fig. 285: Locating LH Recliner Outboard Cover
Courtesy of FORD MOTOR CO.

All seats

12. Release the cushion trim cover retainer from around the safety belt buckle and separate the hook-and-loop strip.

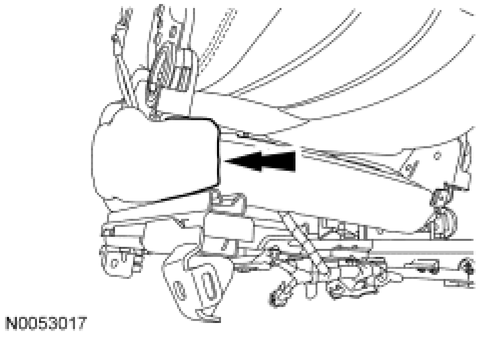


Fig. 286: Locating Cushion Trim Cover Retainer
Courtesy of FORD MOTOR CO.

13. Separate the cable at the LH recliner in the following sequence.
    1. Separate the cable from the LH recliner.
    2. Squeeze the cable housing tabs together and separate from the LH recliner.
14. Release the first cushion trim cover J-clip from the rear of the cushion frame.
15. Disconnect and detach the electrical connectors.

- Slide and disengage the side air bag module electrical connector locking clip, release the tab and disconnect the side air bag module electrical connector. Detach any pin-type retainers.
- If equipped, disconnect the heated seat electrical connector and detach any pin-type retainers.

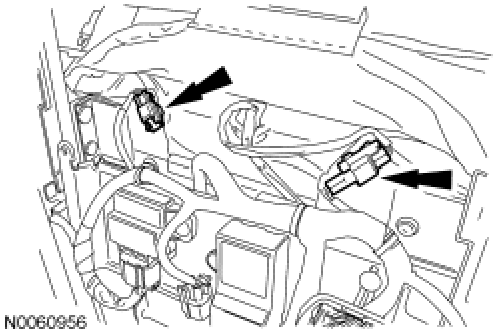


Fig. 287: Locating Heated Seat Electrical Connector & Pin-Type Retainers
Courtesy of FORD MOTOR CO.

16. Detach and route out the side air bag wire harness.

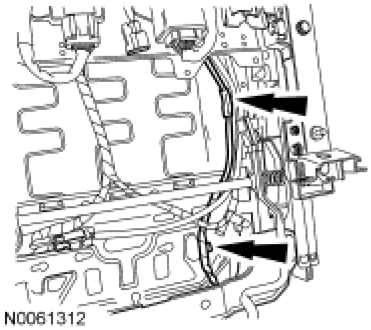


Fig. 288: Locating Side Air Bag Wire Harness
Courtesy of FORD MOTOR CO.

17. Route out the side air bag wire harness from the seat track and cushion.

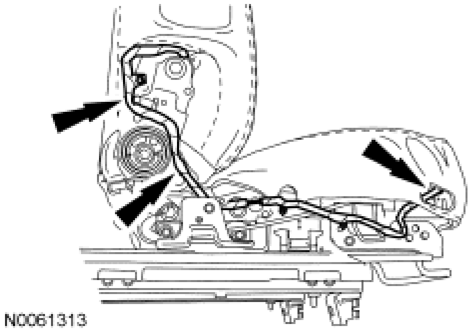


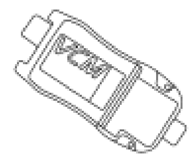
Fig. 289: Locating Side Air Bag Wire Harness From Seat Track & Cushion
Courtesy of FORD MOTOR CO.

All seats

18. Remove the 4 recliner-to-cushion frame bolts and remove the backrest assembly.
    - To install, tighten to 55 Nm (41 lb-ft).
19. To install, reverse the removal procedure.
20. Install the front seat and repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.
21. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT BACKREST COVER - FRONT, WITHOUT FOLD FLAT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

WARNING: **Front seat backrest trim covers installed on seats equipped with seat side air bags cannot be repaired. A new trim cover must be installed. Cleaning is permissible. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: The air bag warning lamp illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without**

Fold Flat.

3. Detach the side air bag bolt cover.

NOTE: Note the position of the side air bag module locator hook in the side air bag module bracket (on the seat back frame) for installation.

4. Remove the bolt and lift up and out to detach the side air bag module from the seat backrest.
    - To install, tighten to 10 Nm (89 lb-in).
5. Slide and disengage the side air bag module electrical connector locking clip, and then release the tab and disconnect the side air bag module electrical connector and remove the side air bag module.
6. Detach the 2 pin-type retainers and trim cover flaps from the recliners.

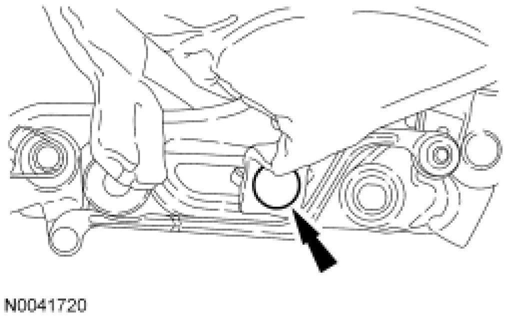


Fig. 290: Locating Pin-Type Retainers
Courtesy of FORD MOTOR CO.

CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

7. Release the outer and inner backrest trim cover lower J-clips and partially invert the trim cover to the hook-and-loop strips.

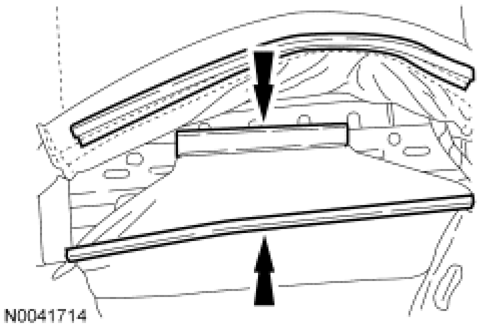


Fig. 291: Locating Outer And Inner Backrest Trim Cover Lower J-Clips
Courtesy of FORD MOTOR CO.

NOTE: The head restraint guides are not interchangeable. Note location for

installation.

8. Reach up into the backrest and squeeze the head restraint guide ends together to release. Pull the 2 head restraint guides out of the backrest frame.

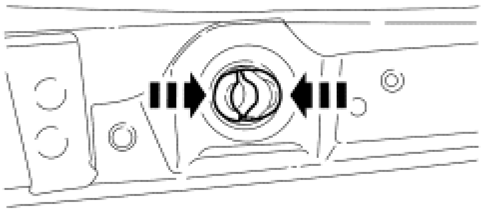


Fig. 292: Removing Head Restraint Guides From Backrest Frame
Courtesy of FORD MOTOR CO.

9. Remove all rows of hog rings from the backrest trim cover and separate the hook-and-loop strips while inverting the trim cover up the backrest.
10. Remove the rear upper hog rings and backrest trim cover.
    - To install, make sure the climate controlled seat backrest manifold is correctly aligned to the foam pad, if equipped.

WARNING: **If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

WARNING: **Inspect the seat side air bag module and mounting surfaces for any damage or foreign material before installing the seat side air bag module. If any damage is found, install new components. If any foreign material is found, remove it. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.**

NOTE: **A backrest trim cover for a seat with a side air bag module is different than a backrest trim cover for a seat without a side air bag module. Make sure the correct backrest trim cover is being installed.**

11. To install, reverse the removal procedure.
12. Install the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold**

Flat.

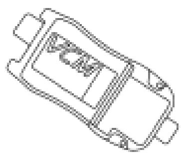
13. Install the front seat and repower the SRS. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

    Passenger seat

14. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT BACKREST COVER - FRONT, WITH FOLD FLAT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

WARNING: **Front seat backrest trim covers installed on seats equipped with seat side air bags cannot be repaired. A new trim cover must be installed. Cleaning is permissible. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.**

NOTE: If a side air bag deployment took place, a new side air bag module and bolt must be installed. The side air bag module bracket on the backrest frame should be inspected and replaced if necessary.

NOTE: The air bag warning lamp illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Only the front passenger seat can come equipped with optional fold-flat backrest.

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Fold the seat backrest down to the fold-flat position.
3. Remove the spring clip and manual recliner handle.
4. Remove the cushion side shield in the following sequence.
    1. Pull out on the side and rear of the cushion side shield, releasing the retainers.
    2. Separate the wire harness pin-type retainers from the cushion side shield.
    3. Remove the cushion side shield.
5. Remove the RH recliner outboard cover retainer cover.
6. Pull the head of the RH recliner outboard cover retainer up to release, then remove the retainer.

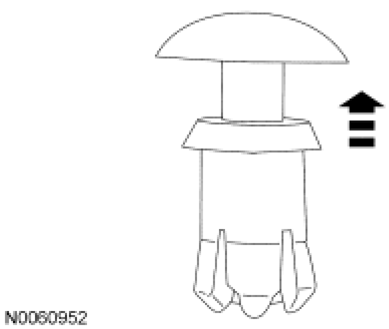


Fig. 293: Pulling Head Of Recliner Outboard Cover Retainer Up To Release
Courtesy of FORD MOTOR CO.

7. Remove the RH recliner outboard cover in the following sequence.
    1. Pull out on the RH recliner outboard cover at the front and rear to release the cover retainers and at the bottom, pull the cover away from the recliner.
    2. Slide the RH recliner outboard cover back to separate from the recliner.
8. Route out the side air bag wire harness and remove the RH recliner outboard cover.

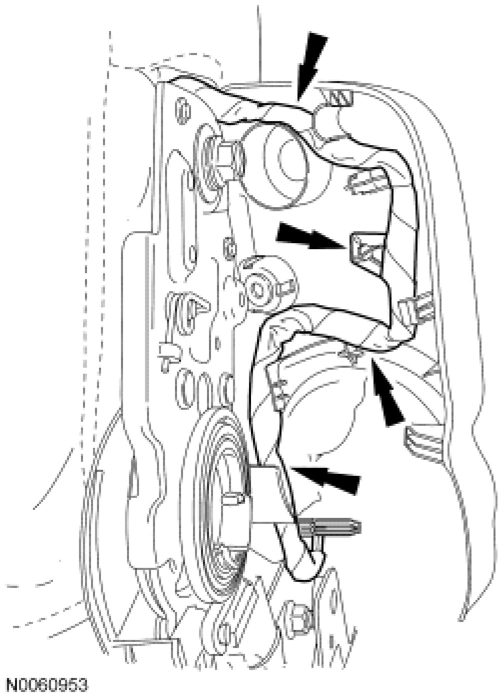


Fig. 294: Locating RH Recliner Outboard Cover
Courtesy of FORD MOTOR CO.

9. Pull the head of the LH recliner outboard cover retainer up to release, then remove the retainer.

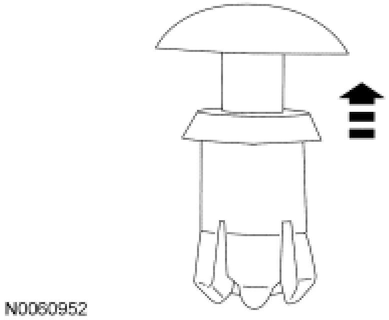


Fig. 295: Pulling Head Of Recliner Outboard Cover Retainer Up To Release
Courtesy of FORD MOTOR CO.

10. Remove the LH recliner outboard cover in the following sequence.
    1. Pull out on the LH recliner outboard cover at the front and rear to release the cover retainers and at the bottom, pull the cover away from the recliner.
    2. Slide the LH recliner outboard cover back to separate from the recliner.
        - If not equipped with heated seats, remove the LH recliner outboard cover.
11. If equipped with heated seats, route out the heated seat wire harness and remove the LH recliner outboard cover.

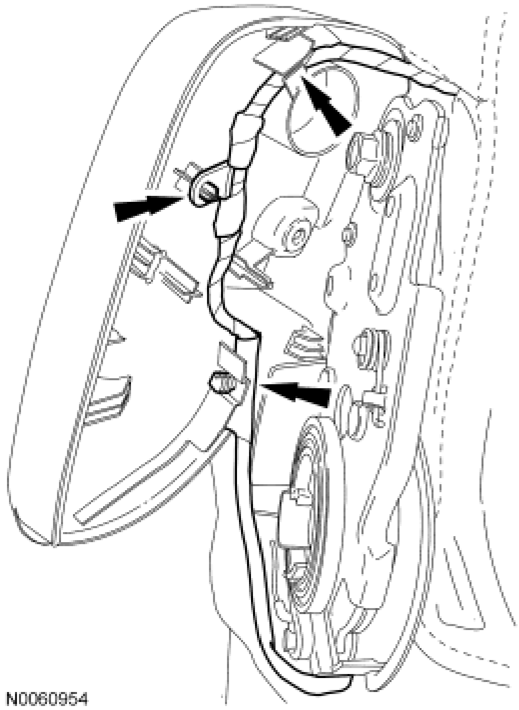


Fig. 296: Locating LH Recliner Outboard Cover
Courtesy of FORD MOTOR CO.

12. Release the cushion trim cover retainer from around the safety belt buckle and separate the hook-and-loop strip.

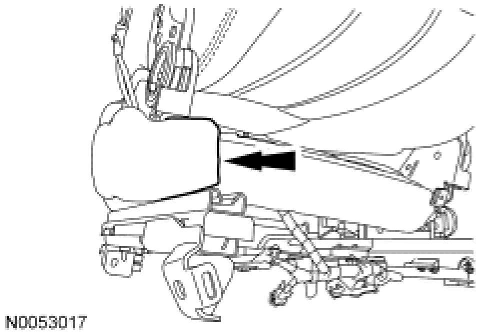


Fig. 297: Locating Cushion Trim Cover Retainer
Courtesy of FORD MOTOR CO.

13. Release the first cushion trim cover J-clip from the rear of the cushion frame.
14. Disconnect and detach the electrical connectors.
    - Slide and disengage the side air bag module electrical connector locking clip, release the tab and disconnect the side air bag module electrical connector. Detach any pin-type retainers.
    - If equipped, disconnect the heated seat electrical connector and detach any pin-type retainers.

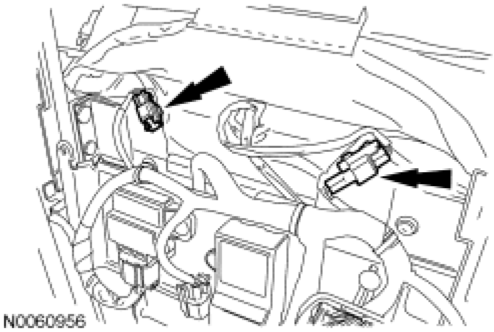


Fig. 298: Locating Heated Seat Electrical Connector & Pin-Type Retainers
Courtesy of FORD MOTOR CO.

15. Detach the side air bag bolt cover.
16. Remove the bolt, lift up and out to separate the side air bag module from the seat backrest.
17. Slide and disengage the side air bag module electrical connector locking clip, release the tab and disconnect the side air bag module electrical connector.
18. Detach and route out the side air bag wire harness.

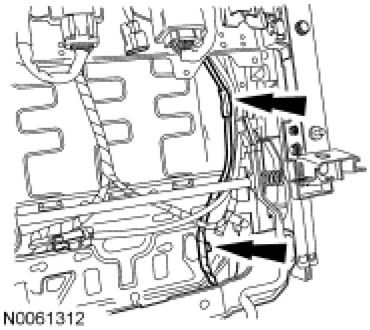


Fig. 299: Locating Side Air Bag Wire Harness
Courtesy of FORD MOTOR CO.

19. Route out the side air bag wire harness from the seat track and cushion.

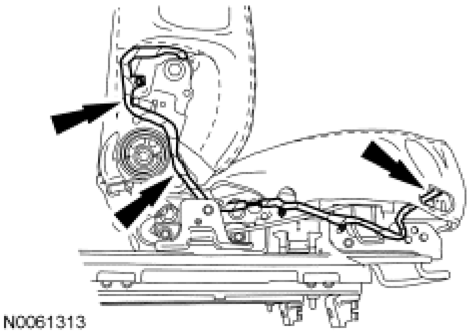


Fig. 300: Locating Side Air Bag Wire Harness From Seat Track & Cushion
Courtesy of FORD MOTOR CO.

20. Remove the 4 recliner-to-backrest frame bolts and remove the backrest assembly.
21. Remove the head restraint.
    1. Using an appropriate tool, push in the hole while lifting up and release the head restraint from the head restraint guide.
    2. Push in on the head restraint guide release tab and remove the head restraint.

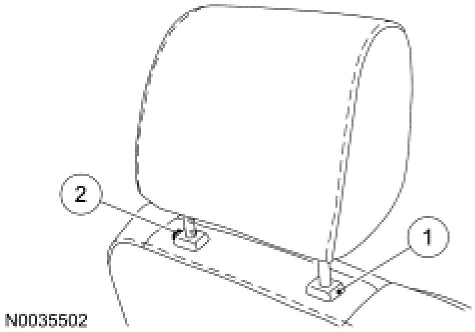


Fig. 301: Identifying Head Restraint Guide Release Tabs
Courtesy of FORD MOTOR CO.

22. Release the outer and inner backrest trim cover lower J-clips.

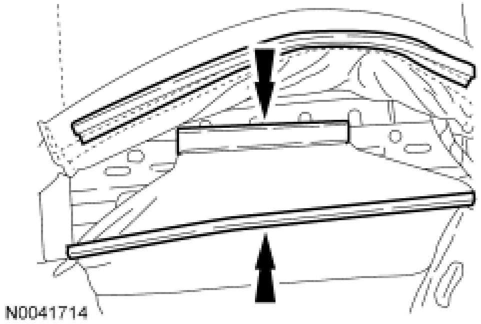


Fig. 302: Locating Outer And Inner Backrest Trim Cover Lower J-Clips
Courtesy of FORD MOTOR CO.

23. Separate the hook-and-loop strips on each side, at the bottom of the backrest trim cover.

CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

24. Place a hand between the backrest trim cover and backrest foam pad and carefully separate the hook-and-loop strips.
25. Invert the backrest trim cover to the hog rings.
26. Remove the hog rings attaching the backrest trim cover to the backrest foam pad in front and the backrest frame wire in the rear.
    - Feed the side air bag wire harness through the side of the backrest trim cover.

- If equipped with heat, feed the wire harness through the side of the backrest trim cover.

27. Invert the backrest trim cover up as far as it will go.
28. Remove the pin-type retainers and the hard back panel.

NOTE: The head restraint guides are not interchangeable. Note location for installation.

29. Reach up into the backrest and squeeze the head restraint guide ends together to release. Pull the 2 head restraint guides out of the backrest frame.

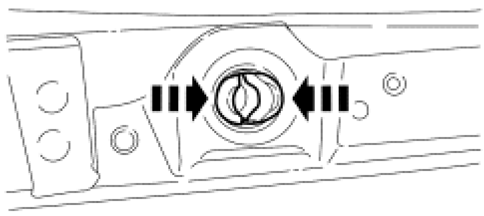


Fig. 303: Removing Head Restraint Guides From Backrest Frame
Courtesy of FORD MOTOR CO.

30. Remove the backrest trim cover.

INSTALLATION

1. Position the backrest trim cover to the backrest foam pad.

NOTE: The head restraint guides are not interchangeable.

2. Install the 2 head restraint guides through the backrest trim cover and into the backrest frame.
3. Position the hard back panel and install the pin-type retainers.
4. Roll the backrest trim cover down and install hog rings attaching the backrest trim cover to the backrest foam pad in front and the backrest frame wire in the rear.
   - Feed the side air bag wire harness through the side of the backrest trim cover.
   - If equipped with heat, feed the wire harness through the side of the backrest trim cover.
5. Attach the hook-and-loop strips at the bottom of the backrest trim cover.
6. Attach the inner and outer backrest trim cover lower J-clips.
7. Install the head restraint.

WARNING: If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air

bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

WARNING: **Inspect the seat side air bag module and mounting surfaces for any damage or foreign material before installing the seat side air bag module. If any damage is found, install new components. If any foreign material is found, remove it. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.**

8. Connect the side air bag module electrical connector, then slide and engage the side air bag electrical connector locking clip.
9. Install the side air bag module to the mounting bracket on the backrest frame.
   - Position the side air bag module locator hook in the side air bag bracket.
10. Align the bolt hole and install the side air bag bolt.
    - Tighten to 10 Nm (89 lb-in).
11. Install the side air bag bolt cover.
12. Position the backrest assembly and install the 4 recliner-to-backrest frame bolts.
    - Tighten to 55 Nm (41 lb-ft).
13. Route the side air bag wire harness down the side of the seat and through the cushion frame hole.

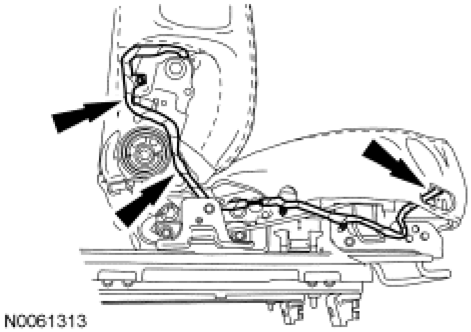


Fig. 304: Locating Side Air Bag Wire Harness From Seat Track & Cushion
Courtesy of FORD MOTOR CO.

14. Route and attach the side air bag wire harness.

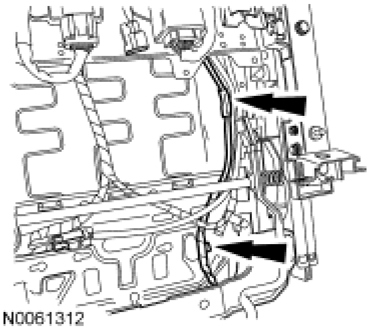

N0061312

Fig. 305: Locating Side Air Bag Wire Harness
Courtesy of FORD MOTOR CO.

15. Connect the heated seat and side air bag electrical connectors.
    - If equipped, connect the heated seat electrical connector, route the wire harness and attach any pin-type retainers.
    - Connect the side air bag module electrical connector, then slide and engage the side air bag electrical connector locking clip. Route the wire harness and attach any pin-type retainers.

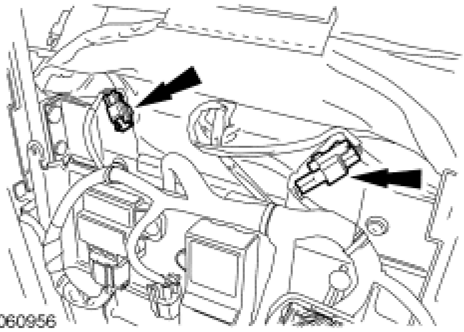

N0060956

Fig. 306: Locating Heated Seat Electrical Connector & Pin-Type Retainers
Courtesy of FORD MOTOR CO.

16. Attach the first cushion trim cover J-clip to the rear of the cushion frame.
17. Attach the hook-and-loop strip and fasten the cushion trim cover around the safety belt buckle.

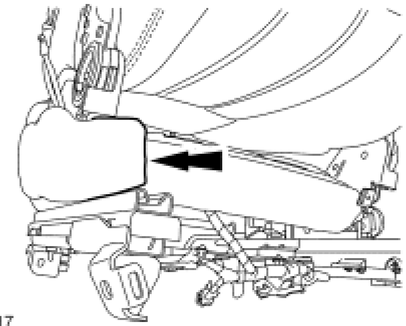

N0053017

Fig. 307: Locating Cushion Trim Cover Retainer
Courtesy of FORD MOTOR CO.

18. Install the LH recliner outboard cover and retainer to the recliner.
    - If equipped, route the heated seat wire harness to the LH recliner outboard cover.

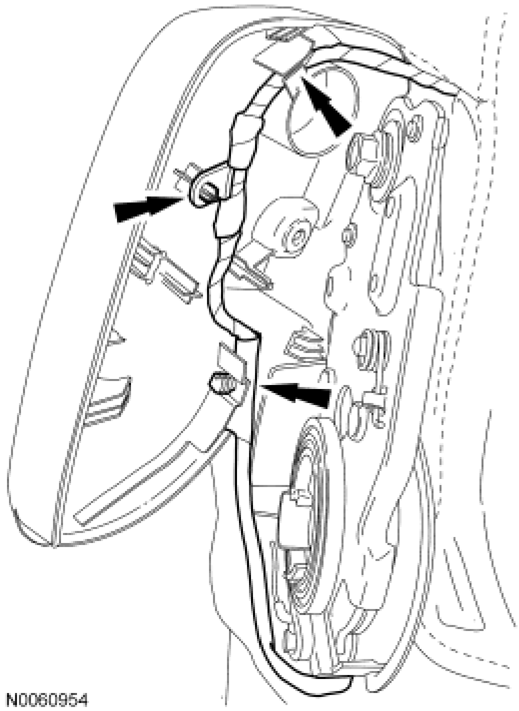


Fig. 308: Locating LH Recliner Outboard Cover
Courtesy of FORD MOTOR CO.

19. Install the RH recliner outboard cover, retainer and retainer cover.
    - Route the side air bag wire harness to the RH recliner outboard cover.

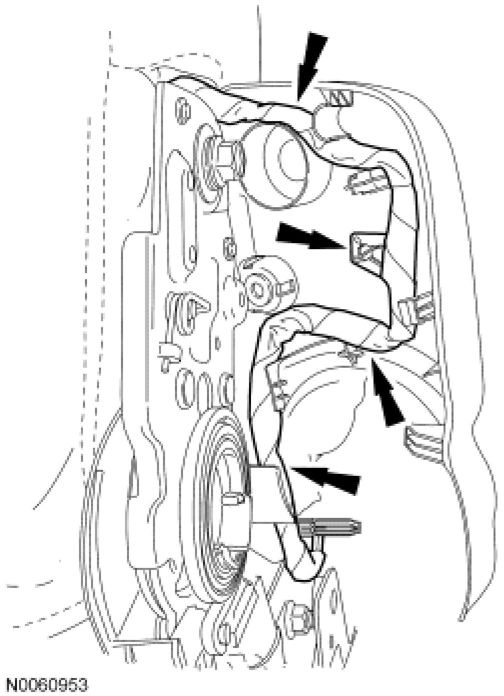


Fig. 309: Locating RH Recliner Outboard Cover
Courtesy of FORD MOTOR CO.

20. Install the cushion side shield.
    - Position the cushion side shield and engage the side and rear retainers.
        - Attach the side air bag wire harness pin-type retainers to the cushion side shield.
21. Put the spring clip on the manual recliner handle. Align it to the recliner and push in, seating the spring clip.
22. Install the front seat and repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.
23. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT CUSHION COVER - FRONT

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold Flat** or **Seat Backrest - Front, With Fold Flat**.

   NOTE: Trim cover J-clip configurations vary with seat option.

3. Release all the remaining J-clips attaching the trim cover to the cushion frame.

   CAUTION: Use care when separating the seat cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.

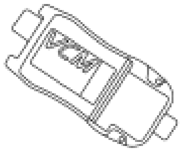
4. Release the hook-and-loop strips, remove the hog rings (if equipped), separate the cushion trim cover from the cushion foam pad and remove.
5. To install, reverse the removal procedure.
6. Install the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold Flat** or **Seat Backrest - Front, With Fold Flat**.
7. Install the front seat and repower the SRS. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

   Passenger seat

8. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT TRACK

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold Flat** or **Seat Backrest - Front, With Fold Flat**.

Passenger seat with failed horizontal motor

3. To remove the occupant classification sensor (OCS) rails, remove the 2 seat track horizontal drive unit bolts. This will allow the power seat tracks to move manually for access to the 8 OCS rail bolts.

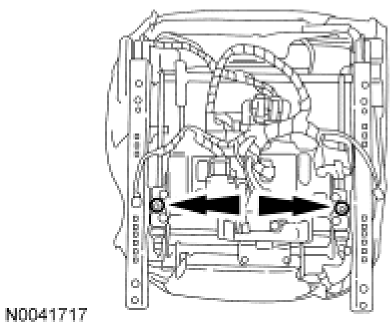


Fig. 310: Locating Bolts
Courtesy of FORD MOTOR CO.

Passenger seat receiving a new seat track

4. Remove the inboard and outboard OCS rails. For additional information, refer to Occupant Classification Sensor in **SUPPLEMENTAL RESTRAINT SYSTEM** article.

Power seat

5. If equipped, disconnect the seat control switch and remove the cushion side shield.

Heated seat

NOTE: Passenger seat shown, driver seat similar.

6. Disconnect the cushion heater mat electrical connector.

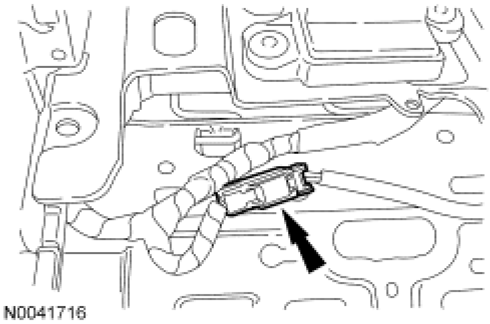


Fig. 311: Locating Cushion Heater Mat Electrical Connector
Courtesy of FORD MOTOR CO.

All seats

7. Detach the hook-and-loop strips from around the safety belt buckle assembly.
8. Detach all wiring harness pin-type retainers from the cushion frame.
9. Release the cushion trim cover J-clips and remove the seat cushion foam pad and cushion trim cover.

Climate controlled seat

CAUTION: Inspect the climate controlled seat cushion manifold and foam pad for crush or obstruction before installation and repair as needed.

NOTE: Covering the thermo-electric device (TED) openings is recommended to prevent foreign material from entering the TED.

10. Disconnect the TED assembly electrical connector.

All seats

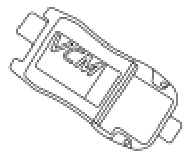
11. Remove the 4 cushion frame-to-seat track nuts and separate the cushion frame and seat track.
    - To install, tighten to 36 Nm (27 lb-ft).
12. Detach any remaining wiring harness retainers attached to the cushion frame and remove the seat track.
13. To install, reverse the removal procedure.
14. If a new seat track is installed, install the inboard and outboard OCS rails. For additional information, refer to Occupant Classification Sensor in **SUPPLEMENTAL RESTRAINT SYSTEM** article.
15. Install the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold Flat** or **Seat Backrest - Front, With Fold Flat**.
16. Install the front seat and repower the SRS. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

Passenger seat

17. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT RECLINER MOTOR

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: The manual recliners and power recliners are serviced as part of the backrest frame.

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold Flat**.
3. Detach the 2 pin-type retainers and trim cover flaps from the recliners.

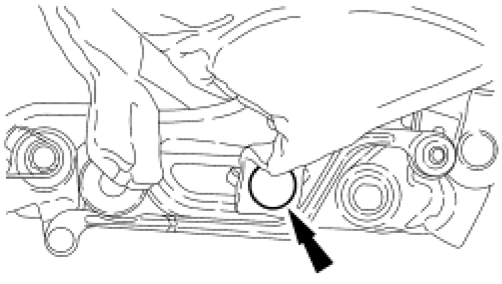

N0041720

Fig. 312: Locating Pin-Type Retainers
Courtesy of FORD MOTOR CO.

CAUTION: Use care when separating the seat back trim cover from the hook-

and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

4. Release the 2 outer and inner backrest trim cover lower J-clips, hook-and-loop strips and partially invert the trim cover.

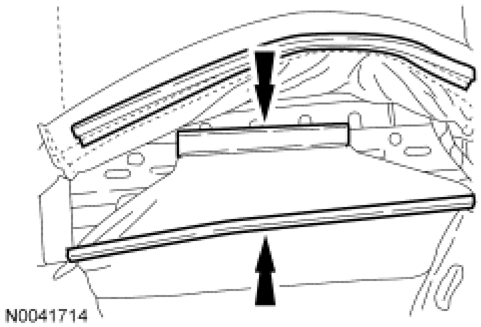


Fig. 313: Locating Outer And Inner Backrest Trim Cover Lower J-Clips
Courtesy of FORD MOTOR CO.

5. Remove the one-way push clip on the RH side of the power recliner. Slide the recliner shaft out from the LH side of the seat enough to clear the RH recliner and power recline motor.
6. Disconnect the electrical connector, remove the screw and the power recline motor.

INSTALLATION

All seats

CAUTION: Avoid rotating the recliner shaft until the recliner is fully installed or the recliners will not be synchronized.

1. Install the recliner motor in the following sequence:
   1. Position the recliner shaft through the recliner motor and RH recliner.
   2. Install a new one-way push clip onto the recliner shaft at the RH recliner.
   3. Slightly turn the recliner motor to align the bolt hole with the hole in the RH recliner and install the recliner motor bolt.
      - Tighten to 6 Nm (53 lb-in).
   4. Connect the recliner motor electrical connector.
2. Roll the backrest trim cover down, attach the hook-and-loop strips and connect the inner and outer backrest trim cover lower J-clips.
3. Attach the 2 pin-type retainers and trim cover flaps to the recliners.
4. Install the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold Flat**.
5. Install the front seat and repower the SRS. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

Passenger seat

6. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT RECLINER - FRONT, WITH FOLD FLAT

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

NOTE: **The air bag warning lamp illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

NOTE: **Only the front passenger seat can come equipped with optional fold-flat recliners.**

NOTE: **Recliners on seats that do not fold-flat are not serviced separately, they are serviced with the backrest frame.**

LH or RH recliner

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Fold the seat backrest down to the fold-flat position.
3. Remove the spring clip and manual recliner handle.
4. Remove the cushion side shield in the following sequence.
    1. Remove the cushion side shield screw.
    2. Pull out on the side and the rear of the cushion side shield, releasing the retainers.
    3. Remove the cushion side shield.
5. Remove the RH recliner outboard cover in the following sequence.
    1. Remove the scrivet.
    2. Release the clips at the front and rear of the recliner cover.

   3. Remove the RH recliner outboard cover.
6. Separate the cable at the RH recliner in the following sequence.
   1. Release the cable housing from the RH recliner.
   2. Separate the cable from the RH recliner.

RH recliner only

7. Remove the 2 recliner-to-cushion frame bolts, 2 recliner-to-backrest frame bolts and remove the RH recliner.
   - To install, tighten to 55 Nm (41 lb-ft).

LH recliner only

8. Remove the LH recliner outboard cover in the following sequence.
   1. Remove the scrivet.
   2. Release the clips at the front and rear of the recliner cover.
   3. Separate the side air bag module and heated seat (if equipped) wire harnesses from the recliner cover.
   4. Remove the LH recliner outboard cover.
9. Release the cushion trim cover retainer from around the safety belt buckle and separate the hook-and-loop strip.

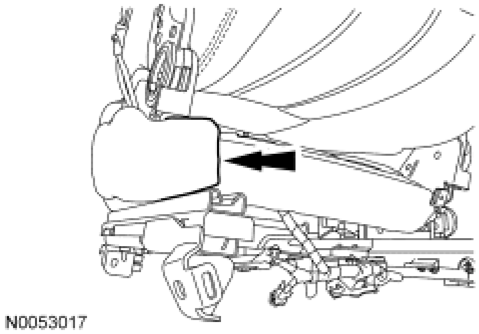


Fig. 314: Locating Cushion Trim Cover Retainer
Courtesy of FORD MOTOR CO.

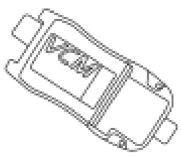
10. Separate the cable at the LH recliner in the following sequence.
    1. Separate the cable from the LH recliner.
    2. Squeeze the cable housing tabs together and separate from the LH recliner.
11. Remove the 2 recliner-to-cushion frame bolts, 2 recliner-to-backrest frame bolts and remove the LH recliner.
    - To install, tighten to 55 Nm (41 lb-ft).

All seats

12. To install, reverse the removal procedure.
13. Install the front seat and repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.
14. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

LUMBAR ASSEMBLY

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

NOTE: The air bag warning lamp illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold Flat**.
3. Detach the side air bag bolt cover.

   NOTE: Note the position of the side air bag module locator hook in the side air bag module bracket (on the seat back frame) for installation.

4. Remove the bolt and lift up and out to detach the side air bag module from the seat backrest.
   - To install, tighten to 10 Nm (89 lb-in).
5. Slide and disengage the side air bag module electrical connector locking clip, and then release the tab and disconnect the side air bag module electrical connector and remove the side air bag module.
6. Detach the 2 pin-type retainers and trim cover flaps from the recliners.

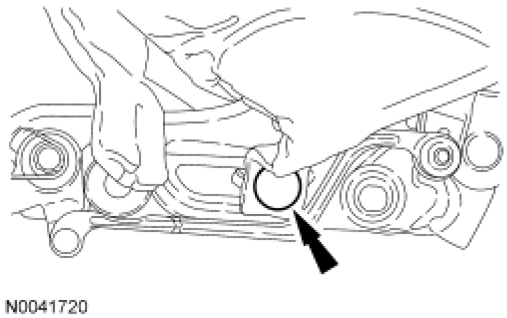


Fig. 315: Locating Pin-Type Retainers
Courtesy of FORD MOTOR CO.

CAUTION: Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

7. Release the 2 outer and inner backrest trim cover lower J-clips and partially invert the trim cover to the hook-and-loop strips.

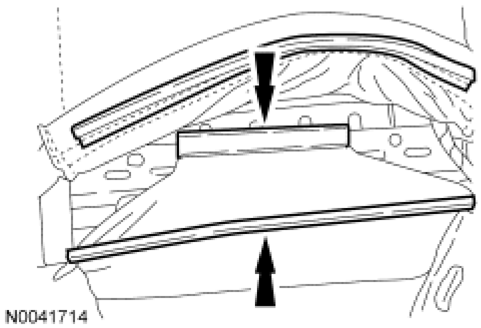


Fig. 316: Locating Outer And Inner Backrest Trim Cover Lower J-Clips
Courtesy of FORD MOTOR CO.

NOTE: The head restraint guides are not interchangeable. Note location for installation.

8. Reach up into the backrest and squeeze the head restraint guide ends together to release. Pull the 2 head restraint guides out of the backrest frame.

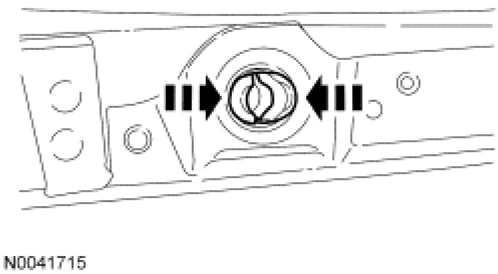


Fig. 317: Removing Head Restraint Guides From Backrest Frame
Courtesy of FORD MOTOR CO.

CAUTION: Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

9. Remove all rows of hog rings from the backrest trim cover and separate the hook-and-loop strips while inverting the trim cover up the backrest.
10. Remove the rear upper hog rings attaching the trim cover to the backrest frame and remove the trim cover.
11. Remove the foam pad from the backrest frame.
    - If equipped with climate controlled seats, remove the hog rings from the upper support spring.
    - If equipped with heated seats, detach pin-type retainer and backrest heater mat wiring harness from the backrest frame.
12. Release the 2 lumbar spring clips from the backrest frame and remove the lumbar.
    - Route out the manual lumbar cable, if equipped.
        - Note the routing of the lumbar cable for installation.
    - Disconnect the electrical connector from the power lumbar motor, if equipped.

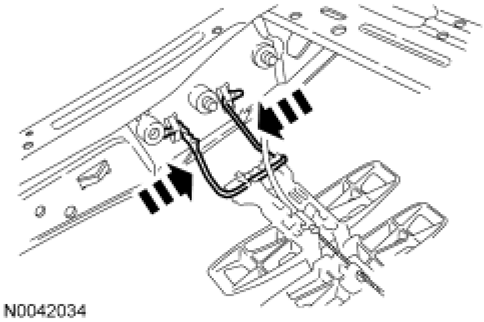


Fig. 318: Releasing Lumbar Spring Clips
Courtesy of FORD MOTOR CO.

WARNING: **If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a**

new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

WARNING: **Inspect the seat side air bag module and mounting surfaces for any damage or foreign material before installing the seat side air bag module. If any damage is found, install new components. If any foreign material is found, remove it. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.**

NOTE: **A backrest trim cover for a seat with a side air bag module is different than a backrest trim cover for a seat without a side air bag module. Make sure the correct backrest trim cover is being installed.**

13. To install, reverse the removal procedure.
14. Install the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold Flat**.
15. Install the front seat and repower the SRS. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

    Passenger seat

16. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT BACKREST THERMO-ELECTRIC DEVICE

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

NOTE: **The air bag warning lamp illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: The backrest thermo-electric device (TED) filter is detachable from the TED assembly housing and can be replaced without TED removal.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold Flat**.
3. Detach the side air bag bolt cover.

NOTE: Note the position of the side air bag module locator hook in the side air bag module bracket (on the seat back frame) for installation.

4. Remove the bolt and lift up and out to detach the side air bag module from the seat backrest.
   - To install, tighten to 10 Nm (89 lb-in).
5. Slide and disengage the side air bag module electrical connector locking clip, and then release the tab and disconnect the side air bag module electrical connector and remove the side air bag module.
6. Detach the 2 pin-type retainers and trim cover flaps from the recliners.

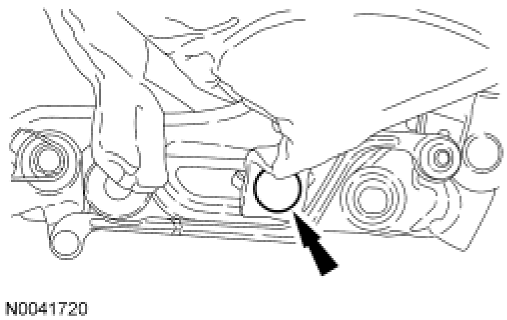


Fig. 319: Locating Pin-Type Retainers
Courtesy of FORD MOTOR CO.

CAUTION: Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

7. Release the 2 outer and inner backrest trim cover lower J-clips and partially invert the trim cover to the hook-and-loop strips.

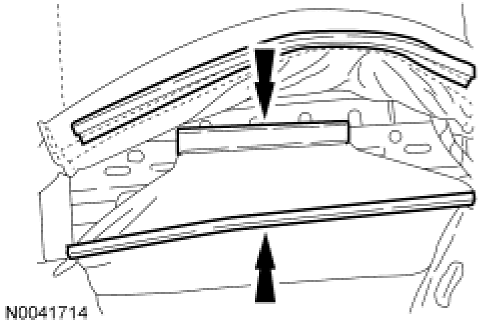


Fig. 320: Locating Outer And Inner Backrest Trim Cover Lower J-Clips
Courtesy of FORD MOTOR CO.

NOTE: The head restraint guides are not interchangeable. Note location for installation.

8. Reach up into the backrest and squeeze the head restraint guide ends together to release. Pull the 2 head restraint guides out of the backrest frame.

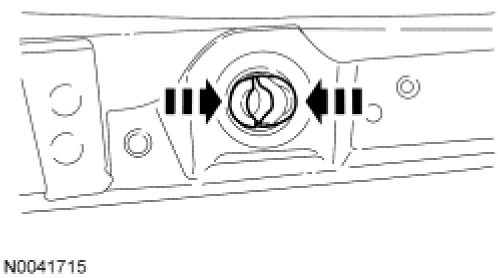


Fig. 321: Removing Head Restraint Guides From Backrest Frame
Courtesy of FORD MOTOR CO.

CAUTION: Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

9. Separate the hook-and-loop strips and invert the trim cover up the backrest to the rear upper hog rings.
10. Remove the rear upper hog rings and trim cover.

CAUTION: Inspect the climate controlled seat backrest manifold for crush and obstruction before installation. If damaged, install a new backrest manifold.

11. If necessary, remove the climate controlled seat backrest manifold from the foam pad.
    - To install, align the backrest manifold and insert into the valleys of the foam pad.
        - Check for correct fit between the manifold, foam pad and TED assembly, to make sure there

is no air flow obstruction or cushion crush.

12. Remove the hog rings from the upper support spring and remove the foam pad.

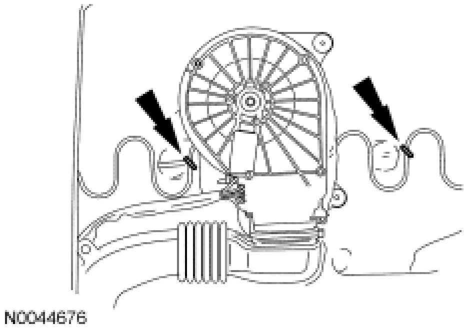


Fig. 322: Locating Hog Rings
Courtesy of FORD MOTOR CO.

13. Disconnect the backrest TED assembly electrical connector and detach the wiring harness retainers.

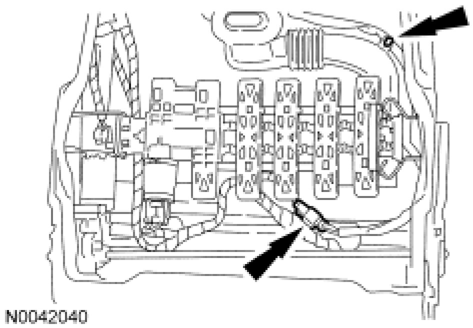


Fig. 323: Locating Backrest TED Assembly Electrical Connector And Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

14. Remove the TED exhaust duct.
    - Cut and remove the tie strap.
        - During installation, install a new tie strap.
    - Remove the pin-type retainer and separate the exhaust duct from the TED.
15. Disconnect the backrest upper support spring from the backrest frame and remove the spring support with the TED attached.
16. If necessary, detach the backrest TED filter from the TED.

NOTE: Note the TED position on the support spring for installation.

17. Use an appropriate tool and separate the TED from the upper backrest support spring.

CAUTION: Cover the TED openings before removing any rivets to prevent foreign material from entering the TED.

18. Remove the 3 rivets and bracket from the TED.

WARNING: If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

WARNING: Inspect the seat side air bag module and mounting surfaces for any damage or foreign material before installing the seat side air bag module. If any damage is found, install new components. If any foreign material is found, remove it. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.

NOTE: A backrest trim cover for a seat with a side air bag module is different than a backrest trim cover for a seat without a side air bag module. Make sure the correct backrest trim cover is being installed.

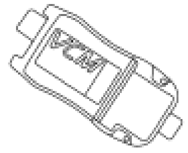
19. To install, reverse the removal procedure.
20. Install the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold Flat**.
21. Install the front seat and repower the SRS. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

    Passenger seat

22. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT CUSHION THERMO-ELECTRIC DEVICE

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: The cushion thermo-electric device (TED) filter is detachable from the TED assembly housing from underneath the seat cushion.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
   - Fully raise the seat before depowering the SRS to aid cushion TED assembly access.
2. Disconnect the TED electrical connector.

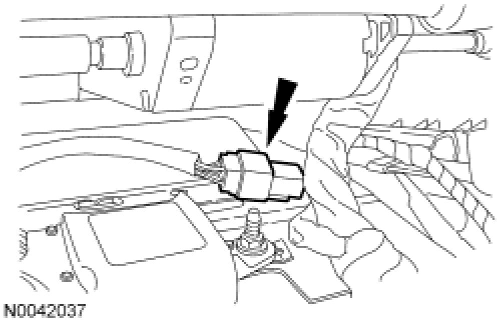


Fig. 324: Locating TED Electrical Connector
Courtesy of FORD MOTOR CO.

CAUTION: Inspect the climate controlled seat cushion manifold and foam pad for crush or obstruction before installation and repair as needed. Failure to do so may cause the climate control to work inefficiently.

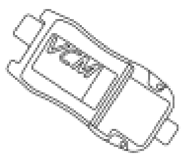
3. Remove the 3 nuts and TED assembly from the cushion frame.
   - To install, tighten to 6 Nm (53 lb-in).
   - To install, check for correct fit between the cushion manifold, foam pad and TED assembly, to make sure there is no airflow obstruction, cushion crush or foreign material.
4. To install, reverse the removal procedure.
5. Install the front seat and repower the SRS. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

   Passenger seat

6. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

DUAL CLIMATE CONTROLLED SEAT MODULE (DCSM)

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL

NOTE: The air bag warning lamp illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: When installing a new dual climate controlled seat module (DCSM), it is necessary to carry out programmable module installation (PMI). For additional information, refer to MODULE CONFIGURATION article.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

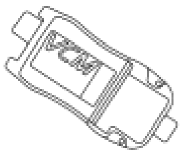
1. Before removing the DCSM, carry out the appropriate steps in the PMI procedure. For additional information, refer to **MODULE CONFIGURATION** article.
2. Remove the front passenger seat. For additional information, refer to **Seat - Front**.
3. Remove the DCSM from the cushion electrical bracket.
   - Release the locking wedges and disconnect the 3 DCSM electrical connectors.
   - Remove the 2 rivets and DCSM.

INSTALLATION

1. Install the DCSM to the seat.
   - Position the DCSM to the electrical bracket and install 2 new rivets.
   - Connect the 3 DCSM electrical connectors and locking wedges.
2. Install the front seat and repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.
3. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.
4. After installing the DCSM, carry out the appropriate steps in the PMI procedure. For additional information, refer to **MODULE CONFIGURATION** article.

HEATED SEAT MODULE

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

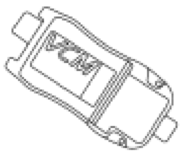
NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the front passenger seat. For additional information, refer to **Seat - Front**.
2. Remove the heated seat module from the cushion electrical bracket.
    - Disconnect the heated seat module electrical connector.
    - Remove the rivet and heated seat module.
3. To install, reverse the removal procedure.
4. Install the front passenger seat and repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.
5. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT CONTROL SWITCH

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

REMOVAL AND INSTALLATION

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of

faults before releasing the vehicle to the customer.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the spring clip and manual recliner handle, if equipped.
3. Pull and remove the manual lumbar control knob and seat control switch button(s), if equipped.
4. Detach and position aside the cushion side shield in the following sequence.
    1. Pull the side shield away from the seat cushion at the front edge and release the forward and side retainers.
    2. Pull the side shield rearward to release the rear retainer and position the cushion side shield aside.
        - Return any detached retainers to the side shield.
        - To install, position the rear retainer clip on the cushion side shield through the hole in the backrest trim cover flap before attaching to the rear edge of the seat.
5. Disconnect the seat control switch, release the cushion side shield retainers and remove the seat control switch.
6. To install, reverse the removal procedure.
7. Install the front seat and repower the SRS. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

    Passenger seat

8. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

MEMORY SET SWITCH

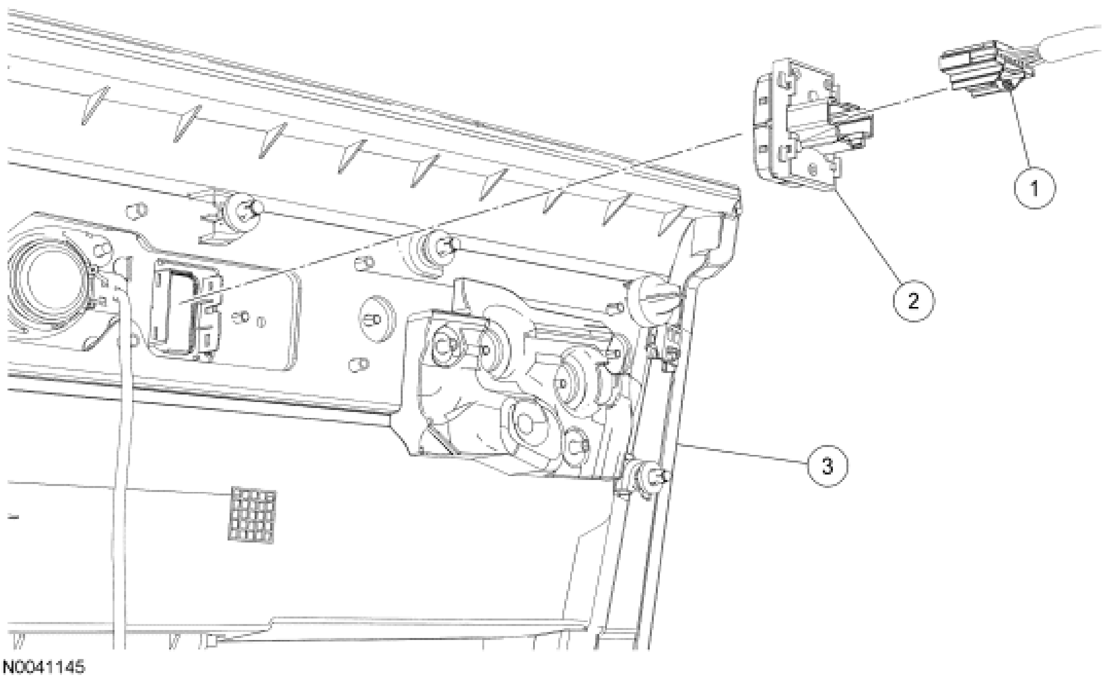


Fig. 325: Exploded View Of Memory Set Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Electrical connector (part of 14631)
2	14776	Memory SET switch
3	-	Driver interior door panel assembly

REMOVAL AND INSTALLATION

1. Remove the driver interior door panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Disconnect the electrical connector, release the 4 tabs and remove the memory SET switch.
3. To install, reverse the removal procedure.

SEAT - EXPLODED VIEW, REAR

NOTE: Seat backrest with armrest shown, seat backrest without armrest similar.

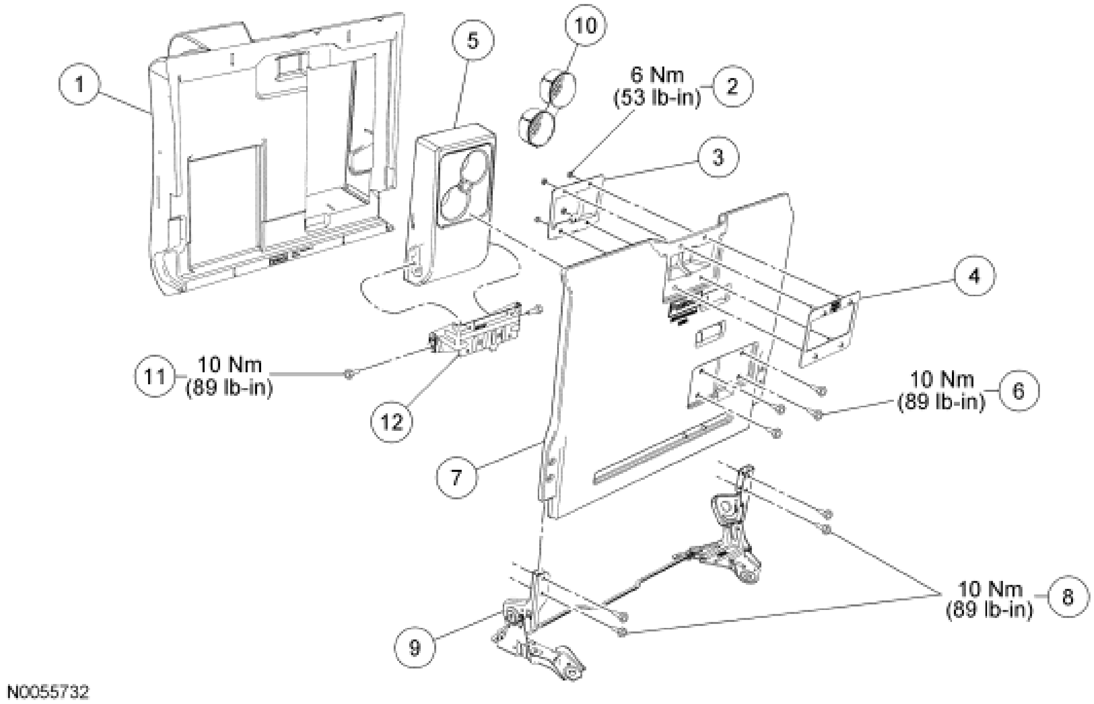


Fig. 326: Exploded View Of Rear Seat With Torque Specifications - 60 Percent
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	66801/66601	Backrest foam pad/trim cover
2	N620480	Striker-to-backrest frame nut (4 required)
3	-	Backrest latch striker (part of 613A39)
4	-	Striker support plate (part of 613A39)
5	67112	Armrest assembly (if equipped)
6	N605892	Armrest-to-backrest bolt (if equipped) (4 required)
7	613A39	Backrest frame
8	N605892	Backrest-to-pivot bolts (4 required)
9	-	Backrest pivot assembly (part of 613A39)
10	67112	Rubber insert, armrest cup holder (if equipped)
11	W712494	Armrest pivot bolt (if equipped) (2 required)
12	67210	Armrest bracket (if equipped)

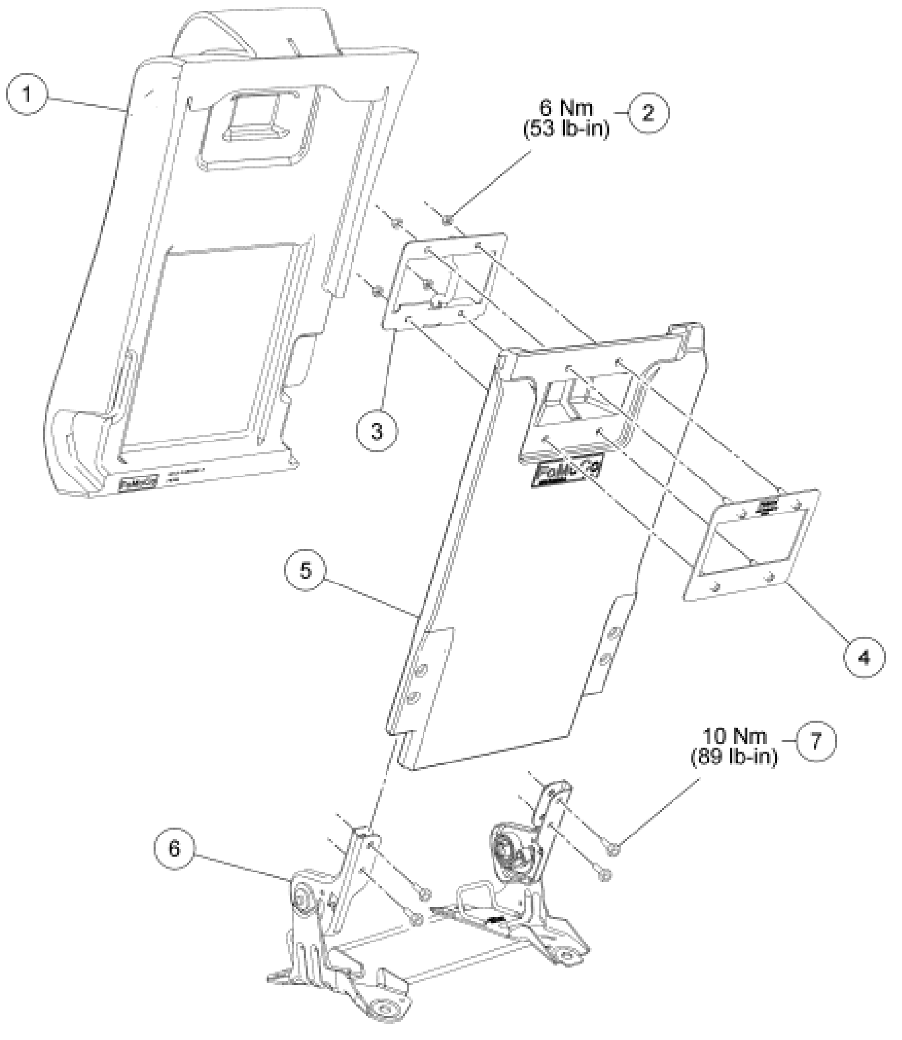


Fig. 327: Exploded View Of Rear Seat With Torque Specifications - 40 Percent
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	66800/66600	Backrest foam pad/trim cover
2	N620480	Striker-to-backrest frame nut (4 required)
3	-	Backrest latch striker (part of 613A38)
4	-	Striker support plate (part of 613A38)
5	613A38	Backrest frame
6	-	Backrest pivot assembly (part of 613A38)
7	N605892	Backrest-to-pivot bolt (4 required)

1. For additional information, refer to the procedures.

SEAT BACKREST - REAR

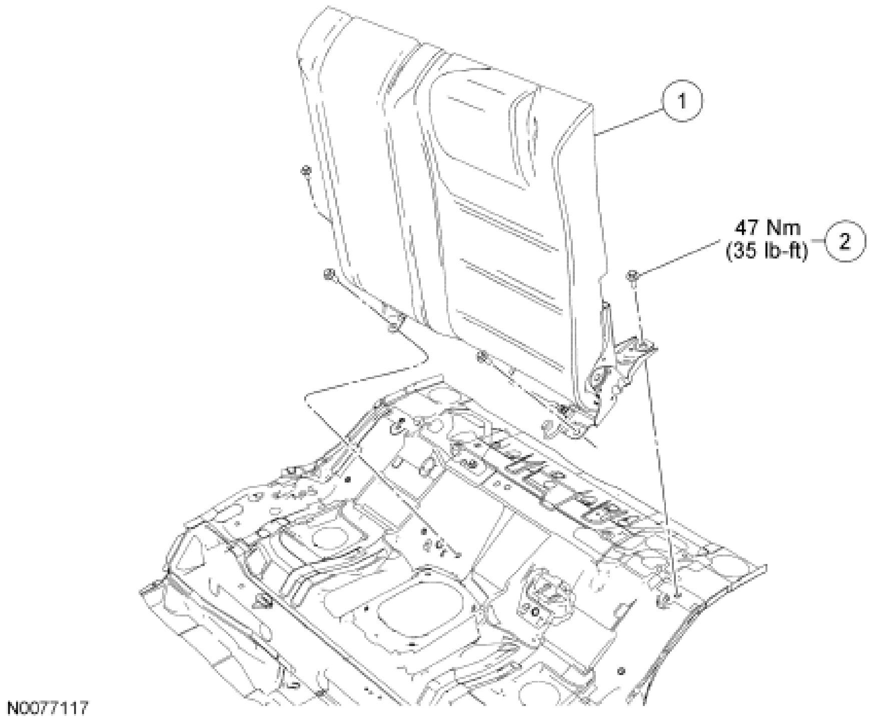


Fig. 328: Exploded View Of Rear Seat Backrest With Torque Specification - 60 Percent
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Backrest assembly
2	W707858	Backrest-to-floor bolt (4 required)

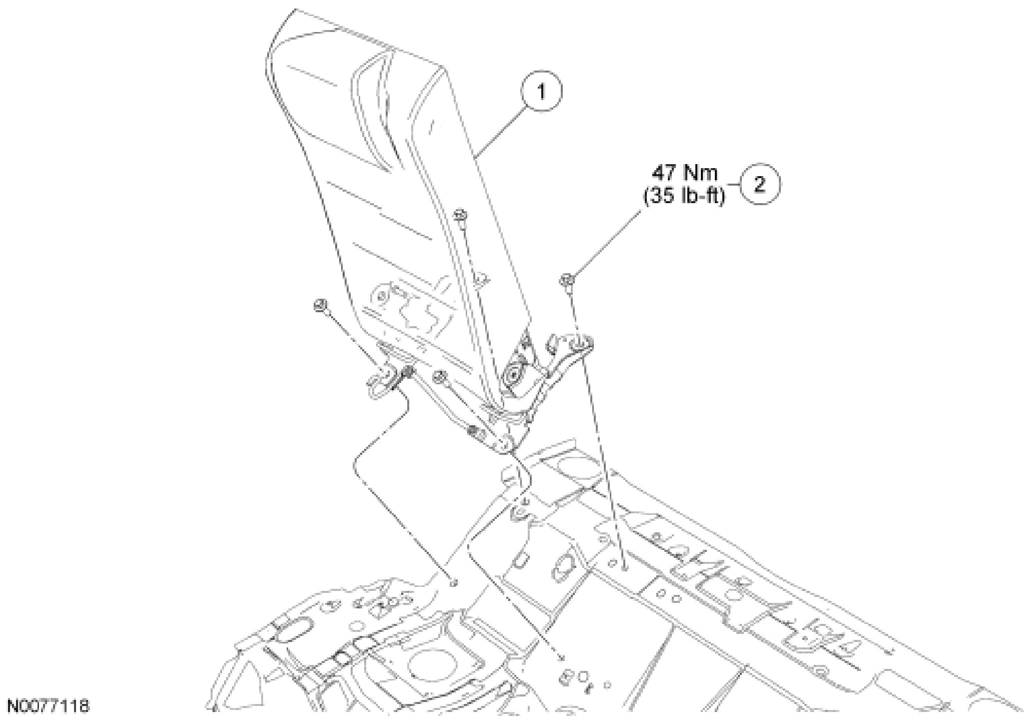


Fig. 329: Exploded View Of Rear Seat Backrest With Torque Specification - 40 Percent
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Backrest assembly
2	W707858	Backrest-to-floor bolt (4 required).

REMOVAL

NOTE: LH side shown, RH side similar.

1. Remove the rear seat cushion. For additional information, refer to **Seat Cushion - Rear**.
2. Remove the 2 forward backrest-to-floor bolts from the affected rear backrest assembly.

NOTE: If the center safety belt retractor locks and the safety belt webbing prevents the backrest from lowering, raise the backrest upward to release the safety belt retractor and belt webbing.

3. Release the backrest latch in the luggage compartment area and position the backrest downward.
4. Position aside the floor trim cover behind the backrest to gain access to the rearward backrest-to-floor bolts and remove the 2 bolts.
5. Raise the rear seat backrest and hinge assembly upward from the 2 locator pins on the floor and remove the backrest.

INSTALLATION

Backrest

NOTE: Make sure the rear seat safety belt webbing is positioned in front of the backrest assembly for installation and is not positioned underneath the backrest pivot assembly.

1. Position the rear seat backrest pivot assembly to the 2 locator pins on the floor.

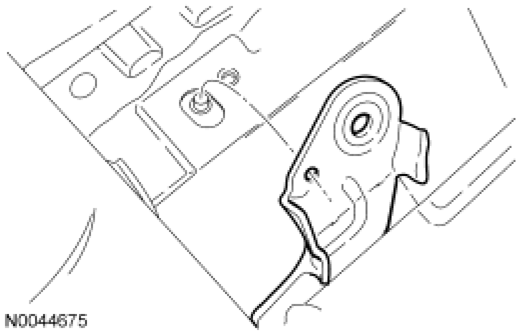


Fig. 330: Identifying Rear Seat Backrest Pivot Assembly Position
Courtesy of FORD MOTOR CO.

2. Install the 2 rearward backrest-to-floor bolts.
   - Tighten to 47 Nm (35 lb-ft).
3. Position the backrest upright and install the 2 forward backrest-to-floor bolts.
   - Tighten to 47 Nm (35 lb-ft).
4. Check backrest latch and latch release operation.
   - Raise the backrest and check for good backrest fit and latch closure when upright.

Backrest latch alignment

5. If backrest latch alignment is needed, remove the parcel shelf to access the rear backrest latch nuts. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
6. Loosen the 2 rear backrest latch nuts and adjust the latch position as necessary for good backrest fit and latch closure when upright.
   - Tighten to 48 Nm (35 lb-ft).

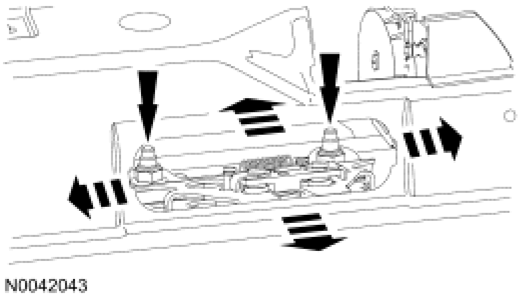


Fig. 331: Adjusting Latch Position
Courtesy of FORD MOTOR CO.

7. Install the parcel shelf. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

   Backrest

8. Check the rear seat active restraints for operation and accessibility.
   - Make sure the safety belts and buckles are accessible to the occupants after installation.
   - Verify the safety belt retractor operates without excessive effort or binding.

SEAT BACKREST COVER - REAR, 40 PERCENT

REMOVAL AND INSTALLATION

1. Remove the rear seat cushion. For additional information, refer to **Seat Cushion - Rear**.
2. Remove the 40 percent rear seat backrest. For additional information, refer to **Seat Backrest - Rear**.
3. Release the lower J-strip, 4 J-clips and remove the staples from each side.

CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

4. Partially invert the trim cover separating the hook-and-loop strips and remove the first row of hog rings.
5. Continue to invert the backrest trim cover separating the hook-and-loop strips and removing all rows of hog rings working up the backrest.
6. Remove the backrest trim cover.
7. To install, reverse the removal procedure.
8. Install the 40 percent rear seat backrest assembly. For additional information, refer to **Seat Backrest - Rear**.
9. Install the rear seat cushion. For additional information, refer to **Seat Cushion - Rear**.

SEAT BACKREST COVER - REAR, 60 PERCENT

REMOVAL AND INSTALLATION

All seats

1. Remove the rear seat cushion. For additional information, refer to **Seat Cushion - Rear**.
2. Remove the 60 percent rear seat backrest. For additional information, refer to **Seat Backrest - Rear**.
3. Release the trim cover lower J-strip.

   Seats equipped with armrest

4. Invert the trim cover enough to gain access to the armrest-to-backrest bolts.
5. Remove the 4 armrest-to-backrest bolts and support plate.
   - For installation, adjust the armrest horizontally as needed for good fit.
   - To install, tighten to 10 Nm (89 lb-in).
6. Separate the armrest assembly from the backrest and position aside.
   - For assembly, align the armrest bracket locator tab to the backrest frame.
7. Release the 4 pin-type retainers, separate the armrest trim cover panel from the backrest and remove the armrest assembly.
   - For a broken retainer, push the remaining end through and into the backrest frame and install a new pin-type retainer during assembly.

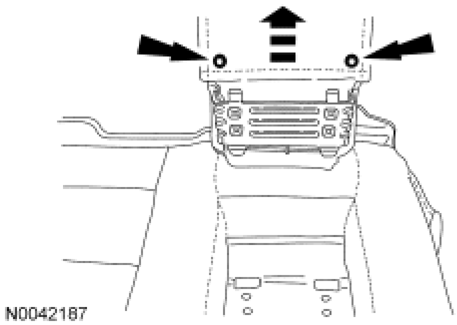


Fig. 332: Removing Armrest Assembly
Courtesy of FORD MOTOR CO.

8. Remove the pin-type retainer from the backrest trim cover armrest pocket.

   All seats

9. Release the 4 lower trim cover J-clips at both sides of the backrest and remove the staples.

CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

10. Continue to invert the backrest trim cover separating the hook-and-loop strips and removing all rows of hog rings working up the backrest.
11. Remove the backrest trim cover.
12. To install, reverse the removal procedure.
13. Install the 60 percent rear seat backrest assembly. For additional information, refer to **Seat Backrest - Rear**.
14. Install the rear seat cushion. For additional information, refer to **Seat Cushion - Rear**.

SEAT ARMREST - REAR

REMOVAL AND INSTALLATION

1. Remove the rear seat cushion. For additional information, refer to **Seat Cushion - Rear**.
2. Remove the 60 percent rear seat backrest. For additional information, refer to **Seat Backrest - Rear**.
3. Release the lower J-strip and partially invert the backrest trim cover to access the armrest-to-backrest bolts.
4. Remove the 4 armrest-to-backrest bolts and support plate.
   - For installation, adjust the armrest horizontally as needed for good fit.
   - To install, tighten to 10 Nm (89 lb-in).
5. Separate the armrest and bracket assembly from the backrest and position aside.
   - For installation, align the armrest bracket locator tab to the backrest frame.
6. Release the 4 pin-type retainers, separate the armrest trim cover panel from the backrest and remove the armrest assembly.
   - For a broken retainer, push the remaining end through and into the backrest frame and install a new pin-type retainer during installation.

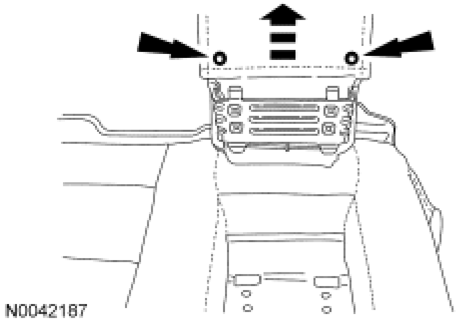


Fig. 333: Removing Armrest Assembly
Courtesy of FORD MOTOR CO.

7. To install, reverse the removal procedure.
8. Install the 60 percent rear seat backrest assembly. For additional information, refer to **Seat Backrest - Rear**.
9. Install the rear seat cushion. For additional information, refer to **Seat Cushion - Rear**.

SEAT BACKREST LATCH - REAR

NOTE: **LH side shown, RH side similar.**

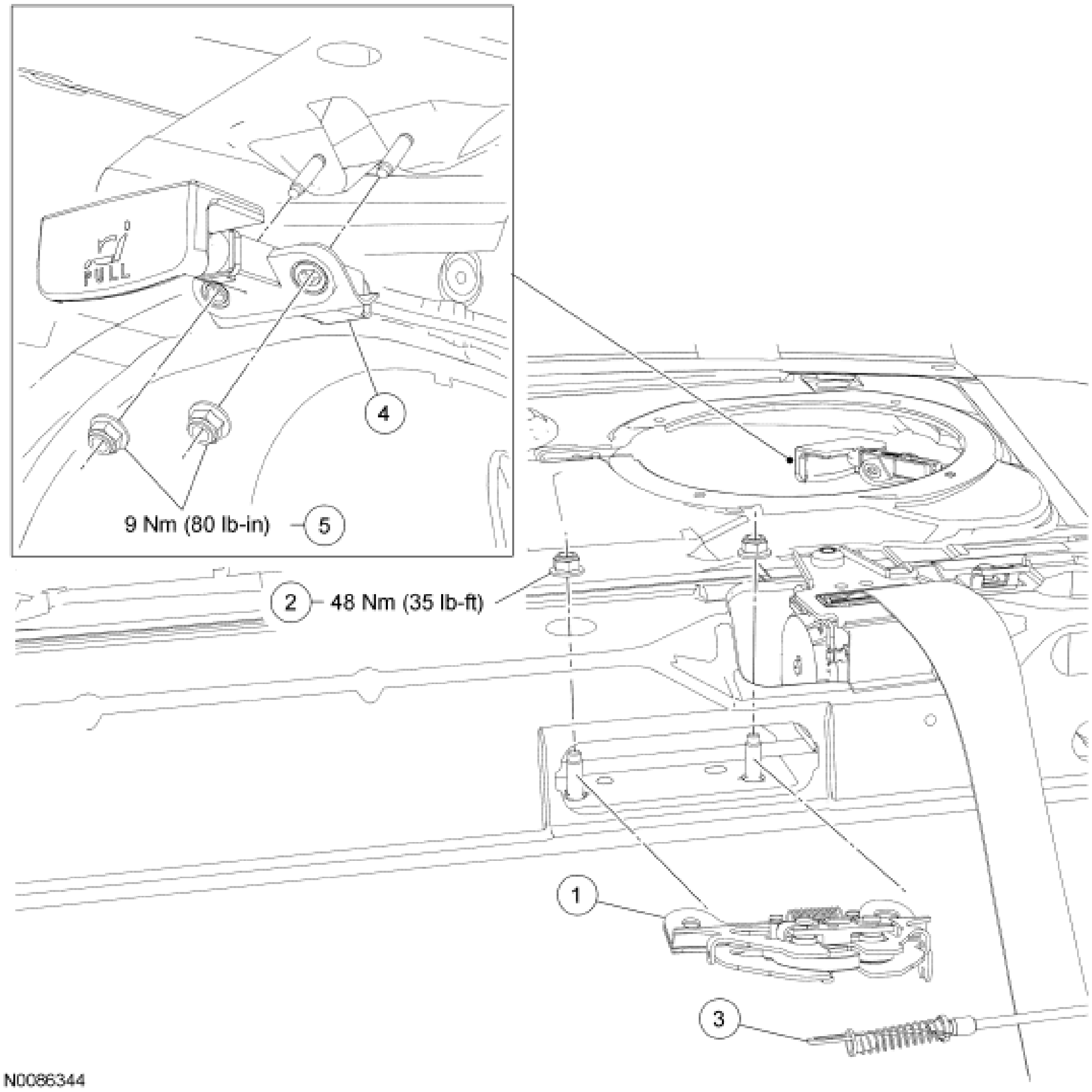


Fig. 334: Exploded View Of Rear Seat Backrest Latch With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	613D61	Backrest latch assembly
2	W520103	Latch-to-body nut (2 required)
3	601L60	Latch release cable assembly
4	624A94	Latch release handle bracket
5	W520101	Latch release handle bracket nuts (2 required)

REMOVAL

NOTE: LH side shown, RH side similar.

1. Remove the parcel shelf from the rear of the vehicle to access the rear backrest latch nuts. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

NOTE: Make sure the affected backrest is released.

2. Access the luggage compartment, detach the trim pin-type retainer and position the trim aside.
3. Remove the 2 nuts and detach the latch release handle bracket.
4. Detach the 2 pin-type retainers and latch cable assembly.
   - Note the cable routing for installation.
5. Detach the release cable from the latch and remove.
6. Remove the backrest latch.
   - Remove the 2 nuts and backrest latch.

INSTALLATION

1. Position the backrest latch to the 2 studs.
2. Install the 2 latch nuts and hand tighten.
3. Attach the release cable to the latch.
4. Route the release cable, position the release handle and bracket to the 2 studs and install the 2 nuts.
   - Tighten to 9 Nm (80 lb-in).
   - Install the 2 release cable pin-type retainers.
   - Position the trim and install the pin-type retainer.
5. Adjust the latch position as necessary for good backrest fit and latch closure when upright.
   - Tighten to 48 Nm (35 lb-ft).

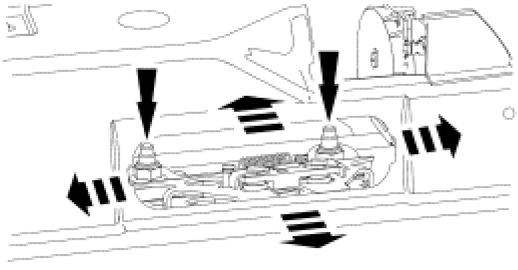


Fig. 335: Adjusting Latch Position
Courtesy of FORD MOTOR CO.

6. Install the parcel shelf. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

SEAT CUSHION - REAR

NOTE: Backrest pad and frame removed for clarity.

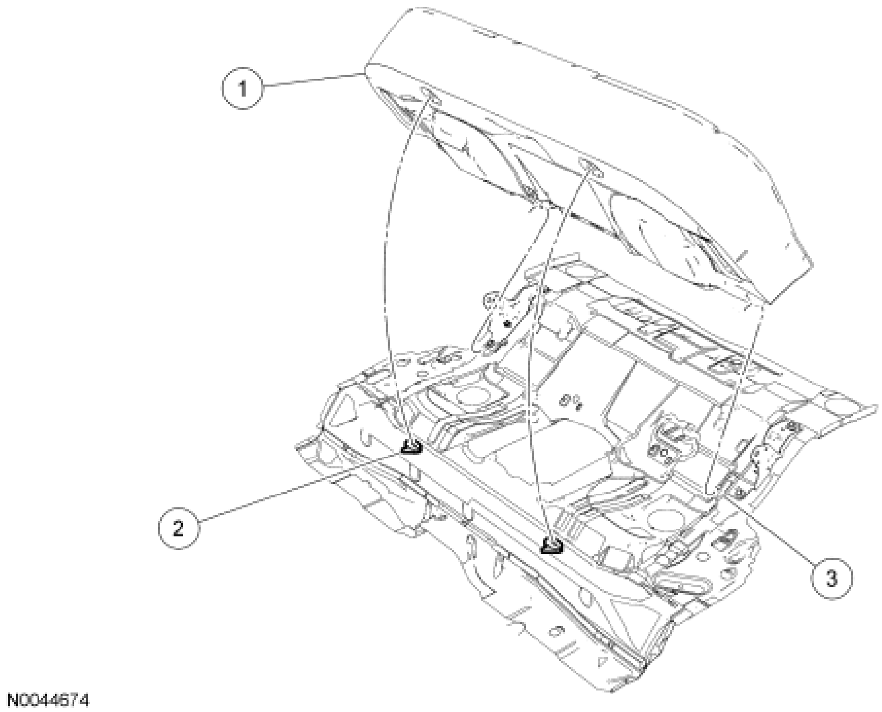


Fig. 336: Exploded View Of Rear Seat Cushion
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Cushion assembly
2	624A14	Cushion latch (2 required)
3	-	Cushion rear retainer (2 required, part of rear backrest pivot assemblies)

REMOVAL AND INSTALLATION

CAUTION: Do not force the latches or cushion to release. Applying excessive force to release the rear seat cushion latches can damage them.

NOTE: Make sure the 2 rear cushion latches are fully disengaged before raising the seat cushion to avoid damaging the latches.

1. Fully release the 2 latches and slightly raise the rear seat cushion front edge to disengage from the floor.
2. Push the rear seat cushion slightly rearward to disengage the rear edge of the cushion from the rear retainers and remove.
   - To install, position the rear seat cushion frame wire over the rear retainers.
3. To install, reverse the removal procedure.

- Make sure the safety belts and buckles are accessible to the occupants after installation.

SEAT CUSHION COVER - REAR

1. Remove the rear seat cushion. For additional information, refer to **Seat Cushion - Rear**.
2. Release the drawstring and remove the hog rings.

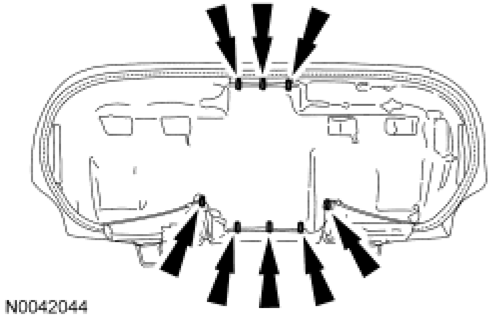


Fig. 337: Locating Hog Rings
Courtesy of FORD MOTOR CO.

CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

3. Partially invert the trim cover and release the hook-and-loop strips up to the hog rings.
4. Remove the hog rings and continue to release the hook-and-loop strips and separate the trim cover from the foam pad.

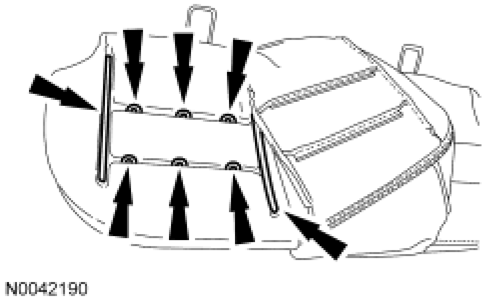


Fig. 338: Locating Hog Rings And Loop Strips
Courtesy of FORD MOTOR CO.

5. To install, reverse the removal procedure.
6. Install the rear seat cushion. For additional information, refer to **Seat Cushion - Rear**.

SEAT BOLSTER - REAR

NOTE: LH side shown, RH side similar.

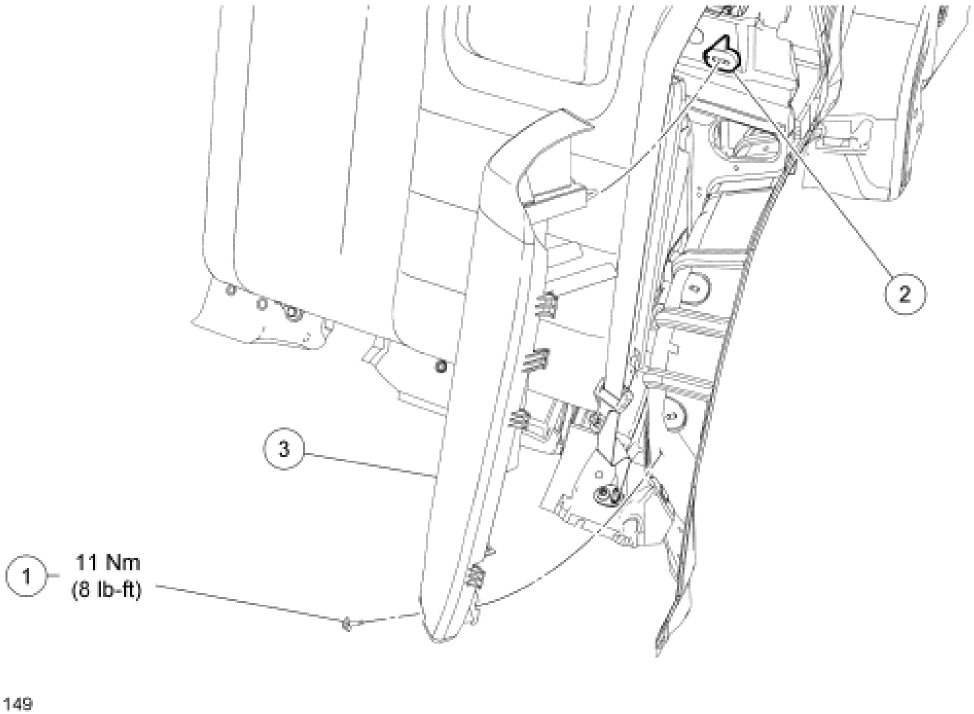


Fig. 339: Exploded View Of Rear Seat Bolster With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W710330	Bolster bolt
2	-	Bolster latch
3	66893	Rear seat side bolster

REMOVAL

NOTE: Do not apply excessive forward force to the side bolsters or damage may occur.

1. Remove the rear seat cushion. For additional information, refer to **Seat Cushion - Rear**.
2. Remove the bolt from the affected side bolster.
3. Release and lower the rear seat backrest at the affected side.
4. If removing the LH side bolster, fashion a tool for releasing the LH side bolster as shown:

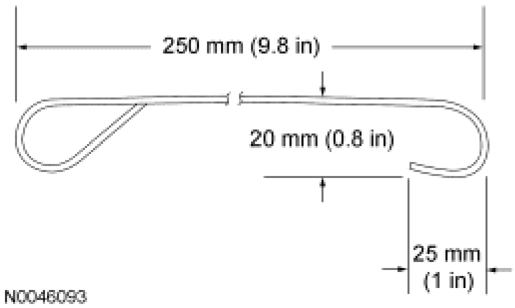


Fig. 340: Identifying Seat Bolster With Specification
Courtesy of FORD MOTOR CO.

NOTE: **LH side shown, RH side similar.**

NOTE: **The latch release tabs are accessible through a small service notch located on the rear inboard edge of each side bolster (behind the bolster trim cover sew seam).**

5. Locate the service notch behind the rear inboard edge of the affected side bolster to access the latch release tab.

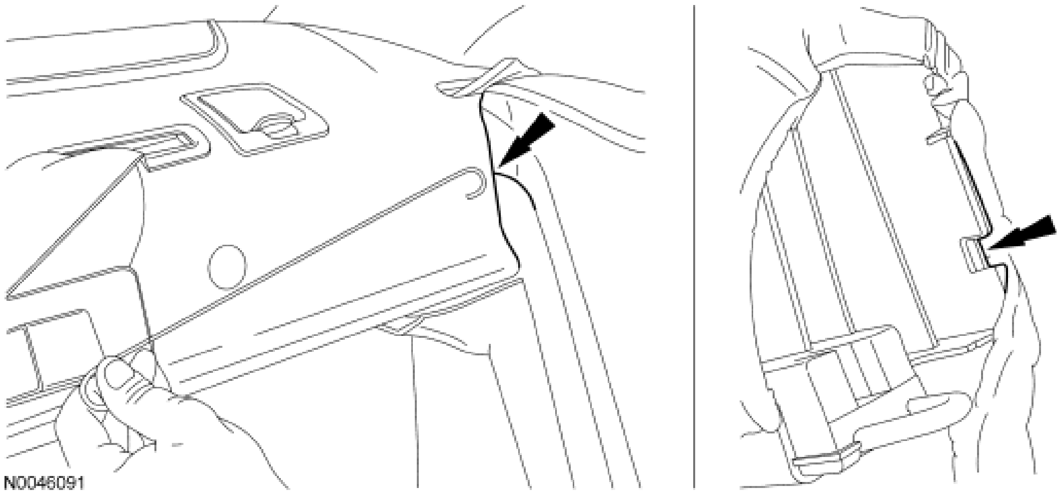


Fig. 341: Locating Service Notch
Courtesy of FORD MOTOR CO.

NOTE: **Do not force the latch or side bolster to release. Applying excessive force can damage the latch.**

NOTE: **Latch shown with bolster removed for clarity.**

6. To remove the LH side bolster, use a hooked pick or fashion a hooked tool to pull the latch release toward the RH side of the vehicle and release the side bolster.

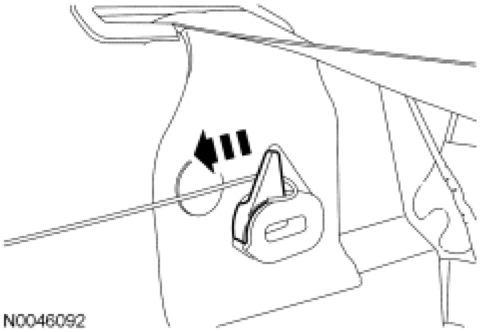


Fig. 342: Removing LH Side Bolster
Courtesy of FORD MOTOR CO.

NOTE:	**Do not force the latch or side bolster to release. Applying excessive force can damage the latch.**

NOTE:	**Latch shown with bolster removed for clarity.**

7. To remove the RH side bolster, use a flat-blade screwdriver to push the latch release toward the RH side of the vehicle and release the side bolster.

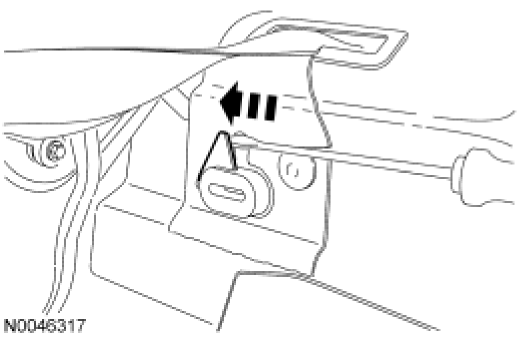


Fig. 343: Removing RH Side Bolster
Courtesy of FORD MOTOR CO.

8. With the affected bolster latch released, pull the side bolster forward and remove.

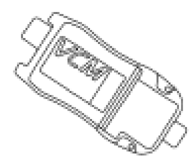
INSTALLATION

1. Position the side bolster, align and insert to the latch.
2. Align the bolt holes and install the side bolster bolt.
    - Tighten to 11 Nm (8 lb-ft).
3. Install the rear seat cushion. Refer to **Seat Cushion - Rear**.
    - Make sure the safety belts and buckles are accessible to the occupants after installation.

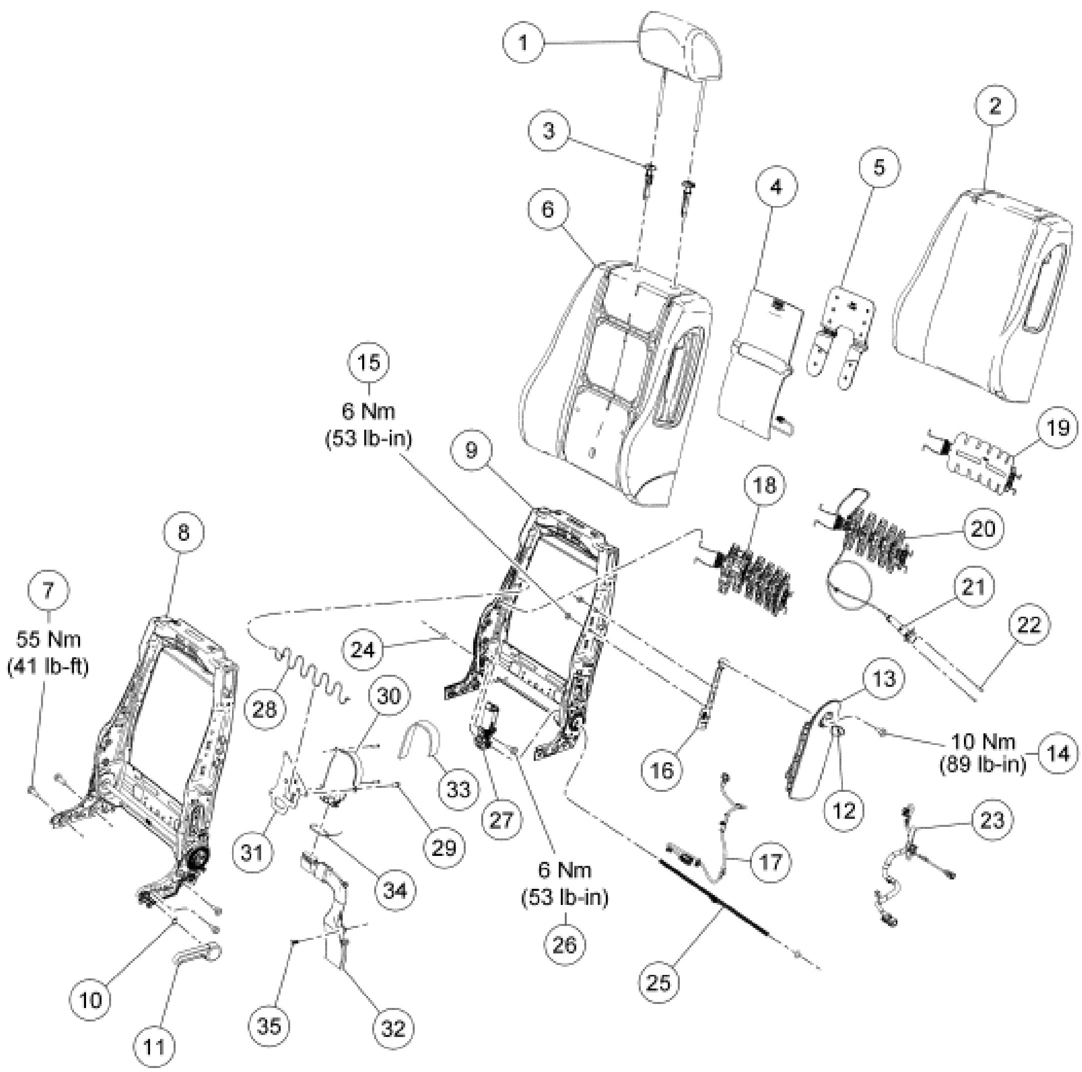
DISASSEMBLY AND ASSEMBLY

SEAT BACKREST - FRONT, WITHOUT FOLD FLAT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

NOTE: Driver backrest shown, passenger backrest similar.



N0044667

Fig. 344: Exploded View Of Front Seat Backrest, Without Fold-Flat With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	611A08	Head restraint
2	64417	Backrest trim cover
3	610A16	Head restraint guide (2 required)
4	14D696	Backrest heater mat (if equipped)
5	19N550	Backrest manifold, climate controlled seat (if equipped)
6	64811	Backrest foam pad
7	W500632	Backrest-to-cushion bolt (4 required)
8	61018	Backrest frame (with manual recliner) (if equipped)
9	608A15	Backrest frame (with power recliner) (if equipped)
10	-	Spring clip, recliner handle (part of 61199) (if equipped)
11	61199	Handle, recliner (if equipped)
12	-	Cover, side air bag module bolt (part of 611D11)
13	611D11	Side air bag module
14	N605892	Bolt, side air bag module
15	N620480	Nut, side air bag bracket (2 required)
16	611D79	Side air bag bracket
17	14K155	Wiring harness, side air bag
18	65500	Lumbar assembly, power (if equipped)
19	64842	Lumbar assembly, static (if equipped)
20	65500	Lumbar assembly, manual (if equipped)
21	610C01	Manual lumbar control (if equipped)
22	-	Rivet, manual lumbar control (2 required, if equipped)
23	14C693	Wiring harness, power seat backrest (if equipped)
24	-	Pal nut, recliner torque shaft (2 required)
25	613A68	Recliner torque shaft
26	W790022	Bolt, recliner motor (if equipped)
27	14547	Recliner motor (if equipped)
28	64646	Upper support spring
29	-	Rivet, climate controlled seat thermo-electric device (TED) (3 required, if equipped)
30	19N550	TED assembly (if equipped)
31	18D583	Bracket, TED assembly (if equipped)
32	18D507	Exhaust duct, climate controlled seat TED assembly (if equipped)
33	-	Filter, climate controlled seat TED assembly (if equipped)
34	-	Tie strap
35	W790002	Pin-type retainer

DISASSEMBLY

WARNING: **Always carry or place a live air bag module with the air bag and**

deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

WARNING: **Front seat backrest trim covers installed on seats equipped with seat side air bags cannot be repaired. A new trim cover must be installed. Cleaning is permissible. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.**

NOTE: If a side air bag deployment took place, a new side air bag module and bolt must be installed. The side air bag module bracket on the backrest frame should be inspected and replaced if necessary.

NOTE: The air bag warning lamp illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: The manual recliners and power recliners are serviced as part of the backrest frame.

NOTE: Driver seat shown, passenger seat similar.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold Flat**.
3. Detach the side air bag bolt cover.

NOTE: Note the position of the side air bag module locator hook in the side air bag module bracket (on the seat back frame) for installation.

4. Remove the bolt and lift up and out to detach the side air bag module from the seat backrest.
5. Slide and disengage the side air bag module electrical connector locking clip, and then release the tab and disconnect the side air bag module electrical connector and remove the side air bag module.
6. Detach the 2 pin-type retainers and trim cover flaps from the recliners, if equipped.

CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

7. Release the outer and inner backrest trim cover lower J-clips and partially invert the trim cover to the hook-and-loop strips.

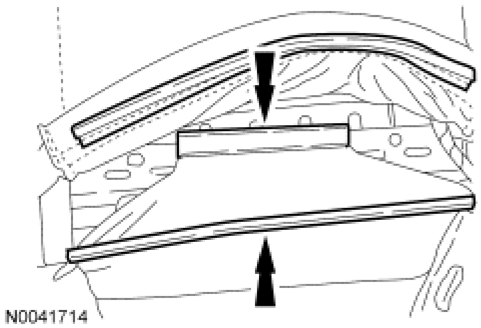


Fig. 345: Locating Outer And Inner Backrest Trim Cover Lower J-Clips
Courtesy of FORD MOTOR CO.

NOTE: The head restraint guides are not interchangeable. Note location for installation.

8. Reach up into the backrest and squeeze the head restraint guide ends together to release. Pull the 2 head restraint guides out of the backrest frame.

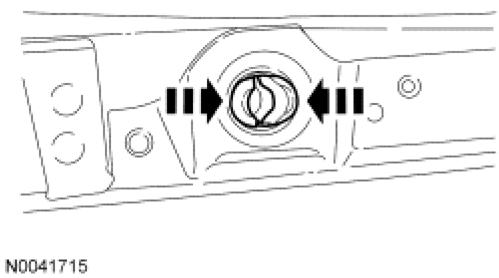


Fig. 346: Removing Head Restraint Guides From Backrest Frame
Courtesy of FORD MOTOR CO.

CAUTION: Use care when separating the seat back trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

9. Remove all rows of hog rings from the backrest trim cover, if equipped and separate the hook-and-loop strips while inverting the trim cover up the backrest.
10. Remove the rear upper hog rings and backrest trim cover.

Heated seat

11. Detach pin-type retainer and backrest heater mat wiring harness from the backrest frame.

All seats

12. Separate the backrest foam pad from the backrest frame.
    - If equipped with climate controlled seats, remove the hog rings from the upper support spring.
    - If necessary, remove the backrest heater mat (if equipped) or the backrest climate controlled seat manifold (if equipped) from the foam pad.

NOTE: Note the side air bag module wire harness routing for assembly.

13. Release the side air bag module wire harness pin-type retainers and remove the side air bag module wiring harness from the backrest frame.
14. Release the 2 lumbar spring clips from the backrest frame and remove the lumbar assembly.
    - Route out the lumbar cable from the backrest frame, if equipped.
        - Note the routing of the lumbar cable for installation.
    - Disconnect the electrical connector from the power lumbar motor, if equipped.

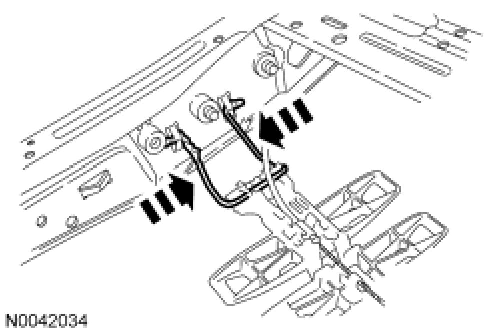


Fig. 347: Releasing Lumbar Spring Clips
Courtesy of FORD MOTOR CO.

Climate controlled seat

15. Disconnect the backrest thermo-electric device (TED) assembly electrical connector and detach the wiring harness retainers.

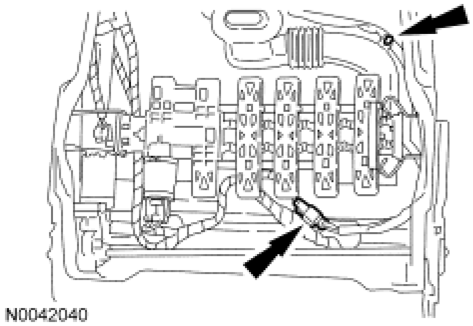


Fig. 348: Locating Backrest TED Assembly Electrical Connector And Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

16. Remove the TED exhaust duct.
    - Cut and remove the tie strap.
    - Remove the retainer and separate the exhaust duct from the TED.

NOTE: Note the TED position on the support spring for installation. If needed, use an appropriate tool and separate the TED from the upper backrest support spring.

17. Disconnect the backrest upper support spring from the backrest frame and remove the spring support with the TED attached.

Seat with power recliner

18. Remove the one-way push clip on the RH side of the power recliner. Slide the recliner shaft out from the LH side of the seat enough to clear the RH recliner and power recline motor.
19. Disconnect the electrical connector, remove the bolt and the power recline motor.

All seats

20. Remove the 2 nuts and side air bag mounting bracket.
21. Detach any pin-type retainers, route out and remove the wiring harness, if equipped.

ASSEMBLY

All seats

1. Route and install the backrest wiring harness, if removed.
2. Install the side air bag mounting bracket and 2 nuts, if removed.
    - Tighten to 6 Nm (53 lb-in).

Seat with power recliner

NOTE: The recliners are synchronized. Avoid rotating the recliner shaft until fully installed.

3. Install the recliner motor.
    1. Position the recliner shaft through the recliner motor and RH recliner.
    2. Install a new one-way push clip onto the recliner shaft at the RH recliner.
    3. Slightly turn the recliner motor to align the bolt hole with the hole in the RH recliner and install the recliner motor bolt.
        - Tighten to 6 Nm (53 lb-in).
    4. Connect the recliner motor electrical connector.

Climate controlled seat

CAUTION: Before assembly, inspect the climate controlled seat components for damage, crush, obstruction and foreign material and repair as needed.

4. Install the upper support spring and TED assembly to the backrest frame.
    - Attach the TED and bracket to the backrest upper support spring as noted in disassembly, if removed.
5. Connect the exhaust duct to the TED and install a new tie strap.
6. Connect the TED electrical connector.

All seats

7. Attach the lumbar assembly spring clips and install the lumbar assembly to the backrest frame.
    - Route the lumbar cable to the backrest as in disassembly, if equipped.
    - Connect the power lumbar motor electrical connector, if equipped.
8. Install the side air bag wiring harness.
    - Route the side air bag wiring harness to the backrest frame as noted in disassembly and install the push pin-type retainers.
9. Position the backrest foam pad to the backrest frame.
    - If removed, install a new backrest heater mat.
        - For installation, peel away the paper from the adhesive strips, align and apply the new heater mat to the backrest foam pad being sure to tuck the heater mat into the foam pad creases.
        - The heater mat must lay flat on the foam pad with no wrinkles.

Climate controlled seat

CAUTION: Before assembly, inspect the climate controlled seat components for damage, crush, obstruction and foreign material and repair as needed.

10. If removed, align the backrest manifold and insert into the valleys of the foam pad.
    - Check for correct fit between the manifold, foam pad and TED assembly, to make sure there is no air flow obstruction or cushion crush.

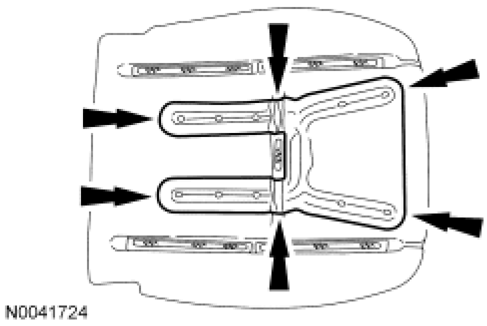


Fig. 349: Locating Backrest Manifold Position
Courtesy of FORD MOTOR CO.

11. Install new hog rings to the upper support spring and foam pad.

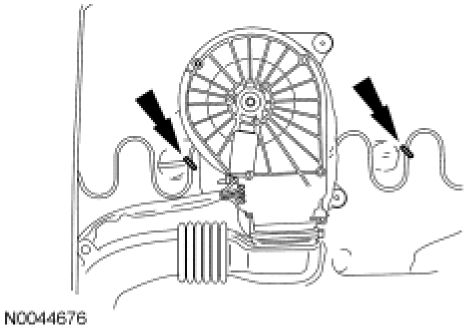


Fig. 350: Locating Hog Rings
Courtesy of FORD MOTOR CO.

All seats

NOTE: A backrest trim cover for a seat with a side air bag module is different than a backrest trim cover for a seat without a side air bag module. Make sure the correct backrest trim cover is being installed.

12. Position the backrest trim cover to the backrest frame and foam pad and install new rear upper hog rings to the backrest frame.
13. Roll the backrest trim cover downward and attach the hook-and-loop strips.
    - If removed, install new hog rings as noted during disassembly.

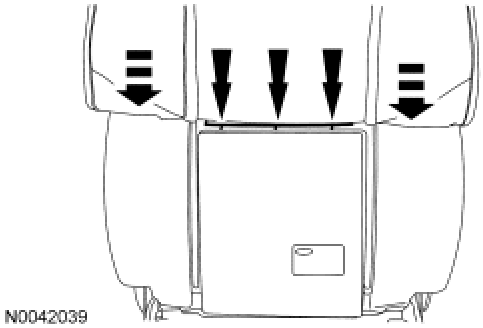


Fig. 351: Attaching Hook And Loop Strips
Courtesy of FORD MOTOR CO.

NOTE: **The head restraint guides are keyed to the backrest frame and are not interchangeable.**

14. Install the 2 head restraint guides to the backrest.
15. Connect the inner and outer backrest trim cover J-strips.
16. Install the 2 pin-type retainers and trim cover flaps to the recliners, if equipped.

WARNING: **If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

WARNING: **Inspect the seat side air bag module and mounting surfaces for any damage or foreign material before installing the seat side air bag module. If any damage is found, install new components. If any foreign material is found, remove it. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.**

17. Connect the side air bag module electrical connector and then slide and engage the side air bag electrical connector locking clip.
18. Install the side air bag module to the mounting bracket on the backrest frame.
    - Position the side air bag module locator hook in the side air bag bracket the seat back frame.
19. Align the bolt hole and install the side air bag bolt.
    - Tighten to 10 Nm (89 lb-in).
20. Install the side air bag bolt cover.
21. Install the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold Flat**.

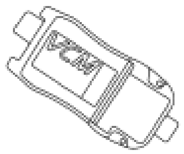
22. Install the front seat and repower the SRS. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

    Passenger seat

23. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT BACKREST - FRONT, WITH FOLD FLAT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

NOTE: Optional backrest on passenger seat only.

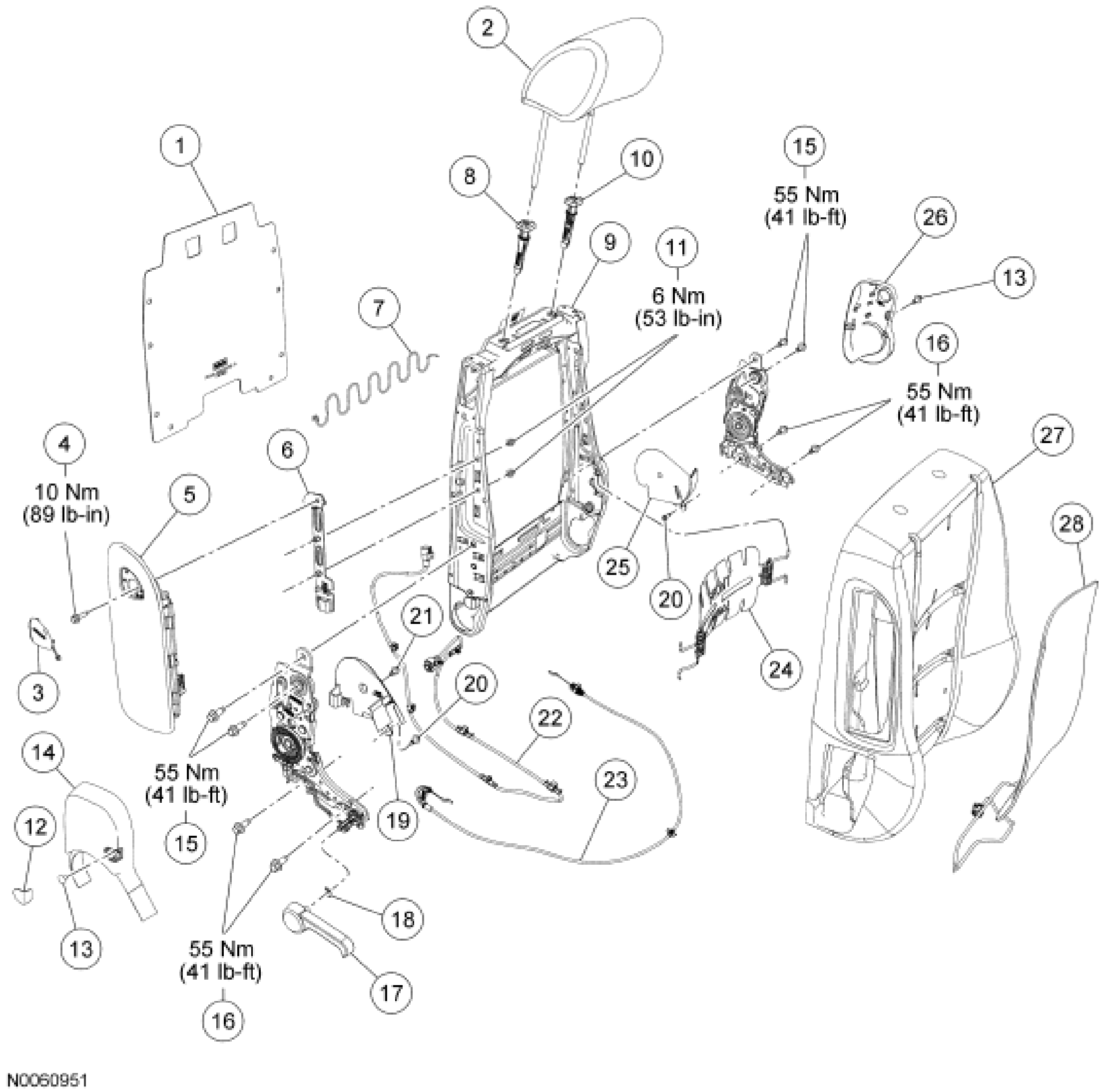


Fig. 352: Exploded View Of Front Seat Backrest With Torque Specifications - With Fold Flat
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	60770	Hard back panel
2	611A08	Head restraint
3	-	Cover, side air bag module bolt (part of 611D10)
4	N605892	Bolt, side air bag module
5	611D10	Side air bag module
6	611D78	Side air bag bracket
7	64646	Upper support spring
8	610A18	Head restraint guide
9	60136	Backrest frame
10	610A16	Head restraint guide

11	N620480	Nut, side air bag brackets (2 required)
12	-	RH recliner outboard cover retainer cover
13	W790016	Recliner outboard cover retainers (2 required)
14	63174	RH recliner outboard cover
15	W500632	Recliner-to-backrest frame bolts (4 required)
16	W500632	Recliner-to-cushion frame bolts (4 required)
17	61198	Handle, recliner (if equipped)
18	-	Spring clip, recliner handle (part of 61198) (if equipped)
19	63174	RH recliner inboard cover
20	W790016	Pin-type retainers (2 required)
21	W790016	Screw (2 required)
22	14K155	Wiring harness, side air bag
23	62648	Recliner cable
24	64842	Lumbar assembly, static
25	63175	LH recliner inboard cover
26	63175	LH recliner outboard cover
27	64810/-	Backrest foam pad/backrest trim cover
28	14D696	Backrest heater mat (if equipped)

DISASSEMBLY

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

WARNING: **Front seat backrest trim covers installed on seats equipped with seat side**

air bags cannot be repaired. A new trim cover must be installed. Cleaning is permissible. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.

NOTE: If a side air bag deployment took place, a new side air bag module and bolt must be installed. A new side air bag module bracket on the backrest frame should be inspected and installed if necessary.

NOTE: The air bag warning lamp illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat backrest. For additional information, refer to **Seat Backrest - Front, With Fold Flat**.
3. Detach the side air bag bolt cover.
4. Remove the bolt, lift up and out to separate the side air bag module from the seat backrest.
5. Slide and disengage the side air bag module electrical connector locking clip, release the tab and disconnect the side air bag module electrical connector.
6. Remove the 4 recliner-to-backrest frame bolts and remove the recliners.
7. Remove the head restraint in the following sequence.
    1. Using an appropriate tool, push in the hole while lifting up and release the head restraint from the head restraint guide.
    2. Push in on the head restraint guide release tab and remove the head restraint.

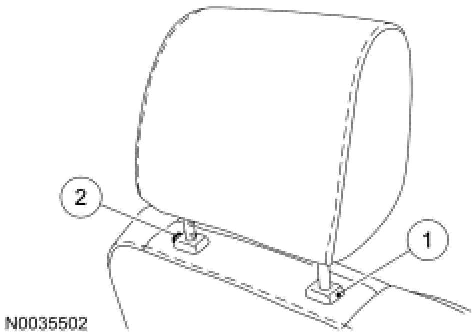


Fig. 353: Identifying Head Restraint Guide Release Tabs
Courtesy of FORD MOTOR CO.

8. Release the outer and inner backrest trim cover lower J-clips.

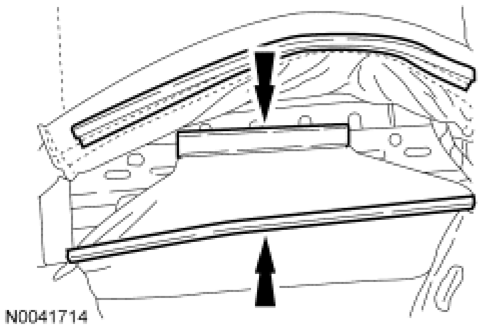


Fig. 354: Locating Outer And Inner Backrest Trim Cover Lower J-Clips
Courtesy of FORD MOTOR CO.

9. Separate the hook-and-loop strips on each side, at the bottom of the backrest trim cover.

CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

10. Place a hand between the backrest trim cover and backrest foam pad and carefully separate the hook-and-loop strips.
11. Invert the backrest trim cover to the hog rings.
12. Remove the hog rings attaching the backrest trim cover to the backrest foam pad in front and the backrest frame wire in the rear.
    - Feed the side air bag and heated seat (if equipped) wire harnesses through the side of the backrest trim cover.
13. Invert the backrest trim cover up as far as it will go.
14. Remove the pin-type retainers and the hard back panel.

NOTE: The head restraint guides are not interchangeable. Note location for installation.

15. Reach up into the backrest and squeeze the head restraint guide ends together to release. Pull the 2 head restraint guides out of the backrest frame.

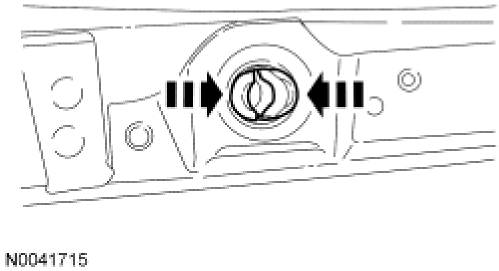


Fig. 355: Removing Head Restraint Guides From Backrest Frame

Courtesy of FORD MOTOR CO.

16. Remove the backrest trim cover.
17. Separate the backrest frame from the backrest foam pad.
18. Release the 2 static lumbar spring clips from the backrest frame and remove the static lumbar assembly.
19. Remove the 2 nuts and side air bag mounting bracket.

Seats with heat

20. If necessary, remove the backrest heater mat from the backrest foam pad.

ASSEMBLY

Seats with heat

1. If necessary, attach the backrest heater mat to the backrest foam pad.

All seats

2. Position the side air bag mounting bracket and install the 2 nuts.
   - Tighten to 6 Nm (53 lb-in).
3. Install the static lumbar assembly.
4. Position the backrest frame into the backrest foam pad.
5. Position the backrest trim cover to the backrest foam pad.

NOTE: The head restraint guides are not interchangeable.

6. Install the 2 head restraint guides through the backrest trim cover and into the backrest frame.
7. Position the hard back panel and install the pin-type retainers.
8. Roll the backrest trim cover down, attaching the hook-and-loop strips and install hog rings attaching the backrest trim cover to the backrest foam pad in front and the backrest frame wire in the rear.
   - Feed the side air bag and heated seat (if equipped) wire harnesses through the side of the backrest trim cover.
9. Attach the hook-and-loop strips at the bottom of the backrest trim cover.
10. Attach the inner and outer backrest trim cover lower J-clips.
11. Position the recliners to the backrest frame and install the 4 recliner-to-backrest frame bolts.
    - Tighten to 55 Nm (41 lb-ft).
12. Install the head restraint.

WARNING: **If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the**

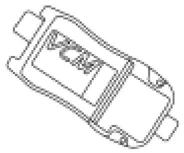
seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

WARNING: **Inspect the seat side air bag module and mounting surfaces for any damage or foreign material before installing the seat side air bag module. If any damage is found, install new components. If any foreign material is found, remove it. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increase the risk of serious personal injury or death in a crash.**

13. Connect the side air bag module electrical connector, then slide and engage the side air bag electrical connector locking clip.
14. Install the side air bag module to the mounting bracket on the backrest frame.
    - Position the side air bag module locator hook in the side air bag bracket.
15. Align the bolt hole and install the side air bag bolt.
    - Tighten to 10 Nm (89 lb-in).
16. Install the side air bag bolt cover.
17. Install the front seat backrest. For additional information, refer to **Seat Backrest - Front, With Fold Flat**.
18. Install the front seat and repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.
19. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT CUSHION - FRONT

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

NOTE: **Power seat track shown, manual seat track similar.**

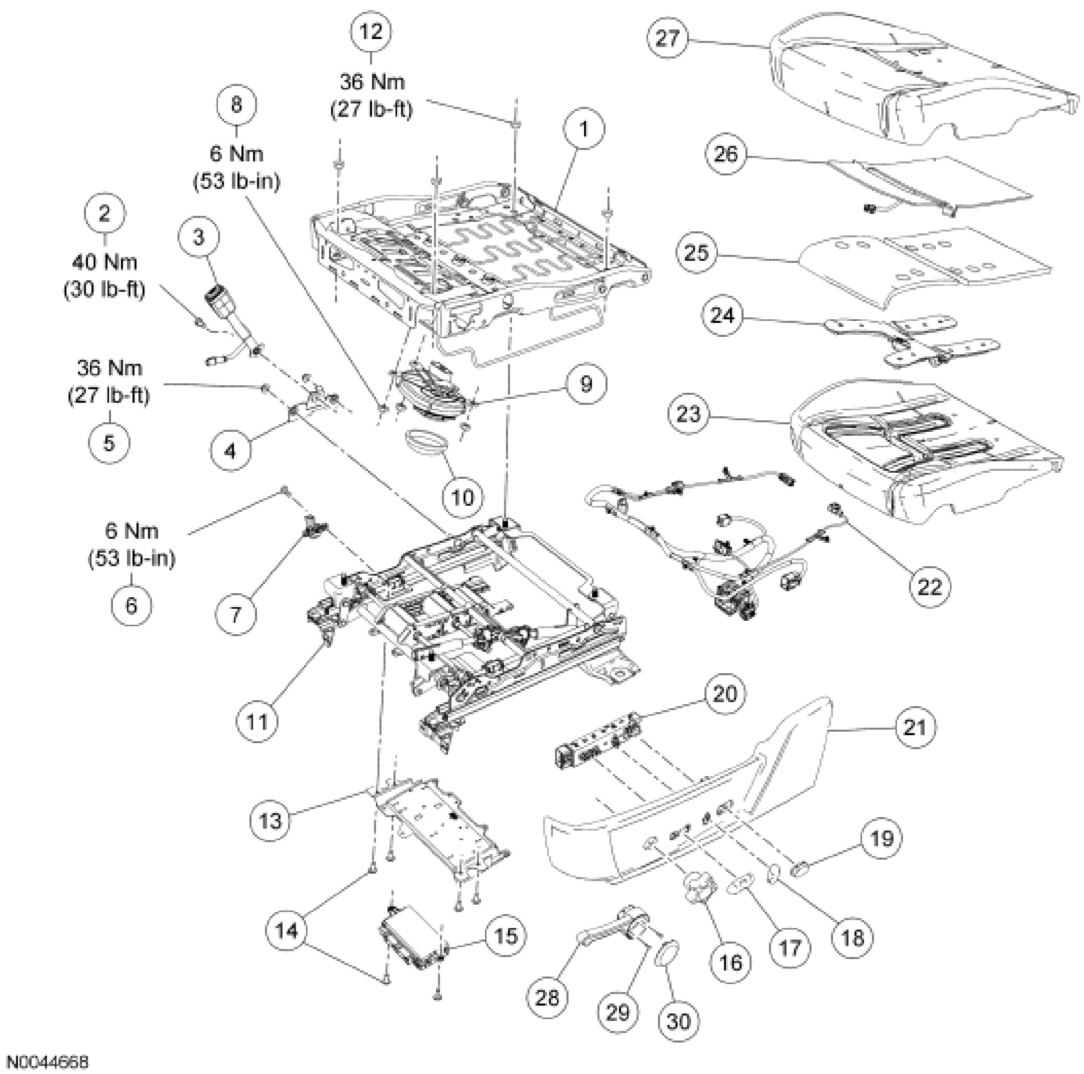


Fig. 356: Exploded View Of Driver Seat Cushion With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	63101	Cushion frame
2	-	Bolt, safety belt buckle (part of 61203)
3	61203	Safety belt buckle
4	-	Safety belt buckle bracket
5	W520113	Nut, safety belt buckle bracket-to-seat track (2 required)
6	W505256-S	Bolt, seat position sensor (part of 61203) (driver only)
7	14B416	Seat position sensor (driver only)
8	N620480	Nut, climate controlled seat device (thermo-electric device [TED]) (3 required) (if equipped)
9	19N550	Cushion TED, climate controlled seat (if equipped)

10	19E880	Cushion TED filter (if equipped)
11	61711	Seat track
12	W520113	Seat track-to-cushion frame nut (4 required)
13	610E34	Electrical bracket
14	-	Pop rivets (4 required)
15	14C708	Driver seat module (DSM) (if equipped)
16	62622	Manual lumbar control knob (if equipped)
17	14711	Seat control switch knob (if equipped)
18	14711	Power recline switch knob (if equipped)
19	14711	Power lumbar switch knob (if equipped)
20	14A701	Seat control switch (if equipped)
21	62187	Cushion side shield
22	14A699	Driver seat wire harness
23	632A23	Cushion foam pad
24	19N550	Manifold, climate controlled seat (if equipped)
25	632A23	Cushion insert (if equipped)
26	14D696	Cushion heater mat (if equipped)
27	62900	Cushion trim cover
28	61753	Manual height adjust handle (if equipped)
29	W711217	Screw, manual height adjust handle (if equipped)
30	62768	Cover, manual height adjust handle (if equipped)

NOTE: Power seat track shown, manual seat track similar.

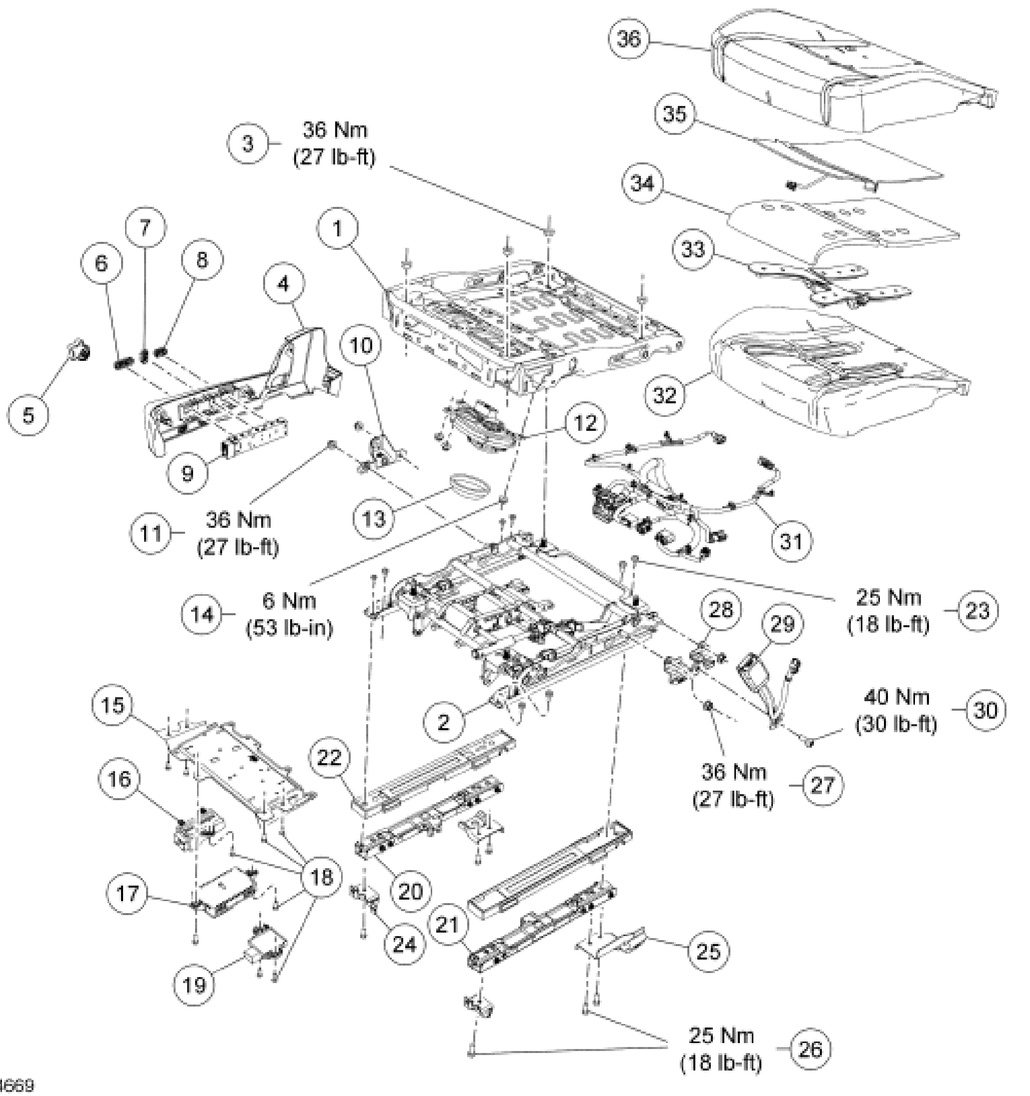


Fig. 357: Exploded View Of Passenger Seat Cushion With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	63100	Cushion frame
2	61710	Seat track
3	W520113	Seat track-to cushion frame nut (4 required)
4	62186	Cushion side shield
5	62622	Manual lumbar control knob (if equipped)
6	14711	Seat control switch knob (if equipped)
7	14711	Power recline switch knob (if equipped)
8	14711	Power lumbar switch knob (if equipped)
9	14A701	Seat control switch (if equipped)
10	-	Safety belt anchor bracket

11	W520113	Nut, safety belt anchor bracket (2 required)
12	19N550	Cushion device (thermo-electric device [TED]), climate controlled seat (if equipped)
13	19E880	Cushion TED filter (if equipped)
14	N620480	Nut, cushion TED (3 required) (if equipped)
15	610E34	Electrical bracket
16	14C724	Heated seat module (if equipped)
17	14C724	Dual climate controlled seat module (DCSM) (if equipped)
18	31134/31147	Pop rivets (quantity varies with seat option)
19	14B422	Occupant classification system module (OCSM)
20	61708	OCS rail, outboard
21	61709	OCS rail, inboard
22	62126/62127	OCS rail shield (2 required)
23	W712479	OCS rail-to-seat track bolt (8 required)
24	61912/61913	Seat riser, front (2 required)
25	61912/61913	Seat riser, rear (2 required)
26	-	Bolts, seat riser-to-seat tracks (6 required)
27	W520113	Nut, safety belt buckle bracket (2 required)
28	-	Safety belt buckle bracket
29	61202	Safety belt buckle
30	-	Bolt, safety belt buckle (part of 61202)
31	14A698	Passenger seat wire harness
32	632A22	Cushion foam pad
33	19N550	Cushion manifold, climate controlled seat (if equipped)
34	-	Cushion insert (if equipped)
35	14D698	Cushion heater mat (if equipped)
36	62900	Cushion trim cover

DISASSEMBLY AND ASSEMBLY

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

1. Remove the front seat. For additional information, refer to **Seat - Front**.
2. Remove the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold Flat** or **Seat Backrest - Front, With Fold Flat**.
3. Remove the seat track. For additional information, refer to **Seat Track**.

CAUTION: Use care when separating the seat cushion trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the cushion foam pad.

4. Release the hook-and-loop strips, remove the hog rings, if equipped and separate the cushion trim cover from the cushion foam pad.

Heated seat

5. If necessary, remove the cushion heater mat and route out the wire harness through the cushion foam pad opening.
   - For installation, peel away the paper from the adhesive strips, align and apply the new heater mat to the cushion foam pad being sure to tuck the heater mat into the foam pad creases.
     - The heater mat must lay flat on the foam pad with no wrinkles.

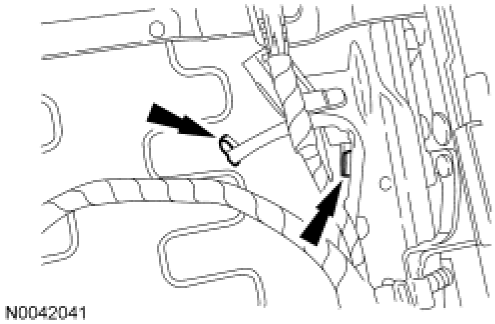


Fig. 358: Locating Wire Harness Routing
Courtesy of FORD MOTOR CO.

Climate controlled seat

CAUTION: Before assembly, inspect the climate controlled seat components for damage, crush, obstruction and foreign material and repair as needed.

6. If necessary, remove the cushion manifold from the foam pad.
   - For installation, align the cushion manifold and insert into the valleys of the foam pad.
     - Check for correct fit between the manifold, foam pad and thermo-electric device (TED) assembly, to make sure there is no airflow obstruction or cushion crush.

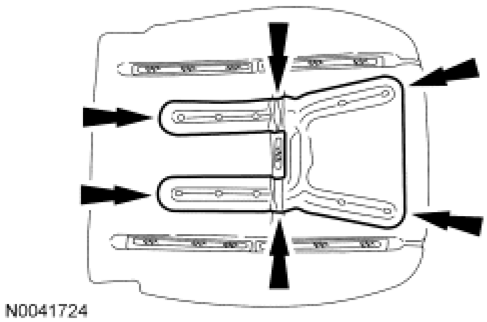


Fig. 359: Locating Backrest Manifold Position
Courtesy of FORD MOTOR CO.

NOTE:	**Covering the TED openings is recommended to prevent foreign material from entering the TED.**

7. Remove the 3 nuts and TED assembly from the cushion frame.
   - To install, tighten to 6 Nm (53 lb-in).
   - For installation, check for correct fit between the cushion manifold, foam pad and TED assembly, to make sure there is no air flow obstruction, cushion crush or foreign material.

Fold flat seats

8. Remove the recliner cable.

All seats

9. To assemble, reverse the disassembly procedure.
10. Install the seat track. For additional information, refer to **Seat Track**.
11. Install the front seat backrest. For additional information, refer to **Seat Backrest - Front, Without Fold Flat** or **Seat Backrest - Front, With Fold Flat**.
12. Install the front seat and repower the SRS. **If a passenger seat has been serviced, do not prove out the SRS at this time.** For additional information, refer to **Seat - Front**.

Passenger seat

13. Carry out the Occupant Classification Sensor (OCS) System Zero Seat Weight Test. For additional information, refer to the General Procedures portion of **SUPPLEMENTAL RESTRAINT SYSTEM** article.

SEAT BACKREST - REAR, 60 PERCENT

NOTE:	**Seat backrest with armrest shown, seat backrest without armrest similar.**

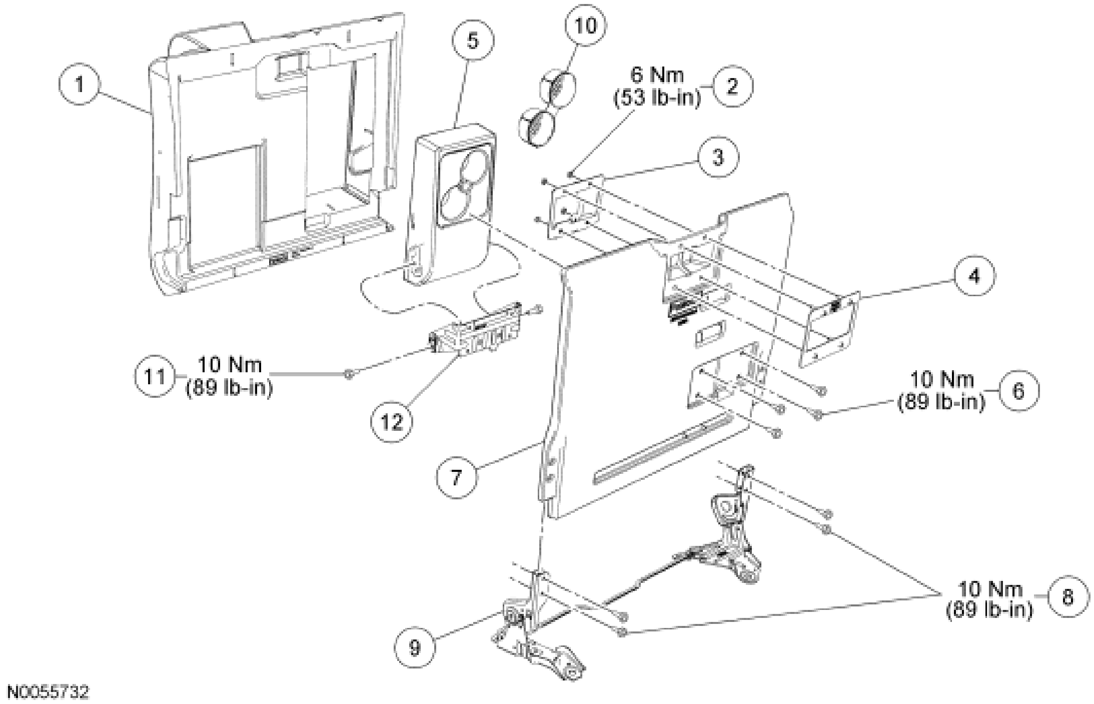


Fig. 360: Exploded View Of Rear Seat Backrest With Torque Specifications - 60 Percent
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	66801/66601	Backrest foam pad/trim cover
2	N620480	Striker-to-backrest frame nut (4 required)
3	-	Backrest latch striker (part of 613A39)
4	-	Striker support plate (part of 613A39)
5	67112	Armrest assembly (if equipped)
6	N605892	Armrest-to-backrest bolt (4 required, if equipped)
7	613A39	Backrest frame
8	N605892	Backrest-to-pivot bolts (4 required)
9	-	Backrest pivot assembly (part of 613A39)
10	67112	Rubber insert, armrest cup holder (if equipped)
11	W712494	Armrest pivot bolt (2 required) (if equipped)
12	67210	Armrest bracket (if equipped)

DISASSEMBLY AND ASSEMBLY

All seats

1. Remove the rear seat cushion. For additional information, refer to **Seat Cushion - Rear**.
2. Remove the 60 percent rear seat backrest. For additional information, refer to **Seat Backrest - Rear**.
3. Release the trim cover lower J-strip.

Seats equipped with armrest

4. Invert the trim cover enough to gain access to the armrest-to-backrest bolts.
5. Remove the 4 armrest-to-backrest bolts and support plate.
    - For installation, adjust the armrest horizontally as needed for good fit.
    - To install, tighten to 10 Nm (89 lb-in).
6. Separate the armrest assembly from the backrest and position aside.
    - For assembly, align the armrest bracket locator tab to the backrest frame.
7. Release the 4 pin-type retainers, separate the armrest trim cover panel from the backrest and remove the armrest assembly.
    - For a broken retainer, push the remaining end through and into the backrest frame and install a new pin-type retainer during assembly.

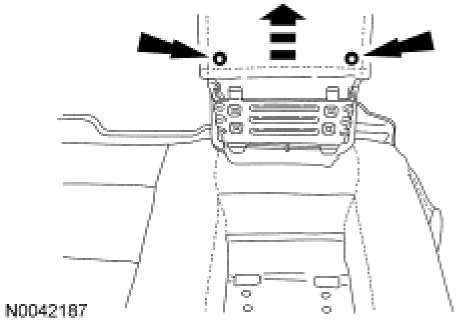


Fig. 361: Removing Armrest Assembly
Courtesy of FORD MOTOR CO.

8. Remove the pin-type retainer from the backrest trim cover armrest pocket.
9. To disassemble the armrest assembly, remove the cup holder rubber insert, 2 armrest pivot bolts and armrest bracket.
    - To install, tighten to 10 Nm (89 lb-in).

All seats

10. Release the 4 lower trim cover J-clips at both sides of the backrest and remove the staples.

CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

11. Invert the backrest trim cover separating the hook-and-loop strips and remove all rows of hog rings

working up the backrest.

12. Remove the backrest trim cover and foam pad from the backrest frame.
13. Remove the 4 backrest-to-pivot bolts.
    - To install, tighten to 10 Nm (89 lb-in).
14. Remove the 4 striker-to-backrest frame nuts, backrest latch striker and support plate.
    - To install, tighten to 6 Nm (53 lb-in).
15. To assemble, reverse the disassembly procedure.

SEAT BACKREST - REAR, 40 PERCENT

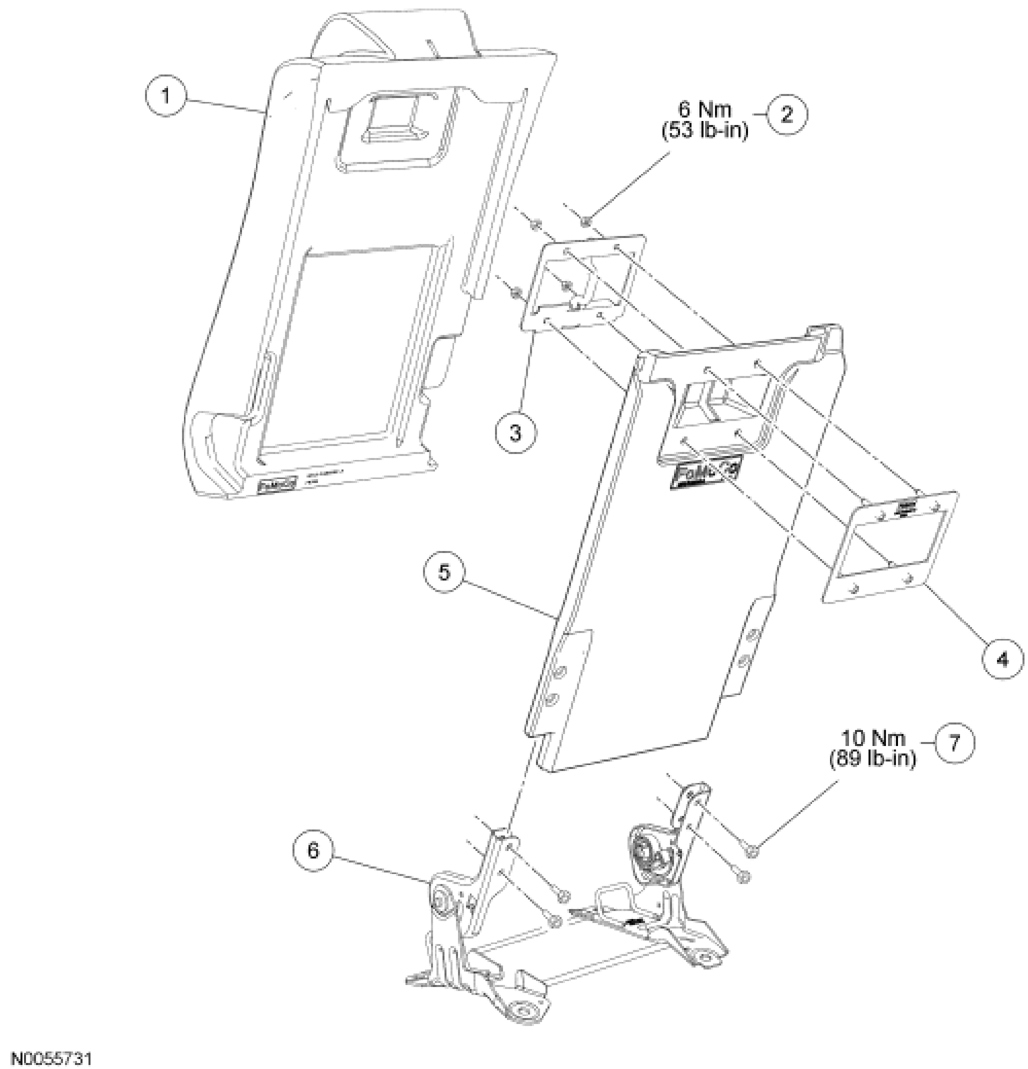


Fig. 362: Exploded View Of Rear Seat Backrest With Torque Specifications - 40 Percent
Courtesy of FORD MOTOR CO.

Item	Part Number	Description

1	66800/66600	Backrest foam pad/trim cover
2	N620480	Striker-to-backrest frame nut (4 required)
3	-	Backrest latch striker (part of 613A38)
4	-	Striker support plate (part of 613A38)
5	613A38	Backrest frame
6	-	Backrest pivot assembly (part of 613A38)
7	N605892	Backrest-to-pivot bolt (4 required)

DISASSEMBLY AND ASSEMBLY

1. Remove the rear seat cushion. For additional information, refer to **Seat Cushion - Rear**.
2. Remove the 40 percent rear seat backrest. For additional information, refer to **Seat Backrest - Rear**.
3. Release the lower J-strip, 4 J-clips and remove the staples from each side.

CAUTION: Use care when separating the backrest trim cover from the hook-and-loop strip, or the hook-and-loop strip can be torn from the backrest foam pad.

4. Partially invert the trim cover separating the hook-and-loop strips and remove the first row of hog rings.
5. Continue to invert the backrest trim cover separating the hook-and-loop strips and removing all rows of hog rings working up the backrest.
6. Remove the backrest trim cover.
7. Remove the foam pad from the backrest frame.
8. Remove the 4 backrest-to-pivot bolts.
   - To install, tighten to 10 Nm (89 lb-in).
9. Remove the 4 striker to backrest frame nuts and backrest latch striker and support plate.
   - To install, tighten to 6 Nm (53 lb-in).
10. To assemble, reverse the disassembly procedure.

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Speed Control - Fusion, Milan & MKZ

DESCRIPTION AND OPERATION

SPEED CONTROL

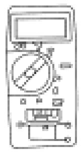
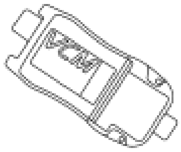
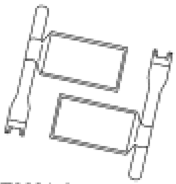
The speed control system consists of the following components:

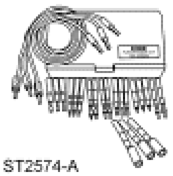
- Speed control switches
- Speed control deactivator switch (part of the stoplamp switch)
- Stoplamp switch
- Clutch pedal speed control deactivator switch (manual transaxle)
- Speed control indicator
- PCM

DIAGNOSTIC TESTS

SPEED CONTROL

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST2621-A	Restraint System Diagnostic Tool (2 required)	418-F395
	Flex Probe Kit	105-R025C or equivalent

 ST2574-A		

Principles of Operation

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The speed control system is controlled by the PCM. The speed control system is designed to maintain a selected vehicle speed above 48 km/h (30 mph) to the maximum limited vehicle speed. The speed control system is controlled by the steering wheel mounted switches (ON, OFF, SET+, SET- and RESUME), the stoplamp switch, the clutch pedal speed control deactivator switch (manual transaxle), and the speed control deactivator switch (part of the stoplamp switch). The steering wheel mounted switches are hardwired to the PCM through the clockspring.

The speed control functions include:

- Turning the speed control system on
- Setting and maintaining the desired vehicle speed
- Accelerating the vehicle speed
- Decelerating the vehicle speed
- Turning the vehicle speed control system off
- Canceling the speed control

Pressing and releasing the ON switch turns the speed control system on. Pressing and releasing the SET+ or SET- switch while the vehicle is traveling at the desired speed activates the speed control system.

Tapping the SET+ or the SET- switch while in the set mode respectively, increases or decreases the maintained vehicle speed by 1.6 km/h (1 mph) per tap. If the respective button is pressed and held, the vehicle speed continues to accelerate or decelerate until the button is released.

Pressing and releasing the OFF switch, or switching the ignition switch to the OFF position, turns the speed control system off. Applying the brake pedal puts the speed control system into the STANDBY mode. Pressing the RESUME button, when the speed control system is in the STANDBY mode causes the vehicle to accelerate to the last set speed. Resume does not function if the OFF button is pressed, the ignition switch is in the OFF position, or if the current vehicle speed is below the minimum operational speed.

The clockspring provides the electrical interface between the steering column wiring and the speed control switches in the steering wheel.

The clutch pedal speed control deactivator switch is incorporated on vehicles equipped with a manual transaxle. When the clutch pedal is applied with the vehicle speed control system engaged, the normally closed switch

opens and signals the PCM to deactivate the speed control.

The speed control deactivator switch (part of the stoplamp switch) is provided as an additional safety feature. When the brake pedal is applied, the speed control deactivator switch opens and removes the voltage signal from the PCM input circuit, deactivating the speed control system.

Whenever the speed control system is engaged and active, a speed control icon on the instrument cluster (IC) is illuminated.

The inputs to the PCM are:

- Output shaft speed (OSS) sensor
- Digital transmission range (TR) sensor (automatic transaxle)
- Speed control switch
- Clutch pedal speed control deactivator switch (manual transaxle)
- Speed control deactivator switch (part of the stoplamp switch)
- Accelerator pedal position sensor
- Smart junction box (SJB)
- Parking brake

The outputs of the PCM are:

- Speed control indicator lamp
- Throttle command

The speed control system throttle position is completely controlled by the PCM through the electronically controlled throttle body. Speed control electronics are contained entirely within the PCM.

When the speed control system is active, the PCM corrects for deviations in the actual vehicle speed by proportionally moving the throttle plate. The PCM modulates the throttle to minimize error between the actual vehicle speed and the desired speed.

The PCM strategy uses the throttle control for smooth accelerations.

The PCM sends a message over the controller area network (CAN) to the IC whenever the speed control telltale should be turned on or off.

In the event of an off command or a deactivation request from any source, the speed control system carries out a deactivation and immediately returns the throttle to the idle position.

The speed control system provides self-diagnostics. Speed control is disabled anytime an error is detected in the system. No cluster telltale or message center messages are displayed when faults occur. Fault codes are logged by the PCM.

An electronically controlled throttle system fault also causes the speed control system to be disabled and the

malfunction indicator lamp (MIL) illuminates, or a message center message is displayed.

Additionally, the following conditions cause the speed control system to deactivate:

- Transmission gear selector in a position other than D or OD (automatic transaxle)
- Vehicle clutch pedal is applied (manual transaxle)
- Speed control set speed is over-ridden with the accelerator pedal for a period longer than 5 minutes
- Vehicle speed loss from set speed of greater than 16 km/h (10 mph) occurs
- Vehicle speed falls below the minimum allowable limit of 48 km/h (30 mph)
- Parking brake is applied
- Speed control switch is pressed or stuck for longer than 2 minutes

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Throttle body	• Battery junction box (BJB) fuse 49 (15A) • Wiring, terminals or connectors • Speed control switch • Clutch pedal speed control deactivator switch (manual transaxle) • Digital transmission range (TR) sensor (automatic transaxle) • Speed control deactivator switch (part of the stoplamp switch) • Stoplamp switch • PCM

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. Verify the speedometer operates correctly without speed control by test driving the vehicle. If the speedometer does not operate correctly, refer to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
5. Verify the stoplamp operate correctly with the ignition switch in the ON position. If the stoplamp do not

operate correctly, refer to **EXTERIOR LIGHTING** article.

6. Verify the parking brake warning indicator is operating correctly. If the parking brake warning indicator does not operate correctly, refer to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

NOTE: Make sure to use the latest scan tool software release.

7. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

8. If the scan tool does not communicate with the VCM:
   - Check the VCM connection to the vehicle.
   - Check the scan tool connection to the VCM.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
9. If the scan tool does not communicate with the vehicle:
   - Verify the ignition key is in the ON position.
   - Verify the scan tool operation with a known good vehicle.
   - Refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
10. Carry out the network test.
    - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
    - If the network test passes, retrieve and record the continuous memory DTCs.
11. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.
12. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
13. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Charts

PCM DTC CHART

DTCs	Description	Action
P0579	Cruise Control Multifunction Input A Circuit Range/Performance	Go to **Pinpoint Test C**.
P0581	Cruise Control Multifunction Circuit High	Go to **Pinpoint Test C**.
P0833	Clutch Pedal Switch B Circuit	Go to **Pinpoint Test D**.
P1572	Brake Pedal Switch Circuit	Go to **Pinpoint Test B**.
P1703	Brake Switch Out of Self-Test Range	Go to **Pinpoint Test B**.
		REFER to the **Introduction -**

All other DTCs	-	**Gasoline Engines** article to continue diagnosis.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The speed control is inoperative	• PCM not configured for speed control • Stoplamp switch • Clutch pedal position (CPP) switch (manual transaxle) • Speed control switch • Digital transmission range (TR) sensor (automatic transaxle) • Vehicle speed signal • PCM	• Go to **Pinpoint Test A**.
• The speed control does not disengage when the clutch is applied	• Wiring, terminals or connectors • Clutch pedal speed control deactivator switch • PCM	• Go to **Pinpoint Test D**.
• The speed control indicator lamp is always on	• Wiring, terminals or connectors • Instrument cluster (IC) • PCM	• REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

Pinpoint Tests

Pinpoint Test A: The Speed Control Is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Speed Control for schematic and connector information.

Normal Operation

The PCM sends a signal through circuit VES10 (WH) to the speed control switches, which passes through the clockspring. The return signal is sent to the PCM through circuit RES08 (GN/BN) and the clockspring. When the brake pedal is applied, the smart junction box (SJB) sends a message to the PCM to deactivate the speed control if engaged.

The speed control deactivator switch (part of the stoplamp switch) interrupts circuit CES09 (VT/OG) removing the voltage signal to the PCM when the brake pedal is applied. This is a redundant signal to the PCM.

This pinpoint test is intended to diagnose the following:

- PCM not configured for speed control
- Stoplamp switch
- Clutch pedal position (CPP) switch
- Speed control switch
- Digital transmission range (TR) sensor
- Vehicle speed signal
- PCM

PINPOINT TEST A: THE SPEED CONTROL IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

A1 VERIFY PCM CONFIGURATION

- Enter the following diagnostic mode on the diagnostic tool: Programmable Parameters
- Verify that the speed control is enabled in the PCM.
- **Is the speed control enabled?**

  YES : Go to A2.

  NO : Enable the speed control in the PCM using the scan tool programmable parameters menu. If no parameter exists, REFER to **MODULE CONFIGURATION** article to carry out PCM programmable module installation (PMI). TEST the system for normal operation.

A2 CHECK FOR DTCs

- Review the recorded DTCs from the PCM self-test.
- **Are any non-speed control DTCs recorded?**

  YES : REFER to the **Introduction - Gasoline Engines** article. REPAIR all PCM DTCs and RETEST the speed control.

  NO : Go to A3.

A3 CHECK THE SPEED CONTROL COMMAND SWITCH (SCCS) PID

- Start the engine.
- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger
- With the engine running, monitor the PCM SCCS PID while pressing the speed control switches as follows:

Speed Control Switch	PID Minimum Value	PID Maximum Value

OFF	0.00 volts	1.089 volts
SET -	2.192 volts	3.057 volts
SET +	3.057 volts	3.721 volts
RESUME	3.721 volts	4.209 volts
ON	4.209 volts	4.556 volts
No switch pressed	4.556 volts	4.839 volts

- **Are the PCM SCCS PID values OK?**

  YES : TURN the engine off. Go to A5.

  NO : TURN the engine off. Go to A4.

A4 CHECK THE SPEED CONTROL SWITCH

- Key in OFF position.
- Disconnect: PCM C175b

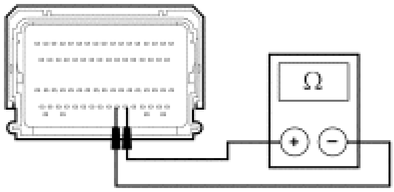


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Fig. 1: Checking Speed Control Switch
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and the PCM C175b-57, circuit RES08 (GN/BN), harness side while pressing the speed control switches as follows:

Speed Control Switch	Resistance Value
OFF	Less than 5 ohms
SET -	298 - 304 ohms
	596 - 608

SET +	ohms
RESUME	1,101 - 1,123 ohms
ON	2,091 - 2,133 ohms
No switch pressed	4,279 - 4,363 ohms

- **Are the speed control switch resistance values OK?**

  YES : Go to A9 .

  NO : INSTALL a new speed control switch. REFER to **Speed Control Switch**. TEST the system for normal operation.

A5 CHECK THE STOPLAMP SWITCH (BOO) PID

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger
- Monitor the PCM BOO PID.
- Apply and release the brake pedal.
- **Does the PID value agree with the brake pedal position?**

  YES : If equipped with an automatic transmission, go to A7.

  If equipped with a manual transmission, go to A6.

  NO : Go to **Pinpoint Test B**.

A6 CHECK THE CPP SWITCH (CPP_TT) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger
- Monitor the PCM CPP_TT PID while pressing and releasing the clutch pedal.
- **Does the PID value agree with the clutch pedal position?**

  YES : Go to A8.

  NO : Go to **Pinpoint Test D**.

A7 CHECK THE DIGITAL TR SENSOR (TR) PID

- Connect: PCM C175b
- Apply the parking brake.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger
- Monitor the PCM TR PID.
- Select DRIVE.
- **Does the PID value agree with the transmission range selector lever position?**

YES : Go to A8.

NO : REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article to diagnose the digital TR sensor.

A8 CHECK THE VEHICLE SPEED

NOTE: This step may require an assistant.

- Enter the following diagnostic mode on the diagnostic tool: ABS DataLogger
- Monitor and record the ABS LF_WSPD (left front wheel speed) PID while driving the vehicle at 48 km/h (30 mph) as indicated on the speedometer.
- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger
- Monitor and record the PCM VSS (vehicle speed signal) PID while driving the vehicle at 48 km/h (30 mph).
- **Does the speed indicated by the ABS LF_WSPD PID match the PCM VSS PID?**

  YES : Go to A9.

  NO : REFER to the **Introduction - Gasoline Engines** article to diagnose the output shaft speed (OSS) sensor signal.

A9 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article or **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test B: DTC P1572 or P1703 - Brake On/Off Circuit Failure

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Speed Control for schematic and connector information.

Normal Operation

When the brake pedal is applied, the smart junction box (SJB) sends a message to the PCM to deactivate the speed control if engaged.

The speed control deactivator switch (part of the stoplamp switch) interrupts circuit CES09 (VT/OG) removing the voltage signal to the PCM when the brake pedal is applied. This is a redundant signal to the PCM.

DTC P1572 sets when the PCM does not sense the proper sequence of the brake pedal input signal from both the speed control deactivator and stoplamp switches when the brake pedal is pressed and released.

DTC P1703 sets when there is an open or short in the deactivator switch circuits or when there is an open or short in the stoplamp circuits.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Speed control deactivator switch (integral to the stoplamp switch)
- ABS module
- PCM

PINPOINT TEST B: DTC P1572 OR DTC P1703 - BRAKE ON/OFF CIRCUIT FAILURE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

B1 CHECK THE OPERATION OF THE STOPLAMP

- Key in ON position.
- Operate the stoplamp.
- **Do the stoplamp operate correctly?**

  YES : Go to B2.

  NO : REFER to **EXTERIOR LIGHTING** article to continue diagnosis of the stoplamp.

B2 CHECK CIRCUIT CCB08 (VT/WH) FOR VOLTAGE

- Key in OFF position.
- Disconnect: PCM C175b
- Key in ON position.

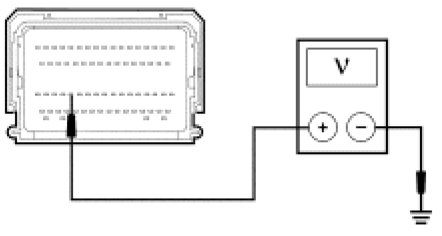

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Fig. 2: Checking Circuit CCB08 (VT/WH) For Voltage

Courtesy of FORD MOTOR CO.

- While applying the brake pedal, measure the voltage between the PCM C175b-46, circuit CCB08 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts with the brake pedal applied?**

  YES : Go to B3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B3 CHECK THE SPEED CONTROL DEACTIVATOR SWITCH FOR CORRECT OPERATION

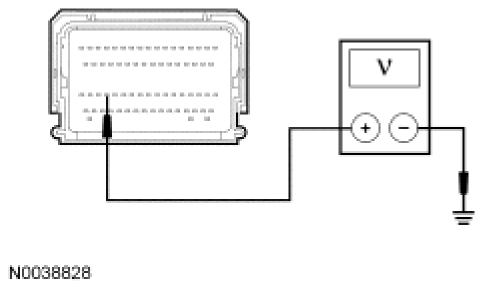


Fig. 3: Checking Speed Control Deactivator Switch For Correct Operation
Courtesy of FORD MOTOR CO.

- While firmly applying and releasing the brake pedal, measure the voltage between the PCM C175b-47, circuit CES09 (VT/OG), harness side and ground.
- **Is the voltage greater than 10 volts with the brake pedal released and 0 volts with the brake pedal firmly applied?**

  YES : Go to B9.

  NO : Go to B4.

B4 CHECK CIRCUIT CBP49 (VT/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: Stoplamp Switch C278
- Key in ON position.

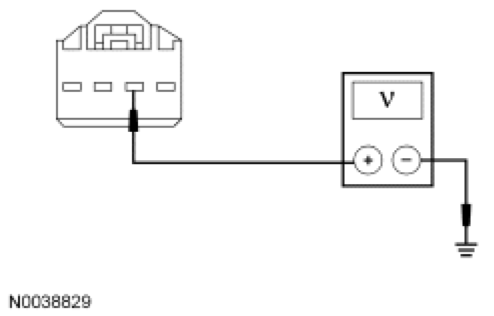


Fig. 4: Checking Circuit CBP49 (VT/GY) For An Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between the stoplamp switch C278-2, circuit CBP49 (VT/GY), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to B5.

  NO : VERIFY the battery junction box (BJB) fuse 49 (15A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

B5 CHECK CIRCUIT CES09 (VT/OG) FOR A SHORT TO VOLTAGE

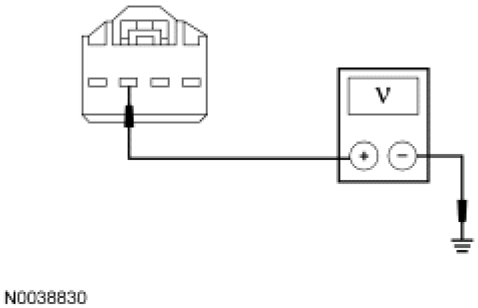


Fig. 5: Checking Circuit CES09 (VT/OG) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the stoplamp switch C278-3, circuit CES09 (VT/OG), harness side and ground.
- **Is any voltage present?**

  YES : Go to B6.

  NO : Go to B7.

B6 CHECK THE ABS MODULE FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: ABS Module C135
- Key in ON position.

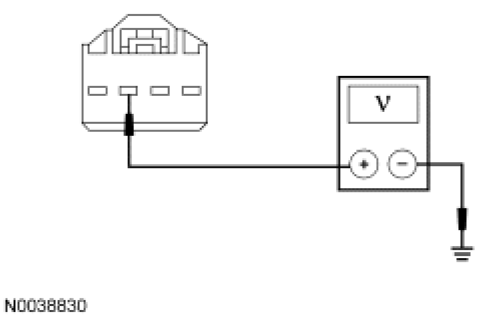


Fig. 6: Checking ABS Module For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the stoplamp switch C278-3, circuit CES09 (VT/OG), harness side

and ground.

- **Is any voltage present?**

  YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to B8.

B7 CHECK CIRCUIT CES09 (VT/OG) FOR AN OPEN

- Key in OFF position.

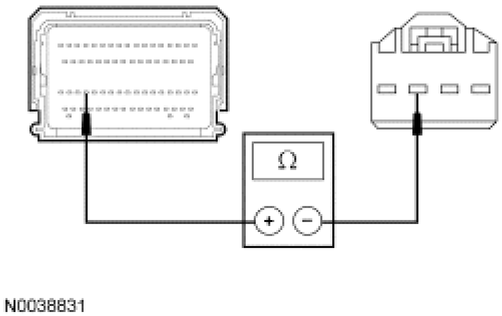


Fig. 7: Checking Circuit CES09 (VT/OG) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the stoplamp switch C278-3, circuit CES09 (VT/OG), harness side and the PCM C175b-47, circuit CES09 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new stoplamp switch. REFER to **EXTERIOR LIGHTING** article. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to B9.

B8 CHECK FOR CORRECT ABS MODULE OPERATION

- Disconnect all the ABS module connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the ABS module connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ABS module. REFER to **VEHICLE DYNAMIC SYSTEMS** article. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

B9 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:

    - corrosion
    - damaged pins
    - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article or **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Pinpoint Test C: DTC P0579 or P0581 - Speed Control Switch Circuit Failure

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Speed Control for schematic and connector information.

Normal Operation

The PCM sends a signal through circuit VES10 (WH) to the speed control switches, which passes through the clockspring. The return signal is sent to the PCM through circuit RES08 (GN/BN) and the clockspring.

DTC P0579 may set when a speed control switch is stuck or the switch circuits are open, shorted to voltage or shorted to ground.

DTC P0581 sets when the speed control switch circuits are shorted to voltage or open.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Clockspring
- Speed control switch
- PCM

PINPOINT TEST C: DTC P0579 OR DTC P0581 - SPEED CONTROL SWITCH CIRCUIT FAILURE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

C1 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: PCM C175b
- Key in ON position.

- Turn the parking lamps on.

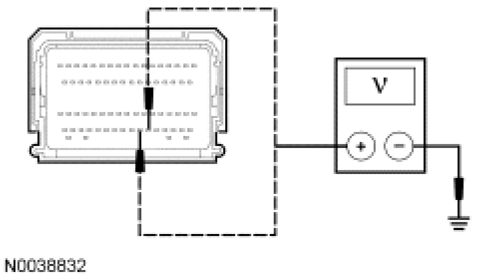


Fig. 8: Checking Speed Control Switch Circuitry For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.
- **Is any voltage present?**

  YES : TURN the parking lamps off. Go to C2 .

  NO : TURN the parking lamps off. Go to C4 .

C2 CHECK CIRCUITS VES10 (WH) AND RES08 (GN/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: Clockspring C218a
- Key in ON position.
- Turn the parking lamps on.

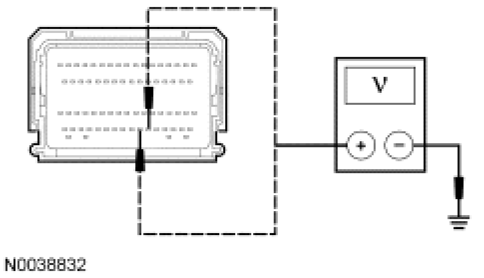


Fig. 9: Checking Circuits VES10 (WH) & RES08 (GN/BN) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

  NO : TURN the parking lamps off. Go to C3 .

C3 CHECK THE CLOCKSPRING FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Connect: Clockspring C218a

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

- Remove the driver air bag module. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Upper Clockspring C218b
- Connect the restraint system diagnostic tools (418-F395) to the upper clockspring air bag connector.
- Connect the battery.
- Key in ON position.
- Turn the parking lamps on.

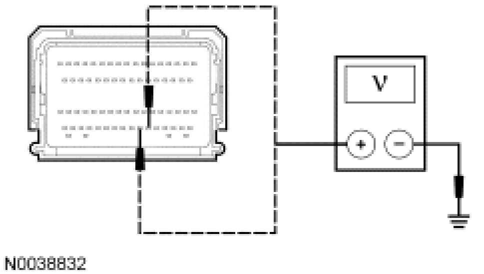


Fig. 10: Checking Clockspring For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.
- **Is any voltage present?**

  YES : INSTALL a new clockspring. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. DISCONNECT the battery. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL a new speed control switch. REFER to **Speed Control Switch**. DISCONNECT the battery. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

C4 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR A SHORT TO GROUND

- Key in OFF position.

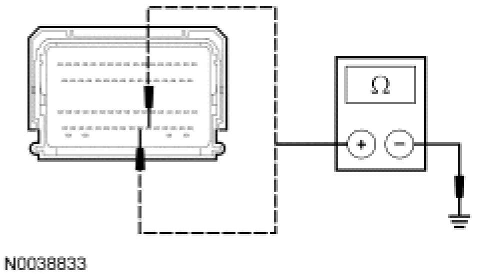


Fig. 11: Checking Speed Control Switch Circuitry For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to C7.

  NO : Go to C5.

C5 CHECK THE CLOCKSPRING FOR A SHORT TO GROUND

- Remove the driver air bag module. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
- Disconnect: Upper Clockspring C218b

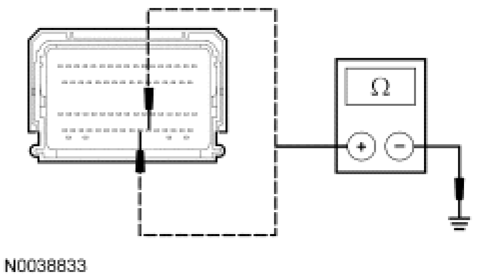


Fig. 12: Checking Clockspring For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new speed control switch. REFER to **Speed Control Switch**. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to C6.

C6 CHECK CIRCUITS VES10 (WH) AND RES08 (GN/BN) FOR A SHORT TO GROUND

- Disconnect: Clockspring C218a

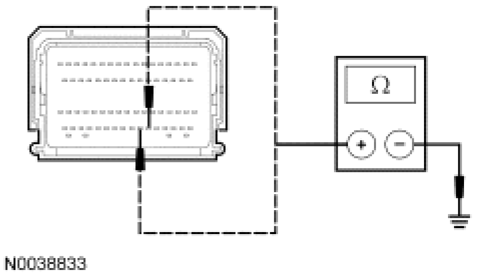


Fig. 13: Checking Circuits VES10 (WH) & RES08 (GN/BN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and ground; and between the PCM C175b-57, circuit RES08 (GN/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : INSTALL a new clockspring. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

  NO : REPAIR the circuit in question. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

C7 CHECK THE SPEED CONTROL SWITCH CIRCUITRY FOR AN OPEN

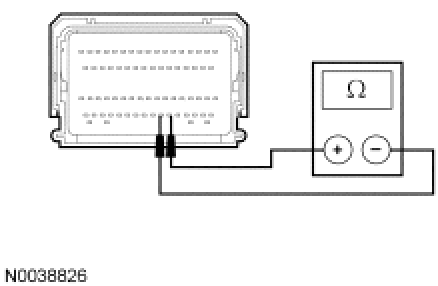


Fig. 14: Checking Speed Control Switch Circuitry For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and the PCM C175b-57, circuit RES08 (GN/BN), harness side.
- **Is the resistance between 4,279 and 4,363 ohms?**

  YES : Go to C10.

  NO : Go to C8.

C8 CHECK CIRCUITS VES10 (GN/BK) AND RES08 (GN/BN) FOR AN OPEN

- Disconnect: Clockspring C218a

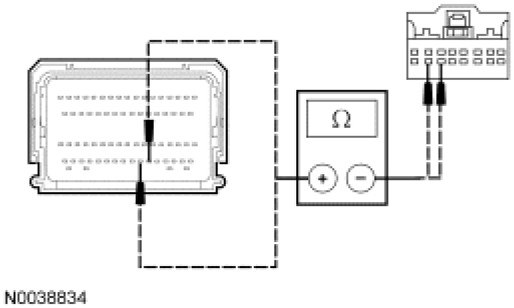


Fig. 15: Checking Circuits VES10 (GN/BK) & RES08 (GN/BN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the PCM C175b-56, circuit VES10 (WH), harness side and the clockspring C218a-15, circuit VES10 (WH), harness side; and between the PCM C175b-57, RES08 (GN/BN), harness side and the clockspring C218a-14, circuit RES08 (GN/BN), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to C9.

  NO : REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C9 CHECK THE CLOCKSPRING

- Remove the driver air bag module. Refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

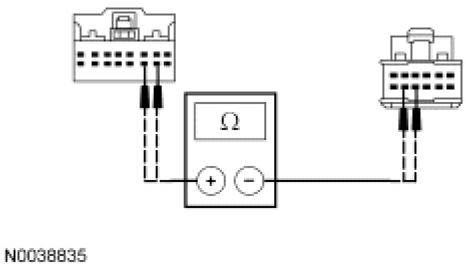


Fig. 16: Checking Clockspring
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clockspring C218a pin 15, component side and the upper clockspring C218b pin 8, component side; and between the clockspring C218a pin 14, component side and the upper clockspring C218b pin 9, component side.
- **Are the resistances less than 5 ohms?**

  YES : INSTALL a new speed control switch. REFER to **Speed Control Switch**. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

  NO : INSTALL a new clockspring. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

C10 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article or **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. INSTALL the driver air bag module. REFER to **SUPPLEMENTAL RESTRAINT SYSTEM** article. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: DTC P0833 - Clutch Pedal Switch B Circuit

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Speed Control for schematic and connector information.

Normal Operation

Vehicles equipped with a manual transaxle have an additional clutch pedal speed control deactivator switch. The PCM sends a signal through circuit CE904 (GN/VT) to the clutch pedal speed control deactivator switch. The return signal is sent to the PCM through circuit RE407 (YE/VT).

DTC P0833 sets when there is an open in the clutch pedal speed control deactivator switch circuits.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Clutch pedal speed control deactivator switch
- PCM

PINPOINT TEST D: DTC P0833 - CLUTCH PEDAL SWITCH B CIRCUIT

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

D1 CHECK THE CPP SWITCH (CPP_TT) PID

- Key in ON position.

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger
- Monitor the PCM CPP_TT PID while pressing and releasing the clutch pedal.
- **Does the PID value agree with the clutch pedal position?**

  YES : Go to D4.

  NO : Go to D2.

D2 CHECK THE CLUTCH PEDAL SPEED CONTROL DEACTIVATOR SWITCH

- Key in OFF position.
- Disconnect: Clutch Pedal Speed Control Deactivator Switch C2354

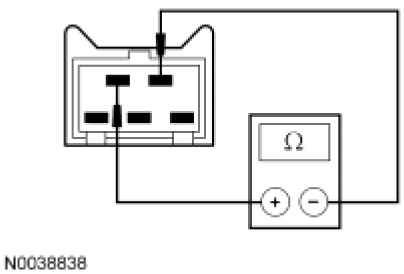


Fig. 17: Checking Clutch Pedal Speed Control Deactivator Switch
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clutch pedal speed control deactivator switch C2354 pin 4, component side and the clutch pedal speed control deactivator switch C2354 pin 5, component side.
- **Is the resistance less than 5 ohms with the clutch pedal released?**

  YES : Go to D3.

  NO : INSTALL a new clutch pedal speed control deactivator switch. CLEAR the DTCs. REPEAT the self-test.

D3 CHECK CIRCUIT CE904 (GN/VT) FOR AN OPEN

- Disconnect: PCM C175b

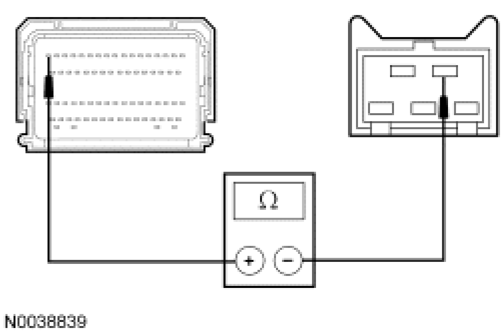


Fig. 18: Checking Circuit CE904 (GN/VT) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clutch pedal speed control deactivator switch C2354-4, circuit CE904 (GN/VT), harness side and the PCM C175b-17, circuit CE904 (GN/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to D4.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

D4 CHECK CIRCUIT RE407 (YE/VT) FOR AN OPEN

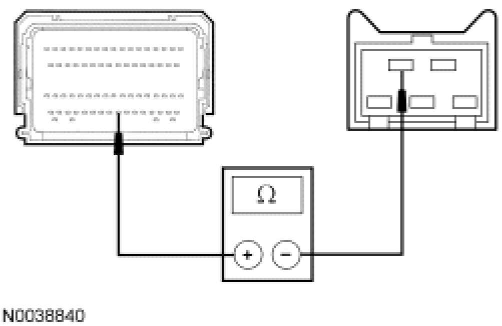


Fig. 19: Checking Circuit RE407 (YE/VT) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the clutch pedal speed control deactivator switch C2354-5, circuit RE407 (YE/VT), harness side and the PCM C175b-58, circuit RE407 (YE/VT), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to D5.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

D5 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Check for:
  - corrosion
  - damaged pins
  - pushed-out pins
- Connect all the PCM connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article or **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

REMOVAL AND INSTALLATION

SPEED CONTROL SWITCH

NOTE: **Fusion shown, Milan similar.**

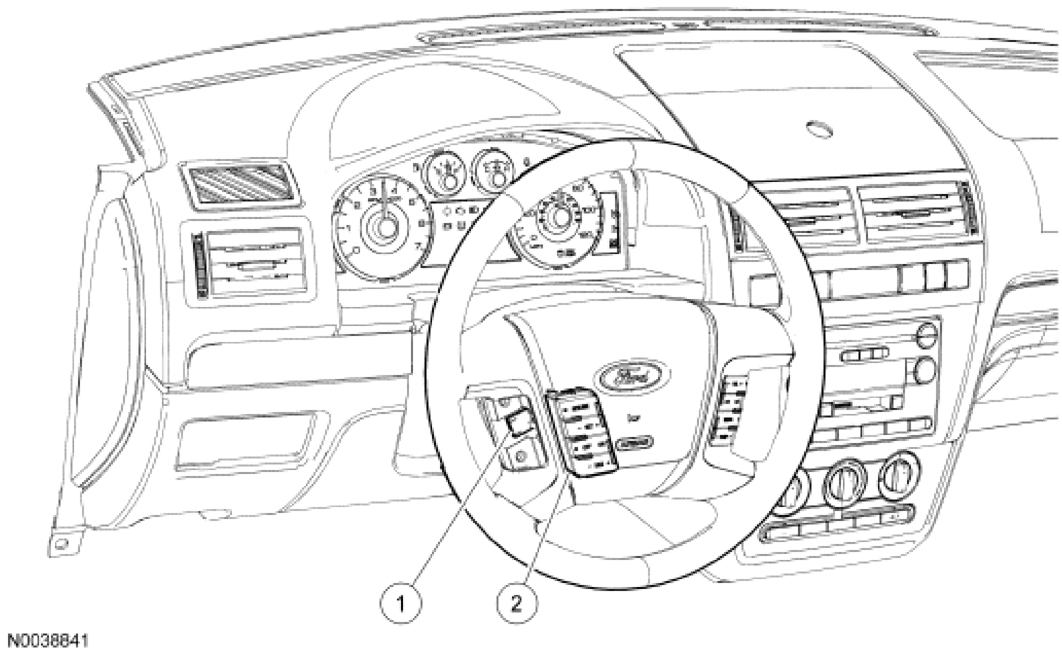


Fig. 20: Exploded View Of Speed Control Switch - Fusion, Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Speed control switch electrical connector (part of 14A411)
2	9C888	Speed control switch

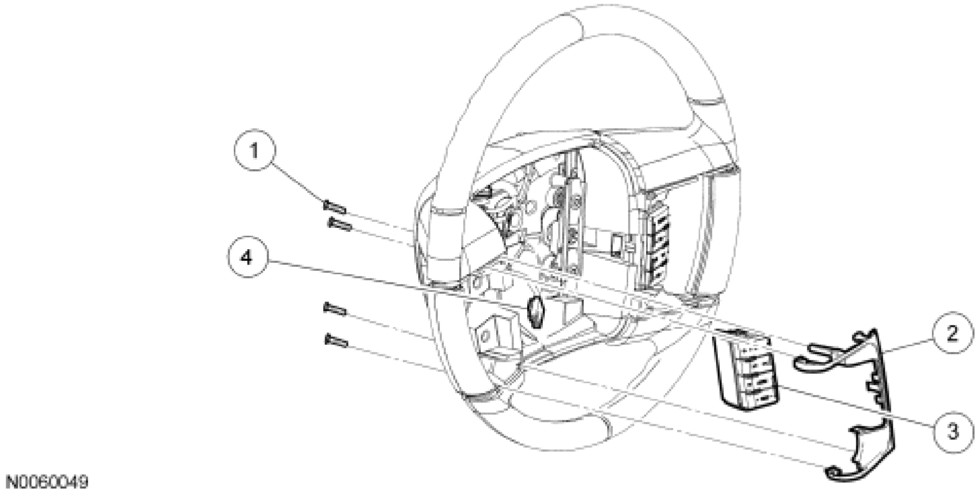


Fig. 21: Exploded View Of Speed Control Switch - MKZ
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Steering wheel controls bezel screws (4 required)
2	-	Steering wheel controls bezel
3	9C888	Speed control switch
4	-	Speed control switch electrical connector (part of 14A441)

REMOVAL AND INSTALLATION

MKZ

1. Remove the driver air bag module. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
2. Remove the 4 screws and the steering wheel control bezel.

   All vehicles

3. Remove the speed control switch by pulling the switch toward the rear of the vehicle.
   - Disconnect the electrical connector.
4. Remove the steering wheel controls bezel, if equipped.
5. To install, reverse the removal procedure.

2008 ENGINE

Starting System - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Starter motor bolt and stud bolt (2.3L)	25	18	-
Starter motor bolts (3.0L and 3.5L)	27	20	-
Starter motor solenoid battery cable nut	12	9	-
Starter motor solenoid wire nut	5	-	44

DESCRIPTION AND OPERATION

STARTING SYSTEM

The starting system consists of the following components:

- Starter motor
- Starter motor relay - part of smart junction box (SJB)
- Transmission range (TR) sensor - automatic transmission
- Clutch cutoff switch - manual transmission
- Battery
- Ignition switch
- PCM
- Start diode

When the key is placed in the START position, the starter solenoid is energized and a magnetic field is created in the starter solenoid windings. The iron plunger core is drawn into the starter solenoid coil, and a drive lever and pin connected to the starter drive engages the drive pinion gear to the flexplate/flywheel ring gear. When the plunger is pulled all the way in, its contact disc closes the circuit between the battery and the starter motor solenoid feed terminals. This sends current to the motor, and the drive pinion gear cranks the flexplate/flywheel to start the engine. When current flows to the starter motor, the starter solenoid pull-in coil is bypassed and the hold-in coil keeps the drive pinion gear engaged with the flywheel until the ignition switch is released from the START position.

An overrunning clutch in the starter drive protects the starter motor from excessive speeds during the brief period before the driver releases the ignition switch from the START position as the engine starts.

Vehicles equipped with a manual transaxle have a clutch cutoff switch mounted on the clutch pedal bracket. The clutch cutoff switch prevents operation of the starter motor unless the clutch is fully depressed.

Vehicles equipped with an automatic transmission have a TR sensor mounted on the transaxle. The TR sensor prevents operation of the starter motor unless NEUTRAL or PARK is selected. The vehicle has one-touch integrated start (OTIS), a computer-assisted cranking system. This feature assists in starting the engine. If the ignition key is turned to the START position and released when the engine begins cranking, the engine may continue cranking for up to 10 seconds or until the vehicle starts.

One-Touch Integrated Start (OTIS)

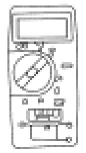
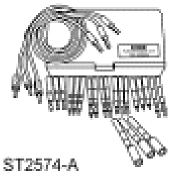
Once the ignition is turned to the START position and the vehicle is in NEUTRAL or PARK, the PCM reads starter motor request (SMR) from the ignition switch and gains control of the starter engagement. The customer is no longer in the loop after the initial crank request, the customer may release the key to the RUN/START position. The PCM will disengage the starter motor based on the following events:

- The engine is started (RPM threshold)
- A set time has been exceeded (calibrated)
- The ignition key has been turned to the OFF position

DIAGNOSTIC TESTS

STARTING SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2574-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operation

Starting System - Anti-Theft Intervention

The starting system is electronically controlled by the passive anti-theft system (PATS). PATS is controlled by the instrument cluster. PATS recognizes the correct electronically coded ignition key and the instrument cluster will send a message to the PCM to provide a ground for the starter relay. The energized relay provides voltage to the starter solenoid, thereby allowing the starter motor to activate.

Inspection and Verification

WARNING: **Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.**

NOTE: When working on the starter system, make sure the anti-theft system is operating correctly.

1. Verify the customer concern by operating the starting system to duplicate the conditions.
2. Inspect to determine if any of the following mechanical or electrical concerns apply.

VISUAL INSPECTION CHART

Mechanical	Electrical

• Starter motor
• Starter motor bolts
• Flexplate
• Flywheel
	• Battery
	• Battery junction box (BJB) fuse(s):
	  ○ 2 (60A)
	  ○ 14 (15A)
	• Smart junction box (SJB) fuse(s):
	  ○ 10 (30A)
	  ○ 22 (7.5A) - 3.0L and 3.5L vehicles only
	• Wiring harness
	• Starter motor relay - non-serviceable (part of SJB)
	• Anti-theft system
	• Loose or corroded connections

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the PCM.
9. If the DTCs retrieved are related to the concern, go to PCM DTC Chart or the Passive Anti-Theft System (PATS) DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

PCM DTC CHART

DTC	Description	Source	Action
P0512	Starter Request Circuit - Circuit has Power With the Ignition in the OFF Position	PCM	CARRY OUT the Ignition Switch Component Test. Refer to COMPONENT TESTING. If necessary, INSTALL a new ignition switch. If the ignition switch passed the component test, REPAIR circuit CDC35 (BU/WH) for a short to power.
P0706	TR Sensor Circuit Failure	PCM	Refer to the appropriate Automatic Transmission article for the procedure.
P0707	TR circuit low input	PCM	Refer to the appropriate Automatic Transmission article for the procedure.
P0708	TR circuit high input	PCM	Refer to the appropriate Automatic Transmission article for the procedure.
P0704	Clutch switch input circuit	PCM	REFER to **Introduction - Gasoline Engines** article.
P0830	Clutch Pedal Switch A Circuit	PCM	REFER to **Introduction - Gasoline Engines** article.
P0833	Clutch Pedal Switch B Circuit	PCM	REFER to **Introduction - Gasoline Engines** article.

PASSIVE ANTI-THEFT SYSTEM (PATS) - DTC CHART

DTC	Description	Source	Action
B1213	Anti-Theft Number of Programmed Keys is Below Minimum	Instrument Cluster	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1342	ECU is Faulted	Instrument Cluster	CLEAR the DTCs. CARRY OUT the instrument cluster self-test. If DTC B1342 is retrieved, INSTALL a new instrument cluster. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B1600	PATS Key Transponder Signal is Not Received - Damaged Key or Non-PATS Key	Instrument Cluster	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder (Unprogrammed PATS Key)	Instrument Cluster	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder (Partial Key Read)	Instrument Cluster	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B1681	PATS Transceiver Module Signal is Not Received (Damaged, Not Connected or Damaged Wiring)	Instrument Cluster	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2103	Defective Transceiver	Instrument Cluster	INSTALL a new PATS transceiver. REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2141	NVM Memory Failure (No Target ID Stored in Instrument Cluster)	Instrument Cluster	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.
B2431	Transponder Programming Failed	Instrument Cluster	REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The engine does not crank	• Battery • Battery junction box (BJB) fuse(s):	• Go to **Pinpoint Test A**.

	2 (60A) 14 (15A) - Smart junction box (SJB) fuse(s): 10 (30A) 22 (7.5A) - 3.0L and 3.5L vehicles - Starter motor - PCM - Circuitry - Starter motor relay - non-serviceable (part of SJB) - Ignition switch - Anti-theft system - Start diode - Transmission range (TR) sensor - automatic transmission - Clutch cutoff switch - manual transmission	
One-touch integrated start (OTIS) does not operate correctly	- Circuitry - PCM	Go to **Pinpoint Test B**.
The engine cranks slowly	- Battery - Starter motor - Circuitry	CARRY OUT the Starter Motor Component Test.
Unusual starter noise	- Starter motor mounting - Starter motor - Incorrect starter drive engagement	Go to **Pinpoint Test C**.
The starter spins but the engine does not crank	Starter motor	INSPECT the starter motor mounting and engagement. REPAIR as necessary.
	Damaged flywheel/flexplate ring gear teeth	INSPECT the flywheel/flexplate ring gear for damaged, missing or worn teeth. REPAIR as necessary.

Pinpoint Tests

Pinpoint Test A: The Engine Does Not Crank

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Starting System for schematic and connector information.

Normal Operation

Under normal operation, constant power is supplied to the starter relay on circuit SBB02 (YE/RD), the starter on circuit SDC02 (RD) and to the ignition switch on circuit SBB14 (BN/RD). When the key is placed in the START position, with the vehicle in PARK or NEUTRAL or with the clutch pedal depressed, power is supplied to the smart junction box (SJB) on circuit CDC36 (GN/WH) to the starter relay. Inputs from the transmission range (TR) sensor and clutch cutoff switch to the PCM provide a ground to the starter relay on circuit CDC12 (YE). When the coil of the relay is energized, it sends power to the starter motor on circuit CDC25 (BN/GN).

This pinpoint test is intended to diagnose the following:

- Battery
- Fuse(s)
- Ignition switch
- Starter motor relay - non-serviceable (part of SJB)
- PCM
- Anti-theft system
- Circuitry

PINPOINT TEST A: THE ENGINE DOES NOT CRANK

A1 CHECK THE BATTERY

- Check the battery condition and charge. Refer to **BATTERY, MOUNTING AND CABLES** article.
- **Is the battery OK?**

  YES : Go to A2.

  NO : CHARGE or INSTALL a new battery as necessary. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

A2 CHECK THE PATS AND PCM FOR DTCs

- Check for PATS and PCM DTCs.
- **Were any PATS and PCM DTCs retrieved?**

  YES : REFER to **ANTI-THEFT - PASSIVE ANTI-THEFT SYSTEM (PATS)** article to diagnose the PATS DTCs. REFER to **Introduction - Gasoline Engines** article to diagnose the PCM DTCs.

  NO : For automatic transmission, go to A3. For manual transmission, go to A4.

A3 CHECK THE AUTOMATIC TRANSMISSION RANGE (TR) SENSOR

- Enter the following diagnostic mode on the scan tool: Transmission Control Module (TCM) DataLogger PID.
- While observing the TCM TR sensor PID, place the vehicle in PARK and NEUTRAL.

- **Does the PID match the gear selection?**

  YES : Go to A4.

  NO : Go to the appropriate automatic transmission section to diagnose the TR sensor.

A4 CHECK THE STARTER MOTOR RELAY ENABLE (STRT_RLY) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID STRT_RLY with the ignition switch in the START position.
- **Does the PID change from DISABLED to ENABLED?**

  YES : Go to A5.

  NO : Go to A12.

A5 CHECK THE STARTER MOTOR CONTROL OUTPUT DETECTED (SMC_MON) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID SMC_MON with the ignition switch in the START position.
- **Does the PID change from OFF to ON?**

  YES : Go to A6.

  NO : Go to A19.

A6 CHECK THE BATTERY GROUND CABLE

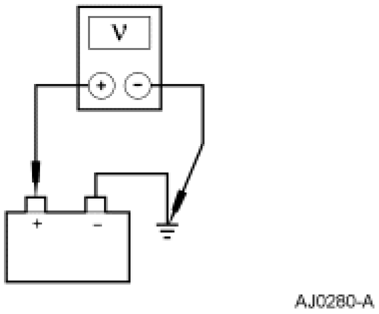


Fig. 1: Checking Battery Ground Cable
Courtesy of FORD MOTOR CO.

- Measure the voltage between the positive battery post and the battery ground cable connection at the engine.
- **Is the voltage greater than 10 volts?**

  YES : Go to A7.

  NO : INSTALL a new battery ground cable. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

A7 CHECK THE STARTER MOTOR GROUND

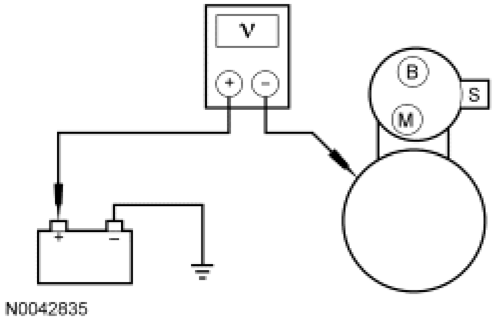


Fig. 2: Checking Starter Motor Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the positive battery post and the starter motor case.
- **Is the voltage greater than 10 volts?**

  YES : Go to A8.

  NO : CLEAN the starter motor mounting flange and make sure the starter motor is correctly mounted. TEST the system for normal operation.

A8 CHECK THE POWER SUPPLY TO THE STARTER MOTOR

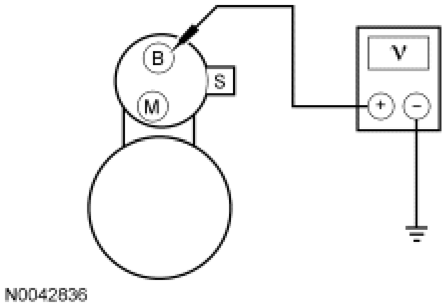


Fig. 3: Checking Power Supply To Starter Motor
Courtesy of FORD MOTOR CO.

- Measure the voltage between starter motor C197A, circuit SDC02 (RD) and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A9.

  NO : INSTALL a new positive battery cable. REFER to **BATTERY, MOUNTING AND CABLES** article. TEST the system for normal operation.

A9 CHECK THE STARTER MOTOR B-PIN

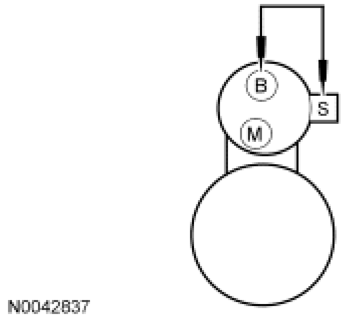


Fig. 4: Checking Starter Motor B-Pin
Courtesy of FORD MOTOR CO.

- Connect one end of a fused (30A) jumper wire to starter motor solenoid C197A, circuit SDC02 (RD). Momentarily connect the other end of the jumper to starter motor C197B, circuit CDC25 (BN/GN).
- **Did the starter motor engage and the engine crank?**

  YES : Go to A10.

  NO : INSTALL a new starter motor. REFER to **Starter Motor - 2.3L**, **Starter Motor - 3.0L** or **Starter Motor - 3.5L**. TEST the system for normal operation.

A10 CHECK THE CIRCUIT TO THE STARTER MOTOR

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

- Key in OFF position.
- Disconnect: Starter Motor Solenoid C197B
- Disconnect: SJB C2280A

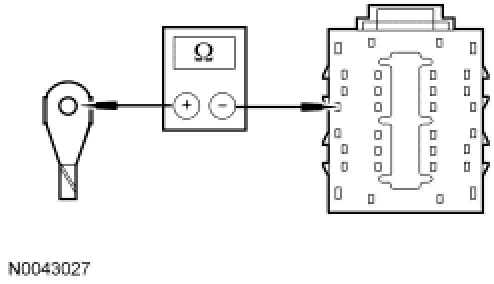


Fig. 5: Checking Circuit To Starter Motor
Courtesy of FORD MOTOR CO.

- Measure the resistance between starter solenoid S-terminal C197B, circuit CDC25 (BN/GN) harness side and the SJB C2280A-17, circuit CDC25 (BN/GN) harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to A11.

NO : REPAIR the circuit CDC25 (BN/GN). TEST the system for normal operation.

A11 CHECK THE STARTER MOTOR RELAY POWER

- Connect: Starter Motor Solenoid C197B
- Connect: SJB C2280A
- Disconnect: SJB C2280F

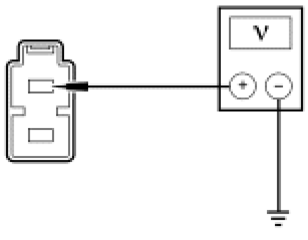


Fig. 6: Checking Starter Motor Relay Power
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280F-1, circuit SBB02 (YE/RD) and ground.
- **Is the voltage greater than 10 volts?**

YES : INSTALL a new SJB. TEST the system for normal operation.

NO : REPAIR circuit SBB02 (YE/RD). TEST the system for normal operation.

A12 CHECK THE STARTER DIODE

- Disconnect: Starter Diode

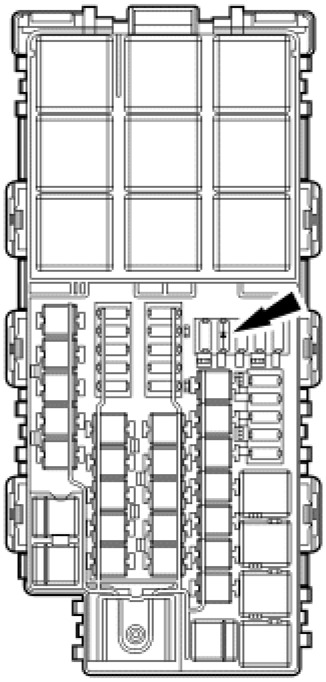


Fig. 7: Checking Starter Diode
Courtesy of FORD MOTOR CO.

- Carry out a Starter Diode Test.
- **Is the starter diode open or shorted?**

  YES : INSTALL a new starter diode. TEST the system for normal operation.

  NO : Go to A13.

A13 CHECK CIRCUIT CDC35 (BU/WH) FOR VOLTAGE

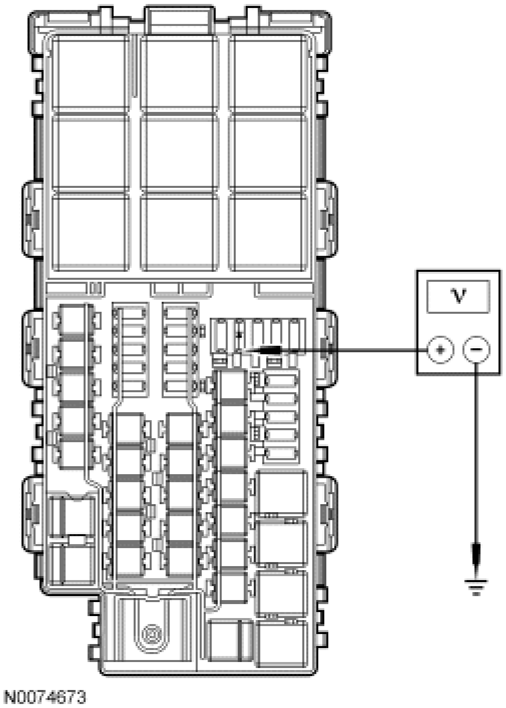


Fig. 8: Checking Circuit CDC35 (BU/WH) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between battery junction box (BJB) starter diode cell, circuit CDC35 (BU/WH) and ground with the ignition switch in the START position.
- **Is the voltage greater than 10 volts?**

  YES : Go to A16.

  NO : Go to A14.

A14 CHECK CIRCUIT SBB14 (BN/RD) FOR VOLTAGE

- Disconnect: Ignition Switch C250

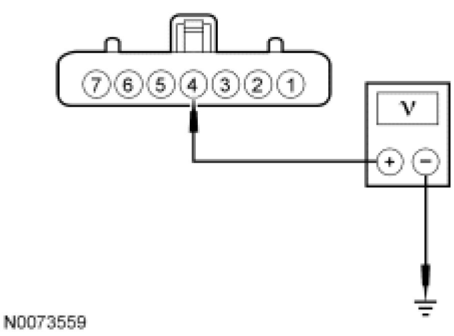


Fig. 9: Checking Circuit SBB14 (BN/RD) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ignition switch C250-4, circuit SBB14 (BN/RD), harness side and ground.

- **Is the voltage greater than 10 volts?**

  YES : Go to A15.

  NO : REPAIR circuit SBB14 (BN/RD). TEST the system for normal operation.

A15 CHECK THE IGNITION SWITCH

- Carry out the Ignition Switch Component Test. Refer to COMPONENT TESTING.
- **Did the ignition switch pass the component test?**

  YES : REPAIR circuit CDC35 (BU/WH). TEST the system for normal operation.

  NO : INSTALL a new ignition switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

A16 CHECK CIRCUIT CDC36 (GN/WH) FOR AN OPEN

- Disconnect: Start Diode
- Disconnect: PCM C175B

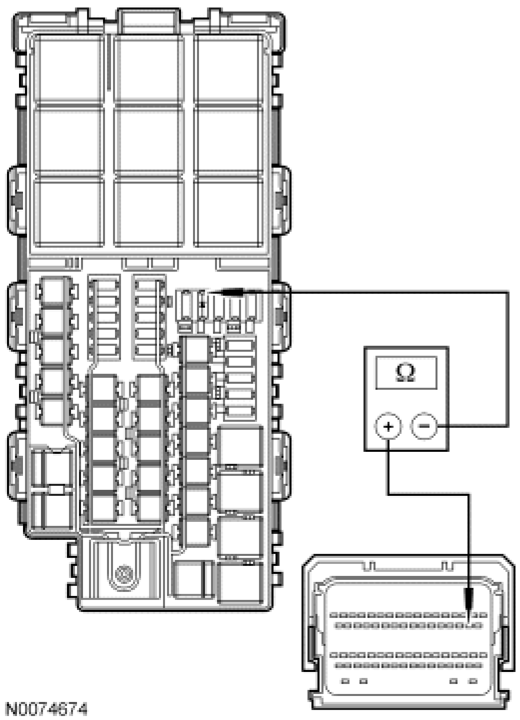


Fig. 10: Checking Circuit CDC36 (GN/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between the BJB start diode cell, circuit CDC36 (BU/WH), harness side and PCM C175B-19, circuit CDC36 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A17.

  NO : REPAIR circuit CDC36 (BU/WH). TEST the system for normal operation.

A17 CHECK THE START SIGNAL TO THE STARTER MOTOR RELAY

- Connect: Start Diode

- Disconnect: SJB C2280B

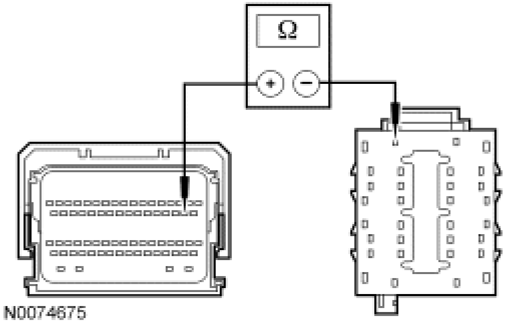


Fig. 11: Checking Start Signal To Starter Motor Relay
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280B-30, circuit CDC36 (GN/WH), harness side and C175B-19, circuit CDC36 (GN/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A18.

  NO : REPAIR circuit CDC36 (BU/WH). TEST the system for normal operation.

A18 CHECK CIRCUIT CDC35 (BU/WH) FOR AN OPEN

- Connect: SJB C2280B

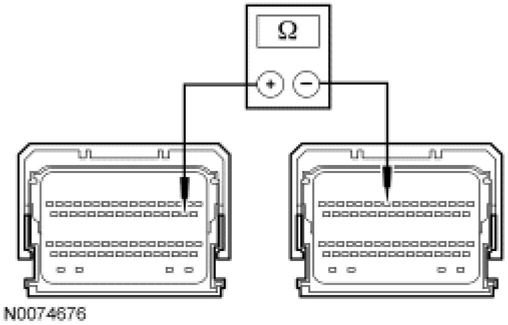


Fig. 12: Checking Circuit CDC35 (BU/WH) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between PCM C175B-19, circuit CDC36 (GN/WH), harness side and PCM C175B-10, circuit CDC35 (BU/WH) harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

  NO : REPAIR circuit CDC35 (BU/WH). TEST the system for normal operation.

A19 CHECK CIRCUIT CDC12 (YE) FOR AN OPEN

- Key in OFF position.

- Disconnect: PCM C175B
- Disconnect: SJB C2280A

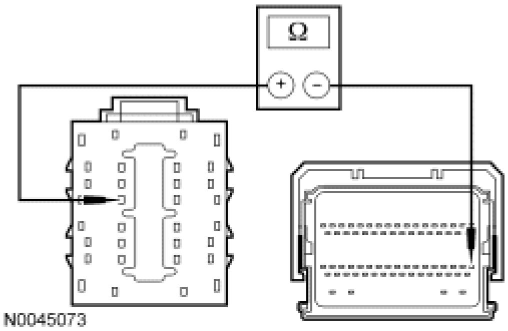


Fig. 13: Checking Circuit CDC12 (YE) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280A-18, circuit CDC12 (YE), harness side and PCM C175B-34, circuit CDC12 (YE), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A20.

  NO : REPAIR circuit CDC12 (YE). TEST the system for normal operation.

A20 CHECK STARTER MOTOR RELAY

- Key in OFF position.
- Disconnect: SJB C2280B
- Disconnect: SJB C2280A

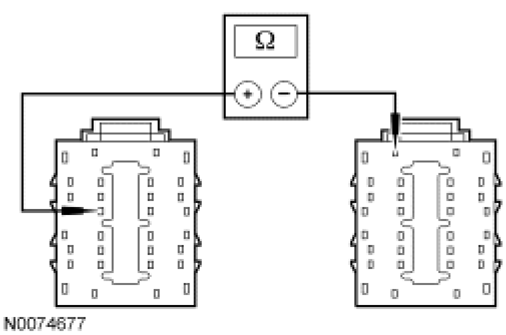


Fig. 14: Checking Starter Motor Relay
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280A-18, circuit CDC12 (YE), component side and SJB C2280B-30, circuit CE336 (GN/WH), component side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

NO : INSTALL a new SJB. TEST the system for normal operation.

Pinpoint Test B: One-Touch Integrated Start (OTIS) Does Not Operate Correctly

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Starting System for schematic and connector information.

Normal Operation

When the ignition switch is turned in the START position and released, the PCM receives a starter motor request (SMR) signal through circuit CDC35 (BU/WH). With the vehicle in PARK or NEUTRAL, power flows from the PCM to the starter motor relay through circuit CDC36 (GN/WH). A ground is supplied through circuit CDC12 (YE) from the PCM causing the starter motor relay coil to energize and the relay contacts close. This allows power from starter motor relay through circuit CDC25 (BN/GN) to the starter solenoid. The solenoid is grounded at the starter motor. Energizing the starter solenoid will engage the starter drive into the ring gear and closes the solenoid contacts allowing power directly from the battery through circuit SDC02 (RD) to the starter motor to start the engine. The customer is no longer in the loop after the initial crank request, the customer may release the key to the RUN/START position. The PCM will disengage the starter motor based on engine running (RPM threshold), a set crank time has been exceeded or the ignition switch has been turned to the OFF position.

This pinpoint test is intended to diagnose the following:

- Circuitry
- PCM

PINPOINT TEST B: ONE-TOUCH INTEGRATED START (OTIS) DOES NOT OPERATE CORRECTLY

B1 CHECK THE STATUS OF ONE-TOUCH INTEGRATED START (OTIS) (OTS_STAT) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID OTS_STAT with the ignition switch in the RUN position.
- **Is the OTIS PID enabled?**

  YES : Go to B2.

  NO : ENABLE OTIS. TEST the system for normal operation. If OTIS will not enable, INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

B2 CHECK THE KEY POSITION FOR START INDICATED (START_KEY) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID START_KEY with the ignition switch in the START position.
- **Does the PID change from OFF to ON?**

  YES : Go to B4.

  NO : Go to B3.

B3 CHECK CIRCUIT CDC35 (BU/WH)

- Disconnect: Start Diode
- Disconnect: PCM C175B

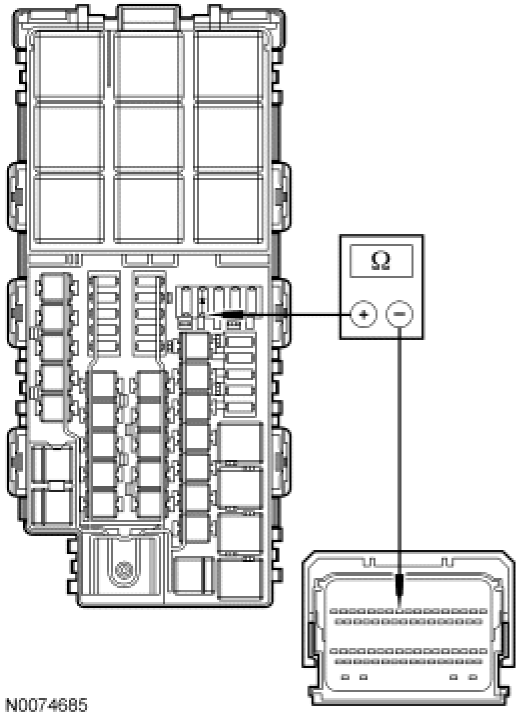


Fig. 15: Checking Circuit CDC35 (BU/WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between the start diode cell, circuit CDC35 (BU/WH), harness side and PCM C175B-10, circuit CDC35 (BU/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

  NO : REPAIR circuit CDC35 (BU/WH). TEST the system for normal operation.

B4 CHECK THE STARTER MOTOR RELAY ENABLE (STRT_RLY) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID STRT_RLY with the ignition switch in the START position.
- **Does the PID change from DISABLED to ENABLED?**

  YES : Go to B6.

  NO : Go to B5.

B5 CHECK THE CIRCUIT CDC36 (GN/WH) BETWEEN THE BJB AND THE PCM

- Key in OFF position.
- Disconnect: PCM C175B

- Disconnect: SJB C2280B

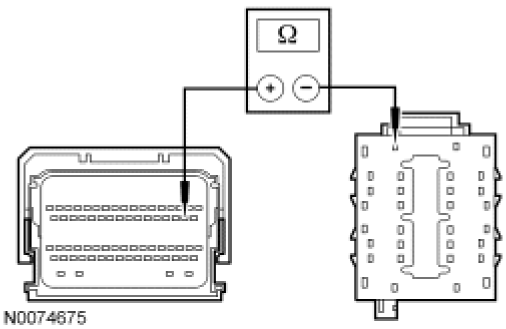


Fig. 16: Checking Circuit CDC36 (GN/WH) Between BJB & PCM
Courtesy of FORD MOTOR CO.

- Measure the resistance between the SJB C2280B-30, circuit CDC36 (GN/WH), harness side and C175B-19, circuit CDC36 (GN/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

  NO : REPAIR circuit CDC36 (GN/WH). TEST the system for normal operation.

B6 CHECK THE STARTER MOTOR CONTROL OUTPUT DETECTED (SMC_MON) PID

- Enter the following diagnostic mode on the diagnostic tool: PCM DataLogger/PID
- Monitor the PCM PID SMC_MON with the ignition switch in the START position.
- **Does the PID change from OFF to ON?**

  YES : REPAIR circuit CDC12 (YE). TEST the system for normal operation.

  NO : INSTALL a new PCM. REFER to **ELECTRONIC ENGINE CONTROLS - 2.3L** article, **ELECTRONIC ENGINE CONTROLS - 3.0L (4V)** article or **ELECTRONIC ENGINE CONTROLS - 3.5L** article. TEST the system for normal operation.

Pinpoint Test C: Unusual Starter Noise

This pinpoint test is intended to diagnose the following:

- Starter motor mounting
- Starter motor mounting bolts
- Starter motor drive
- Flywheel or flexplate ring gear
- Starter motor

PINPOINT TEST C: UNUSUAL STARTER NOISE

C1 CHECK THE STARTER MOUNTING

- Inspect the starter motor mounting bolts for looseness.
- **Is the starter motor mounted correctly?**

  YES : Go to C2.

  NO : INSTALL the starter motor correctly. REFER to **Starter Motor - 2.3L**, **Starter Motor - 3.0L** or **Starter Motor - 3.5L**. TEST the system for normal operation.

C2 CHECK FOR ENGINE NOISE

- Turn the ignition switch to the OFF position.
- Connect a fused jumper wire from the B-terminal to the S-terminal of the starter motor. Engage the starter motor and verify that the noise is due to the starter operation.
- **Is the noise due to the starter motor engagement?**

  YES : Go to C3.

  NO : REFER to **ENGINE SYSTEM - GENERAL INFORMATION** article to continue the diagnosis.

C3 CHECK FOR UNUSUAL WEAR

- Remove the starter motor. Refer to **Starter Motor - 2.3L**, **Starter Motor - 3.0L** or **Starter Motor - 3.5L**.
- Inspect the ring gear for damaged or worn teeth.
- **Is the noise due to flexplate/flywheel ring gear tooth damage?**

  YES : INSTALL a new flexplate/flywheel ring gear. EXAMINE the starter pinion teeth. If damaged, INSTALL a new starter motor. REFER to **Starter Motor - 2.3L**, **Starter Motor - 3.0L** or **Starter Motor - 3.5L**. TEST the system for normal operation.

  NO : INSTALL a new starter motor. REFER to **Starter Motor - 2.3L**, **Starter Motor - 3.0L** or **Starter Motor - 3.5L**. TEST the system for normal operation.

Component Tests

WARNING: **Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.**

Connect the 73III Automotive Meter at the component terminal rather than at the wiring end connector. Making a connection at the wiring end connector could result in false readings because the meter will not pick up a high resistance between the wiring connector and the component.

Starter Motor - Motor Feed Circuit

1. Make sure the battery is fully charged. Carry out a battery load test. Refer to **BATTERY, MOUNTING AND CABLES** article.
2. Disconnect the inertia fuel shutoff (IFS) switch.
3. Connect a remote starter switch between the starter solenoid S-terminal and the battery positive (+) terminal.

4. Connect the 73III Automotive Meter positive lead to the battery positive (+) post. Connect the negative lead to the M-terminal.

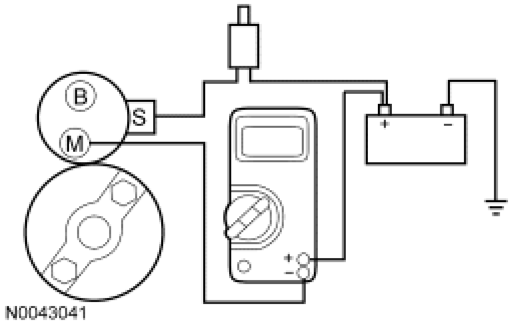


Fig. 17: Checking Voltage In Motor Feed Circuit
Courtesy of FORD MOTOR CO.

5. Engage the remote starter switch. Read and record the voltage. The voltage reading should be 0.8 volt or less.
6. If the voltage reading is 0.8 volt or less, go to the Starter Motor - Ground Circuit Component Test.
7. If the voltage reading is greater than 0.8 volt, this is an indication of excessive resistance in the connections, the positive battery cable or in the starter solenoid. Move the 73III Automotive Meter negative lead to the starter solenoid B-terminal and repeat the test. If the voltage reading at the B-terminal is lower than 0.8 volt, the concern is either in the connections at the starter solenoid or in the solenoid contacts.
8. Remove the cables from solenoid B-, S- and M-terminals. Clean the cables and connections and reinstall the cables to the correct terminals. Repeat Steps 3 through 6. If the voltage drop reading is still greater than 0.8 volt when checked at the M-terminal and less than 0.8 volt when checked at the B-terminal, the concern is in the solenoid contacts. Install a new starter motor.
9. If the voltage reading taken at the solenoid B-terminal is still greater than 0.8 volt after cleaning the cables and the connections at the solenoid, the concern is either in the positive (+) battery cable connection or in the positive battery cable itself. Clean the positive (+) battery cable connection. If this does not solve the problem, install a new positive battery cable. Refer to **BATTERY, MOUNTING AND CABLES** article.

Starter Motor - Ground Circuit

A slow cranking condition can be caused by resistance in the ground or return portion of the cranking circuit. Check the voltage drop in the ground circuit as follows:

1. Connect the 73III Automotive Meter positive lead to the starter motor housing (the connection must be clean and free of rust or grease). Connect the negative lead to the negative (-) battery terminal.

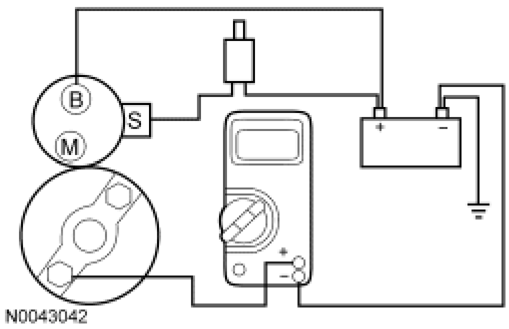


Fig. 18: Checking Voltage Drop In Ground Circuit
Courtesy of FORD MOTOR CO.

2. Engage the remote starter switch and crank the engine. Read and record the voltage reading. The reading should be 0.5 volt or less.
3. If the voltage is more than 0.5 volt, clean the negative cable connections at the battery, the body ground connections and the starter ground connections. Retest.
4. If the voltage is more than 0.5 volt, install a new cable. If the voltage reading is less than 0.5 volt and the engine still cranks slowly, install a new starter motor.

REMOVAL AND INSTALLATION

STARTER MOTOR - 2.3L

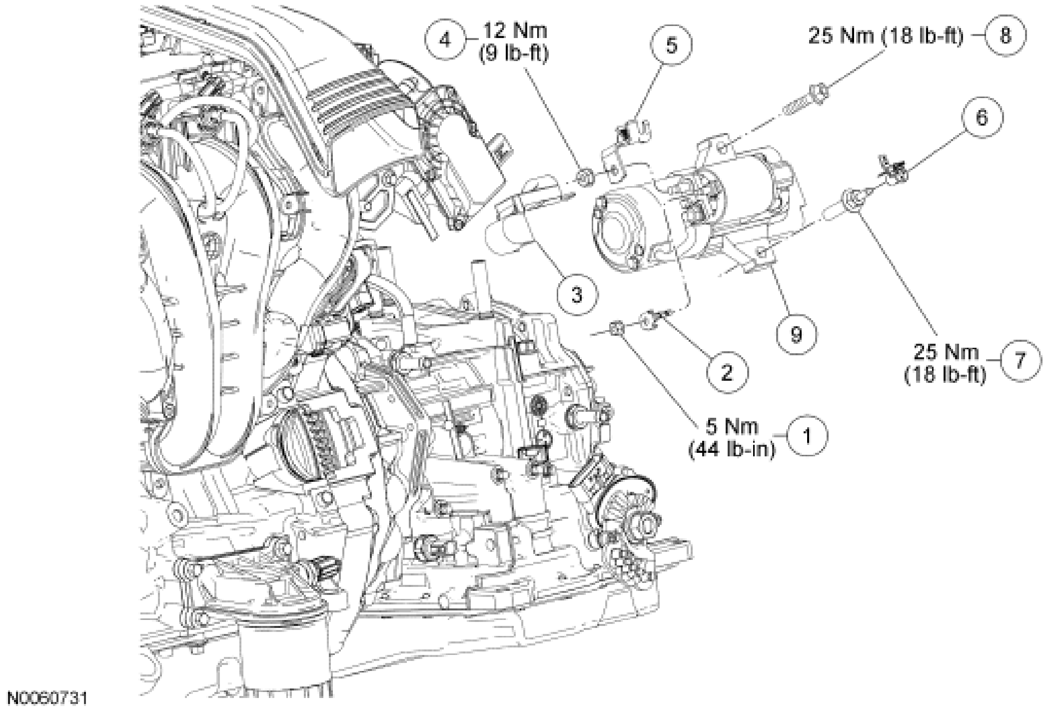


Fig. 19: Exploded View Of Starter Motor With Torque Specifications - 2.3L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N805320	Starter motor solenoid wire nut
2	14463	Starter motor solenoid wire (part of 12B637)
3	14603	Starter motor solenoid battery cable terminal cover
4	W706414	Starter motor solenoid battery cable nut
5	14463	Starter motor solenoid battery cable (part of 14B060)
6	14A169	Wire harness retainer (part of 12B637)
7	W706194	Starter motor stud bolt
8	W705877	Starter motor bolt
9	11000	Starter motor

REMOVAL AND INSTALLATION

WARNING: **Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. If equipped, remove the 7 screws and the underbody cover.

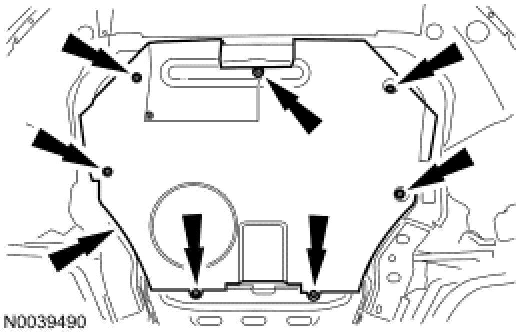


Fig. 20: Locating Splash Shield Bolts
Courtesy of FORD MOTOR CO.

4. Remove the starter motor solenoid wire nut and position the wire aside.
   - To install, tighten to 5 Nm (44 lb-in).
5. Position the starter motor solenoid battery cable terminal cover aside.
6. Remove the starter motor solenoid battery cable nut and position the cable aside.
   - To install, tighten to 12 Nm (9 lb-ft).

7. Disconnect the wiring harness retainer from the starter motor stud bolt and position the wiring harness aside.
8. Remove the starter motor bolt, stud bolt and the starter motor.
   - To install, tighten to 25 Nm (18 lb-ft).
9. To install, reverse the removal procedure.

STARTER MOTOR - 3.0L

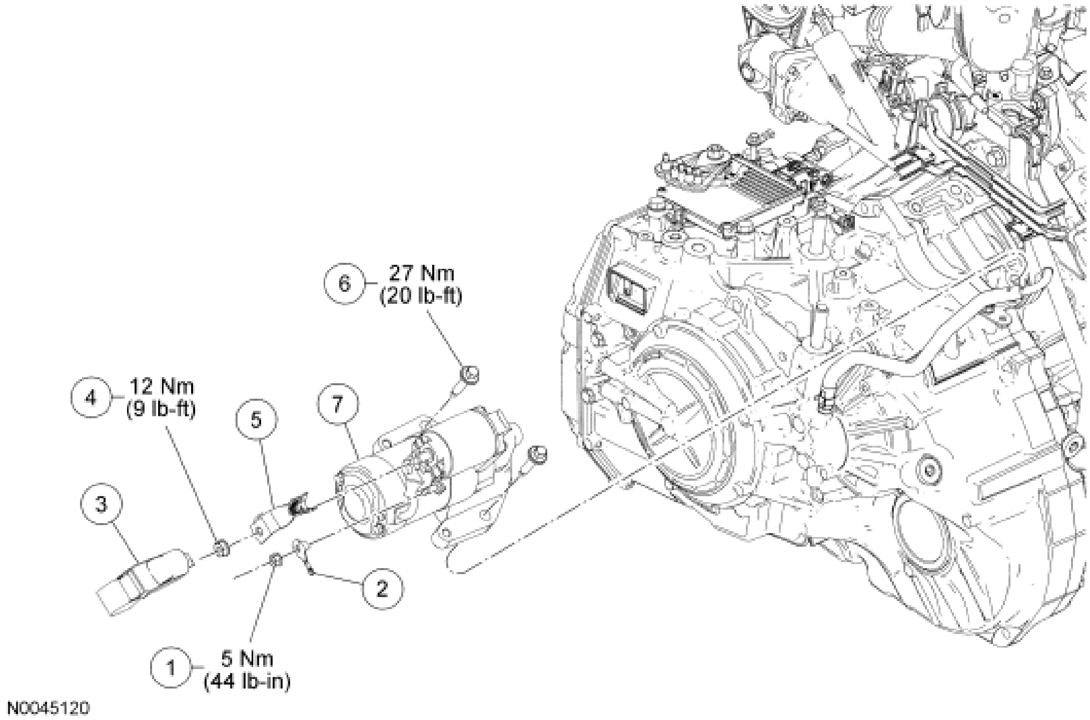


Fig. 21: Exploded View Of Starter Motor With Torque Specifications - 3.0L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N805320	Starter motor solenoid wire nut
2	14463	Starter motor solenoid wire (part of 12B637)
3	14603	Starter motor solenoid battery cable terminal cover
4	W706414	Starter motor solenoid battery cable nut
5	14463	Starter motor solenoid battery cable (part of 14B060)
6	W503297	Starter motor bolt (2 required)
7	11000	Starter motor

WARNING: **Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to**

cause a skin burn. Failure to follow this instruction may result in serious personal injury.

1. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
2. Remove the starter motor solenoid wire nut and position the wire aside.
   - To install, tighten to 5 Nm (44 lb-in).
3. Position the starter motor solenoid terminal battery cable cover aside.
4. Remove the starter motor solenoid battery cable nut and position aside the cable.
   - To install, tighten to 12 Nm (9 lb-ft).
5. Remove the 2 starter motor bolts and the starter motor.
   - To install, tighten to 27 Nm (20 lb-ft).
6. To install, reverse the removal procedure.

STARTER MOTOR - 3.5L

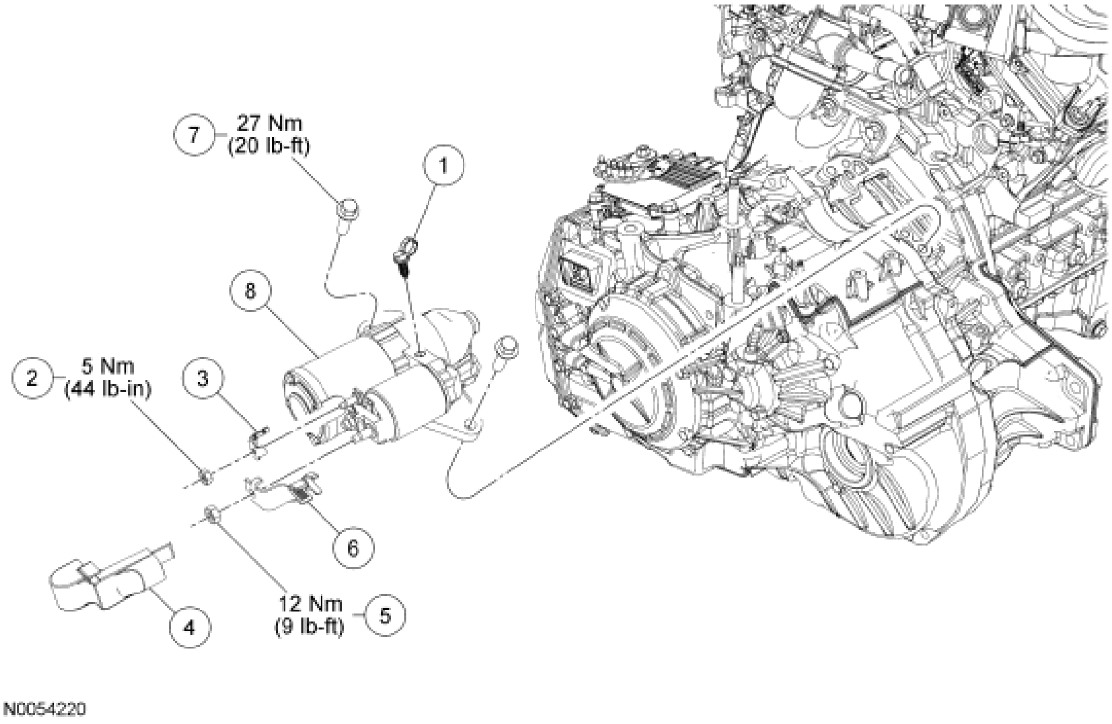


Fig. 22: Exploded View Of Starter Motor With Torque Specifications - 3.5L
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14197	Starter motor wire harness pin-type retainer (part of 14B060)
2	N805320	Starter motor solenoid wire nut
3	14463	Starter motor solenoid wire (part of 14B060)

4	14603	Starter motor solenoid battery cable terminal cover
5	W706414	Starter motor solenoid battery cable nut
6	14463	Starter motor solenoid battery cable (part of 14B060)
7	W503297	Starter motor bolt (2 required)
8	11000	Starter motor

WARNING: **Always disconnect the battery ground cable at the battery before disconnecting the starter motor battery terminal lead. If a tool is shorted at the starter motor battery terminal, the tool can quickly heat enough to cause a skin burn. Failure to follow this instruction may result in serious personal injury.**

1. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
2. Detach the starter motor wire harness pin-type retainer.
3. Remove the starter motor solenoid wire nut and position the wire aside.
   - To install, tighten to 5 Nm (44 lb-in).
4. Position the starter motor solenoid terminal battery cable cover aside.
5. Remove the starter motor solenoid battery cable nut and position aside the cable.
   - To install, tighten to 12 Nm (9 lb-ft).
6. Remove the 2 starter motor bolts and the starter motor.
   - To install, tighten to 27 Nm (20 lb-ft).
7. To install, reverse the removal procedure.

GENERAL INFORMATION

State Emission Standards - Gasoline

ALASKA

NOTE: Because of frequent revisions in state emission standards, the emission standards listed in this article should only be used as a guide.

NOTE: As of March 1, 2012, Alaska is not testing for tailpipe emissions.

ALASKA EMISSION STANDARDS - ANCHORAGE & FAIRBANKS (2-SPEED IDLE TEST)

Application	Idle HC ppm (CO %)	2500 RPM HC ppm (CO %)
Passenger Cars (1)		
1968-71	1000 (5.0)	1000 (4.0)
1972-74	1000 (4.0)	1000 (3.0)
1975-80	1000 (2.0)	1000 (2.0)
1981-83	1000 (1.0)	1000 (1.0)
1984-93	750 (1.0)	750 (1.0)
1994-	200 (0.5)	200 (0.5)
Light & Medium Duty Trucks (1)		
1968-72	1000 (5.0)	1000 (4.0)
1973-78	1000 (4.0)	1000 (3.0)
1979-83	1000 (2.0)	1000 (2.0)
1984-93	750 (1.0)	750 (1.0)
1994-	220 (0.5)	220 (0.5)
Heavy Duty Vehicles (2)		
1968-73	1000 (5.0)	1000 (5.0)
1974-93	1000 (4.0)	1000 (4.0)
1994-	220 (1.0)	220 (1.0)

(1) 8500 GVWR or less.

(2) 8500 GVWR or more.

ARIZONA

NOTE: Curb idle only test are for vehicles with full-time 4WD, non-defeatable traction control and motorcycles. Curb idle and loaded cruise tests are performed on 1967-80 light-duty gasoline powered vehicles and all heavy-duty gasoline powered vehicles.

ARIZONA EMISSION STANDARDS - PHOENIX AREA (CURB IDLE & LOADED CRUISE TESTS)

Application [1]	Idle HC ppm (CO %)	[2] Loaded/Cruise HC ppm (CO %)
Light Duty Vehicles (6000 GVWR Or Less)		
1967-71 4-Cyl. Or Less	500 (5.50)	500 (4.20)
1967-71 More Than 4-Cyl.	450 (5.00)	450 (3.75)
1972-74 4-Cyl. Or Less	400 (5.50)	400 (4.20)
1972-74 More Than 4-Cyl.	400 (5.00)	400 (3.75)
1975-78 4-Cyl. Or Less	250 (2.20)	250 (1.65)
1975-78 More Than 4-Cyl.	250 (2.00)	250 (1.50)
Light Duty Vehicles (8500 GVWR Or Less)		
1979 4-Cyl. Or Less	220 (2.20)	220 (1.65)
1979 More Than 4-Cyl.	220 (2.20)	220 (1.50)
1980	220 (1.20)	220 (1.20)
1981 & Newer	220 (1.20)	.....
Light Duty Trucks (6000 GVWR Or Less)		
1967-80	[3]	[3]
Light Duty Trucks (6001-8500 GVWR)		
1967-74	[3]	[3]
1975-78	350 (4.00)	350 (3.00)
1979 4-Cyl. Or Less	220 (2.20)	220 (1.65)
1979 More Than 4-Cyl.	220 (2.00)	220 (1.50)
1980	220 (1.20)	220 (1.20)
1981 & Newer	220 (1.20)	.....
Heavy Duty Trucks (Greater Than 8500 GVWR)		
1967-74	[3]	[3]
1975-78	350 (4.00)	350 (3.00)
1979 & Newer	300 (4.00)	300 (3.00)
Motorcycles		
1967 & Newer	1800 (5.50)	.....

(1) 4-stroke engines only.

(2) Except AWD, non-defeatable traction control and motorcycles.

(3) Same as light duty vehicles.

ARIZONA EMISSION STANDARDS - PHOENIX AREA (IM147 TEST)

Application	HC gpm (CO gpm)	NOx gpm
Light Duty Vehicles		
1981-82	3.0 (25.0)	3.5
1983-85	2.4 (20.0)	3.5
1986-89	1.6 (15.0)	2.5

1990-93	1.0 (12.0)	2.5
1994 & Newer	0.8 (12.0)	2.0
Light Trucks (6000 GVWR Or Less)		
1981-85	4.0 (40.0)	5.5
1986-89	3.0 (25.0)	4.5
1990-93	2.0 (20.0)	4.0
1994 & Newer	1.6 (20.0)	3.0
Light Duty Trucks (6000-8500 GVWR)		
1981-85	4.4 (48.0)	7.0
1986-87	4.0 (40.0)	5.5
1988-89	3.0 (25.0)	5.5
1990-93	3.0 (25.0)	5.0
1994 & Newer	2.4 (25.0)	4.0

NOTE: Curb idle test only for 1967-80 light-duty gasoline vehicles, all vehicles with full-time 4WD and/or non-defeatable traction control and motorcycles. Curb idle and loaded cruise tests are performed on all 1981 and later vehicles except those with full-time 4WD and/or non-defeatable traction control.

ARIZONA EMISSION STANDARDS - TUCSON AREA (CURB IDLE & LOADED CRUISE TESTS)

Application (1)	Idle HC ppm (CO %)	(2) Loaded/Cruise HC ppm (CO %)
Light Duty Vehicles (6000 GVWR Or Less)		
1967-71 4-Cyl. Or Less	500 (5.50)	.....
1967-71 More Than 4-Cyl.	450 (5.00)	.....
1972-74 4-Cyl. Or Less	400 (5.50)	.....
1972-74 More Than 4-Cyl.	400 (5.00)	.....
1975-78 4-Cyl. Or Less	250 (2.20)	.....
1975-78 More Than 4-Cyl.	250 (2.00)	.....
Light Duty Vehicles (8500 GVWR Or Less)		
1979 4-Cyl. Or Less	220 (2.20)	.....
1979 More Than 4-Cyl.	220 (2.20)	.....
1980	220 (1.20)	.....
1981 & Newer	220 (1.20)	220 (1.20)
Light Duty Trucks (6000 GVWR Or Less)		
1967-80	(3)	(3)
Light Duty Trucks (6001-8500 GVWR)		
1967-74	(3)	(3)
1975-78	350 (4.00)	.....
1979 4-Cyl. Or Less	220 (2.20)	.....
1979 More Than 4-Cyl.	220 (2.00)	.....

1980	220 (1.20)	.....
1981 & Newer	220 (1.20)	220 (1.20)
Heavy Duty Trucks (Greater Than 8500 GVWR)		
1967-74	(3)	(3)
1975-78	350 (4.00)	.....
1979-80	300 (4.00)	.....
1981 & Newer	300 (4.00)	300 (3.00)
Motorcycles		
1967 & Newer	1800 (5.50)	.....

(1) 4-stroke engines only.

(2) Except AWD, non-defeatable traction control and motorcycles.

(3) Same as light duty vehicles.

CALIFORNIA

CALIFORNIA EMISSION STANDARDS ASM TESTS

Specific vehicle cutpoints are available on the California BAR web site at www.bar.ca.gov under the Industry tab, then Cutpoints Application.

ESC	MODEL YEAR GROUP	VEHICLE TYPE (by GVWR and LVW)					PASS/FAIL EMISSION STANDARD						GROSS POLLUTER STANDARD					
							ASM 5015			ASM 2525			ASM 5015			ASM 2525		
		PC	LDT1	LDT2	MDV		HC	CO	NO	HC	CO	NO	HC	CO	NO	HC	CO	NO
1	1974-	X	X	X		A	235.4	2.56	1301.5	185.4	2.36	1161.5	435.4	4.26	2659.3	385.4	4.06	2459.3
						B	436041.7	4453.19	1192593.0	436041.7	4453.19	1192593.0	436041.7	4453.19	1703703.7	436041.7	4453.19	1703703.7
2	1975-1980	X				A	123.0	0.91	1016.3	90.3	0.71	876.3	315.3	2.51	2051.9	265.3	2.31	1851.9
						B	273316.7	1362.96	1043519.0	273316.7	1362.96	1043519.0	273316.7	1362.96	1490740.7	273316.7	1362.96	1490740.7
3	1981-1983	X				A	63.2	0.64	850.0	42.1	0.44	680.0	253.1	2.14	1844.4	192.4	1.94	1644.4
						B	234259.3	1064.81	894444.5	212963.0	1064.81	894444.5	234259.3	1064.81	1277777.8	212963.0	1064.81	1277777.8
4	1984-1986	X				A	67.0	0.52	850.0	42.1	0.32	680.0	242.4	2.02	1744.4	192.4	1.82	1544.4
						B	212963.0	979.63	894444.5	212963.0	979.63	894444.5	212963.0	979.63	1277777.8	212963.0	979.63	1277777.8
5	1987-1992	X				A	57.0	0.48	608.0	31.7	0.32	547.0	231.7	1.98	1729.6	181.7	1.82	1529.6
						B	191666.7	851.85	596296.3	191666.7	979.63	596296.3	191666.7	851.85	851851.9	191666.7	979.63	851851.9
6	1993-1995	X				A	59.0	0.29	617.1	24.3	0.23	547.0	234.3	1.79	1759.3	184.3	1.73	1559.3
						B	89951.3	724.07	271314.8	89951.3	851.85	596296.3	128501.9	724.07	553703.7	128501.9	851.85	553703.7
7	1996-2000	X				A	16.8	0.29	260.0	0.5	0.23	547.0	234.3	1.79	1759.3	184.3	1.73	1559.3
						B	128501.9	724.07	596296.3	128501.9	851.85	596296.3	128501.9	724.07	553703.7	128501.9	851.85	553703.7
8	2001-2003	X				A	16.8	0.29	260.0	0.5	0.23	547.0	234.3	1.79	1759.3	184.3	1.73	1559.3
						B	128501.9	724.07	596296.3	128501.9	851.85	596296.3	128501.9	724.07	553703.7	128501.9	851.85	553703.7
9	2004+	X				A	16.8	0.29	260.0	0.5	0.23	547.0	234.3	1.79	1759.3	184.3	1.73	1559.3
						B	128501.9	724.07	596296.3	128501.9	851.85	596296.3	128501.9	724.07	553703.7	128501.9	851.85	553703.7
10	1975-1978		X			A	139.4	1.08	1320.9	105.0	0.88	1180.9	330.0	2.58	2487.0	280.0	2.38	2287.0
						B	225000.0	2025.00	745370.4	225000.0	2025.00	745370.4	225000.0	2025.00	1064814.8	225000.0	2025.00	1064814.8
11	1979-1983		X			A	139.4	0.88	1315.7	80.0	0.68	1175.7	320.0	2.38	2479.6	255.0	2.18	2279.6
						B	225000.0	2025.00	596296.3	150000.0	2025.00	596296.3	225000.0	2025.00	851851.9	150000.0	2025.00	851851.9
12	1984-1987		X			A	91.3	0.41	945.0	63.1	0.50	840.0	280.0	1.71	1850.0	230.0	1.80	1700.0
						B	150000.0	1725.00	525000.0	150000.0	2250.00	1050000.0	150000.0	1725.00	750000.0	150000.0	2250.00	1500000.0
13	1988-1992		X			A	83.0	0.27	875.0	63.1	0.43	735.0	270.0	1.57	1600.0	220.0	1.73	1400.0
						B	150000.0	1725.00	525000.0	150000.0	1875.00	525000.0	150000.0	1725.00	750000.0	150000.0	1875.00	750000.0
14	1993-1995		X			A	68.3	0.30	377.0	33.3	0.40	630.0	247.5	1.60	1350.0	197.5	1.70	1400.0
						B	78750.0	1350.00	525000.0	78750.0	1500.00	525000.0	112500.0	1350.00	750000.0	112500.0	1500.00	750000.0
15	1996-2000		X			A	22.1	0.30	377.0	5.8	0.40	630.0	247.5	1.60	1350.0	197.5	1.70	1400.0
						B	112500.0	1350.00	525000.0	112500.0	1500.00	525000.0	112500.0	1350.00	750000.0	112500.0	1500.00	750000.0
16	2001-2003		X			A	22.1	0.30	377.0	5.8	0.40	630.0	247.5	1.60	1350.0	197.5	1.70	1400.0
						B	112500.0	1350.00	525000.0	112500.0	1500.00	525000.0	112500.0	1350.00	750000.0	112500.0	1500.00	750000.0
17	2004+		X			A	22.1	0.30	377.0	5.8	0.40	630.0	247.5	1.60	1350.0	197.5	1.70	1400.0
						B	112500.0	1350.00	525000.0	112500.0	1500.00	525000.0	112500.0	1350.00	750000.0	112500.0	1500.00	750000.0
18	1975-1978			X		A	139.4	1.08	1320.9	105.0	0.88	1180.9	330.0	2.58	2487.0	280.0	2.38	2287.0
						B	225000.0	2025.00	745370.4	225000.0	2025.00	745370.4	225000.0	2025.00	1064814.8	225000.0	2025.00	1064814.8
19	1979-1983			X		A	139.4	0.88	1315.7	80.0	0.68	1175.7	320.0	2.38	2479.6	255.0	2.18	2279.6
						B	225000.0	2025.00	596296.3	150000.0	2025.00	596296.3	225000.0	2025.00	851851.9	150000.0	2025.00	851851.9
20	1984-1987			X		A	91.3	0.41	945.0	63.1	0.50	840.0	280.0	1.71	1850.0	230.0	1.80	1700.0
						B	150000.0	1725.00	525000.0	150000.0	2250.00	1050000.0	150000.0	1725.00	750000.0	150000.0	2250.00	1500000.0
21	1988-1992			X		A	83.0	0.27	875.0	63.1	0.43	735.0	270.0	1.57	1600.0	220.0	1.73	1400.0
						B	150000.0	1725.00	525000.0	150000.0	1875.00	525000.0	150000.0	1725.00	750000.0	150000.0	1875.00	750000.0
22	1993-1995			X		A	68.3	0.30	377.0	33.3	0.40	630.0	247.5	1.60	1350.0	197.5	1.70	1400.0
						B	78750.0	1350.00	525000.0	78750.0	1500.00	525000.0	112500.0	1350.00	750000.0	112500.0	1500.00	750000.0
23	1996-2000			X		A	22.1	0.30	377.0	5.8	0.40	630.0	247.5	1.60	1350.0	197.5	1.70	1400.0
						B	112500.0	1350.00	525000.0	112500.0	1500.00	525000.0	112500.0	1350.00	750000.0	112500.0	1500.00	750000.0
24	2001-2003			X		A	22.1	0.30	377.0	5.8	0.40	630.0	247.5	1.60	1350.0	197.5	1.70	1400.0
						B	112500.0	1350.00	525000.0	112500.0	1500.00	525000.0	112500.0	1350.00	750000.0	112500.0	1500.00	750000.0
25	2004+			X		A	22.1	0.30	377.0	5.8	0.40	630.0	247.5	1.60	1350.0	197.5	1.70	1400.0
						B	112500.0	1350.00	525000.0	112500.0	1500.00	525000.0	112500.0	1350.00	750000.0	112500.0	1500.00	750000.0
26	1978-				X	A	173.3	2.90	1703.3	123.3	2.70	1563.3	423.3	5.40	3233.3	373.3	5.20	3033.3
						B	583333.3	3500.00	1633333.3	583333.3	3500.00	1633333.3	583333.3	3500.00	2333333.3	583333.3	3500.00	2333333.3
27	1979-1983				X	A	139.4	0.88	1315.7	80.0	0.68	1175.7	320.0	2.38	2479.6	255.0	2.18	2279.6
						B	225000.0	2025.00	596296.3	150000.0	2025.00	596296.3	225000.0	2025.00	851851.9	150000.0	2025.00	851851.9
28	1984-1987				X	A	91.3	0.41	945.0	63.1	0.50	840.0	280.0	1.71	1850.0	230.0	1.80	1700.0
						B	150000.0	1725.00	525000.0	150000.0	2250.00	1050000.0	150000.0	1725.00	750000.0	150000.0	2250.00	1500000.0
29	1988-1992				X	A	83.0	0.27	875.0	63.1	0.43	735.0	270.0	1.57	1600.0	220.0	1.73	1400.0
						B	150000.0	1725.00	525000.0	150000.0	1875.00	525000.0	150000.0	1725.00	750000.0	150000.0	1875.00	750000.0
30	1993-1995				X	A	83.0	0.30	875.0	60.0	0.70	735.0	300.0	1.60	1750.0	250.0	2.00	1550.0
						B	150000.0	1350.00	525000.0	150000.0	1500.00	525000.0	150000.0	1350.00	750000.0	150000.0	1500.00	750000.0
31	1996-2000				X	A	71.2	0.30	875.0	60.0	0.70	735.0	300.0	1.60	1750.0	250.0	2.00	1550.0
						B	150000.0	1350.00	525000.0	150000.0	1500.00	525000.0	150000.0	1350.00	750000.0	150000.0	1500.00	750000.0
32	2001-2003				X	A	71.2	0.30	875.0	60.0	0.70	735.0	300.0	1.60	1750.0	250.0	2.00	1550.0
						B	150000.0	1350.00	525000.0	150000.0	1500.00	525000.0	150000.0	1350.00	750000.0	150000.0	1500.00	750000.0
33	2004+				X	A	71.2	0.30	875.0	60.0	0.70	735.0	300.0	1.60	1750.0	250.0	2.00	1550.0
						B	150000.0	1350.00	525000.0	150000.0	1500.00	525000.0	150000.0	1350.00	750000.0	150000.0	1500.00	750000.0

Fig. 1: California Emission Standards - Enhanced & Partially Enhanced Program Areas - Light & Medium Duty Vehicles (ASM Test)

ESC	MODEL YEAR GROUP	VEHICLE TYPE (by GVWR and LVW)						PASS/FAIL EMISSION STANDARD						GROSS POLLUTER STANDARD					
								ASM 5015			ASM 2525			ASM 5015			ASM 2525		
		PC	LDT1	LDT2	MDV	HDV		HC	CO	NO	HC	CO	NO	HC	CO	NO	HC	CO	NO
46	1978-					X	A	243.8	3.92	2615.8	199.8	3.92	2770.8	594.9	7.29	4970.0	605.4	7.57	5375.4
							B	583333.3	3500.00	1633333.3	583333.3	3500.00	1633333.3	583333.3	3500.00	1633333.3	583333.3	3500.00	1633333.3
47	1979 - 1983					X	A	205.5	2.16	2250.6	106.0	1.96	2400.6	454.2	6.62	4231.1	338.1	6.54	4657.2
							B	225000.0	2025.00	596296.3	150000.0	2025.00	596296.3	225000.0	2025.00	596296.3	150000.0	2025.00	596296.3
48	1984 - 1987					X	A	143.0	1.60	2162.5	78.0	1.80	1975.0	307.5	6.67	4238.5	250.0	6.48	3989.5
							B	150000.0	1725.00	525000.0	150000.0	2250.00	1050000.0	150000.0	1725.00	525000.0	150000.0	2250.00	1050000.0
49	1988 - 1992					X	A	105.0	1.01	2112.5	78.0	1.24	2062.5	300.0	5.87	3865.9	250.0	4.98	3929.9
							B	150000.0	1725.00	525000.0	150000.0	1875.00	525000.0	150000.0	1725.00	525000.0	150000.0	1875.00	525000.0
50	1993 - 1995					X	A	105.0	0.49	1912.5	75.0	1.22	1862.5	300.0	2.61	3825.0	250.0	3.49	3929.9
							B	150000.0	1350.00	525000.0	150000.0	1500.00	525000.0	150000.0	1350.00	525000.0	150000.0	1500.00	525000.0
51	1996 - 2000					X	A	105.0	0.49	1662.5	75.0	1.16	1462.5	300.0	2.61	3325.0	250.0	3.32	3085.9
							B	150000.0	1350.00	525000.0	150000.0	1500.00	525000.0	150000.0	1350.00	525000.0	150000.0	1500.00	525000.0
52	2001+					X	A	105.0	0.49	1662.5	75.0	1.16	1462.5	300.0	2.61	3325.0	250.0	3.32	3085.9
							B	150000.0	1350.00	525000.0	150000.0	1500.00	525000.0	150000.0	1350.00	525000.0	150000.0	1500.00	525000.0

Fig. 2: California Emission Standards - Enhanced & Partially Enhanced Program Areas - Heavy Duty Vehicles (ASM Test)

LEGEND

ESC - Emission Standard Category

GVWR - Manufacture's Gross Vehicle Weight Rating

LVW - Loaded Vehicle Weight

PC - Passenger Car

LDT1 - Light-Duty Truck up through 3750 LVW and GVWR no greater than 6000 lbs.

LDT2 - Light-Duty Truck greater than 3750 LVW and GVWR no greater than 6000 lbs.

MDV - Medium-Duty Vehicle, GVWR from 6001 to 8500 lbs.

HC - Hydrocarbon, ppm

CO - Carbon Monoxide, %

NO - Nitric Oxide, ppm

PASS/FAIL EMISSION STANDARDS = A+B / VTW

PASS/FAIL STANDARDS - Emission standards used to determine if a vehicle passes the emission inspection. A vehicle passes if the emission levels are equal to or less than the standards for HC, CO and NO for ASM 5015 and ASM 2525.

GROSS POLLUTER STANDARDS - Emission standards used to designate a vehicle as a gross polluter. A vehicle is designated as a gross polluter if the emission levels at the time of the initial inspection, before repairs are greater than the gross polluter standards for HC, CO or NO for ASM 5015 or ASM 2525.

NOTE: If test data on emission pass/fail rates or gross polluter identification rates indicate adjustments are required, the emission standards may be increased or decreased by the bureau by 30% or by the following tolerances, or standards may be set for any specific vehicle and engine configuration which the bureau determines has excessive errors of commission of omission, whichever is necessary to comply with Section 44001.5 of the Health and Safety Code.

COLORADO

COLORADO EMISSION STANDARDS - ENHANCED PROGRAM (IM240)

Application	HC gpm	CO gpm	NOx gpm
Passenger Cars			
1982	3.5	45	5.0
1983	3.5	30	4.5
1984	3.0	30	4.5
1985	2.5	20	4.5
1986	2.5	20	4.5
1987	2.5	20	4.0
1988 & 1989	2.0	20	4.0
1990	2.0	20	3.5
1991	1.5	20	3.5
1992	1.5	15	3.5

1993	1.5	15	3.5
1994	1.2	15	3.0
1995	1.2	15	2.5
1996	1.2	15	2.0
1997	1.2	15	2.0
1998 & Newer	1.2	15	1.5
Light Duty Vehicles			
1982	6.0	65	6.0
1983	6.0	65	6.0
1984	5.0	55	6.0
1985	4.5	45	6.0
1986	4.0	40	6.0
1987	3.5	30	5.5
1988 & 1989	3.0	25	5.0
1990	3.0	25	5.0
1991	2.5	25	4.5
1992	2.5	25	4.5
1993	2.5	25	4.5
1994	2.0	20	4.0
1995	2.0	20	4.0
1996	1.2	15	3.5
1997	1.2	15	3.0
1998	1.2	15	2.0
1999 & Newer	1.2	15	2.0

COLORADO EMISSION STANDARDS - 2-SPEED IDLE TEST

Application	**HC ppm**	**CO %**
Passenger Cars & Light Duty Trucks		
1970 & Earlier	1000	3.5
1971	1000	3.0
1972	1000	3.0
1973	1000	3.0
1974	1000	3.0
1975	600	2.0
1976	600	2.0
1977	400	1.5
1978	400	1.5
1979	400	1.5
1980	400	1.5
1981 & Newer	220	1.2
Heavy Duty Trucks (6000 GVWR Or Greater)		

1967 Or Earlier	1500	7.0
1968-69	1200	6.5
1969	1200	6.5
1970	1000	5.5
1971	1000	5.5
1972	1000	5.5
1973	1000	5.5
1974	1000	5.5
1975	1000	5.5
1976	1000	5.5
1977	1000	5.5
1978	1000	5.5
Heavy Duty Trucks (8501 GVWR Or Greater)		
1979	800	4.0
1980	800	3.5
1981	600	3.0
1982	600	3.0
1983	600	3.0
1984	600	3.0
1985	600	3.0
1986 & Newer	300	2.0

CONNECTICUT

CONNECTICUT EMISSION STANDARDS - IDLE TEST

Application	**HC ppm (CO)**
10,000 GVWR Or Less	
1979	250 (2.1)
1980	225 (2.0)
1981-82	200 (1.2)
1983	175 (1.0)
1984-87	150 (1.0)
1988 & Newer	125 (1.0)

DELAWARE

DELAWARE EMISSION STANDARDS - KENT, NEW CASTLE & SUSSEX COUNTIES (IDLE TEST)

Application	**HC ppm (CO %)**
Light Duty Vehicles (6000 GVWR Or Less)	
1968-70	900 (9.0)

1971-74	600 (6.0)
1975-79	400 (4.0)
1980	220 (2.0)
1981 & Newer	220 (1.2)
Light Duty Trucks (6001-8500 GVWR)	
1970-72	900 (9.0)
1973-78	600 (6.0)
1979-83	400 (4.0)
1984 & Newer	220 (1.2)

DISTRICT OF COLUMBIA

DISTRICT OF COLUMBIA EMISSION STANDARDS - IDLE TEST

Application	**HC ppm (CO %)**
Light Duty Vehicles & Trucks (26000 GVWR Or Less)	
1968-70	1250 (11.0)
1971-74	1200 (9.0)
1975-79	600 (6.5)
1980	300 (1.5)
1981 & Newer	220 (1.2)

GEORGIA

NOTE: **The Georgia program incorporates original U.S. EPA recommended start-up ASM2525 and ASM5015 standards for 1995 and older model year vehicles. Refer to appropriate model year range in appropriate table. See U. S. EPA ASM2525 & ASM5015 START-UP EMISSION STANDARDS.**

GEORGIA EMISSION STANDARDS - 2-SPEED IDLE TEST

Application (1)	**HC ppm (CO %)**
1979	500 (5.0)
1980	350 (3.5)
1981-83	250 (1.5)
1984 & Newer	220 (1.2)
(1) 8500 GVWR or less.	

IDAHO

IDAHO EMISSION STANDARDS - 2-SPEED IDLE TEST

Application	**HC ppm (CO %)**
Light Duty Vehicles	

8500 GVWR Or Less	
1965-74	900 (5.0)
1975-79	700 (3.0)
1980	400 (1.5)
1981 & Newer	220 (1.2)
Heavy Duty Trucks	
8501 GVWR Or More	
1965-74	900 (6.0)
1975-80	700 (5.0)
1981 & Newer	500 (3.0)

ILLINOIS

ILLINOIS EMISSION STANDARDS - IM240 TEST

Application	HC gpm	CO gpm
Light Duty Vehicles (6000 GVWR Or Less)		
1981-82	2.00	60.0
1983-87	2.00	30.0
1988-95	0.80	15.0
1996 & Newer	0.60	10.0
Light Duty Trucks (6000 GVWR Or Less)		
1981-83	7.50	100.0
1984-87	3.20	80.0
1988-95	1.60	40.0
1996 & Newer (3750 LVW Or More) (1)	0.80	13.0
1996 & Newer (3750 LVW Or Less) (1)	0.60	10.0
Light Duty Trucks (6001-6500 GVWR)		
1981-83	7.50	100.0
1984-87	3.20	80.0
1988-95	1.60	40.0
1996 & Newer (5750 ALVW Or More)	0.80	15.0
1996 & Newer (5750 ALVW Or Less)	0.80	13.0
(1) Loaded Vehicle Weight (LVW) is vehicle curb weight plus 300 lbs.		

ILLINOIS EMISSION STANDARDS - IDLE TEST

Application	HC ppm (CO %)
Passenger Vehicles (6000 GVWR Or Less)	
1968-71	900 (9.0)
1972-74	800 (8.0)
1975-77	700 (7.0)

1978-79	600 (6.0)
1980	300 (3.0)
1981 & Newer	220 (1.2)
Light Duty Vehicles (8000 GVWR Or Less)	
1968-71	900 (9.0)
1972-74	800 (8.0)
1975-78	700 (7.0)
1979-80	600 (6.0)
1981-83	300 (3.0)
1984 & Newer	220 (1.2)
Heavy Duty Vehicles (8001 GVWR Or More)	
1968-71	1500 (9.5)
1972-78	900 (9.0)
1979-84	700 (7.0)
1985 & Newer	300 (3.0)

INDIANA

INDIANA EMISSION STANDARDS - IM93 TEST

Application	**HC gpm (CO gpm)**	**NOx (gpm)**
Passenger Cars		
1981-82	2.0 (60)	3.0
1983-86	2.0 (30)	3.0
1987-90	1.4 (20)	3.0
1991-95	0.8 (15)	2.5
1996 & Newer	0.6 (10)	2.5
Light Duty Trucks (6000 GVWR Or Less)		
1981-83	5.0 (80)	7.0
1984-86	3.2 (70)	7.0
1987-90	2.2 (55)	3.5
1991-95	1.6 (40)	3.0
1996 & Newer	0.8 (20)	3.0
Light Duty Trucks (6001-8500 GVWR)		
1981-83	5.0 (80)	7.0
1984-86	3.2 (70)	7.0
1987-90	2.2 (55)	5.0
1991-96	1.6 (40)	4.5
1997 & Newer	0.8 (20)	4.5
Heavy Duty Trucks (8501-9000 GVWR)		
1981-82	7.5 (100)	8.0
1983-84	6.0 (100)	8.0

1985-86	5.0 (75)	8.0
1987-90	3.0 (60)	8.0
1991-97	2.4 (40)	8.0
1998 & Newer	2.0 (30)	6.0

INDIANA EMISSION STANDARDS - IDLE TEST

Application	HC ppm (CO %)
Passenger Cars	
1976-79	350 (3.5)
1980	250 (2.0)
1981 & Newer	220 (1.2)
Light Duty Trucks (6000 GVWR Or Less)	
1976-78	500 (5.0)
1979-83	350 (3.5)
1984 & Newer	220 (1.2)
Medium Duty Trucks (6001-8500 GVWR)	
1976-78	500 (5.0)
1979-83	350 (3.5)
1984 & Newer	220 (1.2)

KENTUCKY

NOTE: Currently, there is no emission testing in Kentucky.

KENTUCKY EMISSION STANDARDS - BOONE, CAMPBELL & KENTON COUNTIES (IDLE TEST)

Application	HC ppm (CO)
Passenger Cars (Automobiles)	
1968	950 (8.5)
1969	900 (8.5)
1970	850 (8.1)
1972	800 (8.0)
1973	800 (7.8)
1974	800 (7.6)
1975	700 (7.5)
1976	700 (6.5)
1977	650 (6.3)
1978	600 (5.5)
1979	600 (4.5)
1980	250 (2.5)
1981 & Newer	220 (1.2)

Light Duty Trucks (6000 GVWR Or Less)	
1968	1300 (8.0)
1969	1200 (8.0)
1970-71	1100 (8.0)
1972-73	1000 (7.8)
1974	950 (7.8)
1975	900 (7.0)
1976-77	700 (7.0)
1978	700 (6.3)
1979	450 (5.5)
1980	450 (4.0)
1981	350 (1.7)
1982 & Newer	220 (1.2)
Light Duty Trucks (6001-10,000 GVWR)	
1969	1500 (9.0)
1970	1100 (8.0)
1971	1000 (8.0)
1972-75	950 (7.5)
1976	900 (7.5)
1977	850 (7.5)
1978	700 (6.0)
1979	650 (5.5)
1980	550 (5.0)
1981	450 (4.0)
1982	400 (2.5)
1983	350 (2.0)
1984	220 (1.5)
1985 & Newer	220 (1.2)
Heavy Duty Trucks (10,001-18,000 GVWR)	
1968	1500 (9.0)
1969-70	1300 (8.5)
1971	1200 (8.5)
1972-76	1000 (7.0)
1977-80	900 (6.5)
1982-83	400 (3.0)
1984 & Newer	250 (1.5)

MARYLAND

MARYLAND EMISSION STANDARDS - IM240 TEST

Application	HC gpm (CO gpm)	NOx gpm

Light Duty Vehicles (6000 GVWR Or Less)		
1984-87	1.80 (30.0)	2.8
1988-90	1.40 (30.0)	2.5
1991-93	1.00 (20.0)	2.2
1994-95	0.90 (20.0)	2.1
Light Duty Trucks (6000 GVWR Or Less)		
1984-87	2.80 (80.0)	5.8
1988-90	2.40 (80.0)	3.0
1991-93	2.00 (60.0)	2.7
1994-95	1.80 (60.0)	2.6
Light Duty Trucks (6001-8500 GVWR)		
1984-87	2.90 (80.0)	6.6
1988-90	2.40 (80.0)	4.2
1991-93	2.00 (60.0)	4.0
1994-95	1.80 (60.0)	3.7
Heavy Duty Trucks (8501-9999 GVWR)		
1984	5.80 (100.0)	7.7
1985-86	4.70 (80.0)	7.7
1987	3.00 (80.0)	7.7
1988-90	2.60 (80.0)	7.0
1991-97	2.50 (60.0)	5.5
1998 & Newer	2.20 (60.0)	4.0

MARYLAND EMISSION STANDARDS - IDLE TEST

Application	**HC ppm (CO %)**
Light Duty Vehicles (6000 GVWR Or Less)	
1977	500 (6.0)
1978	430 (5.5)
1979	400 (4.0)
1980	220 (1.7)
1981 & Newer	220 (1.2)
Light Duty Trucks (6001-9999 GVWR)	
1977	580 (7.0)
1978	550 (6.7)
1979	470 (5.0)
1980	350 (5.0)
1981	250 (3.0)
1982	220 (2.5)
1983	220 (1.5)
1984 & Newer	220 (1.2)
Heavy Duty Trucks (10,000-26,000 GVWR)	

1977-78	650 (7.0)
1979	650 (6.5)
1980-82	500 (6.0)
1983	500 (3.5)
1984-85	440 (3.0)
1986	280 (2.5)
1987 & Newer	220 (1.2)

MASSACHUSETTS

MASSACHUSETTS EMISSION STANDARDS - MA31 TEST

Application	HC gpm (CO gpm)	NOx gpm
Passenger Cars		
1984-90	2.0 (30)	3.0
1991-95	1.2 (20)	2.5
1996 & Newer	0.8 (13)	2.0
Light Duty Trucks (6000 GVWR Or Less)		
1984-87	3.2 (80)	7.0
1988-1990	3.2 (80)	3.5
1991-95	2.4 (60)	3.0
1996 & Newer (3750 LVW (1) Or Less)	0.8 (15)	2.0
1996 & Newer (3751 LVW (1) Or Greater)	1.0 (20)	2.5
Light Duty Trucks (6001-8500 GVWR)		
1984-87	3.2 (80)	7.0
1988-90	3.2 (80)	5.0
1991-95	2.4 (60)	4.5
1996 & Newer (5750 ALVW (2) Or Less)	1.0 (20)	2.5
1996 & Newer (5751 ALVW (2) Or Greater)	2.4 (60)	4.0
Heavy Duty Trucks (8501-10,000 Or Greater)		
1984-87	3.2 (80)	7.0
1988-90	3.2 (80)	5.0
1991-95	2.4 (60)	4.5
1996 & Newer	2.4 (60)	4.0

(1) Loaded Vehicle Weight (LVW).

(2) Adjusted Loaded Vehicle Weight (ALVW).

MASSACHUSETTS EMISSION STANDARDS - 2-SPEED IDLE TEST

Application	HC ppm (CO %)
All Vehicles	
1984-86	220 (0.80)

1987 & Newer	100 (0.60)

MISSOURI

MISSOURI EMISSION STANDARDS - JEFFERSON, ST. CHARLES & ST. LOUIS COUNTIES - IM240 TEST

Application	HC gpm (CO gpm)	NOx gpm
Light Duty Vehicles (6000 GVWR Or Less)		
1981-82	0.80 (30.0)	2.0
1983-95	0.80 (15.0)	2.0
1996 & Newer	0.60 (10.0)	1.5
Light Duty Trucks (6000 GVWR Or Less)		
1981-83	3.40 (70.0)	4.5
1984-87	1.60 (40.0)	4.5
1988-95	1.60 (40.0)	2.5
1996 & Newer (Less Than 3750 LVW)	0.80 (13.0)	1.8
1996 & Newer (3750 LVW Or Less)	0.60 (10.0)	1.5
Light Duty Trucks (6001-8500 GVWR)		
1981-83	3.4 (70.0)	4.5
1984-87	1.6 (40.0)	4.5
1988-95	1.60 (40.0)	3.5
1996 & Newer (5750 ALVW Or Less)	0.80 (13.0)	1.8
1996 & Newer (5750 ALVW Or More)	0.80 (15.0)	2.0

MISSOURI EMISSION STANDARDS - FRANKLIN, JEFFERSON, ST. CHARLES & ST. LOUIS COUNTIES - IDLE TEST

Application (1)	HC ppm (CO %)
1971-74	700 (7.0)
1975-79	600 (6.0)
1980	300 (3.0)
1981 & Newer	220 (1.2)
(1) 8500 GVWR or less.	

MISSOURI EMISSION STANDARDS - FRANKLIN, JEFFERSON, ST. CHARLES & ST. LOUIS COUNTIES - REMOTE SENSING CLEAN SCREEN TEST

Application (1)	HC ppm (CO %)	NOx ppm
All Vehicles (8500 GVWR Or Less)		
1971 & Newer	200 (0.5)	2000
(1) 8500 GVWR or less.		

NEVADA

NEVADA EMISSION STANDARDS - 2-SPEED IDLE TEST

Application	HC ppm (CO %)
Light Duty Vehicles (8500 GVWR Or Less)	
1968-69	800 (4.0)
1970-74	700 (3.5)
1975-78	500 (2.5)
1979-80	500 (2.0)
1981 & Newer	220 (1.2)
Heavy Duty Vehicles (8501 GVWR Or More)	
1968-69	1400 (7.0)
1970-78	1400 (6.0)
1979	1000 (5.0)
1980	1000 (4.0)
1981 & Newer	1000 (3.5)

NEW JERSEY

NOTE: **The New Jersey program incorporates original U.S. EPA recommended start-up ASM5015 standards for 1981 and newer model year vehicles. Refer to appropriate model year range in appropriate table. See U. S. EPA ASM2525 & ASM5015 START-UP EMISSION STANDARDS.**

NEW JERSEY EMISSION STANDARDS - 2-SPEED IDLE TEST

Application	Idle HC ppm (CO %)	2500 RPM HC ppm (CO %)
Light Duty Vehicles (8500 GVWR Or Less)		
1967 & Earlier	1400 (8.5)	.....
1968-70	700 (7.0)	.....
1971-74	500 (5.0)	.....
1975-80	300 (3.0)	.....
1981 & Newer	220 (1.2)	100 (0.5)
Heavy Duty Vehicles (8501 GVWR Or Greater)		
1967 & Earlier	1400 (8.5)	.....
1968-70	1200 (8.5)	.....
1971-74	700 (6.0)	.....
1975-78	500 (4.0)	.....
1979 & Earlier	300 (3.0)	.....

NEW MEXICO

NEW MEXICO EMISSION STANDARDS - 2-SPEED IDLE TEST

Application	Idle HC ppm (CO %)	2500 RPM HC ppm (CO %)
Light Duty Vehicles (6000 GVWR Or Less)		
1975-78	500 (5.0)	500 (5.0)
1979-80	400 (4.0)	400 (4.0)
1981-85	220 (1.2)	220 (1.2)
1986-90	200 (1.2)	200 (1.2)
1991-95	180 (1.2)	180 (1.2)
Light Duty Trucks (6001-8000 GVWR)		
1975-78	600 (6.0)	600 (6.0)
1979-80	600 (4.5)	600 (4.5)
1981-82	400 (2.7)	400 (3.0)
1983-88	300 (1.2)	300 (3.0)
1989-95	220 (1.2)	220 (1.2)
Medium Duty Trucks (8001-10,000 GVWR)		
1975 & Newer	650 (6.5)	650 (6.5)

NEW YORK

NEW YORK EMISSION STANDARDS - IM240 TEST

Application	HC gpm Composite	HC gpm Phase 2	CO gpm Composite	CO gpm Phase 2	NOx gpm Both
Light Duty Vehicles					
1981-82	0.80	0.50	30.0	24.0	2.0
1983-95	0.80	0.50	15.0	12.0	2.0
1996 & Newer	0.60	0.40	10.0	8.0	1.5
Light Duty Trucks (6000 GVWR Or Less)					
1981-83	3.40	2.00	70.0	56.0	4.5
1984-87	1.60	1.00	40.0	32.0	4.5
1988-95	1.60	1.00	40.0	32.0	2.5
1996 & Newer (3750 LVW Or Less)	0.60	0.40	10.0	8.0	1.5
1996 & Newer (3751 LVW Or More)	0.80	0.50	13.0	10.0	1.8
Light Duty Trucks (6501-8500 GVWR)					
1981-83	3.40	2.00	70.0	56.0	4.5
1984-87	1.60	1.00	40.0	32.0	4.5
1988-95	1.60	1.00	40.0	32.0	3.5
1996 & Newer (5750 ALVW Or Less)	0.80	0.50	13.0	10.0	1.8
1996 & Newer (5751 ALVW Or More)	0.80	0.50	15.0	12.0	2.0

NEW YORK EMISSION STANDARDS - IDLE TEST

Application	HC ppm (CO %)

Light Duty Vehicles (8500 GVWR Or Less)	
1978	300 (3.0)
1979-80	300 (2.5)
1981 & Newer	220 (1.2)
Heavy Duty Vehicles (8501 GVWR Or More)	
1978	600 (4.5)
1979 & Newer	300 (3.0)

NORTH CAROLINA

NORTH CAROLINA EMISSION STANDARDS - IDLE TEST

Application	HC ppm (CO %)
Light Duty Vehicles (8500 GVWR Or Less)	
1977	450 (4.5)
1978-79	350 (3.5)
1980	250 (2.0)
1981 & Newer	250 (1.2)
Heavy Duty Trucks (8501 GVWR Or More)	
1977-78	500 (5.0)
1979 & Newer	400 (4.0)

OHIO

NOTE: **The Ohio program incorporates original U.S. EPA recommended start-up ASM2525 standards for all model year vehicles. Refer to appropriate model year range in appropriate table. See U. S. EPA ASM2525 & ASM5015 START-UP EMISSION STANDARDS.**

OHIO EMISSION STANDARDS - 2-SPEED IDLE TEST

Application	HC ppm (CO %)
1978	350 (4.0)
1979	275 (3.0)
1980	230 (2.0)
1981 & Newer	220 (1.2)

OREGON

OREGON EMISSION STANDARDS - METROPOLITAN PORTLAND ENHANCED AREA - BAR31

Application	HC gpm (CO gpm)	NOx gpm
Light Duty Passenger Cars		
1981-82	2.0 (64)	3.70

1983-89	2.0 (32)	3.70
1990-95	1.2 (30)	3.00
1996 & Newer	OBD-II Test	OBD-II Test
Light Duty Trucks (6000 GVWR Or Less)		
1981-83	8.5 (149)	8.32
1984-87	4.0 (85)	8.32
1988-89	4.0 (85)	4.62
1990-95	2.4 (80)	3.75
1996 & Newer	OBD-II Test	OBD-II Test
Light Duty Trucks (6001-8500 GVWR)		
1981-83	8.5 (149)	8.32
1984-87	4.0 (85)	8.32
1988-89	4.0 (85)	6.47
1990-95	2.4 (80)	5.25
1996 & Newer	OBD-II Test	OBD-II Test

OREGON EMISSION STANDARDS - METROPOLITAN PORTLAND & ROGUE VALLEY AREA BASIC TEST - 2-SPEED IDLE TEST

Application	Idle HC ppm (CO %)	2500 RPM HC ppm (CO %)
Light Duty Passenger Cars (6000 GVWR Or Less)		
1975-80 (No Catalyst)	300 (2.5)	-
1975-80 (Catalyst)	220 (1.0)	-
1981 & Newer (All)	220 (1.0)	220 (1.0)
1975 & Newer (2-Stroke)	n/a (7.0)	-
Light Duty Trucks (6001-8500 GVWR)		
1975-78 (All)	350 (2.5)	-
1979-80 (No Catalyst)	300 (2.5)	-
1979-80 (Catalyst)	220 (1.0)	-
1981 & Newer (All)	220 (1.0)	220 (1.0)
1996 & Newer (3750 LVW Or Less)	0.9 (20)	2.25
Heavy Duty Trucks (8501 GVWR Or More)		
1975-78 (Carbureted)	500 (4.0)	n/a (3.0)
1975-78 (Fuel Injection)	500 (4.0)	-
1979-84 (Carbureted)	350 (3.0)	n/a (3.0)
1979-84 (Fuel Injection)	350 (3.0)	-
1985 & Newer (No Catalyst)	350 (3.0)	n/a (3.0)
1985 & Newer (W/Catalyst)	220 (1.0)	220 (1.0)

OREGON EMISSION STANDARDS - METROPOLITAN PORTLAND & ROGUE VALLEY AREA BASIC TEST - EXHAUST OPACITY TEST

Application	Opacity % @ Idle	Opacity % @

		High Idle
1975 & Newer		
2-Cycle Engines	20	.....
Gasoline Engines	0	0

PENNSYLVANIA

NOTE: The Pennsylvania (in Philadelphia area) program incorporates original U.S. EPA recommended start-up ASM5015 standards for 1981 and newer model year vehicles. Refer to appropriate model year range in appropriate table. See **U. S. EPA ASM2525 & ASM5015 START-UP EMISSION STANDARDS****.**

PENNSYLVANIA EMISSION STANDARDS - PITTSBURGH & OLDER PHILADELPHIA VEHICLES - IDLE TEST

Application	HC ppm (CO %)
6000 GVWR Or Less	
1975-79	400 (4.0)
1980	300 (3.0)
1981-92	220 (1.2)
1993 & Newer	130 (1.0)
6001-9000 GVWR	
1975-78	650 (6.0)
1979	400 (4.0)
1980	300 (3.0)
1981-92	220 (1.2)
1993 & Newer	180 (1.0)

RHODE ISLAND

RHODE ISLAND EMISSION STANDARDS - RI2000 TEST

Application	HC gpm (CO gpm)	NOx gpm
Light Duty Vehicles		
1974 & Earlier	15.92 (132.44)	14.92
1975-76	6.74 (96.21)	9.92
1977-79	6.74 (96.21)	6.59
1980	2.25 (45.48)	6.59
1981-82	2.25 (45.48)	3.25
1983-95	2.25 (23.74)	3.25
1996 & Newer	1.84 (16.50)	2.42
Light Duty Trucks (6000 GVWR Or Less)		
1975 & Earlier	16.94 (175.92)	14.92

1975-78	8.78 (117.95)	9.92
1979-83	7.55 (103.45)	7.42
1984-87	3.88 (59.97)	7.42
1988-90	3.88 (59.97)	4.09
1991-95	3.88 (59.97)	4.09
1996 & Newer (3750 LVW Or Less)	1.84 (16.50)	2.42
1996 & Newer (3751 LVW Or More)	2.25 (20.84)	2.92
Light Duty Trucks (6001-8500 GVWR)		
1974 & Earlier	16.94 (175.92)	14.92
1975-78	8.78 (117.95)	9.92
1979-83	7.55 (103.45)	7.42
1984-87	3.88 (59.97)	7.42
1989-90	3.88 (59.97)	5.75
1991-95	3.88 (59.97)	5.75
1996 & Newer (5750 LVW Or Less)	2.25 (20.84)	2.92
1996 & Newer (5751 LVW or More)	5.51 (23.74)	3.25

RHODE ISLAND EMISSION STANDARDS - 2-SPEED IDLE TEST

Application Idle [1]	**HC ppm (CO %)**
1967 & Earlier	800 (7.0)
1968-74	700 (6.0)
1975-78	300 (3.0)
1979-80	300 (2.5)
1981 & Newer	220 (1.2)
(1) 8500 GVWR or less.	

TENNESSEE

TENNESSEE EMISSION STANDARDS - MEMPHIS - IDLE TEST

Application	**HC ppm (CO %)**
Light Duty Vehicles (9000 GVWR Or Less)	
1971 & Older	900 (8.9)
1972-74	700 (8.2)
1975-79	600 (7.5)
1980	400 (4.7)
1981 & Newer	220 (1.2)
Heavy Duty Trucks (9001-25,999 GVWR)	
1971 & Older	1000 (8.9)
1972-74	1000 (8.2)
1975-79	1000 (8.0)
1980	800 (6.0)

1981 & Newer	400 (4.0)

TENNESSEE EMISSION STANDARDS - DAVIDSON & NASHVILLE COUNTIES - IDLE TEST

Application	HC ppm (CO %)
Light Duty Vehicles (6000 GVWR Or Less)	
1975-77	500 (5.0)
1978-79	400 (4.0)
1980	300 (3.0)
1981 & Newer	220 (1.2)
Medium Duty Trucks (6001-8500 GVWR)	
1975-77	750 (6.5)
1978-79	600 (6.0)
1980	400 (4.5)
1981 & Newer	400 (4.0)

TENNESSEE EMISSION STANDARDS - FOUR COUNTY AREA SURROUNDING NASHVILLE - IDLE TEST

Application	HC ppm (CO %)
Light Duty Vehicles (6000 GVWR Or Less)	
1975-77	500 (5.0)
1978-79	400 (4.0)
1980	300 (3.0)
1981 & Newer	220 (1.2)
Medium Duty Trucks (6001-8500 GVWR)	
1975-77	750 (6.5)
1978-79	600 (6.0)
1980	400 (4.5)
1981 & Newer	400 (4.0)

TEXAS

NOTE: **The Texas program incorporates original U.S. EPA recommended start-up ASM2525 and ASM5015 standards for 1995 and newer model year vehicles. Refer to appropriate model year range in appropriate table. See U. S. EPA ASM2525 & ASM5015 START-UP EMISSION STANDARDS.**

TEXAS EMISSION STANDARDS - 2-SPEED IDLE TEST

Application	HC ppm (CO %)
Light Duty Vehicles (8500 GVWR Or Less)	
1979	600 (6.0)
1980	400 (4.0)
1981 & Newer	220 (1.2)

Heavy Duty Vehicles (8501 GVWR Or More)	
1979-81	700 (7.0)
1982-84	500 (5.0)
1985 & Newer	300 (3.0)

UTAH

UTAH EMISSION STANDARDS - DAVIS COUNTY - DC98 TEST

Application	HC gpm (CO gpm)	NOx gpm
Light Duty Vehicles (6000 GVWR Or Less)		
1989-90	2.00 (30)	3.0
1991-95	1.2 (20)	2.5
Light Duty Trucks (6000 GVWR Or Less)		
1989-90	3.2 (80)	3.5
1991-95	2.4 (60)	3.0
Light Duty Trucks (6001-8500 GVWR)		
1989-90	3.2 (80)	5.0
1991-95	2.4 (60)	4.5

UTAH EMISSION STANDARDS - DAVIS COUNTY - 2-SPEED IDLE TEST

Application	HC ppm (CO %)
Light Duty Vehicles (6000 GVWR Or Less)	
1968-69	800 (6.0)
1970-74	700 (5.0)
1975-76	600 (4.0)
1977-79	500 (3.0)
1980	300 (2.0)
1981-95	220 (1.2)
Light Duty Vehicles (6001-8500 GVWR)	
1968-69	1500 (7.0)
1970-78	1200 (5.0)
1979	500 (3.0)
1980	300 (2.0)
1981-95	220 (1.2)
Heavy Duty Vehicles (8501 GVWR Or More)	
1968-69	1500 (7.0)
1970-78	1200 (5.0)
1979-80	1000 (4.0)
1981 & Newer	800 (3.5)

NOTE: The Salt Lake County program incorporates California style ASM2525 and ASM5015 standards for 1968 and newer model year vehicles; however, actual cutpoints are unique to this program and current information is not available at this time.

UTAH EMISSION STANDARDS - SALT LAKE COUNTY - 2-SPEED IDLE TEST

Application	**HC ppm (CO %)**
Light Duty Vehicles (6000 GVWR Or Less)	
1968-69	800 (6.0)
1970-74	700 (5.0)
1975-76	600 (4.0)
1977-79	500 (3.0)
1980	300 (2.0)
1981 & Newer	220 (1.2)
Light Duty Trucks (6000 GVWR Or Less)	
1968-99	800 (6.0)
1970-74	700 (5.0)
1975-76	600 (4.0)
1977-79	500 (3.0)
1980	300 (2.0)
1981 & Newer	220 (1.2)
Light Duty Trucks (6001-8500 GVWR)	
1968-69	1500 (7.0)
1970-78	1200 (5.0)
1979	500 (3.0)
1980	300 (2.0)
1981 & Newer	220 (1.2)
Heavy Duty Trucks (8500 GVWR Or More)	
1968-69	1500 (7.0)
1970-78	1200 (5.0)
1979-80	1000 (4.0)
1981 & Newer	800 (3.5)

UTAH EMISSION STANDARDS - UTAH & WEBER COUNTIES - 2-SPEED IDLE TEST

Application	**HC ppm (CO %)**
Light Duty Vehicles (6000 GVWR Or Less)	
1968-69	800 (6.0)
1970-74	700 (5.0)
1975-76	600 (4.0)
1977-79	500 (3.0)
1980	300 (2.0)
1981-95	220 (1.2)

Light Duty Trucks (6000 GVWR Or Less)	
1968-99	800 (6.0)
1970-74	700 (5.0)
1975-76	600 (4.0)
1977-79	500 (3.0)
1980	300 (2.0)
1981 & Newer	220 (1.2)
Light Duty Trucks (6001-8500 GVWR)	
1968-69	1500 (7.0)
1970-78	1200 (5.0)
1979	500 (3.0)
1980	300 (2.0)
1981 & Newer	220 (1.2)
Heavy Duty Trucks (8500 GVWR Or More)	
1968-69	1500 (7.0)
1970-78	1200 (5.0)
1979-80	1000 (4.0)
1981 & Newer	800 (3.5)

VIRGINIA

NOTE: **The Virginia program incorporates original U.S. EPA recommended start-up ASM2525 and ASM5015 standards for 1981 and newer model year vehicles. Refer to appropriate model year range in appropriate table. See U. S. EPA ASM2525 & ASM5015 START-UP EMISSION STANDARDS.**

VIRGINIA EMISSION STANDARDS - 2-SPEED IDLE TEST

Application	HC ppm (CO %)
8500 GVWR Or Less	
1975-90	400 (4.0)
1980	220 (2.0)
1981-89	220 (1.2)
1990-95	125 (1.0)
1996 & Newer	100 (0.75)
8501-10,000 GVWR	
1975-79	400 (4.0)
1980	220 (2.0)
1981-90	220 (1.2)
1991-96	150 (1.0)
1997 & Newer	125 (0.75)

WASHINGTON

WASHINGTON EMISSION STANDARDS - ASM2525 TEST

Application	HC ppm (CO %)
1980 & Earlier (Light-Duty Vehicles)	
1750 GVWR	400 (4.2)
1875 GVWR	380 (4.0)
2000 GVWR	350 (3.8)
2125 GVWR	340 (3.6)
2250 GVWR	320 (3.4)
2375 GVWR	300 (3.2)
2500 GVWR	290 (3.0)
2625 GVWR	270 (2.9)
2750 GVWR	260 (2.8)
2875 GVWR	250 (2.7)
3000 GVWR	240 (2.6)
3125 GVWR	230 (2.5)
3250 GVWR	220 (2.4)
3375 GVWR	220 (2.3)
3500 GVWR	210 (2.2)
3625 GVWR	200 (2.1)
3750 Or Greater GVWR (Passenger Cars Only)	200 (2.1)
3750 Or Greater GVWR (Light Duty Trucks)	300 (2.5)
1981 & Newer (Light-Duty Vehicles)	
1750 GVWR	250 (1.8)
1875 GVWR	240 (1.7)
2000 GVWR	220 (1.6)
2125 GVWR	210 (1.5)
2250 GVWR	200 (1.5)
2375 GVWR	190 (1.4)
2500 GVWR	180 (1.3)
2625 GVWR	180 (1.3)
2750 GVWR	171 (1.2)
2875 GVWR	160 (1.2)
3000 GVWR	160 (1.1)
3125 GVWR	150 (1.1)
3250 GVWR	150 (1.0)
3375 GVWR	150 (1.0)
3500 GVWR	150 (1.0)
3625 GVWR	150 (1.0)
3750 Or Greater GVWR (Passenger Cars Only)	150 (1.0)
3750 Or Greater GVWR (Light Duty Trucks)	300 (2.5)

WASHINGTON EMISSION STANDARDS - 2-SPEED IDLE TEST

Application	Idle/2500 RPM HC ppm (CO %)
Light Duty Vehicles (8500 GVWR Or Less)	
1980 & Earlier	600 (3.0)
1981 & Newer	220 (1.2)
Heavy Duty Trucks (8500 GVWR Or More)	
1981 & Newer	400 (3.0)

WISCONSIN

WISCONSIN EMISSION STANDARDS - IM240 TEST

Application	HC gpm (CO gpm)	NOx gpm
Light Duty Vehicles (6000 GVWR Or Less)		
1968-72	7.0 (120)	7.0
1973-74	7.0 (120)	6.0
1975-76	3.0 (65)	6.0
1977-79	3.0 (65)	4.0
1980	2.0 (60)	4.0
1981-82	2.0 (60)	3.0
1983-86	2.0 (30)	3.0
1987-93	0.8 (15)	2.0
1991-95	0.8 (15)	2.0
1996 & Newer	0.6 (10)	1.5
Light Duty Trucks (6000 GVWR Or Less)		
1968-72	7.0 (120)	7.0
1973-74	7.0 (120)	6.0
1975-78	4.0 (80)	6.0
1979-83	3.4 (70)	4.5
1984-86	3.2 (70)	4.5
1987	1.6 (40)	4.5
1988-95	1.6 (40)	2.5
1996 & Newer (3750 LVW Or Less)	0.6 (10)	1.5
1996 & Newer (3751 LVW Or More)	0.8 (13)	1.8
Light Duty Trucks (6001-8500 GVWR)		
1968-72	7.0 (120)	7.0
1973-74	7.0 (120)	6.0
1975-78	4.0 (80)	6.0
1979-83	3.4 (70)	4.5
1984-86	3.2 (70)	4.5
1988-96	1.6 (40)	3.5

1997 & Newer (5750 ALVW Or Less)	0.8 (13)	1.8
1997 & Newer (5751 ALVW Or More)	0.8 (15)	2.0
Heavy Duty Trucks (8501-10,000 GVWR)		
1968-69	20.0 (200)	15.0
1970-73	10.0 (175)	10.0
1974-78	10.0 (150)	10.0
1979-84	7.5 (100)	8.0
1985-86	5.0 (80)	8.0
1987-90	2.0 (40)	6.0
1991-97	2.0 (40)	5.0
1998 & Newer	2.0 (30)	4.0
Heavy Duty Trucks (10,001 GVWR or More)		
1968-69	24.0 (250)	30.0
1970-73	13.0 (175)	20.0
1974-78	13.0 (150)	20.0
1979-84	11.5 (150)	16.0
1985-86	10.0 (150)	16.0
1987-90	3.5 (70)	11.0
1991-97	3.5 (70)	9.0
1998 & Newer	3.5 (60)	7.0

WISCONSIN EMISSION STANDARDS - 2-SPEED IDLE TEST

Application	**HC ppm (CO %)**
Passenger Cars	
1968-71	800 (8.0)
1972-74	550 (7.0)
1975-77	450 (5.5)
1978	350 (4.0)
1979	275 (3.0)
1980	230 (2.0)
1981 & Newer	220 (1.2)
Light Duty Trucks (6000 GVWR Or Less)	
1968-71	800 (8.0)
1972-74	700 (7.0)
1975-77	500 (6.0)
1978	450 (5.0)
1979	300 (3.0)
1980	275 (2.5)
1981-84	250 (2.0)
1985 & Newer	220 (1.2)
Light Duty Trucks (6001-8500 GVWR)	

1968-69	1450 (9.0)
1970-71	800 (8.0)
1972-74	700 (7.0)
1975-77	550 (6.5)
1978	450 (5.5)
1979	300 (3.0)
1980	275 (2.5)
1981-84	250 (2.0)
1985 & Newer	220 (1.2)
Heavy Duty Trucks (8501 GVWR Or More)	
1968-71	1500 (9.5)
1972-78	900 (9.0)
1979-84	700 (7.0)
1985 & Newer	300 (3.0)

U. S. EPA ASM2525 & ASM5015 START-UP EMISSION STANDARDS

U.S. EPA ASM EMISSION STANDARDS - 1968-72 LIGHT DUTY VEHICLES

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	1118 (8.02)	4990	1098 (9.90)	4990
1875	1052 (7.56)	4990	1034 (9.90)	4990
2000	992 (7.14)	4990	975 (9.90)	4990
2125	938 (6.75)	4990	921 (9.66)	4990
2250	887 (6.40)	4990	872 (9.14)	4990
2375	841 (6.07)	4990	827 (8.67)	4990
2500	800 (5.78)	4990	786 (8.25)	4990
2625	761 (5.51)	4990	748 (7.85)	4990
2750	726 (5.26)	4990	714 (7.50)	4772
2875	695 (5.03)	4892	683 (7.17)	4556
3000	666 (4.83)	4680	654 (6.87)	4359
3125	639 (4.64)	4488	628 (6.60)	4180
3250	615 (4.47)	4311	604 (6.35)	4016
3375	593 (4.31)	4150	583 (6.13)	3866
3500	573 (4.17)	4002	563 (5.92)	3728
3625	554 (4.04)	3867	544 (5.73)	3602
3750	537 (3.91)	3741	527 (5.55)	3485
3875	521 (3.80)	3625	512 (5.39)	3377
4000	506 (3.70)	3517	497 (5.24)	3276
4125	492 (3.60)	3416	484 (5.09)	3182

4250	479 (3.51)	3321	471 (4.96)	3094
4375	467 (3.42)	3230	459 (4.83)	3010
4500	455 (3.34)	3145	447 (4.71)	2930
4625	444 (3.26)	3063	436 (4.60)	2854
4750	433 (3.18)	2983	425 (4.49)	2780
4875	423 (3.11)	2907	415 (4.38)	2709
5000	412 (3.03)	2833	405 (4.28)	2540
5125	402 (2.97)	2760	395 (4.18)	2573
5250	393 (2.90)	2690	386 (4.08)	2507
5375	383 (2.83)	2621	376 (3.98)	2443
5500	374 (2.77)	2554	367 (3.89)	2381
5625	365 (2.70)	2489	359 (3.80)	2321
5750	357 (2.64)	2426	350 (3.71)	2262
5875	348 (2.59)	2366	342 (3.62)	2206
6000	341 (2.53)	2308	334 (3.54)	2152
6125	333 (2.48)	2254	327 (3.47)	2102
6250	326 (2.43)	2204	320 (3.40)	2056
6375	320 (2.39)	2159	314 (3.34)	2014
6500	315 (2.35)	2119	309 (3.28)	1977
6625	310 (2.32)	2087	304 (3.23)	1947
6750	307 (2.29)	2062	301 (3.20)	1924
6875	305 (2.28)	2046	299 (3.17)	1909
7000	304 (2.27)	2040	298 (3.17)	1904
7125 Or More	304 (2.27)	2045	298 (3.17)	1904

U.S. EPA ASM EMISSION STANDARDS - 1973-74 LIGHT DUTY VEHICLES

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	1118 (8.02)	4990	1098 (9.90)	4980
1875	1052 (7.56)	4990	1034 (9.90)	4906
2000	992 (7.14)	4919	975 (9.90)	4838
2125	938 (6.75)	4853	921 (9.66)	4776
2250	887 (6.40)	4792	872 (9.14)	4720
2375	841 (6.07)	4736	827 (8.67)	4668
2500	800 (5.78)	4685	786 (8.25)	4620
2625	761 (5.51)	4639	748 (7.85)	4577
2750	726 (5.26)	4596	714 (7.50)	4374
2875	695 (5.03)	4484	683 (7.17)	4176
3000	666 (4.83)	4290	654 (6.87)	3996
3125	639 (4.64)	4114	628 (6.60)	3832

3250	615 (4.47)	3952	604 (6.35)	3681
3375	593 (4.31)	3804	583 (6.13)	3544
3500	573 (4.17)	3669	563 (5.92)	3418
3625	554 (4.04)	3544	544 (5.73)	3302
3750	537 (3.91)	3429	527 (5.55)	3195
3875	521 (3.80)	3323	512 (5.39)	3096
4000	506 (3.70)	3224	497 (5.24)	3003
4125	492 (3.60)	3131	484 (5.09)	2917
4250	479 (3.51)	3044	471 (4.96)	2836
4375	467 (3.42)	2961	459 (4.83)	2759
4500	455 (3.34)	2883	447 (4.71)	2686
4625	444 (3.26)	2807	436 (4.60)	2616
4750	433 (3.18)	2735	425 (4.49)	2549
4875	423 (3.11)	2665	415 (4.38)	2483
5000	412 (3.03)	2597	405 (4.28)	2420
5125	402 (2.97)	2530	395 (4.18)	2359
5250	393 (2.90)	2466	386 (4.08)	2298
5375	383 (2.83)	2403	376 (3.98)	2240
5500	374 (2.77)	2341	367 (3.89)	2183
5625	365 (2.70)	2282	359 (3.80)	2127
5750	357 (2.64)	2224	350 (3.71)	2074
5875	348 (2.59)	2168	342 (3.62)	2022
6000	341 (2.53)	2116	334 (3.54)	1973
6125	333 (2.48)	2066	327 (3.47)	1927
6250	326 (2.43)	2020	320 (3.40)	1884
6375	320 (2.39)	1979	314 (3.34)	1846
6500	315 (2.35)	1943	309 (3.28)	1813
6625	310 (2.32)	1913	304 (3.23)	1785
6750	307 (2.29)	1890	301 (3.20)	1764
6875	305 (2.28)	1875	299 (3.17)	1750
7000	304 (2.27)	1870	298 (3.17)	1745
7125 Or More	304 (2.27)	1874	298 (3.17)	1745

U.S. EPA ASM EMISSION STANDARDS - 1975-76 LIGHT DUTY VEHICLES

Test Weight	**ASM5015**		**ASM2525**	
	HC ppm (CO %)	**NOx ppm**	**HC ppm (CO %)**	**NOx ppm**
1750	774 (3.92)	4990	761 (5.45)	4980
1875	729 (3.70)	4990	717 (5.14)	4906
2000	688 (3.49)	4919	676 (4.85)	4838
2125	650 (3.31)	4853	638 (4.58)	4776

2250	615 (3.13)	4792	604 (4.34)	4720
2375	583 (2.98)	4736	573 (4.12)	4668
2500	554 (2.83)	4685	544 (3.91)	4620
2625	528 (2.70)	4639	518 (3.73)	4577
2750	503 (2.58)	4596	495 (3.56)	4374
2875	481 (2.47)	4484	473 (3.41)	4176
3000	461 (2.37)	4290	453 (3.27)	3996
3125	443 (2.28)	4114	435 (3.14)	3832
3250	426 (2.20)	3952	419 (3.02)	3681
3375	411 (2.12)	3804	404 (2.91)	3544
3500	397 (2.05)	3669	390 (2.82)	3418
3625	384 (1.99)	3544	377 (2.73)	3302
3750	372 (1.93)	3429	365 (2.64)	3195
3875	361 (1.87)	3323	355 (2.57)	3096
4000	351 (1.82)	3224	345 (2.49)	3003
4125	341 (1.77)	3131	335 (2.43)	2917
4250	332 (1.73)	3044	326 (2.36)	2836
4375	323 (1.68)	2961	318 (2.31)	2759
4500	315 (1.64)	2883	310 (2.25)	2686
4625	308 (1.61)	2807	302 (2.19)	2616
4750	300 (1.57)	2735	295 (2.14)	2549
4875	293 (1.53)	2665	288 (2.09)	2483
5000	286 (1.50)	2597	281 (2.04)	2420
5125	279 (1.46)	2530	274 (2.00)	2359
5250	272 (1.43)	2466	267 (1.95)	2298
5375	266 (1.40)	2403	261 (1.90)	2240
5500	259 (1.37)	2341	255 (1.86)	2183
5625	253 (1.34)	2282	248 (1.82)	2127
5750	247 (1.31)	2224	243 (1.78)	2074
5875	241 (1.28)	2168	237 (1.74)	2022
6000	236 (1.25)	2116	232 (1.70)	1973
6125	231 (1.23)	2066	227 (1.66)	1927
6250	226 (1.20)	2020	222 (1.63)	1884
6375	222 (1.18)	1979	218 (1.60)	1846
6500	218 (1.16)	1943	214 (1.57)	1813
6625	215 (1.15)	1913	211 (1.55)	1785
6750	213 (1.14)	1890	209 (1.54)	1764
6875	211 (1.13)	1875	207 (1.52)	1750
7000	211 (1.12)	1870	207 (1.52)	1745
7125 Or More	211 (1.12)	1874	206 (1.52)	1745

U.S. EPA ASM EMISSION STANDARDS - 1977-79 LIGHT DUTY VEHICLES

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	774 (3.92)	4990	761 (5.45)	4950
1875	729 (3.70)	4990	717 (5.14)	4655
2000	688 (3.49)	4707	676 (4.85)	4384
2125	650 (3.31)	4441	638 (4.58)	4136
2250	615 (3.13)	4197	604 (4.34)	3909
2375	583 (2.98)	3974	573 (4.12)	3701
2500	554 (2.83)	3771	544 (3.91)	3512
2625	528 (2.70)	3585	518 (3.73)	3339
2750	503 (2.58)	3416	495 (3.56)	3181
2875	481 (2.47)	3261	473 (3.41)	3037
3000	461 (2.37)	3120	453 (3.27)	2906
3125	443 (2.28)	2992	435 (3.14)	2787
3250	426 (2.20)	2874	419 (3.02)	2677
3375	411 (2.12)	2767	404 (2.91)	2577
3500	397 (2.05)	2668	390 (2.82)	2486
3625	384 (1.99)	2578	377 (2.73)	2401
3750	372 (1.93)	2494	365 (2.64)	2323
3875	361 (1.87)	2417	355 (2.57)	2251
4000	351 (1.82)	2345	345 (2.49)	2184
4125	341 (1.77)	2277	335 (2.43)	2122
4250	332 (1.73)	2214	326 (2.36)	2063
4375	323 (1.68)	2154	318 (2.31)	2007
4500	315 (1.64)	2096	310 (2.25)	1953
4625	308 (1.61)	2042	302 (2.19)	1903
4750	300 (1.57)	1989	295 (2.14)	1854
4875	293 (1.53)	1938	288 (2.09)	1806
5000	286 (1.50)	1889	281 (2.04)	1760
5125	279 (1.46)	1840	274 (2.00)	1715
5250	272 (1.43)	1793	267 (1.95)	1672
5375	266 (1.40)	1747	261 (1.90)	1629
5500	259 (1.37)	1703	255 (1.86)	1587
5625	253 (1.34)	1659	248 (1.82)	1547
5750	247 (1.31)	1617	243 (1.78)	1508
5875	241 (1.28)	1577	237 (1.74)	1471
6000	236 (1.25)	1539	232 (1.70)	1435
6125	231 (1.23)	1503	227 (1.66)	1401
6250	226 (1.20)	1469	222 (1.63)	1371

6375	222 (1.18)	1439	218 (1.60)	1343
6500	218 (1.16)	1413	214 (1.57)	1318
6625	215 (1.15)	1391	211 (1.55)	1298
6750	213 (1.14)	1374	209 (1.54)	1283
6875	211 (1.13)	1364	207 (1.52)	1273
7000 Or More	211 (1.12)	1360	207 (1.52)	1269

U.S. EPA ASM EMISSION STANDARDS - 1980 LIGHT DUTY VEHICLES

Test Weight	**ASM5015**		**ASM2525**	
	HC ppm (CO %)	**NOx ppm**	**HC ppm (CO %)**	**NOx ppm**
1750	291 (2.78)	4990	282 (3.64)	4950
1875	275 (2.63)	4990	266 (3.43)	4655
2000	260 (2.48)	4707	252 (3.24)	4384
2125	246 (2.35)	4441	239 (3.06)	4136
2250	234 (2.23)	4197	227 (2.90)	3909
2375	223 (2.12)	3974	216 (2.76)	3701
2500	212 (2.02)	3771	206 (2.62)	3512
2625	203 (1.92)	3585	197 (2.50)	3339
2750	194 (1.84)	3416	189 (2.39)	3181
2875	187 (1.76)	3261	181 (2.29)	3037
3000	180 (1.69)	3120	174 (2.19)	2906
3125	173 (1.63)	2992	168 (2.11)	2787
3250	167 (1.57)	2874	162 (2.03)	2677
3375	162 (1.52)	2767	157 (1.96)	2577
3500	157 (1.47)	2668	152 (1.89)	2486
3625	152 (1.42)	2578	148 (1.84)	2401
3750	148 (1.38)	2492	144 (1.78)	2323
3875	144 (1.34)	2417	140 (1.73)	2251
4000	140 (1.31)	2345	137 (1.68)	2184
4125	137 (1.27)	2277	133 (1.64)	2122
4250	134 (1.24)	2214	130 (1.60)	2063
4375	131 (1.21)	2154	127 (1.56)	2007
4500	128 (1.18)	2096	124 (1.52)	1953
4625	125 (1.15)	2042	122 (1.48)	1903
4750	122 (1.13)	1989	119 (1.45)	1854
4875	120 (1.10)	1938	117 (1.42)	1806
5000	117 (1.08)	1889	114 (1.38)	1760
5125	115 (1.05)	1840	112 (1.35)	1715
5250	112 (1.03)	1793	110 (1.32)	1672
5375	110 (1.01)	1747	107 (1.29)	1629

5500	108 (0.99)	1703	105 (1.26)	1587
5625	106 (0.97)	1659	103 (1.24)	1547
5750	104 (0.94)	1617	101 (1.21)	1508
5875	102 (0.92)	1577	99 (1.18)	1471
6000	100 (0.91)	1539	97 (1.16)	1435
6125	98 (0.89)	1503	95 (1.13)	1401
6250	96 (0.87)	1469	94 (1.11)	1371
6375	95 (0.86)	1439	92 (1.09)	1343
6500	93 (0.84)	1413	91 (1.08)	1318
6625	92 (0.83)	1391	90 (1.06)	1298
6750	91 (0.82)	1374	89 (1.05)	1283
6875	91 (0.82)	1364	89 (1.04)	1273
7000	91 (0.82)	1360	88 (1.04)	1269
7125 Or More	90 (0.81)	1360	88 (1.04)	1269

U.S. EPA ASM EMISSION STANDARDS - 1981-82 LIGHT DUTY VEHICLES

Test Weight	**ASM5015**		**ASM2525**	
	HC ppm (CO %)	**NOx ppm**	**HC ppm (CO %)**	**NOx ppm**
1750	291 (2.78)	2272	282 (3.64)	2114
1875	275 (2.63)	2181	266 (3.43)	1991
2000	260 (2.48)	2058	252 (3.24)	1877
2125	246 (2.35)	1944	239 (3.06)	1774
2250	234 (2.23)	1839	227 (2.90)	1678
2375	223 (2.12)	1744	216 (2.76)	1592
2500	212 (2.02)	1657	206 (2.62)	1512
2625	203 (1.92)	1577	197 (2.50)	1440
2750	194 (1.84)	1504	189 (2.39)	1374
2875	187 (1.76)	1438	181 (2.29)	1313
3000	180 (1.69)	1378	174 (2.19)	1258
3125	173 (1.63)	1323	168 (2.11)	1208
3250	167 (1.57)	1273	162 (2.03)	1163
3375	162 (1.52)	1227	157 (1.96)	1121
3500	157 (1.47)	1184	152 (1.89)	1082
3625	152 (1.42)	1146	148 (1.84)	1047
3750	148 (1.38)	1110	144 (1.78)	1014
3875	144 (1.34)	1077	140 (1.73)	984
4000	140 (1.31)	1046	137 (1.68)	956
4125	137 (1.27)	1017	133 (1.64)	930
4250	134 (1.24)	990	130 (1.60)	905
4375	131 (1.21)	964	127 (1.56)	882

4500	128 (1.18)	939	124 (1.52)	859
4625	125 (1.15)	916	122 (1.48)	838
4750	122 (1.13)	893	119 (1.45)	818
4875	120 (1.10)	872	117 (1.42)	798
5000	117 (1.08)	850	114 (1.38)	778
5125	115 (1.05)	830	112 (1.35)	760
5250	112 (1.03)	810	110 (1.32)	741
5375	110 (1.01)	790	107 (1.29)	723
5500	108 (0.99)	771	105 (1.26)	706
5625	106 (0.97)	752	103 (1.24)	689
5750	104 (0.94)	734	101 (1.21)	673
5875	102 (0.92)	717	99 (1.18)	657
6000	100 (0.91)	701	97 (1.16)	642
6125	98 (0.89)	685	95 (1.13)	628
6250	96 (0.87)	671	94 (1.11)	615
6375	95 (0.86)	658	92 (1.09)	604
6500	93 (0.84)	647	91 (1.08)	593
6625	92 (0.83)	638	90 (1.06)	585
6750	91 (0.82)	631	89 (1.05)	578
6875	91 (0.82)	626	89 (1.04)	574
7000	91 (0.82)	624	88 (1.04)	573
7125 Or More	90 (0.81)	625	88 (1.04)	573

U.S. EPA ASM EMISSION STANDARDS - 1983-90 LIGHT DUTY VEHICLES

Test Weight	**ASM5015**		**ASM2525**	
	HC ppm (CO %)	**NOx ppm**	**HC ppm (CO %)**	**NOx ppm**
1750	291 (1.64)	2272	282 (1.83)	2114
1875	275 (1.55)	2181	266 (1.72)	1991
2000	260 (1.47)	2058	252 (1.63)	1877
2125	246 (1.39)	1944	239 (1.54)	1774
2250	234 (1.31)	1839	227 (1.47)	1678
2375	223 (1.26)	1744	216 (1.39)	1592
2500	212 (1.20)	1657	206 (1.33)	1512
2625	203 (1.15)	1577	197 (1.27)	1440
2750	194 (1.10)	1504	189 (1.21)	1374
2875	187 (1.05)	1438	181 (1.16)	1313
3000	180 (1.01)	1378	174 (1.12)	1258
3125	173 (0.98)	1323	168 (1.08)	1208
3250	167 (0.94)	1273	162 (1.04)	1163
3375	162 (0.91)	1227	157 (1.00)	1121

3500	157 (0.88)	1184	152 (0.97)	1082
3625	152 (0.86)	1146	148 (0.94)	1047
3750	148 (0.83)	1110	144 (0.92)	1014
3875	144 (0.81)	1077	140 (0.89)	984
4000	140 (0.79)	1046	137 (0.87)	956
4125	137 (0.77)	1017	133 (0.85)	930
4250	134 (0.75)	990	130 (.83)	905
4375	131 (0.74)	964	127 (0.81)	882
4500	128 (0.72)	939	124 (0.79)	859
4625	125 (0.70)	916	122 (0.77)	838
4750	122 (0.69)	893	119 (0.76)	818
4875	120 (0.67)	872	117 (0.74)	798
5000	117 (0.66)	850	114 (0.73)	778
5125	115 (0.65)	830	112 (0.71)	760
5250	112 (0.63)	810	110 (0.70)	741
5375	110 (0.62)	790	107 (0.68)	723
5500	108 (0.61)	771	105 (0.67)	706
5625	106 (0.59)	752	103 (0.65)	689
5750	104 (0.58)	734	101 (0.64)	673
5875	102 (0.57)	717	99 (0.63)	657
6000	100 (0.56)	701	97 (0.62)	642
6125	98 (0.55)	685	95 (0.61)	628
6250	96 (0.54)	671	94 (0.60)	615
6375	95 (0.53)	658	92 (0.59)	604
6500	93 (0.52)	647	91 (0.58)	593
6625	92 (0.52)	638	90 (0.57)	585
6750	91 (0.51)	631	89 (0.57)	578
6875	91 (0.51)	626	89 (0.56)	574
7000	91 (0.51)	624	88 (0.56)	573
7125	90 (0.51)	625	88 (0.56)	573
7250 Or More	90 (0.50)	625	88 (0.56)	573

U.S. EPA ASM EMISSION STANDARDS - 1991-95 LIGHT DUTY VEHICLES

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	224 (1.26)	1819	216 (1.22)	1642
1875	212 (1.19)	1713	205 (1.16)	1547
2000	201 (1.13)	1616	194 (1.09)	1460
2125	191 (1.07)	1527	184 (1.04)	1380
2250	182 (1.02)	1446	175 (0.99)	1307

2375	173 (0.97)	1372	167 (0.94)	1240
2500	166 (0.93)	1304	160 (0.90)	1179
2625	159 (0.89)	1242	153 (0.86)	1123
2750	152 (0.85)	1186	147 (0.82)	1072
2875	146 (0.82)	1134	141 (0.79)	1026
3000	141 (0.79)	1088	136 (0.76)	984
3125	136 (0.76)	1045	132 (0.73)	945
3250	132 (0.73)	1006	127 (0.71)	910
3375	128 (0.71)	970	123 (0.69)	878
3500	124 (0.69)	937	120 (0.67)	848
3625	120 (0.67)	907	117 (0.65)	821
3750	117 (0.65)	879	114 (0.63)	796
3875	114 (0.63)	853	111 (0.61)	773
4000	112 (0.62)	829	108 (0.60)	751
4125	109 (0.60)	807	106 (0.58)	731
4250	107 (0.59)	786	103 (0.57)	712
4375	104 (0.58)	766	101 (0.56)	694
4500	102 (0.57)	747	99 (0.55)	677
4625	100 (0.55)	728	97 (0.54)	661
4750	98 (0.54)	711	95 (0.53)	645
4875	96 (0.53)	694	93 (0.52)	630
5000	94 (0.52)	677	92 (0.51)	615
5125	93 (0.51)	661	90 (0.50)	600
5250	91 (0.50)	646	88 (0.49)	586
5375	89 (0.49)	631	86 (0.48)	573
5500	87 (0.48)	616	85 (0.47)	559
5625	86 (0.47)	601	83 (0.46)	546
5750	84 (0.46)	587	82 (0.45)	534
5875	83 (0.45)	574	80 (0.44)	522
6000	81 (0.44)	561	79 (0.44)	510
6125	80 (0.44)	549	78 (0.43)	499
6250	79 (0.43)	538	76 (0.42)	489
6375	77 (0.42)	528	75 (0.42)	480
6500	76 (0.42)	519	74 (0.41)	473
6625	76 (0.41)	512	74 (0.41)	466
6750	75 (0.41)	507	73 (0.41)	461
6875	75 (0.40)	503	73 (0.40)	458
7000 Or More	74 (0.40)	502	72 (0.40)	457

U.S. EPA ASM EMISSION STANDARDS - 1994 & NEWER + TIER 1 LIGHT DUTY VEHICLES

Test Weight	**ASM5015**		**ASM2525**	

	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	142 (0.80)	1212	136 (0.77)	1095
1875	134 (0.75)	1142	129 (0.73)	1031
2000	127 (0.71)	1077	123 (0.69)	973
2125	121 (0.68)	1018	116 (0.66)	920
2250	115 (0.64)	964	111 (0.62)	871
2375	109 (0.61)	915	106 (0.59)	827
2500	105 (0.59)	869	101 (0.57)	786
2625	100 (0.56)	828	97 (0.54)	749
2750	96 (0.54)	791	93 (0.52)	715
2875	92 (0.52)	756	89 (0.50)	684
3000	89 (0.50)	725	86 (0.48)	656
3125	86 (0.48)	696	83 (0.46)	630
3250	83 (0.46)	670	80 (0.45)	607
3375	81 (0.45)	647	78 (0.43)	585
3500	78 (0.44)	625	76 (0.42)	566
3625	76 (0.42)	605	74 (0.41)	547
3750	74 (0.41)	586	72 (0.40)	531
3875	72 (0.40)	569	70 (0.39)	515
4000	71 (0.39)	553	68 (0.38)	501
4125	69 (0.38)	538	67 (0.37)	487
4250	67 (0.37)	524	65 (0.36)	475
4375	66 (0.36)	510	64 (0.35)	463
4500	65 (0.36)	498	63 (0.35)	440
4625	63 (0.35)	486	61 (0.34)	440
4750	62 (0.34)	474	60 (0.33)	430
4875	61 (0.34)	463	59 (0.33)	420
5000	60 (0.33)	452	58 (0.32)	410
5125	58 (0.32)	441	57 (0.31)	400
5250	57 (0.32)	431	56 (0.31)	391
5375	56 (0.31)	420	55 (0.30)	382
5500	55 (0.30)	410	54 (0.30)	373
5625	54 (0.30)	401	53 (0.29)	364
5750	53 (0.29)	391	52 (0.29)	356
5875	52 (0.29)	383	51 (0.28)	348
6000	51 (0.28)	374	50 (0.28)	340
6125	50 (0.28)	366	49 (0.27)	333
6250	50 (0.27)	359	48 (0.27)	326
6375	49 (0.27)	352	48 (0.26)	320
6500	48 (0.26)	346	47 (0.26)	315

6625	48 (0.26)	341	46 (0.26)	311
6750	47 (0.26)	338	46 (0.26)	307
6875	47 (0.26)	335	46 (0.25)	305
7000 Or More	47 (0.25)	335	46 (0.25)	305

U.S. EPA ASM EMISSION STANDARDS - 1968-72 LIGHT DUTY TRUCKS (6000 GVWR OR LESS)

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	1118 (8.02)	4990	1098 (9.90)	4990
1875	1052 (7.56)	4990	1034 (9.90)	4990
2000	992 (7.14)	4990	975 (9.90)	4990
2125	938 (6.75)	4990	921 (9.66)	4990
2250	887 (6.40)	4990	872 (9.14)	4990
2375	841 (6.07)	4990	827 (8.67)	4990
2500	800 (5.78)	4990	786 (8.25)	4990
2625	761 (5.51)	4990	748 (7.85)	4990
2750	726 (5.26)	4990	714 (7.50)	4772
2875	695 (5.03)	4892	683 (7.17)	4556
3000	666 (4.83)	4680	654 (6.87)	4359
3125	639 (4.64)	4488	628 (6.60)	4180
3250	615 (4.47)	4311	604 (6.35)	4016
3375	593 (4.31)	4150	583 (6.13)	3866
3500	573 (4.17)	4002	563 (5.92)	3728
3625	554 (4.04)	3867	544 (5.73)	3602
3750	537 (3.91)	3741	527 (5.55)	3485
3875	521 (3.80)	3625	512 (5.39)	3377
4000	506 (3.70)	3517	497 (5.24)	3276
4125	492 (3.60)	3416	484 (5.09)	3182
4250	479 (3.51)	3321	471 (4.96)	3094
4375	467 (3.42)	3230	459 (4.83)	3010
4500	455 (3.34)	3145	447 (4.71)	2930
4625	444 (3.26)	3063	436 (4.60)	2854
4750	433 (3.18)	2983	425 (4.49)	2780
4875	423 (3.11)	2907	415 (4.38)	2709
5000	412 (3.03)	2833	405 (4.28)	2540
5125	402 (2.97)	2760	395 (4.18)	2573
5250	393 (2.90)	2690	386 (4.08)	2507
5375	383 (2.83)	2621	376 (3.98)	2443
5500	374 (2.77)	2554	367 (3.89)	2381
5625	365 (2.70)	2489	359 (3.80)	2321

5750	357 (2.64)	2426	350 (3.71)	2262
5875	348 (2.59)	2366	342 (3.62)	2206
6000	341 (2.53)	2308	334 (3.54)	2152
6125	333 (2.48)	2254	327 (3.47)	2102
6250	326 (2.43)	2204	320 (3.40)	2056
6375	320 (2.39)	2159	314 (3.34)	2014
6500	315 (2.35)	2119	309 (3.28)	1977
6625	310 (2.32)	2087	304 (3.23)	1947
6750	307 (2.29)	2062	301 (3.20)	1924
6875	305 (2.28)	2046	299 (3.17)	1909
7000	304 (2.27)	2040	298 (3.17)	1904
7125 Or More	304 (2.27)	2045	298 (3.17)	1904

U.S. EPA ASM EMISSION STANDARDS - 1973-74 LIGHT DUTY TRUCKS (6000 GVWR OR LESS)

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	1118 (8.02)	4990	1098 (9.90)	4980
1875	1052 (7.56)	4990	1034 (9.90)	4906
2000	992 (7.14)	4919	975 (9.90)	4838
2125	938 (6.75)	4853	921 (9.66)	4776
2250	887 (6.40)	4792	872 (9.14)	4720
2375	841 (6.07)	4736	827 (8.67)	4668
2500	800 (5.78)	4685	786 (8.25)	4620
2625	761 (5.51)	4639	748 (7.85)	4577
2750	726 (5.26)	4596	714 (7.50)	4374
2875	695 (5.03)	4484	683 (7.17)	4176
3000	666 (4.83)	4290	654 (6.87)	3996
3125	639 (4.64)	4114	628 (6.60)	3832
3250	615 (4.47)	3952	604 (6.35)	3681
3375	593 (4.31)	3804	583 (6.13)	3544
3500	573 (4.17)	3669	563 (5.92)	3418
3625	554 (4.04)	3544	544 (5.73)	3302
3750	537 (3.91)	3429	527 (5.55)	3195
3875	521 (3.80)	3323	512 (5.39)	3096
4000	506 (3.70)	3224	497 (5.24)	3003
4125	492 (3.60)	3131	484 (5.09)	2917
4250	479 (3.51)	3044	471 (4.96)	2836
4375	467 (3.42)	2961	459 (4.83)	2759
4500	455 (3.34)	2883	447 (4.71)	2686
4625	444 (3.26)	2807	436 (4.60)	2616

4750	433 (3.18)	2735	425 (4.49)	2549
4875	423 (3.11)	2665	415 (4.38)	2483
5000	412 (3.03)	2597	405 (4.28)	2420
5125	402 (2.97)	2530	395 (4.18)	2359
5250	393 (2.90)	2466	386 (4.08)	2298
5375	383 (2.83)	2403	376 (3.98)	2240
5500	374 (2.77)	2341	367 (3.89)	2183
5625	365 (2.70)	2282	359 (3.80)	2127
5750	357 (2.64)	2224	350 (3.71)	2074
5875	348 (2.59)	2168	342 (3.62)	2022
6000	341 (2.53)	2116	334 (3.54)	1973
6125	333 (2.48)	2066	327 (3.47)	1927
6250	326 (2.43)	2020	320 (3.40)	1884
6375	320 (2.39)	1979	314 (3.34)	1846
6500	315 (2.35)	1943	309 (3.28)	1813
6625	310 (2.32)	1913	304 (3.23)	1785
6750	307 (2.29)	1890	301 (3.20)	1764
6875	305 (2.28)	1875	299 (3.17)	1750
7000	304 (2.27)	1870	298 (3.17)	1745
7125 Or More	304 (2.27)	1874	298 (3.17)	1745

U.S. EPA ASM EMISSION STANDARDS - 1975-78 LIGHT DUTY TRUCKS (6000 GVWR OR LESS)

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	843 (5.07)	4990	828 (7.26)	4980
1875	794 (4.78)	4990	780 (6.84)	4906
2000	749 (4.51)	4919	736 (6.45)	4838
2125	707 (4.26)	4853	695 (6.10)	4776
2250	669 (4.04)	4792	658 (5.78)	4720
2375	635 (3.83)	4736	624 (5.48)	4668
2500	603 (3.65)	4685	593 (5.21)	4620
2625	574 (3.48)	4639	564 (4.96)	4577
2750	548 (3.32)	4596	539 (4.73)	4374
2875	524 (3.18)	4484	515 (4.53)	4176
3000	502 (3.05)	4290	493 (4.34)	3996
3125	482 (2.93)	4114	474 (4.17)	3832
3250	464 (2.82)	3952	456 (4.01)	3681
3375	447 (2.72)	3804	440 (3.87)	3544
3500	432 (2.63)	3669	424 (3.74)	3418
3625	418 (2.55)	3544	411 (3.62)	3302

3750	405 (2.47)	3429	398 (3.51)	3195
3875	393 (2.40)	3323	386 (3.40)	3096
4000	382 (2.33)	3224	375 (3.31)	3003
4125	371 (2.27)	3131	365 (3.22)	2917
4250	361 (2.21)	3044	355 (3.13)	2836
4375	352 (2.16)	2961	346 (3.05)	2759
4500	343 (2.11)	2883	337 (2.98)	2686
4625	335 (2.06)	2807	329 (2.90)	2616
4750	327 (2.01)	2735	321 (2.83)	2549
4875	319 (1.96)	2665	313 (2.77)	2483
5000	311 (1.92)	2597	305 (2.70)	2420
5125	304 (1.87)	2530	298 (2.64)	2359
5250	296 (1.83)	2466	291 (2.58)	2298
5375	289 (1.79)	2403	284 (2.51)	2240
5500	282 (1.75)	2341	277 (2.46)	2183
5625	276 (1.71)	2282	271 (2.40)	2127
5750	269 (1.67)	2224	264 (2.34)	2074
5875	263 (1.63)	2168	258 (2.29)	2022
6000	257 (1.60)	2116	252 (2.24)	1973
6125	251 (1.57)	2066	247 (2.19)	1927
6250	246 (1.54)	2020	242 (2.15)	1884
6375	242 (1.51)	1979	237 (2.11)	1846
6500	238 (1.48)	1943	233 (2.07)	1813
6625	234 (1.46)	1913	230 (2.04)	1785
6750	232 (1.45)	1890	227 (2.02)	1764
6875	230 (1.44)	1875	225 (2.00)	1750
7000	229 (1.43)	1870	225 (2.00)	1745
7125 Or More	229 (1.43)	1874	225 (2.00)	1745

U.S. EPA ASM EMISSION STANDARDS - 1979-83 LIGHT DUTY TRUCKS (6000 GVWR OR LESS)

Test Weight	**ASM5015**		**ASM2525**	
	HC ppm (CO %)	**NOx ppm**	**HC ppm (CO %)**	**NOx ppm**
1750	774 (4.31)	4990	761 (6.06)	4960
1875	729 (4.06)	4990	717 (5.70)	4738
2000	688 (3.83)	4778	676 (5.38)	4535
2125	650 (3.63)	4578	638 (5.09)	4349
2250	615 (3.44)	4395	604 (4.82)	4179
2375	583 (3.26)	4228	573 (4.57)	4024
2500	554 (3.10)	4076	544 (4.35)	3881
2625	528 (2.96)	3936	518 (4.14)	3752

2750	503 (2.83)	3809	495 (3.95)	3579
2875	481 (2.71)	3669	473 (3.78)	3417
3000	461 (2.60)	3510	453 (3.62)	3270
3125	443 (2.50)	3366	435 (3.48)	3135
3250	426 (2.40)	3234	419 (3.35)	3012
3375	411 (2.32)	3113	404 (3.23)	2899
3500	397 (2.24)	3002	390 (3.12)	2796
3625	384 (2.17)	2900	377 (3.02)	2701
3750	372 (2.11)	2806	365 (2.93)	2614
3875	361 (2.05)	2719	355 (2.58)	2533
4000	351 (1.99)	2638	345 (2.77)	2457
4125	341 (1.94)	2562	335 (2.69)	2387
4250	332 (1.89)	2490	326 (2.62)	2320
4375	323 (1.84)	2423	318 (2.55)	2258
4500	315 (1.80)	2359	310 (2.49)	2198
4625	308 (1.76)	2297	302 (2.43)	2140
4750	300 (1.72)	2238	295 (2.37)	2085
4875	293 (1.68)	2180	288 (2.32)	2032
5000	286 (1.64)	2125	281 (2.26)	1980
5125	279 (1.60)	2070	274 (2.21)	1930
5250	272 (1.56)	2017	267 (2.16)	1881
5375	26 (1.53)	1966	261 (2.11)	1833
5500	259 (1.49)	1916	255 (2.06)	1786
5625	253 (1.46)	1867	248 (2.01)	1740
5750	247 (1.43)	1820	243 (1.96)	1697
5875	241 (1.40)	1774	237 (1.92)	1654
6000	236 (1.37)	1731	232 (1.88)	1614
6125	231 (1.34)	1690	227 (1.84)	1577
6250	226 (1.31)	1653	222 (1.80)	1542
6375	222 (1.29)	1619	218 (1.77)	1510
6500	218 (1.27)	1590	214 (1.74)	1483
6625	215 (1.25)	1565	211 (1.72)	1460
6750	213 (1.24)	1546	209 (1.70)	1443
6875	211 (1.23)	1534	207 (1.68)	1432
7000	211 (1.23)	1530	207 (1.68)	1428
7125 Or More	211 (1.22)	1531	206 (1.68)	1428

U.S. EPA ASM EMISSION STANDARDS - 1984-87 LIGHT DUTY TRUCKS (6000 GVWR OR LESS)

Test Weight	**ASM5015**		**ASM2525**	
	HC ppm (CO %)	**NOx ppm**	**HC ppm (CO %)**	**NOx ppm**

1750	390 (3.54)	4990	381 (4.85)	4960
1875	368 (3.34)	4990	359 (4.57)	4738
2000	348 (3.16)	4778	339 (4.31)	4535
2125	329 (2.99)	4578	321 (4.08)	4349
2250	312 (2.83)	4395	305 (3.86)	4179
2375	297 (2.69)	4228	290 (3.66)	4024
2500	283 (2.56)	4076	276 (3.48)	3881
2625	270 (2.44)	3936	263 (3.32)	3752
2750	258 (2.33)	3809	252 (3.17)	3579
2875	247 (2.23)	3669	241 (3.03)	3417
3000	237 (2.14)	3510	232 (2.91)	3270
3125	228 (2.06)	3366	223 (2.79)	3135
3250	220 (1.99)	3234	215 (2.69)	3012
3375	213 (1.92)	3113	208 (2.60)	2899
3500	206 (1.86)	3002	201 (2.51)	2796
3625	200 (1.80)	2900	195 (2.43)	2701
3750	194 (1.74)	2806	189 (2.36)	2614
3875	188 (1.69)	2719	184 (2.29)	2533
4000	183 (1.65)	2638	179 (2.22)	2457
4125	179 (1.61)	2562	175 (2.16)	2387
4250	174 (1.56)	2490	170 (2.11)	2320
4375	170 (1.53)	2423	166 (2.06)	2258
4500	166 (1.49)	2359	162 (2.01)	2198
4625	162 (1.46)	2297	159 (1.96)	2140
4750	159 (1.42)	2238	155 (1.91)	2085
4875	155 (1.39)	2180	152 (1.87)	2032
5000	152 (1.36)	2125	148 (1.82)	1980
5125	148 (1.33)	2070	145 (1.78)	1930
5250	145 (1.30)	2017	142 (1.74)	1881
5375	142 (1.27)	1966	139 (1.70)	1833
5500	139 (1.24)	1916	136 (1.66)	1786
5625	136 (1.12)	1867	133 (1.62)	1740
5750	133 (1.19)	1820	130 (1.59)	1697
5875	130 (1.16)	1774	127 (1.55)	1654
6000	127 (1.14)	1731	124 (1.52)	1614
6125	125 (1.11)	1690	122 (1.49)	1577
6250	123 (1.09)	1653	120 (1.46)	1542
6375	120 (1.07)	1619	118 (1.43)	1510
6500	119 (1.06)	1590	116 (1.41)	1483
6625	117 (1.04)	1565	114 (1.39)	1460
6750	116 (1.03)	1546	113 (1.37)	1443
6875				

	115 (1.02)	1534	113 (1.36)	1432
7000	115 (1.02)	1530	112 (1.36)	1428
7125 Or More	115 (1.02)	1531	112 (1.36)	1428

U.S. EPA ASM EMISSION STANDARDS - 1988-90 LIGHT DUTY TRUCKS (6000 GVWR OR LESS)

Test Weight	**ASM5015**		**ASM2525**	
	HC ppm (CO %)	**NOx ppm**	**HC ppm (CO %)**	**NOx ppm**
1750	390 (3.54)	2725	381 (4.85)	2587
1875	368 (3.34)	2649	359 (4.57)	2435
2000	348 (3.16)	2499	339 (4.31)	2295
2125	329 (2.99)	2360	321 (4.08)	2167
2250	312 (2.83)	2232	305 (3.86)	2050
2375	297 (2.69)	2115	290 (3.66)	1943
2500	283 (2.56)	2009	276 (3.48)	1845
2625	270 (2.44)	1912	263 (3.32)	1756
2750	258 (2.33)	1823	252 (3.17)	1675
2875	247 (2.23)	1742	241 (3.03)	1601
3000	237 (2.14)	1668	232 (2.91)	1533
3125	228 (2.06)	1601	223 (2.79)	1471
3250	220 (1.99)	1539	215 (2.69)	1415
3375	213 (1.92)	1483	208 (2.60)	1363
3500	206 (1.86)	1432	201 (2.51)	1316
3625	200 (1.80)	1384	195 (2.43)	1273
3750	194 (1.74)	1340	189 (2.36)	1233
3875	188 (1.69)	1300	184 (2.29)	1195
4000	183 (1.65)	1262	179 (2.22)	1161
4125	179 (1.61)	1227	175 (2.16)	1126
4250	174 (1.56)	1194	170 (2.11)	1098
4375	170 (1.53)	1162	166 (2.06)	1069
4500	166 (1.49)	1132	162 (2.01)	1042
4625	162 (1.46)	1104	159 (1.96)	1015
4750	159 (1.42)	1076	155 (1.91)	990
4875	155 (1.39)	1049	152 (1.87)	966
5000	152 (1.36)	1023	148 (1.82)	942
5125	148 (1.33)	998	145 (1.78)	919
5250	145 (1.30)	974	142 (1.74)	896
5375	142 (1.27)	950	139 (1.70)	874
5500	139 (1.24)	926	136 (1.66)	853
5625	136 (1.12)	904	133 (1.62)	832
5750	133 (1.19)	882	130 (1.59)	812

5875	130 (1.16)	860	127 (1.55)	793
6000	127 (1.14)	840	124 (1.52)	774
6125	125 (1.11)	822	122 (1.49)	757
6250	123 (1.09)	804	120 (1.46)	741
6375	120 (1.07)	788	118 (1.43)	727
6500	119 (1.06)	775	116 (1.41)	714
6625	117 (1.04)	763	114 (1.39)	704
6750	116 (1.03)	755	113 (1.37)	696
6875	115 (1.02)	749	113 (1.36)	691
7000 Or More	115 (1.02)	747	112 (1.36)	689

U.S. EPA ASM EMISSION STANDARDS - 1991-95 LIGHT DUTY TRUCKS (6000 GVWR OR LESS)

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	324 (2.78)	2272	315 (3.64)	2114
1875	306 (2.63)	2181	297 (3.43)	1991
2000	289 (2.48)	2058	281 (3.24)	1877
2125	274 (2.35)	1944	267 (3.06)	1774
2250	260 (2.23)	1839	253 (2.90)	1678
2375	247 (2.12)	1744	241 (2.76)	1592
2500	236 (2.02)	1657	230 (2.62)	1512
2625	225 (1.92)	1577	219 (2.50)	1440
2750	216 (1.84)	1504	210 (2.39)	1374
2875	207 (1.76)	1438	210 (2.29)	1313
3000	199 (1.69)	1378	194 (2.19)	1258
3125	191 (1.63)	1323	186 (2.11)	1208
3250	185 (1.57)	1273	180 (2.03)	1163
3375	179 (1.52)	1227	174 (1.96)	1121
3500	173 (1.47)	1184	169 (1.89)	1082
3625	168 (1.42)	1146	164 (1.84)	1047
3750	163 (1.38)	1110	159 (1.78)	1014
3875	159 (1.34)	1077	155 (1.73)	984
4000	155 (1.31)	1046	151 (1.68)	956
4125	151 (1.27)	1017	147 (1.64)	930
4250	147 (1.24)	990	143 (1.60)	905
4375	144 (1.21)	964	140 (1.56)	882
4500	141 (1.18)	939	137 (1.52)	859
4625	137 (1.15)	916	134 (1.48)	838
4750	134 (1.13)	893	131 (1.45)	818
4875	132 (1.10)	872	128 (1.42)	798

5000	129 (1.08)	850	126 (1.38)	778
5125	126 (1.05)	830	123 (1.35)	760
5250	123 (1.03)	810	120 (1.32)	741
5375	121 (1.01)	790	118 (1.29)	723
5500	118 (0.99)	771	115 (1.26)	706
5625	116 (0.97)	752	113 (1.24)	689
5750	113 (0.94)	734	111 (1.21)	673
5875	111 (0.92)	717	108 (1.18)	657
6000	109 (0.91)	701	106 (1.16)	642
6125	107 (0.89)	685	104 (1.13)	628
6250	105 (.087)	671	102 (1.11)	615
6375	103 (0.86)	658	101 (1.09)	604
6500	102 (0.84)	647	99 (1.08)	593
6625	101 (0.83)	638	98 (1.06)	585
6750	100 (0.82)	631	97 (1.05)	578
6875	99 (0.82)	626	97 (1.04)	574
7000	99 (0.82)	624	96 (1.04)	573
7125 Or More	98 (0.81)	625	96 (1.04)	573

U.S. EPA ASM EMISSION STANDARDS - 1994 + TIER 1 LIGHT DUTY TRUCKS (3750 LVW OR LESS)

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	142 (0.80)	1212	136 (0.77)	1095
1875	134 (0.75)	1142	129 (0.73)	1031
2000	127 (0.71)	1077	123 (0.69)	973
2125	121 (0.68)	1018	116 (0.66)	920
2250	115 (0.64)	964	111 (0.62)	871
2375	109 (0.61)	915	106 (0.59)	827
2500	105 (0.59)	869	101 (0.57)	786
2625	100 (0.56)	828	97 (0.54)	749
2750	96 (0.54)	791	93 (0.52)	715
2875	92 (0.52)	756	89 (0.50)	684
3000	89 (0.50)	725	86 (0.48)	656
3125	86 (0.48)	696	83 (0.46)	630
3250	83 (0.46)	670	80 (0.45)	607
3375	81 (0.45)	647	78 (0.43)	585
3500	78 (0.44)	625	76 (0.42)	566
3625	76 (0.42)	605	74 (0.41)	547
3750	74 (0.41)	586	72 (0.40)	531

3875	72 (0.40)	569	70 (0.39)	515
4000	71 (0.39)	553	68 (0.38)	501
4125	69 (0.38)	538	67 (0.37)	487
4250	67 (0.37)	524	65 (0.36)	475
4375	66 (0.36)	510	64 (0.35)	463
4500	65 (0.36)	498	63 (0.35)	440
4625	63 (0.35)	486	61 (0.34)	440
4750	62 (0.34)	474	60 (0.33)	430
4875	61 (0.34)	463	59 (0.33)	420
5000	60 (0.33)	452	58 (0.32)	410
5125	58 (0.32)	441	57 (0.31)	400
5250	57 (0.32)	431	56 (0.31)	391
5375	56 (0.31)	420	55 (0.30)	382
5500	55 (0.30)	410	54 (0.30)	373
5625	54 (0.30)	401	53 (0.29)	364
5750	53 (0.29)	391	52 (0.29)	356
5875	52 (0.29)	383	51 (0.28)	348
6000	51 (0.28)	374	50 (0.28)	340
6125	50 (0.28)	366	49 (0.27)	333
6250	50 (0.27)	359	48 (0.27)	326
6375	49 (0.27)	352	48 (0.26)	320
6500	48 (0.26)	346	47 (0.26)	315
6625	48 (0.26)	341	46 (0.26)	311
6750	47 (0.26)	338	46 (0.26)	307
6875	47 (0.26)	335	46 (0.25)	305
7000 Or More	47 (0.25)	335	46 (0.25)	305

U.S. EPA ASM EMISSION STANDARDS - 1994 + TIER 1 LIGHT DUTY TRUCKS (3751 LVW OR MORE)

Test Weight	**ASM5015**		**ASM2525**	
	HC ppm (CO %)	**NOx ppm**	**HC ppm (CO %)**	**NOx ppm**
1750	224 (1.26)	1819	216 (1.22)	1642
1875	212 (1.19)	1713	205 (1.16)	1547
2000	201 (1.13)	1616	194 (1.09)	1460
2125	191 (1.07)	1527	184 (1.04)	1380
2250	182 (1.02)	1446	175 (0.99)	1307
2375	173 (0.97)	1372	167 (0.94)	1240
2500	166 (0.93)	1304	160 (0.90)	1179
2625	159 (0.89)	1242	153 (0.86)	1123
2750	152 (0.85)	1186	147 (0.82)	1072

2875	146 (0.82)	1134	141 (0.79)	1026
3000	141 (0.79)	1088	136 (0.76)	984
3125	136 (0.76)	1045	132 (0.73)	945
3250	132 (0.73)	1006	127 (0.71)	910
3375	128 (0.71)	970	123 (0.69)	878
3500	124 (0.69)	937	120 (0.67)	848
3625	120 (0.67)	907	117 (0.65)	821
3750	117 (0.65)	879	114 (0.63)	796
3875	114 (0.63)	853	111 (0.61)	773
4000	112 (0.62)	829	108 (0.60)	751
4125	109 (0.60)	807	106 (0.58)	731
4250	107 (0.59)	786	103 (0.57)	712
4375	104 (0.58)	766	101 (0.56)	694
4500	102 (0.57)	747	99 (0.55)	677
4625	100 (0.55)	728	97 (0.54)	661
4750	98 (0.54)	711	95 (0.53)	645
4875	96 (0.53)	694	93 (0.52)	630
5000	94 (0.52)	677	92 (0.51)	615
5125	93 (0.51)	661	90 (0.50)	600
5250	91 (0.50)	646	88 (0.49)	586
5375	89 (0.49)	631	86 (0.48)	573
5500	87 (0.48)	616	85 (0.47)	559
5625	86 (0.47)	601	83 (0.46)	546
5750	84 (0.46)	587	82 (0.45)	534
5875	83 (0.45)	574	80 (0.44)	522
6000	81 (0.44)	561	79 (0.44)	510
6125	80 (0.44)	549	78 (0.43)	499
6250	79 (0.43)	538	76 (0.42)	489
6375	77 (0.42)	528	75 (0.42)	480
6500	76 (0.42)	519	74 (0.41)	473
6625	76 (0.41)	512	74 (0.41)	466
6750	75 (0.41)	507	73 (0.41)	461
6875	75 (0.40)	503	73 (0.40)	458
7000 Or More	74 (0.40)	502	72 (0.40)	457

U.S. EPA ASM EMISSION STANDARDS - 1968-72 LIGHT DUTY TRUCKS (6001 GVWR OR MORE)

Test Weight	**ASM5015**		**ASM2525**	
	HC ppm (CO %)	**NOx ppm**	**HC ppm (CO %)**	**NOx ppm**
1750	1118 (8.02)	4990	1098 (9.90)	4990
1875	1052 (7.56)	4990	1034 (9.90)	4990

2000	992 (7.14)	4990	975 (9.90)	4990
2125	938 (6.75)	4990	921 (9.66)	4990
2250	887 (6.40)	4990	872 (9.14)	4990
2375	841 (6.07)	4990	827 (8.67)	4990
2500	800 (5.78)	4990	786 (8.25)	4990
2625	761 (5.51)	4990	748 (7.85)	4990
2750	726 (5.26)	4990	714 (7.50)	4772
2875	695 (5.03)	4892	683 (7.17)	4556
3000	666 (4.83)	4680	654 (6.87)	4359
3125	639 (4.64)	4488	628 (6.60)	4180
3250	615 (4.47)	4311	604 (6.35)	4016
3375	593 (4.31)	4150	583 (6.13)	3866
3500	573 (4.17)	4002	563 (5.92)	3728
3625	554 (4.04)	3867	544 (5.73)	3602
3750	537 (3.91)	3741	527 (5.55)	3485
3875	521 (3.80)	3625	512 (5.39)	3377
4000	506 (3.70)	3517	497 (5.24)	3276
4125	492 (3.60)	3416	484 (5.09)	3182
4250	479 (3.51)	3321	471 (4.96)	3094
4375	467 (3.42)	3230	459 (4.83)	3010
4500	455 (3.34)	3145	447 (4.71)	2930
4625	444 (3.26)	3063	436 (4.60)	2854
4750	433 (3.18)	2983	425 (4.49)	2780
4875	423 (3.11)	2907	415 (4.38)	2709
5000	412 (3.03)	2833	405 (4.28)	2640
5125	402 (2.97)	2760	395 (4.18)	2573
5250	393 (2.90)	2690	386 (4.08)	2507
5375	383 (2.83)	2621	376 (3.98)	2443
5500	374 (2.77)	2554	367 (3.89)	2381
5625	365 (2.70)	2489	359 (3.80)	2321
5750	357 (2.64)	2426	350 (3.71)	2262
5875	348 (2.59)	2366	342 (3.62)	2206
6000	341 (2.53)	2308	334 (3.54)	2152
6125	333 (2.48)	2254	327 (3.47)	2102
6250	326 (2.43)	2204	320 (3.40)	2056
6375	320 (2.39)	2159	314 (3.34)	2014
6500	315 (2.35)	2119	309 (3.28)	1977
6625	310 (2.32)	2087	304 (3.23)	1947
6750	307 (2.29)	2062	301 (3.20)	1924
6875	305 (2.28)	2046	299 (3.17)	1909
7000	304 (2.27)	2040	298 (3.17)	1904
7125 Or More				

	304 (2.27)	2045	298 (3.17)	1904

U.S. EPA ASM EMISSION STANDARDS - 1973-74 LIGHT DUTY TRUCKS (6001 GVWR OR MORE)

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	1118 (8.02)	4990	1098 (9.90)	4980
1875	1052 (7.56)	4990	1034 (9.90)	4906
2000	992 (7.14)	4919	975 (9.90)	4838
2125	938 (6.75)	4853	921 (9.66)	4776
2250	887 (6.40)	4792	872 (9.14)	4720
2375	841 (6.07)	4736	827 (8.67)	4668
2500	800 (5.78)	4685	786 (8.25)	4620
2625	761 (5.51)	4639	748 (7.85)	4577
2750	726 (5.26)	4596	714 (7.50)	4374
2875	695 (5.03)	4484	683 (7.17)	4176
3000	666 (4.83)	4290	654 (6.87)	3996
3125	639 (4.64)	4114	628 (6.60)	3832
3250	615 (4.47)	3952	604 (6.35)	3681
3375	593 (4.31)	3804	583 (6.13)	3544
3500	573 (4.17)	3669	563 (5.92)	3418
3625	554 (4.04)	3544	544 (5.73)	3302
3750	537 (3.91)	3429	527 (5.55)	3195
3875	521 (3.80)	3323	512 (5.39)	3096
4000	506 (3.70)	3224	497 (5.24)	3003
4125	492 (3.60)	3131	484 (5.09)	2917
4250	479 (3.51)	3044	471 (4.96)	2836
4375	467 (3.42)	2961	459 (4.83)	2759
4500	455 (3.34)	2883	447 (4.71)	2686
4625	444 (3.26)	2807	436 (4.60)	2616
4750	433 (3.18)	2735	425 (4.49)	2549
4875	423 (3.11)	2665	415 (4.38)	2483
5000	412 (3.03)	2597	405 (4.28)	2420
5125	402 (2.97)	2530	395 (4.18)	2359
5250	393 (2.90)	2466	386 (4.08)	2298
5375	383 (2.83)	2403	376 (3.98)	2240
5500	374 (2.77)	2341	367 (3.89)	2183
5625	365 (2.70)	2282	359 (3.80)	2127
5750	357 (2.64)	2224	350 (3.71)	2074
5875	348 (2.59)	2168	342 (3.62)	2022
6000	341 (2.53)	2116	334 (3.54)	1973

6125	333 (2.48)	2066	327 (3.47)	1927
6250	326 (2.43)	2020	320 (3.40)	1884
6375	320 (2.39)	1979	314 (3.34)	1846
6500	315 (2.35)	1943	309 (3.28)	1813
6625	310 (2.32)	1913	304 (3.23)	1785
6750	307 (2.29)	1890	301 (3.20)	1764
6875	305 (2.28)	1875	299 (3.17)	1750
7000	304 (2.27)	1870	298 (3.17)	1745
7125 Or More	304 (2.27)	1874	298 (3.17)	1745

U.S. EPA ASM EMISSION STANDARDS - 1975-78 LIGHT DUTY TRUCKS (6001 GVWR OR MORE)

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	843 (5.07)	4990	828 (7.26)	4980
1875	794 (4.78)	4990	780 (6.84)	4906
2000	749 (4.51)	4919	736 (6.45)	4838
2125	707 (4.26)	4853	695 (6.10)	4776
2250	669 (4.04)	4792	658 (5.78)	4720
2375	635 (3.83)	4736	624 (5.48)	4668
2500	603 (3.65)	4685	593 (5.21)	4620
2625	574 (3.48)	4639	564 (4.96)	4577
2750	548 (3.32)	4596	539 (4.73)	4374
2875	524 (3.18)	4484	515 (4.53)	4176
3000	502 (3.05)	4290	493 (4.34)	3996
3125	482 (2.93)	4114	474 (4.17)	3832
3250	464 (2.82)	3952	456 (4.01)	3681
3375	447 (2.72)	3804	440 (3.87)	3544
3500	432 (2.63)	3669	424 (3.74)	3418
3625	418 (2.55)	3544	411 (3.62)	3302
3750	405 (2.47)	3429	398 (3.51)	3195
3875	393 (2.40)	3323	386 (3.40)	3096
4000	382 (2.33)	3224	375 (3.31)	3003
4125	371 (2.27)	3131	365 (3.22)	2917
4250	361 (2.21)	3044	355 (3.13)	2836
4375	352 (2.16)	2961	346 (3.05)	2759
4500	343 (2.11)	2883	337 (2.98)	2686
4625	335 (2.06)	2807	329 (2.90)	2616
4750	327 (2.01)	2735	321 (2.83)	2549
4875	319 (1.96)	2665	313 (2.77)	2483
5000	311 (1.92)	2597	305 (2.70)	2420

5125	304 (1.87)	2530	298 (2.64)	2359
5250	296 (1.83)	2466	291 (2.58)	2298
5375	289 (1.79)	2403	284 (2.51)	2240
5500	282 (1.75)	2341	277 (2.46)	2183
5625	276 (1.71)	2282	271 (2.40)	2127
5750	269 (1.67)	2224	264 (2.34)	2074
5875	263 (1.63)	2168	258 (2.29)	2022
6000	257 (1.60)	2116	252 (2.24)	1973
6125	251 (1.57)	2066	247 (2.19)	1927
6250	246 (1.54)	2020	242 (2.15)	1884
6375	242 (1.51)	1979	237 (2.11)	1846
6500	238 (1.48)	1943	233 (2.07)	1813
6625	234 (1.46)	1913	230 (2.04)	1785
6750	232 (1.45)	1890	227 (2.02)	1764
6875	230 (1.44)	1875	225 (2.00)	1750
7000	229 (1.43)	1870	225 (2.00)	1745
7125 Or More	229 (1.43)	1874	225 (2.00)	1745

U.S. EPA ASM EMISSION STANDARDS - 1979-83 LIGHT DUTY TRUCKS (6001 GVWR OR MORE)

Test Weight	**ASM5015**		**ASM2525**	
	HC ppm (CO %)	**NOx ppm**	**HC ppm (CO %)**	**NOx ppm**
1750	774 (4.31)	4990	761 (6.06)	4960
1875	729 (4.06)	4990	717 (5.70)	4738
2000	688 (3.83)	4778	676 (5.38)	4535
2125	650 (3.63)	4578	638 (5.09)	4349
2250	615 (3.44)	4395	604 (4.82)	4179
2375	583 (3.26)	4228	573 (4.57)	4024
2500	554 (3.10)	4076	544 (4.35)	3881
2625	528 (2.96)	3936	518 (4.14)	3752
2750	503 (2.83)	3809	495 (3.95)	3579
2875	481 (2.71)	3669	473 (3.78)	3417
3000	461 (2.60)	3510	453 (3.62)	3270
3125	443 (2.50)	3366	435 (3.48)	3135
3250	426 (2.40)	3234	419 (3.35)	3012
3375	411 (2.32)	3113	404 (3.23)	2899
3500	397 (2.24)	3002	390 (3.12)	2796
3625	384 (2.17)	2900	377 (3.02)	2701
3750	372 (2.11)	2806	365 (2.93)	2614
3875	361 (2.05)	2719	355 (2.58)	2533
4000	351 (1.99)	2638	345 (2.77)	2457

4125	341 (1.94)	2562	335 (2.69)	2387
4250	332 (1.89)	2490	326 (2.62)	2320
4375	323 (1.84)	2423	318 (2.55)	2258
4500	315 (1.80)	2359	310 (2.49)	2198
4625	308 (1.76)	2297	302 (2.43)	2140
4750	300 (1.72)	2238	295 (2.37)	2085
4875	293 (1.68)	2180	288 (2.32)	2032
5000	286 (1.64)	2125	281 (2.26)	1980
5125	279 (1.60)	2070	274 (2.21)	1930
5250	272 (1.56)	2017	267 (2.16)	1881
5375	26 (1.53)	1966	261 (2.11)	1833
5500	259 (1.49)	1916	255 (2.06)	1786
5625	253 (1.46)	1867	248 (2.01)	1740
5750	247 (1.43)	1820	243 (1.96)	1697
5875	241 (1.40)	1774	237 (1.92)	1654
6000	236 (1.37)	1731	232 (1.88)	1614
6125	231 (1.34)	1690	227 (1.84)	1577
6250	226 (1.31)	1653	222 (1.80)	1542
6375	222 (1.29)	1619	218 (1.77)	1510
6500	218 (1.27)	1590	214 (1.74)	1483
6625	215 (1.25)	1565	211 (1.72)	1460
6750	213 (1.24)	1546	209 (1.70)	1443
6875	211 (1.23)	1534	207 (1.68)	1432
7000	211 (1.23)	1530	207 (1.68)	1428
7125 Or More	211 (1.22)	1531	206 (1.68)	1428

U.S. EPA ASM EMISSION STANDARDS - 1984-87 LIGHT DUTY TRUCKS (6001 GVWR OR MORE)

Test Weight	**ASM5015**		**ASM2525**	
	HC ppm (CO %)	**NOx ppm**	**HC ppm (CO %)**	**NOx ppm**
1750	390 (3.54)	4990	381 (4.85)	4960
1875	368 (3.34)	4990	359 (4.57)	4738
2000	348 (3.16)	4778	339 (4.31)	4535
2125	329 (2.99)	4578	321 (4.08)	4349
2250	312 (2.83)	4395	305 (3.86)	4179
2375	297 (2.69)	4228	290 (3.66)	4024
2500	283 (2.56)	4076	276 (3.48)	3881
2625	270 (2.44)	3936	263 (3.32)	3752
2750	258 (2.33)	3809	252 (3.17)	3579
2875	247 (2.23)	3669	241 (3.03)	3417
3000	237 (2.14)	3510	232 (2.91)	3270

3125	228 (2.06)	3366	223 (2.79)	3135
3250	220 (1.99)	3234	215 (2.69)	3012
3375	213 (1.92)	3113	208 (2.60)	2899
3500	206 (1.86)	3002	201 (2.51)	2796
3625	200 (1.80)	2900	195 (2.43)	2701
3750	194 (1.74)	2806	189 (2.36)	2614
3875	188 (1.69)	2719	184 (2.29)	2533
4000	183 (1.65)	2638	179 (2.22)	2457
4125	179 (1.61)	2562	175 (2.16)	2387
4250	174 (1.56)	2490	170 (2.11)	2320
4375	170 (1.53)	2423	166 (2.06)	2258
4500	166 (1.49)	2359	162 (2.01)	2198
4625	162 (1.46)	2297	159 (1.96)	2140
4750	159 (1.42)	2238	155 (1.91)	2085
4875	155 (1.39)	2180	152 (1.87)	2032
5000	152 (1.36)	2125	148 (1.82)	1980
5125	148 (1.33)	2070	145 (1.78)	1930
5250	145 (1.30)	2017	142 (1.74)	1881
5375	142 (1.27)	1966	139 (1.70)	1833
5500	139 (1.24)	1916	136 (1.66)	1786
5625	136 (1.12)	1867	133 (1.62)	1740
5750	133 (1.19)	1820	130 (1.59)	1697
5875	130 (1.16)	1774	127 (1.55)	1654
6000	127 (1.14)	1731	124 (1.52)	1614
6125	125 (1.11)	1690	122 (1.49)	1577
6250	123 (1.09)	1653	120 (1.46)	1542
6375	120 (1.07)	1619	118 (1.43)	1510
6500	119 (1.06)	1590	116 (1.41)	1483
6625	117 (1.04)	1565	114 (1.39)	1460
6750	116 (1.03)	1546	113 (1.37)	1443
6875	115 (1.02)	1534	113 (1.36)	1432
7000	115 (1.02)	1530	112 (1.36)	1428
7125 Or More	115 (1.02)	1531	112 (1.36)	1428

U.S. EPA ASM EMISSION STANDARDS - 1988-90 LIGHT DUTY TRUCKS (6001 GVWR OR MORE)

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	390 (3.54)	4084	381 (4.85)	4005
1875	368 (3.34)	4054	359 (4.57)	3767
2000	348 (3.16)	3824	339 (4.31)	3548

2125	329 (2.99)	3609	321 (4.08)	3348
2250	312 (2.83)	3411	305 (3.86)	3165
2375	297 (2.69)	3231	290 (3.66)	2998
2500	283 (2.56)	3066	276 (3.48)	2845
2625	270 (2.44)	2916	263 (3.32)	2706
2750	258 (2.33)	2779	252 (3.17)	2579
2875	247 (2.23)	2654	241 (3.03)	2463
3000	237 (2.14)	2539	232 (2.91)	2357
3125	228 (2.06)	2435	223 (2.79)	2260
3250	220 (1.99)	2340	215 (2.69)	2172
3375	213 (1.92)	2253	208 (2.60)	2092
3500	206 (1.86)	2174	201 (2.51)	2018
3625	200 (1.80)	2100	195 (2.43)	1950
3750	194 (1.74)	2033	189 (2.36)	1887
3875	188 (1.69)	1970	184 (2.29)	1829
4000	183 (1.65)	1912	179 (2.22)	1775
4125	179 (1.61)	1857	175 (2.16)	1724
4250	174 (1.56)	1806	170 (2.11)	1677
4375	170 (1.53)	1757	166 (2.06)	1632
4500	166 (1.49)	1711	162 (2.01)	1589
4625	162 (1.46)	1666	159 (1.96)	1548
4750	159 (1.42)	1624	155 (1.91)	1508
4875	155 (1.39)	1583	152 (1.87)	1470
5000	152 (1.36)	1542	148 (1.82)	1433
5125	148 (1.33)	1503	145 (1.78)	1397
5250	145 (1.30)	1465	142 (1.74)	1362
5375	142 (1.27)	1428	139 (1.70)	1327
5500	139 (1.24)	1392	136 (1.66)	1294
5625	136 (1.12)	1357	133 (1.62)	1261
5750	133 (1.19)	1323	130 (1.59)	1230
5875	130 (1.16)	1290	127 (1.55)	1199
6000	127 (1.14)	1259	124 (1.52)	1171
6125	125 (1.11)	1230	122 (1.49)	1144
6250	123 (1.09)	1203	120 (1.46)	1119
6375	120 (1.07)	1179	118 (1.43)	1096
6500	119 (1.06)	1158	116 (1.41)	1077
6625	117 (1.04)	1140	114 (1.39)	1060
6750	116 (1.03)	1127	113 (1.37)	1048
6875	115 (1.02)	1118	113 (1.36)	1040
7000 Or More	115 (1.02)	1115	112 (1.36)	1037

U.S. EPA ASM EMISSION STANDARDS - 1991-95 LIGHT DUTY TRUCKS (6001 GVWR OR MORE)

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	324 (2.78)	3631	315 (3.64)	3532
1875	306 (2.63)	3586	297 (3.43)	3323
2000	289 (2.48)	3383	281 (3.24)	3131
2125	274 (2.35)	3192	267 (3.06)	2955
2250	260 (2.23)	3018	253 (2.90)	2794
2375	247 (2.12)	2859	241 (2.76)	2646
2500	236 (2.02)	2714	230 (2.62)	2512
2625	225 (1.92)	2581	219 (2.50)	2389
2750	216 (1.84)	2460	210 (2.39)	2277
2875	207 (1.76)	2350	210 (2.29)	2175
3000	199 (1.69)	2249	194 (2.19)	2082
3125	191 (1.63)	2157	186 (2.11)	1997
3250	185 (1.57)	2073	180 (2.03)	1920
3375	179 (1.52)	1997	174 (1.96)	1849
3500	173 (1.47)	1926	169 (1.89)	1784
3625	168 (1.42)	1862	164 (1.84)	1724
3750	163 (1.38)	1802	159 (1.78)	1669
3875	159 (1.34)	1747	155 (1.73)	1618
4000	155 (1.31)	1695	151 (1.68)	1570
4125	151 (1.27)	1647	147 (1.64)	1526
4250	147 (1.24)	1602	143 (1.60)	1484
4375	144 (1.21)	1559	140 (1.56)	1444
4500	141 (1.18)	1518	137 (1.52)	1406
4625	137 (1.15)	1479	134 (1.48)	1370
4750	134 (1.13)	1441	131 (1.45)	1336
4875	132 (1.10)	1405	128 (1.42)	1302
5000	129 (1.08)	1369	126 (1.38)	1269
5125	126 (1.05)	1335	123 (1.35)	1237
5250	123 (1.03)	1031	120 (1.32)	1206
5375	121 (1.01)	1269	118 (1.29)	1176
5500	118 (0.99)	1237	115 (1.26)	1147
5625	116 (0.97)	1206	113 (1.24)	1118
5750	113 (0.94)	1176	111 (1.21)	1090
5875	111 (0.92)	1147	108 (1.18)	1064
6000	109 (0.91)	1120	106 (1.16)	1039
6125	107 (0.89)	1094	104 (1.13)	1015
6250	105 (.087)	1070	102 (1.11)	993

6375	103 (0.86)	1049	101 (1.09)	973
6500	102 (0.84)	1030	99 (1.08)	956
6625	101 (0.83)	1014	98 (1.06)	941
6750	100 (0.82)	1003	97 (1.05)	931
6875	99 (0.82)	995	97 (1.04)	924
7000	99 (0.82)	992	96 (1.04)	921
7125 Or More	98 (0.81)	992	96 (1.04)	921

U.S. EPA ASM EMISSION STANDARDS - 1994 + TIER 1 LIGHT DUTY TRUCKS (5750 LVW OR LESS)

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	224 (1.26)	1819	216 (1.22)	1642
1875	212 (1.19)	1713	205 (1.16)	1547
2000	201 (1.13)	1616	194 (1.09)	1460
2125	191 (1.07)	1527	184 (1.04)	1380
2250	182 (1.02)	1446	175 (0.99)	1307
2375	173 (0.97)	1372	167 (0.94)	1240
2500	166 (0.93)	1304	160 (0.90)	1179
2625	159 (0.89)	1242	153 (0.86)	1123
2750	152 (0.85)	1186	147 (0.82)	1072
2875	146 (0.82)	1134	141 (0.79)	1026
3000	141 (0.79)	1088	136 (0.76)	984
3125	136 (0.76)	1045	132 (0.73)	945
3250	132 (0.73)	1006	127 (0.71)	910
3375	128 (0.71)	970	123 (0.69)	878
3500	124 (0.69)	937	120 (0.67)	848
3625	120 (0.67)	907	117 (0.65)	821
3750	117 (0.65)	879	114 (0.63)	796
3875	114 (0.63)	853	111 (0.61)	773
4000	112 (0.62)	829	108 (0.60)	751
4125	109 (0.60)	807	106 (0.58)	731
4250	107 (0.59)	786	103 (0.57)	712
4375	104 (0.58)	766	101 (0.56)	694
4500	102 (0.57)	747	99 (0.55)	677
4625	100 (0.55)	728	97 (0.54)	661
4750	98 (0.54)	711	95 (0.53)	645
4875	96 (0.53)	694	93 (0.52)	630
5000	94 (0.52)	677	92 (0.51)	615
5125	93 (0.51)	661	90 (0.50)	600

5250	91 (0.50)	646	88 (0.49)	586
5375	89 (0.49)	631	86 (0.48)	573
5500	87 (0.48)	616	85 (0.47)	559
5625	86 (0.47)	601	83 (0.46)	546
5750	84 (0.46)	587	82 (0.45)	534
5875	83 (0.45)	574	80 (0.44)	522
6000	81 (0.44)	561	79 (0.44)	510
6125	80 (0.44)	549	78 (0.43)	499
6250	79 (0.43)	538	76 (0.42)	489
6375	77 (0.42)	528	75 (0.42)	480
6500	76 (0.42)	519	74 (0.41)	473
6625	76 (0.41)	512	74 (0.41)	466
6750	75 (0.41)	507	73 (0.41)	461
6875	75 (0.40)	503	73 (0.40)	458
7000 Or More	74 (0.40)	502	72 (0.40)	457

U.S. EPA ASM EMISSION STANDARDS - 1994 + TIER 1 LIGHT DUTY TRUCKS (5751 LVW OR MORE)

Test Weight	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
1750	324 (2.78)	3178	315 (3.64)	3060
1875	306 (2.63)	3117	297 (3.43)	2879
2000	289 (2.48)	2941	281 (3.24)	2713
2125	274 (2.35)	2776	267 (3.06)	2561
2250	260 (2.23)	2625	253 (2.90)	2422
2375	247 (2.12)	2487	241 (2.76)	2295
2500	236 (2.02)	2361	230 (2.62)	2179
2625	225 (1.92)	2246	219 (2.50)	2073
2750	216 (1.84)	2142	210 (2.39)	1976
2875	207 (1.76)	2046	210 (2.29)	1888
3000	199 (1.69)	1959	194 (2.19)	1808
3125	191 (1.63)	1879	186 (2.11)	1734
3250	185 (1.57)	1806	180 (2.03)	1667
3375	179 (1.52)	1740	174 (1.96)	1606
3500	173 (1.47)	1679	169 (1.89)	1550
3625	168 (1.42)	1623	164 (1.84)	1498
3750	163 (1.38)	1571	159 (1.78)	1451
3875	159 (1.34)	1523	155 (1.73)	1407
4000	155 (1.31)	1479	151 (1.68)	1365
4125	151 (1.27)	1437	147 (1.64)	1327

4250	147 (1.24)	1398	143 (1.60)	1291
4375	144 (1.21)	1360	140 (1.56)	1257
4500	141 (1.18)	1325	137 (1.52)	1224
4625	137 (1.15)	1291	134 (1.48)	1193
4750	134 (1.13)	1259	131 (1.45)	1163
4875	132 (1.10)	1227	128 (1.42)	1134
5000	129 (1.08)	1196	126 (1.38)	1106
5125	126 (1.05)	1167	123 (1.35)	1078
5250	123 (1.03)	1138	120 (1.32)	1051
5375	121 (1.01)	1109	118 (1.29)	1025
5500	118 (0.99)	1082	115 (1.26)	1000
5625	116 (0.97)	1055	113 (1.24)	975
5750	113 (0.94)	1029	111 (1.21)	951
5875	111 (0.92)	1004	108 (1.18)	928
6000	109 (0.91)	980	106 (1.16)	906
6125	107 (0.89)	958	104 (1.13)	886
6250	105 (.087)	937	102 (1.11)	867
6375	103 (0.86)	919	101 (1.09)	850
6500	102 (0.84)	902	99 (1.08)	835
6625	101 (0.83)	889	98 (1.06)	823
6750	100 (0.82)	879	97 (1.05)	813
6875	99 (0.82)	872	97 (1.04)	807
7000	99 (0.82)	870	96 (1.04)	805
7125 Or More	98 (0.81)	870	96 (1.04)	805

U. S. EPA REVISED FINAL ASM EMISSION STANDARDS (ASM5015 & ASM2525)

NOTE: **EPA has not published a revised final standards for High Altitude, Light Duty Trucks 2 (6000-8500 GVWR), or vehicles older than 1980 model year. EPA guidance as of February 2003 states that a program may choose to use combinations of the Original and the Revised Final Standards.**

U.S. EPA REVISED FINAL ASM EMISSION STANDARDS

Application	ASM5015		ASM2525	
	HC ppm (CO %)	NOx ppm	HC ppm (CO %)	NOx ppm
Passenger Cars				
1980	275 (1.3)	8500	500 (2.3)	4750
1981-82	275 (1.3)	3600	500 (2.3)	3500
1983-	275 (1.1)	3600	500 (1.6)	3500

89				
1990 & Newer	275 (1.1)	3600	300 (1.6)	3500
Light Duty Trucks (Less Than 6000 GVWR)				
1980-83	1140 (9.7)	14,145	340 (23.28)	32,200
1984-87	537 (5.4)	14,145	160 (12.96)	32,200
1988-95	537 (5.4)	7380	160 (12.96)	16,800
1996 & Newer	275 (1.1)	6150	82 (4.40)	14,000

U.S. EPA IM240 EMISSION STANDARDS

START-UP STANDARDS

Start-up standards should be used during the first 2 years of program operation. Tier 1 standards are recommended for all 1996 and newer vehicles and may be used for 1994 and newer vehicles certified to Tier 1 standards as well.

U.S. EPA IM240 HYDROCARBONS EMISSION START-UP STANDARDS

Application	**Hydrocarbons (Grams/Mile)**	
	Composite	**Phase 2**
Light Duty Vehicles		
1996 & Newer	0.80	0.50
1991-95	1.20	0.75
1983-90	2.00	1.25
1980-82	2.00	1.25
1975-79	7.50	5.00
1968-74	10.0	6.00
High Altitude Light Duty Vehicles		
1983-84	2.00	1.25
1982	2.00	1.25
Light Duty Trucks (0-6000 Lbs. GVWR)		
1996 & Newer (Less Than 3750 LVW)	0.80	0.50
1996 & Newer (More Than 3750 LVW)	1.00	0.63
1991-95	2.40	1.50
1984-90	3.20	2.00
1979-83	7.50	5.00
1975-78	8.00	5.00

1968-74	10.0	6.00
High Altitude Light Duty Trucks (0-6000 Lbs. GVWR)		
1991 & Newer	3.00	2.00
1984-90	4.00	2.50
1982-83	8.00	5.00
Light Duty Trucks (6001-8500 Lbs. GVWR)		
1996 & Newer (Less Than 5750 ALVW)	1.00	0.63
1996 & Newer (More Than 5750 ALVW)	2.40	1.50
1991-95	2.40	1.50
1984-90	3.20	2.00
1979-83	7.50	5.00
1975-78	8.00	5.00
1968-74	10.0	6.00
High Altitude Light Duty Trucks (6001-8500 Lbs. GVWR)		
1991 & Newer	3.00	2.00
1984-90	4.00	2.50
1982-83	8.00	5.00
Heavy Duty Trucks (Greater Than 8500 Lbs. GVWR)		
1998 & Newer	2.00	1.30
1987-97	3.00	1.90
1985-86	5.00	3.10
1979-84	6.00	3.80
1970-78	10.0	6.30
1969 & Earlier	20.0	12.50

U.S. EPA IM240 CARBON MONOXIDE EMISSION START-UP STANDARDS

Application	**Carbon Monoxide (Grams/Mile)**	
Composite		**Phase 2**
Light Duty Vehicles		
1996 & Newer	15.0	12.0
1991-95	20.0	16.0
1983-90	30.0	24.0
1980-82	60.0	48.0
1975-79	90.0	72.0
1968-74	150.0	120.0
High Altitude Light Duty Vehicles		
1983-84	60.0	48.0
1982	75.0	60.0
Light Duty Trucks (0-6000 Lbs. GVWR)		
1996 & Newer (Less Than 3750 LVW)	15.0	12.0
1996 & Newer (More Than 3750 LVW)	20.0	16.0

1991-95	60.0	48.0
1984-90	80.0	64.0
1979-83	100.0	80.0
1975-78	120.0	96.0
1968-74	150.0	120.0
High Altitude Light Duty Trucks (0-6000 Lbs. GVWR)		
1991 & Newer	70.0	56.0
1984-90	90.0	72.0
1982-83	130.0	104.0
Light Duty Trucks (6001-8500 Lbs. GVWR)		
1996 & Newer (Less Than 5750 ALVW)	20.0	16.0
1996 & Newer (More Than 5750 ALVW)	60.0	48.0
1991-95	60.0	48.0
1984-90	80.0	64.0
1979-83	100.0	80.0
1975-78	120.0	96.0
1968-74	150.0	120.0
High Altitude Light Duty Trucks (6001-8500 Lbs. GVWR)		
1991 & Newer	70.0	56.0
1984-90	90.0	72.0
1982-83	130.0	104.0
Heavy Duty Trucks (Greater Than 8500 Lbs. GVWR)		
1998 & Newer	30.0	24.0
1987-97	60.0	48.0
1985-86	75.0	60.0
1979-84	100.0	80.0
1974-78	150.00	120.0
1970-73	175.00	140.00
1969 & Earlier	200.0	160.0

U.S. EPA IM240 OXIDES OF NITROGEN EMISSION START-UP STANDARDS

Application	**Oxides Of Nitrogen (Grams/Mile)**	
	Composite	**Phase 2**
Light Duty Vehicles		
1996 & Newer	2.0	2.0
1991-95	2.5	2.5
1981-90	3.0	3.0
1977-80	6.0	6.0
1973-76	9.0	9.0
1968-72	10.0	10.0
High Altitude Light Duty Vehicles		

1982-84	3.0	3.0
Light Duty Trucks (0-6000 Lbs. GVWR)		
1996 & Newer (Less Than 3750 LVW)	2.0	2.0
1996 & Newer (More Than 3750 LVW)	2.5	2.5
1991-95	3.0	3.0
1988-90	3.5	3.5
1979-87	7.0	7.0
1973-78	9.0	9.0
1968-72	10.0	10.0
High Altitude Light Duty Trucks (0-6000 Lbs. GVWR)		
1991 & Newer	3.0	3.0
1988-90	3.5	3.5
1982-87	7.0	7.0
Light Duty Trucks (6001-8500 Lbs. GVWR)		
1996 & Newer (Less Than 5750 ALVW)	2.5	2.5
1996 & Newer (More Than 5750 ALVW)	4.0	4.0
1991-95	4.5	4.5
1988-90	5.0	5.0
1979-87	7.0	7.0
1973-78	9.0	9.0
1968-72	10.0	10.0
High Altitude Light Duty Trucks (6001-8500 Lbs. GVWR)		
1991 & Newer	4.5	4.5
1988-90	5.0	5.0
1982-87	7.0	7.0
Heavy Duty Trucks (Greater Than 8500 Lbs. GVWR)		
1998 & Newer	4.0	4.0
1991-97	6.0	6.0
1979-90	8.0	8.0
1970-78	10.0	10.0
1969 & Earlier	15.0	15.0

FINAL STANDARDS

Final standards are recommended for vehicles tested in calendar years 1997 and later. Tier 1 standards are recommended for all 1996 and newer vehicles and may be used for 1994 and newer vehicles.

U.S. EPA IM240 HYDROCARBONS EMISSION FINAL STANDARDS

Application	**Hydrocarbons (Grams/Mile)**	
Composite		**Phase 2**
Light Duty Vehicles		
1996 & Newer	0.60	0.40

1980-95	0.80	0.50
1975-79	3.00	2.00
1968-74	7.00	4.50
High Altitude Light Duty Vehicles		
1982-84	1.20	0.75
Light Duty Trucks (0-6000 Lbs. GVWR)		
1996 & Newer (Less Than 3750 LVW)	0.60	0.40
1996 & Newer (More Than 3750 LVW)	0.80	0.50
1984-95	1.60	1.00
1979-83	3.40	2.00
1975-78	4.00	2.50
1968-74	7.00	4.50
High Altitude Light Duty Trucks (0-6000 Lbs. GVWR)		
1988 & Newer	2.00	1.25
1984-87	2.00	1.25
1982-83	4.00	2.50
Light Duty Trucks (6001-8500 Lbs. GVWR)		
1996 & Newer (Less Than 5750 ALVW)	0.80	0.50
1996 & Newer (More Than 5750 ALVW)	0.80	0.50
1984-95	1.60	1.00
1979-83	3.40	2.00
1975-78	4.00	2.50
1968-74	7.00	4.50
High Altitude Light Duty Trucks (6001-8500 Lbs. GVWR)		
1988 & Newer	2.00	1.25
1984-87	2.00	1.25
1982-83	4.00	2.50
Heavy Duty Trucks (Greater Than 8500 Lbs. GVWR)		
1998 & Newer	2.00	1.30
1987-97	2.00	1.30
1985-86	3.00	1.90
1979-84	5.00	3.10
1970-78	10.0	6.30
1969 & Earlier	20.0	12.50

U.S. EPA IM240 CARBON MONOXIDE EMISSION FINAL STANDARDS

Application	**Carbon Monoxide (Grams/Mile)**	
	Composite	**Phase 2**
Light Duty Vehicles		
1996 & Newer	10.0	8.0
1983-95	15.0	12.0

1980-82	30.0	24.0
1975-79	65.0	52.0
1968-74	120.0	96.0
High Altitude Light Duty Vehicles		
1983-84	30.0	24.0
1982	45.0	36.0
Light Duty Trucks (0-6000 Lbs. GVWR)		
1996 & Newer (Less Than 3750 LVW)	10.0	8.0
1996 & Newer (More Than 3750 LVW)	13.0	10.0
1984-95	40.0	32.0
1979-83	70.0	56.0
1975-78	80.0	64.0
1968-74	120.0	96.0
High Altitude Light Duty Trucks (0-6000 Lbs. GVWR)		
1988 & Newer	60.0	48.0
1984-87	60.0	48.0
1982-83	90.0	72.0
Light Duty Trucks (6001-8500 Lbs. GVWR)		
1996 & Newer (Less Than 5750 ALVW)	13.0	10.0
1996 & Newer (More Than 5750 ALVW)	15.0	12.0
1984-95	40.0	32.0
1979-83	70.0	56.0
1975-78	80.0	64.0
1968-74	120.0	96.0
High Altitude Light Duty Trucks (6001-8500 Lbs. GVWR)		
1984 & Newer	60.0	48.0
1982-83	90.0	72.0
Heavy Duty Trucks (Greater Than 8500 Lbs. GVWR)		
1998 & Newer	30.0	24.0
1987-97	40.0	32.0
1985-86	50.0	40.0
1979-84	75.0	60.0
1974-78	150.0	120.0
1970-73	175.0	140.0
1969 & Earlier	200.0	160.0

U.S. EPA IM240 OXIDES OF NITROGEN EMISSION FINAL STANDARDS

Application	**Oxides Of Nitrogen (Grams/Mile)**	
Composite		**Phase 2**
Light Duty Vehicles		
1996 & Newer	1.5	1.5

1981-95	2.0	2.0
1977-80	4.0	4.0
1973-76	6.0	6.0
1968-72	7.0	7.0
High Altitude Light Duty Vehicles		
1982-84	2.0	2.0
Light Duty Trucks (0-6000 Lbs. GVWR)		
1996 & Newer (Less Than 3750 LVW)	1.5	1.5
1996 & Newer (More Than 3750 LVW)	1.8	1.8
1988-95	2.5	2.5
1979-87	4.5	4.5
1973-78	6.0	6.0
1968-72	7.0	7.0
High Altitude Light Duty Trucks (0-6000 Lbs. GVWR)		
1988 & Newer	2.5	2.5
1982-87	4.5	4.5
Light Duty Trucks (6001-8500 Lbs. GVWR)		
1996 & Newer (Less Than 5750 ALVW)	1.8	1.8
1996 & Newer (More Than 5750 ALVW)	2.0	2.0
1988-95	3.5	3.5
1979-87	4.5	4.5
1973-78	6.0	6.0
1968-72	7.0	7.0
High Altitude Light Duty Trucks (6001-8500 Lbs. GVWR)		
1988 & Newer	3.5	3.5
1982-87	4.5	4.5
Heavy Duty Trucks (Greater Than 8500 Lbs. GVWR)		
1998 & Newer	4.0	4.0
1991-97	5.0	5.0
1979-90	6.0	6.0
1970-78	10.0	10.0
1969 & Earlier	15.0	15.0

2008 ACCESSORIES & BODY, CAB

Steering Column Switches - Fusion, Milan & MKZ

DESCRIPTION AND OPERATION

STEERING COLUMN SWITCHES

The steering column switches consist of the following:

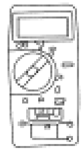
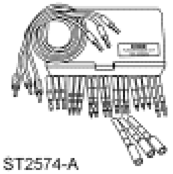
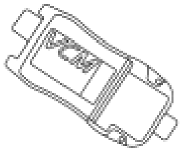
- Multifunction switch
- Ignition switch

The steering column switches receive driver inputs and send signals to various components. The multifunction switch controls the windshield wipers, hazard flasher, turn signal, headlamp low/high beam and headlamp dimmer/flash-to-pass. The ignition switch is used in conjunction with the lock cylinder key to start the vehicle. When the lock cylinder key is switched to different positions, it moves linkages which enable the ignition switch to send battery voltage to various components.

DIAGNOSTIC TESTS

STEERING COLUMN SWITCHES

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2574-A	Flex Probe Kit	105-R025B or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also identified as the Generic Electronic

Module (GEM).

Steering Column Switches - The steering column switches include the ignition switch and the multifunction switch (high beam/low beam, flash-to-pass, turn signal and windshield wiper). The ignition switch is controlled by the ignition lock cylinder with a key. When the ignition lock cylinder is turned using the key, a mechanical connection positions the ignition switch to the selected position and allows the ignition switch to send voltage to specific components. The multifunction switch controls the various components electrically. The headlamp switch sends constant voltage to the headlamps when placed in the ON position, while the flash-to-pass is a momentary switch used to send voltage to the headlamp high beams only. The headlamp high beam/low beam switch sends voltage to the low or high beam headlamps while the headlamps are on. The turn signal switch portion of the multifunction switch operates the left and right turn signals. The windshield wiper switch function uses a ground signal to activate the various wiper modes and the wiper/washer.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical

• Multifunction switch
• Ignition key
• Ignition switch
• Steering column shrouds
	• Battery Junction Box (BJB) fuse 14 (15A)
	• Wiring, terminals or connectors
	• Smart Junction Box (SJB) fuses:
	  ○ 22 (7.5A)
	  ○ 23 (7.5A)
	  ○ 24 (7.5A)
	  ○ 25 (7.5A)
	  ○ 26 (7.5A)
	  ○ 27 (7.5A)
	  ○ 28 (10A)

NOTE: For multifunction switch concerns, refer to one of the following sections:

- **For exterior lighting, refer to EXTERIOR LIGHTING article.**
- **For wipers and washers, refer to WIPERS AND WASHERS article.**

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

NOTE: The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the instrument cluster.
9. If the DTCs retrieved are related to the concern, go to Instrument Cluster DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

DTC Chart

INSTRUMENT CLUSTER DTC CHART

DTC	Description	Source	Action
B1359	Ignition KEY IN Circuit Failure	Instrument Cluster	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
B1360	Ignition RUN/ACC Circuit Failure	Instrument Cluster	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with		• REFER to **MODULE**

the Smart Junction Box (SJB)	• SJB	**COMMUNICATIONS NETWORK** article to diagnose the no communication problem.
• No power in all ignition switch positions	• Battery Junction Box (BJB) fuse • Ignition switch • Wiring, terminals or connectors	• Go to **Pinpoint Test A**.
• No power in ACC	• Ignition switch • Wiring, terminals or connectors	• Go to **Pinpoint Test B**.
• No power in RUN	• Ignition switch • Wiring, terminals or connectors	• Go to **Pinpoint Test C**.
• No power in START	• Ignition switch • Wiring, terminals or connectors	• Go to **Pinpoint Test D**.
• The ignition key is hard to turn	• Ignition key • Ignition lock cylinder • Ignition switch	• Go to the **Ignition Switch - Mechanical**.
• The multifunction switch does not operate correctly	• Multifunction switch • SJB	• For a concern with the exterior lighting, REFER to **EXTERIOR LIGHTING** article. • For a concern with the wipers and washers, REFER to **WIPERS AND WASHERS** article.

Pinpoint Tests

Pinpoint Test A: No Power in All Ignition Switch Positions

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Distribution/SJB for schematic and connector information.

Normal Operation

The ignition switch receives fused battery voltage from Battery Junction Box (BJB) fuse 14 (15A) along circuit SBB14 (BN/RD). The ignition switch has 4 possible states:

- OFF
- ACC
- RUN

- START

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- Ignition switch
- BJB

PINPOINT TEST A: NO POWER IN ALL IGNITION SWITCH POSITIONS

NOTE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

A1 CHECK FOR VOLTAGE AT THE IGNITION SWITCH

- Disconnect: Ignition Switch C250

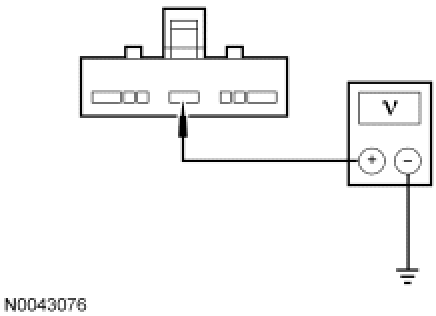


Fig. 1: Checking Circuit SBB14 (BN/RD) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between ignition switch C250-4, circuit SBB14 (BN/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new ignition switch. REFER to **Ignition Switch**. TEST the system for normal operation.

  NO : VERIFY that BJB fuse 14 (15A) is OK. If OK, go to A2 .

  If the fuse is not OK, REPAIR the BJB or circuit SBB14 (BN/RD) as necessary. INSTALL a new fuse. TEST the system for normal operation.

A2 CHECK CIRCUIT SBB14 (BN/RD) FOR AN OPEN

- Disconnect: BJB Fuse 14 (15A)

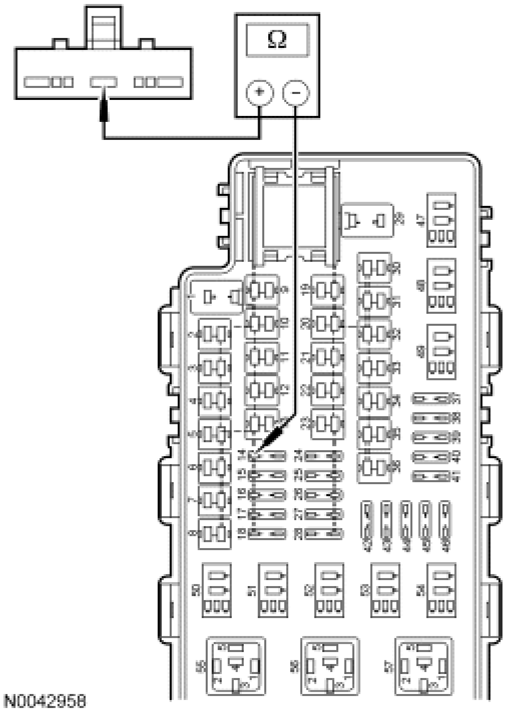


Fig. 2: Checking Circuit SBB14 (BN/RD) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between ignition switch C250-4, circuit SBB14 (BN/RD), harness side and BJB fuse 14 (15A), circuit SBB14 (BN/RD), output side.
- **Is the resistance less than 5 ohms?**

  YES : REPAIR or INSTALL a new BJB. TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

Pinpoint Test B: No Power in ACC

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Distribution/SJB for schematic and connector information.

Normal Operation

The ignition switch ACC circuit provides fused ignition voltage, along circuit CDC33 (VT/GN) to the Smart Junction Box (SJB), when the key is in the ACC position.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Ignition switch
- SJB

PINPOINT TEST B: NO POWER IN ACC

NOTE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

B1 CHECK CIRCUIT CDC33 (VT/GN) FOR VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280b
- Key in ACCESSORY position.

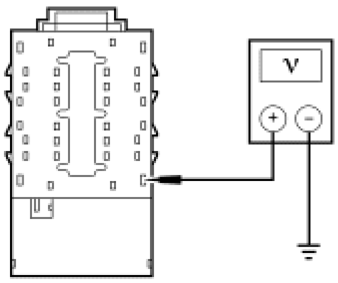


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Fig. 3: Checking Circuit CDC33 (VT/GN) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280b-4, circuit CDC33 (VT/GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to B3.

  NO : Go to B2.

B2 CHECK CIRCUIT CDC33 (VT/GN) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Disconnect: Ignition Switch C250

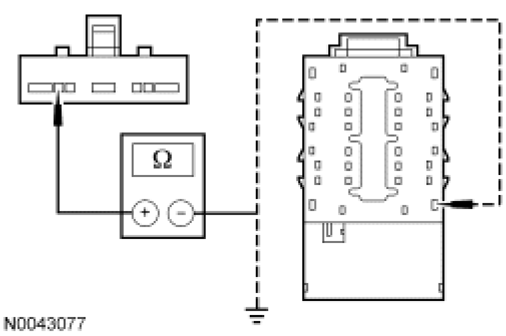

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Fig. 4: Checking Circuit CDC33 (VT/GN) For Open Or Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between:

    - ignition switch C250-6, circuit CDC33 (VT/GN), harness side and SJB C2280b-4, circuit CDC33 (VT/GN), harness side.
    - ignition switch C250-6, circuit CDC33 (VT/GN), harness side and ground.
- **Are the resistances less than 5 ohms between the components and greater than 10,000 ohms to ground?**

  YES : Go to B4.

  NO : REPAIR the circuit. TEST the system for normal operation.

B3 CHECK THE IGNITION SWITCH

- Carry out the Ignition Switch Component Test. Refer to **Ignition Switch - Mechanical**.
- **Is the ignition switch OK?**

  YES : Go to B4.

  NO : INSTALL a new ignition switch. REFER to **Ignition Switch**. CLEAR the DTCs. REPEAT the self-test.

B4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
    - corrosion.
    - pushed-out pins.
    - spread terminals.
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

Pinpoint Test C: No Power in RUN

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Distribution/SJB for schematic and connector information.

Normal Operation

The ignition switch RUN circuit provides fused ignition voltage, along circuit CDC34 (WH/OG) to the Smart Junction Box (SJB), when the key is in the RUN position.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Ignition switch

- SJB

PINPOINT TEST C: NO POWER IN RUN

NOTE: **Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

C1 CHECK CIRCUIT CDC34 (WH/OG) FOR VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280b
- Key in ON position.

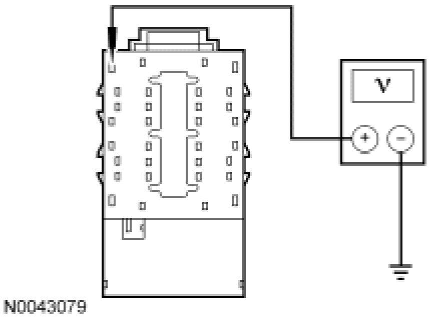


Fig. 5: Checking Circuit CDC34 (WH/OG) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280b-29, circuit CDC34 (WH/OG), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to C3.

  NO : Go to C2.

C2 CHECK CIRCUIT CDC34 (WH/OG) FOR AN OPEN OR SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280b
- Disconnect: Ignition Switch C250

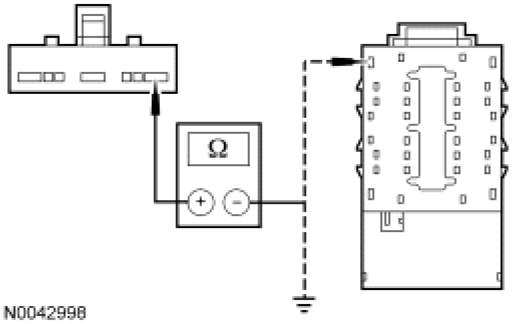


Fig. 6: Checking Circuit CDC34 (WH/OG) For Open Or Short To Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between:
  - ignition switch C250-1, circuit CDC34 (WH/OG), harness side and SJB C2280b-29, circuit CDC34 (WH/OG), harness side.
  - ignition switch C250-1, circuit CDC34 (WH/OG), harness side and ground.
- **Are the resistances less than 5 ohms between the ignition switch and the SJB, and greater than 10,000 ohms between the ignition switch and ground?**

  YES : Go to C3.

  NO : REPAIR the circuit. TEST the system for normal operation.

C3 CHECK THE IGNITION SWITCH

- Disconnect: Ignition Switch C250
- Carry out the Ignition Switch Component Test. Refer to **Ignition Switch - Mechanical**.
- **Is the ignition switch OK?**

  YES : Go to C4.

  NO : INSTALL a new ignition switch. REFER to **Ignition Switch**. CLEAR the DTCs. REPEAT the self-test.

C4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: No Power in START

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Power Distribution/SJB for schematic and connector information.

Normal Operation

The ignition switch START circuit provides fused ignition voltage, along circuit CDC35 (BU/WH) to the Smart Junction Box (SJB), when the key is in the START position.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Ignition switch
- SJB

PINPOINT TEST D: NO POWER IN START

NOTE:	**Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.**

D1 CHECK CIRCUIT CDC35 (BU/WH) FOR VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280b
- Key in START position.

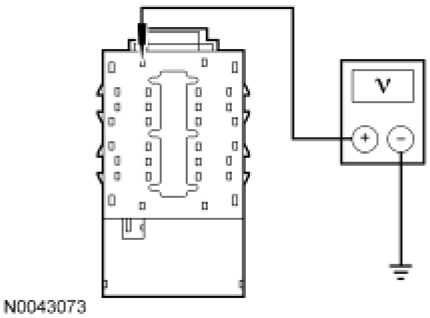


Fig. 7: Checking Circuit CDC35 (BU/WH) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280b-30, circuit CDC35 (BU/WH), harness side and ground while turning the key to the crank position.
- **Is the voltage greater than 10 volts?**

  YES : Go to D3.

  NO : Go to D2.

D2 CHECK CIRCUIT CDC35 (BU/WH) FOR AN OPEN OR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: Ignition Switch C250

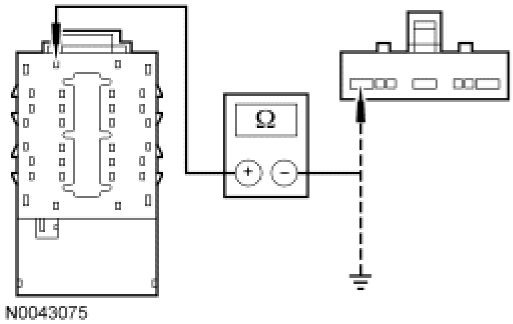


Fig. 8: Checking Circuit CDC35 (BU/WH) For Open Or Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between:
  - ignition switch C250-7, circuit CDC35 (BU/WH), harness side and SJB C2280b-30, circuit CDC35 (BU/WH), harness side.
  - SJB C2280b-30, circuit CDC35 (BU/WH), harness side and ground.
- **Are the resistances less than 5 ohms between the ignition switch and the SJB, and greater than 10,000 ohms between the SJB and ground?**

  YES : Go to D3.

  NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

D3 CHECK FOR CORRECT SJB OPERATION

- Inspect the SJB connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Component Tests

Ignition Switch - Mechanical

The following conditions can cause difficulty in operating the ignition switch and lock cylinder:

- Burrs on the lock cylinder key
- Insufficient lube on the lock cylinder

- Binding lock cylinder
- Burrs or foreign material around the rack-and-pinion actuator in the lock cylinder housing
- Insufficient lube on the actuator (do not apply lubricant to the inside of the ignition switch)
- Binding ignition switch

If the steering wheel lock is engaged with the wheels loaded against a curb, high effort will be necessary to turn the key from lock. Turn the steering wheel to either side of the lock to unload the system.

Carry out the following test to determine if the ignition switch and lock cylinder are operating correctly.

1. Inspect the ignition key for any burrs, damage or incorrect cut. Have a new ignition key made as necessary.

NOTE: **The steering wheel may be locked full left or full right. If the steering wheel is locked, it will be necessary to apply turning effort to the steering wheel in the direction of the lock while turning the key.**

2. Turn the key to the ACC position and then the RUN position.
   - If the ignition key turns to the ACC and RUN position, continue with Step 3.
   - If the ignition key will not turn to the ACC and RUN position, continue with Step 4.

NOTE: **The ignition switch and lock cylinder should return from the START position back to the RUN position without assistance.**

3. Turn the ignition key to the START position and release the key.
   - If the ignition switch and lock cylinder return from the START position back to the RUN position without assistance, the ignition switch is operating correctly at this time.
   - If the ignition switch and lock cylinder do not return from the START position back to the RUN position without assistance, continue with Step 4.
4. Remove the ignition lock cylinder. Refer to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
5. Rotate the ignition lock cylinder through all of the switch positions.
   - If the lock cylinder operates correctly, continue with Step 6.
   - If the lock cylinder does not operate correctly, install a new ignition lock cylinder. Refer to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.
6. Check for binding or sticking ignition switch actuating rod, burrs around the rack-and-pinion actuator in the ignition lock cylinder housing or insufficient lubrication.
   - If there is sufficient lubrication and there are no burrs, binding or sticking conditions; install a new ignition switch. Refer to **Ignition Switch**.
   - If there is insufficient lubrication, burrs, binding or sticking conditions; repair or lubricate as necessary.

Ignition Switch - Electrical

Refer to **Component Tests**.

Multifunction Switch - Electrical

Refer to **Component Tests**.

REMOVAL AND INSTALLATION

IGNITION SWITCH

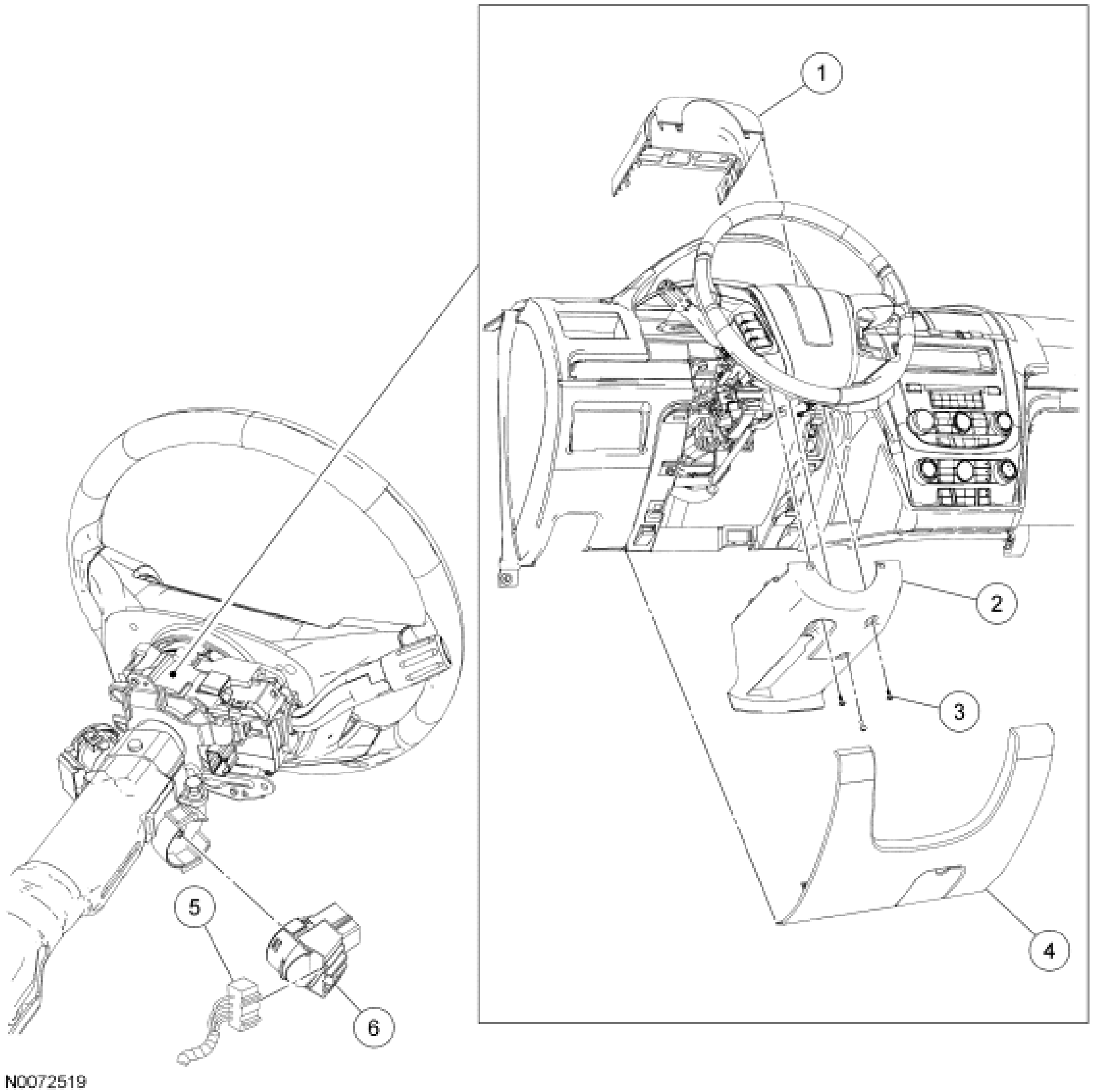


Fig. 9: Exploded View Of Ignition Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3530	Upper steering column shroud

2	3K512	Lower steering column shroud
3	W707658	Lower steering column shroud screw (3 required)
4	5404459	Steering column opening cover
5	-	Ignition switch electrical connector (part of 14401)
6	11572	Ignition switch

REMOVAL AND INSTALLATION

NOTE: Do not remove the ignition lock cylinder and the ignition switch at the same time or damage to the column may result.

1. Depower the Supplemental Restraint System (SRS). For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

   NOTE: The steering column opening cover is held in place by tabs that clip to the instrument panel.

2. Remove the steering column opening cover by pulling straight outward.

   NOTE: Release the upper steering column shroud, by pressing inward on the sides of the shroud and lifting upwards.

3. Remove the upper steering column shroud.
4. Release the tilt lever, remove the 3 lower steering column shroud screws and then the shroud.

   NOTE: Lower the steering column to the lowest tilt position.

5. Disconnect the ignition switch electrical connector.
6. Press the 2 tabs and remove the ignition switch.
7. To install, reverse the removal procedure.
8. Repower the SRS. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

STEERING COLUMN MULTIFUNCTION SWITCH

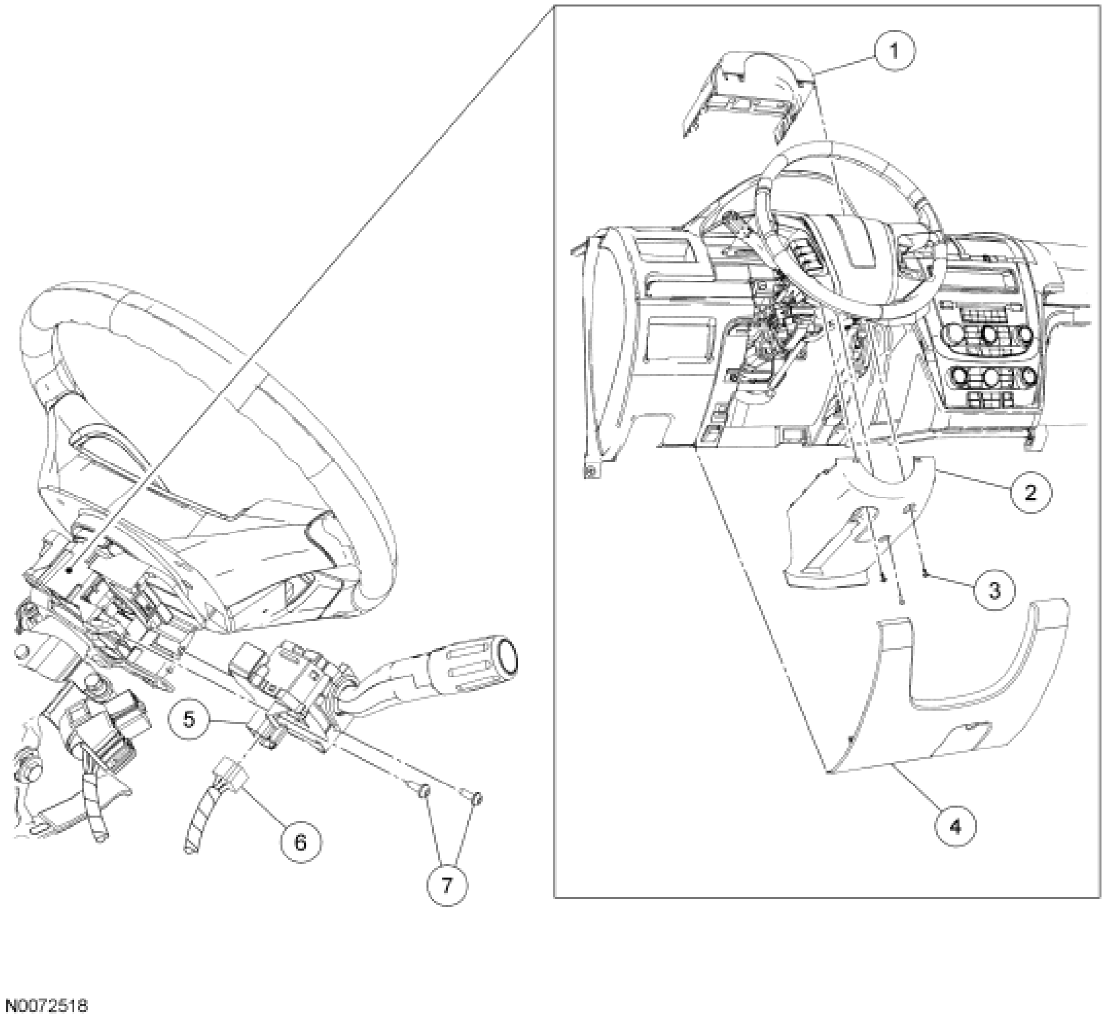


Fig. 10: Exploded View Of Steering Column Multifunction Switch
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3530	Upper steering column shroud
2	3K512	Lower steering column shroud
3	W707658	Lower steering column shroud screw (3 required)
4	5404459	Steering column opening cover
5	14K147	Multifunction switch
6	-	Multifunction switch electrical connector (part of 14401)
7	W503521	Multifunction switch screws (2 required)

REMOVAL AND INSTALLATION

NOTE: The steering column opening cover is held in place by tabs that clip to the instrument panel.

1. Remove the steering column opening cover by pulling straight outward.

NOTE: Release the upper steering column shroud, by pressing inward on the sides of the shroud and lifting upwards.

2. Remove the upper steering column shroud.
3. Release the tilt lever, remove the 3 lower steering column shroud screws and then the shroud.
4. Disconnect the multifunction switch electrical connector.
5. Remove the 2 multifunction switch screws and the switch.
6. To install, reverse the removal procedure.

STEERING COLUMN LOCK MODULE

REMOVAL AND INSTALLATION

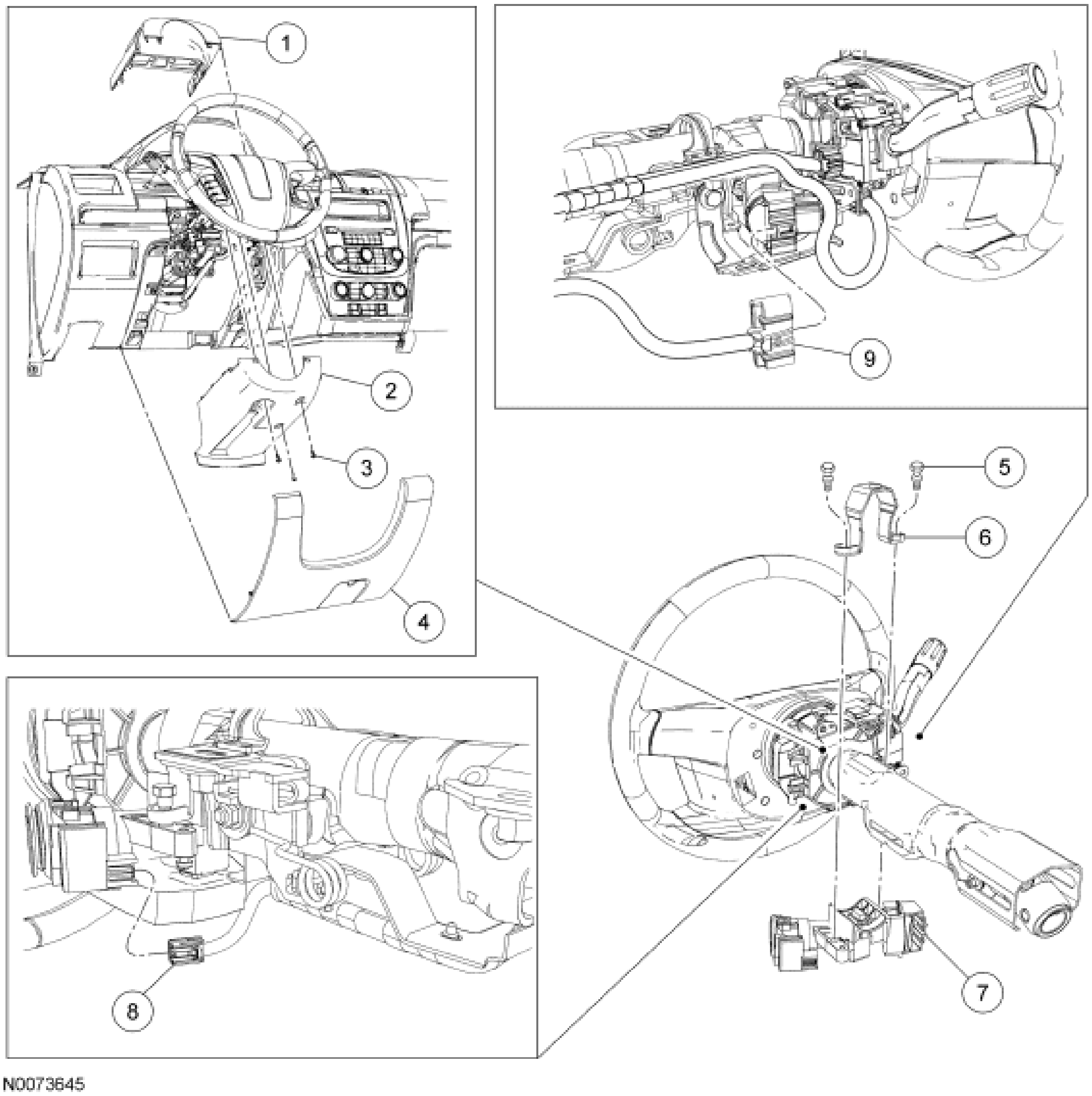


Fig. 11: Exploded View Of Steering Column Lock Module
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3530	Upper steering column shroud
2	3K512	Lower steering column shroud
3	W707658	Lower steering column shroud screw (3 required)
4	5404459	Steering column opening cover
5	-	Steering column lock module bolt (2 required)
6	-	Steering column lock module clamp
7	3K772	Steering column lock module assembly
8	-	Passive Anti-Theft System (PATS)

		electrical connector (part of 14401)
9	-	Ignition switch electrical connector (part of 14401)

NOTE: The steering column opening cover is held in place by tabs that clip to the instrument panel.

1. Remove the steering column opening cover by pulling straight outward.

NOTE: Release the upper steering column shroud, by pressing inward on the sides of the shroud and lifting upwards.

2. Remove the upper steering column shroud.
3. Release the tilt lever, remove the 3 lower steering column shroud screws and then the shroud.
4. Disconnect the Passive Anti-Theft System (PATS) and ignition switch electrical connectors.
5. Disconnect the multifunction switch electrical connector.

NOTE: After cutting slots in the lock module bolts, clean all metal shavings and foreign material from the steering column.

6. Using a suitable tool, cut slots into the heads of the 2 steering column lock module bolts.

NOTE: The lock module bolts are designed to sheer off when tightened.

7. Remove the 2 steering column lock module bolts using a screwdriver.
   - Discard the bolts.
   - To install, use new steering column lock module bolts and tighten until the heads of the bolts shear off.
8. Remove the steering column lock module clamp and the steering column lock module assembly.

NOTE: Align the locating tab on the steering column lock module with the window of the steering column tube. Verify that the lock module operates correctly.

9. To install, reverse the removal procedure.

2008 STEERING

Steering Column - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Steering column opening cover reinforcement bolts	3	-	27
Steering column shaft bolt	20	-	177
Steering column support bracket nut	21	15	-
Steering wheel nut	35	26	-

DESCRIPTION AND OPERATION

STEERING COLUMN

The steering column consists of the following:

- Steering wheel
- Steering column
- Upper and lower steering column shafts
- Steering column switches
- Ignition lock cylinder

The steering column is the mechanical linkage between the steering wheel and the steering gear. The steering wheel is mounted to a shaft which passes through the center of the steering column. The shaft is centered by roller ball bearings within the steering column. The steering column shaft then connects the steering column to the steering gear. The upper and lower steering column shaft connections utilize U-joint type couplings. The tilt and telescopic functions of the steering column are controlled by a mechanical lever on the underside of the steering column, which uses a cam to lock and unlock the steering column. When the tilt/telescopic column lever is unlocked, the steering column can then be adjusted to various positions. The steering column switches (multifunction and ignition) are mounted to the steering column. These switches are covered by the upper and lower steering column shrouds.

For steering column switch service information, refer to **STEERING COLUMN SWITCHES** article.

For ignition lock cylinder service information, refer to **HANDLES, LOCKS, LATCHES AND ENTRY SYSTEMS** article.

DIAGNOSTIC TESTS

STEERING COLUMN

Refer to **STEERING SYSTEM - GENERAL INFORMATION** article.

REMOVAL AND INSTALLATION

STEERING WHEEL

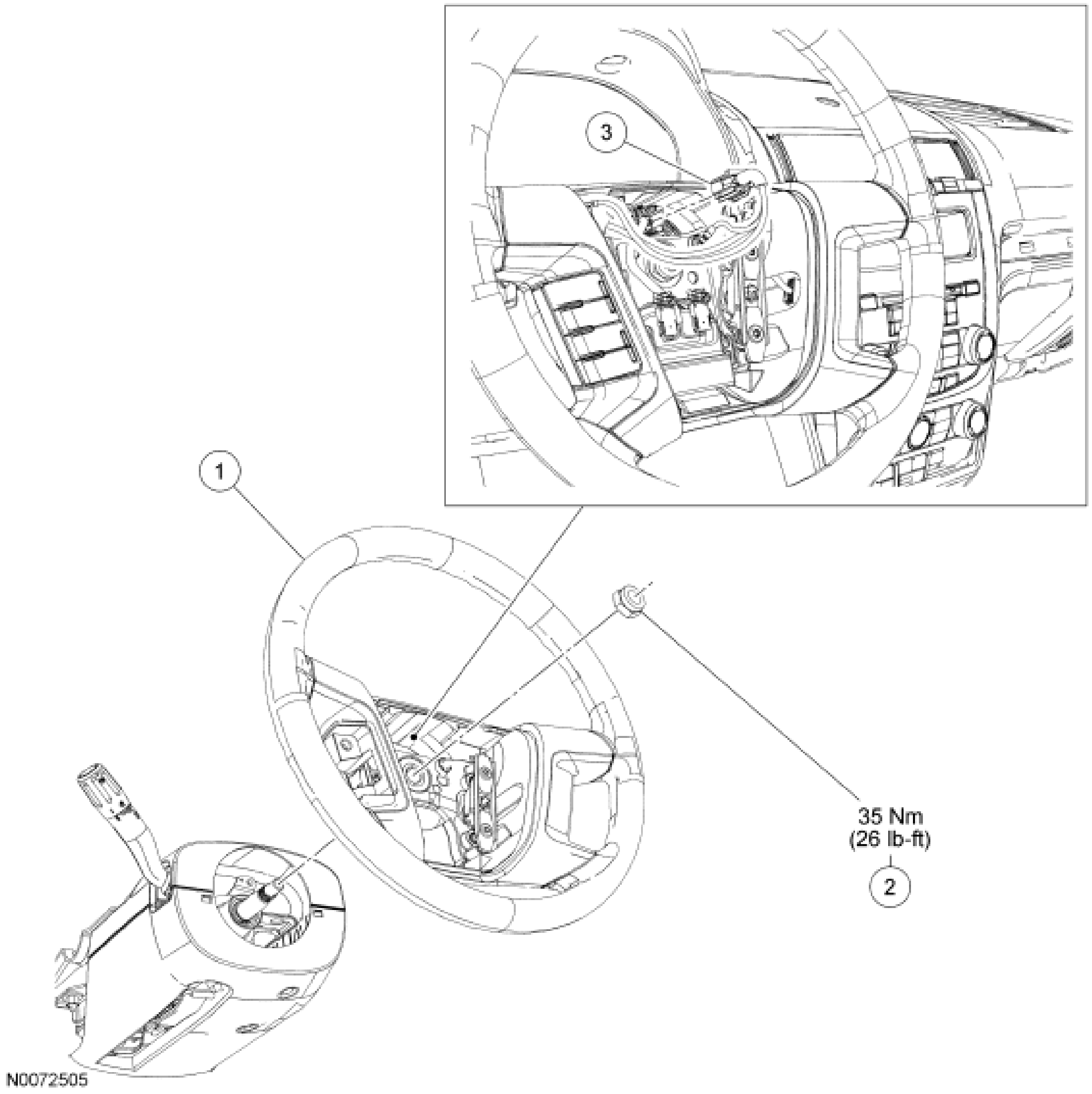


Fig. 1: Exploded View Of Steering Wheel With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3600/ 3F563	Steering wheel (urethane/leather)
2	W711835	Steering wheel nut
3	-	Steering wheel switches electrical connector (part of 3600/3F563)

REMOVAL AND INSTALLATION

1. Position the steering wheel in the straight-ahead position and turn the ignition switch to the OFF position.
    - Remove the key.
2. Remove the driver air bag module. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

NOTE: Mark the steering wheel and column shaft for reference during installation.

3. Remove the steering wheel nut.
    - To install, tighten to 35 Nm (26 lb-ft).
4. Disconnect the steering wheel switches electrical connector.

NOTE: Do not remove the steering wheel by hitting the shaft with a hammer. Damage to the column may occur.

5. Using a suitable puller, remove the steering wheel.
6. To install, reverse the removal procedure.
    - Align the steering wheel using the reference mark.

STEERING COLUMN

REMOVAL AND INSTALLATION

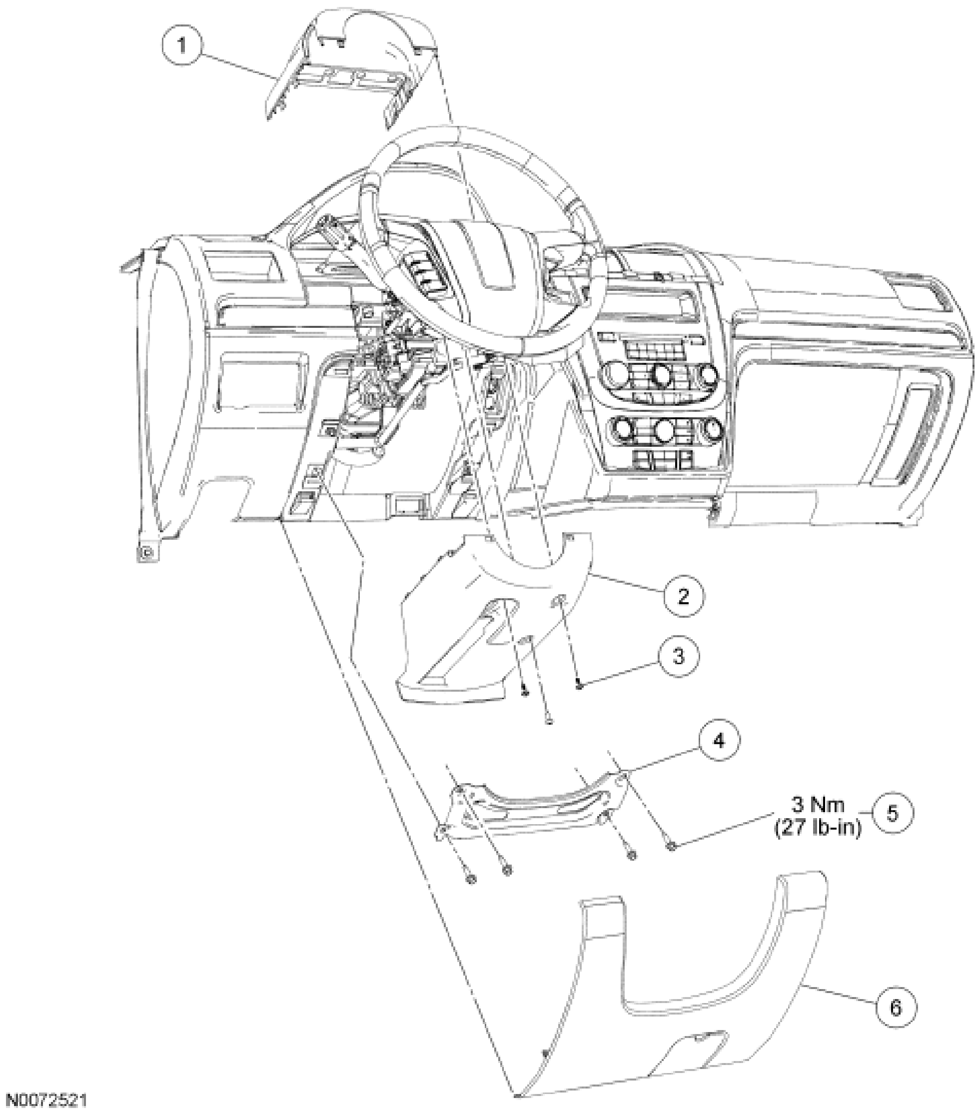


Fig. 2: Exploded View Of Steering Column With Torque Specification (1 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3530	Upper steering column shroud
2	3K512	Lower steering column shroud
3	W707658	Lower steering column shroud screw (3 required)
4	017A28	Steering column opening cover reinforcement
5	W505422	Steering column opening cover reinforcement bolt (4 required)
6	04459	Steering column opening cover

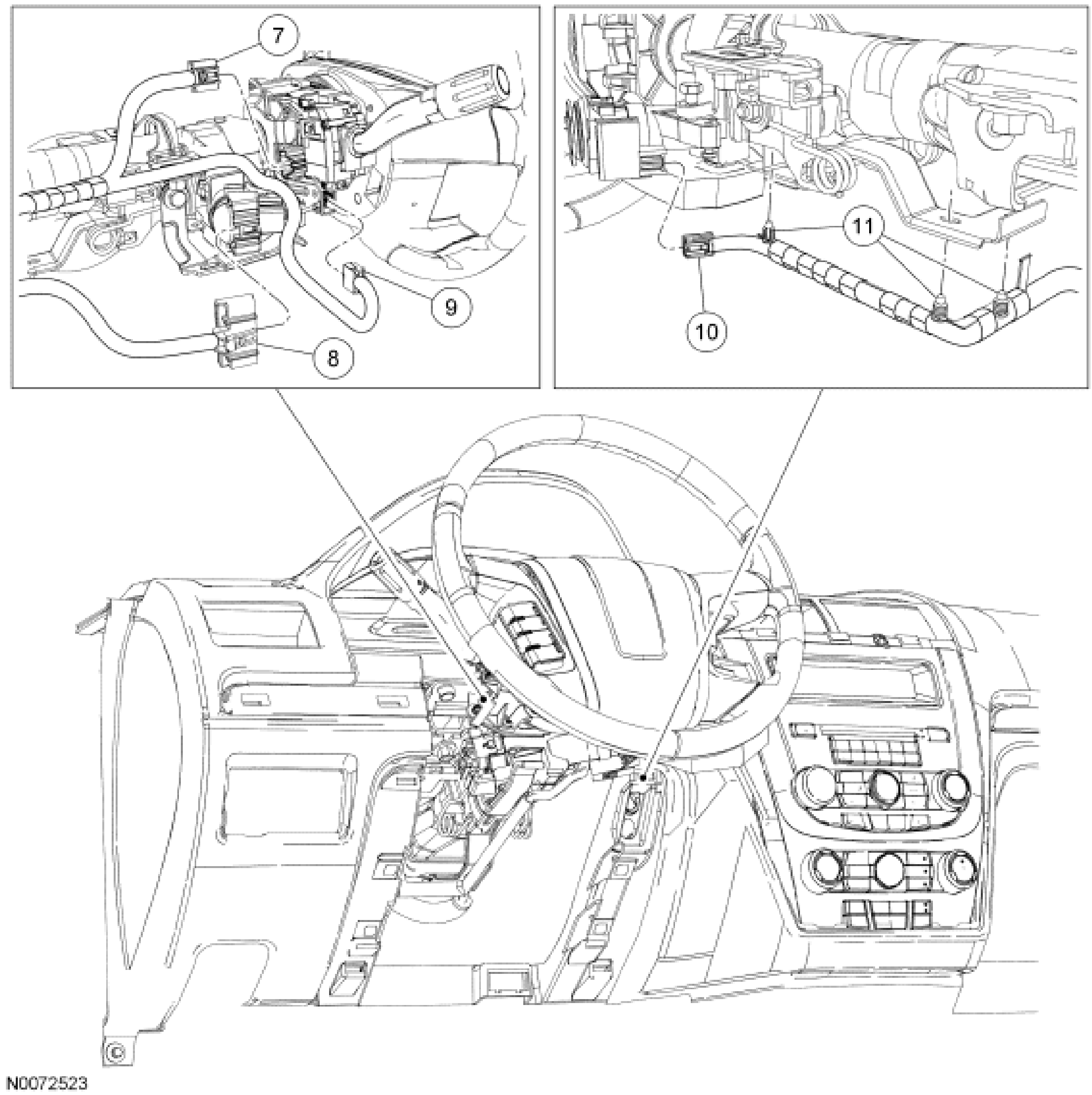


Fig. 3: Exploded View Of Steering Column (2 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
7	-	Multifunction switch electrical connector (part of 14401)
8	-	Ignition switch electrical connector (part of 14401)
9	-	Clockspring electrical connector (part of 14401)
10	-	Passive Anti-Theft System (PATS) electrical connector (part of 14401)
11	-	Wiring harness retainers (3 required) (part of 14401)

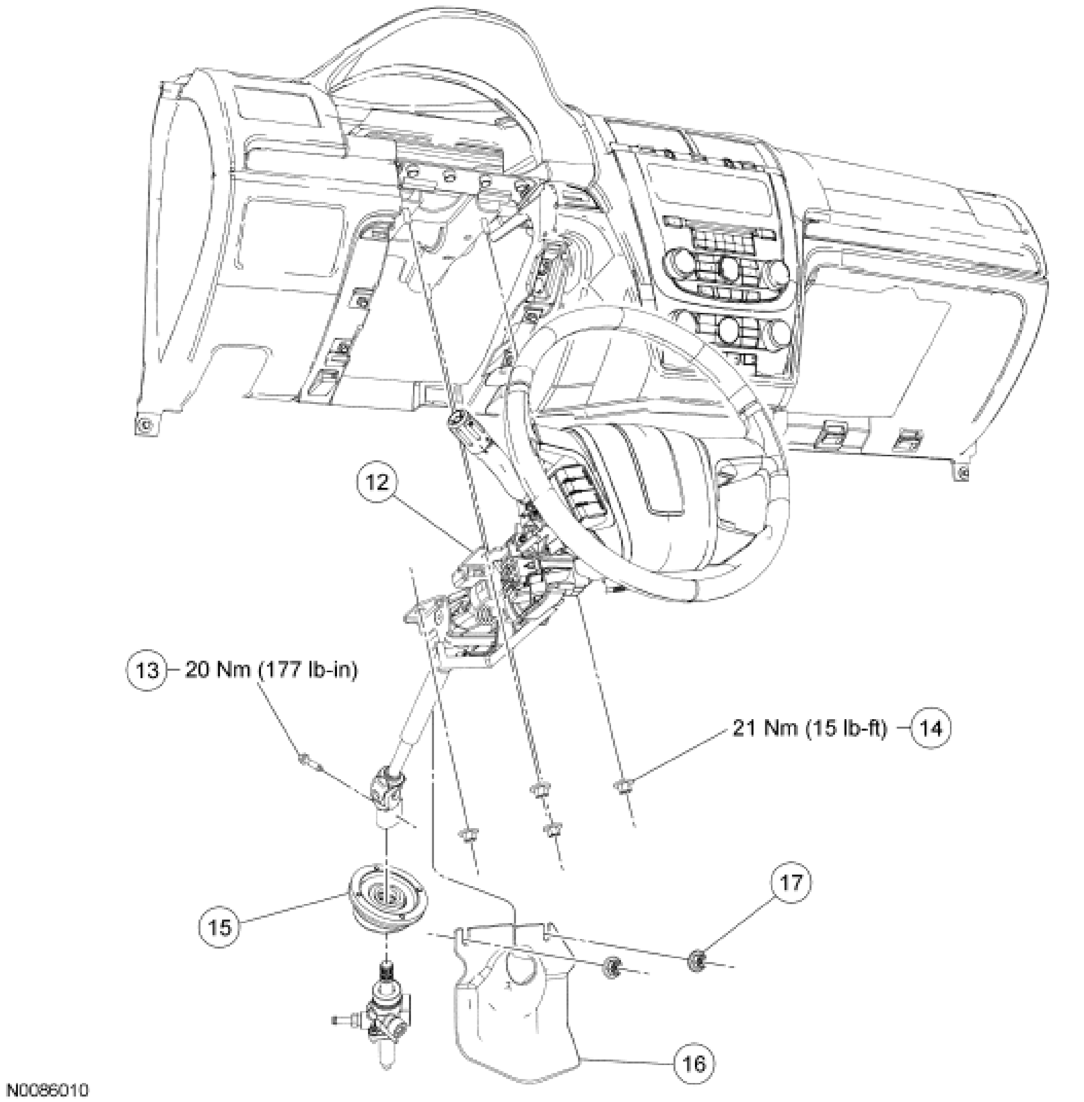


Fig. 4: Exploded View Of Steering Column With Torque Specifications (3 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
12	3C529	Steering column
13	3R827	Steering column shaft bolt
14	N806423	Steering column support bracket nut (4 required)
15	3C611B	Steering gear/dash seal
16	3C611A	Lower steering column shaft joint cover
17	W704904	Lower steering column shaft joint cover nut

1. Turn the steering wheel to the straight-ahead position and turn the ignition switch to the OFF position.

- Remove the key.

2. Depower the Supplemental Restraint System (SRS). For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.
3. Remove the steering column shrouds. Refer to **Steering Column Shroud**.
4. Disconnect the multifunction switch, ignition switch and clockspring electrical connectors.
5. Disconnect the Passive Anti-Theft System (PATS) electrical connector.
6. Detach the wiring harness retainers and position the wiring harness aside.
7. Remove the 2 lower steering column shaft joint cover bolts and cover.

NOTE: Do not allow the steering column to rotate while the steering column shaft is disconnected, or damage to the clockspring may result. If there is evidence that the steering column has rotated, the clockspring must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.

NOTE: Index-mark the steering column shaft position to the steering gear for reference during installation.

8. Remove the steering column shaft bolt and disconnect the shaft from the steering gear.
    - To install, tighten to 20 Nm (177 lb-in).

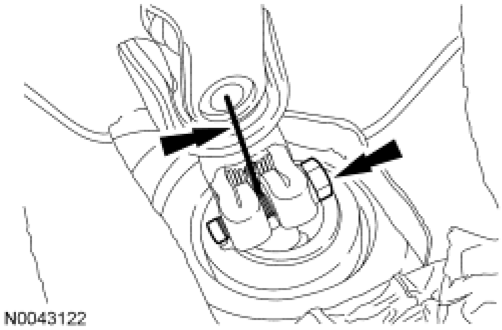


Fig. 5: Locating Steering Column Shaft Index Mark And Bolt
Courtesy of FORD MOTOR CO.

9. Remove the 4 steering column support bracket nuts and the steering column.
    - To install, tighten to 21 Nm (15 lb-ft).
10. To install, reverse the removal procedure.
11. Repower the SRS. For additional information, refer to **SUPPLEMENTAL RESTRAINT SYSTEM** article.

STEERING COLUMN SHROUD

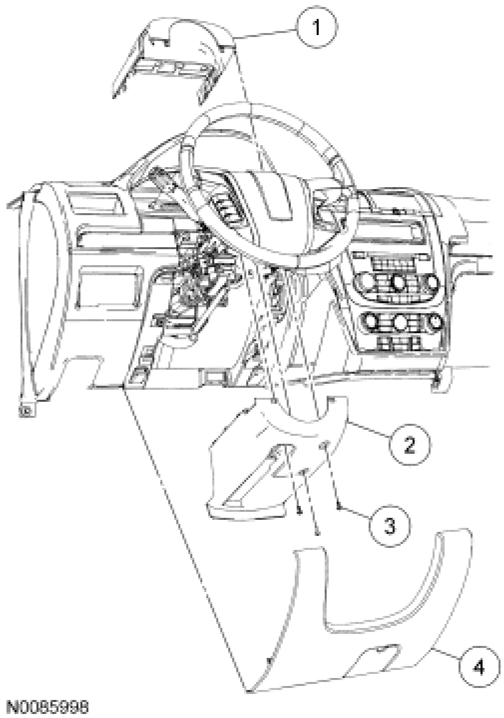


Fig. 6: Exploded View Of Steering Column Shroud
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3530	Upper steering column shroud
2	3K512	Lower steering column shroud
3	W707658	Lower steering column shroud screw
4	5404459	Steering column opening cover

REMOVAL AND INSTALLATION

NOTE: The steering column opening cover is held in place by tabs that clip to the instrument panel.

1. Remove the steering column opening cover by pulling straight outward.

NOTE: Release the upper steering column shroud by pressing inward on the sides of the shroud and lifting upwards.

2. Remove the upper steering column shroud.
3. Release the tilt lever, remove the 3 lower steering column shroud screws and then the shroud.
4. To install, reverse the removal procedure.

2008 GENERAL INFORMATION

Steering System - General Information - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	-	-
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V	1.4L (2.5 pt)[a]

[a] Capacities listed are average system capacities and may vary.

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Power Steering Gear	
Turning effort	35 N (7.86 lb)
Power Steering Pump	
Flow (2.3L engine)	9.3-7.0L/min (2.47-1.84 gpm) Fluid @ 74°-80°C (165°-175°F) Engine @ 2,100 RPM
Flow (3.0L engine)	9.3-7.4L/min (2.47-1.95 gpm) Fluid @ 74°-80°C (165°-175°F) Engine @ 2,000 RPM
Minimum capacity (all engines)	3.4L/min (0.89 gpm) Fluid @ 74°-80°C (165°-175°F) Pressure 517 kPa (749 psi)
Pressure (2.3L engine)	648 kPa (94 psi) Fluid @ 74°-80°C (165°-175°F) Engine @ 2,000 RPM
Pressure (3.0L engine)	1069 kPa (155 psi) Fluid @ 74°-80°C (165°-175°F)

	Engine @ 2,000 RPM
Relief pressure (2.3L engine)	9,720-10.170 kPa (1,409-1,475 psi)
Relief pressure (3.0L engine)	9,090-9,540 kPa (1,318-1,284 psi)
Power Steering Purge Vacuum	
Air purge vacuum	68-85 kPa (20-25 in/Hg)

DESCRIPTION AND OPERATION

STEERING SYSTEM

The power steering system consists of the following components:

- Power steering pump
- Power steering fluid reservoir
- Steering gear
- Power steering fluid cooler
- Power steering lines
- Steering column
- Steering column shaft

The power steering system transfers driver inputs at the steering wheel to the front wheels of the vehicle. The steering column, hydraulic system and linkages that transfer these driver inputs make up the steering system. Gearing and hydraulic assist are used to significantly reduce steering efforts.

For information on the power steering fluid reservoir, power steering pump, power steering lines and steering gear, refer to **POWER STEERING** article.

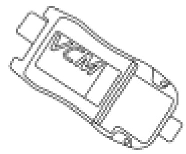
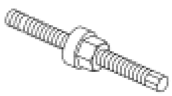
For information on the steering wheel, steering column and steering column shaft, refer to **STEERING COLUMN** article.

DIAGNOSTIC TESTS

STEERING SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
	100W/12 Volt DC UV Lamp	164-R0751

 ST2834-A	Dial Thermometer 0-220°F	023-R0007 or equivalent
 ST1287-A	Evacuation Cap, Power Steering	211-265 or equivalent
 ST1385-A	Vacuum Pump Kit	416-D002 (D95L-7559-A) or equivalent
 ST1185-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Material

Item	Specification
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	-
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Principles of Operation

Power Steering - The power steering system uses a vane-type pump to move the fluid from the reservoir to the steering gear and through the rest of the steering hydraulic system. The power steering pump is mounted to the engine and driven by the engine accessory drive belt. Power steering fluid is pulled into the pump from the reservoir. The power steering fluid is then trapped between the pump vanes and moved to the high pressure side of the pump creating a flow of fluid. The restriction of this flow by the steering gear creates the pressure that provides the steering assist. A combined pressure relief/flow valve is built into the pump to control the maximum pressure and flow provided to the steering system. This action prevents damage to the system and provides the correct level of assist during all engine speeds. While under pressure, the power steering fluid flows through the high pressure power steering line to the steering gear. The fluid exits the gear and flows through the return line, cooler and finally to the reservoir. The reservoir slows the fluid, allows air to escape and filters the fluid before returning it to the pump.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

VISUAL INSPECTION CHART

Mechanical
• Fluid level • Tire pressure • Tires • Drive belt • Drive belt tensioner • Steering column alignment • Tie-rod ends • Suspension components • Steering column shaft U-joints • Intermediate shaft bolts • Power steering reservoir baffle • Power steering reservoir screen • Power steering pressure lines, fittings or O-rings • Power steering return hoses and clamps • Steering gear • Power steering pump • Power steering pressure switch

3. Inspect the power steering fluid for the following conditions:
   - Aeration or foam: Purge the power steering system. Refer to **Power Steering System Purging - 2.3L** or **Power Steering System Purging - 3.0L, 3.5L** .
   - Overheating or contamination: Flush the power steering system. Refer to **Power Steering System Flushing**.

NOTE: It may be necessary to add power steering fluid to achieve the correct level.

4. Check the fluid level and clean the power steering components.

   With the ignition OFF:

   - check the power steering fluid level and add fluid as necessary.
   - wipe off any visible signs of fluid or residue build up.

CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.

- Start the engine and turn the steering wheel from stop-to-stop several times.

5. Visually inspect the power steering hydraulic line/hose connections for leaks.
   - If a leak is detected at a threaded fitting or clamp plate joint, tighten to specification. If the leak is still evident, visually inspect the O-rings or Teflon® seals. Install new O-rings or Teflon® seals as necessary. Refer to **POWER STEERING** article.
   - If a leak is detected at a constant tension spring clamp, verify that the hose is not damaged and fully installed on the hose fitting. Make sure that the constant tension spring clamp is correctly positioned. If the leak remains, install a new constant tension spring clamp.
   - If a leak is detected at a screw clamp joint, verify that the hose is fully installed on the hose fitting before tightening the screw clamp. If the leak remains, install a new screw clamp. Refer to **POWER STEERING** article.
   - If a leak is detected at the power steering pressure switch, install a new switch. Refer to the appropriate Engine article for the procedure.
6. Visually inspect the power steering components for leaks.
   - If a leak is detected in the power steering pressure line or return hose, install a new hose. Refer to **POWER STEERING** article.
   - If a leak is detected in the power steering pump, install a new power steering pump. Refer to **POWER STEERING** article.

   NOTE: On vehicles with rack-and-pinion steering gear, it may be necessary to remove the bellows boot clamp from the steering gear bellows boot to inspect for internal steering gear leaks.

   - If a leak is detected in the steering gear, repair or install a new steering gear. Refer to **POWER STEERING** article.
   - If a leak is detected in the power steering reservoir, install a new reservoir. Refer to **POWER STEERING** article.
7. For information on power steering leak detection, refer to **Component Tests** in this article.
8. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding.
9. If the cause is not visually evident, verify the symptom and Go to **Symptom Chart - Steering System** or Go to **Symptom Chart - Noise, Vibration and Harshness (NVH)**.

Steering System Symptom Definitions

Drift/Pull

Pull is described as a tugging sensation felt by the hands on the steering wheel that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with the hands off the steering wheel.

- A vehicle-related drift/pull on a flat road can cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.
- Drift/pull can be induced by conditions external to the vehicle, such as wind or road camber.

Excessive Steering Wheel Play

Excessive steering wheel play is a condition in which there is too much steering wheel movement before the wheels move. A small amount of steering wheel free play is considered normal.

Lack of Assist or Inconsistent Assist

Lack of assist or inconsistent assist is experienced when the steering wheel effort is higher than normal. Hard steering can remain constant through the full turn or occur near the end of a turn. It is important to know the difference between hard steering/lack of assist and poor returnability/sticky steering.

Hard steering or lack of assist can result from either hydraulic or mechanical conditions. It is extremely important to know if this concern occurs during driving or during high-effort parking maneuvers.

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to describe the poor return of the steering wheel to center after a turn or steering correction is completed.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Symptom Chart - Steering System

Symptom Chart - Steering System

Condition	Possible Sources	Action
• Steering has lack of assist or inconsistent assist	• Contaminated power steering fluid	• CHECK the power steering fluid for contamination. FLUSH the power steering system as necessary. REFER to **Power Steering System Flushing**.
	• Steering gear • Power steering pump • Restricted power steering lines/hoses	• Go to **Pinpoint Test A**.
• Excessive steering wheel play	• Steering gear	• REPAIR or INSTALL a new steering gear as necessary. REFER to **POWER STEERING** article.

	• Steering column • Steering column shaft/coupling • Steering linkage • Ball joints • Strut bearing plate	• Go to **Pinpoint Test B**.
• Steering system drift/pull/wander	• Unevenly loaded vehicle	• CORRECT the vehicle loading as necessary.
	• Tire pressure • Wheel alignment • Steering column shaft/coupling • Frame alignment • Steering gear	• Go to **Pinpoint Test C**.
• Poor returnability/sticky steering	• Binding steering column shaft/coupling U-joints	• INSTALL a new steering column shaft. REFER to **STEERING COLUMN** article.
	• Loose, worn or damaged steering linkage	• Go to **Steering Linkage Test**.
	• Binding suspension components	• To continue the suspension diagnosis, REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.
	• Binding steering column bearing(s)	• INSTALL a new steering column. REFER to **STEERING COLUMN** article.
	• Binding dash boot seal	• INSTALL a new dash boot seal. REFER to **STEERING COLUMN** article.
	• Steering gear	• REPAIR or INSTALL a new steering gear as necessary. REFER to **POWER STEERING** article.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of

their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

Symptom Chart - Noise, Vibration and Harshness (NVH)

Condition	Possible Sources	Action
• Steering system cold start noise	• Blockage in the power steering fluid reservoir caused by power steering fluid contamination	**NOTE:** **Some noise during an extremely cold start (-12.2°C [-10°F]) is normal and should improve as the steering system warms up (usually within 60 seconds).** **NOTE:** **It may be necessary to remove the power steering fluid reservoir to flush contamination trapped in the reservoir screen.** • CHECK the power steering fluid reservoir for contamination. FLUSH the power steering system as necessary. REFER to **Power Steering System Flushing**.
	• Air in the steering hydraulic system (aerated fluid)	• CHECK for leaks in the system. REFER to Power Steering Leak Test Component Test. PURGE the air from the system. REFER to **Power Steering System Purging - 2.3L** or **Power Steering System Purging - 3.0L, 3.5L**.
• Steering grunt or shudder - occurs when turning into or out of a turn at low speeds (temperature sensitive)	• Air in the steering hydraulic system (aerated fluid)	• CHECK for leaks in the system. REFER to Power Steering Leak Test Component Test. PURGE the air from the system. REFER to **Power Steering System Purging - 2.3L** or **Power Steering System Purging - 3.0L, 3.5L**.
	• Steering gear or power steering hoses	• Go to **Steering Gear Grunt/Shudder Test**.
		NOTE: **Some amount of clonk noise is considered acceptable. If in**

		doubt of the acceptability, compare to another vehicle.
• Steering system clonk - hydraulic knocking sound	• Air in the steering hydraulic system (aerated fluid)	• CHECK for leaks in the system. REFER to Power Steering Leak Test Component Test. PURGE the air from the system. REFER to **Power Steering System Purging - 2.3L** or **Power Steering System Purging - 3.0L, 3.5L**.
• Power steering pump moan - loud humming noise occurs when the steering wheel is rotated to the stop position. Produces a 120-600 Hz frequency that changes with RPM	• Low fluid	• CHECK the fluid level. FILL as necessary. REFER to **Power Steering System Filling - 2.3L** or **Power Steering System Filling - 3.0L, 3.5L**.
	• Air in the steering hydraulic system (aerated fluid)	• CHECK for leaks in the system. REFER to Power Steering Leak Test Component Test. PURGE the air from the system. REFER to **Power Steering System Purging - 2.3L** or **Power Steering System Purging - 3.0L, 3.5L**. If a pump moan still exists, INSTALL a new power steering pump. REFER to **POWER STEERING** article.
	• Power steering fluid reservoir or screen is blocked or damaged	• INSPECT the reservoir. FLUSH or INSTALL a new reservoir as necessary.
	• Power steering line/hose grounded to chassis	• INSPECT the power steering lines/hoses. REPAIR as necessary.
	• Power steering pump brackets loose or misaligned	• CHECK bolts, brackets and bracket alignment. TIGHTEN bolts to specification. REPAIR or INSTALL new brackets as necessary. REFER to **POWER STEERING** article.
	• Steering gear isolators	• INSPECT the isolators for wear or damage. REPAIR as necessary.
• Steering gear clunk - occurs only while cornering over a bump (can be temperature	• Steering gear	• INSPECT the steering gear for loose mounting bolts. TIGHTEN to specification as necessary. REFER

sensitive)		to **POWER STEERING** article.
• Feedback (rattle, chuckle or knocking noise in the steering gear) - roughness is felt in the steering wheel when the vehicle is driven over rough surfaces	• Steering column shaft/coupling joints damaged or worn • Loose, damaged or worn tie-rod ends • Steering gear insulators or mounting bolts loose or damaged • Steering column shaft/coupling bolts are loose • Steering column damaged or worn	• INSTALL a new steering column shaft. REFER to **STEERING COLUMN** article. • INSPECT and INSTALL new tie-rod ends as necessary. Go to **Steering Linkage Test**. • TIGHTEN the bolts to specification or INSTALL new bolts as necessary. REFER to **POWER STEERING** article. • TIGHTEN the bolts to specification. REFER to **STEERING COLUMN** article. • REPAIR or INSTALL a new steering column as necessary. REFER to **STEERING COLUMN** article.
• Power steering hiss or whistle	• Steering column shaft/coupling-to-steering gear is binding or misaligned • Grounded or loose steering column boot at the dash panel • Damaged or worn steering gear input shaft and valve • Power steering pump low relief pressure • Restricted power steering lines/hoses	• REPAIR or INSTALL a new steering column shaft as necessary. REFER to **STEERING COLUMN** article. • REPAIR as necessary. • REPAIR or INSTALL a new steering gear as necessary. REFER to **POWER STEERING** article. • Go to **Pinpoint Test A**. • Go to **Pinpoint Test A**.
• Steering column rattle	• Loose bolts or attaching brackets • Loose, worn or insufficiently lubricated column bearings	• TIGHTEN the bolts to specification. • LUBRICATE bearings or INSTALL new steering column bearings or steering column as necessary. REFER to **STEERING**

	• Steering shaft insulators damaged or worn • Steering column shaft/coupling compressed or extended	**COLUMN** article. • INSTALL new insulators. REFER to **STEERING COLUMN** article. • INSPECT the rubber spider coupling for damage. INSTALL a new intermediate/flexible shaft. REFER to **STEERING COLUMN** article.
• Steering gear squeak	• Incorrect power steering fluid in system	• If incorrect power steering fluid is suspected, FLUSH the power steering system. REFER to **Power Steering System Flushing**. If noise persists after system flush, INSTALL a new steering gear. REFER to **POWER STEERING** article.
	• Steering gear rotary seal	**NOTE:** **Use the chassis ears to verify that the steering gear is the source of the noise. It may be necessary to replicate the customer operating conditions (fluid temperature, turning rate of steering wheel) to get the squeak to reoccur.** • INSTALL a new steering gear as necessary. REFER to **POWER STEERING** article.
	• Stone shield (if equipped)	• MAKE SURE that the stone shield is correctly installed and that it is not making contact with the steering shaft. REPOSITION stone shield or INSTALL a new stone shield as necessary.
• Steering column squeak, cracks or grinds	• Insufficiently lubricated steering shaft bushings	• LUBRICATE the steering shaft and shaft tube seals.
	• Loose or misaligned steering column shrouds	• TIGHTEN or ALIGN the steering column shrouds.
	• Steering wheel rubbing against steering column shrouds	• REPOSITION the steering column shrouds.
	• Upper or lower bearing sleeves out of position	• REPOSITION the bearing sleeves.

• Power steering pump noisy	• Power steering pump	• INSTALL a new power steering pump as necessary. REFER to **POWER STEERING** article.
• Power steering pump relief noise	• Power steering fluid flow into the bypass valve of the pump valve housing, with fluid temperature below 54°C (130°F)	• Acceptable condition.
• Power steering pump whine noise	• Aerated fluid	• CHECK for a leak in the system. REFER to Power Steering Fluid Leak Test Component Test. PURGE the air from the system. REFER to **Power Steering System Purging - 2.3L** or **Power Steering System Purging - 3.0L, 3.5L**.
	• Damaged power steering pump	• INSTALL a new power steering pump as necessary. REFER to **POWER STEERING** article.
• High speed shake or shimmy - occurs at high speeds	• Worn or damaged steering linkage components	• Go to **Steering Linkage Test**.

Pinpoint Tests

Pinpoint Test A: Steering Has Lack of Assist or Inconsistent Assist

NOTE: **Hard steering or lack of assist is experienced when the steering wheel effort exceeds specifications. Hard steering can remain constant through the full turn, occur near the end of a turn or differ right to left. It is important to know the difference between hard steering/lack of assist and poor returnability/sticky steering.**

This pinpoint test is intended to diagnose the following:

- Steering gear
- Power steering pump
- Power steering hoses

PINPOINT TEST A: STEERING HAS LACK OF ASSIST OR INCONSISTENT ASSIST

A1 CHECK THE STEERING ASSIST WITH THE ENGINE RPM RAISED

CAUTION: **Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.**

- Set the engine at 2,100 RPM and turn the steering wheel fully to the left and right.
- **Is steering assist normal with the engine RPM raised?**

  YES : INSTALL a new power steering pump. REFER to **POWER STEERING** article.

  NO : Go to A2.

A2 CHECK FOR A CHANGE OF ASSIST ON LEFT AND RIGHT TURNS

- With the engine at idle, turn the steering wheel fully to the left and to the right.
- **Does the steering assist change when turning from right to left?**

  YES : INSTALL a new steering gear. REFER to **POWER STEERING** article.

  NO : Go to A3.

A3 CHECK THE STEERING LINES AND HOSES FOR RESTRICTIONS

- Inspect the steering lines and hoses for damage, kinks or restrictions.
- **Are the steering lines or hoses damaged, kinked or restricted?**

  YES : INSTALL new lines or hoses as necessary.

  NO : Go to A4.

A4 MONITOR THE ENGINE RPM CHANGES

CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.

NOTE: Make sure that the vehicle is on a flat dry surface, all accessories are in the OFF position and that the steering system is at normal operating temperature.

- Connect the diagnostic tool.
- Start the engine.
- With the engine at idle, raise the power steering fluid temperature to 74-80°C (165-176°F) by rotating the steering wheel fully to the left and right several times.
- While monitoring the engine RPM with the scan tool, turn the steering wheel quickly to the left stop position and then to the right stop position.
- Note the engine RPM during the turns.
- **Does the engine RPM change (even temporarily) more than 30 RPM when turning the steering wheel?**

  YES : INSTALL a new steering gear. REFER to **POWER STEERING** article.

  NO : INSTALL a new power steering pump. REFER to **POWER STEERING** article.

Pinpoint Test B: Excessive Steering Wheel Play

This pinpoint test is intended to diagnose the following:

- Steering column bearings
- Steering linkage

- Suspension components

PINPOINT TEST B: EXCESSIVE STEERING WHEEL PLAY

B1 CHECK THE STEERING COLUMN BEARINGS

- Inspect the steering column mounting fasteners and bearings for looseness.
- **Are the fasteners and bearings OK?**

  YES : Go to B2.

  NO : TIGHTEN the steering column mounting fasteners or INSTALL a new steering column. REFER to **STEERING COLUMN** article.

B2 CHECK THE STEERING LINKAGE FOR LOOSENESS

- Carry out the **Steering Linkage Test**.
- **Is the steering linkage OK?**

  YES : To diagnose suspension components, REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

  NO : INSTALL new steering linkage components as necessary. Refer to the appropriate Steering System article for the procedure.

Pinpoint Test C: Steering System Drift/Pull/Wander

This pinpoint test is intended to diagnose the following:

- Steering gear
- Intermediate shaft
- Intermediate shaft U-joints
- Steering gear mounts
- Suspension components

PINPOINT TEST C: STEERING SYSTEM DRIFT/PULL/WANDER

C1 CHECK FOR TIRE PULL

- Rotate the front wheel and tire assemblies side to side. Refer to the appropriate Suspension article for the procedure.
- Carry out a road test on a smooth, flat road.
- **Does the vehicle drift/pull?**

  YES : If vehicle pulls in the opposite direction, go to C2 .

  If vehicle pulls in the original direction, go to C3 .

  NO : The concern has been corrected.

C2 ROTATE THE WHEEL AND TIRE ASSEMBLIES FRONT TO REAR

- Rotate the wheel and tire assemblies front to rear. Refer to the appropriate Suspension article for the procedure.

- Carry out a road test on a smooth, flat road.
- **Does the vehicle drift/pull?**

  YES : Go to C3.

  NO : The concern has been corrected.

C3 CHECK THE STEERING COLUMN INTERMEDIATE SHAFT

NOTE: **Be sure to keep the clockspring centered when disconnecting the intermediate shaft. Refer to the appropriate Body article for the procedure.**

- Check the steering column and intermediate shaft for grounding.
- Disconnect the steering column intermediate shaft at the steering column.
- Inspect the steering column intermediate shaft U-joints for looseness or wear.
- **Are the steering column intermediate shaft universal joints OK?**

  YES : Go to C4.

  NO : INSTALL a new steering column intermediate shaft as necessary. REFER to **STEERING COLUMN** article.

C4 CHECK THE STEERING GEAR MOUNTING

- Check the steering gear mounts for looseness or wear.
- **Are the steering gear mounts OK?**

  YES : Go to C5.

  NO : INSTALL a new steering gear as necessary. REFER to **POWER STEERING** article.

C5 CHECK THE STEERING GEAR

- Carry out the **Steering Gear Valve Test**.
- **Is the steering gear valve OK?**

  YES : Go to C6.

  NO : REPAIR or INSTALL a new steering gear as necessary. REFER to **POWER STEERING** article.

C6 CHECK THE SUSPENSION COMPONENTS

- Check for loose or worn suspension components.
- **Are the suspension components OK?**

  YES : Go to C7.

  NO : INSTALL new suspension components as necessary. Refer to the appropriate Suspension article for the procedure.

C7 CHECK THE WHEEL ALIGNMENT

NOTE: **The vehicle will tend to pull toward the side with the least positive caster and the most positive camber.**

- Using a suitable alignment system, measure the wheel alignment settings. Refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article

- **Are the alignment settings within specifications?**

  YES : CHECK for correct frame alignments. Refer to the appropriate Frame and Mounting article for the procedure.

  NO : ADJUST the alignment angles to specifications. DO NOT exceed the specifications. TEST the system for normal operation.

Component Tests

Power Steering Fluid Leak Test

NOTE: This test should only be carried out if a leak in the system has not been detected during a thorough visual inspection. Refer to Inspection and Verification.

1. Check the power steering fluid level. If necessary, add the specified power steering fluid.
2. Remove the power steering pump reservoir cap and tightly install the evacuation cap to the power steering pump reservoir.
3. Install the hose from the fill adapter manifold tee to the evacuation cap on the power steering pump reservoir.
4. Install the vacuum pump to the evacuation cap.
5. Using the vacuum pump, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.
6. Observe the vacuum gauge for 30 seconds. If the vacuum gauge reading drops more than 3 kPa (0.88 in-Hg) a leak is present.
7. Remove the vacuum pump.

   CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.

8. Start the engine. With the engine at idle, raise the power steering fluid temperature to 74-80°C (165-176°F) by rotating the steering wheel fully to the left and right several times.
9. Visually inspect the system for leaks. If a leak is evident, repair as necessary. If a leak is not evident, add the specified UV fluorescent tracer dye to the power steering fluid. Use 14.78 mL (1/2 oz) of dye solution for every 1.89L (2 qt) of power steering fluid.

   CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.

10. Start the engine. With the engine at idle, raise the power steering fluid temperature to 74-80°C (165-176°F) by rotating the steering wheel fully to the left and right several times.
11. Using the special tool (UV lamp), inspect the system for traces of UV dye. Repair as necessary.

Steering Gear Valve Test

1. With the vehicle in motion, place the transmission in NEUTRAL and turn the engine OFF.
   - If the vehicle does not pull with the engine OFF, repair or install a new steering gear. Refer to **POWER STEERING** article.
2. If the vehicle pulls with the engine OFF, switch the right side front wheel to the left side of the vehicle and the left side front wheel to the right side of the vehicle.
3. If the vehicle pulls to the opposite side, switch the front wheels with the rear wheels keeping them on the same side of the vehicle.
4. If the vehicle pull direction does not change, check the front suspension components, wheel alignment and frame alignment. Refer to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

Steering Gear Grunt/Shudder Test

1. Start and run the vehicle to operating temperature.
2. Set engine idle speed to 1,200 RPM.

CAUTION: Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may occur.

3. Rotate the steering wheel to the RH stop, then turn the steering wheel 90 degrees back from that position. Slowly turn the steering wheel back and forth approximately 1/12 of a full turn.
4. Turn the steering wheel another 90 degrees. Slowly turn the steering wheel back and forth approximately 1/12 of a full turn.
5. Repeat the test with the power steering fluid at different temperatures.
6. If a light grunt is heard or a low (50-200 Hz) shudder is present, this is a normal steering system condition.
7. If a loud grunt is heard, or a strong shudder is felt, purge the power steering system. Refer to **Power Steering System Purging - 2.3L** or **Power Steering System Purging - 3.0L, 3.5L**. If a loud grunt or strong shudder still exists, check the power steering lines/hoses for restrictions or damage and repair as necessary. Refer to **POWER STEERING** article. If the lines/hoses are OK, install a new steering gear. Refer to **POWER STEERING** article.

Steering Linkage Test

NOTE: Excessive vertical motion of the studs relative to the sockets may indicate excessive wear.

1. With the vehicle on the ground and the parking brake applied, start the vehicle and carry out the following:
   - Have an assistant rotate the steering wheel back and forth 360 degrees and watch for relative motion of the studs in the steering linkage ball sockets.
   - Watch for loose steering gear mounting.
2. As an additional check, with the key ON/engine OFF (KOEO) and the front wheels raised off the ground, grasp the wheel at the front and rear and watch for excessive play or binding in the joints while trying to

steer the wheels.

3. Install new components if necessary. Tighten any worn, damaged or loose components. Refer to the appropriate Steering System article for the procedure.

GENERAL PROCEDURES

POWER STEERING SYSTEM FLUSHING

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

CAUTION: Do not mix oil types. Any mixture or any unapproved oil can lead to seal deterioration and leaks. A leak can ultimately cause loss of fluid, which may result in a loss of power steering assist.

1. Remove the power steering fluid reservoir cap.
2. Using a suitable suction device, remove the power steering fluid from the reservoir.
3. Disconnect the power steering fluid return hose from the reservoir.
    - Remove the clamp.
4. Plug the power steering fluid reservoir inlet port.
5. Attach an extension hose to the power steering return hose.

NOTE: Do not reuse the power steering fluid that has been flushed from the power steering system.

6. Place the open end of the extension hose into a suitable container.

NOTE: Do not overfill the reservoir.

7. Fill the power steering fluid reservoir with new fluid.

CAUTION: Do not allow the power steering pump to run completely dry of power steering fluid. Damage to the power steering pump may occur.

8. Start the engine while simultaneously turning the steering wheel to lock and then immediately turn the ignition switch to the OFF position.

NOTE: Avoid turning the steering wheel without the engine running as this may cause air to be pulled into the steering gear.

NOTE: Do not overfill the reservoir.

9. Fill the power steering fluid reservoir with the approved power steering fluid.
10. Repeat Steps 8 and 9, turning the steering wheel in the opposite direction each time, until the fluid exiting the power steering fluid return hose is clean and clear of foreign material.
11. Remove the extension hose from the power steering return hose.
12. Remove the plug from the power steering fluid reservoir inlet port.
13. Install the power steering return hose to the reservoir.
    - Install the clamp.

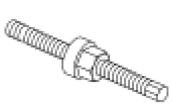
NOTE: It is necessary to properly fill the power steering system to remove any trapped air and completely fill the power steering system components.

If, after properly filling the power steering system, there is power steering noise accompanied by evidence of aerated fluid and there are no fluid leaks, it may be necessary to purge the power steering system. For additional information, refer to Power Steering System Purging - 2.3L or Power Steering System Purging - 3.0L, 3.5L.

14. Fill the power steering system. For additional information, refer to **Power Steering System Filling - 2.3L** or **Power Steering System Filling - 3.0L, 3.5L**.

POWER STEERING SYSTEM PURGING - 3.0L, 3.5L

Special Tools

Illustration	Tool Name	Tool Number
 ST1385-A	Vacuum Pump Kit	416-D002 (D95L-7559-A) or equivalent
 ST1287-A	Evacuation Cap, Power Steering	211-265 or equivalent

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

CAUTION: If the air is not purged from the power steering system correctly, premature power steering pump failure can result. The condition can occur on pre-delivery vehicles with evidence of aerated fluid or on vehicles that have had steering component repairs.

NOTE: A whine heard from the power steering pump can be caused by air in the system. The power steering purge procedure must be carried out prior to any component repair for which power steering noise complaints are accompanied by evidence of aerated fluid.

1. Remove the power steering pump reservoir cap. Check the fluid.
2. Raise the front of the vehicle and support it on safety stands. For additional information, refer to **JACKING AND LIFTING** article.
3. Tightly insert the stopper of the vacuum pump into the reservoir.
4. Start the engine.
5. Install the vacuum pump, apply vacuum and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg).
6. If equipped with Hydro-Boost®, apply the brake pedal twice.

CAUTION: Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may occur.

7. Cycle the steering wheel fully from stop-to-stop 10 times.
8. Stop the engine.
9. Release the vacuum and remove the vacuum pump.

NOTE: Do not overfill the reservoir.

10. Fill the reservoir.
    - Use approved transmission fluid.
11. Start the engine.
12. Install the vacuum pump. Apply and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg).

CAUTION: Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may occur.

13. Cycle the steering wheel fully from stop-to-stop 10 times.
14. Stop the engine, release the vacuum and remove the vacuum pump.

NOTE: Do not overfill the reservoir.

15. Fill the reservoir as needed and install the reservoir cap.

16. Visually inspect the power steering system for leaks.

NOTE: Do not overfill the reservoir.

17. Fill the reservoir as needed and visually inspect the power steering system for leaks.
18. Install the reservoir cap.

POWER STEERING SYSTEM PURGING - 2.3L

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

NOTE: Do not turn the steering wheel during the fluid level inspection, or the fluid level changes and cannot be inspected correctly.

1. Check the power steering fluid level and add fluid as necessary.
2. Raise the front of the vehicle and support it on safety stands. For additional information, refer to **JACKING AND LIFTING** article.
3. Slowly turn the steering wheel fully to the left and right several times with the engine not running (minimum 10 times in each direction).
4. Check the power steering fluid level and add fluid as necessary.
5. Repeat Steps 3 and 4 until the fluid level stabilizes.
6. Lower the vehicle.
7. Start the engine and let it idle.

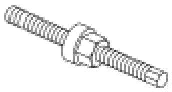
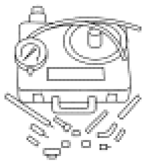
CAUTION: Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may occur.

8. Slowly turn the steering wheel fully to the left and right several times (minimum 10 times in each direction).
9. Verify that the power steering fluid is not foamy and that the fluid level has not dropped.
   - If the fluid level has dropped, add fluid as necessary and repeat Steps 8 and 9.

POWER STEERING SYSTEM FILLING - 3.0L, 3.5L

Special Tools

Illustration	Tool Name	Tool Number
		416-D002 (D95L-7559-A) or

 ST1385-A	Vacuum Pump Kit	equivalent
 ST1287-A	Evacuation Cap, Power Steering	211-265 or equivalent
 ST1296-A	Fill Adapter Manifold, Power Steering	211-327 or equivalent

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

CAUTION: If the air is not purged from the power steering system correctly, premature power steering pump failure may result. The condition can occur on pre-delivery vehicles with evidence of aerated fluid or on vehicles that have had steering component repairs.

1. Remove the power steering pump reservoir cap.
2. Tightly install the evacuation cap to the power steering pump reservoir.
3. Install the hose from the fill adapter manifold tee to the evacuation cap on the power steering pump reservoir.
4. Install the vacuum pump to the fill adapter manifold control valve.
5. Install the hose to the opposite fill adapter manifold control valve and submerge the open end of the hose into a container of new power steering fluid.

NOTE: The fill adapter manifold control valves are in the OPEN position when the point of the handles face the center of the fill adapter manifold.

6. Close the fill adapter manifold control valve connected to the power steering fluid container.
7. Open the fill adapter manifold control valve connected to the vacuum pump.
8. Using the vacuum pump, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.
9. Observe the vacuum gauge for 30 seconds.

10. If the vacuum gauge reading drops more than 3 kPa (0.88 in-Hg), correct any leaks in the power steering system or the filling tools before proceeding.

NOTE: The vacuum pump gauge reading will drop slightly during this step.

11. Slowly open the fill adapter manifold control valve connected to the power steering fluid container until power steering fluid completely fills the hose.
12. Close the fill adapter manifold control valve connected to the power steering fluid container.
13. Using the vacuum pump, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system.
14. Close the fill adapter manifold control valve connected to the vacuum pump.
15. Slowly open the fill adapter manifold control valve connected to the power steering fluid container.
16. When the power steering fluid has drained from the hose connected to the power steering fluid container, close the fill adapter manifold control valve connected to the power steering fluid container.
17. Remove the tools from the vehicle.
18. Install the power steering reservoir cap.

CAUTION: Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may occur.

NOTE: There will be a slight drop in the power steering fluid level in the power steering fluid reservoir when the engine is started.

19. Start the engine and turn the steering wheel from stop-to-stop.
20. Turn the ignition switch to the OFF position.

NOTE: Do not overfill the reservoir.

21. Remove the power steering reservoir cap and fill the reservoir.
22. Install the power steering reservoir cap.

POWER STEERING SYSTEM FILLING - 2.3L

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

1. Inspect the power steering fluid level and add fluid to the specified level as necessary.
2. Start the engine and inspect for fluid aeration. If fluid aeration is evident, carry out the power steering system purging procedure. For additional information, refer to **Power Steering System Purging - 2.3L**.

2008 RESTRAINTS

Supplemental Restraint System - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Front impact severity sensor bolt	12	9	-
Occupant classification sensor (OCS) system rail mounting bolts	25	18	-
Passenger air bag module bolts	8	-	71
Restraints control module (RCM) bolts	12	9	-
Seat position sensor bolt	6	-	53
Seat risers-to-OCS system rail bolts	25	18	-
Side air bag module bolt	10	-	89
Side air curtain module bolts	7	-	62
Side impact sensor (B-pillar) bolt	12	9	-
Side impact sensor (C-pillar) bolt	12	9	-

DESCRIPTION AND OPERATION

AIR BAG AND SAFETY BELT PRETENSIONER SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

The air bag supplemental restraint system (SRS) is designed to provide increased collision protection for front seat and second row outboard occupants, in addition to that provided by the 3-point safety belt system. Safety belt use is necessary to obtain the best occupant protection and to receive the full advantage of the SRS.

This vehicle line contains dual stage deployment (advanced restraint system) driver and front passenger air bag modules. These vehicles are also equipped with driver and front passenger safety belt retractor pretensioners, side air curtains and seat side air bag modules in the front seats.

Side air curtains deploy from the headliner, protecting the first and second row outboard occupants during a side impact. Seat side air bag modules deploy from the outboard front seat backrest upon a side impact. In addition, a front impact severity sensor is mounted to the lower radiator support, a seat position sensor is mounted to the driver seat and a usage detection switch is added to the front driver and passenger outboard buckles.

Vehicles are also equipped with an occupant classification sensor (OCS) system as part of the front passenger seat. The OCS includes 2 OCS rails and an occupant classification system module (OCSM).

The serviceable air bag and safety belt pretensioner SRS components are shown in the following illustration.

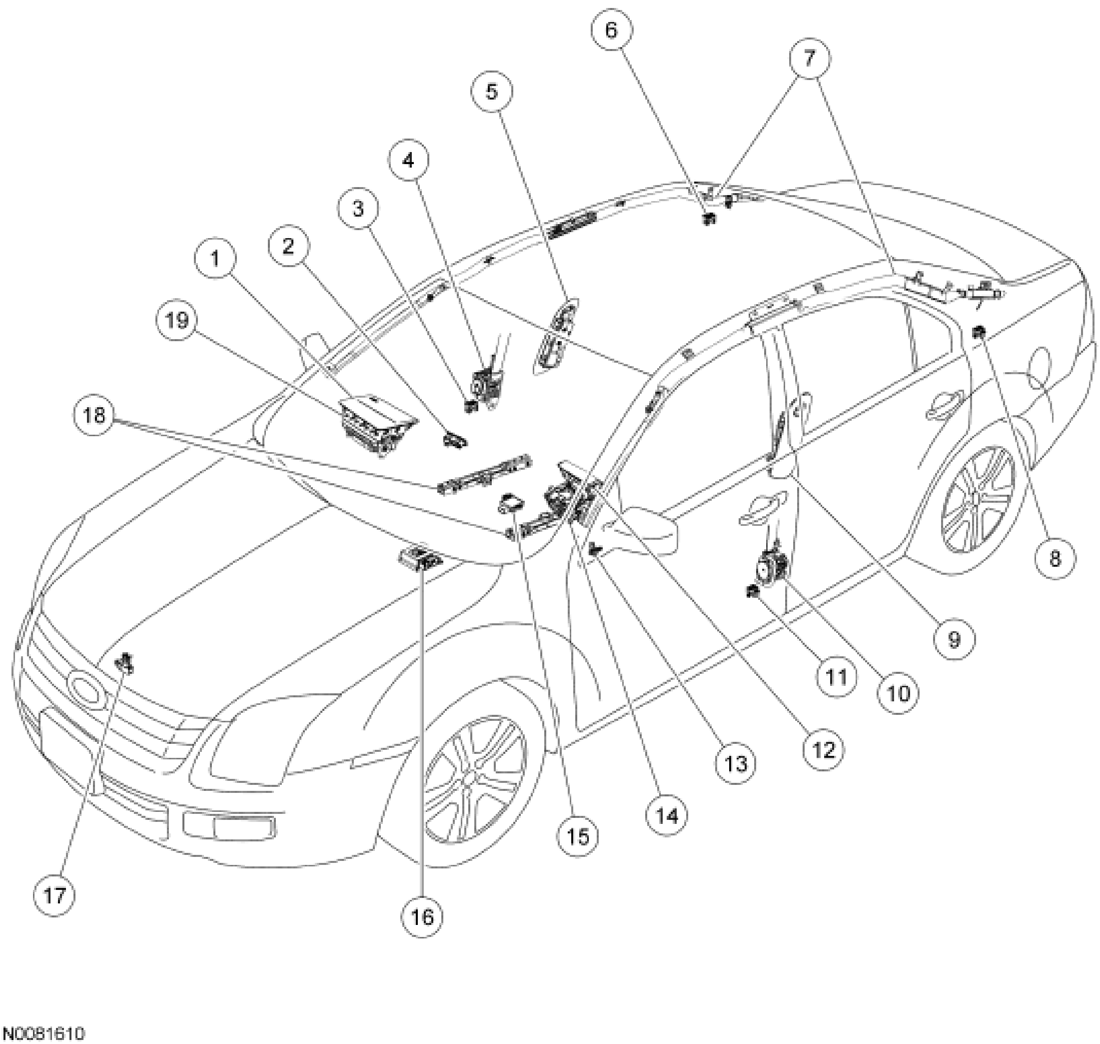


Fig. 1: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) Components
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	04338	Passenger air bag cover (part of kit)
2	13D734	Passenger air bag deactivation (PAD) indicator
3	14B345	Passenger side first row impact sensor
4	611B08	Passenger safety belt retractor pretensioner
5	611D10	Passenger seat side air bag module
6	14B004	Second row RH side impact sensor
7	042D94 RH/ 042D95 LH	Side air curtain modules
8	14B004	Second row LH side impact sensor
9	611D11	Driver seat side air bag module
10	611B09	Driver safety belt retractor pretensioner

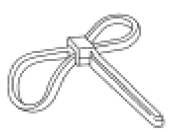
11	14B345	Driver side first row impact sensor
12	043B13	Driver air bag module
13	14B416	Driver seat track position sensor
14	14A664	Clockspring
15	14B422	Occupant classification system module (OCSM)
16	14B321	Restraints control module (RCM)
17	14B004	Front impact severity sensor
18	61708	Occupant classification system (OCS) rails (2 required)
19	044A74	Passenger air bag module assembly

DIAGNOSTIC TESTS

AIR BAG AND SAFETY BELT PRETENSIONER SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ for schematic and connector information.

Special Tools

Illustration	Tool Name	Tool Number
 ST1436-A	Flex Probe Kit	105-R025C or equivalent
 ST1185-A	FLUKE 73III Automotive Meter	105-R0057 or equivalent
 ST1385-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

Principles of Operation

A supplemental restraint system (SRS) consists of a dual stage driver and passenger air bag module, safety belt retractor pretensioners, side air bag modules and side air curtains (containing an inflator/squib or gas generator and an air bag), impact sensors, a restraints control module (RCM), a clockspring, an air bag warning indicator, occupant classification sensor (OCS) system and a passenger air bag deactivation (PAD) indicator. These components are all interconnected by a wiring harness and powered by the vehicle's battery. The RCM includes

a backup power supply. This feature provides sufficient backup power to deploy the SRS components in the event that the ignition circuit is lost or damaged during impact. The backup power supply will deplete its stored energy approximately one minute after power and/or ground has been removed from the RCM. The RCM performs an internal, external circuitry and component "self-test" during each startup. If a SRS fault exists, the RCM sends a message to instrument cluster (IC) module to illuminate the air bag warning indicator. In addition to the self-test at start up, the RCM continuously monitors all of its external and internal circuitry for faults.

In a frontal collision, the impact sensors located in the front of the vehicle detect the sudden deceleration and send an electrical signal to the RCM. The RCM uses the information from the impact sensors and the OCS system in the deployment determination. If the RCM determines that SRS deployment is required, the RCM sends voltage and current to the squib(s) causing the solid chemical propellant to undergo a rapid chemical reaction. This controlled reaction produces harmless nitrogen gas that fills the air bag(s)/side air curtains and/or activates the safety belt pretensioners/adaptive load limiting retractor(s) to control the tension of the safety belt (s).

In certain side collisions, the air curtain and seat-mounted side air bag on the side affected by the collision will be inflated, except that the OCS system will deactivate the passenger seat-mounted side air bag if it detects an empty unbuckled passenger seat or an unbuckled child or small person in the passenger seat. The side air curtain was designed to inflate between the side window area and occupant to further enhance the head protection provided to occupants in side impact collisions. The seat-mounted side air bag was designed to inflate between the door panel and occupant to further enhance the protection provided occupants in side impact collisions.

The RCM communicates through the data link connector (DLC) the current and historical DTCs on the high-speed controller area network (HS-CAN). The RCM also communicates over the HS-CAN to the IC module, occupant classification system module (OCSM) and PCM.

Air Bag Warning Indicator

The air bag warning indicator:

- is located in the instrument cluster (IC) module.
- lamp and circuitry prove out is a function of the instrument cluster module. The instrument cluster will prove out the air bag warning indicator by lighting the air bag warning indicator for 6 seconds and then turn off.
- will flash and/or illuminate based on the message the instrument cluster module receives from the restraints control module (RCM).
- will illuminate if the instrument cluster module does not receive a message from the RCM.

Air Bag Module Second Stage Deployment Check

Because the driver and passenger front air bags each have 2 deployment stages, it is possible that Stage 1 has deployed and Stage 2 has not.

If a front air bag module has deployed, it is **mandatory** that the front air bag module be remotely deployed using the appropriate air bag disposal procedure.

- For information on driver air bag module and/or passenger air bag module remote deployment, refer to **Pyrotechnic Device Disposal**.

Clockspring

The clockspring:

- is mounted on the steering column, behind the steering wheel.
- allows for continuous electrical connections between the driver air bag module and the restraints control module (RCM) when the steering wheel is turned.

Driver Air Bag Module

The driver air bag module:

- is installed as an assembly.
- is a dual-stage air bag, deploying at 1 of 2 different rates depending upon impact severity.
- is mounted in the center of the steering wheel.

Electrical System

The electrical system that supports the supplemental restraint system (SRS):

- is powered from the battery through the ignition circuit.
- provides the electrical path from the restraints control module (RCM) to the SRS components.
- provides a communication path from the RCM to the air bag warning indicator, located in the instrument cluster (IC) module, via the high-speed control area network (HS-CAN).
- provides the electrical communication path from the RCM to the DLC and all other modules on the HS-CAN.

High-Speed Controller Area Network (HS-CAN)

This vehicle utilizes a communication system called a high-speed controller area network (HS-CAN). The HS-CAN consists of a twisted pair of wires connected to some of the following:

- ABS module
- Instrument cluster (IC) module
- PCM
- Transmission control module (TCM)
- Restraints control module (RCM)
- Occupant classification system module (OCSM)
- Data link connector (DLC)

The HS-CAN circuits use a bias voltage of approximately 2.5 volts. The HS-CAN also uses 2 terminating resistors, one contained within the PCM, the other in the instrument cluster (IC) module. The terminating

resistors are not serviced separately. The terminating resistors have a value of 120 ohms each, for a normal operating system total of 60 ohms. The HS-CAN may operate with only one terminating resistor and may communicate with only one circuit functioning. Refer to **MODULE COMMUNICATIONS NETWORK** article.

Impact Sensors

> WARNING: **If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.**

The impact sensors provide data to the restraints control module (RCM) for use in calculating impact severity. This is accomplished using various electrical sensors located throughout the vehicle.

For these vehicles, the supplemental restraint system (SRS) employs 6 impact sensors. One of the sensors is integral to the RCM and is not separately serviceable. The RCM is mounted on the center tunnel between the front seats. There is one front impact severity sensor located in the front-center of the vehicle, behind the grille and 4 side impact sensors. The first row side impact sensors are located in each of the front doors behind the trim panel, the second row side impact sensors are located on or near the base of the C-pillar. Mounting orientation is critical for correct operation of all impact sensors.

The side impact sensors are **not** interchangeable between the first and second row.

Loops/Squibs

All deployable devices contain an initiating device called a squib. The squib is part of the deployment loop. Air bag/safety canopies/side air curtain modules can contain more than one squib, some vehicles may have up to 4 squibs in one air bag module. Squibs are often referred to as loops during the diagnostic process.

Occupant Classification Sensor (OCS) System

The occupant classification sensor (OCS) system is found only on the front passenger seat. The front passenger OCS system is comprised of the following: 2 OCS rails (weight sensors) that are mounted to the underside of each side seat track; an occupant classification system module (OCSM) mounted to the electrical bracket underneath the seat cushion pan. The weight of any occupant or object on the front passenger seat is electronically communicated to the OCSM.

The OCS system is also used for operation of the passenger Belt-Minder®. For information on the passenger Belt-Minder® feature, refer to **SAFETY BELT SYSTEM** article. To deactivate or reactivate the passenger Belt-Minder® feature, refer to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article or the Owner's Literature.

When the front passenger seat is removed for service, the Zero Seat Weight Test must be carried out after the installation of the front passenger seat. When an OCS system component is installed new, the System Reset must be carried out after the installation of the front passenger seat. The Zero Seat Weight Test and/or System

Reset must be carried out only as instructed to do so in the Workshop article. For information on the Zero Seat Weight Test and/or System Reset, refer to **Occupant Classification Sensor (OCS) System Zero Seat Weight Test** or **Occupant Classification Sensor (OCS) System Reset**.

Occupant Classification System Module (OCSM)

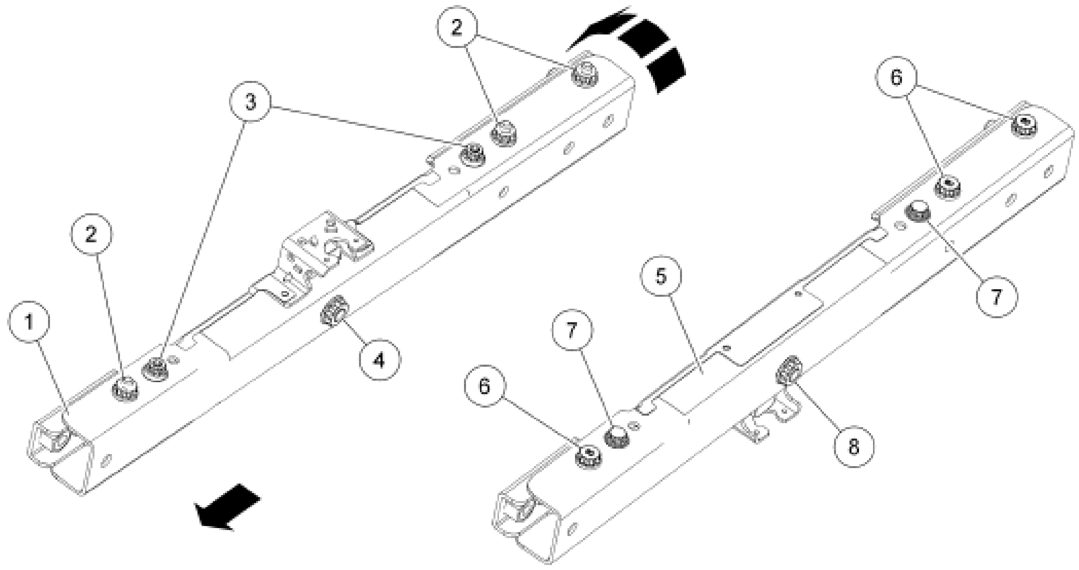
Based on programmed limits, the occupant classification system module (OCSM) will inform the restraints control module (RCM), via a high-speed controller area network (HS-CAN), of the weight of any occupant or object on the front passenger seat. The RCM uses this information in determining if the passenger air bag module or passenger seat side air bag module is to be deployed in the event of a deployable collision.

The OCSM monitors the occupant classification sensor (OCS) system for faults and communicates on-demand and continuous DTCs via the data link connector (DLC) with the use of a scan tool.

Occupant Classification Sensor (OCS) Rails (Weight Sensors)

WARNING: **Do not disassemble the occupant classification sensor (OCS) rail or tighten or loosen any of the nuts and bolts installed to the OCS rail body. Only the 8 bolts that attach the 2 OCS rails to the seat track may be removed and installed. Failure to follow these instructions may result in incorrect operation of the OCS system and increase the risk of serious personal injury or death in a crash.**

NOTE: The illustration below is indicating the fasteners of the occupant classification sensor (OCS) rails (weight sensors) that must not be tightened or loosened. The OCS rails are installed individually as an assembly and require no adjustment.



N0041796

Fig. 2: Fasteners Of OCS Rails (Weight Sensors) Must Not Be Tightened Or Loosened
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	61708	Occupant classification sensor (OCS) rail, outboard side
2	-	Stopper nut(s) and bolt(s) outboard side
3	-	Sensor pivot nut(s) and bolt(s) outboard side
4	-	Sensor nut (under assembly) outboard side
5	61708	OCS rail, inboard side
6	-	Stopper nut(s) and bolt(s), inboard side
7	-	Sensor pivot nut(s) and bolt(s), inboard side
8	-	Sensor nut (under assembly), inboard side

The components that make up the OCS system (occupant classification system module [OCSM], inboard OCS rail and outboard OCS rail) are serviced separately.

Passenger Air Bag Deactivation (PAD) Indicator

The passenger air bag deactivation (PAD) indicator is a visual indicator used to inform the front seat occupants of the passenger air bag deactivation state. The PAD indicator is located in the integrated control panel (ICP) in a position visible to each front seat occupant.

The restraints control module (RCM) controls the state of the PAD indicator through a direct hardwire connection, based on information provided by the occupant classification sensor (OCS) system. The PAD indicator is lit to indicate the passenger air bag module is deactivated (off). Some exceptions to this are made in certain scenarios such as when the front passenger seat is determined to be empty, and therefore indication of a deactivated passenger air bag module is not necessary. In all cases, the PAD indicator is unlit when the passenger air bag module is activated (on).

When the ignition switch is in the RUN position, the PAD indicator prove-out period is initiated by the RCM. The RCM briefly activates the PAD indicator to prove-out the indicator function and verify to the front seat occupants proper functional operation of the PAD indicator.

When an OCS fault is present, the supplemental restraint system (SRS) defaults the passenger air bag module to on (activated) regardless of the size of the occupant in the front passenger seat. The PAD indicator will be unlit. For information on the OCS, refer to **Occupant Classification Sensor**.

The following table indicates the passenger air bag status and the PAD indicator status based the size of the front passenger occupant.

PASSENGER AIR BAG AND PAD INDICATOR STATUS

Occu- pant Size	Passenger Safety Belt Buckle Status	Pass. Air Bag Status	PAD Ind. Status
None	Unbuckled	Disabled	Unlit
None	Buckled	Disabled	Lit

Infant or Small Child	Buckled/ Unbuckled	Disabled	Lit
Adult Sized	Buckled/ Unbuckled	Enabled	Unlit

Passenger Air Bag Module

NOTE: **References to the passenger air bag module must not be confused with the side (seat-mounted) air bag components of the supplemental restraint system (SRS).**

The passenger air bag module:

- is a dual-stage air bag, deploying at 1 of 2 different rates depending upon impact severity, safety belt usage and passenger seat occupant classification.
- will deploy upon receiving a flow of current from the restraints control module (RCM).
- is installed as an assembly.
- is mounted in the right side of the instrument panel.

Restraints Control Module (RCM)

WARNING: If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.

NOTE: **Prior to removal of the restraints control module (RCM) module, it is necessary to upload module configuration information to the scan tool. This information needs to be downloaded into the new RCM module once installed. Refer to MODULE CONFIGURATION article.**

NOTE: **When a new PCM is installed, the air bag warning indicator will illuminate when the ignition switch is ON. The warning indicator will remain on until PCM configuration is restored. Clear restraints control module (RCM) DTCs.**

NOTE: **When installing a new RCM, always make sure the correct RCM is being installed. If an incorrect RCM is installed, erroneous DTCs will result.**

The RCM carries out the following functions:

- deploys the air bag(s)/side air curtain(s) in the event of a deployable collision.
- activates the safety belt retractor pretensioner to control tension on the safety belt in the event of a deployable collision.
- monitors the supplemental restraint system (SRS) for faults.
- sends a message to the instrument cluster module to flash/illuminate the air bag warning indicator if a

fault is detected.
- communicates through the data link connector (DLC) the current or historical DTCs.

The RCM monitors the SRS for possible faults. If an SRS fault exists, the RCM sends a message to instrument cluster (IC) module to illuminate the air bag warning indicator.

When the ignition is cycled (turned OFF and then ON), the instrument cluster will prove out the air bag warning indicator by lighting for 6 seconds and then turn off. If a current SRS fault exists, the RCM requests illumination of the air bag warning indicator and will remain illuminated for the rest of the key cycle. The RCM will also communicate the on-demand (current) and continuous (historical) DTCs through the DLC, to the scan tool. If the RCM requests illumination of the air bag warning indicator and the air bag warning indicator does not function, the IC module will automatically activate an audible chime. The chime is a series of 5 sets of 5 tone bursts. If the chime is heard, the SRS and the air bag warning indicator require repair.

The RCM includes a backup power supply. This feature provides sufficient backup power to deploy the air bags in the event that the ignition circuit is lost or damaged during impact. The backup power supply will deplete its stored energy approximately one minute after power and/or ground has been removed from the RCM.

Safety Belt Pretensioners

As part of the supplemental restraint system (SRS), the driver and front passenger safety belt retractors are equipped with pretensioners. The safety belt retractor pretensioners remove excess slack from the safety belt webbing. The pretensioners are activated by the restraints control module (RCM) when the module detects a collision event force exceeding a programmed limit.

Safety Belt Buckle Switches

As part of the supplemental restraint system (SRS), the driver and front passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckle switches indicate to the restraints control module (RCM) whether the safety belts are buckled or unbuckled. The RCM uses this information in determining the deployment of the dual-stage driver and passenger air bag modules.

Safety Belt Tension Sensor

The safety belt tension sensor:

- is part of the front passenger safety belt retractor assembly.
- is located at the safety belt anchor point on the passenger seat.
- is used in conjunction with the occupant classification sensor (OCS) system.
- is a 3-wire Hall-effect sensor that is part of the front passenger safety belt and retractor assembly.

The safety belt tension sensor is used by the OCS system to identify the presence of a child safety seat on the front passenger seat. The safety belt tension sensor senses the tension on the safety belt assembly then provides an output to the occupant classification system module (OCSM), indicating that the safety belt assembly is cinched. After sensing the weight applied to the seat by the occupant and using the safety belt tension sensor input, the OCSM determines how the occupant should be classified and communicates this information to the restraints control module (RCM). If the occupant is classified as a child, the RCM will then automatically

deactivate the passenger air bag module and illuminate the passenger air bag deactivation (PAD) indicator.

Seat Track Position Sensors

The seat track position sensors are mounted to a bracket attached to the driver and passenger seat track. The seat track position sensor informs the restraints control module (RCM) of the driver/passenger seat position. The RCM uses this information in determining the deployment of the dual-stage driver/passenger air bag module.

Secondary Air Bag Warning (Chime)

The secondary air bag warning chime, is an audible chime controlled by the instrument cluster (IC) module. If the IC module has detected a fault with the air bag warning indicator, a DTC will be stored in the memory of the IC module. Upon receiving the message from the restraints control module (RCM) that a supplemental restraint system (SRS) fault has been detected, the IC module will sound the secondary air bag warning chime in a pattern of 5 sets of 5 beeps.

Side Air Bag Module

NOTE: References to side air bag modules refer to the seat-mounted, not to the steering wheel or instrument panel mounted air bag components of the supplemental restraint system (SRS).

A side air bag module provides protection of the thorax area (between the neck and abdomen) of the body, working in conjunction with the head protection provided by a side air curtain module.

The side air bag module:

- will deploy upon receiving a flow of current from the restraints control module (RCM), initiated by the side impact sensor and internal RCM circuitry.
- is installed as an assembly.
- is mounted in the driver or passenger seat backrest.
- is used in conjunction with a side air curtain module.

Side Air Curtain Module

WARNING: Anytime the safety canopy or side air curtain module has deployed, a new headliner and new A-, B- and C-pillar upper trim panels and attaching hardware must be installed. Remove any other damaged components and hardware and install new components and hardware as needed. Failure to follow these instructions may result in the safety canopy or side air curtain module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

The side air curtain module:

- will deploy upon receiving a flow of current from the restraints control module (RCM) initiated by the side impact sensors and internal RCM circuitry when a side impact is detected.

- is installed as an assembly.
- is mounted above the headliner.
- attaches from the A-pillar frame to the C-pillar frame.
- cannot be interchanged from side to side.

Diagnostic Instructions

The symptom chart can be used to help locate supplemental restraint system (SRS) concerns if no DTCs are retrieved and the listed symptoms are observed. Whether or not the listed symptoms are observed, always carry out the following:

1. Run the Self Test to determine what on-demand and continuous memory DTCs are being sensed by the restraints control module (RCM)/occupant classification system module (OCSM).
2. Retrieve all SRS DTCs and fault PIDs stored in the RCM and OCSM memory.
3. If on-demand DTCs are different than continuous memory DTCs, always repair the on-demand DTCs first.

   A DTC can indicate several concerns. The DTCs are to assist in system diagnosis and are not to be considered definitive. Always refer to the pinpoint test corresponding to the DTC to determine where the concern lies and to repair the concern correctly.

Diagnostic Test Options

Scan tool options:

- Retrieve/Clear Continuous Memory DTCs
- Self Test/On-Demand

Refer to the manufacturer's literature for the scan tool being used for correct scan tool test options.

Self Test/On-Demand

The on-demand Self Test option is used to verify that no electrical concerns exist with the air bag supplemental restraint system (SRS). Upon entering the self-test, the restraints control module (RCM)/occupant classification system module (OCSM) will make an electrical check of each electrical component in the system. If a concern is detected, a DTC is displayed on the scan tool with a brief description of the DTC. The self-test should always be carried out after any repair to verify that the repair was successful.

To run the on-demand Self Test, follow these steps:

1. Connect the scan tool to the data link connector (DLC).
2. Turn the ignition switch to the ON position.
3. Follow the manufacturer's instructions for the scan tool being used.
4. Select Self Test.
5. Select RCM or OCSM (selecting Restraints retrieves DTC's from both modules).

6. The module will run the self-test and display on-demand (reflecting hard system concerns) and continuous memory (historic) DTCs on the scan tool.

Self Test/Continuous Memory and Clear DTCs

During vehicle operation, the restraints control module (RCM)/occupant classification system module (OCSM) will detect and store both intermittent and hard failure DTCs in non-volatile memory. The DTC strategy employed by the restraints control module (RCM)/occupant classification system module (OCSM) incorporates a time-out scheme for determining when a concern exists in the system. This requires a concern to exist for up to one minute in the system before the RCM/OCSM will detect it. For the RCM/OCSM to determine that a concern no longer exists, the concern must be absent for up to one minute. The actual detection time-outs vary with each DTC and module. DTCs can be retrieved with a scan tool using the Self Test option. All DTCs stored in the RCM and OCSM will be displayed on the scan tool along with a brief description of the DTC. If no DTCs are present, the scan tool will display a SYSTEM PASSED message. This option can also be used to clear DTCs from the RCM and OCSM memory, as long as the concern no longer exists.

Once 75 hours of operation have been recorded by the RCM and 128 key cycles have been recorded by the OCSM since the concern was last detected, all continuous memory DTCs will automatically be removed from memory.

To retrieve or clear DTCs, follow these steps:

1. Connect the scan tool to the data link connector (DLC).
2. Turn the ignition switch to the ON position.
3. Follow the manufacturer's instructions for the scan tool being used.
4. Select Self Test.
5. Select RCM or OCSM. (selecting Restraints retrieves DTC's from both modules).

NOTE: Before proceeding with the clearing operation, make note of the DTCs displayed. Once cleared, DTCs cannot be retrieved.

6. All DTCs will be displayed on the screen.
7. Clear the DTCs. After clearing the DTCs, cycle the key OFF, then ON.
    - Continuous memory DTCs that have been cleared will **not** reoccur as "continuous memory" in the same key cycle. Only new DTCs which were **not** present before clearing can occur as "continuous memory" after clearing.

DataLogger PID/Data

The DataLogger PID/Data option allows the scan tool operator to read the state of PIDs to aid in diagnosing the system. PIDs are real time measurements of parameters, such as voltages and resistances, calculated by the restraints control module (RCM)/occupant classification system module (OCSM) sent to the scan tool for display. Many of the PIDs supported by the modules are calculated periodically and are, therefore, not true real time readings.

To retrieve PIDs, follow these steps:

1. Connect the scan tool to the data link connector (DLC).
2. Turn the ignition switch to the ON position.
3. Follow the manufacturer's instructions for the scan tool being used.
4. Select DataLogger.
5. Select RCM or OCSM.

Active Commands

Occupant Classification Sensor (OCS)

System Reset active command sets the zero set point or rezeros the occupant classification sensor (OCS) system. Refer to **Occupant Classification Sensor**.

Instrument Cluster Module

These commands allow the technician to verify the operation of instrument cluster module components and subsystems.

Lamp Fault Codes (LFCs)

This vehicle line does not utilize LFCs.

Diagnosing Customer Concerns With On-Demand DTCs

If the air bag warning indicator is reported ON by the customer when the vehicle comes in for service, connect the scan tool and follow the **DIAGNOSTIC TESTS** to identify the concern.

Once the DTC is known, read the Normal Operation of the pinpoint test for the DTC involved.

Using the scan tool with the use of PIDs and active command(s) may be of assistance in diagnosing the concern.

- Follow the depowering procedure as directed.
- Determine the location of components involved in creating the DTC.
- Carry out a thorough visual inspection of:
  - components.
  - connectors.
  - splices and wiring harnesses.
  - insulation on conductors.

Diagnosing Customer Concerns With Continuous Memory DTCs

If an air bag warning indicator ON is reported by the customer but is not present when the vehicle comes in for service, follow the **DIAGNOSTIC TESTS** to identify the intermittent DTC.

Once the DTC is known, read the Normal Operation part of the pinpoint test for the DTC involved.

- Follow the depowering procedure as directed.
- Determine the location of components involved in creating the DTC.
- Carry out a thorough visual inspection of:
    - components.
    - connectors.
    - splices and wiring harnesses.
    - insulation on conductors.

Fault PIDs

There are 2 types of fault PIDs that can be reported by the restraints control module (RCM) and/or occupant classification system module (OCSM). The first type, considered conventional, has only one level of fault reporting and identifies a specific concern for a given component and points to a particular diagnostic path, example: DTC B1317 (Battery Voltage High).

The second type uses a process within the software of the controller that maps the byte and bit to name a specific device and fault condition. This process is called Bit-mapping and is referred to as fault PIDs in the diagnosis of the vehicle. This type does not identify the specific concern or component on the first level of fault reporting, Example: DTC B2293 (Restraint system - Airbag Fault). DTC B2293 can have up to 28 specific on-demand fault PIDs (areas of concern) associated with this DTC.

Those associated fault PIDs are an extension of the information provided by the DTC and are identified by the same DTC number. A scan tool must be used to view DTCs and their fault PIDs. Once a scan tool has retrieved a DTC, use the scan tool to view the fault PIDs. In the diagnostic path, other types of PIDs are sometimes used to determine the root cause (example: resistance or voltage PIDs).

When viewing of fault PIDs has been carried out, the scan tool can display the PIDs associated with that DTC, including the status or state that exists (on-demand [active] DTC) or existed (continuous memory [historic]) DTC. Refer to the manufacturer instructions for the scan tool being used on how to view fault PIDs.

Prove Out Procedure

Turn the ignition switch from the OFF to the ON position and visually monitor the air bag warning indicator with all supplemental restraint system (SRS) components connected. The instrument cluster (IC) module will illuminate the air bag warning indicator continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag warning indicator will:

- fail to light.
- remain lit continuously.
- flash.

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the restraints control module (RCM) to complete the testing of the SRS. If the air bag warning indicator is inoperative and an SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator will need to be repaired before diagnosis can continue.

Diagnostic Test Modes

Two menu options are available under the diagnostic test modes:

- Retrieve/Clear Continuous DTCs
- Self Test/On-Demand

Retrieve/Clear Continuous DTCs

During vehicle operation, the restraints control module (RCM) and occupant classification system module (OCSM) will detect and store both intermittent and hard failure DTCs in non-volatile memory. The DTC strategy employed by the RCM/OCSM incorporates a time-out scheme for determining when a concern exists in the system. This requires a concern to exist for up to one minute in the system before the RCM/OCSM will detect it. For the RCM/OCSM to determine that a concern no longer exists, the concern must be absent for up to one minute. The actual detection time-outs vary with each DTC. The DTCs can be retrieved with a scan tool using the retrieve/clear continuous DTCs option. Any DTCs stored in the RCM/OCSM will be displayed on the scan tool along with a brief description of the DTC. If no DTCs are present, the scan tool will display a SYSTEM PASSED message. This option can also be used to clear DTCs from the RCM/OCSM memory, as long as the concern no longer exists.

Once 128 key cycles have been recorded by the OCSM since the concern was last detected, the DTC will automatically be removed from memory.

Once 75 hours of operation have been recorded by the RCM since the concern was last detected, the DTC will automatically be removed from memory.

To retrieve or clear DTCs, follow these steps:

1. Connect the scan tool to the data link connector (DLC).
2. Turn the ignition switch to the ON position.
3. Follow the manufacturer's instructions for the scan tool being used.

NOTE: **Before proceeding with the clearing operation, make note of the DTCs displayed. Once cleared, DTCs cannot be retrieved.**

4. All continuous DTCs will be displayed on the screen.
5. Clear the DTCs. After clearing the DTCs, cycle the key OFF, then ON.
    - Continuous DTCs that have been cleared will **not** reoccur as "continuous" in the same key cycle. Only new DTCs which were **not** present before clearing can occur as "continuous" after clearing.

Self Test/On-Demand

The on-demand Self Test option is used to verify that no electrical concerns exist with the air bag SRS. Upon entering the self-test, the RCM/OCSM will make an electrical check of each electrical component in the system. If a concern is detected, a DTC is displayed on the scan tool with a brief description of the DTC. The self-test should always be carried out after any repair to verify that the repair was successful.

To run the on-demand Self Test, follow these steps:

1. Connect the scan tool to the data link connector (DLC).
2. Turn the ignition switch to the ON position.
3. Follow the manufacturer's instructions for the scan tool being used.
4. Select Self Test.
5. Select RCM or OCSM (selecting Restraints retrieves DTC's from both modules).
6. The module will run the self-test and display on-demand (reflecting hard system concerns) and continuous memory (historic) DTCs on the scan tool.

Zero Seat Weight Test

The Zero Seat Weight Test verifies the occupant classification sensor (OCS) system measures zero weight for an empty seat. It is necessary to carry out the Zero Seat Weight Test any time the front passenger seat is removed from the vehicle or as directed in the workshop article procedure.

Active Commands

Occupant Classification Sensor (OCS) System Reset

The Occupant Classification Sensor (OCS) System Reset active command sets the zero set point and rezeros the OCS. Refer to **Occupant Classification Sensor**.

Air Bag Reconnect Checklist

The checklist below should be completed following diagnosis or repair of any air bag system concern:

- All in-seat harness connectors connected?
- Occupant classification sensor (OCS) system connected?
- All air bag modules connected?
- Side air curtain modules connected?
- Safety belt pretensioner connectors connected?
- Restraints control module (RCM) connected?
- All sensors (front impact severity sensor, side impact sensor, safety belt tension sensor) connected?
- RCM fuse installed?
- Battery connected?

Air Bag Module Second Stage Deployment Check

Because the driver and passenger front air bags each have 2 deployment stages, it is possible that Stage 1 has deployed and Stage 2 has not.

If a front air bag module has deployed, it is **mandatory** that the front air bag module be remotely deployed using the appropriate air bag disposal procedure to make sure the second stage has been deployed.

- For information on driver or passenger air bag module remote deployment, refer to **Pyrotechnic Device Disposal**.

Glossary

Disconnect the Component

Disconnect the component means to disconnect the component vehicle harness connector, not to remove the component. Do not reconnect a disconnected component unless instructed to do so.

Deactivate the Supplemental Restraint System (SRS)

Deactivate the supplemental restraint system (SRS) means to carry out a deactivation procedure. Refer to **Supplemental Restraint System (SRS) Deactivation and Reactivation**.

Depower the SRS

Depower the SRS means to disconnect the battery and remove the restraints control module (RCM) fuse. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

Deployment Loop

The deployment loop is made up of the RCM, deployable device, air bag(s), safety belt pretensioners (safety canopies/side air curtains, deployable steering columns, load limiting retractor, adaptive tether, adaptive vent, if equipped) and associated circuits.

Install a New Component

Install a new component means to remove the existing component and install a new authorized part obtained from Ford Customer Service Division.

Prove Out the SRS

Prove out the SRS means to turn the ignition switch from the OFF to the ON position and visually monitor the air bag warning indicator with all SRS components connected. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag warning indicator will either fail to light, flash or remain lit continuously. The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and an SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator will need to be repaired before diagnosis can continue.

Reactivate the SRS

Reactivate the SRS means to carry out the reactivation procedure. Refer to **Supplemental Restraint System (SRS) Deactivation and Reactivation**.

Reconnect the SRS

Reconnect the SRS means to reconnect all system components. Refer to **Air Bag Reconnect Checklist**.

Repower the SRS

Repower the SRS means, turn the ignition ON, install the RCM fuse and connect the battery ground cable. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

Secondary Air Bag Warning

The secondary air bag warning is an audible fault format that consists of 5 sets of 5 tone bursts, with each set of 5 tone bursts separated by a 5-second quiet period. One tone burst cycle will consist of one-second on and one-second off. This series of 5 activations is repeated every 30 minutes.

Squib

A squib (igniter) is a device designed to convert electrical energy to the heat energy necessary to deploy a pyrotechnic restraints system device.

Verify the SRS

Verify the SRS means to prove out the system with restraint system components in place.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
• Damaged restraints control module (RCM) or loose mounting • Damaged occupant classification system module (OCSM)/component or loose mounting • Damaged front impact severity sensor(s) or loose mounting • Damaged side impact sensor(s) or loose mounting • Damaged or disconnected passenger air bag deactivation	• Open smart junction box (SJB) fuse 25 (7.5A) • Damaged wiring harness • Loose, damaged or corroded connectors • Circuitry open/shorted • Damaged shorting bars

(PAD) indicator	

NOTE: The smart junction box (SJB) may also be identified as the generic electronic module (GEM).

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record on-demand and continuous memory DTCs from the restraints control module (RCM) and occupant classification system module (OCSM).
8. If the DTCs retrieved are related to the concern, go to the Supplemental Restraint System (SRS) DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
9. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

Supplemental Restraint System (SRS) DTC Chart

The DTCs can be retrieved from the restraints control module (RCM) and the occupant classification system module (OCSM) with a scan tool via the data link connector (DLC).

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DTC CHART

DTC[a]	Description	Retrieved From	Action To Take
Continuous	The Air Bag Warning Indicator	Restraints control	Go to **Pinpoint Test A**.

Lamp	is Illuminated Continuously	module (RCM)	
B1231	Event Threshold Exceeded (Crash Data Memory Full)	RCM	INSTALL a new RCM, CARRY OUT programmable module installation (PMI) and INSTALL new impact sensors. REFER to **Inspection and Repair After a Supplemental Restraint System (SRS) Deployment** and **Restraints Control Module (RCM)**.
B1231	Event Threshold Exceeded (Crash Data Memory Full)	Occupant classification system module (OCSM)	INSTALL new OCS rails and CLEAR all OCSM and RCM DTCs. REFER to **Occupant Classification Sensor** and **Inspection and Repair After a Supplemental Restraint System (SRS) Deployment**.
B1317	Battery Voltage High	RCM	CHECK battery voltage; to be below 18 volts. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1317	Battery Voltage High	OCSM	**NOTE:** **If no on-demand or continuous DTC is present in the RCM and DTC B1317 is only present in the OCSM continuous, CLEAR all OCSM DTCs and PROVE OUT the SRS.** CHECK battery voltage; to be below 18 volts. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1318	Battery Voltage Low	RCM	CHECK battery voltage; to be above 8 volts. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1318	Battery Voltage Low	OCSM	**NOTE:** **If no on-demand or continuous DTC is present in the RCM and DTC B1318 is only present in the OCSM continuous, CLEAR all OCSM DTCs and PROVE OUT the SRS.** CHECK battery voltage; to be above 8 volts. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article.
B1342	ECU (RCM) is Faulted	RCM	INSTALL a new RCM and CARRY OUT PMI. REFER to **Restraints**

			Control Module (RCM).
B1342	ECU (OCSM) is Faulted	OCSM	CARRY OUT Occupant Classification Sensor (OCS) System Reset. REFER to **Occupant Classification Sensor (OCS) System Reset**. DO NOT carry out the Zero Seat Weight Test at this time. CLEAR the DTCs and REPEAT the self-test. If the DTC is no longer present, CARRY OUT the Zero Weight Test to complete the repair. If the DTC is still present, INSTALL a new OCSM. REFER to **Occupant Classification System Module (OCSM)**.
B1884	PAD Warning Lamp Circuit Failure	RCM	Go to **Pinpoint Test B**.
B1890	PAD Warning Lamp Circuit Short to Battery	RCM	Go to **Pinpoint Test C**.
B2290	Occupant Classification System Fault	RCM	**NOTE:** **If no on-demand or continuous DTC is present in the OCSM and DTC B2290 is only present in the RCM as a continuous DTC, CLEAR all RCM DTCs and PROVE OUT the SRS.** The OCSM reported a fault message to the RCM. CARRY OUT on-demand self test of the OCSM and RETRIEVE continuous DTCs.
B2290 (Rail Type System)	Occupant Classification System Fault	OCSM	**NOTE:** **If no on-demand or continuous DTC is present in the RCM and DTC B2290 is only present in the OCSM continuous, CLEAR all OCSM DTCs and PROVE OUT the SRS.** Go to **Pinpoint Test D**.
B2292	Restraint System - Safety Belt Pretensioner Fault	RCM	Go to **Pinpoint Test E**.
B2293	Restraint System - Air Bag Fault	RCM	Go to **Pinpoint Test F**.
B2294	Restraint System - Curtain Fault	RCM	Go to **Pinpoint Test G**.
B2295	Restraint System - Side Air Bag Fault	RCM	Go to **Pinpoint Test H**.

B2296	Restraint System - Impact Sensor Fault	RCM	Go to **Pinpoint Test I**.
B2434	Drivers Seat Belt Buckle Switch Circuit Short to Ground	RCM	Go to **Pinpoint Test J**.
B2435	Drivers Seat Belt Buckle Switch Resistance Out of Range	RCM	Go to **Pinpoint Test K**.
B2438	Passengers Seat Belt Buckle Switch Short to Ground	RCM	Go to **Pinpoint Test L**.
B2439	Passengers Seat Belt Buckle Switch Resistance Out of Range	RCM	Go to **Pinpoint Test M**.
B2477	Module Configuration Failure	RCM	CARRY OUT PMI on the RCM. CLEAR the DTC. If the DTC does not clear, CARRY OUT PMI on the RCM once again. CLEAR the DTC. If the DTC does not clear, INSTALL a new RCM and CARRY OUT PMI. REFER to **Restraints Control Module (RCM)**.
B2607	Harness/Configuration Mismatch	RCM	INSTALL a new RCM and CARRY OUT PMI. REFER to **Restraints Control Module (RCM)**.
B2691	Seat Belt Buckle Switch Circuit Fault, Front Driver's Side	RCM	Go to **Pinpoint Test N**.
B2692	Front Passenger's Seat Belt Buckle Switch Circuit Fault	RCM	Go to **Pinpoint Test O**.
B2792	Cross Link Between Firing Loops	RCM	Go to **Pinpoint Test P**.
B229A	Occupant Classification System Contamination	OCSM	**NOTE:** **If no on-demand or continuous DTC is present in the RCM and DTC B229A is only present in the OCSM continuous, CLEAR all OCSM DTCs and PROVE OUT the SRS.** Go to **Pinpoint Test Q**.
B229B	Occupant Classification System Obstruction	OCSM	**NOTE:** **If no on-demand or continuous DTC is present in the RCM and DTC B229B is only present in the OCSM continuous, CLEAR all OCSM DTCs and PROVE OUT the SRS.** Go to **Pinpoint Test R**.

C1414	Incorrect Module Design Level (Incorrect Vehicle Application)	RCM	INSTALL a new RCM and CARRY OUT PMI. REFER to **Restraints Control Module (RCM)**.
C1941	Zero Seat Weight Test Failure	OCSM	Can only be reported when carrying out Zero Seat Weight Test. REFER to **Occupant Classification Sensor (OCS) System Zero Seat Weight Test**.
C1946	Front Driver's Seat Track Position Switch Circuit Open	RCM	Go to **Pinpoint Test S**.
C1947	Front Driver's Seat Track Position Switch Circuit Short to Ground	RCM	Go to **Pinpoint Test T**.
C1948	Front Driver's Seat Track Position Switch Circuit Resistance Out of Range	RCM	Go to **Pinpoint Test U**.
C1981	Front Driver's Seat Track Position Switch Circuit Fault	RCM	Go to **Pinpoint Test V**.
U0300	Internal Control Module Software Incompatibility	RCM	INSTALL a new RCM and CARRY OUT PMI. REFER to **Restraints Control Module (RCM)**.
U1900	CAN Communication Bus Fault - Receive Error	RCM	**NOTE:** **DTC U1900 will set in a module that is reporting a communication fault from another module on the data bus. The module that reports the fault is not the problem module. Do not install a new RCM as part of repair for a RCM DTC U1900 fault.** VIEW and RECORD IC_MSG_RCM, PCM_MSG_RCM and OCS_MSG_RCM PIDs to determine the module with the concern. REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnosis the high-speed controller area network (HS-CAN)/module concern.
U1900	CAN Communication Bus Fault - Receive Error	OCSM	**NOTE:** **DTC U1900 will set in a module that is reporting a communication fault from another module on the data bus. The module that reports the fault is not the problem module. Do not install a new OCSM as part of repair for a OCS DTC U1900 fault.**

			REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnosis the HS-CAN/RCM concern.
U2050	No Application Present	RCM	INSTALL a new RCM and CARRY OUT PMI. REFER to **Restraints Control Module (RCM)**.
U2050	No Application Present	OCSM	**NOTE:** **If no on-demand or continuous DTC is present in the RCM and DTC U2050 is only present in the OCSM continuous, CLEAR all OCSM DTCs and PROVE OUT the SRS.** INSTALL a new OCSM. REFER to **Occupant Classification System Module (OCSM)**.
U2051	One or More Calibration Files Missing/Corrupt	RCM	INSTALL a new RCM and CARRY OUT PMI. REFER to **Restraints Control Module (RCM)**.
U2051	One or More Calibration Files Missing/Corrupt	OCSM	INSTALL a new OCSM. REFER to **Occupant Classification System Module (OCSM)**.

[a] DTC: Retrieved using scan tool.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• Air bag warning indicator is illuminated continuously	• Fuse • DTC • Wiring, terminals or connectors • Data link connector (DLC) • Restraints control module (RCM)	• Go to **Pinpoint Test A**.
• Air bag indicator flashing at 5 Hz rate	• RCM not configured	• INSTALL a new RCM and CARRY OUT programmable module installation (PMI). REFER to **Restraints Control Module (RCM)**.
• Audible tone - DTCs	• Supplemental restraint system (SRS) system	• REFER to Supplemental Restraint

retrieved	fault and air bag warning indicator fault	System (SRS) DTC Chart.
• No communication with the RCM	• Open fuse • Circuitry • Scan tool • DLC • RCM	• REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the no communication concern.
• No communication with the occupant classification system module (OCSM)	• Open fuse • Circuitry • Scan tool • DLC • OCSM	• REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the no communication concern.

Pinpoint Tests

Pinpoint Test A: The Air Bag Warning Indicator is Illuminated Continuously

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

During normal operation, the instrument cluster (IC) module will illuminate the air bag warning indicator continuously for 6 seconds after the ignition switch is placed to the RUN or ON position. If the supplemental restraint system (SRS) is fault free, the air bag warning indicator will turn off and remain off. If a fault is detected in the SRS, the restraints control module (RCM) will communicate to the IC module via the high-speed controller area network (HS-CAN) to illuminate the air bag warning indicator and it will remain illuminated for the rest of the key cycle. The instrument cluster module will illuminate the air bag warning indicator based on messaging from the RCM or if there is no communication between the RCM and IC module.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- IC module
- RCM

PINPOINT TEST A: THE AIR BAG WARNING INDICATOR IS ILLUMINATED CONTINUOUSLY

WARNING: **Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

A1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Were any continuous memory or on-demand DTCs retrieved?**

  YES : If on-demand or continuous memory DTCs were retrieved, go to the **Supplemental Restraint System (SRS) DTC Chart** for diagnostic direction.

  Do not clear any DTCs until all DTCs have been resolved.

  NO : If the RCM **does** communicate with the scan tool, REFER to**INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article to diagnose the IC module concern.

  If the RCM **does not** communicate with the scan tool, REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the no communication concern.

  Do not clear any DTCs until all DTCs have been resolved.

Pinpoint Test B: DTC B1884 - PAD Warning Lamp Circuit Failure

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

When the ignition is in the ON position, the passenger air bag deactivation (PAD) indicator prove-out period is initiated by the restraints control module (RCM). The RCM briefly activates the PAD indicator to verify to the occupants correct functional operation of the PAD indicator. Refer to **Passenger Air Bag Deactivation (PAD) Indicator**.

If the RCM detects an open or short to ground on the PAD indicator circuit, it will store DTC B1884 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B1884 PAD Warning Lamp Circuit Failure - If the RCM detects an open circuit or short to ground on the PAD indicator circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PAD indicator
- RCM

PINPOINT TEST B: DTC B1884 - PAD WARNING LAMP CIRCUIT FAILURE

WARNING: **Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

B1 CHECK FOR CONTINUOUS OR ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B1884 retrieved?**

  YES : If the PAD indicator **does** illuminate, go to B2.

  If the PAD indicator **does not** illuminate, go to B4.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not

retrieved on demand). The fault condition is not present at this time. Go to B8.

B2 CHECK CIRCUIT CR116 (GN/WH) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: PAD Indicator C2355

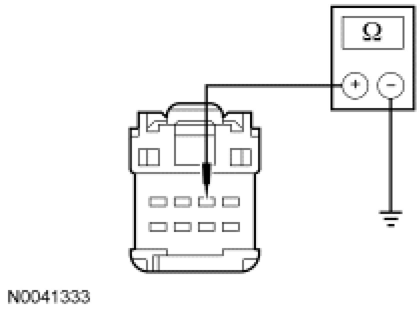


Fig. 3: Checking Circuit CR116 (GN/WH) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between PAD indicator C2355-2, circuit CR116 (GN/WH), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B7.

  NO : Go to B3.

B3 CHECK THE RCM FOR LOW RESISTANCE

- Disconnect: RCM C310a and C310b

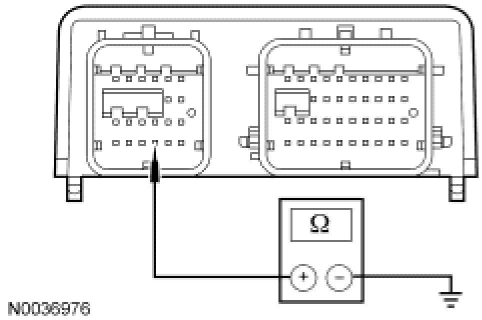


Fig. 4: Checking RCM For Low Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a pin 22, component side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR circuit CR116 (GN/WH). Go to B9.

  NO : Go to B7.

B4 CHECK CIRCUIT CR116 (GN/WH) FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Disconnect: PAD Indicator C2355

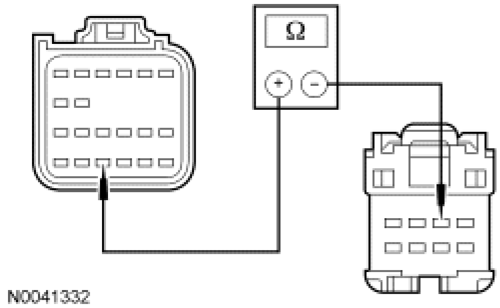


Fig. 5: Checking Circuit CR116 (GN/WH) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between PAD indicator C2355-2, circuit CR116 (GN/WH), harness side and RCM C310a-22, circuit CR116 (GN/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to B5.

  NO : REPAIR circuit CR116 (GN/WH). Go to B9.

B5 CHECK CIRCUIT CBP24 (VT/GN) FOR VOLTAGE

- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

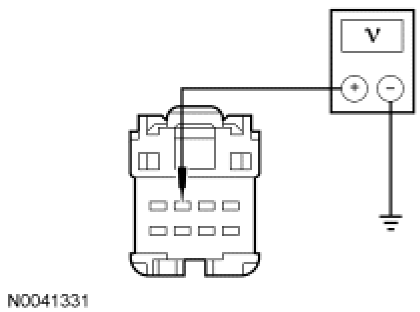


Fig. 6: Checking Circuit CBP24 (VT/GN) For Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between PAD indicator C2355-3, circuit CBP24 (VT/GN), harness side and ground.

- **Is the voltage greater than 10 volts?**

  YES : Go to B6.

  NO : VERIFY smart junction box (SJB) fuse 24 is OK. If OK, REPAIR circuit CBP24 (VT/GN). Go to B9.

B6 CHECK THE PAD INDICATOR LAMP

- Key in OFF position.
- Deactivate the SRS. Refer to **Supplemental Restraint System (SRS) Deactivation and Reactivation**.
- Connect: PAD Indicator C2355
- Key in ON position.

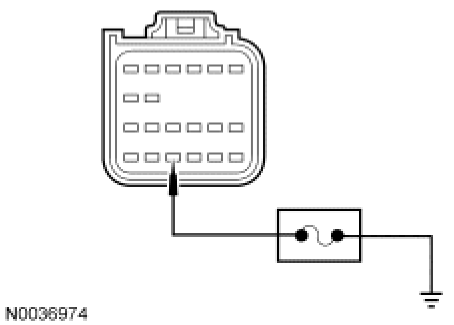


Fig. 7: Checking PAD Indicator Lamp
Courtesy of FORD MOTOR CO.

- Connect a fused jumper wire between RCM C310a-22, circuit CR116 (GN/WH), harness side and ground.
- **Does the PAD indicator illuminate?**

  YES : Go to B7.

  NO : INSTALL a new PAD indicator. REFER to **Passenger Air Bag Deactivation (PAD) Indicator**. Go to B9.

B7 CONFIRM THE RCM FAULT

NOTE:	**Make sure all restraint system component electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: PAD Indicator C2355 (if disconnected in prior step)
- Connect: RCM C310a and C310b (if disconnected in prior step)
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B1884 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to B9.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to B9.

B8 CHECK FOR AN INTERMITTENT FAULT

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B1884 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to B2.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of intermittent open or short to ground on circuit CR116 (GN/WH). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to B9.

B9 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
  - If previously directed to deactivate the SRS, reactivate the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Deactivation and Reactivation**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN

the vehicle to the customer.

Pinpoint Test C: DTC B1890 - PAD Warning Lamp Circuit Short to Battery

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

When the ignition is in the ON position, the passenger air bag deactivation (PAD) indicator prove-out period is initiated by the restraints control module (RCM). The RCM briefly activates the PAD indicator to verify to the occupants correct functional operation of the PAD indicator. Refer to **Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)**.

If the RCM detects a short to voltage on the PAD indicator circuit, it will store DTC B1890 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B1890 PAD Warning Lamp Circuit Short to Battery - If the RCM detects a short to voltage on the PAD indicator circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- PAD indicator
- RCM

PINPOINT TEST C: DTC B1890 - PAD WARNING LAMP CIRCUIT SHORT TO BATTERY

WARNING: **Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

C1 CHECK FOR CONTINUOUS OR ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B1890 retrieved?**

  YES : Go to C2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to C4.

C2 CHECK CIRCUIT CR116 (GN/WH) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: PAD Indicator C2355
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

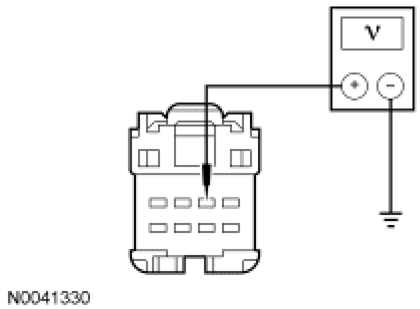


Fig. 8: Checking Circuit CR116 (GN/WH) For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between PAD indicator C2355-2, circuit CR116 (GN/WH), harness side and ground.
- **Is any voltage present?**

  YES : Go to C3.

  NO : REPAIR circuit CR116 (GN/WH). Go to C5.

C3 CHECK THE RCM

- Key in OFF position.

- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM

NOTE: **DTC B1884 should be retrieved when carrying out the on-demand self test due to an open on circuit CR116 (GN/WH). DTC B1890 should not be retrieved at this time.**

- **Was RCM on-demand DTC B1890 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to C5.

  NO : INSTALL a new PAD indicator. Go to C5.

C4 CHECK FOR AN INTERMITTENT FAULT

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B1890 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to C2.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of intermittent short to voltage on circuit CR116 (GN/WH). ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to C5.

C5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test D: DTC B2290 - Occupant Classification System Fault

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

NOTE: DTC B2290, reported by the restraints control module (RCM), is informational only and indicates the presence of a fault in the occupant classification system module (OCSM). Refer to the Supplemental Restraints System (SRS) DTC Chart when DTC B2290 is reported by the RCM for diagnostic instructions.

NOTE: The following pinpoint test must only be used to diagnose DTC B2290 when reported by the OCSM.

Normal Operation

The occupant classification sensor (OCS) system is used to classify the front passenger seat occupant in the event of a deployable impact. Refer to **Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)**.

The OCSM monitors the 2 OCS rails (weight sensors) and circuitry for faults. If the OCSM detects a fault with the sensor(s) or circuitry, it will store DTC B2290 in memory and send a message to the RCM which will store DTC B2290 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

Fault PIDs[a]	Description	Fault Trigger Condition
2290_8_OD and 2290_8_CM	Passenger Seat OCS Sensor No.2 Circuit Short to Battery	When the OCSM senses a short to voltage on either one of sensor 2 circuits, a fault will be indicated.
2290_9_OD and 2290_9_CM	Passenger Seat OCS Sensor No.2 Circuit Short to Ground	When the OCSM senses a short to ground on either one of sensor 1 circuits, a fault will be indicated.
2290_10_OD and 2290_10_CM	Passenger Seat OCS Sensor No.2 Comm. Fault / Open	When the OCSM is unable to communicate with sensor 2 or senses an open circuit, a fault will be indicated.
2290_11_OD and 2290_11_CM	Passenger Seat OCS Sensor No.2 Internal Fault	When the OCSM senses an internal failure with sensor 2, a fault will be indicated.
2290_12_OD and 2290_12_CM	Passenger Seat OCS Sensor	When the OCSM senses a short to voltage on either one of sensor 2

	No.1 Circuit Short to Battery	circuits, a fault will be indicated.
2290_13_OD and 2290_13_CM	Passenger Seat OCS Sensor No.1 Circuit Short to Ground	When the OCSM senses a short to ground on either one of sensor 2 circuits, a fault will be indicated.
2290_14_OD and 2290_14_CM	Passenger Seat OCS Sensor No.1 Comm. Fault/Open	When the OCSM is unable to communicate with sensor 1 or senses an open circuit, a fault will be indicated.
2290_15_OD and 2290_15_CM	Passenger Seat OCS Sensor No.1 Internal Fault	When the OCSM is unable to communicate with sensor 1 or senses an open circuit, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2290. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2290.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- OCS component

PINPOINT TEST D: DTC B2290 - OCCUPANT CLASSIFICATION SYSTEM FAULT

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

D1 CHECK FOR CONTINUOUS OR ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - OCSM - View and Record All B2290 Fault PIDs
  - Refer to PID list in Normal Operation to view B2290 fault PIDs.
- **Do any OCSM on-demand DTC B2290 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to D2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to D14.

D2 CHECK THE SEAT WIRING AND CONNECTORS

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Carry out a thorough visual inspection of the OCS system wiring, terminals and connectors and the related seat wiring harness and body wiring harness terminals and connectors.
- **Were any problems noted?**

  YES : REPAIR the seat connectors and wiring as needed. Go to D15.

  NO : Using the fault PIDs recorded in Step D1, go to the appropriate pinpoint test step.

  For 2290_15_CM (Passenger Seat OCS Sensor No.1 Internal Fault) or 2290_11_CM (Passenger Seat OCS Sensor No.2 Internal Fault), INSTALL a new OCS rail (weight sensor). REFER to **Occupant Classification Sensor**.

  For 2290_14_CM (Passenger Seat OCS Sensor No.1 Comm. Fault/Open), go to D3.

  For 2290_10_CM (Passenger Seat OCS Sensor No.2 Comm. Fault / Open), go to D6.

  For 2290_13_CM (Passenger Seat OCS Sensor No.1 Circuit Short to Ground), go to D9.

  For 2290_9_CM (Passenger Seat OCS Sensor No.2 Circuit Short to Ground), go to D10.

  For 2290_12_CM (Passenger Seat OCS Sensor No.1 Circuit Short to Battery), go to D11.

  For 2290_8_CM (Passenger Seat OCS Sensor No.2 Circuit Short to Battery), go to D12.

D3 CHECK CIRCUITS VR212 (YE/GN) AND RR140 (GN/OG) FOR AN OPEN

- Disconnect: OCSM C3159
- Disconnect: OCS Rail 1 C3294

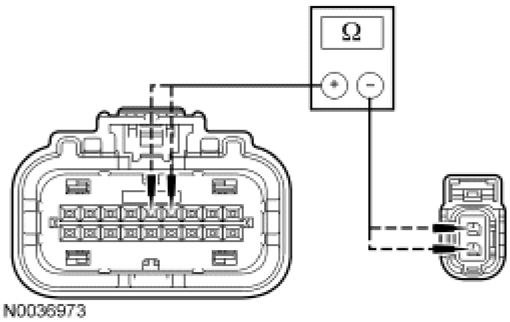


Fig. 9: Checking Circuits VR212 (YE/GN) & RR140 (GN/OG) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCSM C3159-4, circuit VR212 (YE/GN), harness side and OCS rail 1 C3294-2, circuit VR212 (YE/GN), harness side; and between OCSM C3159-5, circuit RR140 (GN/OG), harness side and OCS rail 1 C3294-1, circuit RR140 (GN/OG), harness side.
- **Are the resistances less than 0.5 ohm?**

  YES : Go to D4.

  NO : REPAIR circuit VR212 (YE/GN) or circuit RR140 (GN/OG). Go to D15.

D4 CHECK FOR A SHORT BETWEEN CIRCUITS VR212 (YE/GN) AND RR140 (GN/OG)

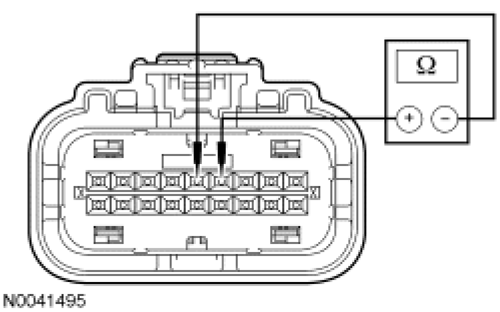


Fig. 10: Checking For A Short Between Circuits VR212 (YE/GN) & RR140 (GN/OG)
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCSM C3159-4, circuit VR212 (YE/GN), harness side and OCSM C3159-5, circuit RR140 (GN/OG), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to D5.

  NO : REPAIR circuits VR212 (YE/GN) and RR140 (GN/OG). Go to D15.

D5 CHECK THE OCS MODULE

- Install a known good OCS rail. Refer to **Occupant Classification Sensor**.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Carry out System Reset. Refer to **Occupant Classification Sensor (OCS) System Reset**.
- Key in OFF position.

NOTE: The ignition switch must be cycled after the System Reset.

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - OCSM - View and Record All B2290 Fault PIDs
    - Refer to PID list in Normal Operation to view B2290 fault PIDs.
- **Do any OCSM on-demand DTC B2290 fault PIDs indicate a fault?**

  YES : INSTALL a new OCSM. Refer to **Occupant Classification System Module (OCSM)**. Go to D15.

  NO : Fault corrected. Go to D15.

D6 CHECK CIRCUITS VR211 (WH/BN) AND RR141 (VT/BN) FOR AN OPEN

- Disconnect: OCSM C3159
- Disconnect: OCS Sensor 2 C3293

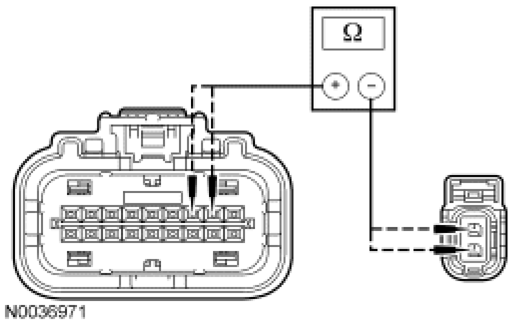


Fig. 11: Checking Circuits VR211 (WH/BN) & RR141 (VT/BN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCSM C3159-2, circuit VR211 (WH/BN), harness side and OCS sensor 2 C3293-2, circuit VR211 (WH/BN), harness side; and between OCSM C3159-3, circuit RR141 (VT/BN), harness side and OCS sensor 2 C3293-1, circuit RR141 (VT/BN), harness side.
- **Are the resistances less than 0.5 ohm?**

  YES : Go to D7.

  NO : REPAIR circuit VR211 (WH/BN) or circuit RR141 (VT/BN). Go to D15.

D7 CHECK FOR A SHORT BETWEEN CIRCUITS VR211 (WH/BN) AND RR141 (VT/BN)

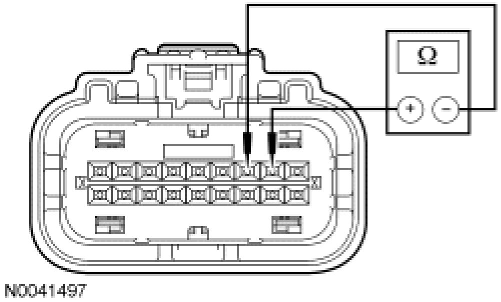


Fig. 12: Checking For A Short Between Circuits VR211 (WH/BN) & RR141 (VT/BN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCSM C3159-2, circuit VR211 (WH/BN), harness side and OCSM C3159-3, circuit RR141 (VT/BN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to D8.

  NO : REPAIR circuits VR211 (WH/BN) and RR141 (VT/BN). Go to D15.

D8 CHECK THE OCS MODULE

- Install a known good OCS rail. Refer to **Occupant Classification Sensor**.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Carry out System Reset. Refer to **Occupant Classification Sensor (OCS) System Reset**.
- Key in OFF position.

NOTE: The ignition switch must be cycled after the System Reset.

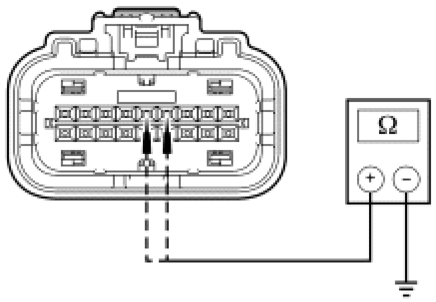
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - OCSM - View and Record All B2290 Fault PIDs
  - Refer to PID list in Normal Operation to view B2290 fault PIDs.
- **Do any OCSM on-demand DTC B2290 fault PIDs indicate a fault?**

  YES : INSTALL a new OCSM. Refer to **Occupant Classification System Module (OCSM)**. Go to D15.

  NO : Fault corrected. Go to D15.

D9 CHECK CIRCUITS VR212 (YE/GN) AND RR140 (GN/OG) FOR A SHORT TO GROUND

- Disconnect: OCSM C3159



N0036972

Fig. 13: Checking Circuits VR212 (YE/GN) & RR140 (GN/OG) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCSM C3159-4, circuit VR212 (YE/GN), harness side and ground; and between OCSM C3159-5, circuit RR140 (GN/OG), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to D13.

  NO : REPAIR circuit VR212 (YE/GN) or circuit RR140 (GN/OG). Go to D15.

D10 CHECK CIRCUITS VR211 (WH/BN) AND RR141 (VT/BN) FOR A SHORT TO GROUND

- Disconnect: OCSM C3159

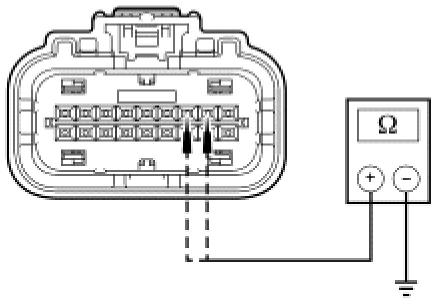


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Fig. 14: Checking Circuits VR211 (WH/BN) & RR141 (VT/BN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between OCSM C3159-2, circuit VR211 (WH/BN), harness side and ground; and between OCSM C3159-3, circuit RR141 (VT/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to D13.

  NO : REPAIR circuit VR211 (WH/BN) or circuit RR141 (VT/BN). Go to D15.

D11 CHECK CIRCUITS VR212 (YE/GN) AND RR140 (GN/OG) FOR A SHORT TO VOLTAGE

- Disconnect: Passenger Seat Side Air Bag Module C313
- Disconnect: OCSM C3159
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Key in ON position.

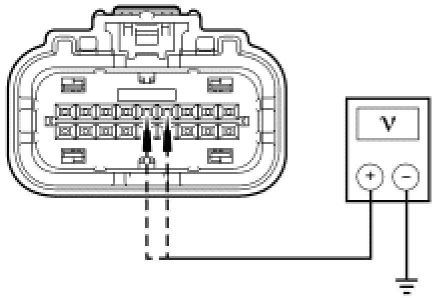

Fig. 15: Checking Circuits VR212 (YE/GN) & RR140 (GN/OG) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between:
  - OCSM C3159-4, circuit VR212 (YE/GN), harness side and ground.
  - OCSM C3159-5, circuit RR140 (GN/OG), harness side and ground.
- **Is any voltage present on either circuit?**

  YES : REPAIR circuit VR212 (YE/GN) or circuit RR140 (GN/OG). Go to D15.

  NO : Go to D13.

D12 CHECK CIRCUITS VR211 (WH/BN) AND RR141 (VT/BN) FOR A SHORT TO VOLTAGE

- Disconnect: Passenger Seat Side Air Bag Module C313
- Disconnect: OCSM C3159
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

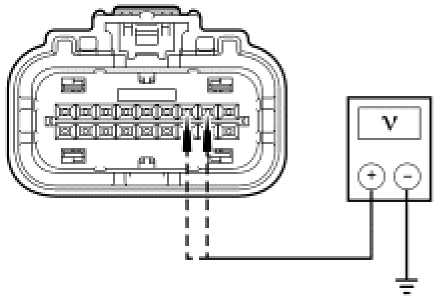

Fig. 16: Checking Circuits VR211 (WH/BN) & RR141 (VT/BN) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between:
  - OCSM C3159-2, circuit VR211 (WH/BN), harness side and ground.
  - OCSM C3159-3, circuit RR141 (VT/BN), harness side and ground.

- **Is any voltage present on either circuit?**

  YES : REPAIR circuit VR211 (WH/BN) or circuit RR141 (VT/BN). Go to D15.

  NO : Go to D13.

D13 CHECK THE OCS

NOTE: Make sure all restraint system component electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Install a new OCS rail. Refer to **Occupant Classification Sensor**.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Carry out System Reset. Refer to **Occupant Classification Sensor (OCS) System Reset**.
- Key in OFF position.

NOTE: The ignition switch must be cycled after the System Reset.

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - OCSM - View and Record All B2290 Fault PIDs
  - Refer to PID list in Normal Operation to view B2290 fault PIDs.
- **Do any OCSM on-demand DTC B2290 fault PIDs indicate a fault?**

  YES : INSTALL a new OCSM. REFER to **Occupant Classification System Module (OCSM)**. Go to D15.

  NO : Fault corrected. Go to D15.

D14 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Seat Side Air Bag Module C313
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - OCSM - View and Record All B2290 Fault PIDs
  - Refer to PID list in Normal Operation to view B2290 fault PIDs.

- **Do any OCSM on-demand DTC B2290 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

  Go to D2.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to D15.

D15 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test E: DTC B2292 - Restraint System - Seatbelt Pretensioner Fault

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) continuously monitors the safety belt retractor pretensioner circuits for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store DTC B2292 in memory if any of these conditions are detected to be outside of their respectful range. If the RCM detects a fault, it will send a message to the instrument cluster (IC) module to illuminate the air bag

warning indicator.

As the RCM continuously monitors safety belt retractor pretensioner circuits for resistance, it expects a normal resistance between 1.31 and 4.29 ohms.

If a loop resistance is between 0.9 and 1.31 or between 4.29 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

Fault PIDs[a]	Description	Fault Trigger Condition
2292_24_OD and 2292_24_CM	Pretensioner Circuit Short to Ground, Front Passenger Side	When the RCM senses a short to ground on either of the passenger pretensioner circuits, a fault will be indicated.
2292_25_OD and 2292_25_CM	Pretensioner Circuit Short to Battery, Front Passenger Side	When the RCM senses a short to voltage on either of the passenger pretensioner circuits, a fault will be indicated.
2292_26_OD and 2292_26_CM	Pretensioner Circuit Open, Front Passenger Side	When the RCM measures resistance greater than 5 ohms between the passenger pretensioner circuits, a fault will be indicated.
2292_27_OD and 2292_27_CM	Pretensioner Circuit Resistance Low, Front Passenger Side	When the RCM measures resistance less than 0.9 ohm between the passenger pretensioner circuits, a fault will be indicated.
2292_28_OD and 2292_28_CM	Pretensioner Circuit Short to Ground, Front Driver Side	When the RCM senses a short to ground on either of the driver pretensioner circuits, a fault will be indicated.
2292_29_OD and 2292_29_CM	Pretensioner Circuit Short to Battery, Front Driver Side	When the RCM senses a short to voltage on either of the driver pretensioner circuits, a fault will be indicated.
2292_30_OD and 2292_30_CM	Pretensioner Circuit Open, Front Driver Side	When the RCM measures resistance greater than 5 ohms between the driver pretensioner circuits, a fault will be indicated.
2292_31_OD and 2292_31_CM	Pretensioner Circuit Resistance Low, Front Driver Side	When the RCM measures resistance less than 0.9 ohm between the driver pretensioner

		circuits, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2292. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous memory DTC B2292.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Safety belt retractor pretensioner
- RCM

PINPOINT TEST E: DTC B2292 - RESTRAINT SYSTEM - SEATBELT PRETENSIONER FAULT

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

E1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2292 Fault PIDs

  - Refer to PID list in Normal Operation to view B2292 fault PIDs.
- **Do any RCM on-demand DTC B2292 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

  Using the fault PIDs recorded, go to the appropriate pinpoint test step.

  For 2292_31_OD (Pretensioner Circuit Resistance Low, Front Driver Side), go to E2.

  For 2292_30_OD (Pretensioner Circuit Open, Front Driver Side), go to E2.

  For 2292_28_OD (Pretensioner Circuit Short to Ground, Front Driver Side), go to E9.

  For 2292_29_OD (Pretensioner Circuit Short to Battery, Front Driver Side), go to E11.

  For 2292_27_OD (Pretensioner Circuit Resistance Low, Front Passenger Side), go to E12.

  For 2292_26_OD (Pretensioner Circuit Open, Front Passenger Side), go to E12.

  For 2292_24_OD (Pretensioner Circuit Short to Ground, Front Passenger Side), go to E19.

  For 2292_25_OD (Pretensioner Circuit Short to Battery, Front Passenger Side), go to E21.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time.

  Using the fault PIDs recorded, go to the appropriate pinpoint test step.

  For 2292_31_CM (Pretensioner Circuit Resistance Low, Front Driver Side), 2292_27_CM (Pretensioner Circuit Resistance Low, Front Passenger Side), 2292_30_CM (Pretensioner Circuit Open, Front Driver Side) and 2292_26_CM (Pretensioner Circuit Open, Front Passenger Side), go to E24.

  For 2292_28_CM (Pretensioner Circuit Short to Ground, Front Driver Side) and 2292_24_CM (Pretensioner Circuit Short to Ground, Front Passenger Side), go to E26.

  For 2292_29_CM (Pretensioner Circuit Short to Battery, Front Driver Side) and 2292_25_CM (Pretensioner Circuit Short to Battery, Front Passenger Side), go to E27.

E2 CHECK THE DRIVER SAFETY BELT PRETENSIONER RESISTANCE PID (DR_PTENS)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - PID
- Enter the following diagnostic mode on the diagnostic tool: DR_PTENS (Pretensioner Circuit Resistance, Driver side) Resistance PID
- **Does the resistance PID value read between 1.31 and 4.29 ohms?**

  YES : Go to E23.

NO : Go to E3.

E3 CHECK THE DRIVER SAFETY BELT RETRACTOR PRETENSIONER RESISTANCE PID (DR_PTENS) WHILE CARRYING OUT A HARNESS TEST

- Continue monitoring the DR_PTENS (Pretensioner Circuit Resistance, Driver side) resistance PID while carrying out a harness test of the driver safety belt retractor pretensioner circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out a harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to E28.

  NO : If the driver safety belt retractor pretensioner resistance PID is less than 1.31 ohms, go to E4.

  If the driver safety belt retractor pretensioner resistance PID is greater than 4.29 ohms, go to E6.

E4 CHECK DRIVER SAFETY BELT RETRACTOR PRETENSIONER CIRCUIT FAULT PIDs (2292_31_OD) AND (2292_30_OD) FOR LOW RESISTANCE AND OPEN

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Retractor Pretensioner C323
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2292_30_OD (Pretensioner Circuit Open, Front Driver Side)
  - 2292_31_OD (Pretensioner Circuit Resistance Low, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the driver pretensioner disconnected, an open circuit fault would normally be retrieved.
- **Did the driver safety belt retractor pretensioner on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to E22.

  NO : Go to E5.

E5 CHECK FOR A SHORT BETWEEN DRIVER SAFETY BELT RETRACTOR PRETENSIONER CIRCUITS CR120 (BU/OG) AND RR120 (BN/GN)

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

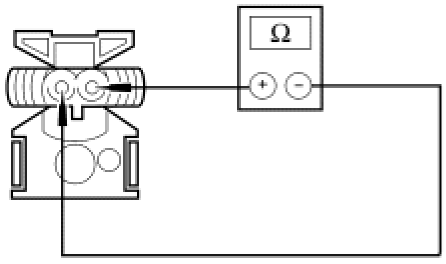

Fig. 17: Checking For A Short Between Driver Safety Belt Retractor Pretensioner Circuits CR120 (BU/OG) & RR120 (BN/GN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver safety belt retractor pretensioner C323-1, circuit CR120 (BU/OG), harness side and C323-2, circuit RR120 (BN/GN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to E23.

  NO : REPAIR circuits CR120 (BU/OG) and RR120 (BN/GN). Go to E28.

E6 CHECK THE DRIVER SAFETY BELT RETRACTOR PRETENSIONER CIRCUIT FAULT PIDs (2292_30_OD) AND (2292_31_OD) FOR AN OPEN AND LOW RESISTANCE

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Retractor Pretensioner C323
- Connect a jumper wire between driver safety belt pretensioner C3201-1, circuit CR120 (BU/OG), harness side and C3201-2, circuit RR120 (BN/GN), harness side.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2292_30_OD (Pretensioner Circuit Open, Front Driver Side)
  - 2292_31_OD (Pretensioner Circuit Resistance Low, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the driver pretensioner circuits shorted together, a low resistance fault would normally be retrieved.
- **Did the driver safety belt retractor pretensioner on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to E22.

  NO : Go to E7.

E7 CHECK CIRCUIT CR120 (BU/OG) FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the jumper wire from the driver safety belt retractor pretensioner C323.
- Disconnect: RCM C310a and C310b

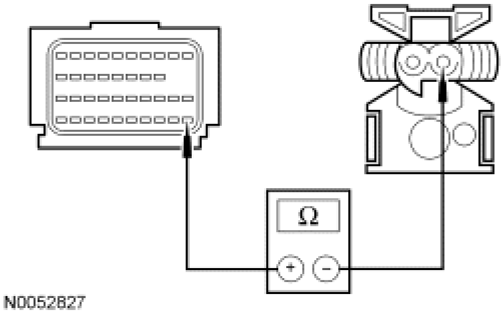

Fig. 18: Checking Circuit CR120 (BU/OG) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-31, circuit CR120 (BU/OG), harness side and driver safety belt retractor pretensioner C323-1, circuit CR120 (BU/OG), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to E8.

  NO : REPAIR circuit CR120 (BU/OG). Go to E28.

E8 CHECK CIRCUIT RR120 (BN/GN) FOR AN OPEN

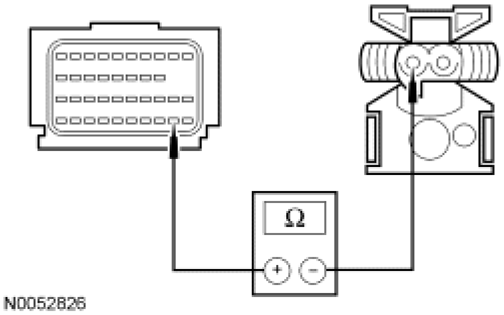

Fig. 19: Checking Circuit RR120 (BN/GN) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-32, circuit RR120 (BN/GN), harness side and driver safety belt retractor pretensioner C323-2, circuit RR120 (BN/GN), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to E23.

  NO : REPAIR circuit RR120 (BN/GN). Go to E28.

E9 CHECK THE DRIVER SAFETY BELT RETRACTOR PRETENSIONER CIRCUIT FAULT PIDs (2292_28_OD) AND (2292_30_OD) FOR A SHORT TO GROUND AND OPEN

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Retractor Pretensioner C323
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2292_28_OD (Pretensioner Circuit Short to Ground, Front Driver Side)
  - 2292_30_OD (Pretensioner Circuit Open, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the driver pretensioner disconnected, an open circuit fault would normally be retrieved.
- **Did the driver safety belt retractor pretensioner on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to E22.

NO : Go to E10.

E10 CHECK CIRCUITS CR120 (BU/OG) AND RR120 (BN/GN) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

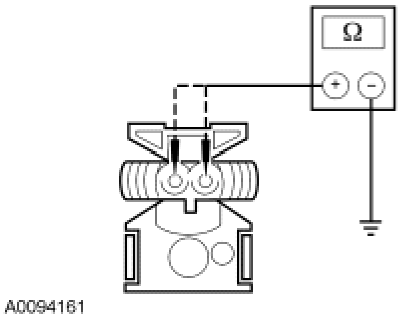

Fig. 20: Checking Circuits CR120 (BU/OG) & RR120 (BN/GN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver safety belt retractor pretensioner C323-1, circuit CR120 (BU/OG), harness side and ground; and between driver safety belt retractor pretensioner C323-2, circuit RR120 (BN/GN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to E23.

  NO : REPAIR circuit CR120 (BU/OG) or circuit RR120 (BN/GN). Go to E28.

E11 CHECK CIRCUITS CR120 (BU/OG) AND RR120 (BN/GN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Side Air Bag Module C328
- Disconnect: Driver Safety Belt Retractor Pretensioner C323
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

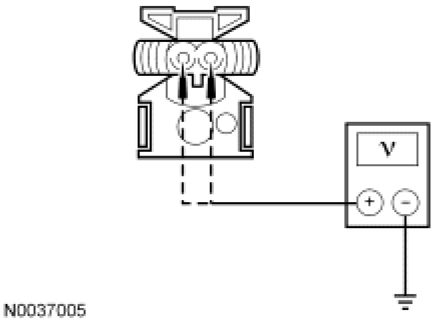

Fig. 21: Checking Circuits CR120 (BU/OG) & RR120 (BN/GN) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between:
  - driver safety belt retractor pretensioner C323-1, circuit CR120 (BU/OG), harness side and ground.
  - driver safety belt retractor pretensioner C323-2, circuit RR120 (BN/GN), harness side and ground.
- **Is any voltage present on either circuit?**

  YES : REPAIR circuit CR120 (BU/OG) or circuit RR120 (BN/GN). Go to E28.

  NO : Go to E23.

E12 CHECK THE PASSENGER SAFETY BELT PRETENSIONER RESISTANCE PID (PS_PTENS)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - PID
- Enter the following diagnostic mode on the diagnostic tool: PS_PTENS (Passenger Retractor Circuit Resistance) Resistance PID
- **Does the resistance PID value read between 1.31 and 4.29 ohms?**

  YES : Go to E23.

  NO : Go to E13.

E13 CHECK THE PASSENGER SAFETY BELT RETRACTOR PRETENSIONER RESISTANCE PID (PS_PTENS) WHILE CARRYING OUT A HARNESS TEST

- Continue monitoring the PS_PTENS (Passenger Retractor Circuit Resistance) resistance PID while carrying out a harness test of the passenger safety belt retractor pretensioner circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to E28.

  NO : If the passenger safety belt retractor pretensioner resistance PID is less than 1.31 ohms, go to E14.

  If the passenger safety belt retractor pretensioner resistance PID is greater than 4.29 ohms, go to

E16.

E14 CHECK THE PASSENGER SAFETY BELT RETRACTOR PRETENSIONER CIRCUIT FAULT PIDs (2292_26_OD) AND (2292_27_OD) FOR AN OPEN AND LOW RESISTANCE

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Belt Retractor Pretensioner C3202
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2292_26_OD (Pretensioner Circuit Open, Front Passenger Side)
  - 2292_27_OD (Pretensioner Circuit Resistance Low, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the passenger pretensioner disconnected, an open circuit fault would normally be retrieved.
- **Did the passenger safety belt retractor pretensioner on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to E22.

  NO : Go to E15.

E15 CHECK FOR A SHORT BETWEEN THE PASSENGER SAFETY BELT RETRACTOR PRETENSIONER CIRCUITS RR121 (VT) AND CR121 (GY/VT)

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

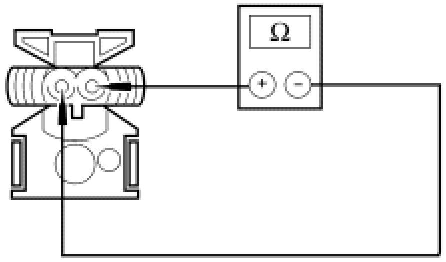

Fig. 22: Checking For A Short Between Passenger Safety Belt Retractor Pretensioner Circuits RR121 (VT) & CR121 (GY/VT)
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger safety belt retractor pretensioner C3202-1, circuit CR121 (GY/VT), harness side and C3202-2, circuit RR121 (VT), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to E23.

  NO : REPAIR circuits CR121 (GY/VT) and RR121 (VT). Go to E28.

E16 CHECK THE PASSENGER SAFETY BELT PRETENSIONER CIRCUIT FAULT PIDs (2292_26_OD) AND (2292_27_OD) FOR AN OPEN AND LOW RESISTANCE

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Belt Retractor Pretensioner C3202
- Connect a jumper wire between passenger safety belt pretensioner C3202-1, circuit CR121 (GY/VT), harness side and C3202-2, circuit RR121 (VT), harness side.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2292_26_OD (Pretensioner Circuit Open, Front Passenger Side)
  - 2292_27_OD (Pretensioner Circuit Resistance Low, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the passenger pretensioner circuits shorted together, a low resistance fault would normally be retrieved.

- **Did the passenger safety belt retractor pretensioner on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to E22.

  NO : Go to E17.

E17 CHECK CIRCUIT RR121 (VT) FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the jumper wire from passenger safety belt retractor pretensioner C3202.
- Disconnect: RCM C310a and C310b

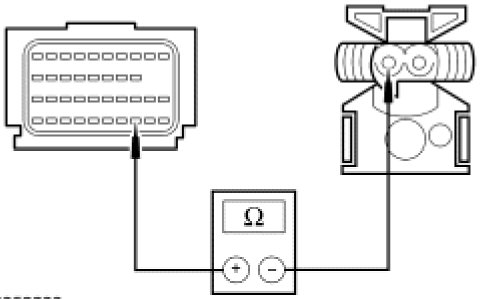

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Fig. 23: Checking Circuit RR121 (VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-33, circuit RR121 (VT), harness side and passenger safety belt retractor pretensioner C3202-2, circuit RR121 (VT), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to E18.

  NO : REPAIR circuit RR121 (VT). Go to E28.

E18 CHECK CIRCUIT CR121 (GY/VT) FOR AN OPEN

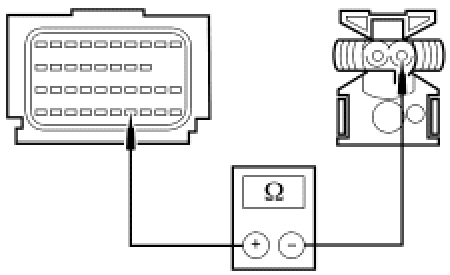

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Fig. 24: Checking Circuit CR121 (GY/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-34, circuit CR121 (GY/VT), harness side and

passenger safety belt retractor pretensioner C3202-1, circuit CR121 (GY/VT), harness side.

- **Is the resistance less than 0.5 ohm?**

  YES : Go to E23.

  NO : REPAIR circuit CR121 (GY/VT). Go to E28.

E19 CHECK THE PASSENGER SAFETY BELT RETRACTOR PRETENSIONER CIRCUIT FAULT PIDs (2292_24_OD) AND (2292_26_OD) FOR A SHORT TO GROUND AND OPEN

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Belt Retractor Pretensioner C3202
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2292_24_OD (Pretensioner Circuit Short to Ground, Front Passenger Side)
  - 2292_26_OD (Pretensioner Circuit Open, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2292 on-demand fault PIDs with the passenger pretensioner disconnected, an open circuit fault would normally be retrieved.
- **Did the passenger safety belt retractor pretensioner on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to E22.

  NO : Go to E20.

E20 CHECK CIRCUITS RR121 (VT) AND CR121 (GY/VT) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

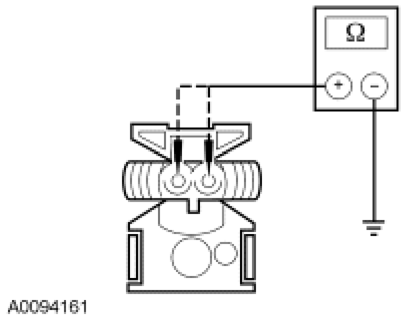

Fig. 25: Checking Circuits RR121 (VT) & CR121 (GY/VT) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger safety belt retractor pretensioner C3202-2, circuit RR121 (VT), harness side and ground; and between passenger safety belt retractor pretensioner C3202-1, circuit CR121 (GY/VT), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to E23.

  NO : REPAIR circuit RR121 (VT) or circuit CR121 (GY/VT). Go to E28.

E21 CHECK CIRCUITS RR121 (VT) AND CR121 (GY/VT) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Side Air Bag Module C314
- Disconnect: Passenger Safety Belt Retractor Pretensioner C3202
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

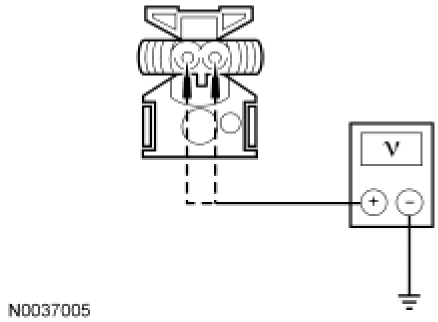

Fig. 26: Checking Circuits RR121 (VT) & CR121 (GY/VT) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between:
  - passenger safety belt retractor pretensioner C3202-2, circuit RR121 (VT), harness side and

ground.
- passenger safety belt retractor pretensioner C3202-1, circuit CR121 (GY/VT), harness side and ground.

- **Is any voltage present on either circuit?**

  YES : REPAIR circuit RR121 (VT) or circuit CR121 (GY/VT). Go to E28.

  NO : Go to E23.

E22 CONFIRM THE SAFETY BELT RETRACTOR PRETENSIONER FAULT

NOTE: **Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Affected Safety Belt Retractor Pretensioner C323 (Driver) C3202 (Passenger)
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2292 Fault PIDs
  - Refer to PID list in Normal Operation to view B2292 fault PIDs.
- **Does the original RCM on-demand DTC B2292 fault PID indicate a fault?**

  YES : INSTALL a new driver or passenger safety belt retractor pretensioner. REFER to **SAFETY BELT SYSTEM** article. Go to E28.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected.

  For 2292_31_CM (Pretensioner Circuit Resistance Low, Front Driver Side), 2292_27_CM (Pretensioner Circuit Resistance Low, Front Passenger Side), 2292_30_CM (Pretensioner Circuit Open, Front Driver Side) and 2292_26_CM (Pretensioner Circuit Open, Front Passenger Side), go to E24.

  For 2292_28_CM (Pretensioner Circuit Short to Ground, Front Driver Side) and 2292_24_CM (Pretensioner Circuit Short to Ground, Front Passenger Side), go to E26.

  For 2292_29_CM (Pretensioner Circuit Short to Battery, Front Driver Side) and 2292_25_CM (Pretensioner Circuit Short to Battery, Front Passenger Side), go to E27.

E23 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: All Restraint System Components (if previously disconnected)
- Connect: RCM C310a and C310b (if previously disconnected)
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2292 Fault PIDs
  - Refer to PID list in Normal Operation to view B2292 fault PIDs.
- **Does the original RCM on-demand DTC B2292 fault PID indicate a fault?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to E28.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected.

  For 2292_31_CM (Pretensioner Circuit Resistance Low, Front Driver Side), 2292_27_CM (Pretensioner Circuit Resistance Low, Front Passenger Side), 2292_30_CM (Pretensioner Circuit Open, Front Driver Side) and 2292_26_CM (Pretensioner Circuit Open, Front Passenger Side), go to E24.

  For 2292_28_CM (Pretensioner Circuit Short to Ground, Front Driver Side) and 2292_24_CM (Pretensioner Circuit Short to Ground, Front Passenger Side), go to E26.

  For 2292_29_CM (Pretensioner Circuit Short to Battery, Front Driver Side) and 2292_25_CM (Pretensioner Circuit Short to Battery, Front Passenger Side), go to E27.

E24 CHECK SAFETY BELT RETRACTOR PRETENSIONER RESISTANCE PIDs FOR AN INTERMITTENT LOW RESISTANCE OR OPEN

- If the fault PID was reported for the driver safety belt retractor pretensioner, monitor the DR_PTENS (Pretensioner Circuit Resistance, Driver side) resistance PID.
- If the fault PID was reported for the passenger safety belt retractor pretensioner, monitor the PS_PTENS (Passenger Retractor Circuit Resistance) pretensioner resistance PID.

NOTE: A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5.0 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make

sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition.

- Attempt to recreate the fault by wiggling the connectors (including any inline connectors) and flexing the wire harness.
- **Does any safety belt retractor pretensioner resistance PID indicate less than 1.31 ohms or greater than 4.29 ohms?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to E28.

  NO : Go to E25.

E25 CHECK THE HARNESS AND CONNECTORS

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect the affected safety belt retractor pretensioner C323 (driver) or C3202 (passenger):
  - inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damage, pinched, cut or pierced wires.
- **Were any concerns found?**

  YES : REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to E28.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to E28.

E26 CHECK SAFETY BELT RETRACTOR PRETENSIONER CIRCUIT FAULT PIDs FOR AN INTERMITTENT SHORT TO GROUND

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - PID
- If the fault PID was reported for the driver safety belt retractor pretensioner, monitor the 2292_28_OD (Pretensioner Circuit Short to Ground, Front Driver Side) on-demand fault PID on the scan tool.
- If the fault PID was reported for the passenger safety belt retractor pretensioner, monitor the 2292_24_OD (Pretensioner Circuit Short to Ground, Front Passenger Side) on-demand fault PID on the scan tool.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds

for the scan tool display to update.

- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any safety belt retractor pretensioner on-demand fault PID indicate a fault is present?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to E28.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to E28.

E27 CHECK SAFETY BELT PRETENSIONER CIRCUIT FAULT PIDs FOR AN INTERMITTENT SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect the side air bag module electrical connector C328 (driver) or C3252 (passenger) on the side with the affected pretensioner.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- If the fault PID was reported for the driver safety belt retractor pretensioner, monitor the 2292_29_OD (Pretensioner Circuit Short to Battery, Front Driver Side) on-demand fault PID.
- If the fault PID was reported for the passenger safety belt retractor pretensioner, monitor the 2292_25_OD (Pretensioner Circuit Short to Battery, Front Passenger Side) on-demand fault PID.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.
- Attempt to recreate the fault by wiggling the connectors (including any inline connectors) and flexing the wire harness.
- **Does the safety belt retractor pretensioner short to battery on-demand fault PID indicate a fault is present?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to E28.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire

harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to E28.

E28 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test F: DTC B2293 - Restraint System - Air Bag Fault

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) continuously monitors all front air bag module circuits (loop) for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store DTC B2293 in memory if any of these conditions are detected to be outside of their respectful range. If the RCM detects a fault on any of the front air bag circuits, it will store DTC B2293 in memory and send a message to the instrument cluster module to illuminate the air bag warning indicator.

As the RCM continuously monitors all front air bag module circuits for resistance, it expects a normal resistance for the driver and passenger air bag modules loop 1 and 2, between 1.31 to 4.29 ohms.

If a loop resistance for the driver and/or passenger air bag loop 1 and/or 2 is between 0.9 and 1.31 or between 4.29 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

Fault PIDs[a]	Description	Fault Trigger Condition

2293_16_OD and 2293_16_CM	Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side	When the RCM measures resistance less than 0.9 ohm between the passenger air bag loop circuits, a fault will be indicated.
2293_17_OD and 2293_17_CM	Air Bag Circuit Open - Loop No. 2, Front Passenger Side	When the RCM measures resistance greater than 5 ohms between the passenger air bag loop circuits, a fault will be indicated.
2293_18_OD and 2293_18_CM	Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side	When the RCM senses a short to voltage on either of the passenger air bag loop circuits, a fault will be indicated.
2293_19_OD and 2293_19_CM	Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side	When the RCM senses a short to ground on either of the passenger air bag loop circuits, a fault will be indicated.
2293_20_OD and 2293_20_CM	Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side	When the RCM measures resistance less than 0.9 ohm between the driver air bag loop circuits, a fault will be indicated.
2293_21_OD and 2293_21_CM	Air Bag Circuit Open - Loop No. 2, Front Driver Side	When the RCM measures resistance greater than 5 ohms between the driver air bag loop circuits, a fault will be indicated.
2293_22_OD and 2293_22_CM	Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side	When the RCM senses a short to voltage on either of the driver air bag loop circuits, a fault will be indicated.
2293_23_OD and 2293_23_CM	Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side	When the RCM senses a short to ground on either of the driver air bag loop circuits, a fault will be indicated.
2293_24_OD and 2293_24_CM	Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side	When the RCM measures resistance less than 0.9 ohm between the passenger air bag loop circuits, a fault will be indicated.
2293_25_OD and 2293_25_CM	Air Bag Circuit Open - Loop No. 1, Front Passenger Side	When the RCM measures resistance greater than 5 ohms between the passenger air bag

		loop circuits, a fault will be indicated.
2293_26_OD and 2293_26_CM	Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side	When the RCM senses a short to voltage on either of the passenger air bag loop circuits, a fault will be indicated.
2293_27_OD and 2293_27_CM	Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side	When the RCM senses a short to ground on either of the passenger air bag loop circuits, a fault will be indicated.
2293_28_OD and 2293_28_CM	Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side	When the RCM measures resistance less than 0.9 ohm between the driver air bag loop circuits, a fault will be indicated.
2293_29_OD and 2293_29_CM	Air Bag Circuit Open - Loop No. 1, Front Driver Side	When the RCM measures resistance greater than 5 ohms between the driver air bag loop circuits, a fault will be indicated.
2293_30_OD and 2293_30_CM	Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side	When the RCM senses a short to voltage on either of the driver air bag loop circuits, a fault will be indicated.
2293_31_OD and 2293_31_CM	Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side	When the RCM senses a short to ground on either of the driver air bag loop circuits, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2293. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2293.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Clockspring
- Driver air bag module
- RCM

PINPOINT TEST F: DTC B2293 - RESTRAINT SYSTEM - AIR BAG FAULT

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the**

accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

F1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2293 Fault PIDs
  - Refer to PID list in Normal Operation to view B2293 fault PIDs.
- **Do any RCM on-demand DTC B2293 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

  Using the fault PIDs recorded, go to the appropriate pinpoint test step.

  For 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side), go to F2.

  For 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side), go to F2.

  For (2293_31_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side), go to F10.

  For driver air bag module loop 1 with a short to battery fault (2293_30_OD), go to F13.

  For 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), go to F15.

  For 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side), go to F15.

  For 2293_23_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), go to F23.

For 2293_22_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side), go to F26.

For 2293_24_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side), go to F28.

For 2293_25_OD (Air Bag Circuit Open - Loop No. 1, Front Passenger Side), go to F28.

For 2293_27_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side), go to F34.

For 2293_26_OD (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side), go to F36.

For 2293_16_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side), go to F37.

For 2293_17_OD (Air Bag Circuit Open - Loop No. 2, Front Passenger Side), go to F37.

For 2293_19_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side), go to F43.

For 2293_18_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side), go to F45.

NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time.

Using the fault PIDs recorded, go to the appropriate pinpoint test step.

For 2293_28_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side) or 2293_20_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), go to F50.

For 2293_29_CM (Air Bag Circuit Open - Loop No. 1, Front Driver Side) or 2293_21_CM (Air Bag Circuit Open - Loop No. 2, Front Driver Side), go to F50.

For 2293_31_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side) or 2293_23_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), go to F51.

For 2293_30_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side) or 2293_22_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side), go to F53.

For 2293_24_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side) or 2293_16_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side), go to F50.

For 2293_25_CM (Air Bag Circuit Open - Loop No. 1, Front Passenger Side) or 2293_17_CM (Air Bag Circuit Open - Loop No. 2, Front Passenger Side), go to F50.

For 2293_27_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side) or 2293_19_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side), go to F52.

For 2293_26_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side) or 2293_18_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side), go to F54.

F2 CHECK THE DRIVER AIR BAG MODULE LOOP 1 RESISTANCE PID (D_ABAGR)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - PID
- Enter the following diagnostic mode on the diagnostic tool: D_ABAGR (Driver Air Bag) Resistance PID
- **Does the resistance PID value read between 1.31 and 4.29 ohms?**

  YES : Go to F49.

  NO : Go to F3.

F3 CHECK THE DRIVER AIR BAG MODULE LOOP 1 RESISTANCE PID (D_ABAGR) WHILE CARRYING OUT A HARNESS TEST

NOTE: Do not remove the driver air bag module from its mounted position at this time.

- With the driver air bag in its mounted position, continue monitoring the D_ABAGR (Driver Air Bag) resistance PID while carrying out a harness test of the driver air bag circuits and accessible connectors (including any inline connectors) by wiggling and flexing the wire harness, connectors, tilting and rotating the steering wheel frequently.
- **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness or INSTALL a new clockspring as needed. REFER to **Clockspring**. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to F56.

  NO : If the driver air bag module loop 1 resistance PID is less than 1.31 ohms, go to F4.

  If the driver air bag module loop 1 resistance PID is greater than 4.29 ohms, go to F7.

F4 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUIT FAULT PIDs (2293_28_OD) AND (2293_29_OD) LOW RESISTANCE AND OPEN

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint**

System (SRS) Depowering and Repowering.

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side)
  - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to F46.

  NO : Go to F5.

F5 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUIT FAULT PIDS (2293_28_OD) AND (2293_29_OD) FOR LOW RESISTANCE AND OPEN (DRIVER AIR BAG REMOVED)

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Clockspring C218a
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side)
  - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to F48.

  NO : Go to F6.

F6 CHECK THE RCM FOR LOW RESISTANCE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

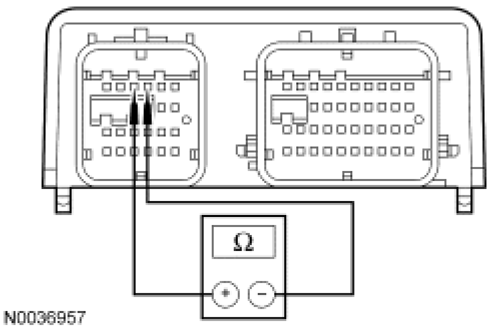

Fig. 27: Checking RCM For Low Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a pin 3 and C310a pin 4, component side.
- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR101 (VT/BN) and RR101 (YE/GN). Go to F56.

  NO : Go to F49.

F7 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUIT FAULT PIDs (2293_29_OD) AND (2293_28_OD) FOR AN OPEN AND LOW RESISTANCE

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Connect a jumper wire between driver air bag module loop 1 electrical connector pin-1, harness side and pin-2, harness side.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side)

    - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 1 circuits shorted together, a low resistance fault would normally be retrieved on loop 1. Loop 2 will show an open circuit fault due to the driver air bag being disconnected.
- **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a open circuit to a low resistance fault?**

  YES : Go to F46.

  NO : Go to F8.

F8 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUIT FAULT PIDs (2293_29_OD) AND (2293_28_OD) FOR AN OPEN AND LOW RESISTANCE (CLOCKSPRING DISCONNECTED)

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the jumper wire from driver air bag module loop 1 electrical connector.
- Disconnect: Clockspring C218a
- Connect a jumper wire between clockspring C218a-1, circuit CR101 (VT/BN), harness side and clockspring C218a-9, circuit RR101 (YE/GN), harness side.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
    - 2293_28_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side)
    - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 1 circuits shorted together, a low resistance fault would normally be retrieved on loop 1. Loop 2 will show an open circuit fault due to the driver air bag being disconnected.
- **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a open circuit to a low resistance fault?**

  YES : Go to F48.

  NO : Go to F9.

F9 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUITS CR101 (VT/BN) AND RR101 (YE/GN) FOR AN OPEN BETWEEN THE CLOCKSPRING AND RCM

- Key in OFF position.

- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the jumper wire from the clockspring connector.
- Disconnect: RCM C310a and C310b

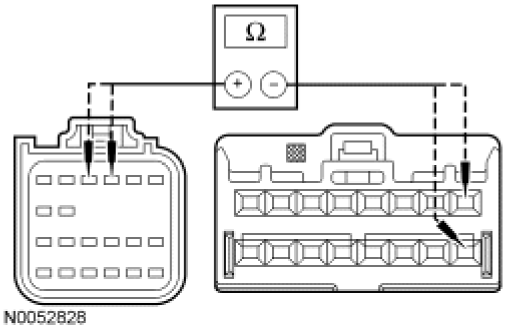

Fig. 28: Checking Driver Air Bag Module Loop 1 Circuits CR101 (VT/BN) & RR101 (YE/GN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a-4, circuit CR101 (VT/BN), harness side and clockspring C218a-1, circuit CR101 (VT/BN), harness side; and between RCM C310a-3, circuit RR101 (YE/GN), harness side and clockspring C218a-9, circuit RR101 (YE/GN), harness side.
- **Are the resistances less than 0.5 ohm?**

  YES : Go to F49.

  NO : REPAIR circuit CR101 (VT/BN) or circuit RR101 (YE/GN). Go to F56.

F10 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUIT FAULT PIDs (2293_31_OD) AND (2293_29_OD) FOR A SHORT TO GROUND AND OPEN

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side)

  - 2293_31_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to F46.

  NO : Go to F11.

F11 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUIT FAULT PIDs (2293_31_OD) AND (2293_29_OD) FOR A SHORT TO GROUND AND OPEN (CLOCKSPRING DISCONNECTED)

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Clockspring C218a
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side)
  - 2293_31_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to F48.

  NO : Go to F12.

F12 CHECK CIRCUITS CR101 (VT/BN) AND RR101 (YE/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND CLOCKSPRING

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

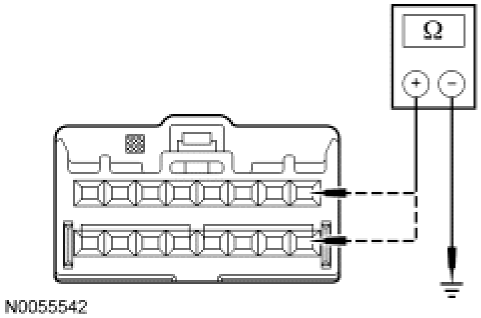

Fig. 29: Checking Circuits CR101 (VT/BN) & RR101 (YE/GN) For A Short To Ground Between RCM & Clockspring
Courtesy of FORD MOTOR CO.

- Measure the resistance between clockspring C218a-1, circuit CR101 (VT/BN), harness side and ground; and between clockspring C218a-9, circuit RR101 (YE/GN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to F49.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR101 (VT/BN) or circuit RR101 (YE/GN). Go to F56.

F13 CHECK THE DRIVER AIR BAG MODULE LOOP 1 CIRCUIT FAULT PIDs (2293_30_OD) AND (2293_29_OD) FOR A SHORT TO VOLTAGE AND OPEN (CLOCKSPRING DISCONNECTED)

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Disconnect: Clockspring C218a
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_29_OD (Air Bag Circuit Open - Loop No. 1, Front Driver Side)

    - 2293_31_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 1 on-demand fault PIDs change from indicating a short to battery to an open circuit fault?**

  YES : Go to F48.

  NO : Go to F14.

F14 CHECK CIRCUITS CR101 (VT/BN) AND RR101 (YE/GN) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND CLOCKSPRING

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

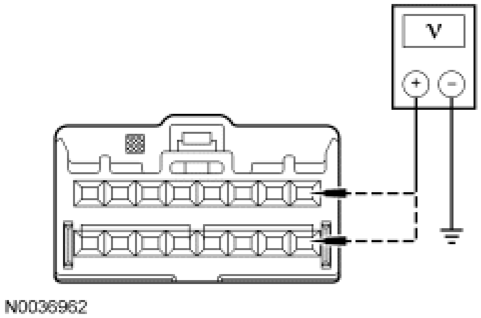

Fig. 30: Checking Circuits CR101 (VT/BN) & RR101 (YE/GN) For A Short To Voltage Between RCM & Clockspring
Courtesy of FORD MOTOR CO.

- Measure the voltage between:
    - clockspring C218a-1, circuit CR101 (VT/BN), harness side and ground.
    - clockspring C218a-9, circuit RR101 (YE/GN), harness side and ground.
- **Is any voltage present on either circuit?**

  YES : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR101 (VT/BN) or circuit RR101 (YE/GN). Go to F56.

  NO : Go to F49.

F15 CHECK THE DRIVER AIR BAG MODULE LOOP 2 RESISTANCE PID (D_ABAGR2)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - PID
- Enter the following diagnostic mode on the diagnostic tool: D_ABAGR2 (Driver Air Bag #2 Resistance) Resistance PID
- **Does the resistance PID value read between 1.31 and 4.29 ohms?**

  YES : Go to F49.

  NO : Go to F16.

F16 CHECK THE DRIVER AIR BAG MODULE LOOP 2 RESISTANCE PID (D_ABAGR2) WHILE CARRYING OUT A HARNESS TEST

NOTE: **Do not remove the driver air bag module from its mounted position at this time.**

- With the driver air bag in its mounted position, continue monitoring the D_ABAGR2 (Driver Air Bag #2 Resistance) resistance PID while carrying out a harness test of the driver air bag circuits and accessible connectors (including any inline connectors), by wiggling and flexing the wire harness, connectors, tilting and rotating the steering wheel frequently.
- **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness or INSTALL a new clockspring as needed. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to F56.

  NO : If the driver air bag module loop 2 resistance PID is less than 1.31 ohms, go to F17.

  If the driver air bag module loop 2 resistance PID is greater than 4.29 ohms, go to F20.

F17 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUIT FAULT PIDs (2293_20_OD) AND (2293_21_OD) FOR LOW RESISTANCE AND OPEN

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record

The Following Fault PIDs
  - 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side)
  - 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to F46.

  NO : Go to F18.

F18 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUIT FAULT PIDs (2293_20_OD) AND (2293_21_OD) FOR LOW RESISTANCE AND OPEN (CLOCKSPRING DISCONNECTED)

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Disconnect: Clockspring C218a
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side)
  - 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to F48.

  NO : Go to F19.

F19 CHECK THE RCM FOR LOW RESISTANCE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

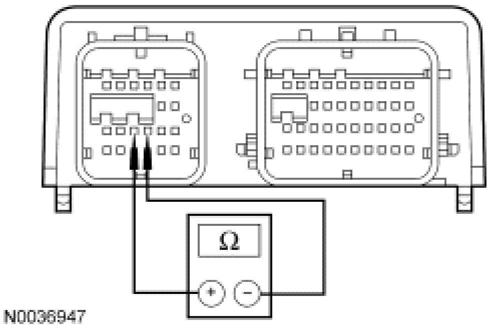

Fig. 31: Checking RCM For Low Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a pin 15 and C310a pin 16, component side.
- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR102 (BU) and RR102 (WH). Go to F56.

  NO : Go to F49.

F20 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUIT FAULT PIDs (2293_21_OD) AND (2293_20_OD) FOR AN OPEN AND LOW RESISTANCE

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Connect a jumper wire between driver air bag module loop 2 electrical connector, pin-1, harness side and pin-2, harness side.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side)
  - 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 2 circuits shorted together, a low resistance fault would normally be retrieved on loop 2. Loop 1 will show an open circuit fault due to the driver air bag being disconnected.
- **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating an open**

circuit to a low resistance fault?

YES : Go to F46.

NO : Go to F21.

F21 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUIT FAULT PIDs (2293_21_OD) AND (2293_20_OD) FOR AN OPEN AND LOW RESISTANCE (CLOCKSPRING DISCONNECTED)

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Remove the jumper wire from driver air bag module loop 2 electrical connector.
- Disconnect: Clockspring C218a
- Connect a jumper wire between clockspring C218a-2, circuit CR102 (BU), harness side and clockspring C218a-10, circuit RR102 (WH), harness side.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
    - 2293_20_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side)
    - 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module loop 2 circuits shorted together, a low resistance fault would normally be retrieved on loop 2. Loop 1 will show an open circuit fault due to the driver air bag being disconnected.
- **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to F48.

  NO : Go to F22.

F22 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUITS CR102 (BU) AND RR102 (WH) FOR AN OPEN BETWEEN THE CLOCKSPRING AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the jumper wire from the clockspring connector.
- Disconnect: RCM C310a and C310b

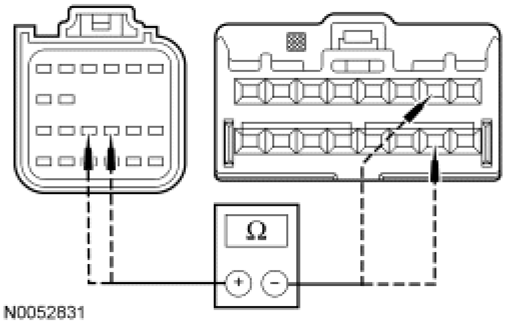

Fig. 32: Checking Driver Air Bag Module Loop 2 Circuits CR102 (BU) & RR102 (WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a-16, circuit CR102 (BU), harness side and clockspring C218a-2, circuit CR102 (BU), harness side; and between RCM C310a-15, circuit RR102 (WH), harness side and clockspring C218a-10, circuit RR102 (WH), harness side.
- **Are the resistances less than 0.5 ohm?**

  YES : Go to F49.

  NO : REPAIR circuit CR102 (BU) or circuit RR102 (WH). Go to F56.

F23 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUIT FAULT PIDs (2293_23_OD) AND (2293_21_OD) FOR A SHORT TO GROUND AND OPEN

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)
  - 2293_23_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

YES : Go to F46.

NO : Go to F24.

F24 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUIT FAULT PIDs (2293_23_OD) AND (2293_21_OD) FOR A SHORT TO GROUND AND OPEN (CLOCKSPRING DISCONNECTED)

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Disconnect: Clockspring C218a
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)
  - 2293_23_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to F48.

  NO : Go to F25.

F25 CHECK CIRCUITS CR102 (BU) AND RR102 (WH) FOR A SHORT TO GROUND BETWEEN THE RCM AND CLOCKSPRING

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

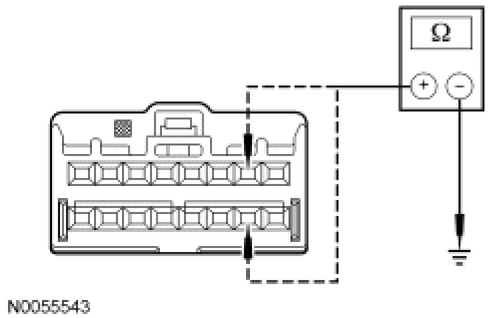

Fig. 33: Checking Circuits CR102 (BU) & RR102 (WH) For A Short To Ground Between

RCM & Clockspring
Courtesy of FORD MOTOR CO.

- Measure the resistance between clockspring C218a-2, circuit CR102 (BU), harness side and ground; and between clockspring C218a-10, circuit RR102 (WH), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to F49.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR102 (BU) or circuit RR102 (WH). Go to F56.

F26 CHECK THE DRIVER AIR BAG MODULE LOOP 2 CIRCUIT FAULT PIDs (2293_22_OD) AND (2293_21_OD) FOR A SHORT TO VOLTAGE AND OPEN (CLOCKSPRING DISCONNECTED)

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Disconnect: Clockspring C218a
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_21_OD (Air Bag Circuit Open - Loop No. 2, Front Driver Side)
  - 2293_22_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the driver air bag module/clockspring disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the driver air bag module loop 2 on-demand fault PIDs change from indicating a short to battery to an open circuit fault?**

  YES : Go to F48.

  NO : Go to F27.

F27 CHECK CIRCUITS CR102 (BU) AND RR102 (WH) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND CLOCKSPRING

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

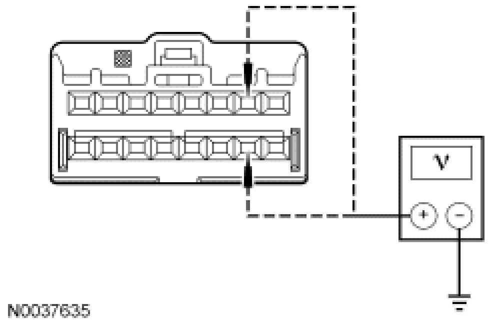

Fig. 34: Checking Circuits CR102 (BU) & RR102 (WH) For A Short To Voltage Between RCM & Clockspring
Courtesy of FORD MOTOR CO.

- Measure the voltage between:
  - clockspring C218a-2, circuit CR102 (BU), harness side and ground.
  - clockspring C218a-10, circuit RR102 (WH), harness side and ground.
- **Is any voltage present on either circuit?**

  YES : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR102 (BU) or circuit RR102 (WH). Go to F56.

  NO : Go to F49.

F28 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 RESISTANCE PID (P_ABAGR)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - PID
- Enter the following diagnostic mode on the diagnostic tool: P_ABAGR (Passenger Air Bag) Resistance PID
- **Does the resistance PID value read between 1.31 and 4.29 ohms?**

  YES : Go to F49.

  NO : Go to F29.

F29 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 RESISTANCE PID (P_ABAGR) WHILE CARRYING OUT A HARNESS TEST

NOTE: **Do not remove the passenger air bag module from its mounted**

position at this time.

- With the passenger air bag in its mounted position, continue monitoring the P_ABAGR (Passenger Air Bag) resistance PID while carrying out a harness test of the passenger air bag module circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to F56.

  NO : If the passenger air bag module loop 1 resistance PID is less than 1.31 ohms, go to F30.

  If the passenger air bag module loop 1 resistance PID is greater than 4.29 ohms, go to F32.

F30 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 CIRCUIT FAULT PIDs (2293_24_OD) AND (2293_25_OD) FOR LOW RESISTANCE AND OPEN

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_24_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side)
  - 2293_25_OD (Air Bag Circuit Open - Loop No. 1, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the passenger air bag module loop 1 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to F47.

  NO : Go to F31.

F31 CHECK THE RCM FOR LOW RESISTANCE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

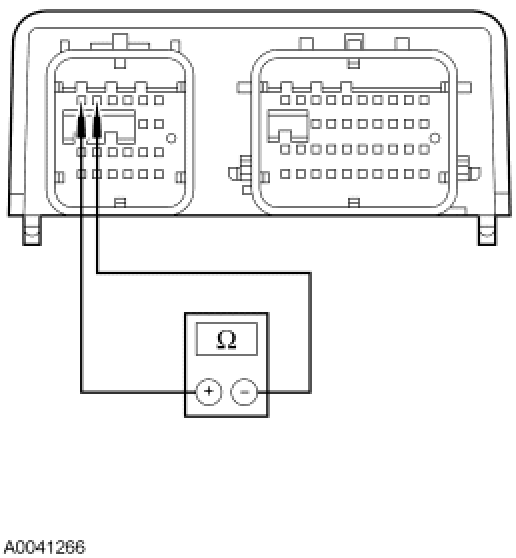

Fig. 35: Checking RCM For Low Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a pin 1 and C310a pin 2, component side.
- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR103 (GY/BU) and RR103 (VT/GN). Go to F56.

  NO : Go to F49.

F32 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 CIRCUIT FAULT PIDs (2293_25_OD) AND (2293_24_OD) FOR AN OPEN AND LOW RESISTANCE

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256a and C256b

- Connect a jumper wire between passenger air bag module C256a-1, circuit CR103 (GY/BU), harness side and C256a-2, circuit RR103 (VT/GN), harness side.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_24_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side)
  - 2293_25_OD (Air Bag Circuit Open - Loop No. 1, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module loop 1 circuits shorted together, a low resistance fault would normally be retrieved on loop 1. Loop 2 will show an open circuit fault due to the passenger air bag being disconnected.
- **Did the passenger air bag module loop 1 on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to F47.

  NO : Go to F33.

F33 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 CIRCUITS FOR AN OPEN BETWEEN THE PASSENGER AIR BAG MODULE AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the jumper wire from passenger air bag module C256.
- Disconnect: RCM C310a and C310b

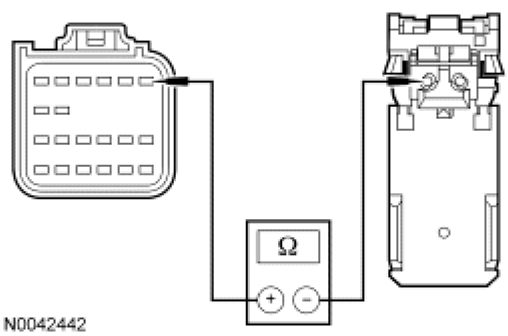

Fig. 36: Checking Circuit CR103 (GY/BU) For Open Between RCM And Passenger Air Bag Module
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a-1, circuit CR103 (GY/BU), harness side and passenger air bag module C256a-1, circuit CR103 (GY/BU), harness side.

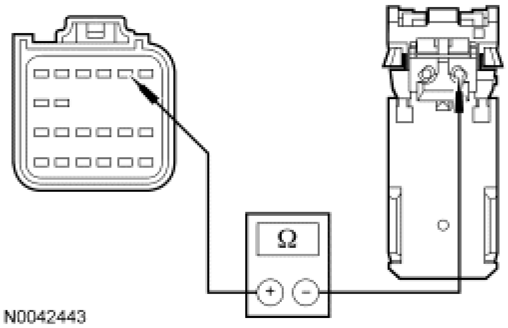

Fig. 37: Checking Circuit RR103 (VT/GN) For Open Between RCM And Passenger Air Bag Module
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a-2, circuit RR103 (VT/GN), harness side and passenger air bag module C256a-2, circuit RR103 (VT/GN), harness side.
- **Are the resistances less than 0.5 ohm?**

  YES : Go to F49.

  NO : REPAIR circuit CR103 (GY/BU) or circuit RR103 (VT/GN). Go to F56.

F34 CHECK THE PASSENGER AIR BAG MODULE LOOP 1 CIRCUIT FAULT PIDs (2293_27_OD) AND (2293_25_OD) FOR SHORT TO GROUND AND OPEN

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256a
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_25_OD (Air Bag Circuit Open - Loop No. 1, Front Passenger Side)
  - 2293_27_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the passenger air bag module loop 1 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

YES : Go to F47.

NO : Go to F35.

F35 CHECK CIRCUITS CR103 (GY/BU) AND RR103 (VT/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

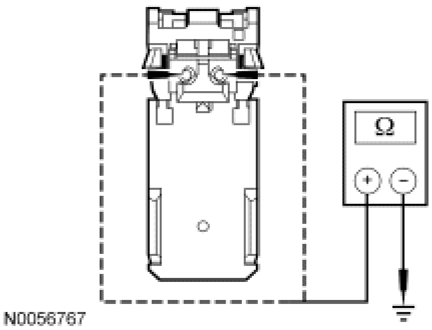

Fig. 38: Checking Circuits CR103 (GY/BU) & RR103 (VT/GN) For A Short To Ground Between RCM & Passenger Air Bag Module
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger air bag module C256a-1, circuit CR103 (GY/BU), harness side and ground; and between passenger air bag module C256a-2, circuit RR103 (VT/GN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to F49.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR103 (GY/BU) or circuit RR103 (VT/GN). Go to F56.

F36 CHECK CIRCUITS CR103 (GY/BU) AND RR103 (VT/GN) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND PASSENGER AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

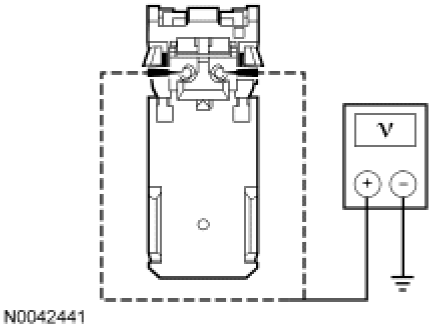

Fig. 39: Checking Circuits CR103 (GY/BU) & RR103 (VT/GN) For A Short To Voltage Between RCM & Passenger Air Bag Module
Courtesy of FORD MOTOR CO.

- Measure the voltage between:
  - passenger air bag module C256a-1, circuit CR103 (GY/BU), harness side and ground.
  - passenger air bag module C256a-2, circuit RR103 (VT/GN), harness side and ground.
- **Is any voltage present on either circuit?**

  YES : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR103 (GY/BU) or circuit RR103 (VT/GN). Go to F56.

  NO : Go to F49.

F37 CHECK PASSENGER AIR BAG MODULE LOOP 2 RESISTANCE PID (P_ABAGR2)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - PID
- Enter the following diagnostic mode on the diagnostic tool: P_ABAGR2 (Passenger Side Air Bag #2 Resistance) Resistance PID
- **Does the resistance PID value read between 1.31 and 4.29 ohms?**

  YES : Go to F49.

  NO : Go to F38.

F38 CHECK PASSENGER AIR BAG MODULE LOOP 2 RESISTANCE PID (P_ABAGR2) WHILE CARRYING OUT A HARNESS TEST

NOTE: Do not remove the passenger air bag module from its mounted position at this time.

- With the passenger air bag in its mounted position, continue monitoring the P_ABAGR2 (Passenger Side Air Bag #2 Resistance) resistance PID while carrying out a harness test of the passenger air bag module circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer

to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to F56.

NO : If the passenger air bag module loop 2 resistance PID is less than 1.31 ohms, go to F39.

If the passenger air bag module loop 2 resistance PID is greater than 4.29 ohms, go to F41.

F39 CHECK PASSENGER AIR BAG MODULE LOOP 2 CIRCUIT FAULT PIDs (2293_16_OD) AND (2293_17_OD) FOR LOW RESISTANCE AND OPEN

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256a and C256b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_16_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side)
  - 2293_17_OD (Air Bag Circuit Open - Loop No. 2, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the passenger air bag module loop 2 on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to F47.

  NO : Go to F40.

F40 CHECK THE RCM FOR LOW RESISTANCE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

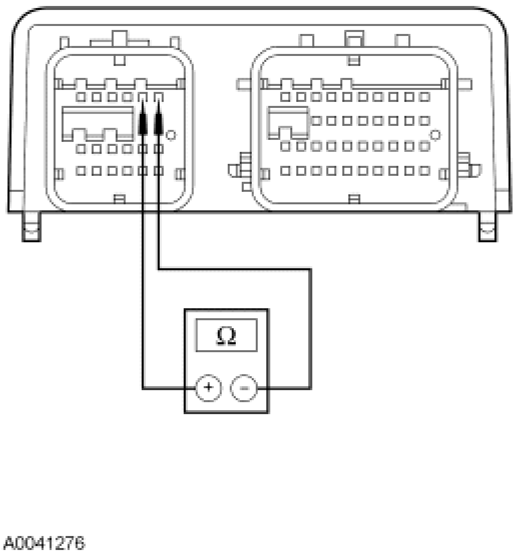

Fig. 40: Checking RCM For Low Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a pin 5 and C310a pin 6, component side.
- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR104 (YE/GY) and RR104 (WH/BU). Go to F56.

  NO : Go to F49.

F41 CHECK PASSENGER AIR BAG MODULE LOOP 2 CIRCUIT FAULT PIDs (2293_17_OD) AND (2293_16_OD) FOR AN OPEN AND LOW RESISTANCE

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256a and C256b
- Connect a jumper wire between passenger air bag module C256b-1, circuit CR104 (YE/GY), harness side and C256b-2, circuit RR104 (WH/BU), harness side.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
    - 2293_16_OD (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side)
    - 2293_17_OD (Air Bag Circuit Open - Loop No. 2, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module loop 2 circuits shorted together, a low resistance fault would normally be retrieved on loop 2. Loop 1 will show an open circuit fault due to the passenger air bag module being disconnected.
- **Did the passenger air bag module loop 2 on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to F47.

  NO : Go to F42.

F42 CHECK PASSENGER AIR BAG MODULE LOOP 2 CIRCUITS FOR AN OPEN BETWEEN THE PASSENGER AIR BAG MODULE AND RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the jumper wire from passenger air bag module C256.
- Disconnect: RCM C310a and C310b

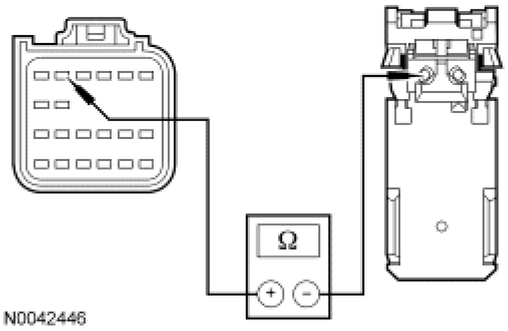

Fig. 41: Checking Circuit CR104 (YE/GY) For Open Between RCM And Passenger Air Bag Module
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a-5, circuit CR104 (YE/GY), harness side and passenger air bag module C256b-1, circuit CR104 (YE/GY), harness side.

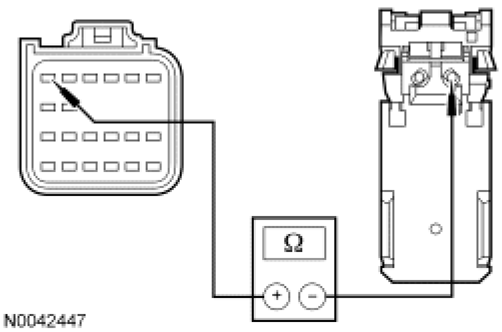

Fig. 42: Checking Circuit RR104 For Open Between RCM And Passenger Air Bag Module
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310a-6, circuit RR104 (WH/BU), harness side and passenger air bag module C256b-2, circuit RR104 (WH/BU), harness side.
- **Are the resistances less than 0.5 ohm?**

  YES : Go to F49.

  NO : REPAIR circuit CR104 (YE/GY) or circuit RR104 (WH/BU). Go to F56.

F43 CHECK PASSENGER AIR BAG MODULE LOOP 2 CIRCUIT FAULT PIDs (2293_19_OD) AND (2293_17_OD) FOR A SHORT TO GROUND AND OPEN

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256a and C256b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2293_17_OD (Air Bag Circuit Open - Loop No. 2, Front Passenger Side)
  - 2293_19_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2293 on-demand fault PIDs with the passenger air bag module disconnected, open circuit faults would normally be retrieved on loop 1 and loop 2.
- **Did the passenger air bag module loop 2 on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to F47.

NO : Go to F44.

F44 CHECK CIRCUITS CR104 (YE/GY) AND RR104 (WH/BU) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

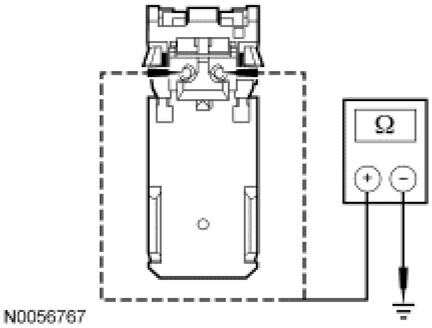

Fig. 43: Checking Circuits CR104 (YE/GY) & RR104 (WH/BU) For A Short To Ground Between RCM & Passenger Air Bag Module
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger air bag module C256b-1, circuit CR104 (YE/GY), harness side and ground; and between passenger air bag module C256b-2, circuit RR104 (WH/BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to F49.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR104 (YE/GY) or circuit RR104 (WH/BU). Go to F56.

F45 CHECK CIRCUITS CR104 (YE/GY) AND RR104 (WH/BU) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND PASSENGER AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256a and C256b
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

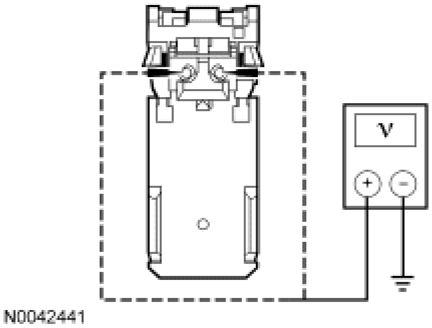

Fig. 44: Checking Circuits CR104 (YE/GY) & RR104 (WH/BU) For A Short To Voltage Between RCM & Passenger Air Bag Module
Courtesy of FORD MOTOR CO.

- Measure the voltage between:
  - passenger air bag module C256b-1, circuit CR104 (YE/GY), harness side and ground.
  - passenger air bag module C256b-2, circuit RR104 (WH/BU), harness side and ground.
- **Is any voltage present on either circuit?**

  YES : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR104 (YE/GY) or circuit RR104 (WH/BU). Go to F56.

  NO : Go to F49.

F46 CONFIRM THE DRIVER AIR BAG MODULE FAULT

NOTE: Make sure all restraint system components and the RCM electrical connectors are connected before carrying out the on-demand self-test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Install the driver air bag module. Refer to **Driver Air Bag Module**.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2293 Fault PIDs
  - Refer to PID list in Normal Operation to view B2293 fault PIDs.
- **Does the original on-demand DTC B2293 fault PID indicate a fault?**

  YES : INSTALL a new driver air bag module. REFER to **Driver Air Bag Module**. Go to F56.

NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected.

For 2293_28_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side) or 2293_20_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), go to F50.

For 2293_29_CM (Air Bag Circuit Open - Loop No. 1, Front Driver Side) or 2293_21_CM (Air Bag Circuit Open - Loop No. 2, Front Driver Side), go to F50.

For 2293_31_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side) or 2293_23_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), go to F51.

For 2293_30_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side) or 2293_22_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side), go to F53.

F47 CONFIRM THE PASSENGER AIR BAG MODULE FAULT

NOTE: Make sure all restraint system components and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Passenger Air Bag Module C256a and C256b (if previously disconnected)
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2293 Fault PIDs
  - Refer to PID list in Normal Operation to view B2293 fault PIDs.
- **Does the original on-demand DTC B2293 fault PID indicate a fault?**

YES : INSTALL a new passenger air bag module. REFER to **Passenger Air Bag Module**. Go to F56.

NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected.

For 2293_24_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side) or

2293_16_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side), go to F50.

For 2293_25_CM (Air Bag Circuit Open - Loop No. 1, Front Passenger Side) or 2293_17_CM (Air Bag Circuit Open - Loop No. 2, Front Passenger Side), go to F50.

For 2293_27_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side) or 2293_19_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side), go to F52.

For 2293_26_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side) or 2293_18_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side), go to F54.

F48 CONFIRM THE CLOCKSPRING FAULT

NOTE: Make sure all restraint system components and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Clockspring C218a
- Install the driver air bag module. Refer to **Driver Air Bag Module**.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2293 Fault PIDs
  - Refer to PID list in Normal Operation to view B2293 fault PIDs.
- **Does the original on-demand DTC B2293 fault PID indicate a fault?**

  YES : INSTALL a new clockspring. REFER to **Clockspring**. Go to F56.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected.

  For 2293_28_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side) or 2293_20_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), go to F50.

  For 2293_29_CM (Air Bag Circuit Open - Loop No. 1, Front Driver Side) or 2293_21_CM (Air Bag Circuit Open - Loop No. 2, Front Driver Side), go to F50.

For 2293_31_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side) or 2293_23_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), go to F51.

For 2293_30_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side) or 2293_22_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side), go to F53.

F49 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system components and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- If previously removed, install the driver air bag module. Refer to **Driver Air Bag Module**.
- Connect: Clockspring C218a (if previously disconnected)
- Connect: Passenger Air Bag Module C256 (if previously disconnected)
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2293 Fault PIDs
  - Refer to PID list in Normal Operation to view B2293 fault PIDs.
- **Does the original on-demand DTC B2293 fault PID indicate a fault?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to F56.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected.

  For 2293_28_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Driver Side) or 2293_20_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Driver Side), go to F50.

  For 2293_29_CM (Air Bag Circuit Open - Loop No. 1, Front Driver Side) or 2293_21_CM (Air Bag Circuit Open - Loop No. 2, Front Driver Side), go to F50.

  For 2293_31_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side) or 2293_23_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side), go to F51.

  For 2293_30_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side) or

2293_22_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side), go to F53.

For 2293_24_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 1, Front Passenger Side) or 2293_16_CM (Air Bag Inflator Circuit Resistance Low - Loop No. 2, Front Passenger Side), go to F50.

For 2293_25_CM (Air Bag Circuit Open - Loop No. 1, Front Passenger Side) or 2293_17_CM (Air Bag Circuit Open - Loop No. 2, Front Passenger Side), go to F50.

For 2293_27_CM (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side) or 2293_19_CM (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side), go to F52.

For 2293_26_CM (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side) or 2293_18_CM (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side), go to F54.

F50 CHECK THE DRIVER OR PASSENGER AIR BAG MODULE CIRCUIT RESISTANCE PIDs FOR AN INTERMITTENT LOW RESISTANCE OR OPEN CIRCUIT

- If the fault PID was reported for the driver air bag module loop 1 or loop 2, monitor the following on the scan tool:
  - D_ABAGR (Driver air bag) resistance PID.
  - D_ABAGR2 (Driver Air Bag #2 Resistance) resistance PID.
- If the fault PID was reported for the passenger air bag module loop 1 or loop 2, monitor the following on the scan tool:
  - P_ABAGR (Passenger air bag) resistance PID.
  - P_ABAGR2 (Passenger Side Air Bag #2 Resistance) resistance PID.

NOTE: **A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5.0 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition.**

NOTE: **Do not remove the driver or passenger air bag module from its mounted position at this time.**

- With the driver or passenger air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors), and flexing the wire harness, tilting and rotating the steering wheel frequently.
- **Does any driver or passenger air bag resistance PID indicate less than 1.31 ohms or greater than 4.29 ohms?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to F56.

  NO : Go to F55.

F51 CHECK THE DRIVER AIR BAG MODULE CIRCUIT FAULT PIDs FOR AN INTERMITTENT SHORT TO GROUND

- Monitor the 2293_31_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Driver Side) and 2293_23_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Driver Side) on-demand fault PIDs on the scan tool.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

NOTE: **Do not remove the driver air bag module from its mounted position at this time.**

- With the driver air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness, tilting and rotating the steering wheel frequently.
- **Does any driver air bag module short to ground fault PID indicate a fault is present?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to F56.

  NO : Go to F55.

F52 CHECK THE PASSENGER AIR BAG MODULE CIRCUIT FAULT PIDs FOR AN INTERMITTENT SHORT TO GROUND

- Key in ON position.
- Monitor the 2293_27_OD (Air Bag Circuit Short to Ground - Loop No. 1, Front Passenger Side) and 2293_19_OD (Air Bag Circuit Short to Ground - Loop No. 2, Front Passenger Side) on-demand fault PIDs on the scan tool.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

NOTE: **Do not remove the passenger air bag module from its mounted position at this time.**

- With the passenger air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any passenger air bag module short to ground fault PID indicate a fault is present?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to F56.

  NO : Go to F55.

F53 CHECK THE DRIVER AIR BAG MODULE CIRCUIT FAULT PIDs FOR AN INTERMITTENT SHORT TO VOLTAGE

- Key in OFF position.

- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the driver air bag module. Refer to **Driver Air Bag Module**.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Monitor the 2293_30_OD (Air Bag Circuit Short to Battery - Loop No. 1, Front Driver Side) and 2293_22_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front Driver Side) on-demand fault PIDs on the scan tool.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness, tilting and rotating the steering wheel frequently.
- **Does any driver air bag module short to battery fault PID indicate a fault is present?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to F56.

  NO : Go to F55.

F54 CHECK THE PASSENGER AIR BAG MODULE CIRCUIT FAULT PIDs FOR AN INTERMITTENT SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Air Bag Module C256a and C256b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Monitor the 2293_26_OD (Air Bag Circuit Short to Battery - Loop No. 1, Front Passenger Side) and 2293_18_OD (Air Bag Circuit Short to Battery - Loop No. 2, Front Passenger Side) on-demand fault PIDs on the scan tool.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

NOTE: **Do not remove the passenger air bag module from its mounted position at this time.**

- With the passenger air bag in its mounted position, attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any passenger air bag module short to battery fault PID indicate a fault is present?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING**

DIAGRAMS article for MKZ, Connector Repair Procedures for schematic and connector information. Go to F56.

NO : Go to F55.

F55 CHECK THE HARNESS AND CONNECTORS

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- If the fault PID was reported for the driver air bag:
  - remove the driver air bag module.
  - inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damage, pinched, cut or pierced wires.
- If the fault PID was reported for the passenger air bag:
  - disconnect the passenger air bag module C256a and C256b.
  - inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damage, pinched, cut or pierced wires.
- **Were any concerns found?**

  YES : REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to F56.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition key frequently and rotating the steering wheel (driver air bag module fault). **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to F56.

F56 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints

- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test G: DTC B2294 - Restraint System - Curtain Fault

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) continuously monitors the driver and passenger safety canopy module circuits (loop) for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store DTC B2294 in memory if any of these conditions are detected to be outside of their respectful range. If the RCM detects a fault, it will send a message to the instrument cluster module to illuminate the air bag warning indicator.

As the RCM continuously monitors safety canopy module circuits for resistance, it expects a normal resistance between 1.31 to 4.29 ohms.

If a loop resistance is between 0.9 and 1.31 or between 4.29 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

Fault PIDs[a]	Description	Fault Trigger Condition
2294_24_OD and 2294_24_CM	A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side	When the RCM measures resistance less than 0.9 ohm between the passenger safety canopy circuits, a fault will be indicated.
2294_25_OD and 2294_25_CM	A - B or A - C Pillar Curtain Circuit Open, Passenger Side	When the RCM measures resistance greater than 5 ohms between the passenger safety canopy circuits, a fault will be indicated.
2294_26_OD and 2294_26_CM	A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side	When the RCM senses a short to ground on either of the passenger safety canopy circuits, a fault will be indicated.

2294_27_OD and 2294_27_CM	A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side	When the RCM senses a short to voltage on either of the passenger safety canopy circuits, a fault will be indicated.
2294_28_OD and 2294_28_CM	A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side	When the RCM measures resistance less than 0.9 ohm between the driver safety canopy circuits, a fault will be indicated.
2294_29_OD and 2294_29_CM	A - B or A - C Pillar Curtain Circuit Open, Driver Side	When the RCM measures resistance greater than 5 ohms between the driver safety canopy circuits, a fault will be indicated.
2294_30_OD and 2294_30_CM	A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side	When the RCM senses a short to ground on either of the driver safety canopy circuits, a fault will be indicated.
2294_31_OD and 2294_31_CM	A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side	When the RCM senses a short to voltage on either of the driver safety canopy circuits, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2294. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2294.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Safety canopy module
- RCM

PINPOINT TEST G: DTC B2294 - RESTRAINT SYSTEM - CURTAIN FAULT

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough**

inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

G1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2294 Fault PIDs
  - Refer to PID list in Normal Operation to view B2294 fault PIDs.
- **Do any RCM on-demand DTC B2294 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

  Using the fault PIDs recorded, go to the appropriate pinpoint test step.

  For 2294_28_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side), go to G2.

  For 2294_29_OD (A - B or A - C Pillar Curtain Circuit Open, Driver Side), go to G2.

  For 2294_30_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side), go to G9.

  For 2294_31_OD (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side), go to G11.

  For 2294_24_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side), go to G12.

  For 2294_25_OD (A - B or A - C Pillar Curtain Circuit Open, Passenger Side), go to G12.

  For 2294_26_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side), go to G19.

  For 2294_27_OD (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side), go to G21.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time.

  Using the fault PIDs recorded, go to the appropriate pinpoint test step.

  For (2294_28_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side),

2294_29_CM (A - B or A - C Pillar Curtain Circuit Open, Driver Side), 2294_24_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side) or 2294_25_CM (A - B or A - C Pillar Curtain Circuit Open, Passenger Side), go to G24.

For 2294_30_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side) or 2294_26_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side), go to G26.

For 2294_31_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side) or 2294_27_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side), go to G27.

G2 CHECK THE DRIVER SAFETY CANOPY MODULE RESISTANCE PID (DCURTL1)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - PID
- Enter the following diagnostic mode on the diagnostic tool: DCURTL1 (Curtain Airbag Driver Loop No.1 Resistance) Resistance PID
- **Does the resistance PID value read between 1.31 and 4.29 ohms?**

  YES : Go to G23.

  NO : Go to G3.

G3 CHECK THE DRIVER SAFETY CANOPY MODULE RESISTANCE PID (DCURTL1) WHILE CARRYING OUT A HARNESS TEST

- Continue monitoring the DCURTL1 (Curtain Airbag Driver Loop No.1 Resistance) Resistance PID while carrying out a harness test of the driver safety canopy circuits and accessible connectors (including any inline connectors) by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to G28.

  NO : If the driver safety canopy resistance PID is less than 1.31 ohm, go to G4.

  If the driver safety canopy resistance PID is greater than 4.29 ohms, go to G7.

G4 CHECK THE DRIVER SAFETY CANOPY MODULE CIRCUIT FAULT PIDs (2294_28_OD) AND (2294_29_OD) FOR LOW RESISTANCE AND OPEN

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Canopy C3055

- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2294_28_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side)
  - 2294_29_OD (A - B or A - C Pillar Curtain Circuit Open, Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the driver safety canopy disconnected, an open circuit fault would normally be retrieved.
- **Did the driver safety canopy on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to G22.

  NO : Go to G5.

G5 CHECK FOR A SHORT BETWEEN DRIVER SAFETY CANOPY CIRCUITS CR109 (BN/BU) AND RR109 (BU/GN)

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Measure the resistance between driver safety canopy C3055-1, circuit CR109 (BN/BU), harness side and C3055-2, circuit RR109 (BU/GN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to G23.

  NO : Go to G6.

G6 CHECK THE RCM FOR LOW RESISTANCE

- Disconnect: RCM C310a and C310b

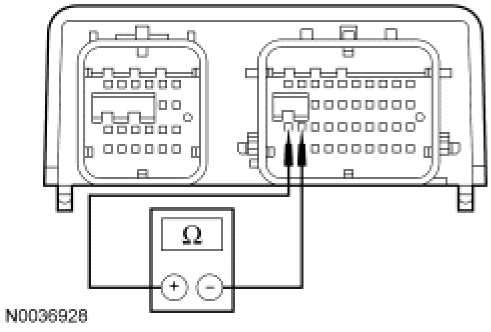

Fig. 45: Checking RCM For Low Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b pin 21, component side, and C310b pin 22, component side.

- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR109 (BN/BU) and RR109 (BU/GN). Go to G28.

  NO : Go to G23.

G7 CHECK THE DRIVER SAFETY CANOPY MODULE CIRCUIT FAULT PIDs (2294_29_OD) AND (2294_28_OD) FOR AN OPEN

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Canopy C3055
- Connect a fused jumper wire between driver safety canopy C3055-1, circuit CR109 (BN/BU), harness side and C3055-2, circuit RR109 (BU/GN), harness side.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2294_28_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side)
  - 2294_29_OD (A - B or A - C Pillar Curtain Circuit Open, Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the driver safety canopy circuits shorted together, a low resistance fault would normally be retrieved.
- **Did the driver safety canopy on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to G22.

  NO : Go to G8.

G8 CHECK CIRCUITS CR109 (BN/BU) AND RR109 (BU/GN) FOR AN OPEN BETWEEN THE RCM AND DRIVER SAFETY CANOPY MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the fused jumper wire from the driver safety canopy C3055.
- Disconnect: RCM C310a and C310b

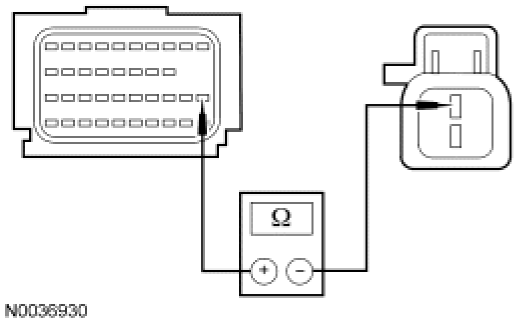

Fig. 46: Measuring Resistance Between RCM C310B-21, Circuit CR109 (BN/BU), Harness Side & Driver Safety Canopy C3055-1
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-21, circuit CR109 (BN/BU), harness side and driver safety canopy C3055-1, circuit CR109 (BN/BU), harness side.

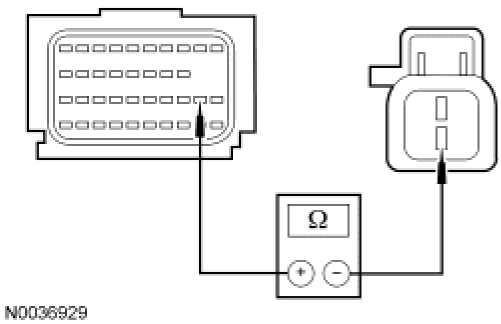

Fig. 47: Measuring Resistance Between RCM C310B-22, Circuit RR109 (BU/GN), Harness Side & Driver Safety Canopy C3055-2
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-22, circuit RR109 (BU/GN), harness side and driver safety canopy C3055-2, circuit RR109 (BU/GN), harness side.
- **Are the resistances less than 0.5 ohm?**

  YES : Go to G23.

  NO : REPAIR circuit CR109 (BN/BU) or circuit RR109 (BU/GN). Go to G28.

G9 CHECK THE DRIVER SAFETY CANOPY MODULE CIRCUIT FAULT PIDs (2294_30_OD) AND (2294_29_OD) FOR A SHORT TO GROUND AND OPEN

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and**

Repowering.

- Disconnect: Driver Safety Canopy C3055
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2294_29_OD (A - B or A - C Pillar Curtain Circuit Open, Driver Side)
  - 2294_30_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the driver safety canopy disconnected, an open circuit fault would normally be retrieved.
- **Did the driver safety canopy on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to G22.

  NO : Go to G10.

G10 CHECK CIRCUITS CR109 (BN/BU) AND RR109 (BU/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND DRIVER SAFETY CANOPY MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

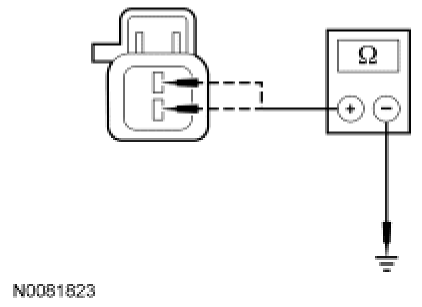

Fig. 48: Checking Circuits CR109 (BN/BU) & RR109 (BU/GN) For A Short To Ground Between RCM & Driver Safety Canopy Module
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver safety canopy C3055-1, circuit CR109 (BN/BU), harness side and ground; and between driver safety canopy C3055-2, circuit RR109 (BU/GN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to G23.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either

circuit. Do not remove or defeat the shorting bar.

REPAIR circuit CR109 (BN/BU) or circuit RR109 (BU/GN). Go to G28.

G11 CHECK CIRCUITS CR109 (BN/BU) AND RR109 (BU/GN) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND DRIVER SAFETY CANOPY MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Canopy C3055
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Measure the voltage between:
  - driver safety canopy C3055-1, circuit CR109 (BN/BU), harness side and ground.
  - driver safety canopy C3055-2, circuit RR109 (BU/GN), harness side and ground.
- **Is any voltage present on either circuit?**

  YES : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR109 (BN/BU) or circuit RR109 (BU/GN). Go to G28.

  NO : Go to G23.

G12 CHECK THE PASSENGER SAFETY CANOPY MODULE RESISTANCE PID (PCURTL1)

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - PID
- Enter the following diagnostic mode on the diagnostic tool: PCURTL1 (Curtain Airbag Passenger Loop No.1 Resistance) Resistance PID
- **Does the resistance PID value read between 1.31 and 4.29 ohms?**

  YES : Go to G23.

  NO : Go to G13.

G13 CHECK THE PASSENGER SAFETY CANOPY MODULE RESISTANCE PID (PCURTL1) WHILE CARRYING OUT A HARNESS TEST

- Continue monitoring the PCURTL1 (Curtain Airbag Passenger Loop No.1 Resistance) resistance PID while carrying out a harness test of the passenger safety canopy circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to G28.

NO : If the passenger safety canopy resistance PID is less than 1.31 ohm, go to G14.

If the passenger safety canopy resistance PID is greater than 4.29 ohms, go to G17.

G14 CHECK THE PASSENGER SAFETY CANOPY MODULE CIRCUIT FAULT PIDs (2294_24_OD) AND (2294_25_OD) FOR LOW RESISTANCE AND OPEN

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Canopy C3056
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2294_24_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side)
  - 2294_25_OD (A - B or A - C Pillar Curtain Circuit Open, Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the passenger safety canopy disconnected, an open circuit fault would normally be retrieved.
- **Did the passenger safety canopy on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to G22.

  NO : Go to G15.

G15 CHECK FOR A SHORT BETWEEN PASSENGER SAFETY CANOPY CIRCUITS CR111 (BN/WH) AND RR111 (YE/VT)

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Measure the resistance between passenger safety canopy module C3056-1, circuit CR111 (BN/WH), harness side and C3056-2, circuit RR111 (YE/VT), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to G23.

  NO : Go to G16.

G16 CHECK THE RCM FOR LOW RESISTANCE

- Disconnect: RCM C310a and C310b

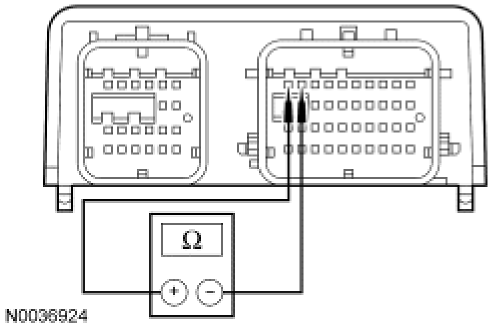

Fig. 49: Checking RCM For Low Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b pin 1, component side, and C310b pin 2, component side.
- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR111 (BN/WH) and RR111 (YE/VT). Go to G28.

  NO : Go to G23.

G17 CHECK THE PASSENGER SAFETY CANOPY MODULE CIRCUIT FAULT PIDs (2294_24_OD) AND (2294_24_OD) FOR AN FOR AN OPEN AND LOW RESISTANCE

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Canopy C3056
- Connect a fused jumper wire between passenger safety canopy C3056-1, circuit CR111 (BN/WH), harness side and C3056-2, circuit RR111 (YE/VT), harness side.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2294_24_OD (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side)
  - 2294_25_OD (A - B or A - C Pillar Curtain Circuit Open, Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the passenger safety

canopy circuits shorted together, a low resistance fault would normally be retrieved.

- **Did the passenger safety canopy on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to G22.

  NO : Go to G18.

G18 CHECK CIRCUITS CR111 (BN/WH) AND RR111 (YE/VT) FOR AN OPEN BETWEEN THE RCM AND PASSENGER SAFETY CANOPY MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the jumper wire from the passenger safety canopy C3056.
- Disconnect: RCM C310a and C310b

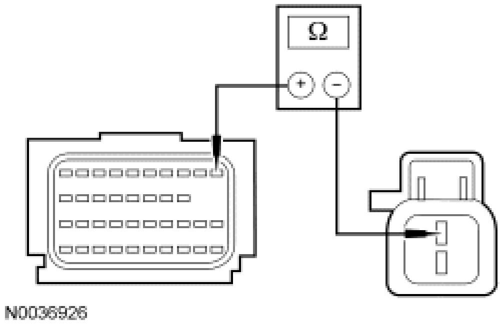

Fig. 50: Measuring Resistance Between RCM C310B-1, Circuit CR111 (BN/WH), Harness Side & Passenger Safety Canopy Module C3056-1
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-1, circuit CR111 (BN/WH), harness side and passenger safety canopy module C3056-1, circuit CR111 (BN/WH), harness side.

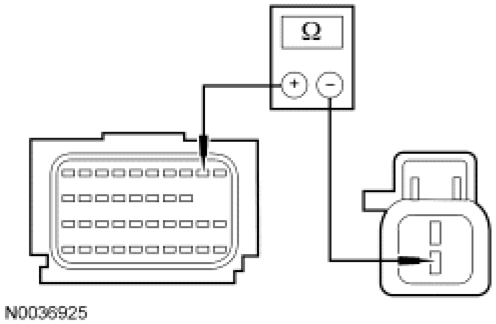

Fig. 51: Measuring Resistance Between RCM C310B-2, Circuit RR111 (YE/VT), Harness Side & Passenger Safety Canopy Module C3056-2
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-2, circuit RR111 (YE/VT), harness side and passenger safety canopy module C3056-2, circuit RR111 (YE/VT), harness side.

- **Are the resistances less than 0.5 ohm?**

  YES : Go to G23.

  NO : REPAIR circuit CR111 (BN/WH) or circuit RR111 (YE/VT). Go to G28.

G19 CHECK THE PASSENGER SAFETY CANOPY MODULE CIRCUIT FAULT PIDs (2294_26_OD) AND (2294_25_OD) FOR A SHORT TO GROUND AND OPEN

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Canopy C3056
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2294_25_OD (A - B or A - C Pillar Curtain Circuit Open, Passenger Side)
  - 2294_26_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2294 on-demand fault PIDs with the passenger safety canopy disconnected, an open circuit fault would normally be retrieved.
- **Did the passenger safety canopy on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to G22.

  NO : Go to G20.

G20 CHECK CIRCUITS CR111 (BN/WH) AND RR111 (YE/VT) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER SAFETY CANOPY MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

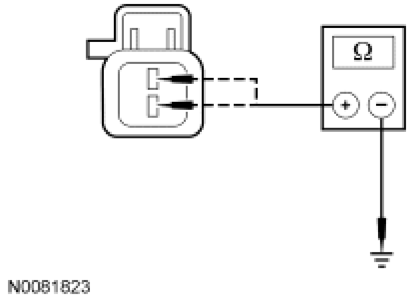

Fig. 52: Checking Circuits CR111 (BN/WH) & RR111 (YE/VT) For A Short To Ground Between RCM & Passenger Safety Canopy Module
Courtesy of FORD MOTOR CO.

- Measure the resistance between passenger safety canopy C3056-1, circuit CR111 (BN/WH), harness side and ground; and between passenger safety canopy C3056-2, circuit RR111 (YE/VT), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to G23.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR111 (BN/WH) or circuit RR111 (YE/VT). Go to G28.

G21 CHECK CIRCUITS CR111 (BN/WH) AND RR111 (YE/VT) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND PASSENGER SAFETY CANOPY MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Canopy C3056
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Measure the voltage between:
  - passenger safety canopy C3056-1, circuit CR111 (BN/WH), harness side and ground
  - passenger safety canopy C3056-2, circuit RR111 (YE/VT), harness side and ground.
- **Is any voltage present on either circuit?**

  YES : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR111 (BN/WH) or circuit RR111 (YE/VT). Go to G28.

  NO : Go to G23.

G22 CONFIRM THE SAFETY CANOPY MODULE FAULT

NOTE: **Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Affected Safety Canopy C3055 (Driver) C3056 (Passenger)
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2294 Fault PIDs
  - Refer to PID list in Normal Operation to view B2294 fault PIDs.
- **Does the original RCM on-demand B2294 fault PID indicate a fault?**

  YES : INSTALL a new driver or passenger safety canopy. REFER to **Side Air Curtain Module**. Go to G28.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected.

  For (2294_28_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side), 2294_29_CM (A - B or A - C Pillar Curtain Circuit Open, Driver Side), 2294_24_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side) or 2294_25_CM (A - B or A - C Pillar Curtain Circuit Open, Passenger Side), go to G24.

  For 2294_30_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side) or 2294_26_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side), go to G26.

  For 2294_31_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side) or 2294_27_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side), go to G27.

G23 CONFIRM THE RCM FAULT

NOTE: **Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.

- If previously directed to disconnect any SRS component(s):
  - depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
  - connect all previously disconnected restraint system component(s), including RCM C310a and C310b.
  - repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2294 Fault PIDs
  - Refer to PID list in Normal Operation to view B2294 fault PIDs.
- **Does the original RCM on-demand B2294 fault PID indicate a fault?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to G28.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected.

  For (2294_28_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Driver Side), 2294_29_CM (A - B or A - C Pillar Curtain Circuit Open, Driver Side), 2294_24_CM (A - B or A - C Pillar Curtain Circuit Resistance Low, Passenger Side) or 2294_25_CM (A - B or A - C Pillar Curtain Circuit Open, Passenger Side), go to G24.

  For 2294_30_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side) or 2294_26_CM (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side), go to G26.

  For 2294_31_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side) or 2294_27_CM (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side), go to G27.

G24 CHECK SAFETY CANOPY MODULE CIRCUIT RESISTANCE PIDs FOR AN INTERMITTENT LOW RESISTANCE OR OPEN

- If the fault PID was reported for the driver safety canopy, monitor the DCURTL1 (Curtain Airbag Driver Loop No.1 Resistance) resistance PID on the scan tool.
- If the fault PID was reported for the passenger safety canopy, monitor the PCURTL1 (Curtain Airbag Passenger Loop No.1 Resistance) resistance PID on the scan tool.

NOTE: **A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5.0 ohms may or may not set an on-demand DTC yet indicates a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition.**

- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing

the wire harness.

- **Does any safety canopy resistance PID indicate less than 1.31 ohms or greater than 4.29 ohms?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to G28.

  NO : Go to G25.

G25 CHECK THE HARNESS AND CONNECTORS

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect the affected safety canopy module C3055 (driver) or C3056 (passenger):
  - inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damage, pinched, cut or pierced wires.
- **Were any concerns found?**

  YES : REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to G28.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to G28

G26 CHECK SAFETY CANOPY MODULE CIRCUIT FAULT PIDs FOR AN INTERMITTENT SHORT TO GROUND

- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - PID
- If the fault PID was reported for the driver safety canopy, monitor the 2294_30_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Driver Side) fault PID on the scan tool.
- If the fault PID was reported for the passenger safety canopy, monitor the 2294_26_OD (A - B or A - C Pillar Curtain Circuit Short to Ground, Passenger Side) fault PID on the scan tool.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to a 2-second delay for the scan tool display to update.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors), and flexing the wire harness.
- **Does any safety canopy on-demand fault PID indicate a fault is present?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to G28.

NO : The fault is not present and cannot be recreated at this time.

CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to G28

G27 CHECK SAFETY CANOPY MODULE CIRCUIT FAULT PIDs FOR AN INTERMITTENT SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- If the fault PID was reported for the driver safety canopy, disconnect the driver safety canopy module C3055.
- If the fault PID was reported for the passenger safety canopy, disconnect the passenger safety canopy module C3056.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to a 2-second delay for the scan tool display to update.
- Monitor the 2294_31_OD (A - B or A - C Pillar Curtain Circuit Short to Battery, Driver Side) or 2294_27_OD (A - B or A - C Pillar Curtain Circuit Short to Battery, Passenger Side) fault PIDs on the scan tool.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any safety canopy on-demand fault PID indicate a fault is present?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to G28.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to G28

G28 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an**

accidental deployment.

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test H: DTC B2295 - Restraint System - Side Air Bag Fault

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

A side air bag module provides protection of the thorax area (between the neck and abdomen) of the body, working in conjunction with the head protection provided by a safety canopy module. Refer to **Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)**.

The restraints control module (RCM) continuously monitors the driver and passenger side air bag module circuits (loop) for an acceptable resistance range, unacceptable voltage and shorts to ground. The RCM will set on-demand and store DTC B2294 in memory if any of these conditions are detected to be outside of their respectful range. If the RCM detects a fault, it will send a message to the instrument cluster module to illuminate the air bag warning indicator.

As the RCM continuously monitors side air bag module circuits for resistance, it expects a normal resistance between 1.31 to 4.29 ohms.

If a loop resistance is between 0.9 and 1.31 or between 4.29 and 5 ohms, there exists a strong potential for an intermittent fault, a DTC may or may not set. The RCM will also set an on-demand DTC if the loop resistance is less than 0.9 ohm or greater than 5 ohms.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

Fault PIDs[a]	Description	Fault Trigger Condition
2295_24_OD and 2295_24_CM	Side Air Bag Circuit Resistance	When the RCM measures resistance less than 0.9 ohm between the passenger side air

	Low, Front Passenger Side	bag module circuits, a fault will be indicated.
2295_25_OD and 2295_25_CM	Side Air Bag Circuit Open, Front Passenger Side	When the RCM measures resistance greater than 5 ohms between the passenger side air bag module circuits, a fault will be indicated.
2295_26_OD and 2295_26_CM	Side Air Bag Circuit Short to Ground, Front Passenger Side	When the RCM senses a short to ground on either of the passenger side air bag module circuits, a fault will be indicated.
2295_27_OD and 2295_27_CM	Side Air Bag Circuit Short to Battery, Front Passenger Side	When the RCM senses a short to voltage on either of the passenger side air bag module circuits, a fault will be indicated.
2295_28_OD and 2295_28_CM	Side Air Bag Circuit Resistance Low, Front Driver Side	When the RCM measures resistance less than 0.9 ohm between the driver side air bag module circuits, a fault will be indicated.
2295_29_OD and 2295_29_CM	Side Air Bag Circuit Open, Front Driver Side	When the RCM measures resistance greater than 5 ohms between the driver side air bag module circuits, a fault will be indicated.
2295_30_OD and 2295_30_CM	Side Air Bag Circuit Short to Ground, Front Driver Side	When the RCM senses a short to ground on either of the driver side air bag module circuits, a fault will be indicated.
2295_31_OD and 2295_31_CM	Side Air Bag Circuit Short to Battery, Front Driver Side	When the RCM senses a short to voltage on either of the driver side air bag module circuits, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2295. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2295.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Side air bag module
- RCM

PINPOINT TEST H: DTC B2295 - RESTRAINT SYSTEM - SIDE AIR BAG FAULT

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

H1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2295 Fault PIDs
  - Refer to PID list in Normal Operation to view B2295 fault PIDs.
- **Do any RCM on-demand B2295 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

  Using the fault PIDs recorded, go to the appropriate pinpoint test step.

  For 2295_28_OD (Side Air Bag Circuit Resistance Low, Front Driver Side), go to H2.

  For (2295_29_OD (Side Air Bag Circuit Open, Front Driver Side), go to H2.

  For 2295_30_OD (Side Air Bag Circuit Short to Ground, Front Driver Side), go to H9.

  For 2295_31_OD (Side Air Bag Circuit Short to Battery, Front Driver Side), go to H11.

  For 2295_24_OD (Side Air Bag Circuit Resistance Low, Front Passenger Side), go to H12.

  For 2295_25_OD (Side Air Bag Circuit Open, Front Passenger Side), go to H12.

For 2295_26_OD (Side Air Bag Circuit Short to Ground, Front Passenger Side), go to H19.

For (2295_27_OD (Side Air Bag Circuit Short to Battery, Front Passenger Side), go to H21.

NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time.

Using the fault PIDs recorded, go to the appropriate pinpoint test step.

For 2295_28_CM (Side Air Bag Circuit Resistance Low, Front Driver Side), 2295_29_CM (Side Air Bag Circuit Open, Front Driver Side), 2295_24_CM (Side Air Bag Circuit Resistance Low, Front Passenger Side) or 2295_25_CM (Side Air Bag Circuit Open, Front Passenger Side), go to H24.

For (2295_30_CM (Side Air Bag Circuit Short to Ground, Front Driver Side) or 2295_26_CM (Side Air Bag Circuit Short to Ground, Front Passenger Side), go to H26.

For 2295_31_CM (Side Air Bag Circuit Short to Battery, Front Driver Side) or 2295_27_CM (Side Air Bag Circuit Short to Battery, Front Passenger Side), go to H27.

H2 CHECK THE DRIVER SIDE AIR BAG MODULE RESISTANCE PID (DS_AB)

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - PID
- Enter the following diagnostic mode on the diagnostic tool: DS_AB (Driver Side Impact Air Bag Resistance) Resistance PID
- **Does the resistance PID value read between 1.31 and 4.29 ohms?**

  YES : Go to H23.

  NO : Go to H3.

H3 CHECK THE DRIVER SIDE AIR BAG RESISTANCE PID (DS_AB) WHILE CARRYING OUT A HARNESS TEST

- Continue monitoring the DS_AB (Driver Side Impact Air Bag Resistance) resistance PID while carrying out a harness test of the driver side air bag circuits and accessible connectors (including any inline connectors) by wiggling connectors and flexing the wire harness.
- **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to H28.

  NO : If the driver side air bag resistance PID is less than 1.31 ohms, go to H4.

  If the driver safety canopy resistance PID is greater than 4.29 ohms, go to H7.

H4 CHECK THE DRIVER SIDE AIR BAG MODULE CIRCUIT FAULT PIDs (2295_28_OD) AND (2295_29_OD) FOR LOW RESISTANCE AND OPEN

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Side Air Bag Module C328
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2295_28_OD (Side Air Bag Circuit Resistance Low, Front Driver Side)
  - 2295_29_OD (Side Air Bag Circuit Open, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the driver side air bag disconnected, an open circuit fault would normally be retrieved.
- **Did the driver side air bag on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to H22.

  NO : Go to H5.

H5 CHECK FOR A SHORT BETWEEN DRIVER SEAT SIDE AIR BAG CIRCUITS CR105 (GN/BU) AND RR105 (GY/YE)

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Measure the resistance between driver side air bag C328-2, circuit CR105 (GN/BU), harness side and C328-1, circuit RR105 (GY/YE), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to H22.

  NO : Go to H6.

H6 CHECK THE RCM FOR LOW RESISTANCE

- Disconnect: RCM C310a and C310b

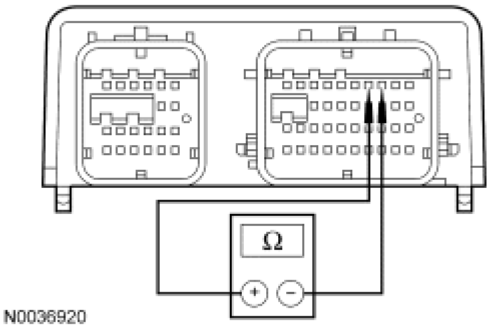

Fig. 53: Checking RCM For Low Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b pin 7, component side, and C310b pin 8, component side.
- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR105 (GN/BU) and RR105 (GY/YE). Go to H25.

  NO : Go to H23.

H7 CHECK THE DRIVER SIDE AIR BAG MODULE CIRCUIT FAULT PIDs (2295_29_OD) AND (2295_28_OD) FOR AN OPEN AND LOW RESISTANCE

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Side Air Bag Module C328
- Connect a jumper wire between driver side air bag C328-2, circuit CR105 (GN/BU), harness side and C328-1, circuit RR105 (GY/YE), harness side.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2295_28_OD (Side Air Bag Circuit Resistance Low, Front Driver Side)
  - 2295_29_OD (Side Air Bag Circuit Open, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the driver side air bag module circuits shorted together, a low resistance fault would normally be retrieved.
- **Did the driver side air bag on-demand fault PIDs change from indicating an open circuit to a**

low resistance fault?

YES : Go to H22.

NO : Go to H8.

H8 CHECK CIRCUITS CR105 (GN/BU) AND RR105 (GY/YE) FOR AN OPEN BETWEEN THE RCM AND DRIVER SIDE AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the jumper wire from the driver side air bag C328.
- Disconnect: RCM C310a and C310b

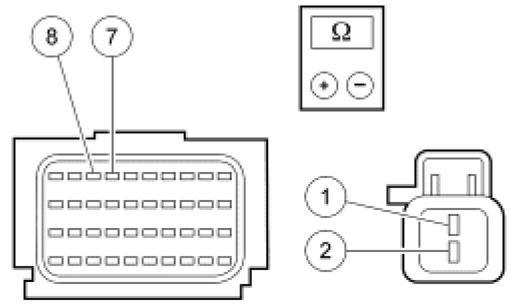

Fig. 54: Checking Circuits CR105 (GN/BU) & RR105 (GY/YE) For An Open Between RCM & Driver Side Air Bag Module
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b, harness side and driver seat side air bag C328, harness side using the following chart.

RCM	Circuit	Driver Seat Side Air Bag Module
C310b-8	CR105 (GN/BU)	C328-2
C310b-7	RR105 (GY/YE)	C328-1

- **Are the resistances less than 0.5 ohm?**

YES : Go to H23.

NO : REPAIR circuit CR105 (GN/BU) or RR105 (GY/YE). Go to H28.

H9 CHECK THE DRIVER SIDE AIR BAG MODULE CIRCUIT FAULT PIDs (2295_30_OD) AND (2295_28_OD) FOR A SHORT TO GROUND AND OPEN

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Side Air Bag Module C328
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2295_29_OD (Side Air Bag Circuit Open, Front Driver Side)
  - 2295_30_OD (Side Air Bag Circuit Short to Ground, Front Driver Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the driver side air bag module disconnected, an open circuit fault would normally be retrieved.
- **Did the driver side air bag on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to H22.

  NO : Go to H10.

H10 CHECK CIRCUITS CR109 (BN/BU) AND RR109 (BU/GN) FOR A SHORT TO GROUND BETWEEN THE RCM AND DRIVER SIDE AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Measure the resistance between driver side air bag C328-2, circuit CR105 (GN/BU), harness side and ground; and between driver side air bag C328-1, circuit RR105 (GY/YE), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to H23.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR105 (GN/BU) or RR105 (GY/YE). Go to H28.

H11 CHECK CIRCUITS CR105 (GN/BU) AND RR105 (GY/YE) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND DRIVER SIDE AIR BAG MODULE

- Key in OFF position.

- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Side Air Bag Module C328
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

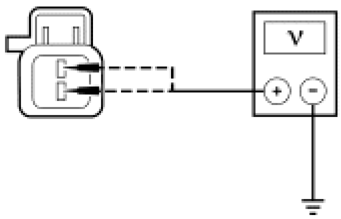

Fig. 55: Checking Circuits CR105 (GN/BU) & RR105 (GY/YE) For A Short To Voltage Between RCM & Driver Side Air Bag Module
Courtesy of FORD MOTOR CO.

- Measure the voltage between:
  - driver side air bag C328-2, circuit CR105 (GN/BU), harness side and ground.
  - driver side air bag C328-1, circuit RR105 (GY/YE), harness side and ground.
- **Is any voltage present on either circuit?**

  YES : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR105 (GN/BU) or RR105 (GY/YE). Go to H28.

  NO : Go to H23.

H12 CHECK THE PASSENGER SIDE AIR BAG MODULE RESISTANCE PID (PS_AB)

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - PID
- Enter the following diagnostic mode on the diagnostic tool: PS_AB (Passenger Side Impact Air Bag Resistance) Resistance PID
- **Does the resistance PID value read between 1.31 and 4.29 ohms?**

  YES : Go to H23.

  NO : Go to H13.

H13 CHECK THE PASSENGER SIDE AIR BAG RESISTANCE PID (PS_AB) WHILE CARRYING OUT A HARNESS TEST

- Continue monitoring the PS_AB (Passenger Side Impact Air Bag Resistance) resistance PID while

carrying out a harness test of the passenger side air bag circuits and accessible connectors (including any inline connectors), by wiggling connectors and flexing the wire harness.

- **Does the resistance PID value read between 1.31 and 4.29 ohms while carrying out the harness test?**

  YES : DEPOWER the SRS and REPAIR the connector, terminals or wire harness as needed. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to H28.

  NO : If the passenger side air bag resistance PID is less than 1.31 ohms, go to H14.

  If the passenger side air bag resistance PID is greater than 4.29 ohms, go to H17.

H14 CHECK THE PASSENGER SIDE AIR BAG MODULE CIRCUIT FAULT PIDs (2295_24_OD) AND (2295_25_OD) FOR LOW RESISTANCE AND OPEN

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Side Air Bag Module C314
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2295_24_OD (Side Air Bag Circuit Resistance Low, Front Passenger Side)
  - 2295_25_OD (Side Air Bag Circuit Open, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the passenger side air bag module disconnected, an open circuit fault would normally be retrieved.
- **Did the passenger side air bag on-demand fault PIDs change from indicating a low resistance to an open circuit fault?**

  YES : Go to H22.

  NO : Go to H15.

H15 CHECK FOR A SHORT BETWEEN PASSENGER SEAT SIDE AIR BAG CIRCUITS CR106 (VT/GY) AND RR106 (YE/OG)

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Measure the resistance between passenger side air bag C314-2, circuit CR106 (VT/GY), harness side and C314-1, circuit RR106 (YE/OG), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to H23.

  NO : Go to H16.

H16 CHECK THE RCM FOR LOW RESISTANCE

- Disconnect: RCM C310a and C310b

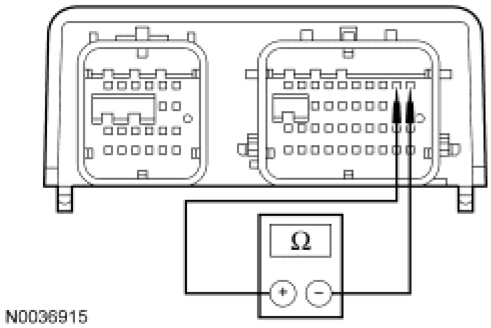

Fig. 56: Checking RCM For Low Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b pin 9, component side, and C310b pin 10, component side.
- **Is the resistance greater than 10,000 ohms?**

  YES : REPAIR circuits CR106 (VT/GY) and RR106 (YE/OG). Go to H28.

  NO : Go to H23.

H17 CHECK THE PASSENGER SIDE AIR BAG MODULE CIRCUIT FAULT PIDs (2295_25_OD) AND (2295_24_OD) FOR AN OPEN AND LOW RESISTANCE

NOTE:	This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Side Air Bag Module C314
- Connect a jumper wire between passenger side air bag C314-2, circuit CR106 (VT/GY), harness side and C314-1, circuit RR106 (YE/OG), harness side.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2295_24_OD (Side Air Bag Circuit Resistance Low, Front Passenger Side)
  - 2295_25_OD (Side Air Bag Circuit Open, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the passenger side air bag circuits shorted together, a low resistance fault would normally be retrieved.
- **Did the passenger side air bag on-demand fault PIDs change from indicating an open circuit to a low resistance fault?**

  YES : Go to H22.

  NO : Go to H18.

H18 CHECK CIRCUITS CR106 (VT/GY) AND RR111 (GN/OG) FOR AN OPEN BETWEEN THE RCM AND PASSENGER SIDE AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the jumper wire from the passenger side air bag C314.
- Disconnect: RCM C310a and C310b

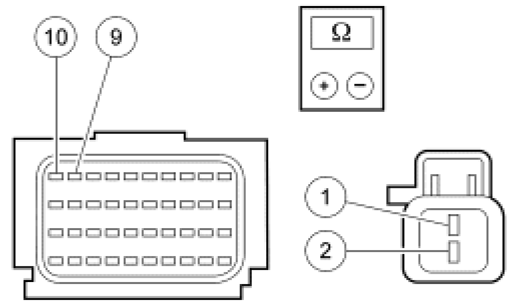

Fig. 57: Checking Circuits CR106 (VT/GY) & RR111 (GN/OG) For An Open Between RCM & Passenger Side Air Bag Module
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b, harness side and passenger seat side air bag module C314, harness side using the following chart.

RCM	Circuit	Passenger Seat Side Air Bag Module
C310b-9	CR106 (VT/GY)	C314-2
C310b-10	RR106 (YE/OG)	C314-1

- **Are the resistances less than 0.5 ohm?**

  YES : Go to H23.

  NO : REPAIR circuit CR106 (VT/GY) or RR106 (YE/OG). Go to H28.

H19 CHECK THE PASSENGER SIDE AIR BAG MODULE CIRCUIT FAULT PIDs (2295_26_OD) AND (2295_25_OD) FOR A SHORT TO GROUND AND OPEN

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Side Air Bag Module C314
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record The Following Fault PIDs
  - 2295_25_OD (Side Air Bag Circuit Open, Front Passenger Side)
  - 2295_26_OD (Side Air Bag Circuit Short to Ground, Front Passenger Side)
- **DIAGNOSTIC TIP:** When viewing DTC B2295 on-demand fault PIDs with the passenger side air bag module disconnected, an open circuit fault would normally be retrieved.
- **Did the passenger side air bag on-demand fault PIDs change from indicating a short to ground to an open circuit fault?**

  YES : Go to H22.

  NO : Go to H20.

H20 CHECK CIRCUITS CR106 (VT/GY) AND RR106 (YE/OG) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER SIDE AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

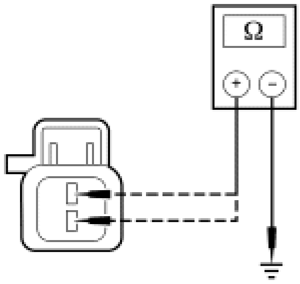

Fig. 58: Checking Circuits CR106 (VT/GY) & RR106 (YE/OG) For A Short To Ground Between RCM & Passenger Side Air Bag Module
Courtesy of FORD MOTOR CO.

- Measure the resistance between:
  - passenger side air bag C314-2, circuit CR106 (VT/GY), harness side and ground.
  - passenger side air bag C314-1, circuit RR106 (YE/OG), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to H23.

  NO : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR106 (VT/GY) or circuit RR106 (YE/OG). Go to H28.

H21 CHECK CIRCUITS CR106 (VT/GY) AND RR106 (YE/OG) FOR A SHORT TO VOLTAGE BETWEEN THE RCM AND PASSENGER SIDE AIR BAG MODULE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Side Air Bag Module C314
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Measure the voltage between:
  - passenger side air bag C314-2, circuit CR106 (VT/GY), harness side and ground.
  - passenger side air bag C314-1, circuit RR106 (YE/OG), harness side and ground.
- **Is any voltage present on either circuit?**

  YES : Due to the shorting bar feature in the RCM electrical connector, the fault can exist in either circuit. Do not remove or defeat the shorting bar.

  REPAIR circuit CR106 (VT/GY) or RR106 (YE/OG). Go to H28.

NO : Go to H23.

H22 CONFIRM THE SIDE AIR BAG MODULE FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Affected Side Air Bag C328 (Driver) C314 (Passenger)
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2295 Fault PIDs
  - Refer to PID list in Normal Operation to view B2295 fault PIDs.
- **Does the original RCM on-demand DTC B2295 fault PID indicate a fault?**

  YES : REMOVE and INSPECT the seat side air bag module jumper harness, connector terminals for damage. REFER to **Side Air Bag Module**. If a concern is found, REPAIR or INSTALL a new seat jumper harness. Go to H28.

  If a concern was not found, INSTALL a new driver or passenger side air bag module. Go to H28.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected.

  For 2295_28_CM (Side Air Bag Circuit Resistance Low, Front Driver Side), 2295_29_CM (Side Air Bag Circuit Open, Front Driver Side), 2295_24_CM (Side Air Bag Circuit Resistance Low, Front Passenger Side) or 2295_25_CM (Side Air Bag Circuit Open, Front Passenger Side), go to H24.

  For (2295_30_CM (Side Air Bag Circuit Short to Ground, Front Driver Side) or 2295_26_CM (Side Air Bag Circuit Short to Ground, Front Passenger Side), go to H26.

  For 2295_31_CM (Side Air Bag Circuit Short to Battery, Front Driver Side) or 2295_27_CM (Side Air Bag Circuit Short to Battery, Front Passenger Side), go to H27.

H23 CONFIRM THE RCM FAULT

NOTE: **Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- If previously directed to disconnect any SRS component(s):
  - depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
  - connect all previously disconnected restraint system component(s), including RCM C310a and C310b.
  - repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2295 Fault PIDs
  - Refer to PID list in Normal Operation to view B2295 fault PIDs.
- **Does the original RCM on-demand DTC B2295 fault PID indicate a fault?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to H28.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. Using the fault PIDs recorded, go to the appropriate pinpoint test step and CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected.

  For 2295_28_CM (Side Air Bag Circuit Resistance Low, Front Driver Side), 2295_29_CM (Side Air Bag Circuit Open, Front Driver Side), 2295_24_CM (Side Air Bag Circuit Resistance Low, Front Passenger Side) or 2295_25_CM (Side Air Bag Circuit Open, Front Passenger Side), go to H24.

  For (2295_30_CM (Side Air Bag Circuit Short to Ground, Front Driver Side) or 2295_26_CM (Side Air Bag Circuit Short to Ground, Front Passenger Side), go to H26.

  For 2295_31_CM (Side Air Bag Circuit Short to Battery, Front Driver Side) or 2295_27_CM (Side Air Bag Circuit Short to Battery, Front Passenger Side), go to H27.

H24 CHECK SIDE AIR BAG MODULE CIRCUIT RESISTANCE PIDs FOR AN INTERMITTENT LOW RESISTANCE OR OPEN

- If the fault PID was reported for the driver side air bag module, monitor the DS_AB (Driver Side Impact Air Bag Resistance) resistance PID on the scan tool.
- If the fault PID was reported for the passenger side air bag, monitor the PS_AB (Passenger Side Impact Air Bag Resistance) resistance PID on the scan tool.

NOTE: **A resistance PID that reads between 0.9 and 1.31 ohms or between 4.29 and 5 ohms may or may not set an on-demand DTC yet indicates**

a strong potential of an intermittent fault condition. Make sure to thoroughly check wire harness(es), connectors and terminals as they are the likely source of the fault condition.

- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any side air bag on-demand fault PID indicate a fault is present or is the side air bag resistance PID less than 1.31 ohms or greater than 4.29 ohms?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to H28.

  NO : Go to H25.

H25 CHECK THE HARNESS AND CONNECTORS

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect the affected side air bag module C328 (driver) C314 (passenger):
  - inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
  - inspect wire harness for any damage, pinched, cut or pierced wires.
- **Were any concerns found?**

  YES : REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to H28.

  NO : The fault is not present and cannot be recreated at this time. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to H28.

H26 CHECK SIDE AIR BAG MODULE CIRCUIT FAULT PIDs FOR AN INTERMITTENT SHORT TO GROUND

- If the fault PID was reported for the driver side air bag module, monitor the 2295_30_OD (Side Air Bag Circuit Short to Ground, Front Driver Side) fault PID on the scan tool.
- If the fault PID was reported for the passenger side air bag, monitor the 2295_26_OD (Side Air Bag Circuit Short to Ground, Front Passenger Side) fault PID on the scan tool.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to a 2-second delay for the scan tool display to update.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any side air bag on-demand fault PID indicate a fault is present?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING**

DIAGRAMS article for MKZ, Connector Repair Procedures for schematic and connector information. Go to H28.

NO : The fault is not present and cannot be recreated at this time. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to H28.

H27 CHECK SIDE AIR BAG MODULE CIRCUIT FAULT PIDs FOR AN INTERMITTENT SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect the affected side air bag module C328 (driver) C314 (passenger).
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- **DIAGNOSTIC TIP:** When monitoring fault PIDs with the scan tool, it may take up to a 2-second delay for the scan tool display to update.
- Monitor the 2295_31_OD (Side Air Bag Circuit Short to Battery, Front Driver Side) or 2295_27_OD (Side Air Bag Circuit Short to Battery, Front Passenger Side) on-demand fault PIDs on the scan tool.
- Attempt to recreate the fault by wiggling connectors (including any inline connectors) and flexing the wire harness.
- **Does any side air bag on-demand fault PID indicate a fault is present?**

  YES : DEPOWER the SRS and REPAIR as necessary. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information. Go to H28.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to H28.

H28 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

  WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).

- If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test I: DTC B2296 - Restraint System - Impact Sensor Fault

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) continuously communicates with all impact sensors for external and internal sensor data. The RCM also continuously monitors all of the impact sensor circuits for a short to voltage, short to ground and open circuits. If the RCM detects any communication or circuit faults with any of the impact sensors, it will store DTC B2296 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

Fault PIDs[a]	Description	Fault Trigger Condition
2296_18_OD and 2296_18_CM	Driver/Center Front Crash Sensor Internal Fault	When the RCM senses an internal failure with the driver/center front impact sensor, a fault will be indicated.
2296_19_OD and 2296_19_OD	Driver/Center Front Crash Sensor Mount/Communication Fault	When the RCM is unable to communicate with the driver/center front impact sensor, a fault will be indicated.
2296_24_OD and 2296_24_CM	Side Crash Sensor 2 Internal Fault, Passenger side	When the RCM senses an internal failure with the passenger side second row impact sensor, a fault will be indicated.
2296_25_OD and 2296_25_CM	Side Crash Sensor Mount or Communication Fault, Row No.2 Passenger Side	When the RCM is unable to communicate with the passenger side second row impact sensor, a fault will be indicated.

2296_26_OD and 2296_26_CM	Side Crash Sensor 2 Internal Fault, Driver side	When the RCM senses an internal failure with the driver side second row impact sensor, a fault will be indicated.
2296_27_OD and 2296_27_CM	Side Crash Sensor Mount or Communication Fault, Row No.2 Driver Side	When the RCM is unable to communicate with the driver side second row impact sensor, a fault will be indicated.
2296_28_OD and 2296_28_CM	Side Crash Sensor Internal Fault, Front Passenger Side	When the RCM senses an internal failure with the passenger side first row impact sensor, a fault will be indicated.
2296_29_OD and 2296_29_CM	Side Crash Sensor Mount or Communication Fault, Front Passenger Side	When the RCM is unable to communicate with the passenger side first row impact sensor, a fault will be indicated.
2296_30_OD and 2296_30_CM	Side Crash Sensor Internal Fault, Front Driver Side	When the RCM senses an internal failure with the driver/center front impact sensor, a fault will be indicated.
2296_31_OD and 2296_31_CM	Side Crash Sensor Mount or Communication Fault, Front Driver Side	When the RCM is unable to communicate with the driver side first row impact sensor, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2296. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2296.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Impact sensor
- Incorrect sensor mounting
- RCM

PINPOINT TEST I: DTC B2296 - RESTRAINT SYSTEM - IMPACT SENSOR FAULT

WARNING: **Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of**

personal injury or death in a crash.

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Do not probe any impact sensor. The impact sensor can not be tested using a multi-meter.

I1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Do any RCM on-demand DTC B2296 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

  Using the fault PIDs recorded, go to the appropriate pinpoint test step.

  For 2296_31_OD (Side Crash Sensor Mount or Communication Fault, Front Driver Side), go to I2.

  For 2296_30_OD (Side Crash Sensor Internal Fault, Front Driver Side), INSTALL a new first row driver side impact sensor. REFER to **Side Impact Sensor - B-Pillar**. Go to I54.

  For 2296_29_OD (Side Crash Sensor Mount or Communication Fault, Front Passenger Side), go to I12.

  For 2296_28_OD (Side Crash Sensor Internal Fault, Front Passenger Side), INSTALL a new first

row passenger side impact sensor. REFER to **Side Impact Sensor - B-Pillar**. Go to I54.

For 2296_27_OD (Side Crash Sensor Mount or Communication Fault, Row No.2 Driver Side), go to I22.

For 2296_26_OD (Side Crash Sensor 2 Internal Fault, Driver side), INSTALL a new second row driver side impact sensor. REFER to **Side Impact Sensor - C-Pillar**. Go to I54.

For 2296_25_OD (Side Crash Sensor Mount or Communication Fault, Row No.2 Passenger Side), go to I32.

For 2296_24_OD (Side Crash Sensor 2 Internal Fault, Passenger side), INSTALL a new second row passenger side impact sensor. REFER to **Side Impact Sensor - C-Pillar**. Go to I54.

For 2296_19_OD (Driver/Center Front Crash Sensor Mount/Communication Fault), go to I42.

For 2296_18_OD (Driver/Center Front Crash Sensor Internal Fault), INSTALL a new front impact severity sensor. REFER to **Front Impact Severity Sensor**. Go to I54.

NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand. The fault condition is not present at this time. Go to I53.

I2 INSPECT THE FIRST ROW DRIVER SIDE IMPACT SENSOR MOUNTING AND MOUNTING SURFACE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Access the first row driver side impact sensor. Refer to **Side Impact Sensor - B-Pillar**.
- Inspect the first row driver side impact sensor for:
  - loose electrical connector.
  - improper mounting.
  - loose sensor mounting bolt.
- Remove the first row driver side impact sensor.
- Visually inspect the first row driver side impact sensor, electrical connector and mounting surface for damage, corrosion or dirt.
- **Was a significant amount of corrosion or dirt found, the first row driver side impact sensor attached to the mounting surface incorrectly or was the impact sensor bolt not fully seated and tightened correctly?**

  YES : CLEAN, TIGHTEN the bolt or REPAIR the mounting surface as necessary. REINSTALL the first row driver side impact sensor. Go to I54.

  NO : Go to I3.

I3 INSTALL THE FIRST ROW DRIVER SIDE IMPACT SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST

- Clean and repair the mounting surface as necessary.

- Clean the first row driver side impact sensor mounting bolt.
- Install the first row driver side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Do any RCM on-demand DTC B2296 fault PIDs indicate a fault?**

  YES : Go to I4.

  NO : Fault corrected. Go to I54.

I4 CHECK THE FIRST ROW DRIVER SIDE IMPACT SENSOR GROUND CIRCUIT RR131 (VT/GY) FOR HIGH RESISTANCE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: First Row Driver Side Impact Sensor C3057
- Measure the resistance between first row driver side impact sensor C3057-2, circuit RR131 (VT/GY), harness side and the first row driver side impact sensor case ground.
- **Is the resistance less than 10 ohms?**

  YES : Go to I6.

  NO : Go to I5.

I5 CLEAN THE FIRST ROW DRIVER SIDE IMPACT SENSOR MOUNTING SURFACE AND CARRY OUT THE ON-DEMAND SELF TEST

- Remove the first row driver side impact sensor.
- Clean and repair the mounting surface as necessary.
- Clean the first row driver side impact sensor mounting bolt.
- Install the first row driver side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Do any RCM on-demand DTC B2296 fault PIDs indicate a fault?**

  YES : Go to I6.

  NO : Fault corrected. Go to I54.

I6 CHECK FIRST ROW DRIVER SIDE IMPACT SENSOR CIRCUITS VR217 (GY/YE) AND RR131 (VT/GY) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: First Row Driver Side Impact Sensor C3057
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

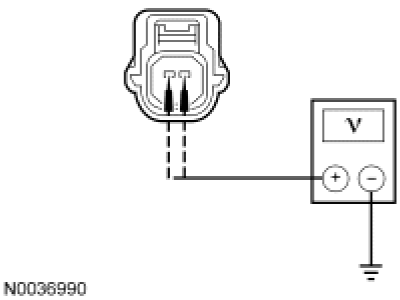

Fig. 59: Checking First Row Driver Side Impact Sensor Circuits VR217 (GY/YE) & RR131 (VT/GY) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between:
  - first row driver side impact sensor C3057-2, circuit RR131 (VT/GY), harness side and ground.
  - first row driver side impact sensor C3057-1, circuit VR217 (GY/YE), harness side and ground.
- **Is any voltage present on either circuit?**

  YES : REPAIR circuit VR217 (GY/YE) or circuit RR131 (VT/GY). Go to I54.

  NO : Go to I7.

I7 CHECK FIRST ROW DRIVER SIDE IMPACT SENSOR CIRCUITS VR217 (GY/YE) AND CIRCUIT RR131 (VT/GY) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

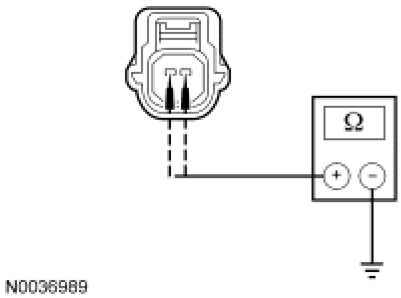

Fig. 60: Checking First Row Driver Side Impact Sensor Circuits VR217 (GY/YE) & RR131 (VT/GY) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between first row driver side impact sensor C3057-2, circuit RR131 (VT/GY), harness side and ground; and between C3057-1, circuit VR217 (GY/YE), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to I8.

  NO : REPAIR short to ground in circuit VR217 (GY/YE) or circuit RR131 (VT/GY). Go to I54.

I8 CHECK CIRCUIT VR217 (GY/YE) FOR AN OPEN BETWEEN THE RCM AND FIRST ROW DRIVER SIDE IMPACT SENSOR

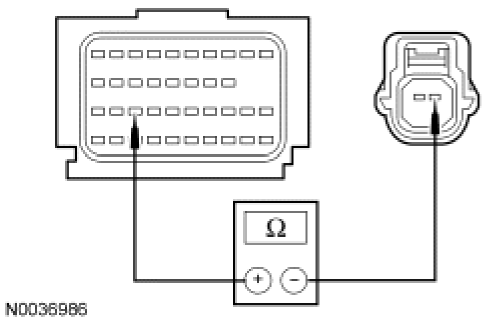

Fig. 61: Measuring Resistance
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-28, circuit VR217 (GY/YE), harness side and first row driver side impact sensor C3057-1, circuit VR217 (GY/YE), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to I9.

  NO : REPAIR circuit VR217 (GY/YE). Go to I54.

I9 CHECK CIRCUIT RR131 (VT/GY) FOR AN OPEN BETWEEN THE RCM AND FIRST ROW DRIVER SIDE IMPACT SENSOR

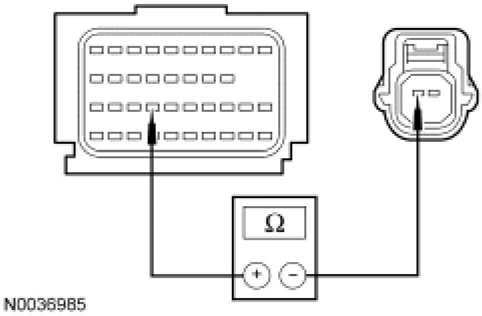

Fig. 62: Checking Circuit RR131 (VT/GY) For An Open Between RCM & First Row Driver Side Impact Sensor
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-27, circuit RR131 (VT/GY), harness side and first row driver side impact sensor C3057-2, circuit RR131 (VT/GY), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to I10.

  NO : REPAIR circuit RR131 (VT/GY). Go to I54.

I10 CHECK FOR A SHORT BETWEEN FIRST ROW DRIVER SIDE IMPACT SENSOR CIRCUITS VR217 (GY/YE) AND RR131 (VT/GY)

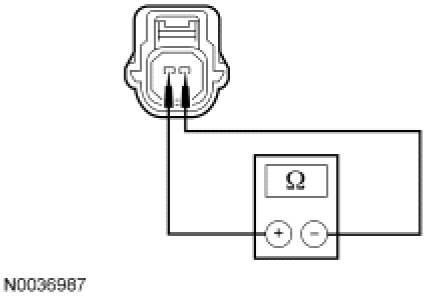

Fig. 63: Checking For A Short Between First Row Driver Side Impact Sensor Circuits VR217 (GY/YE) & RR131 (VT/GY)
Courtesy of FORD MOTOR CO.

- Measure the resistance between first row driver side impact sensor C3057-1, circuit VR217 (GY/YE), harness side and C3057-2, circuit RR131 (VT/GY), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to I11.

  NO : REPAIR circuit VR217 (GY/YE) and circuit RR131 (VT/GY). Go to I54.

I11 CHECK THE FIRST ROW DRIVER SIDE IMPACT SENSOR

- Connect: RCM C310a and C310b
- Install a known good first row driver side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint**

System (SRS) Depowering and Repowering.

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Do any RCM fault PIDs for the first row driver side impact sensor indicate a fault?**

  YES : Go to I52.

  NO : Fault corrected. Go to I54.

I12 INSPECT THE FIRST ROW PASSENGER SIDE IMPACT SENSOR MOUNTING AND MOUNTING SURFACE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Access the first row passenger side impact sensor. Refer to **Side Impact Sensor - B-Pillar**.
- Inspect the first row passenger side impact sensor for:
  - loose electrical connector.
  - incorrect mounting.
  - loose sensor mounting bolt.
- Remove the first row passenger side impact sensor.
- Visually inspect the first row passenger side impact sensor, electrical connector and mounting surface for damage, corrosion or dirt.
- **Was a significant amount of corrosion or dirt found, the first row passenger side impact sensor attached to the mounting surface incorrectly or was the impact sensor bolt not fully seated and tightened correctly?**

  YES : CLEAN, TIGHTEN the bolt or REPAIR the mounting surface as necessary. REINSTALL the first row passenger side impact sensor. Go to I54.

  NO : Go to I13.

I13 INSTALL THE FIRST ROW PASSENGER SIDE IMPACT SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST

- Clean and repair the mounting surface as necessary.
- Clean the first row passenger side impact sensor mounting bolt.
- Install the first row passenger side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.

- **Do any RCM on-demand DTC B2296 fault PIDs indicate a fault?**

  YES : Go to I14.

  NO : Fault corrected. Go to I54.

I14 CHECK THE FIRST ROW PASSENGER SIDE IMPACT SENSOR GROUND CIRCUIT RR132 (BU/WH) FOR HIGH RESISTANCE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: First Row Passenger Side Impact Sensor C3058
- Measure the resistance between the first row passenger side impact sensor C3058-2, circuit RR132 (BU/WH), harness side and the first row passenger side impact sensor case ground.
- **Is the resistance less than 10 ohms?**

  YES : Go to I16.

  NO : Go to I15.

I15 CLEAN THE FIRST ROW PASSENGER SIDE IMPACT SENSOR MOUNTING SURFACE AND CARRY OUT THE ON-DEMAND SELF TEST

- Remove the first row passenger side impact sensor.
- Clean and repair the mounting surface as necessary.
- Clean the first row passenger side impact sensor mounting bolt and ground wire.
- Install the first row passenger side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Do any RCM on-demand DTC B2296 fault PIDs indicate a fault?**

  YES : Go to I16.

  NO : Fault corrected. Go to I54.

I16 CHECK FIRST ROW PASSENGER SIDE IMPACT SENSOR CIRCUITS VR218 (YE/OG) AND RR132 (BU/WH) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: First Row Passenger Side Impact Sensor C3058
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

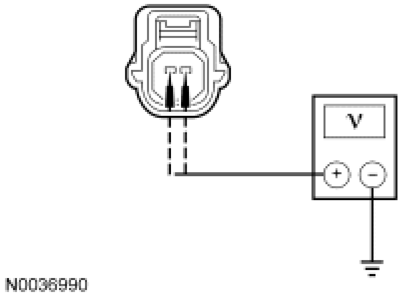

Fig. 64: Checking First Row Passenger Side Impact Sensor Circuits VR218 (YE/OG) & RR132 (BU/WH) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between:
  - first row passenger side impact sensor C3058-1, circuit VR218 (YE/OG), harness side and ground.
  - first row passenger side impact sensor C3058-2, circuit RR132 (BU/WH), harness side and ground.
- **Is any voltage present on either circuit?**

  YES : REPAIR circuit VR218 (YE/OG) or circuit RR132 (BU/WH). Go to I54.

  NO : Go to I17.

I17 CHECK FIRST ROW PASSENGER SIDE IMPACT SENSOR CIRCUITS VR218 (YE/OG) AND RR132 (BU/WH) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

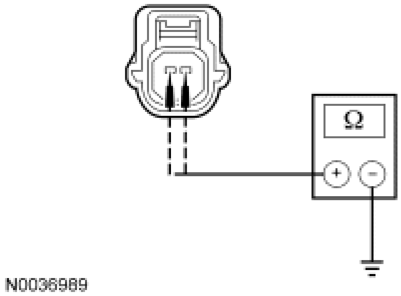

Fig. 65: Checking First Row Passenger Side Impact Sensor Circuits VR218 (YE/OG) & RR132 (BU/WH) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between first row passenger side impact sensor C3058-1, circuit VR218 (YE/OG), harness side and ground; and between C3058-2, circuit RR132 (BU/WH), harness side and ground.

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to I18.

  NO : REPAIR circuit VR218 (YE/OG) or circuit RR132 (BU/WH). Go to I54.

I18 CHECK CIRCUIT VR218 (YE/OG) FOR AN OPEN BETWEEN THE RCM AND FIRST ROW PASSENGER SIDE IMPACT SENSOR

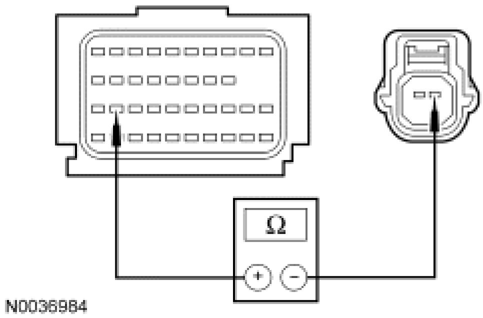

Fig. 66: Checking Circuit VR218 (YE/OG) For An Open Between RCM & First Row Passenger Side Impact Sensor
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-29, circuit VR218 (YE/OG), harness side and first row passenger side impact sensor C3058-1, circuit VR218 (YE/OG), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to I19.

  NO : REPAIR circuit VR218 (YE/OG). Go to I54.

I19 CHECK CIRCUIT RR132 (BU/WH) FOR AN OPEN BETWEEN THE RCM AND FIRST ROW PASSENGER SIDE IMPACT SENSOR

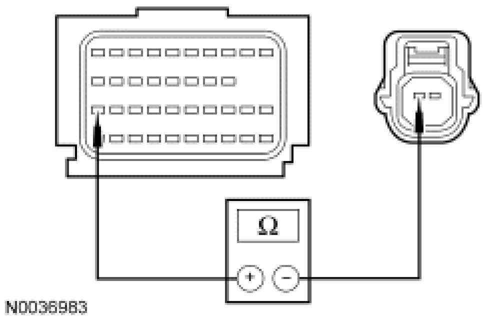

Fig. 67: Checking Circuit RR132 (BU/WH) For An Open Between RCM & First Row Passenger Side Impact Sensor
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-30, circuit RR132 (BU/WH), harness side and first row passenger side impact sensor C3058-2, circuit RR132 (BU/WH), harness side.
- **Is the resistance less than 0.5 ohm?**

YES : Go to I20.

NO : REPAIR circuit RR132 (BU/WH). Go to I54.

I20 CHECK FOR A SHORT BETWEEN FIRST ROW PASSENGER SIDE IMPACT SENSOR CIRCUITS VR218 (YE/OG) AND RR132 (BU/WH)

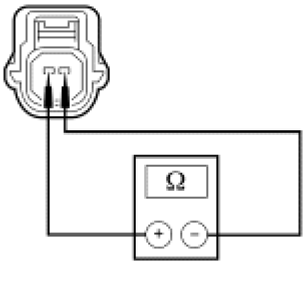

Fig. 68: Checking For A Short Between First Row Passenger Side Impact Sensor Circuits VR218 (YE/OG) & RR132 (BU/WH)
Courtesy of FORD MOTOR CO.

- Measure the resistance between first row passenger side impact sensor C3058-1, circuit VR218 (YE/OG), harness side and C3058-2, circuit RR132 (BU/WH), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to I21.

  NO : REPAIR short between circuits VR218 (YE/OG) and RR132 (BU/WH). Go to I54.

I21 CHECK THE FIRST ROW PASSENGER SIDE IMPACT SENSOR

- Connect: RCM C310a and C310b
- Install a known good first row passenger side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any fault PIDs for the first row passenger side impact sensor indicating a fault?**

  YES : Go to I52.

  NO : Fault corrected. Go to I54.

I22 INSPECT THE SECOND ROW DRIVER SIDE IMPACT SENSOR MOUNTING AND MOUNTING SURFACE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Access the second row driver side impact sensor. Refer to **Side Impact Sensor - C-Pillar**.
- Inspect the second row driver side impact sensor mounting and make sure that the retaining bolt is fully seated and tightened correctly.
- Remove the second row driver side impact sensor.
- Visually inspect the second row driver side impact sensor and mounting surface for damage, corrosion or dirt.
- **Was a significant amount of corrosion or dirt found, the second row driver side impact sensor attached to the mounting surface incorrectly or was the impact sensor bolt not fully seated and tightened correctly?**

  YES : CLEAN, TIGHTEN the bolt or REPAIR the mounting surface as necessary. REINSTALL the second row driver side impact sensor. Go to I54.

  NO : Go to I23.

I23 INSTALL THE SECOND ROW DRIVER SIDE IMPACT SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST

- Clean and repair the mounting surface as necessary.
- Clean the second row driver side impact sensor mounting bolt.
- Install the second row driver side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any fault PIDs for the second row driver side impact sensor indicating a fault?**

  YES : Go to I24.

  NO : Fault corrected. Go to I54.

I24 CHECK THE SECOND ROW DRIVER SIDE IMPACT SENSOR GROUND CIRCUIT RR133 (GY/BN) FOR HIGH RESISTANCE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Second Row Driver Side Impact Sensor C3059
- Measure the resistance between second row driver side impact sensor C3059-2, circuit RR133 (GY/BN), harness side and the second row driver side impact sensor case ground.
- **Is the resistance less than 10 ohms?**

  YES : Go to I26.

  NO : Go to I25.

I25 CLEAN THE SECOND ROW DRIVER SIDE IMPACT SENSOR MOUNTING SURFACE AND CARRY OUT THE ON-DEMAND SELF TEST

- Remove the second row driver side impact sensor.
- Clean and repair the mounting surface as necessary.
- Clean the second row driver side impact sensor mounting bolt.
- Install the second row driver side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any fault PIDs for the second row driver side impact sensor indicating a fault?**

  YES : Go to I26.

  NO : Fault corrected. Go to I54.

I26 CHECK SECOND ROW DRIVER SIDE IMPACT SENSOR CIRCUITS VR219 (GN/WH) AND RR133 (GY/BN) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Second Row Driver Side Impact Sensor C3059
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

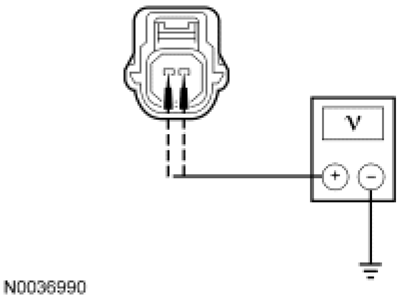

Fig. 69: Checking Second Row Driver Side Impact Sensor Circuits VR219 (GN/WH) & RR133 (GY/BN) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between:
  - second row driver side impact sensor C3059-1, circuit VR219 (GN/WH), harness side and ground.

- second row driver side impact sensor C3059-2, circuit RR133 (GY/BN), harness side and ground.

- **Is any voltage present on either circuit?**

  YES : REPAIR circuit VR219 (GN/WH) or circuit RR133 (GY/BN). Go to I54.

  NO : Go to I27.

I27 CHECK SECOND ROW DRIVER SIDE IMPACT SENSOR CIRCUITS VR219 (GN/WH) AND RR133 (GY/BN) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

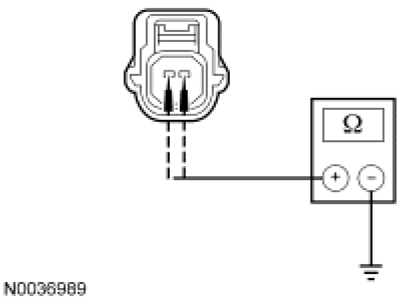

Fig. 70: Checking Second Row Driver Side Impact Sensor Circuits VR219 (GN/WH) & RR133 (GY/BN) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between second row driver side impact sensor C3059-1, circuit VR219 (GN/WH), harness side and ground; and between C3059-2, circuit RR133 (GY/BN), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to I28.

  NO : REPAIR circuit VR219 (GN/WH) or circuit RR133 (GY/BN). Go to I54.

I28 CHECK CIRCUIT VR219 (GN/WH) FOR AN OPEN BETWEEN THE RCM AND SECOND ROW DRIVER SIDE IMPACT SENSOR

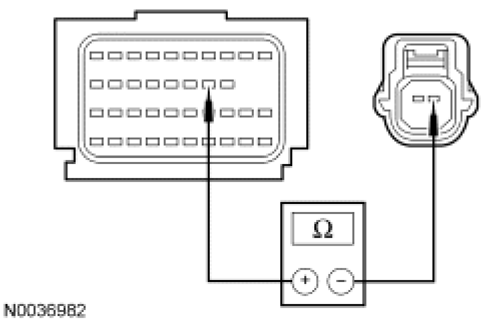

Fig. 71: Checking Circuit VR219 (GN/WH) For An Open Between RCM & Second Row

Driver Side Impact Sensor
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-14, circuit VR219 (GN/WH), harness side and second row driver side impact sensor C3059-1, circuit VR219 (GN/WH), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to I29.

  NO : REPAIR circuit VR219 (GN/WH). Go to I54.

I29 CHECK CIRCUIT RR133 (GY/BN) FOR AN OPEN BETWEEN THE RCM AND SECOND ROW DRIVER SIDE IMPACT SENSOR

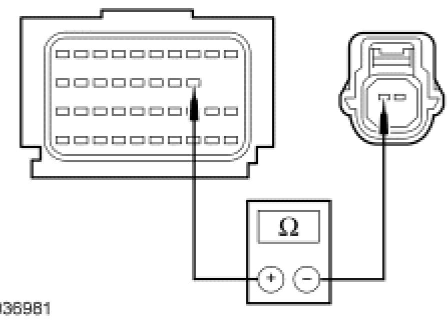

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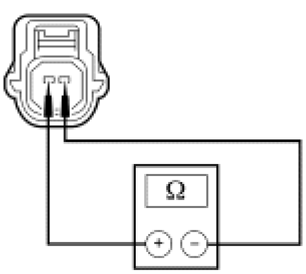
Fig. 72: Checking Circuit RR133 (GY/BN) For An Open Between RCM & Second Row Driver Side Impact Sensor
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-13, circuit RR133 (GY/BN), harness side and second row driver side impact sensor C3059-2, circuit RR133 (GY/BN), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to I30.

  NO : REPAIR circuit RR133 (GY/BN). Go to I54.

I30 CHECK FOR A SHORT BETWEEN SECOND ROW DRIVER SIDE IMPACT SENSOR CIRCUITS VR219 (GN/WH) AND RR133 (GY/BN)



N0036987

Fig. 73: Checking For A Short Between Second Row Driver Side Impact Sensor Circuits VR219 (GN/WH) & RR133 (GY/BN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between second row driver side impact sensor C3059-1, circuit VR219 (GN/WH), harness side and C3059-2, circuit RR133 (GY/BN), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to I31.

  NO : REPAIR circuit VR219 (GN/WH) or circuit RR133 (GY/BN). Go to I54.

I31 CHECK THE SECOND ROW DRIVER SIDE IMPACT SENSOR

- Connect: RCM C310a and C310b
- Install a known good second row driver side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any fault PIDs for the second row driver side impact sensor indicating a fault?**

  YES : Go to I52.

  NO : Fault corrected. Go to I54.

I32 INSPECT THE SECOND ROW PASSENGER SIDE IMPACT SENSOR MOUNTING AND MOUNTING SURFACE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Access the second row passenger side impact sensor. Refer to **Side Impact Sensor - C-Pillar**.
- Inspect the second row passenger side impact sensor mounting and make sure that the retaining bolt is fully seated and tightened correctly.
- Remove the second row passenger side impact sensor.
- Visually inspect the second row passenger side impact sensor and mounting surface for damage, corrosion or dirt.
- **Was a significant amount of corrosion or dirt found, the second row passenger side impact sensor attached to the mounting surface incorrectly or was the impact sensor bolt not fully seated and tightened correctly?**

  YES : CLEAN, TIGHTEN the bolt or REPAIR the mounting surface as necessary. REINSTALL the second row passenger side impact sensor. Go to I54.

  NO : Go to I33.

I33 INSTALL THE SECOND ROW PASSENGER SIDE IMPACT SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST

- Clean and repair the mounting surface as necessary.
- Clean the second row passenger side impact sensor mounting bolt.
- Install the second row passenger side impact sensor.

- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
    - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any fault PIDs for the second row passenger side impact sensor indicating a fault?**

  YES : Go to I34.

  NO : Fault corrected. Go to I54.

I34 CHECK THE SECOND ROW PASSENGER SIDE IMPACT SENSOR GROUND CIRCUIT RR134 (BN/BU) FOR HIGH RESISTANCE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Second Row Passenger Side Impact Sensor C3060
- Measure the resistance between second row passenger side impact sensor C3060-2, circuit RR134 (BN/BU), harness side and the second row passenger side impact sensor case ground.
- **Is the resistance less than 10 ohms?**

  YES : Go to I36.

  NO : Go to I35.

I35 CLEAN THE SECOND ROW PASSENGER SIDE IMPACT SENSOR MOUNTING SURFACE AND CARRY OUT THE ON-DEMAND SELF TEST

- Remove the second row passenger side impact sensor.
- Clean and repair the mounting surface as necessary.
- Clean the second row passenger side impact sensor mounting bolt.
- Install the second row passenger side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
    - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any fault PIDs for the second row passenger side impact sensor indicating a fault?**

  YES : Go to I36.

  NO : Fault corrected. Go to I54.

I36 CHECK SECOND ROW PASSENGER SIDE IMPACT SENSOR CIRCUITS VR220 (VT/OG) AND RR134 (BN/BU) FOR A SHORT TO VOLTAGE

- Key in OFF position.

- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Second Row Passenger Side Impact Sensor C3060
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

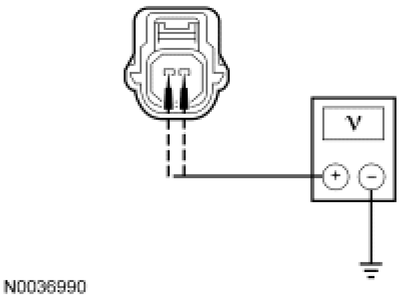


Fig. 74: Checking Second Row Passenger Side Impact Sensor Circuits VR220 (VT/OG) & RR134 (BN/BU) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between:
  - second row passenger side impact sensor C3060-1, circuit VR220 (VT/OG), harness side and ground.
  - second row passenger side impact sensor C3060-2, circuit RR134 (BN/BU), harness side and ground.
- **Is any voltage present on either circuit?**

  YES : REPAIR circuit VR220 (VT/OG) or circuit RR134 (BN/BU). Go to I54.

  NO : Go to I37.

I37 CHECK SECOND ROW PASSENGER SIDE IMPACT SENSOR CIRCUITS VR220 (VT/OG) AND RR134 (BN/BU) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

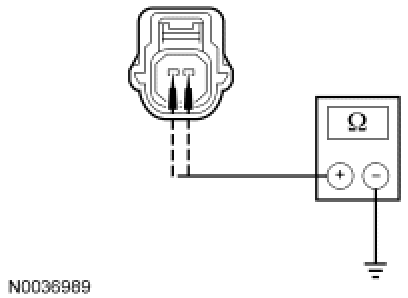


Fig. 75: Checking Second Row Passenger Side Impact Sensor Circuits VR220 (VT/OG) & RR134 (BN/BU) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between second row passenger side impact sensor C3060-1, circuit VR220 (VT/OG), harness side and ground; and between C3060-2, circuit RR134 (BN/BU), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to I38.

  NO : REPAIR circuit VR220 (VT/OG) or circuit RR134 (BN/BU). Go to I54.

I38 CHECK CIRCUIT VR220 (VT/OG) FOR AN OPEN BETWEEN THE RCM AND SECOND ROW PASSENGER SIDE IMPACT SENSOR

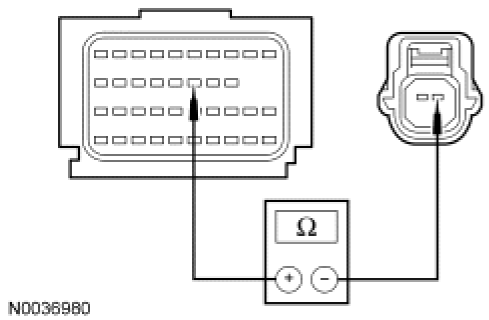


Fig. 76: Checking Circuit VR220 (VT/OG) For An Open Between RCM & Second Row Passenger Side Impact Sensor
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-15, circuit VR220 (VT/OG), harness side and second row passenger side impact sensor C3060-1, circuit VR220 (VT/OG), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to I39.

  NO : REPAIR circuit VR220 (VT/OG). Go to I54.

I39 CHECK CIRCUIT RR134 (BN/BU) FOR AN OPEN BETWEEN THE RCM AND SECOND ROW PASSENGER SIDE IMPACT SENSOR

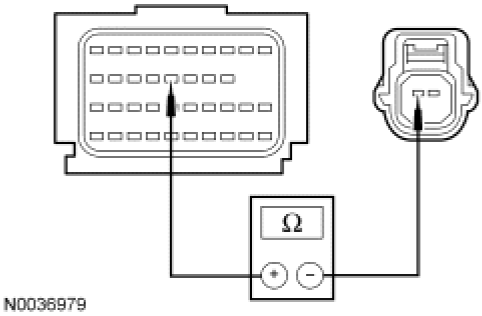


Fig. 77: Checking Circuit RR134 (BN/BU) For An Open Between RCM & Second Row Passenger Side Impact Sensor
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-16, circuit RR134 (BN/BU), harness side and second row passenger side impact sensor C3060-2, circuit RR134 (BN/BU), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to I40.

  NO : REPAIR circuit RR134 (BN/BU). Go to I54.

I40 CHECK FOR A SHORT BETWEEN SECOND ROW PASSENGER SIDE IMPACT SENSOR CIRCUITS VR220 (VT/OG) AND RR134 (BN/BU)

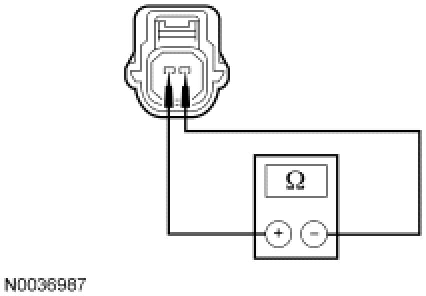


Fig. 78: Checking For A Short Between Second Row Passenger Side Impact Sensor Circuits VR220 (VT/OG) & RR134 (BN/BU)
Courtesy of FORD MOTOR CO.

- Measure the resistance between second row passenger side impact sensor C3060-1, circuit VR220 (VT/OG), harness side and C3060-2, circuit RR134 (BN/BU), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to I41.

  NO : REPAIR circuits VR220 (VT/OG) and RR134 (BN/BU). Go to I54.

I41 CHECK THE SECOND ROW PASSENGER SIDE IMPACT SENSOR

- Connect: RCM C310a and C310b
- Install a known good second row passenger side impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint**

System (SRS) Depowering and Repowering.

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any fault PIDs for the second row passenger side impact sensor indicating a fault?**

  YES : Go to I52.

  NO : Fault corrected. Go to I54.

I42 INSPECT THE FRONT IMPACT SEVERITY SENSOR MOUNTING AND MOUNTING SURFACE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Inspect the front impact severity sensor mounting and make sure that the retaining bolts are fully seated and tightened correctly.
- Remove the front impact severity sensor. Refer to **Front Impact Severity Sensor**.
- Visually inspect the front impact severity sensor and mounting surface for damage, corrosion or dirt.
- **Was a significant amount of corrosion or dirt found, the front impact severity sensor attached to the mounting surface incorrectly or were the front impact severity sensor bolts not fully seated and tightened correctly?**

  YES : CLEAN, TIGHTEN bolts or REPAIR the mounting surface as necessary. REINSTALL the front impact severity sensor. Go to I54.

  NO : Go to I43.

I43 INSTALL THE FRONT IMPACT SEVERITY SENSOR AND CARRY OUT THE ON-DEMAND SELF TEST

- Clean and repair the mounting surface as necessary.
- Clean the front impact severity sensor mounting bolt.
- Install the front impact severity sensor. Refer to **Front Impact Severity Sensor**.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any fault PIDs for the front impact severity sensor indicating a fault?**

  YES : Go to I44.

  NO : Fault corrected. Go to I54.

I44 CHECK THE FRONT IMPACT SEVERITY SENSOR GROUND CIRCUIT RR129 (YE/GY) FOR HIGH RESISTANCE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Front Impact Severity Sensor C177
- Measure the resistance between front impact severity sensor C177-2, circuit RR129 (YE/GY), harness side and the front impact severity sensor case ground.
- **Is the resistance less than 10 ohms?**

  YES : Go to I46.

  NO : Go to I45.

I45 CLEAN THE FRONT IMPACT SEVERITY SENSOR MOUNTING SURFACE AND CARRY OUT THE ON-DEMAND SELF TEST

- Remove the front impact severity sensor. Refer to **Front Impact Severity Sensor**.
- Clean and repair the mounting surface as necessary.
- Clean the front impact severity sensor mounting bolts.
- Install the front impact severity sensor. Refer to **Front Impact Severity Sensor**.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any fault PIDs for the front impact severity sensor indicating a fault?**

  YES : Go to I46.

  NO : Fault corrected. Go to I54.

I46 CHECK FRONT IMPACT SEVERITY SENSOR CIRCUITS VR213 (VT/GN) AND RR129 (YE/GY) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Front Impact Severity Sensor C177
- Disconnect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

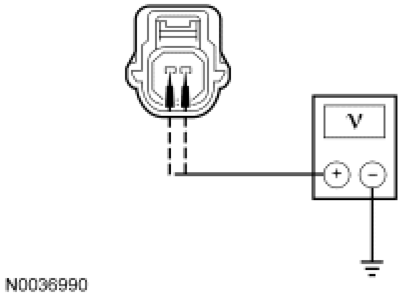


Fig. 79: Checking Front Impact Severity Sensor Circuits VR213 (VT/GN) & RR129 (YE/GY) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between:
  - front impact severity sensor C177-1, circuit VR213 (VT/GN), harness side and ground.
  - front impact severity sensor C177-2, circuit RR129 (YE/GY), harness side and ground.
- **Is any voltage present on either circuit?**

  YES : REPAIR circuit VR213 (VT/GN) or circuit RR129 (YE/GY). Go to I54.

  NO : Go to I47.

I47 CHECK FRONT IMPACT SEVERITY SENSOR CIRCUITS VR213 (VT/GN) AND RR129 (YE/GY) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

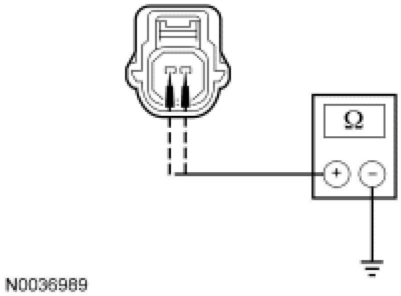


Fig. 80: Checking Front Impact Severity Sensor Circuits VR213 (VT/GN) & RR129 (YE/GY) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between front impact severity sensor C177-1, circuit VR213 (VT/GN), harness side and ground; and between front impact severity sensor C177-2, circuit RR129 (YE/GY), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to I48.

NO : REPAIR circuit VR213 (VT/GN) or circuit RR129 (YE/GY). Go to I54.

I48 CHECK CIRCUIT VR213 (VT/GN) FOR AN OPEN BETWEEN THE RCM AND FRONT IMPACT SEVERITY SENSOR

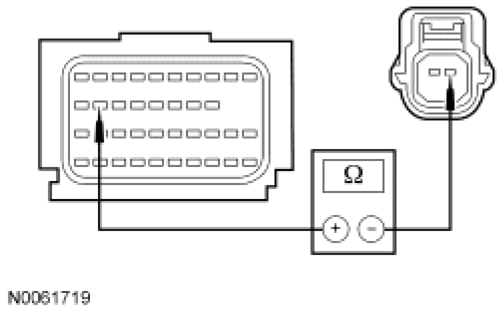


Fig. 81: Checking Circuit VR213 (VT/GN) For An Open Between RCM & Front Impact Severity Sensor
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-19, circuit VR213 (VT/GN), harness side and front impact severity sensor C177-1, circuit VR213 (VT/GN), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to I49.

  NO : REPAIR circuit VR213 (VT/GN). Go to I54.

I49 CHECK CIRCUIT RR129 (YE/GY) FOR AN OPEN BETWEEN THE RCM AND FRONT IMPACT SEVERITY SENSOR

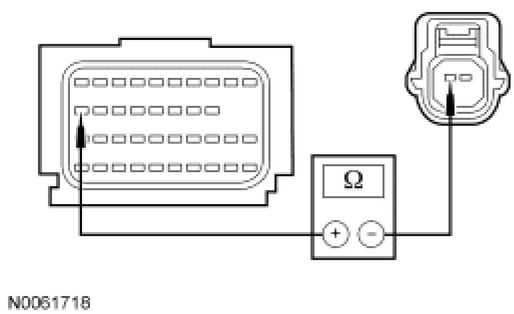


Fig. 82: Checking Circuit RR129 (YE/GY) For An Open Between RCM & Front Impact Severity Sensor
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-20, circuit RR129 (YE/GY), harness side and front impact severity sensor C177-2, circuit RR129 (YE/GY), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to I50.

  NO : REPAIR circuit RR129 (YE/GY). Go to I54.

I50 CHECK FOR A SHORT BETWEEN FRONT IMPACT SEVERITY SENSOR CIRCUITS VR213 (VT/GN) AND RR129 (YE/GY)

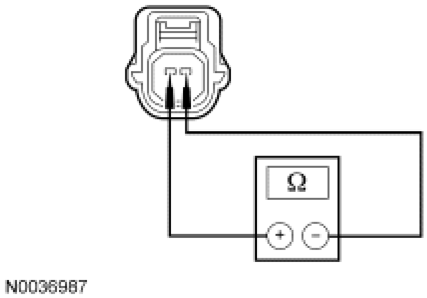


Fig. 83: Checking For A Short Between Front Impact Severity Sensor Circuits VR213 (VT/GN) & RR129 (YE/GY)
Courtesy of FORD MOTOR CO.

- Measure the resistance between front impact severity sensor C177-1, circuit VR213 (VT/GN), harness side and C177-2, circuit RR129 (YE/GY), harness side.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to I51.

  NO : REPAIR circuits VR213 (VT/GN) and RR129 (YE/GY). Go to I54.

I51 CHECK THE FRONT IMPACT SEVERITY SENSOR

- Connect: RCM C310a and C310b
- Install a known good front impact severity sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Were any fault PIDs for the front impact severity sensor indicating a fault?**

  YES : Go to I52.

  NO : Fault corrected. Go to I54.

I52 CONFIRM THE RCM FAULT

NOTE:	**Make sure all restraint system component electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and**

Repowering.

- Install the original impact sensor.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Does the original RCM on-demand DTC B2296 fault PID indicate a fault?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to I54.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to I54.

I53 CHECK FOR AN INTERMITTENT FAULT

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2296 Fault PIDs
  - Refer to PID list in Normal Operation to view B2296 fault PIDs.
- **Do any RCM on-demand DTC B2296 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is now present. The fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

  Using the fault PIDs recorded, go to the appropriate pinpoint test step.

  For 2296_31_OD (Side Crash Sensor Mount or Communication Fault, Front Driver Side), go to I2.

  For 2296_30_OD (Side Crash Sensor Internal Fault, Front Driver Side), INSTALL a new first row driver side impact sensor. REFER to **Side Impact Sensor - B-Pillar**. Go to I54.

  For 2296_29_OD (Side Crash Sensor Mount or Communication Fault, Front Passenger Side), go to I12.

  For 2296_28_OD (Side Crash Sensor Internal Fault, Front Passenger Side), INSTALL a new first row passenger side impact sensor. REFER to **Side Impact Sensor - B-Pillar**. Go to I54.

  For 2296_27_OD (Side Crash Sensor Mount or Communication Fault, Row No.2 Driver Side), go to I22.

  For 2296_26_OD (Side Crash Sensor 2 Internal Fault, Driver side), INSTALL a new second row

driver side impact sensor. REFER to **Side Impact Sensor - C-Pillar**. Go to I54.

For 2296_25_OD (Side Crash Sensor Mount or Communication Fault, Row No.2 Passenger Side), go to I32.

For 2296_24_OD (Side Crash Sensor 2 Internal Fault, Passenger side), INSTALL a new second row passenger side impact sensor. REFER to **Side Impact Sensor - C-Pillar**. Go to I54.

For 2296_19_OD (Driver/Center Front Crash Sensor Mount/Communication Fault), go to I42.

For 2296_18_OD (Driver/Center Front Crash Sensor Internal Fault), INSTALL a new front impact severity sensor. REFER to **Front Impact Severity Sensor**. Go to I54.

NO : The fault is not present and cannot be recreated at this time.

VISUALLY INSPECT the affected impact sensor, mounting surface for damage, corrosion or dirt. INSPECT the wiring, terminals and connectors for damage, corrosion or dirt. CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. ACTIVATE other systems in the same wire harness. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to I54.

I54 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

  WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test J: DTC B2434 - Drivers Seat Belt Buckle Switch Circuit Short to Ground

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and

connector information.

Normal Operation

As part of the supplemental restraint system (SRS), the driver and passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckles are comprised of integrated circuits called Hall-effect switches. The safety belt buckle switches indicate to the restraints control module (RCM) whether the safety belt buckles are buckled or unbuckled.

The RCM supplies current to the safety belt buckle switch. Current flows through the switch, buckled or unbuckled to ground. The RCM will sense the difference in this current draw, 6 mA (unbuckled) or 15 mA (buckled), and use this information in determining the deployment rate of the dual-stage driver and passenger air bag modules. If the RCM detects current out of this range, it will store DTC B2434 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B2434 Drivers Seat Belt Buckle Switch Circuit Short to Ground - If the RCM detects a short to ground on the driver safety belt buckle circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver safety belt buckle switch
- RCM

PINPOINT TEST J: DTC B2434 - DRIVERS SEAT BELT BUCKLE SWITCH CIRCUIT SHORT TO GROUND

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle to the customer.**

J1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2434 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to J2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to J5.

J2 CHECK DRIVER SAFETY BELT BUCKLE SWITCH FOR A SHORT TO GROUND BETWEEN THE RCM

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Buckle Switch C3296
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver safety belt buckle switch disconnected, an open circuit fault would normally be retrieved.
- **Did the driver safety belt buckle switch on-demand DTC change from indicating B2434 to B2691?**

  YES : INSTALL a new driver safety belt buckle assembly. REFER to **SAFETY BELT SYSTEM** article. Go to J6.

  NO : Go to J3.

J3 CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

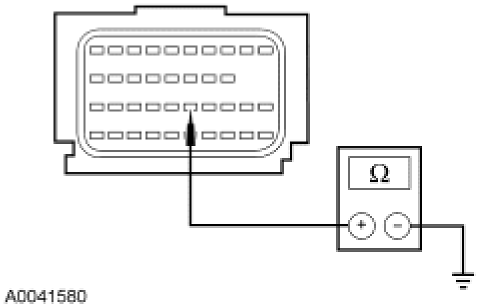


Fig. 84: Checking Driver Safety Belt Buckle Switch Circuit For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure resistance between RCM C310b-25, circuit CR201 (GN/BU), harness side and ground.
- **Is resistance greater than 10,000 ohms?**

  YES : Go to J4.

  NO : REPAIR circuit CR201 (GN/BU). Go to J6.

J4 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system component electrical connectors and the RCM electrical connectors are connected before carrying out the self test. If not, erroneous DTCs will be recorded.

- Connect: Driver Safety Belt Buckle Switch C3296
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2434 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to J6.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to J6.

J5 CHECK FOR AN INTERMITTENT FAULT

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2434 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to J2.

NO : The fault is not present and cannot be recreated at this time.

CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to J6.

J6 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

> WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test K: DTC B2435 - Drivers Seat Belt Buckle Switch Resistance Out of Range

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the supplemental restraint system (SRS), the driver and passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckles are comprised of integrated circuits called Hall-effect switches. The safety belt buckle switches indicate to the restraints control module (RCM) whether the safety belt buckles are buckled or unbuckled.

The RCM supplies current to the safety belt buckle switch. Current flows through the switch, buckled or unbuckled to ground. The RCM will sense the difference in this current draw, 6 mA (unbuckled) or 15 mA (buckled), and use this information in determining the deployment rate of the dual-stage driver and passenger air bag modules. If the RCM detects current out of this range, it will store DTC B2435 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC B2435 Drivers Seat Belt Buckle Switch Resistance Out of Range - If the RCM detects a current out of range between buckled and unbuckled on the driver safety belt buckle switch, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver safety belt buckle and pretensioner assembly
- RCM

PINPOINT TEST K: DTC B2435 - DRIVERS SEAT BELT BUCKLE SWITCH RESISTANCE OUT OF RANGE

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

K1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2435 retrieved?**

YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to K2.

NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to K4.

K2 CHECK THE SAFETY BELT BUCKLE SWITCH

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Safety Belt Buckle Switch C3296
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver safety belt buckle switch disconnected, an open circuit fault would normally be retrieved.
- **Did the driver safety belt buckle switch on-demand DTC change from indicating B2435 to B2691?**

  YES : INSTALL a new driver safety belt buckle assembly. REFER to **SAFETY BELT SYSTEM** article. Go to K5.

  NO : Go to K3.

K3 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Driver Safety Belt Buckle Switch C3296
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2435 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to K5.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to K4.

K4 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect the driver safety belt buckle switch C3296:
  - inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.

  - inspect wire harness for any damage, pinched, cut or pierced wires.
  - repair any concerns found. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information.
- Connect: All Previously Disconnected Component(s) - Connector(s)
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2435 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test.

  Go to K2.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to K5.

K5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test L: DTC B2438 - Passengers Seat Belt Buckle Switch Short to Ground

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and

connector information.

Normal Operation

As part of the supplemental restraint system (SRS), the driver and passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckles are comprised of integrated circuits called Hall-effect switches. The safety belt buckle switches indicate to the restraints control module (RCM) whether the safety belt buckles are buckled or unbuckled.

The RCM supplies current to the safety belt buckle switch. Current flows through the switch, buckled or unbuckled to ground. The RCM will sense the difference in this current draw, 6 mA (unbuckled) or 15 mA (buckled), and use this information in determining the deployment rate of the dual-stage driver and passenger air bag modules. If the RCM detects current out of this range, it will store DTC B2438 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

- DTC B2438 Passenger's Seat Belt Buckle Switch Circuit Short to Ground - If the RCM detects a short to ground on the passenger safety belt buckle circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Passenger safety belt buckle switch
- RCM

PINPOINT TEST L: DTC B2438 - PASSENGERS SEAT BELT BUCKLE SWITCH SHORT TO GROUND

WARNING: Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

L1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2438 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to L2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to L5.

L2 CHECK CIRCUIT CR203 (GY/VT) FOR A SHORT TO GROUND BETWEEN THE RCM AND PASSENGER SAFETY BELT BUCKLE SWITCH

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Belt Buckle Switch C3295/C3301
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the passenger safety belt buckle switch disconnected, an open circuit fault would normally be retrieved.
- **Did the passenger safety belt buckle switch on-demand DTC change from indicating B2438 to B2692?**

  YES : INSTALL a new passenger safety belt buckle assembly. REFER to **SAFETY BELT SYSTEM** article. Go to L6.

  NO : Go to L3.

L3 CHECK THE SAFETY BELT BUCKLE SWITCH

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

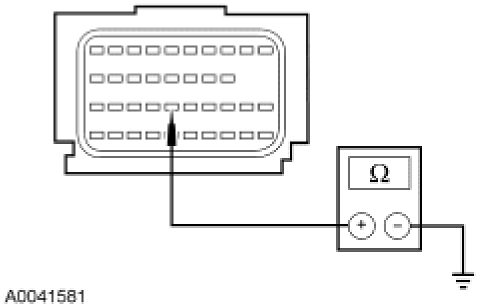


Fig. 85: Checking Safety Belt Buckle Switch
Courtesy of FORD MOTOR CO.

- Measure the resistance between RCM C310b-26, circuit CR203 (GY/VT), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to L4.

  NO : REPAIR circuit CR203 (GY/VT). Go to L6.

L4 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Connect: Passenger Safety Belt Buckle Switch C3295/C3301
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2438 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to L6.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to L5.

L5 CHECK FOR AN INTERMITTENT FAULT

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2438 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to L2.

  NO : The fault is not present and cannot be recreated at this time.

CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to L6.

L6 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

> WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test M: DTC B2439 - Passengers Seat Belt Buckle Switch Resistance Out of Range

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the supplemental restraint system (SRS), the driver and passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckles are comprised of integrated circuits called Hall-effect switches. The safety belt buckle switches indicate to the restraints control module (RCM) whether the safety belt buckles are buckled or unbuckled.

The RCM supplies current to the safety belt buckle switch. Current flows through the switch, buckled or unbuckled to ground. The RCM will sense the difference in this current draw, 6 mA (unbuckled) or 15 mA (buckled), and use this information in determining the deployment rate of the dual-stage driver and passenger air bag modules. If the RCM detects current out of this range, it will store DTC B2439 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

- DTC B2439 Passengers Seat Belt Buckle Switch Resistance Out of Range - If the RCM detects a current out of range between buckled and unbuckled on the passenger safety belt buckle switch, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Passenger safety belt buckle switch
- RCM

PINPOINT TEST M: DTC B2439 - PASSENGERS SEAT BELT BUCKLE SWITCH RESISTANCE OUT OF RANGE

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle to the customer.**

M1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2439 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to M2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to M4.

M2 CHECK THE SAFETY BELT BUCKLE SWITCH

NOTE: **This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the**

fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Safety Belt Buckle Switch C3295/C3301
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the passenger safety belt buckle switch disconnected, an open circuit fault would normally be retrieved.
- **Did the passenger safety belt buckle switch on-demand DTC change from indicating B2439 to B2692?**

  YES : INSTALL a new passenger safety belt buckle assembly. REFER to **SAFETY BELT SYSTEM** article. Go to M5.

  NO : Go to M3.

M3 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Passenger Safety Belt Buckle Switch C3295/C3301
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2439 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to M5.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to M4.

M4 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Disconnect the passenger safety belt buckle switch C3295/C3301:
    - inspect connector(s) (including any inline connectors) for corrosion, loose or spread terminals and loose or frayed wire connections at terminals.
    - inspect wire harness for any damage, pinched, cut or pierced wires.
    - repair any concerns found. Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Connector Repair Procedures for schematic and connector information.
- Connect: All Previously Disconnected Component(s)/Connector(s)
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2439 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to M2.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to M5.

M5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
    - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test N: DTC B2691 - Seat Belt Buckle Switch Circuit Fault, Front Driver's Side

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the supplemental restraint system (SRS), the driver and passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckles are comprised of integrated circuits called Hall-effect switches. The safety belt buckle switches indicate to the restraints control module (RCM) whether the safety belt buckles are buckled or unbuckled.

The RCM supplies current to the safety belt buckle switch. Current flows through the switch, buckled or unbuckled to ground. The RCM will sense the difference in this current draw, 6 mA (unbuckled) or 15 mA (buckled), and use this information in determining the deployment rate of the dual-stage driver and passenger air bag modules.

If the RCM detects an open circuit or short to voltage fault, it will store DTC B2691 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

NOTE: **When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.**

- DTC B2691 Seat Belt Buckle Switch Circuit Fault, Front Driver's Side - If the RCM detects an open or short to voltage on the driver safety belt buckle switch circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver safety belt buckle switch
- RCM

PINPOINT TEST N: DTC B2691 - SEAT BELT BUCKLE SWITCH CIRCUIT FAULT, FRONT DRIVER'S SIDE

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected**

or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

N1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2691 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to N2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to N7.

N2 CHECK DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR AN OPEN BETWEEN THE RCM

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Disconnect: Driver Safety Belt Buckle Switch C3296

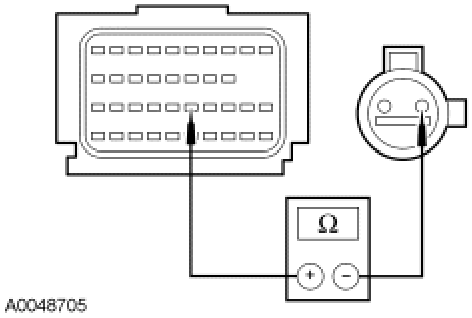


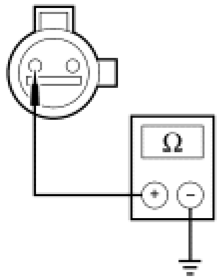
Fig. 86: Checking Driver Safety Belt Buckle Switch Circuit For An Open Between RCM
Courtesy of FORD MOTOR CO.

- Measure resistance between RCM C310b-25, circuit CR201 (GN/BU), harness side and driver safety belt buckle switch C3296-2, circuit CR201 (GN/BU), harness side.
- **Is resistance less than 0.5 ohm?**

  YES : Go to N3.

  NO : REPAIR circuit CR201 (GN/BU). Go to N8.

N3 CHECK CIRCUIT GD127 (BK/BU) FOR AN OPEN



A0048711

Fig. 87: Checking Circuit GD127 (BK/BU) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver safety belt buckle switch C3296-1, circuit GD127 (BK/BU), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to N4.

  NO : REPAIR circuit GD127 (BK/BU). Go to N8.

N4 CHECK CIRCUIT CR201 (GN/BU) FOR A SHORT TO VOLTAGE

- Disconnect: Driver Seat Side Air Bag Module C328
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

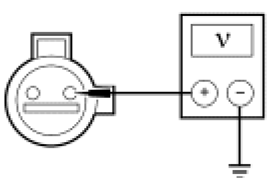


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Fig. 88: Checking Circuit CR201 (GN/BU) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver safety belt buckle switch C3296-2, circuit CR201 (GN/BU), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR circuit CR201 (GN/BU). Go to N8.

  NO : Go to N5.

N5 CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH

NOTE: **This pinpoint test step will attempt to change the fault reported by the**

RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: RCM C310a and C310b
- Connect a fused jumper wire between driver safety belt buckle switch C3296-2, circuit CR201 (GN/BU), harness side and C3296-1, circuit GD127 (BK/BU), harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver safety belt buckle switch circuits shorted together, a short to ground fault would normally be retrieved.
- **Did the driver safety belt buckle switch on-demand DTC change from indicating B2691 to B2434?**

  YES : INSTALL a new driver safety belt buckle assembly. REFER to **SAFETY BELT SYSTEM** article. Go to N8.

  NO : Go to N6.

N6 CONFIRM THE RCM FAULT

NOTE: **Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the fused jumper wire from driver safety belt buckle switch C3296.
- Connect: Driver Safety Belt Buckle Switch C3296
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2691 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to N8.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to N7.

N7 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Seat Side Air Bag Module C328
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2691 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to N2.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to N8.

N8 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test O: DTC B2692 - Front Passenger's Seat Belt Buckle Switch Circuit Fault

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the supplemental restraint system (SRS), the driver and passenger safety belt buckles are equipped with safety belt buckle switches. The safety belt buckles are comprised of integrated circuits called Hall-effect switches. The safety belt buckle switches indicate to the restraints control module (RCM) whether the safety belt buckles are buckled or unbuckled.

The RCM supplies current to the safety belt buckle switch. Current flows through the switch, buckled or unbuckled to ground. The RCM will sense the difference in this current draw, 6 mA (unbuckled) or 15 mA (buckled), and use this information in determining the deployment rate of the dual-stage driver and passenger air bag modules.

If the RCM detects an open circuit or short to voltage fault, it will store DTC B2692 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

- DTC B2692 Front Passenger's Safety Belt Buckle Switch Circuit Fault - If the RCM detects an open or short to voltage on the passenger safety belt buckle switch circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Passenger safety belt buckle switch
- RCM

PINPOINT TEST O: DTC B2692 - FRONT PASSENGER'S SEAT BELT BUCKLE SWITCH CIRCUIT FAULT

WARNING: Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

O1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2692 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to O2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to O7.

O2 CHECK CIRCUIT CR203 (GY/VT) FOR AN OPEN BETWEEN THE RCM AND PASSENGER SAFETY BELT BUCKLE SWITCH

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Disconnect: Passenger Safety Belt Buckle Switch C3295/C3301

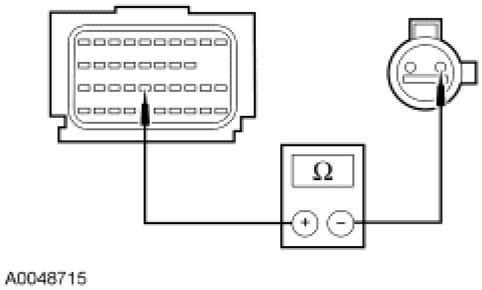


Fig. 89: Checking Circuit CR203 (GY/VT) For An Open Between RCM & Passenger Safety Belt Buckle Switch
Courtesy of FORD MOTOR CO.

NOTE: MKZ shown, Fusion/Milan similar.

- Measure the resistance between RCM C310b-26, circuit CR203 (GY/VT), harness side and the passenger safety belt buckle switch C3295-2 (Fusion/Milan), 3301-2 (MKZ), circuit CR203 (GY/VT), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to O3.

  NO : REPAIR circuit CR203 (GY/VT). Go to O8.

O3 CHECK CIRCUIT GD127 (BK/BU) FOR AN OPEN

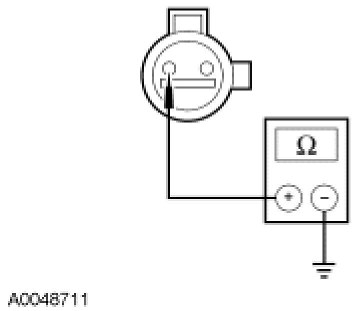


Fig. 90: Checking Circuit GD127 (BK/BU) For An Open
Courtesy of FORD MOTOR CO.

NOTE: MKZ shown, Fusion/Milan similar.

- Measure the resistance between passenger safety belt buckle switch C3295-1 (Fusion/Milan), 3301-1 (MKZ), circuit GD127 (BK/BU), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to O4.

  NO : REPAIR circuit GD127 (BK/BU). Go to O8.

O4 CHECK CIRCUIT CR203 (GY/VT) FOR A SHORT TO VOLTAGE

- Disconnect: Passenger Seat Side Air Bag Module C313
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

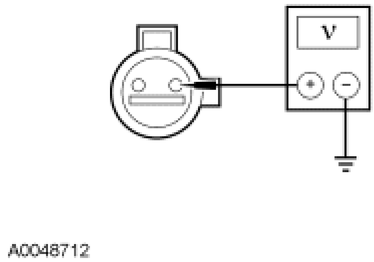


Fig. 91: Checking Circuit CR203 (GY/VT) For A Short To Voltage
Courtesy of FORD MOTOR CO.

NOTE: MKZ shown, Fusion/Milan similar.

- Measure the voltage between passenger safety belt buckle switch C3295-2 (Fusion/Milan), 3301-2 (MKZ), circuit CR203 (GY/VT), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR circuit CR203 (GY/VT). Go to O8.

NO : Go to O5.

O5 CHECK THE SAFETY BELT BUCKLE SWITCH

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: RCM C310a and C310b
- Connect a fused jumper wire between passenger safety belt buckle switch C3295-2 (Fusion/Milan), 3301-2 (MKZ), circuit CR203 (GY/VT), harness side and C3295-1 (Fusion/Milan), 3301-1 (MKZ), circuit GD183 (BK/WH), harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the passenger safety belt buckle switch circuits shorted together, a short to ground fault would normally be retrieved.
- **Did the passenger safety belt buckle switch on-demand DTC change from indicating B2692 to B2438?**

  YES : INSTALL a new passenger safety belt buckle assembly. REFER to **SAFETY BELT SYSTEM** article. Go to O8.

  NO : Go to O6.

O6 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the fused jumper wire from passenger safety belt buckle switch C3295/C3301.
- Connect: Passenger Safety Belt Buckle Switch C3295/C3301
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2692 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to O8.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK

for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to O7.

O7 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Passenger Seat Side Air Bag Module C314
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC B2692 retrieved?**

YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to O2.

NO : The fault is not present and cannot be recreated at this time.

CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to O8.

O8 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test P: DTC B2792 - Cross Link Between Firing Loops

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

The restraints control module (RCM) monitors all the deployable devices for a cross link between the circuits of another deployable device. If the RCM detects a short between the circuits of the deployable devices, it will store DTC B2792 and send a message to the instrument cluster (IC) module to illuminate the air bag indicator.

Fault PIDs[a]	Description	Fault Trigger Condition
2792_8_OD and 2792_8_CM	A-B or A-C pillar Curtain, Passenger Side	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_9_OD and 2792_9_CM	A-B or A-C pillar Curtain, Driver Side	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_12_OD and 2792_12_CM	Side Airbag Passenger	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_13_OD and 2792_13_CM	Side Airbag Driver	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_26_OD and 2792_26_CM	Pretensioner Passenger	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_27_OD and 2792_27_CM	Pretensioner Driver	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_28_OD and 2792_28_CM	Airbag Passenger Front Loop #2	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_29_OD and 2792_29_CM	Airbag Passenger Front Loop #1	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.
2792_30_OD and 2792_30_CM	Airbag Driver Front Loop #2	When the RCM detects a short between the circuits of 2 deployable devices, a fault

		will be indicated.
2792_31_OD and 2792_31_CM	Airbag Driver Front Loop #1	When the RCM detects a short between the circuits of 2 deployable devices, a fault will be indicated.

[a] Fault PIDs that end in OD indicate an on-demand status and are associated with on-demand DTC B2792. Fault PIDs that end in CM indicate continuous memory status and are associated with continuous DTC B2792.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- RCM

PINPOINT TEST P: DTC B2792 - CROSS LINK BETWEEN FIRING LOOPS FAULT

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

P1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record

All B2792 Fault PIDs

- Refer to PID list in Normal Operation to view B2792 fault PIDs.

- **Do any RCM on-demand DTC B2792 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to P2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to P4.

P2 CHECK DEPLOYABLE CIRCUITS FOR A CROSS LINK FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Disconnect **ALL of the affected** deployable devices.
- Using the fault PIDs recorded and the following table, measure the resistance between the circuits of the affected deployable devices.

DEPLOYABLE DEVICES

Fault PID (loop/deployable device)	Connector - Pin	Circuit
2792_31_OD (Airbag Driver Front Loop #1)	• C310a-3 • C310a-4	• RR101 (YE/GN) • CR101 (VT/BN)
2792_30_OD (Airbag Driver Front Loop #2)	• C310a-15 • C310a-16	• RR102 (WH) • CR102 (BU)
2792_29_OD (Airbag Passenger Front Loop #1)	• C310a-1 • C310a-2	• CR103 (GY/BU) • RR103 (VT/GN)
2792_28_OD (Airbag Passenger Front Loop #2)	• C310a-5 • C310a-6	• CR104 (YE/GY) • RR104 (WH/BU)
2792_13_OD (Side Airbag Driver)	• C310b-7 • C310b-8	• RR105 (GY/YE) • CR105 (GN/BU)
	• C310b-	• CR106

2792_12_OD (Side Airbag Passenger)	9 • C310b-10	(VT/GY) • RR106 (YE/OG)
2792_9_OD (A-B or A-C pillar Curtain, Driver Side)	• C310b-21 • C310b-22	• CR109 (BN/BU) • RR109 (BU/GN)
2792_8_OD (A-B or A-C pillar Curtain, Passenger Side)	• C310b-1 • C310b-2	• CR111 (BN/WH) • RR111 (YE/VT)
2792_27_OD (Pretensioner Driver)	• C310b-31 • C310b-32	• CR120 (BU/OG) • RR120 (BN/GN)
2792_26_OD (Pretensioner Passenger)	• C310b-33 • C310b-34	• RR121 (VT) • CR121 (GY/VT)

- **Are the resistances greater than 10,000 ohms between the affected circuits?**

  YES : Go to P3.

  NO : REPAIR the affected circuits. Go to P5.

P3 CONFIRM THE RCM FAULT

NOTE: **Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Connect: RCM C310a and C310b
- Connect: All Previously Disconnected SRS Components
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2792 Fault PIDs
  - Refer to PID list in Normal Operation to view B2792 fault PIDs.
- **Does the original RCM on-demand DTC B2792 fault PID indicate a fault?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to P5.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and

terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to P5.

P4 CHECK FOR AN INTERMITTENT FAULT

- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- If a cross link fault for driver air bag loop 1 or loop 2 is present continuous, remove the driver air bag module. Refer to **Driver Air Bag Module**.
- If a cross link fault for passenger air bag module loop 1 or loop 2 is present continuous, remove the passenger air bag module. Refer to **Passenger Air Bag Module**.
- If a cross link fault for driver seat side air bag is present continuous, disconnect the driver seat side air bag module C327.
- If a cross link fault for passenger seat side air bag is present continuous, disconnect the passenger seat side air bag module C313.
- If a cross link fault for driver side air curtain module is present continuous, disconnect the driver side air curtain module C3055.
- If a cross link fault for passenger side air curtain module is present continuous, disconnect the passenger side air curtain module C3056.
- If a cross link fault for driver safety belt retractor pretensioner is present continuous, disconnect the driver safety belt retractor pretensioner C323.
- If a cross link fault for passenger safety belt retractor pretensioner is present continuous, disconnect the passenger safety belt retractor pretensioner C3202.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- Enter the following diagnostic mode on the diagnostic tool: DataLogger - RCM - View and Record All B2792 Fault PIDs
  - Refer to PID list in Normal Operation to view B2792 fault PIDs.
- **Do any on-demand DTC B2792 fault PIDs indicate a fault?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to P2.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness, cycling the ignition key frequently and rotating the steering wheel (driver air bag module fault). **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to P5.

P5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test Q: DTC B229A - Occupant Classification System Contamination (Rail Type System)

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

The occupant classification sensor (OCS) system is used to classify the front passenger seat occupant in the event of a deployable impact. Refer to **Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)**.

The occupant classification system module (OCSM) monitors the 2 OCS rails (weight sensors) and circuity for faults. If the OCSM detects an object within the OCS rails, it will store DTC B229A in memory and send a message to the restraints control module (RCM) which sends a message to the instrument cluster (IC) module to illuminates the air bag indicator.

- DTC B229A Occupant Classification System Contamination - If the OCSM detects foreign object (s)/substance in one or both OCS rails (weight sensors), it will set this DTC.

This pinpoint test is intended to diagnose the following:

- A foreign object within an occupant classification sensor rail
- OCS system component

PINPOINT TEST Q: DTC B229A - OCCUPANT CLASSIFICATION SYSTEM CONTAMINATION

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

Q1 CHECK FOR CONTINUOUS OR ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM
- **Was OCSM on-demand DTC B229A retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to Q2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to Q5.

Q2 INSPECT THE OCS RAILS

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the passenger seat. Refer to **SEATING** article.
- Remove the affected OCS rail and inspect for the presence of any foreign objects. Refer to **Occupant Classification Sensor**.
- **Were any problems noted?**

  YES : REPAIR as necessary. Go to Q6.

  NO : Go to Q3.

Q3 INSTALL A NEW OCS RAIL

- Install a new OCS rail. Refer to **Occupant Classification Sensor**.
- Install the passenger seat. Refer to **SEATING** article.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM
- **Was OCSM on-demand DTC B229A retrieved?**

  YES : Go to Q4.

  NO : Fault corrected. Go to Q6.

Q4 CONFIRM OCS MODULE FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the passenger seat. Refer to **SEATING** article.
- Install the original OCS rail. Refer to **Occupant Classification Sensor**.
- Install the passenger seat. Refer to **SEATING** article.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM
- **Was OCSM on-demand DTC B229A retrieved?**

  YES : INSTALL a new OCSM. REFER to **Occupant Classification System Module (OCSM)**. Go to Q6.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to Q6.

Q5 CHECK FOR AN INTERMITTENT FAULT

- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM
- **Was OCSM on-demand DTC B229A retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to Q2.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to Q6.

Q6 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test R: DTC B229B - Occupant Classification System Obstruction

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

The occupant classification sensor (OCS) system is used to classify the front passenger seat occupant in the event of a deployable impact. Refer to **Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)**.

The occupant classification system module (OCSM) monitors the weight sensors and circuitry for faults. If the OCSM detects an obstruction on one or all OCS weight sensors, it will store DTC B229B in memory and send a message to the restraints control module (RCM) which sends a message to the instrument cluster (IC) module to illuminates the air bag indicator.

- DTC B229B Occupant Classification System Obstruction - If the OCSM detects a negative force on one or all OCS weight sensors, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- A foreign object placed under or contacting the passenger seat
- OCS system component(s)

PINPOINT TEST R: DTC B229B - OCCUPANT CLASSIFICATION SYSTEM OBSTRUCTION

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of**

serious personal injury or death.

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

R1 CHECK FOR CONTINUOUS OR ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM
- **Was OCSM on-demand DTC B229B retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to R2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to R5.

R2 INSPECT THE OCS SYSTEM

- Key in OFF position.
- Position the seat and inspect under the seat for the presence of any foreign objects contacting the under side of the seat.
- **Were any problems noted?**

  YES : REPAIR as necessary. Go to R6.

  NO : Go to R3.

R3 CHECK THE OCS

- Key in ON position.
- Carry out the Zero Seat Weight Test. **Do not carry out System Reset at this time.** Refer to **Occupant Classification Sensor (OCS) System Zero Seat Weight Test**.
- **Was DTC C1941 retrieved during the Zero Seat Weight Test?**

  YES : INSTALL 2 new OCS rails. REFER to **Occupant Classification Sensor**. Go to R6.

  NO : Go to R4.

R4 CONFIRM OCS MODULE FAULT

- Key in OFF position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM
- **Was OCSM on-demand DTC B229B retrieved?**

YES : INSTALL a new OCSM. REFER to **Occupant Classification System Module (OCSM)**. Go to R6.

NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to R6.

R5 CHECK FOR AN INTERMITTENT FAULT

- Enter the following diagnostic mode on the diagnostic tool: Self Test - OCSM
- **Was OCSM on-demand DTC B229B retrieved?**

YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to R2.

NO : The fault is not present and cannot be recreated at this time.

CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by moving/positioning the passenger seat. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to R6.

R6 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test S: DTC C1946 - Front Driver's Seat Track Position Switch Circuit Open

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and

connector information.

Normal Operation

As part of the supplemental restraint system (SRS), the driver seat is equipped with a seat track position sensor. The seat track position sensor is comprised of integrated circuits called Hall-effect switch. The seat track position sensor indicates to the restraints control module (RCM) the position of the driver seat, forward or rearward.

The RCM supplies current to the seat track position sensor. Current flows through the switch, both in the forward or rearward seat position to ground. The RCM will sense the difference in this current draw, 6 mA (forward) or 15 mA (rearward), and use this information in determining the deployment rate of the dual-stage driver air bag module. If the RCM detects current out of range, it will store C1946 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

- DTC C1946 Front Driver's Seat Track Position Switch Circuit Open - If the RCM detects a open on the driver seat track position sensor circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver seat track position sensor
- RCM

PINPOINT TEST S: DTC C1946 - FRONT DRIVER'S SEAT TRACK POSITION SWITCH CIRCUIT OPEN

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

S1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC C1946 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to S2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to S6.

S2 CHECK CIRCUIT RR137 (BU/GY) FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Seat Track Position Sensor C356
- Connect a fused jumper wire between driver seat track position sensor C356-2, circuit RR137 (BU/GY), harness side and C356-1, circuit GD127 (BK/BU), harness side.
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver seat track position sensor circuits shorted together, a short to ground fault would normally be retrieved.
- **Did the driver seat track position switch on-demand DTC change from indicating C1946 to C1947?**

  YES : INSTALL a new seat track position sensor. REFER to **Seat Position Sensor**. Go to S7.

  NO : Go to S3.

S3 CHECK CIRCUIT RR137 (BU/GY) FOR AN OPEN

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Remover the jumper wire from the driver seat track position sensor C356.
- Measure the resistance between RCM C310b-23, circuit RR137 (BU/GY), harness side and driver seat track position sensor C356-2, circuit RR137 (BU/GY), harness side.
- **Is the resistance less than 0.5 ohm?**

  YES : Go to S4.

  NO : REPAIR circuit RR137 (BU/GY). Go to S7.

S4 CHECK CIRCUIT GD127 (BK/BU) FOR AN OPEN

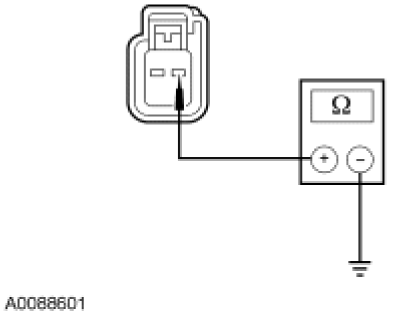


Fig. 92: Checking Circuit GD127 (BK/BU) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat track position sensor C356-1, circuit GD127 (BK/BU) and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to S5.

  NO : REPAIR GD127 (BK/BU). Go to S7.

S5 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Connect: Driver Seat Track Position Sensor C356
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC C1946 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to S7.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to S7.

S6 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

- Disconnect: Driver Side Air Bag Module C328
- Repower the SRS. **Do not** prove out the system at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC C1946 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to S2.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to S7.

S7 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test T: DTC C1947 - Front Driver's Seat Track Position Switch Circuit Short to Ground

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the supplemental restraint system (SRS), the driver seat is equipped with a seat track position sensor. The seat track position sensor is comprised of integrated circuits called Hall-effect switch. The seat track

position sensor indicates to the restraints control module (RCM) the position of the driver seat, forward or rearward.

The RCM supplies current to the seat track position sensor. Current flows through the switch, both in the forward or rearward seat position to ground. The RCM will sense the difference in this current draw, 6 mA (forward) or 15 mA (rearward), and use this information in determining the deployment rate of the dual-stage driver air bag module. If the RCM detects current out of range, it will set a DTC.

If the RCM detects a short to ground, it will store DTC C1947 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

- DTC C1947 Front Driver's Seat Track Position Switch Circuit Short to Ground - If the RCM detects a short to ground on the driver seat track position sensor circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver seat track position sensor
- RCM

PINPOINT TEST T: DTC C1947 - FRONT DRIVER'S SEAT TRACK POSITION SWITCH CIRCUIT SHORT TO GROUND

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle to the customer.**

T1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC C1947 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is

corrected and the DTC is no longer retrieved during the on-demand self test. Go to T2.

NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to T5.

T2 CHECK CIRCUIT RR137 (BU/GY) FOR A SHORT TO GROUND BETWEEN THE RCM AND SEAT TRACK POSITION SENSOR

NOTE:	**This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Seat Track Position Sensor C356
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver seat track position sensor disconnected, an open circuit fault would normally be retrieved.
- **Did the driver seat track position switch on-demand DTC change from indicating C1947 to C1981?**

  YES : INSTALL a new driver seat track position sensor. REFER to **Seat Position Sensor**. Go to T6.

  NO : Go to T3.

T3 CHECK THE SEAT TRACK POSITION SENSOR CIRCUIT RR137 (BU/GY) FOR A SHORT TO GROUND

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b

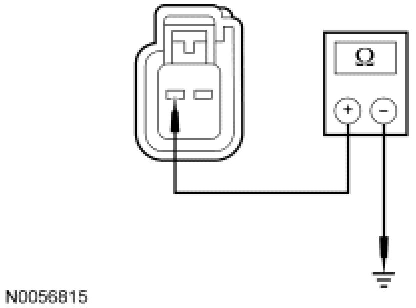


Fig. 93: Checking Seat Track Position Sensor Circuit RR137 (BU/GY) For A Short To Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between driver seat track position sensor C356-2, circuit RR137 (BU/GY) and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to T4.

  NO : REPAIR circuit RR137 (BU/GY). Go to T6.

T4 CONFIRM THE RCM FAULT

NOTE: Make sure all restraint system components, sensor electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: Seat Track Position Sensor C356
- Connect: RCM C310a and C310b
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC C1947 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to T6.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to T5.

T5 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Seat Side Air Bag Module C328
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC C1947 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to T2.

  NO : The fault is not present and cannot be recreated at this time.

CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to T6.

T6 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
    - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test U: DTC C1948 - Front Driver's Seat Track Position Switch Circuit Resistance Out of Range

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

NOTE: **Due to the seat track position sensor being a Hall-effect type sensor, this pinpoint test will be diagnosing a current out of range fault instead of the current DTC definition for a resistance out of range fault.**

Normal Operation

As part of the supplemental restraint system (SRS), the driver seat is equipped with a seat track position sensor. The seat track position sensor is comprised of integrated circuits called Hall-effect switch. The seat track position sensor indicate to the restraints control module (RCM) the position of the driver seat, forward or rearward.

The RCM supplies current to the seat track position sensor. Current flows through the switch, both in the forward or rearward seat position to ground. The RCM will sense the difference in this current draw, 6 mA (forward) or 15 mA (rearward), and use this information in determining the deployment rate of the dual-stage driver air bag module. If the RCM detects current out of range, it will set a DTC.

If the RCM detects a current out of range condition, it will store DTC C1948 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

NOTE: When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.

- DTC C1948 Front Driver's Seat Track Position Switch Circuit Resistance out of Range - If the RCM detects a current out of range between forward and rearward on the driver seat track position switch, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Driver seat track position sensor
- RCM

PINPOINT TEST U: DTC C1948 - FRONT DRIVER'S SEAT TRACK POSITION SWITCH CIRCUIT RESISTANCE OUT OF RANGE

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.

NOTE: Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

U1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC C1948 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to U2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not

retrieved on demand). The fault condition is not present at this time. Go to U4.

U2 CHECK THE DRIVER SEAT TRACK POSITION SENSOR

NOTE: This pinpoint test step will attempt to change the fault reported by the RCM by inducing a different fault condition. If the fault reported changes, this indicates the RCM is functioning correctly and is not the source of the fault.

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Seat Track Position Sensor C356
- Connect a fused jumper wire between driver seat track position sensor C356-2, circuit RR137 (BU/GY), harness side and C356-1, circuit GD127 (BK/BU), harness side.
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **DIAGNOSTIC TIP:** When viewing on-demand DTCs with the driver seat track position sensor circuits shorted together, a short to ground fault would normally be retrieved.
- **Did the driver seat track position sensor on-demand DTC change from indicating C1948 to C1947?**

  YES : INSTALL a new driver seat track position sensor. REFER to **Seat Position Sensor**. Go to U5.

  NO : Go to U3.

U3 CONFIRM THE RCM FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Remove the fused jumper wire from the driver seat track position sensor.
- Connect: Driver Seat Track Position Sensor C356
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC C1948 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to U5.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to U5.

U4 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Seat Side Air Bag Module C328
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC C1948 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to U2.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to U5.

U5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

> WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

- Reconnect all SRS components (if previously disconnected).
  - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

Pinpoint Test V: DTC C1981 - Front Driver's Seat Track Position Switch Circuit Fault

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Supplemental Restraint System for schematic and connector information.

Normal Operation

As part of the supplemental restraint system (SRS), the driver seat is equipped with a seat track position sensor. The seat track position sensor is comprised of integrated circuits called Hall-effect switch. The seat track position sensor indicate to the restraints control module (RCM) the position of the driver seat, forward or rearward.

The RCM supplies current to the seat track position sensor. Current flows through the switch, both in the forward or rearward seat position to ground. The RCM will sense the difference in this current draw, 6 mA (forward) or 15 mA (rearward), and use this information in determining the deployment rate of the dual-stage driver air bag module. If the RCM detects current out of range, it will set a DTC.

If the RCM detects an open circuit or a short to battery on the driver seat track position sensor, it will store DTC C1981 in memory and send a message to the instrument cluster (IC) module to illuminate the air bag warning indicator.

NOTE: **When monitoring fault and/or resistance PIDs with the scan tool, it may take up to 2 seconds for the scan tool display to update.**

- DTC C1981 Front Driver's Seat Track Position Switch Circuit Fault - If the RCM detects a short to voltage on the driver seat track position sensor circuit, it will set this DTC.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- RCM

PINPOINT TEST V: DTC C1981 - FRONT DRIVER'S SEAT TRACK POSITION SWITCH CIRCUIT FAULT

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: **Use the correct probe adapter(s) from the Flex Probe Kit when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

NOTE: **Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test.**

NOTE: **Supplemental restraint system (SRS) components should only be disconnected or reconnected when instructed to do so within a pinpoint test step. Failure to follow this instruction may result in incorrect diagnosis of the SRS.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle**

to the customer.

V1 CHECK FOR CONTINUOUS AND ON-DEMAND DTCs

- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC C1981 retrieved?**

  YES : This is a hard fault. The fault condition is still present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to V2.

  NO : This is an intermittent fault when present as a continuous memory DTC only (DTC not retrieved on demand). The fault condition is not present at this time. Go to V4.

V2 CHECK CIRCUIT RR137 (BU/GY) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: RCM C310a and C310b
- Disconnect: Driver Seat Track Position Sensor C356
- Disconnect: Driver Seat Side Air Bag Module C328
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.

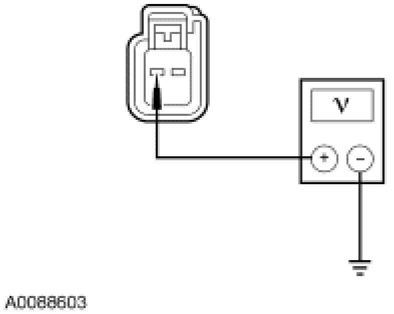


Fig. 94: Checking Circuit RR137 (BU/GY) For A Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between driver seat track position sensor C356-2, circuit RR137 (BU/GY), harness side and ground.
- **Is any voltage present?**

  YES : REPAIR circuit RR137 (BU/GY). Go to V5.

  NO : Go to V3.

V3 CONFIRM THE RCM FAULT

NOTE:	**Make sure all restraint system component electrical connectors and the RCM electrical connectors are connected before carrying out the on-demand self test. If not, erroneous DTCs will be recorded.**

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Connect: RCM C310a and C310b
- Connect: Driver Seat Track Position Sensor C356
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC C1981 retrieved?**

  YES : INSTALL a new RCM. REFER to **Restraints Control Module (RCM)**. Go to V5.

  NO : In the process of diagnosing the fault, the fault condition has become intermittent. CHECK for causes of the intermittent fault in the areas previously worked in, particularly the pins and terminals of electrical connectors that were disconnected. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to V4.

V4 CHECK FOR AN INTERMITTENT FAULT

- Key in OFF position.
- Depower the SRS. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Disconnect: Driver Seat Side Air Bag Module C328
- Repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - RCM
- **Was RCM on-demand DTC C1981 retrieved?**

  YES : This is a hard fault. The fault condition is now present. This fault cannot be cleared until it is corrected and the DTC is no longer retrieved during the on-demand self test. Go to V2.

  NO : The fault is not present and cannot be recreated at this time.

  CHECK for causes of the intermittent fault. ATTEMPT to recreate the hard fault by flexing the wire harness and cycling the ignition key frequently. **Do not install any new SRS components at this time. SRS components should only be installed when directed to do so in the pinpoint test.** REPAIR any intermittent wiring, terminal or connector concerns found. Go to V5.

V5 CHECK FOR ADDITIONAL SRS DTCs

- Key in OFF position.

WARNING: **Turn the ignition OFF and wait one minute to deplete the backup power supply. Failure to follow this instruction may**

result in serious personal injury or death in the event of an accidental deployment.

- Reconnect all SRS components (if previously disconnected).
    - If previously directed to depower the SRS, repower the SRS. **Do not** prove out the SRS at this time. Refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Self Test - Restraints
- **Are any RCM and/or OCSM DTCs retrieved indicating a fault?**

  YES : Do not clear any DTCs until all DTCs have been resolved. Go to the **Supplemental Restraint System (SRS) DTC Chart** for pinpoint test direction.

  NO : CLEAR all RCM and OCSM DTCs. PROVE OUT the SRS. REPAIR is complete. RETURN the vehicle to the customer.

GENERAL PROCEDURES

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEPOWERING AND REPOWERING

Special Tools

Illustration	Tool Name	Tool Number
 ST1385-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

Depowering Procedure

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

WARNING: **To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.**

NOTE: **The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

1. Turn all vehicle accessories OFF.
2. Turn the ignition switch to OFF.
3. At the Smart Junction Box (SJB), located below the LH side of the instrument panel, remove the cover and the RCM fuse 25 (7.5A) from the SJB. For additional information, refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ.
4. Turn the ignition ON and visually monitor the air bag indicator for at least 30 seconds. The air bag warning indicator will remain lit continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.
5. Turn the ignition switch to OFF.

WARNING: **Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.**

See DESCRIPTION AND OPERATION for location of the RCM and impact sensor(s).

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

6. Disconnect the battery ground cable and wait at least one minute. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

Repowering Procedure

1. Turn the ignition switch from OFF to ON.
2. Install RCM fuse 25 (7.5A) to the SJB and close the cover.

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

3. Connect the battery ground cable.
4. Prove out the SRS as follows:

   Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn OFF. If an air bag SRS fault is present, the air bag warning indicator will:

   - fail to light.

   - remain lit continuously.

   - flash at a 5 Hz rate (RCM not configured).

   The air bag warning indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

   Clear all continuous DTCs from the RCM and Occupant Classification System Module (OCSM) using a scan tool.

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEACTIVATION AND REACTIVATION

Special Tools

Illustration	Tool Name	Tool Number
 ST1385-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

Deactivation

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of**

serious personal injury or death.

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

NOTE: The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

All vehicles

1. Turn all vehicle accessories OFF.
2. Turn the ignition switch to OFF.
3. At the smart junction box (SJB), located below the LH side of the instrument panel, remove the cover and the RCM fuse 25 (7.5A) from the SJB. For additional information, refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ.
4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.
5. Turn the ignition OFF.

WARNING: **Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.**

See DESCRIPTION AND OPERATION for location of the RCM and impact sensor(s).

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

6. Disconnect the battery ground cable and wait at least one minute. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

NOTE: There are 2 locking pins that retain the driver air bag module to the steering wheel.

7. Using a 3-mm Allen wrench or a suitable tool through the access hole on the backside of the steering wheel, position the tool against the spring clip and push in, disengaging the clip from the locking pin. With the spring clip disengaged from the locking pin, gently pull back on that side of the driver air bag module to release it from the steering wheel.

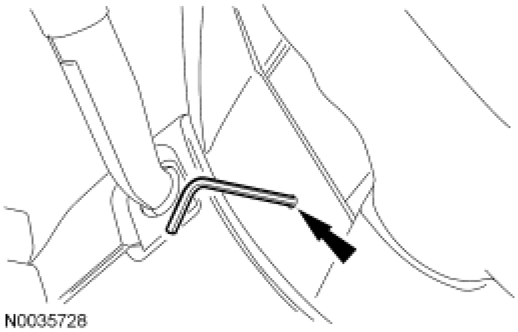


Fig. 95: Locating Allen Wrench
Courtesy of FORD MOTOR CO.

8. Repeat the previous step for the second locking pin.

CAUTION: Do not pull the driver air bag module electrical connectors out by the locking buttons. Damage to the locking buttons can occur.

9. Using a small screwdriver as shown, lift up and release the locking buttons on the driver air bag module electrical connectors. With the locking buttons released, remove the electrical connectors and the driver air bag module.

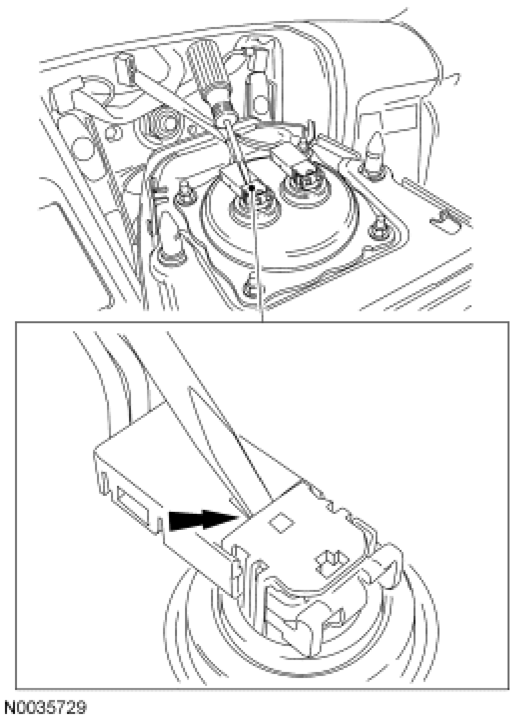


Fig. 96: Releasing Locking Buttons On Driver Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

10. Open the glove compartment door and release the door damper cable, then fully lower the glove compartment door.

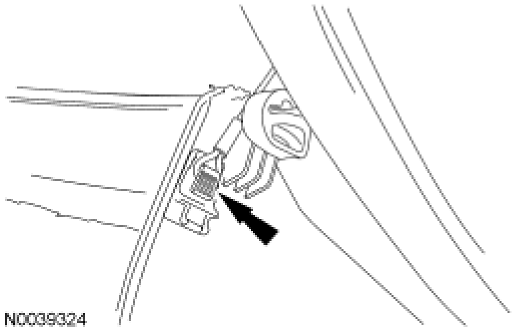
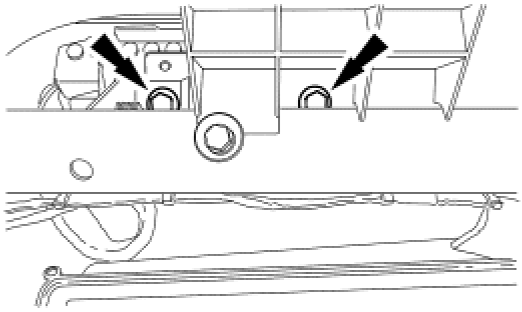


Fig. 97: Locating Door Damper Cable
Courtesy of FORD MOTOR CO.

Fusion and Milan

11. Remove the 2 passenger air bag module bolts.

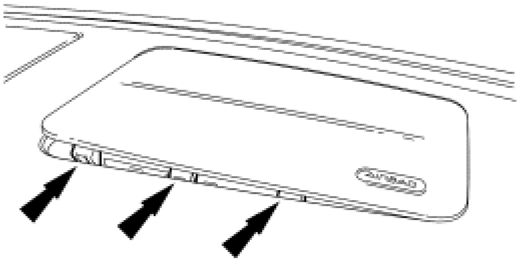


N0040675

Fig. 98: Locating Passenger Air Bag Module Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Do not handle the passenger air bag module by grabbing the edges of the deployment doors. Damage to the passenger air bag module may occur.

12. Release the deployment door clips from the instrument panel and then remove the passenger air bag module from the instrument panel.

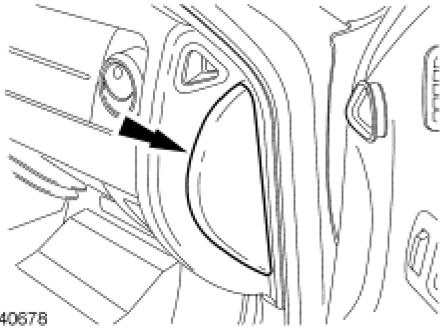


N0040676

Fig. 99: Locating Deployment Door Clips
Courtesy of FORD MOTOR CO.

MKZ

13. Remove the instrument panel end panel.



N0040678

Fig. 100: Locating I/P End Panel
Courtesy of FORD MOTOR CO.

NOTE: Illustration shows the location of the 5 RH instrument panel trim panel nuts located inside of the instrument panel.

14. Through the glove compartment opening and the side of the instrument panel, remove the 5 RH instrument panel trim panel nuts on the inside of the instrument panel.

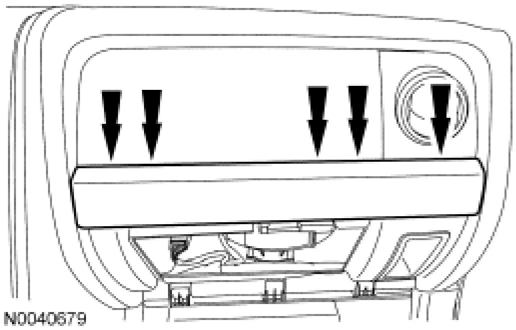


Fig. 101: Locating RH I/P Trim Panel Nuts
Courtesy of FORD MOTOR CO.

15. Pull out releasing the 2 retaining clips and remove the RH instrument panel trim panel.

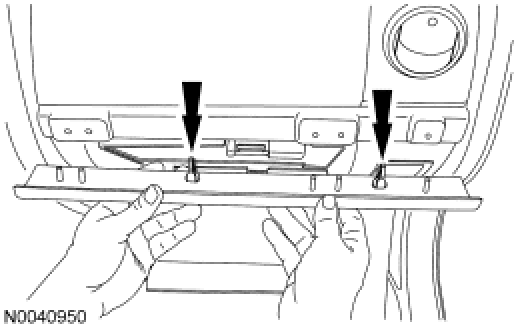


Fig. 102: Locating Retaining Clips
Courtesy of FORD MOTOR CO.

16. Through the glove compartment opening, remove the 2 passenger air bag module bolts.

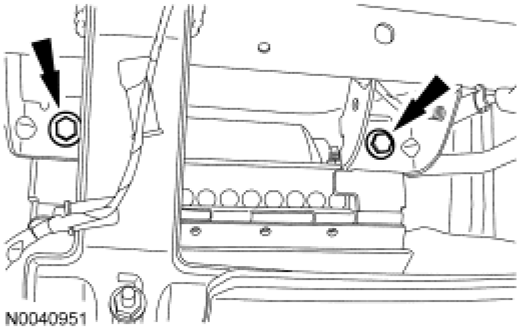


Fig. 103: Locating Passenger Air Bag Module Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Do not handle the passenger air bag module by grabbing the edges of the deployment doors. Damage to the passenger air bag module may occur.

17. Through the glove compartment opening, release the deployment door clips from the instrument panel and then remove the passenger air bag module from the instrument panel.

All vehicles

NOTE: Fusion and Milan shown, MKZ similar.

NOTE: RH shown, LH similar.

18. Using a small screwdriver as shown, lift up and release the locking buttons on the passenger air bag module electrical connectors.

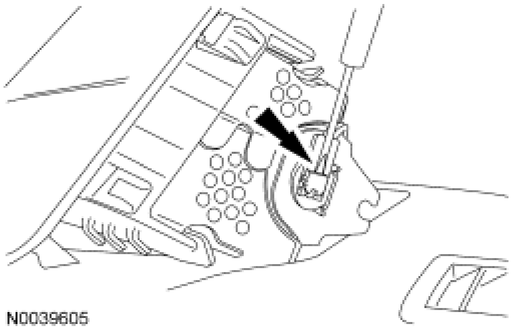


Fig. 104: Locating Passenger Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

CAUTION: Do not pull the passenger air bag module electrical connectors out by the locking buttons. Damage to the locking buttons can occur.

NOTE: Fusion and Milan shown, MKZ similar.

NOTE: RH shown, LH similar.

19. With the locking buttons released, remove the electrical connectors and the passenger air bag module.

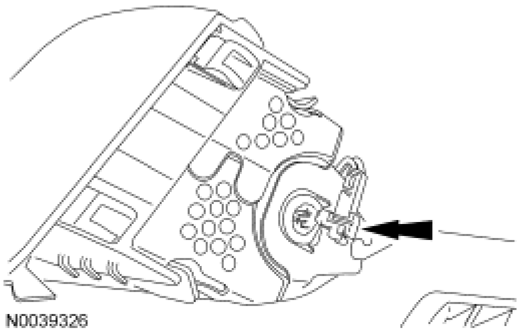


Fig. 105: Locating Passenger Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

20. From under the rear of the passenger seat, slide and disengage the passenger seat side air bag module electrical connector locking clip, and then release the tab and disconnect the passenger seat side air bag module electrical connector.

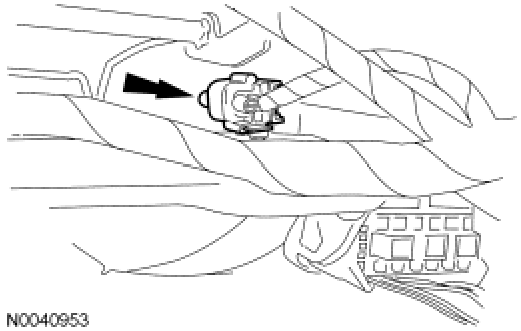


Fig. 106: Locating Passenger Seat Side Air Bag Module Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: Fusion shown, Milan and MKZ similar.

21. Remove the RH C-pillar trim cover retainer caps.

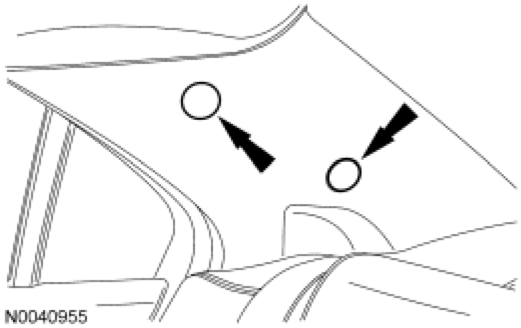


Fig. 107: Locating RH C-Pillar Trim Cover Retainer Caps
Courtesy of FORD MOTOR CO.

22. Remove the 2 retainers and the RH C-pillar trim cover.

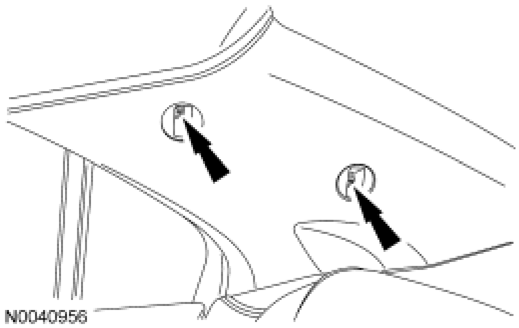


Fig. 108: Locating RH C-Pillar Trim Cover And Retainers
Courtesy of FORD MOTOR CO.

23. Disconnect the RH side air curtain module electrical connector.

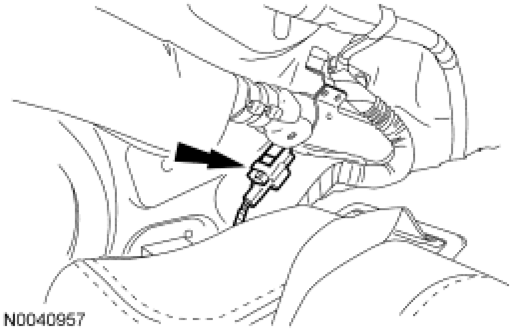


Fig. 109: Locating RH Side Air Curtain Module Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: Fusion shown, Milan and MKZ similar.

24. Remove the LH C-pillar trim cover retainer caps.

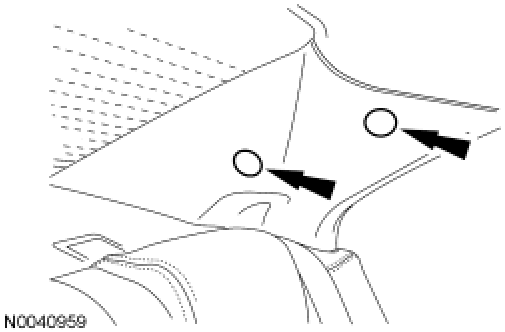


Fig. 110: Locating LH C-Pillar Trim Cover Retainer Caps
Courtesy of FORD MOTOR CO.

25. Remove the 2 retainers and the LH C-pillar trim cover.

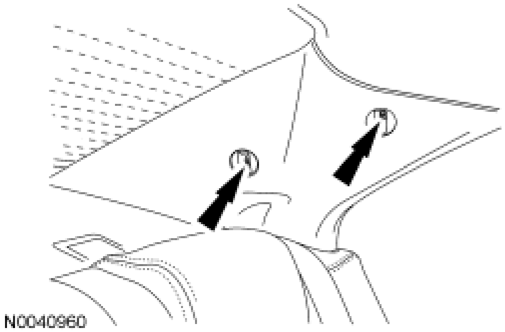


Fig. 111: Locating LH C-Pillar Trim Cover And Retainers
Courtesy of FORD MOTOR CO.

26. Disconnect the LH side air curtain module electrical connector.

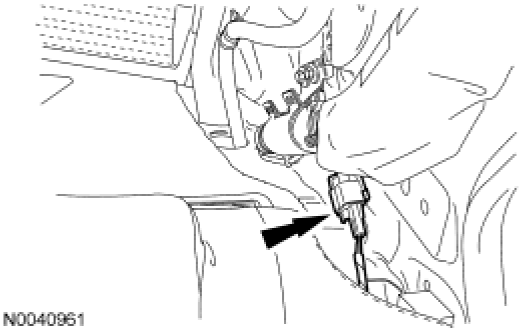


Fig. 112: Locating LH Side Air Curtain Module Electrical Connector
Courtesy of FORD MOTOR CO.

27. From under the rear of the driver seat, slide and disengage the driver seat side air bag module electrical connector locking clip, and then release the tab and disconnect the driver seat side air bag module electrical connector.

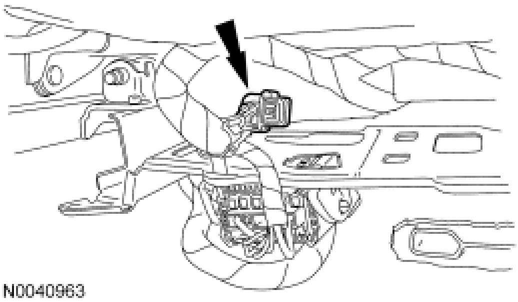


Fig. 113: Locating Driver Seat Side Air Bag Module Electrical Connector
Courtesy of FORD MOTOR CO.

28. Install RCM fuse 25 (7.5A) to the SJB.
29. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

Reactivation

All vehicles

1. Remove restraints control module (RCM) fuse 25 (7.5A) from the SJB.
2. Disconnect the battery ground cable and wait at least one minute.
3. Connect the driver seat side air bag module electrical connector and then slide and engage the seat side air bag electrical connector locking clip.

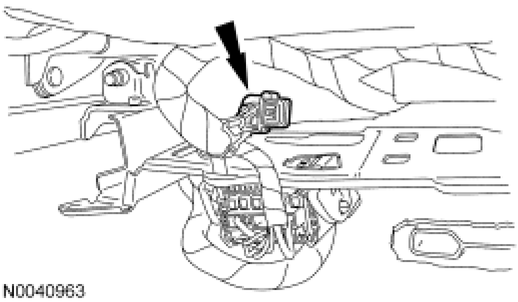


Fig. 114: Locating Driver Seat Side Air Bag Module Electrical Connector
Courtesy of FORD MOTOR CO.

4. Connect the LH side air curtain module electrical connector.

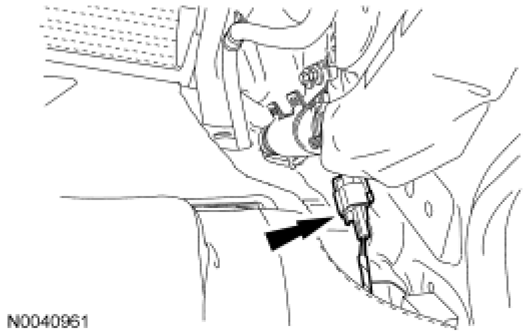


Fig. 115: Locating LH Side Air Curtain Module Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: Fusion shown, Milan and MKZ similar.

5. Install the LH C-pillar trim cover and the retainers.

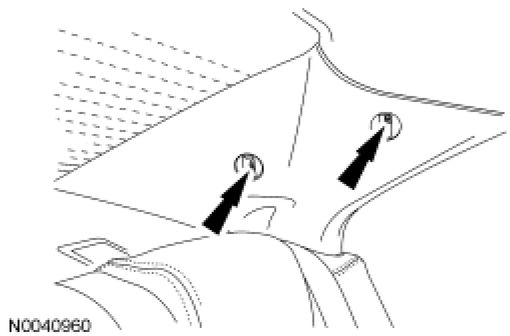


Fig. 116: Locating LH C-Pillar Trim Cover And Retainers
Courtesy of FORD MOTOR CO.

6. Install the LH C-pillar trim cover retainer caps.

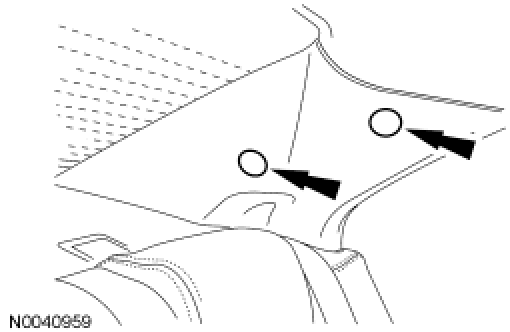


Fig. 117: Locating LH C-Pillar Trim Cover Retainer Caps
Courtesy of FORD MOTOR CO.

7. Connect the RH side air curtain module electrical connector.

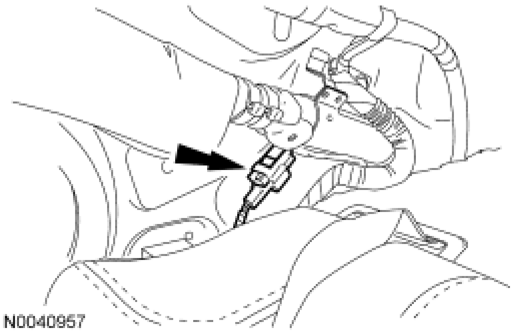


Fig. 118: Locating RH Side Air Curtain Module Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: **Fusion shown, Milan and MKZ similar.**

8. Install the RH C-pillar trim cover and the retainers.

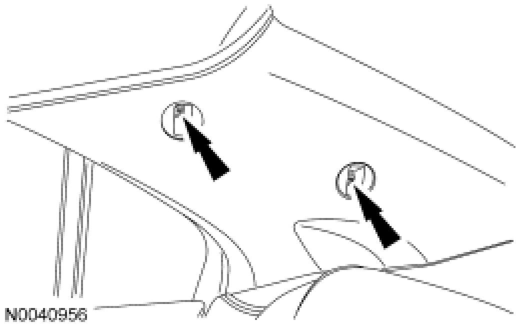


Fig. 119: Locating RH C-Pillar Trim Cover And Retainers
Courtesy of FORD MOTOR CO.

9. Install the RH C-pillar trim cover retainer caps.

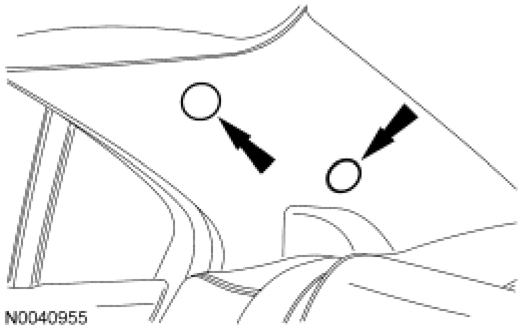


Fig. 120: Locating RH C-Pillar Trim Cover Retainer Caps
Courtesy of FORD MOTOR CO.

10. Connect the passenger seat side air bag module electrical connector and then slide and engage the seat side air bag electrical connector locking clip.

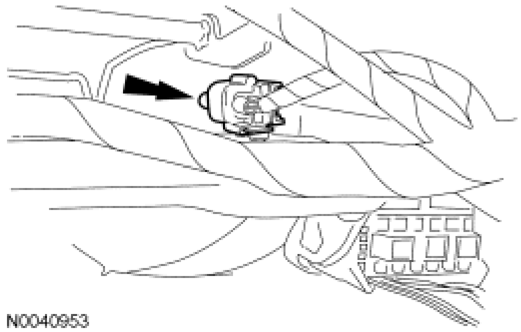


Fig. 121: Locating Passenger Seat Side Air Bag Module Electrical Connector
Courtesy of FORD MOTOR CO.

CAUTION: Do not install the passenger air bag module electrical connectors by the locking buttons. Damage to the locking buttons can occur.

CAUTION: The passenger air bag module electrical connector locking buttons must be in the released position when the connector is being installed, or connector damage may occur.

CAUTION: The passenger air bag module electrical connectors are unique and cannot be reversed when connected to the passenger air bag module. Match the electrical connector key to the keyway in the passenger air bag module. Do not force the electrical connectors into the passenger air bag module.

NOTE: RH shown, LH similar.

11. With the locking buttons released, install the passenger air bag module electrical connectors fully into the passenger air bag module and seat the locking buttons.

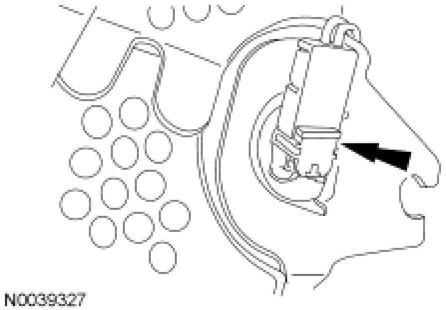


Fig. 122: Locating Passenger Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

MKZ

CAUTION: Do not handle the passenger air bag module by grabbing the edges of the deployment door. Damage to the passenger air bag module may occur.

NOTE: During air bag module installation, make sure all the deployment door clips are fully seated in the instrument panel.

12. Install the passenger air bag module into the instrument panel.
13. Through the glove compartment opening, install the 2 passenger air bag module bolts.
    - Tighten to 8 Nm (71 lb-in).

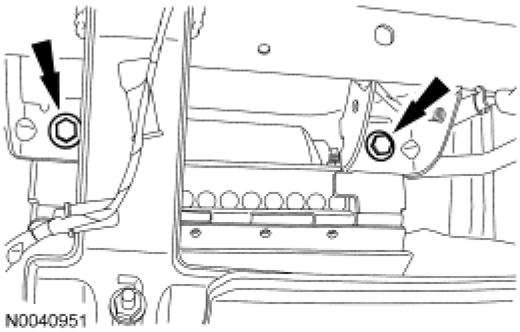


Fig. 123: Locating Passenger Air Bag Module Bolts
Courtesy of FORD MOTOR CO.

14. Align the 2 retaining clips and install the RH instrument panel trim panel.

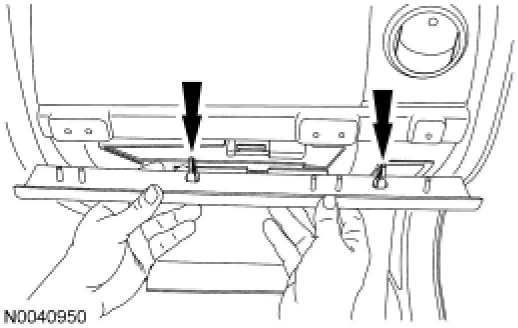


Fig. 124: Locating Retaining Clips
Courtesy of FORD MOTOR CO.

15. Through the glove compartment opening and the side of the instrument panel, install the 5 RH instrument panel trim panel nuts on the inside of the instrument panel.

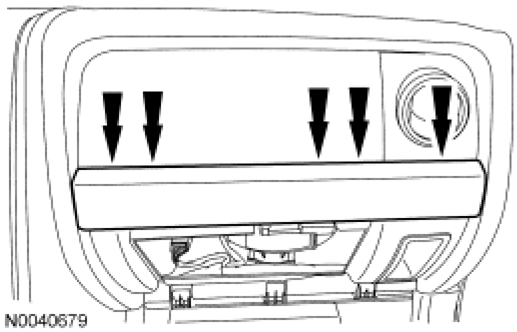


Fig. 125: Locating RH I/P Trim Panel Nuts
Courtesy of FORD MOTOR CO.

16. Install the instrument panel end panel.

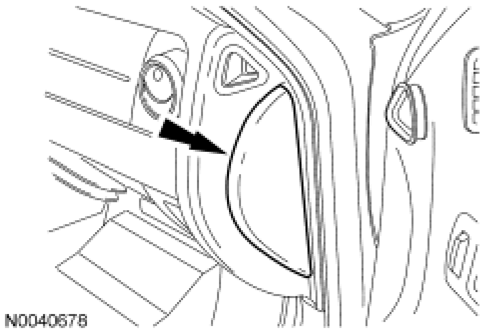


Fig. 126: Locating I/P End Panel
Courtesy of FORD MOTOR CO.

Fusion and Milan

CAUTION: Do not handle the passenger air bag module by grabbing the edges of the deployment doors. Damage to the passenger air bag module may occur.

NOTE: During air bag module installation, make sure all the deployment door clips are fully seated in the instrument panel.

17. Install the passenger air bag module into the instrument panel.

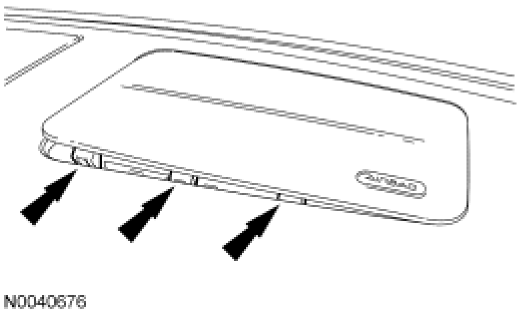


Fig. 127: Locating Deployment Door Clips
Courtesy of FORD MOTOR CO.

18. Install the 2 passenger air bag module bolts.
    - Tighten to 8 Nm (71 lb-in).

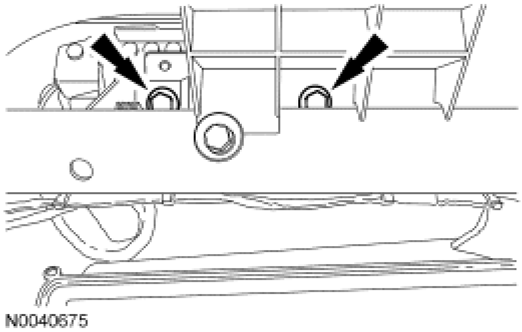


Fig. 128: Locating Passenger Air Bag Module Bolts
Courtesy of FORD MOTOR CO.

19. Attach the glove compartment door damper cable and close the glove compartment door.

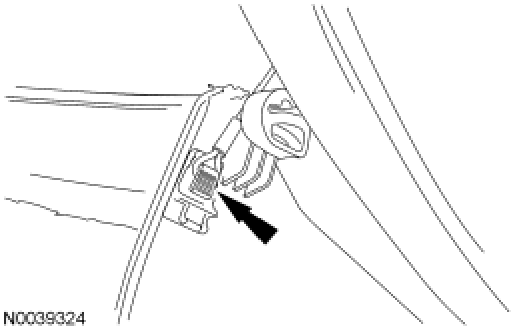


Fig. 129: Locating Door Damper Cable
Courtesy of FORD MOTOR CO.

All vehicles

CAUTION: Do not install the driver air bag module electrical connectors by the

locking buttons. Damage to the locking buttons can occur.

CAUTION: The driver air bag module electrical connector locking buttons must be in the released position when the connector is being installed, or connector damage may occur.

CAUTION: The driver air bag module electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module.

20. With the locking buttons released, install the driver air bag module electrical connectors fully into the driver air bag module and seat the locking buttons.

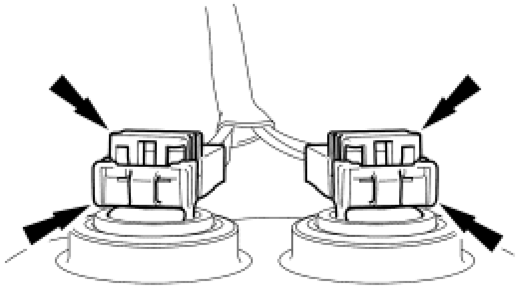

N0035730

Fig. 130: Locating Driver Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: Audible clicks will be heard when both wire clips are seated in the driver air bag module.

21. Align the driver air bag module locking pins to the steering wheel and, while pushing inward, seat the 2 driver air bag module locking pins in the steering wheel wire clips.
    - When the 2 locking pins are seated in place, there should be an even gap between the driver air bag module trim cover and the steering wheel.

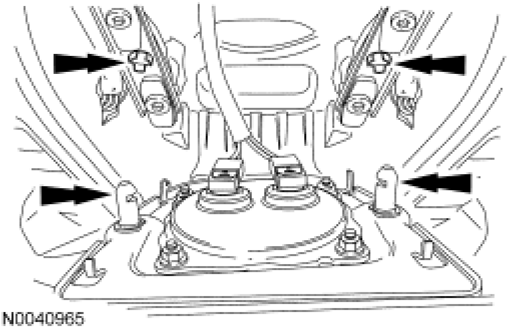

N0040965

Fig. 131: Driver Air Bag Module Locking Pins In Steering Wheel Wire Clips
Courtesy of FORD MOTOR CO.

22. Turn the ignition switch from OFF to ON.
23. Install RCM fuse 25 (7.5A) to the SJB and close the cover.

WARNING: **Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

24. Connect the battery ground cable.
25. Prove out the SRS as follows:

    Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn OFF. If an air bag SRS fault is present, the air bag warning indicator will:

    - fail to light.

    - remain lit continuously.

    - flash at a 5 Hz rate (RCM not configured).

    The air bag warning indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

    Clear all continuous DTCs from the RCM and occupant classification system module (OCSM) using a scan tool.

INSPECTION AND REPAIR AFTER A SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEPLOYMENT

WARNING: **Remove restraint system diagnostic tools from the vehicle prior to road testing. If tools are not removed, the supplemental restraint system (SRS) device may not deploy in a crash. Failure to follow this instruction may result in serious personal injury or death in a crash and possibly violate vehicle safety standards.**

NOTE: **After diagnosing or repairing a Supplemental Restraint System (SRS), the restraint system diagnostic tools (if required) must be removed before operating the vehicle over the road.**

NOTE: Deployable devices (such as air bag modules, pretensioners) may deploy alone or in various combinations depending on the impact event.

NOTE: Always refer to the appropriate workshop article procedures prior to carrying out vehicle repairs affecting the SRS and safety belt system.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

All vehicles

NOTE: Refer to the correct removal and installation procedure for all SRS components being installed.

1. When any deployable device or combination of devices are deployed and/or the Restraints Control Module (RCM) has the DTC B1231 (Event Threshold Exceeded) in memory, the repair of the vehicle SRS is to include the removal of all deployed devices and the installation of new deployable devices, the removal and installation of new impact sensors, and the removal and installation of a new RCM. DTCs must be cleared from all required modules after repairs are carried out.

   Vehicles with Occupant Classification Sensor (OCS) system

   NOTE: After installation of new Occupant Classification Sensor (OCS) system components, carry out the Occupant Classification Sensor (OCS) System Reset procedure as instructed in the workshop article. Refer to the appropriate workshop article for OCS system removal and installation procedure.

2. When a vehicle has been involved in a collision and the Occupant Classification System Module (OCSM) has DTC B1231 stored in memory, the repair of the OCS system is to include the following procedures for the specified system:
   - For rail-type OCS system, inspect the passenger side floorpan for damage and repair as necessary. Install new OCS system rails.
   - For weight sensor bolt-type OCS system, inspect the passenger side floorpan for damage and repair as necessary. Install a new seat track with OCS system weight sensor bolts. DTC must be cleared from the OCSM before carrying out Occupant Classification Sensor (OCS) System Reset. Do not install a new OCSM unless DTC B1231 cannot be cleared.

     NOTE: Most bladder-type OCSM do not store a DTC B1231 in memory after deployment. The DTC B1231 is stored only by the RCM.

   - For bladder-type OCS system, inspect for damage and repair as necessary. If installation of an OCS system component is required, an OCS system service kit must be installed.

   All vehicles

3. When any damage to the impact sensor mounting points or mounting hardware has occurred, repair or install new mounting points and mounting hardware as needed.
4. When the driver air bag module has deployed, a new clockspring must be installed.
5. New driver and/or front passenger safety belt systems (including retractors, buckles and height adjusters) must be installed if the vehicle is involved in a collision that results in deployment of the driver and/or front passenger safety belt pretensioners. For additional information, refer to **SAFETY BELT SYSTEM** article.
6. Inspect the entire vehicle for damage, including the following components:
    - Steering column (deployable column if equipped)
    - Instrument panel knee bolsters and mounting points
    - Instrument panel braces and brackets
    - Instrument panel and mounting points
    - Seats and seat mounting points
    - Safety belts, safety belt buckles and safety belt retractors. For additional information, refer to **SAFETY BELT SYSTEM** article
    - SRS wiring, wiring harnesses and connectors
7. After carrying out the review and inspection of the entire vehicle for damage, repair or install new components as needed.

OCCUPANT CLASSIFICATION SENSOR (OCS) SYSTEM RESET

Special Tools

Illustration	Tool Name	Tool Number
 ST1385-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

System Reset

WARNING: **Before carrying out the System Reset, make sure the occupant classification sensor (OCS) system is at a stable temperature in the range 5°C to 48°C (41°F to 118°F). Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.**

WARNING: **Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a**

crash.

NOTE: **The System Reset active command should only be carried out as directed by the workshop article.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

WARNING: **The following precautions must be taken before carrying out the following procedure on the front passenger seat:**

- **Park the vehicle on level ground.**
- **Make sure the occupant classification sensor (OCS) system is stabilized at a temperature in the range of 5°C to 48°C (41°F to 118°F) and is not exposed to temperatures outside that range.**
- **Make sure the front passenger seat is empty and dry.**
- **Make sure the front passenger seat repair is complete and all attached components (head restraint, seat side shield) are correctly installed.**
- **Make sure the front passenger seat occupant classification sensor (OCS) rail shields are correctly installed.**
- **Make sure nothing is placed in the map pockets (if equipped) of the front passenger seat.**
- **Make sure nothing is underneath the front passenger seat.**
- **Make sure the under-seat body wiring harness and seat wiring harness are not twisted or pinched between the electrical bracket and the No. 2 crossmember, or are not twisted or pinched between the electrical bracket and the floor.**
- **Make sure no non-factory installed items (seat covers, DVD screens) are on or contacting the front passenger seat. If any non-factory items were installed to the seat, remove the item(s) and communicate to the customer that any alteration/modification to the front passenger seat may affect performance of the OCS system. Refer to the Owner's Literature.**
- **Make sure the seat is correctly installed in the vehicle.**

Failure to follow these instructions may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

1. Make sure the front passenger seat is empty, there is nothing underneath the seat, remove any items from the seat that were not factory installed, and make sure that the seat is correctly installed in the vehicle.

2. Position the front passenger seat.
   - Position the seat in the middle of seat track travel.
   - Position the seat backrest in the most forward position.
   - Position the seat height to its lowest position (power seat only).

WARNING: **Remove binding or resistance between all components of the front passenger seat as directed in the following procedure. Failure to follow this instruction may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.**

3. Remove hysteresis from the front passenger seat by firmly hitting the back of the seat head restraint 3 times.

WARNING: **Make sure nothing is placed on the front passenger seat during the following procedure. Do not press, touch or lay anything on the front passenger seat until the following procedure has been completed. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increase the risk of serious personal injury or death in a crash.**

NOTE: Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before carrying out the System Reset active command.

4. Turn the ignition switch ON, wait 8 seconds and carry out the System Reset active command using the scan tool.

NOTE: The ignition switch must be cycled after carrying out the System Reset active command.

5. Cycle the ignition switch ON to OFF.

WARNING: **Make sure nothing is placed on the front passenger seat during the Zero Seat Weight Test. Do not press, touch or lay anything on the front passenger seat until the Zero Seat Weight Test has been completed. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increase the risk of serious personal injury or death in a crash.**

NOTE: Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before carrying out the Zero Seat Weight Test.

6. Turn the ignition switch ON, wait 8 seconds and carry out the Zero Seat Weight Test using the scan tool.

NOTE: If the scan tool responds with system passed, do not carry out the System Reset active command.

1. If the system passed, the repair is complete.
2. If the system did not pass (DTC C1941 Zero Seat Weight Test Failure reported), carry out the following steps.
    - Cycle the ignition switch OFF then ON, wait 8 seconds and carry out the System Reset active command using the scan tool.
    - Cycle the ignition switch OFF then ON and wait 8 seconds.
    - Carry out the Zero Seat Weight Test using the scan tool.
        - If the system passed, the repair is complete.
        - If the system did not pass (DTC C1941 Zero Seat Weight Test Failure reported), install 2 new occupant classification sensor rails and carry out the System Reset procedure. For additional information, refer to **Occupant Classification Sensor** and **Occupant Classification Sensor (OCS) System Reset**.

7. Prove out the supplemental restraint system (SRS) as follows:

    Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag indicator with the air bag modules installed. The air bag indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag indicator will:

    - fail to light.

    - remain lit continuously.

    - flash at a 5 Hz rate (restraint control module [RCM] not configured).

    The air bag indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag indicator and any SRS fault discovered must be diagnosed and repaired.

    Clear all continuous DTCs from the restraints control module and occupant classification system module (OCSM) using a scan tool.

OCCUPANT CLASSIFICATION SENSOR (OCS) SYSTEM ZERO SEAT WEIGHT TEST

Special Tools

Illustration	Tool Name	Tool Number
	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

 ST1385-A		

Zero Seat Weight Test

WARNING: Make sure nothing is placed on the front passenger seat during the following procedure. Do not press, touch or lay anything on the front passenger seat until the following procedure has been completed. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increase the risk of serious personal injury or death in a crash.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

WARNING: The following precautions must be taken before carrying out the following procedure on the front passenger seat:

- **Park the vehicle on level ground.**
- **Make sure the occupant classification sensor (OCS) system is stabilized at a temperature in the range of 5°C to 48°C (41°F to 118°F) and is not exposed to temperatures outside that range.**
- **Make sure the front passenger seat is empty and dry.**
- **Make sure the front passenger seat repair is complete and all attached components (head restraint, seat side shield) are correctly installed.**
- **Make sure the front passenger seat occupant classification sensor (OCS) rail shields are correctly installed.**
- **Make sure nothing is placed in the map pockets (if equipped) of the front passenger seat.**
- **Make sure nothing is underneath the front passenger seat.**
- **Make sure the under-seat body wiring harness and seat wiring harness are not twisted or pinched between the electrical bracket and the No. 2 crossmember, or are not twisted or pinched between the electrical bracket and the floor.**
- **Make sure no non-factory installed items (seat covers, DVD screens) are on or contacting the front passenger seat. If any non-factory items were installed to the seat, remove the item(s) and communicate to the customer that any alteration/modification to the front passenger seat may affect performance of the OCS system. Refer to the Owner's**

Literature.

- **Make sure the seat is correctly installed in the vehicle.**

Failure to follow these instructions may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

1. Make sure the front passenger seat is empty, there is nothing underneath the seat, remove any items from the seat that were not factory installed, and make sure that the seat is correctly installed in the vehicle.
2. Position the front passenger seat.
   - Position the seat in the middle of seat track travel.
   - Position the seat backrest in the most forward position.
   - Position the seat height to its lowest position (power seat only).

WARNING: **Remove binding or resistance between all components of the front passenger seat (as directed in the procedure) prior to carrying out the Zero Seat Weight Test. Failure to follow this instruction may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.**

3. Remove hysteresis from the front passenger seat by firmly hitting the back of the seat head restraint 3 times.

WARNING: **Make sure nothing is placed on the front passenger seat during the Zero Seat Weight Test. Do not press, touch or lay anything on the front passenger seat until the Zero Seat Weight Test has been completed. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increase the risk of serious personal injury or death in a crash.**

NOTE: Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before carrying out the Zero Seat Weight Test.

NOTE: If the scan tool responds with system passed, do not carry out the System Reset active command.

4. Cycle the ignition switch ON, wait 8 seconds and carry out the Zero Seat Weight Test using the scan tool.
   - If the system passed, the repair is complete. Proceed to Step 7.
   - If the system did not pass (DTC C1941 Zero Seat Weight Test Failure reported), repeat Steps 1-4. If the system did not pass the second Zero Seat Weight Test, proceed to the next step.

WARNING: **Make sure nothing is placed on the front passenger seat during the**

Zero Seat Weight Test. Do not press, touch or lay anything on the front passenger seat until the Zero Seat Weight Test has been completed. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increase the risk of serious personal injury or death in a crash.

NOTE: Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before carrying out the Zero Seat Weight Test.

5. Cycle the ignition switch OFF then ON, wait 8 seconds and carry out the System Reset active command using the scan tool.
6. Cycle the ignition switch OFF then ON, wait 8 seconds and carry out the Zero Seat Weight Test using the scan tool.
   - If the system passed, the repair is complete. Proceed to Step 7.
   - If the system did not pass (DTC C1941 Zero Seat Weight Test Failure reported), install 2 new OCS rails and carry out the System Reset procedure. For additional information, refer to **Occupant Classification Sensor** and **Occupant Classification Sensor (OCS) System Reset**.
7. Prove out the supplemental restraint system (SRS) as follows:

   Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag indicator with the air bag modules installed. The air bag indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag indicator will:

   - fail to light.

   - remain lit continuously.

   - flash at a 5 Hz rate (restraints control module [RCM] not configured).

   The air bag indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag indicator and any SRS fault discovered must be diagnosed and repaired.

   Clear all continuous DTCs from the RCM and occupant classification system module (OCSM) using a scan tool.

PYROTECHNIC DEVICE DISPOSAL

Disposal of Deployable Devices and Pyrotechnic Devices That are Undeployed/Inoperative

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

NOTE: All inoperative air bag modules and safety belt pretensioners have been placed on the Mandatory Return List. All discolored or damaged air bag modules must be treated the same as any inoperative live air bag being returned.

1. Depower the Supplemental Restraint System (SRS). For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Remove the undeployed/inoperative device. For additional information, refer to the appropriate procedure or **SAFETY BELT SYSTEM** article.

   NOTE: When installing a new air bag module, a prepaid return postcard is provided with the replacement air bag module. The serial number for the new part and the Vehicle Identification Number (VIN) must be recorded and sent to Ford Motor Company.

3. If installing a new air bag module, record the necessary information and return the inoperative air bag module to Ford Motor Company.

Disposal of Deployable Devices and Pyrotechnic Devices That Are Deployed

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Remove the deployed device. For additional information, refer to the appropriate procedure or **SAFETY BELT SYSTEM** article.

   NOTE: If a dual stage driver or passenger air bag module has deployed due to a crash event, the air bag module requires manual deployment to make sure both stages have deployed before scrapping the vehicle or disposing of the air bag module. To determine if a vehicle is equipped with dual stage driver or passenger air bag modules, refer to DESCRIPTION AND OPERATION.

3. Dispose of the deployed device in the same manner as any other part to be scrapped.

Disposal of Deployable Devices and Pyrotechnic Devices That Require Manual Deployment

1. Safety and environmental concerns require consideration and treatment of restraints system deployable and pyrotechnic devices when disposing of vehicles, deployable devices or pyrotechnic devices. Deploying deployable and pyrotechnic devices before scrapping a vehicle or the device eliminates the potential for hazardous exposures or reactions during processing. If special handling procedures are followed, deployable and pyrotechnic devices can be deployed safely and recycled with the vehicle, shipped separately to a recycling facility or disposed of safely.

   NOTE: To determine the deployable devices a vehicle is equipped with, refer to DESCRIPTION AND OPERATION.

A vehicle equipped with any of the following deployable devices requires manual deployment of the devices before scrapping the vehicle or component. For additional information, refer to the appropriate portion of this procedure.

- Driver air bag module
- Passenger air bag module
- Seat side air bag modules
- Safety canopy modules
- Side air curtain modules

NOTE: To determine the pyrotechnic devices a vehicle is equipped with, refer to DESCRIPTION AND OPERATION.

2. A vehicle equipped with any of the following pyrotechnic devices requires manual deployment of the devices before scrapping the vehicle or component. For additional information, refer to the appropriate portion of this procedure.
   - Safety belt buckle pretensioners
   - Safety belt retractor pretensioners
   - Adaptive load limiting retractors
   - Deployable steering column

NOTE: To determine if a vehicle is equipped with dual stage driver or passenger air bag modules, refer to DESCRIPTION AND OPERATION.

3. If a dual stage driver or passenger air bag module has deployed due to a crash event, the air bag module requires manual deployment to make sure both stages have deployed before scrapping the vehicle or disposing of the air bag module. For additional information, refer to Driver Air Bag Module, Passenger Air Bag Module and Seat Side Air Bag Modules - Remote Deployment in this procedure.

Driver Air Bag Module, Passenger Air Bag Module and Seat Side Air Bag Modules - Remote Deployment

WARNING: Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

WARNING: Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

WARNING: Always carry or place a live safety canopy, or side air curtain module, with the module and tear seam pointed away from your body. Failure to

follow this instruction may result in serious personal injury or death in the event of an accidental deployment.

WARNING: **Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.**

NOTE: For air bag modules with multiple loops, all the loops on the air bag module must be deployed.

NOTE: Some driver and passenger front air bags have 2 deployment stages. After a collision it is possible that Stage 1 has deployed and Stage 2 has not.

If a front air bag module has deployed, it is mandatory that the front air bag module be remotely deployed using the appropriate air bag disposal procedure.

NOTE: A typical air bag disposal is shown that is similar for all vehicles.

All driver, passenger and seat side air bag modules

1. Make a container to house the air bag module for deployment.

   NOTE: The tires must be of sufficient size to accommodate the air bag module.

   - Obtain a tire and wheel assembly and an additional 4 tires (without wheels) of the same size.
   - With the tire and wheel assembly on the bottom, stack the tires.
   - Securely tie all of the tires together.

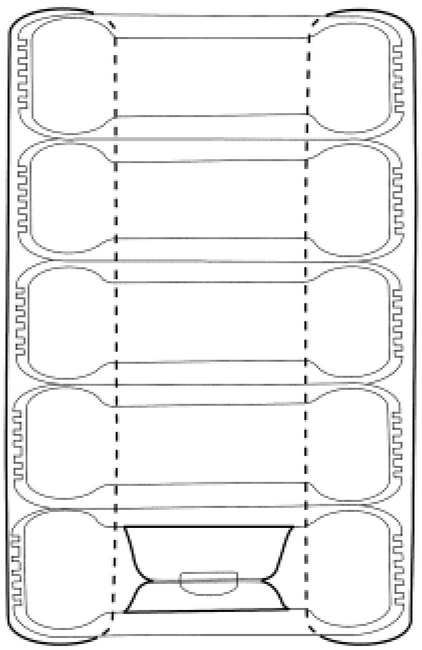


Fig. 132: Placing Air Bag Modules Inside Tire For Deployment
Courtesy of FORD MOTOR CO.

2. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
3. Remove the air bag module. For additional information, refer to the appropriate procedure.

NOTE: If the air bag module does not have a hardwired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the air bag module.

4. Cut each of the air bag module wires near the electrical connector that connects to the vehicle wire harness.
5. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

NOTE: Typical driver air bag module with 2 loops shown, other air bag modules with multiple loops similar.

6. For air bag modules with multiple loops, twist together a wire from each loop then repeat for the remaining wires from each loop.

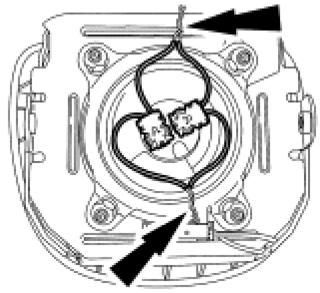


Fig. 133: Locating Air Bag Module Wire Squibs
Courtesy of FORD MOTOR CO.

7. Make a jumper harness to deploy the air bag module.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.
8. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the air bag module or to the twisted-together wires if multiple loops. Use tape or other insulating material to make sure that the leads do not make contact with each other.

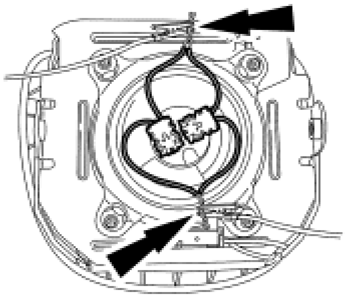


Fig. 134: Connecting Jumper Wires To Squibs
Courtesy of FORD MOTOR CO.

Driver air bag modules

NOTE: Make sure to maintain the connections to the air bag module.

9. With the stack of tires upright and the wheel on the bottom, carefully place the driver air bag module, with the trim cover facing up, on the wheel.

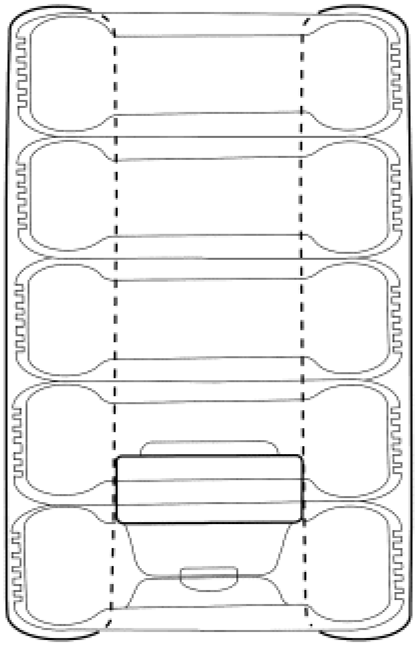


Fig. 135: Placing Driver Air Bag Modules Inside Tires For Deployment
Courtesy of FORD MOTOR CO.

Passenger and seat side air bag modules

NOTE: **Make sure to maintain the connections to the air bag module.**

10. Tip the stack of tires on its side and place the air bag module inside the center tire, making sure that there are 2 tires beneath the tire containing the air bag module and 2 tires (including the tire and wheel assembly) above the tire containing the air bag module.
11. Place the tire stack upright, with the wheel on top.

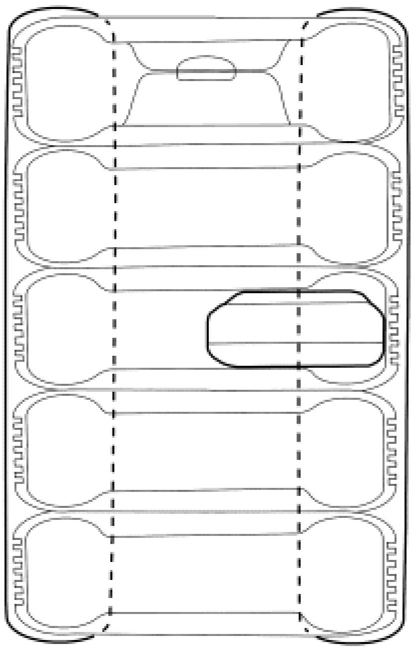


Fig. 136: Identifying Passenger Or Seat Side Air Bag Modules Inside Center Tire
Courtesy of FORD MOTOR CO.

All driver, passenger and seat side air bag modules

12. Remain at least 9.14 m (30 ft) away from the air bag module.
13. From the end of the jumper harness that is not connected to the air bag module, disconnect the 2 wires of the jumper harness from each other.
14. Deploy the air bag module by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.
15. To allow for cooling, wait at least 10 minutes before approaching the deployed air bag module.
16. Dispose of the deployed air bag module in the same manner as any other part to be scrapped.

Safety Belt Buckle Pretensioners, Safety Belt Retractor Pretensioners and Adaptive Load Limiting Safety Belt Retractors - Remote Deployment

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

WARNING: **Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud**

report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

NOTE: A typical safety belt buckle and retractor disposal is shown that is similar for all vehicles.

1. Make a container to house the safety belt buckle or retractor for deployment.

   NOTE: The tires must be of sufficient size to accommodate the safety belt buckle or retractor.

   - Obtain a tire and wheel assembly and an additional 4 tires (without wheels) of the same size.
   - With the tire and wheel assembly on the bottom, stack the tires.
   - Securely tie all of the tires together.

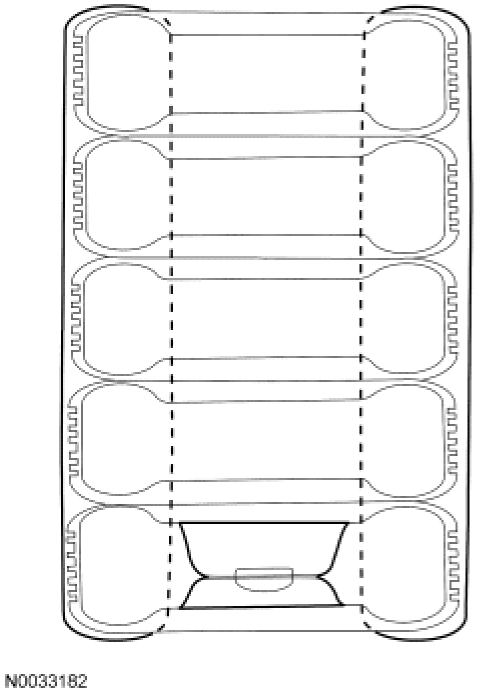


Fig. 137: Placing Air Bag Modules Inside Tire For Deployment
Courtesy of FORD MOTOR CO.

2. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
3. Remove the safety belt buckle or retractor. For additional information, refer to the appropriate procedure in **SAFETY BELT SYSTEM** article.
   - When deploying a safety belt buckle pretensioner, install a nut and bolt of sufficient length and of the same diameter as was used to retain it to the seat.

NOTE: If the safety belt buckle or retractor does not have a hardwired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the safety belt buckle or retractor.

4. Cut each of the safety belt buckle or retractor wires near the electrical connector that connects to the vehicle wire harness.
5. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.
6. Make a jumper harness to deploy the safety belt buckle or retractor.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.

NOTE: Typical safety belt retractor pretensioner shown, other safety belt buckle pretensioners and load limiting retractors similar.

7. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the safety belt buckle or retractor. Use tape or other insulating material to make sure that the leads do not make contact with each other.

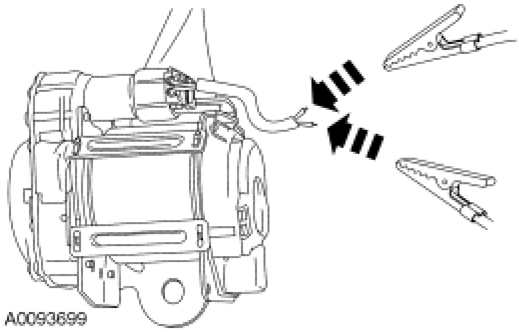


Fig. 138: Attaching Jumper Wires To Safety Belt Retractor Pretensioner
Courtesy of FORD MOTOR CO.

NOTE: Make sure to maintain the connections to the safety belt buckle or retractor.

8. Tip the stack of tires on its side and place the safety belt buckle or retractor inside the center tire, making sure that there are 2 tires beneath the tire containing the safety belt buckle or retractor and 2 tires (including the tire and wheel assembly) above the tire containing the safety belt buckle or retractor.
9. Place the tire stack upright, with the wheel on top.

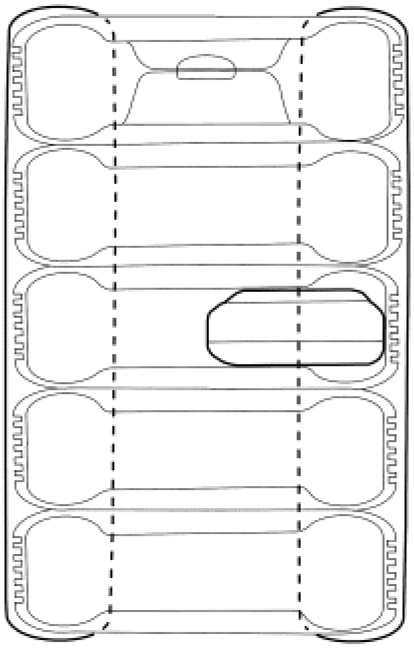


Fig. 139: Identifying Passenger Or Seat Side Air Bag Modules Inside Center Tire
Courtesy of FORD MOTOR CO.

10. Remain at least 9.14 m (30 ft) away from the safety belt buckle or retractor.
11. From the end of the jumper harness that is not connected to the safety belt buckle or retractor, disconnect the 2 wires of the jumper harness from each other.
12. Deploy the safety belt buckle or retractor by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.
13. To allow for cooling, wait at least 10 minutes before approaching the deployed safety belt buckle or retractor.
14. Dispose of the deployed safety belt buckle or retractor in the same manner as any other part to be scrapped.

Safety Belt Buckle Pretensioners, Safety Belt Retractor Pretensioners and Load Limiting Safety Belt Retractors - In-Vehicle Deployment

WARNING: **Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.**

WARNING: **Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud**

report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

NOTE: A typical safety belt buckle and retractor disposal is shown that is similar for all vehicles.

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Access the safety belt buckle or retractor electrical connectors. For additional information, refer to **SAFETY BELT SYSTEM** article.
3. Cut each of the safety belt buckle or retractor wires, leaving at least 101.6 mm (4 in) to work with.
4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.
5. Make a jumper harness to deploy the safety belt buckle or retractor.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.

NOTE: Typical safety belt retractor pretensioner shown, other safety belt buckle pretensioners and load limiting retractors are similar.

6. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the safety belt buckle or retractor. Use tape or other insulating material to make sure that the leads do not make contact with each other.

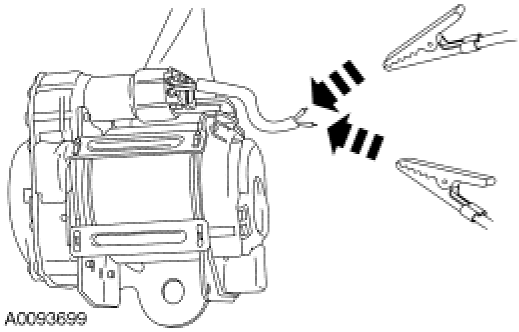


Fig. 140: Attaching Jumper Wires To Safety Belt Retractor Pretensioner
Courtesy of FORD MOTOR CO.

7. Remain at least 9.14 m (30 ft) away from the safety belt buckle or retractor.
8. From the end of the jumper harness that is not connected to the safety belt buckle or retractor, disconnect the 2 wires of the jumper harness from each other.
9. Deploy the safety belt buckle or retractor by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.
10. To allow for cooling, wait at least 10 minutes before approaching the deployed safety belt buckle or retractor.

11. Dispose of the deployed safety belt buckle or retractor in the same manner as any other part to be scrapped.

Safety Canopy Modules and Side Air Curtain Modules - In-Vehicle Deployment

WARNING: **Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.**

NOTE: The safety canopy module deployment for a scrapped vehicle will occur in its installed position in the vehicle.

NOTE: A typical safety canopy module disposal is shown that is similar for all vehicles.

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Access the safety canopy/side air curtain module electrical connectors. For additional information, refer to the appropriate procedure.
3. Cut each of the safety canopy/side air curtain module wires leaving at least 101.6 mm (4 in) to work with.
4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.

NOTE: Typical safety canopy/side air curtain module with 2 loops shown, other safety canopy/side air curtain modules with 2 loops are similar.

5. For safety canopy/side air curtain modules with multiple loops, twist together a wire from each loop then repeat for the remaining wires from each loop.

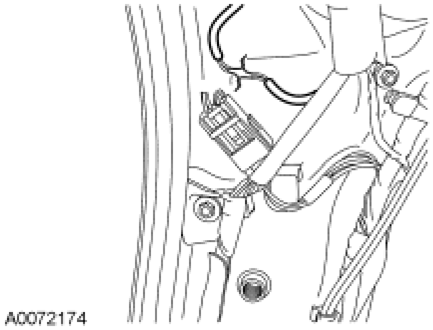


Fig. 141: Identifying Safety Canopy/Side Air Curtain Module Wire Squibs
Courtesy of FORD MOTOR CO.

6. Make a jumper harness to deploy the safety canopy/side air curtain module.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.

- At one end of the jumper harness, connect the wires together.

7. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the safety canopy/side air curtain module or to the twisted-together wires if multiple loops. Use tape or other insulating material to make sure that the leads do not make contact with each other.

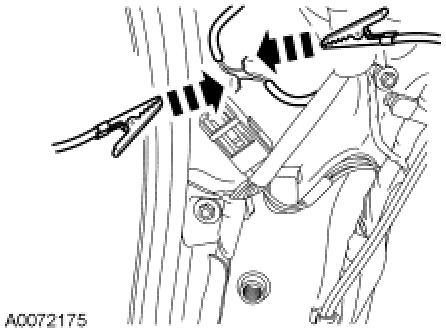


Fig. 142: Connecting Jumper Harness To Twisted Wires
Courtesy of FORD MOTOR CO.

8. From the end of the jumper harness that is not connected to the safety canopy/side air curtain module, disconnect the 2 wires of the jumper harness from each other.
9. Deploy the safety canopy/side air curtain module by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.
10. To allow for cooling, wait at least 10 minutes before approaching the deployed safety canopy/side air curtain module.
11. Dispose of the deployed safety canopy/side air curtain module in the same manner as any other part to be scrapped.

Deployable Steering Column - In-Vehicle Deployment

WARNING: **Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.**

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

NOTE: **It may be necessary to lower or remove the deployable steering column from the instrument panel to access the deployable steering column electrical connector.**

2. Access the deployable steering column electrical connector.

NOTE: If the deployable steering column does not have a hardwired pigtail, it will be necessary to cut the wires and connector(s) from the vehicle wire harness and reconnect to the deployable steering column.

3. Cut each of the deployable steering column wires, leaving at least 101.6 mm (4 in) to work with.
4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires.
5. Make a jumper harness to deploy the deployable steering column.
   - Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.
   - At one end of the jumper harness, connect the wires together.
6. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the deployable steering column. Use tape or other insulating material to make sure that the leads do not make contact with each other.

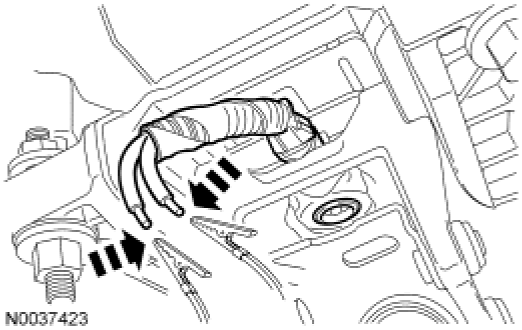


Fig. 143: Connecting Jumper Harness To Wires Of Deployable Steering Column
Courtesy of FORD MOTOR CO.

7. Remain at least 9.14 m (30 ft) away from the deployable steering column.
8. From the end of the jumper harness that is not connected to the deployable steering column, disconnect the 2 wires of the jumper harness from each other.
9. Deploy the deployable steering column by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.
10. To allow for cooling, wait at least 10 minutes before approaching the deployed steering column.
11. Dispose of the deployed steering column in the same manner as any other part to be scrapped.

RIVET NUT REPLACEMENT

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

NOTE: If the safety canopy/side air curtain module has deployed, the tether cord rivet nut must be inspected and replaced if damaged before installing a new safety canopy.

NOTE: A typical rivet nut replacement is shown that is similar for all vehicles.

NOTE: LH shown, RH similar.

1. Depower the Supplemental Restraint System (SRS). For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Remove the necessary trim panel(s). For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
3. Remove the bolt and bracket for the tether cord (if present).

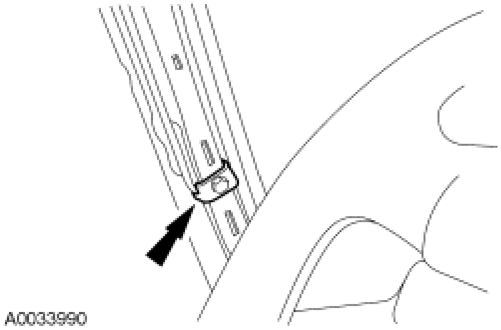


Fig. 144: Tether Cord Bracket & Bolt
Courtesy of FORD MOTOR CO.

4. If needed, position and secure the safety canopy/side air curtain tether cord and bracket assembly aside.
5. Using the appropriate service tool, sand the rivet nut shoulder until the shoulder surface is removed.

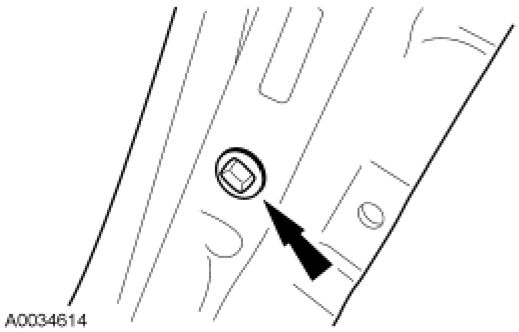


Fig. 145: Rivet Nut Shoulder
Courtesy of FORD MOTOR CO.

6. Punch the remaining portion of the rivet nut through the rivet nut hole.

NOTE: Use only Ford Motor Company factory-authorized replacement parts for rivet nut repair procedure.

7. Obtain the correct square shank rivet nut for the vehicle application from the Ford Master Parts Catalog, and insert it into the rivet nut hole.

8. Using a suitable rivet nut installing tool, install the rivet nut. For additional information, refer to the tool manufacturer's operating instructions.
9. If present, position the tether cord. Install the bolt. See the appropriate component removal and installation procedure or Specifications for the correct torque specification.

NOTE: The tether cord must be positioned correctly in place before installing the A-pillar trim panel.

10. Install the necessary trim panel(s). For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.

REMOVAL AND INSTALLATION

AIR BAG TRIM COVER - PASSENGER

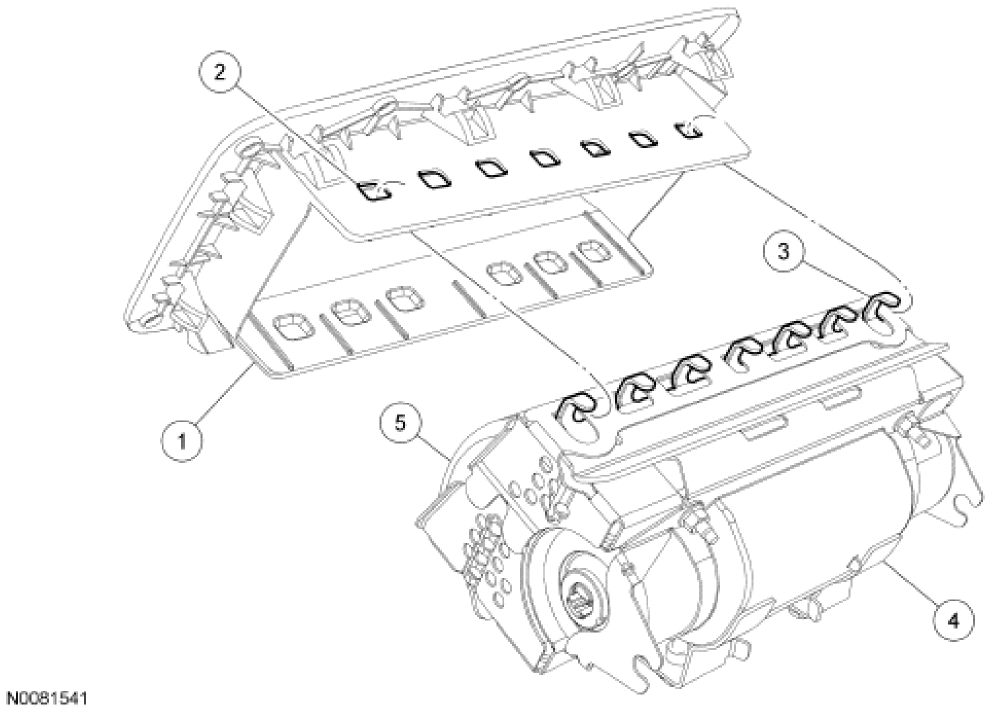


Fig. 146: Exploded View Of Passenger Air Bag Trim Cover - Fusion & Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	04338	Passenger air bag cover
2	-	Passenger air bag cover window (part of passenger air bag cover)
3	-	Passenger air bag canister hook (part of canister)
4	-	Passenger air bag canister (part of 044A74)
5	-	Passenger air bag soft pack (part of 044A74)

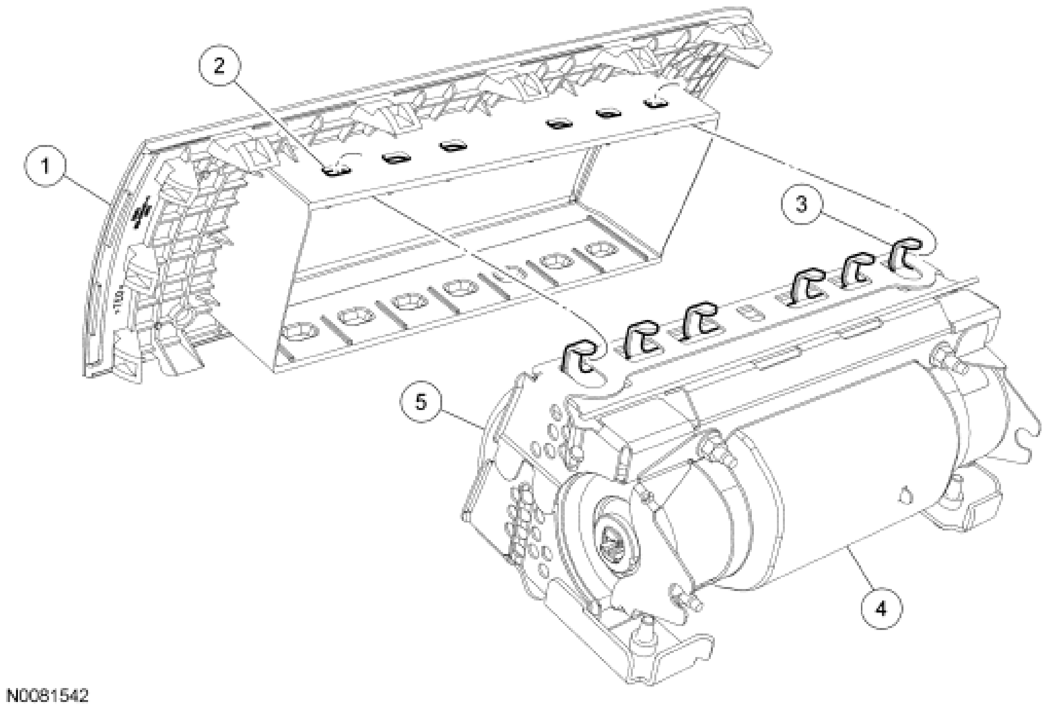


Fig. 147: Exploded View Of Passenger Air Bag Trim Cover - MKZ
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	04338	Passenger air bag cover
2	-	Passenger air bag cover windows (part of passenger air bag cover)
3	-	Passenger air bag canister hooks (part of canister)
4	-	Passenger air bag canister (part of 044A74)
5	-	Passenger air bag soft pack (part of 044A74)

REMOVAL

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

WARNING: **Do not use any sharp tools to separate the passenger air bag module trim cover from the passenger air bag module canister. Sharp tools may damage the passenger air bag module. Failure to follow this instruction may result in the passenger air bag module deploying incorrectly and increases the risk of serious personal injury or death in a crash.**

WARNING: **Do not unpack or unroll the passenger air bag module soft pack. If the**

soft pack becomes unpacked or unrolled, install a new passenger air bag module assembly. Failure to follow these instructions may result in the passenger air bag module deploying incorrectly and increases the risk of serious personal injury or death in a crash.

WARNING: **Do not manipulate or compromise the passenger air bag module hooks during the removal or installation procedure. Failure to follow this instruction may result in the passenger air bag module deploying incorrectly and increases the risk of serious personal injury or death in a crash.**

1. Remove the passenger air bag module. Refer to **Passenger Air Bag Module**.
2. Place a mark on top of the passenger air bag module canister for correct installation.
3. Carefully lift the passenger air bag module cover from the bottom of the air bag module canister, separating the windows from the canister hooks.

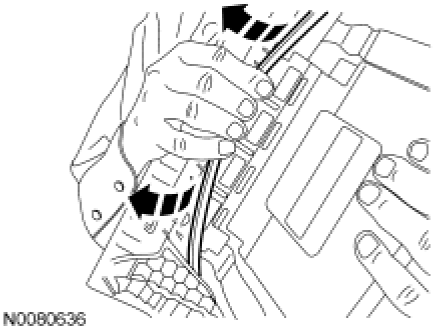


Fig. 148: Lifting Passenger Air Bag Module Cover From Bottom Of Air Bag Module Canister & Separating Windows From Canister Hooks
Courtesy of FORD MOTOR CO.

NOTE: **Place an X mark on the old air bag cover to avoid reinstalling.**

4. Remove the passenger air bag cover from the canister, separating the top windows from the canister hooks.

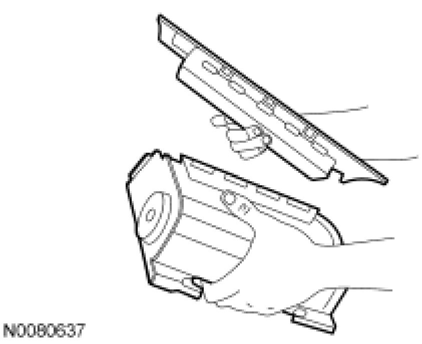


Fig. 149: Removing Passenger Air Bag Cover From Canister & Separating Top Windows From

Canister Hooks
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Place the passenger air bag cover on a clean work surface once it is removed from the shipping package.

   WARNING: **Carefully inspect the passenger air bag trim cover, canister and soft pack before assembly. If any foreign objects are found, remove them before attaching the passenger air bag trim cover to the canister. If the canister or soft pack is damaged, install a new passenger air bag module assembly. Failure to follow this instruction may result in the passenger air bag module deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

2. Match the number of cover windows to the number of canister hooks before attaching the passenger air bag cover to the canister.
3. Match the top of the passenger air bag cover with the canister mark from the removal procedure.
4. Position the canister onto the passenger air bag cover and engage the bottom hooks into the air bag cover windows.
5. Push the top of the passenger air bag cover to engage the top canister hooks.

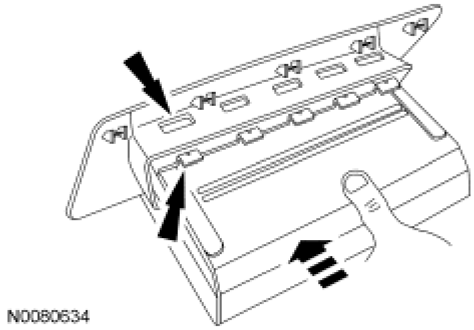


Fig. 150: Pushing Top Of Passenger Air Bag Cover To Engage Top Canister Hooks
Courtesy of FORD MOTOR CO.

6. Inspect the passenger air bag cover windows-to-canister hooks to verify that every window has a hook installed and the sides are not tucked or folded against the air bag canister.

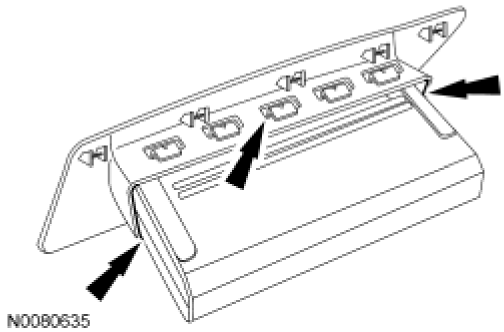


Fig. 151: Inspecting Passenger Air Bag Cover Windows-To-Canister Hooks To Verify Every Window Has A Hook Installed
Courtesy of FORD MOTOR CO.

7. Install the passenger air bag module. Refer to **Passenger Air Bag Module**.
8.

CLOCKSPRING

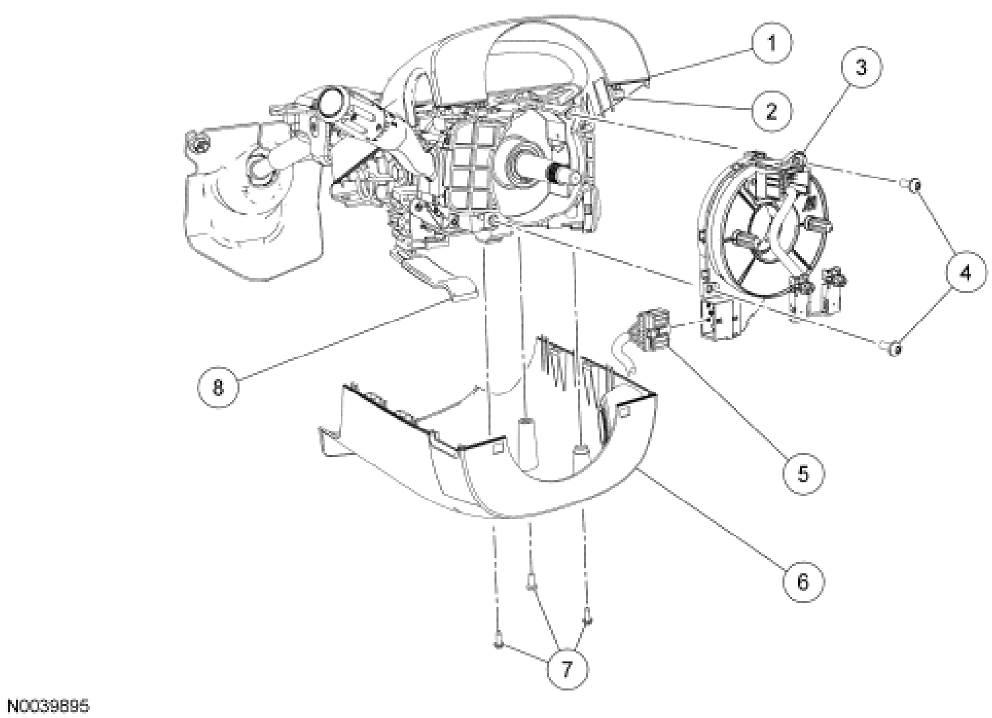


Fig. 152: Exploded View Of Clockspring
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	3530	Upper steering column shroud
2	-	Upper steering column shroud tab (2 required) (part of 3530)

3	14A644	Clockspring
4	W506942	Clockspring screws (2 required)
5	-	Clockspring electrical connector (part of 14401)
6	3K512	Lower steering column shroud
7	-	Lower steering column shroud screws (3 required) (part of 3K512)
8	-	Steering column tilt lock/unlock handle

REMOVAL

NOTE: The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Remove the driver air bag module. For additional information, refer to **Driver Air Bag Module**.

   NOTE: Make sure the road wheels are in the straight-ahead position. Damage to the clockspring may occur.

2. Remove the steering wheel. For additional information, refer to **STEERING COLUMN** article.
3. Release the 2 tabs and position the upper steering column shroud up.
4. Remove the 3 screws and lower steering column shroud.
5. Disconnect the clockspring electrical connector.
6. Remove the 2 clockspring screws and remove the clockspring.

INSTALLATION

All vehicles

1. Install the clockspring and 2 screws.
2. Connect the clockspring electrical connector.
3. Install the lower steering column shroud and 3 screws.
4. Attach the upper steering column shroud to the lower steering column shroud.

   Vehicles installing a new clockspring

5. Install the steering wheel. For additional information, refer to **STEERING SYSTEM - GENERAL**

INFORMATION article.

- After the steering wheel installation, remove the clockspring sealing key.

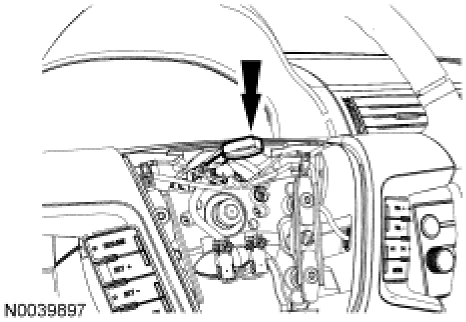


Fig. 153: Locating Clockspring Sealing Key
Courtesy of FORD MOTOR CO.

Vehicle repairs reusing the same clockspring

WARNING: **If the clockspring is not correctly centralized, it may fail prematurely. If in doubt, repeat the centralizing procedure. Failure to follow these instructions may increase the risk of serious personal injury or death in a crash.**

NOTE: Make sure the road wheels are in the straight-ahead position. Damage to the clockspring may occur.

6. If the vehicle's clockspring has rotated out of center, follow these steps to center the clockspring.
   1. Hold the clockspring outer housing stationary.

      NOTE: Overturning will destroy the clockspring. The internal ribbon wire acts as the stop and can be broken from its internal connection.

   2. While turning the rotor counterclockwise, carefully feel for the ribbon wire to run out of length and for a slight resistance. Stop turning at this point.
   3. Turn the clockspring clockwise (approximately 2.25 turns) until the clockspring rotor wiring and connector are in the 12 o'clock position. Clockspring is now centered.
      - Do not allow the rotor to turn from this position.

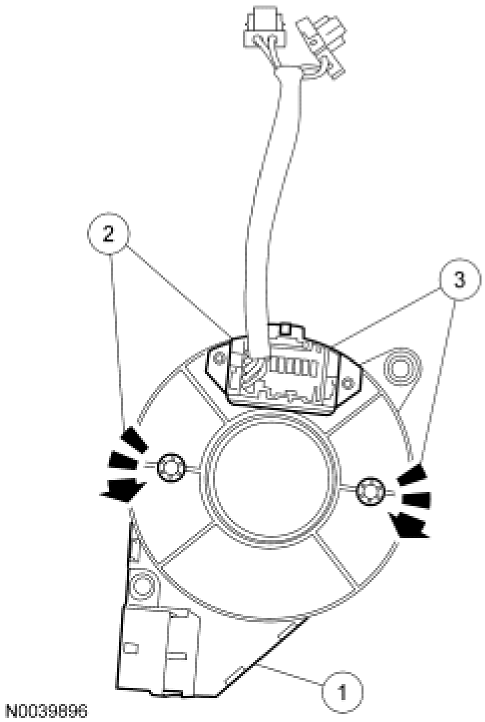


Fig. 154: Centering Clockspring
Courtesy of FORD MOTOR CO.

NOTE: If the vehicle is left unattended by the technician between centralizing the clockspring and installing the steering wheel, the centralizing procedure must be repeated. Damage to the clockspring may occur.

7. Install the steering wheel. For additional information, refer to **STEERING SYSTEM - GENERAL INFORMATION** article.

All vehicles

8. Install the driver air bag module. For additional information, refer to **Driver Air Bag Module**.

DRIVER AIR BAG MODULE

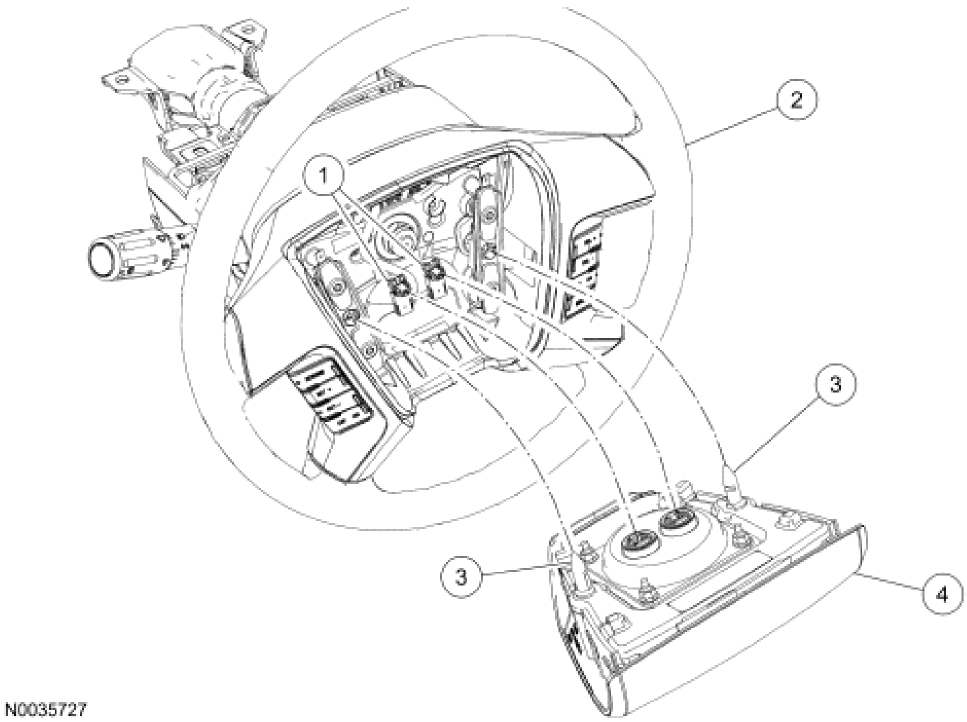


Fig. 155: Exploded View Of Driver Air Bag Module
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Driver air bag module electrical connectors (part of 14A664)
2	3600	Steering wheel
3	-	Driver air bag module locking pins (part of 43B13)
4	43B13	Driver air bag module

REMOVAL

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

NOTE: Repeat this step for both locking pins.

2. Using a 3-mm Allen wrench or a suitable tool through the access hole on the backside of the steering wheel, position the tool against the spring clip and push in, disengaging the clip from the locking pin. With the spring clip disengaged from the locking pin, gently pull back on that side of the driver air bag module to release it from the steering wheel.

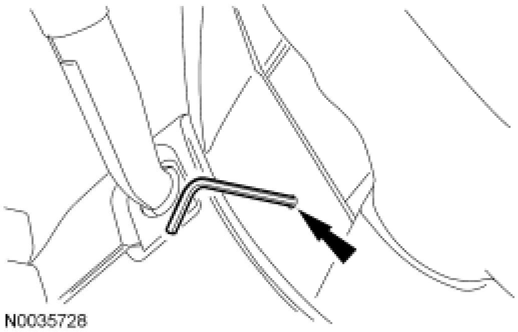


Fig. 156: Locating Allen Wrench
Courtesy of FORD MOTOR CO.

NOTE: Do not pull the driver air bag module electrical connectors out by the locking buttons. Damage to the locking buttons can occur.

3. Using a small screwdriver as shown, lift up and release the locking buttons on the driver air bag module electrical connectors. With the locking buttons released, remove the electrical connectors and the driver air bag module.

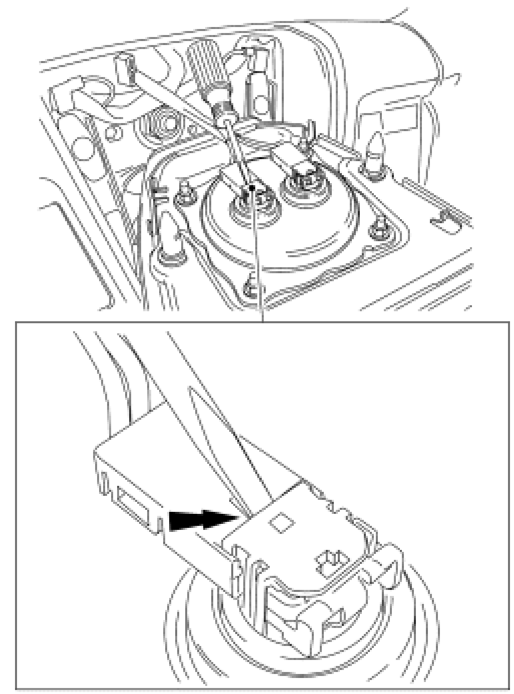


Fig. 157: Releasing Locking Buttons On Driver Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: **The driver air bag module electrical connector locking buttons must be in the released position when connected. Do not install the driver air bag module electrical connectors by the locking buttons. Failure to follow these instructions may cause connector damage.**

1. With the locking buttons released, install the driver air bag module electrical connectors fully into the driver air bag module and seat the locking buttons.

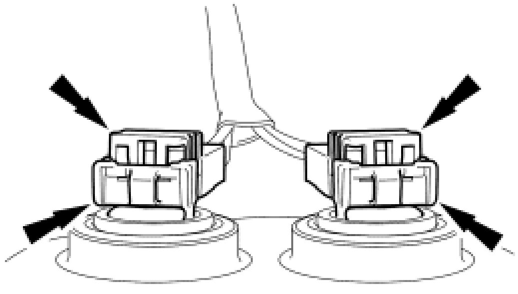


Fig. 158: Locating Driver Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

2. Align the driver air bag module locking pins to the steering wheel and, while pushing inward, seat the 2

driver air bag module locking pins to the steering wheel wire clips.

3. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

FRONT IMPACT SEVERITY SENSOR

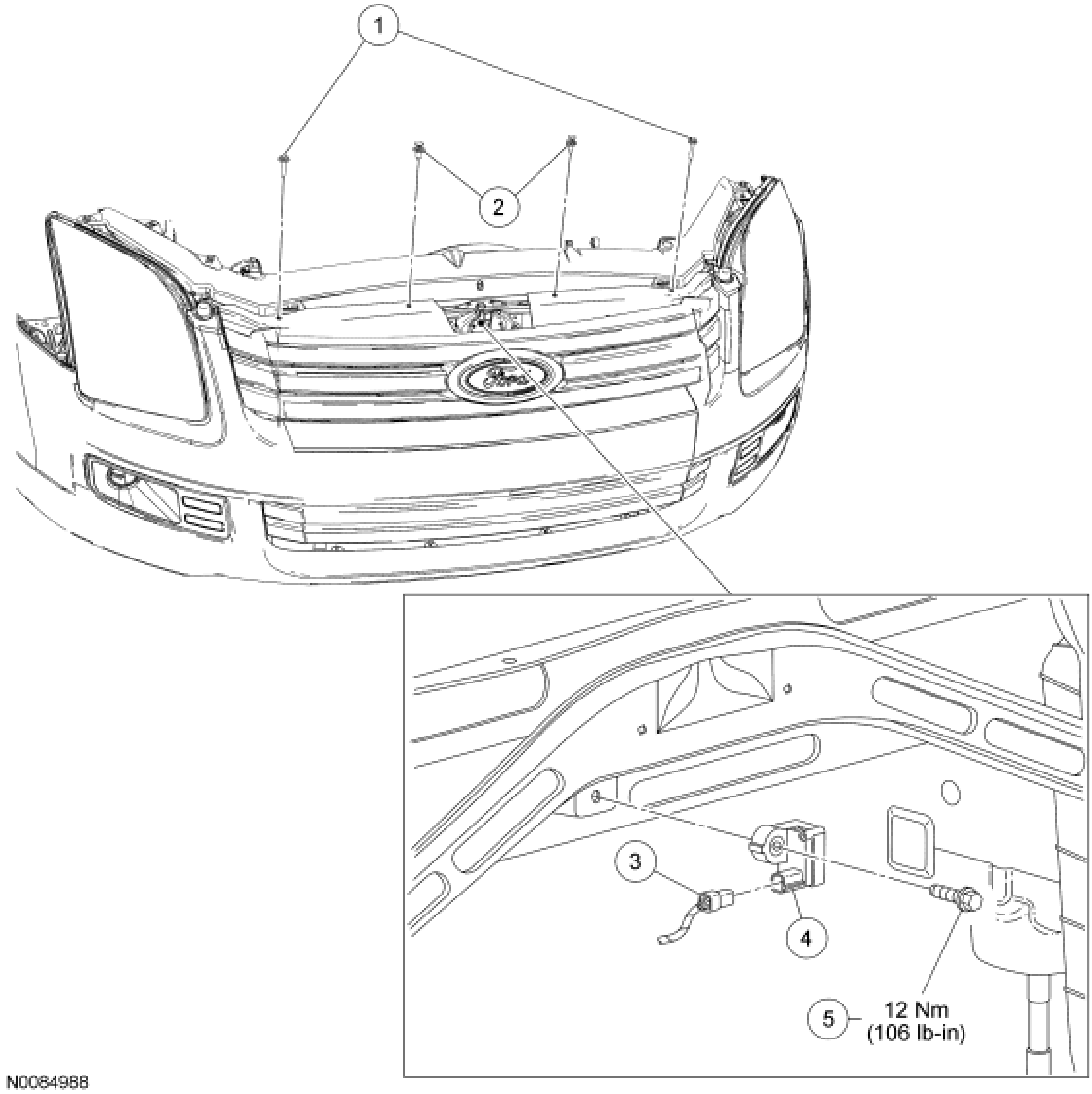


Fig. 159: Exploded View Of Front Impact Severity Sensor With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505426	Upper grille bolts (2 required)
2	N807389	Upper grille pin-type retainers (2 required)
3	-	Front impact severity sensor electrical connector (part of 14290)
4	14B006	Front impact severity sensor assembly

5	W505256	Front impact severity sensor assembly bolt

REMOVAL AND INSTALLATION

WARNING: If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Remove the 2 bolts and the 2 pin-type retainers from the upper grille.
3. While gently positioning forward the upper grille, remove the bolt from the front impact severity sensor assembly.
   - To install, tighten to 12 Nm (106 lb-in).
4. Disconnect the electrical connector and remove the front impact severity sensor assembly.

   WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

   NOTE: Make sure the radiator support and front impact severity sensor and bracket assembly mating surfaces are clean and free of foreign material.

5. To install, reverse the removal procedure.
6. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM)

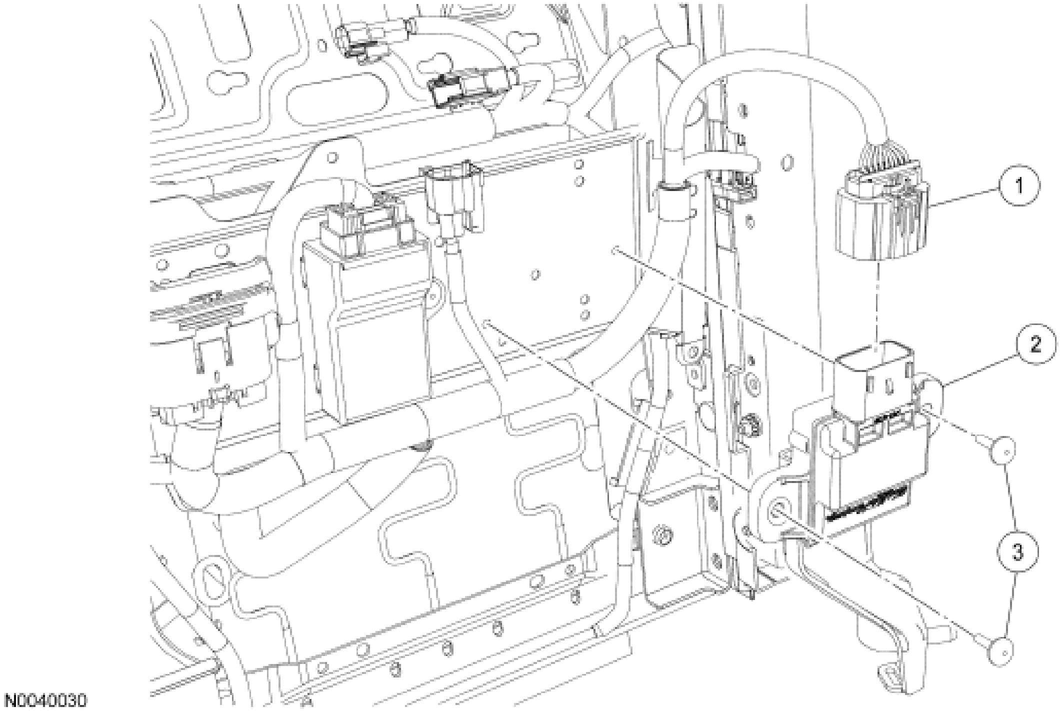


Fig. 160: Exploded View Of Occupant Classification System Module (OCSM)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Occupant classification system module (OCSM) electrical connector (part of 14A698)
2	14B422	OCSM
3	-	OCSM module rivets

REMOVAL

WARNING: **The occupant classification sensor (OCS) rails have a built-in strain gauge which may operate incorrectly if an OCS rail is dropped by itself, dropped after it is installed to the front passenger seat or dropped after it is installed to a front passenger seat track assembly. Use care when handling an OCS rail before or after it is installed to the front passenger seat or seat track assembly. Failure to follow these instructions may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.**

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.**

NOTE: **The SRS must be fully operational and free of faults before releasing the vehicle**

to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and perform the diagnostic procedure again.

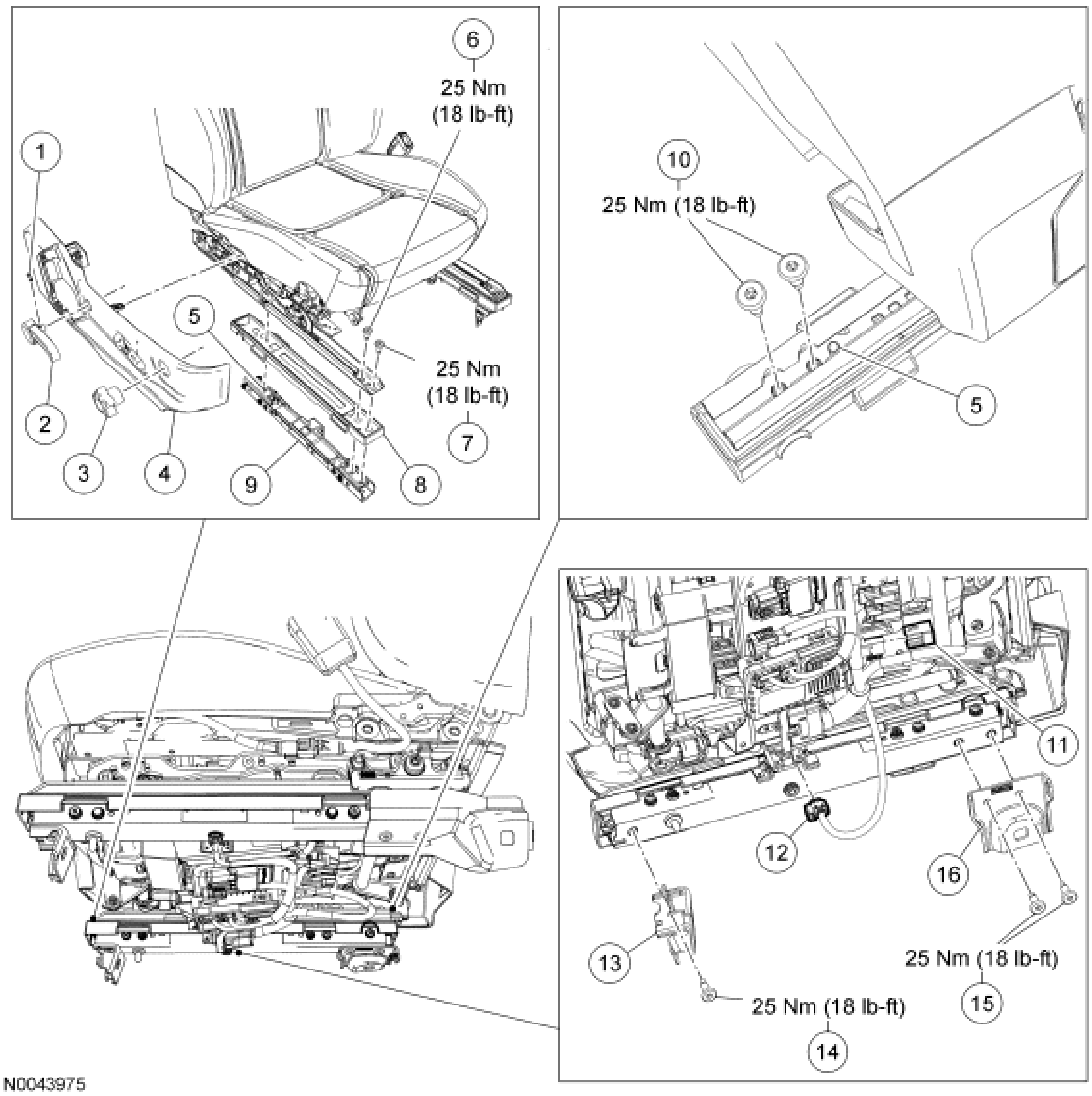
1. Remove the passenger seat. For additional information, refer to **SEATING** article.

   CAUTION: Make sure to remove all metal chips from the occupant classification system module (OCSM) and the surrounding areas after drilling out the rivets. Failure to follow this instruction may result in component damage and/or system failure.

2. Drill out the 2 occupant classification system module (OCSM) rivets.
3. Disconnect the electrical connector and remove the OCSM.
4. To install, reverse the removal procedure.
5. Install the passenger seat and repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to **SEATING** article.
6. Carry out the appropriate procedure after installation of an occupant classification system module (OCSM) system component.
   - If installing the original OCSM, carry out the Occupant Classification System (OCS) Zero Seat Weight Test and prove out the SRS. For additional information, refer to **Occupant Classification Sensor (OCS) System Zero Seat Weight Test**.
   - If installing a new OCSM, carry out the Occupant Classification Sensor (OCS) System Reset procedure and prove out the SRS. For additional information, refer to **Occupant Classification Sensor (OCS) System Reset**.

OCCUPANT CLASSIFICATION SENSOR

NOTE: Outboard shown, inboard similar.



N0043975

Fig. 161: Exploded View Of Occupant Classification Sensor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Manual recliner handle spring clip (part of 61198)
2	61198	Manual recliner handle
3	62622	Manual lumbar control knob
4	62186	Seat cushion side shield
5	-	Occupant classification sensor (OCS) system rail locating pin (part of 61708)
6	-	OCS system rail front mounting position rear bolt (part of 61708)
7	-	OCS system rail front mounting position front bolt (part of 61708)

8	62126	OCS system rail shield
9	61708	OCS system rail
10	-	OCS system rail rear bolts (part of 61708)
11	-	Power seat track motor electrical connector (part of 14A698) (if equipped)
12	-	OCS system rail electrical connector (part of 14A698)
13	61913	Forward seat riser
14	-	Forward seat riser bolt
15	-	Rearward seat riser bolts
16	61913	Rearward seat riser

REMOVAL

WARNING: **The occupant classification sensor (OCS) rails have a built-in strain gauge which may operate incorrectly if an OCS rail is dropped by itself, dropped after it is installed to the front passenger seat or dropped after it is installed to a front passenger seat track assembly. Use care when handling an OCS rail before or after it is installed to the front passenger seat or seat track assembly. Failure to follow these instructions may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.**

WARNING: **Do not disassemble the occupant classification sensor (OCS) rail or tighten or loosen any of the nuts and bolts installed to the OCS rail body. Only the 8 bolts that attach the 2 OCS rails to the seat track may be removed and installed. Failure to follow these instructions may result in incorrect operation of the OCS system and increase the risk of serious personal injury or death in a crash.**

WARNING: **To prevent foreign material and contaminants from entering the occupant classification sensor (OCS) rail, make sure the OCS rail shield is present, is not damaged and is correctly installed to the OCS rail. Failure to follow these instructions may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.**

WARNING: **Use care when handling the front passenger seat and track assembly. Dropping the assembly, placing excessive weight on or sitting on a front passenger seat that is not secured in the vehicle may result in damaged seat components. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.**

NOTE: **The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation**

and does not indicate a supplemental restraint system (SRS) fault.

NOTE: The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and perform the diagnostic procedure again.

All occupant classification sensor (OCS) system rails

1. Remove the passenger seat. For additional information, refer to **SEATING** article.

   Outboard OCS system rail

2. If equipped, remove the manual lumbar control knob.
3. If equipped, remove the spring clip and the manual recliner handle.
4. Detach and position aside the cushion side shield.
   - Pull the side shield away from the seat cushion at the front edge and release the forward and side retainers.
   - Pull the side shield rearward to release the rear retainer and detach the cushion side shield.

   Seat receiving a new OCS system rail

5. Remove the bolt and the forward seat riser from the affected side occupant classification sensor (OCS) system rail.
6. Remove the 2 bolts and the rearward seat riser from the affected side OCS system rail.

   All OCS system rails

   CAUTION: Push only on the tip of the occupant classification sensor (OCS) system electrical connector release tab to release the electrical connector. Do not insert the tool too deep into the OCS system electrical connector or damage to the electrical connector may occur.

   NOTE: Note the position and the routing of the OCS system rail electrical wiring and connector for installation.

7. On the affected side, using a suitable tool, release the tab and disconnect the OCS system rail electrical connector.

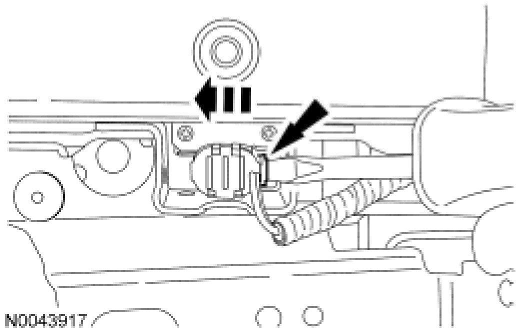


Fig. 162: Disconnecting OCS Rail Electrical Connector
Courtesy of FORD MOTOR CO.

8. If equipped, disconnect the power seat track motor electrical connector.
9. Move the seat to the forward most position.
   - If equipped with a power seat track, apply power and ground to the pins shown.

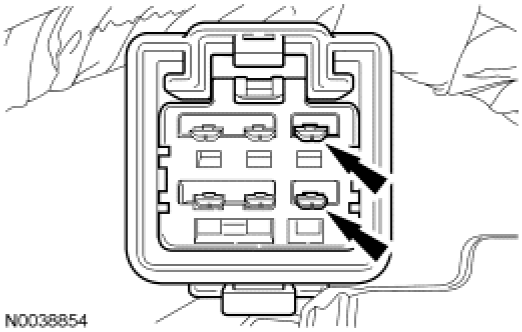


Fig. 163: Locating Power Seat Track Motor Electrical Connector Pins
Courtesy of FORD MOTOR CO.

10. Remove the 2 rear bolts from the affected OCS system rail.
11. Move the seat to the rearward most position.
    - If equipped with a power seat track, apply power and ground to the pins shown.

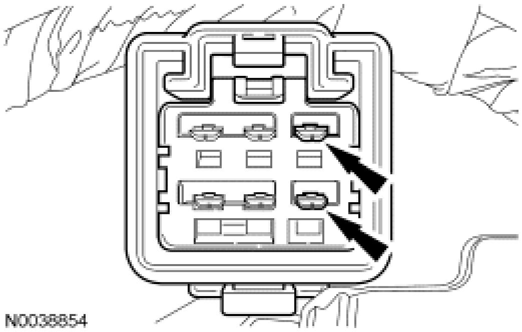


Fig. 164: Locating Power Seat Track Motor Electrical Connector Pins
Courtesy of FORD MOTOR CO.

NOTE: Note what position the locator pin on the OCS system rail goes through the OCS system rail shield and into the rear mounting point of the seat track for installation.

12. Remove the 2 front bolts and the affected OCS system rail and shield.
    - Release the OCS system rail shield rear tab from the OCS system rail.

INSTALLATION

All occupant classification sensor (OCS) system rails

NOTE: If installing a new seat track, position the seat track so the seat will be in the rearward most position before starting installation of the OCS system rails.

WARNING: **To prevent foreign material and contaminants from entering the occupant classification sensor (OCS) rail, make sure the OCS rail shield is present, is not damaged and is correctly installed to the OCS rail. Failure to follow these instructions may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.**

NOTE: Make sure the OCS system rail shield is seated correctly on the OCS system rail. Align the locator pin to the shield and attach the OCS system rail shield rear tab to the OCS system rail.

1. Position the OCS system rail shield on the OCS system rail. Then position the OCS system rail and shield on the seat track while noting the correct installation of the OCS system rail locator pin into the seat track.

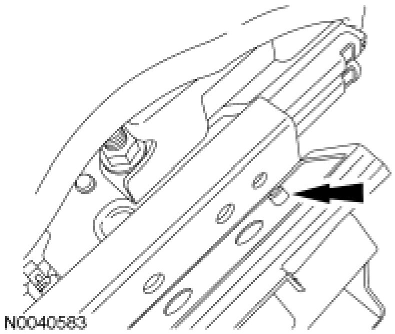


Fig. 165: Locating OCS Rail Locator Pin
Courtesy of FORD MOTOR CO.

NOTE: To make sure of correct installation, the OCS system rail bolts must be installed in the sequence shown.

2. While holding the OCS system rail and shield firmly in position, install the OCS system rail front mounting position rear bolt.

- Tighten to 25 Nm (18 lb-ft).

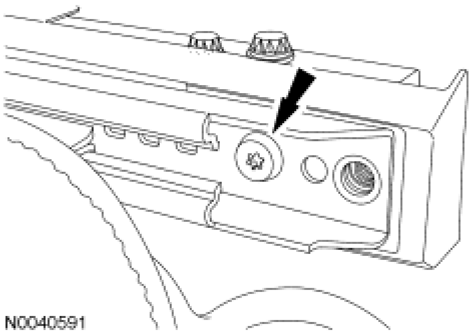


Fig. 166: Locating OCS Rail Front Mounting Position Rear Bolt
Courtesy of FORD MOTOR CO.

3. While still holding the OCS system rail and shield firmly in position, install the OCS system rail front mounting position front bolt.
   - Tighten to 25 Nm (18 lb-ft).

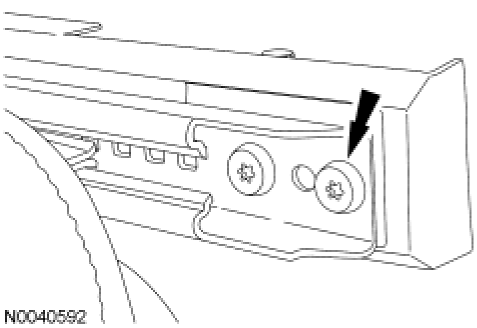


Fig. 167: Locating OCS Rail Front Mounting Position Front Bolt
Courtesy of FORD MOTOR CO.

4. Move the seat to the forward most position.
   - If equipped with a power seat track, apply power and ground to the pins shown.

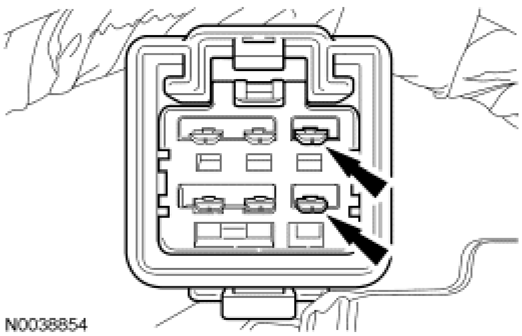


Fig. 168: Locating Power Seat Track Motor Electrical Connector Pins
Courtesy of FORD MOTOR CO.

5. Install the 2 rear OCS system rail bolts.
   - Tighten to 25 Nm (18 lb-ft).
6. Connect the OCS system rail electrical connector.
7. Center the seat track to the seat cushion pan.
   - If equipped with a power seat track, apply power and ground to the pins shown.

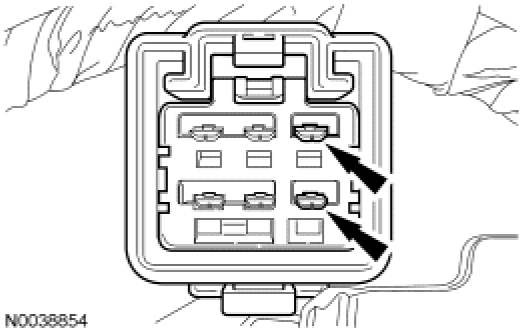


Fig. 169: Locating Power Seat Track Motor Electrical Connector Pins
Courtesy of FORD MOTOR CO.

8. If equipped, connect the power seat track motor electrical connector.

Seat receiving a new OCS system rail

9. Install the rearward seat riser and the 2 bolts.
   - Tighten to 25 Nm (18 lb-ft).
10. Install the forward seat riser and bolt.
   - Tighten to 25 Nm (18 lb-ft).

Outboard OCS system rail

11. Attach the cushion side shield.
   - Position the rear retainer clip on the cushion side shield through the hole in the backrest trim cover flap and attach it to the rear edge of the seat.
12. If equipped, install the spring clip and the manual recliner handle.
13. If equipped, install the manual lumbar control knob.

All OCS system rails

14. Install the passenger seat. **Do not prove out the SRS at this time.** For additional information, refer to **SEATING** article.
15. Carry out the appropriate procedure after installation of an OCS system component.
   - If installing the original OCS system component, carry out the Occupant Classification System (OCS) Zero Seat Weight Test and prove out the SRS. For additional information, refer to **Occupant Classification Sensor (OCS) System Zero Seat Weight Test**.

- If installing a new OCS system component, carry out the Occupant Classification Sensor (OCS) System Reset procedure and prove out the SRS. For additional information, refer to **Occupant Classification Sensor (OCS) System Reset**.

PASSENGER AIR BAG DEACTIVATION (PAD) INDICATOR

NOTE: Fusion/Milan shown, MKZ similar.

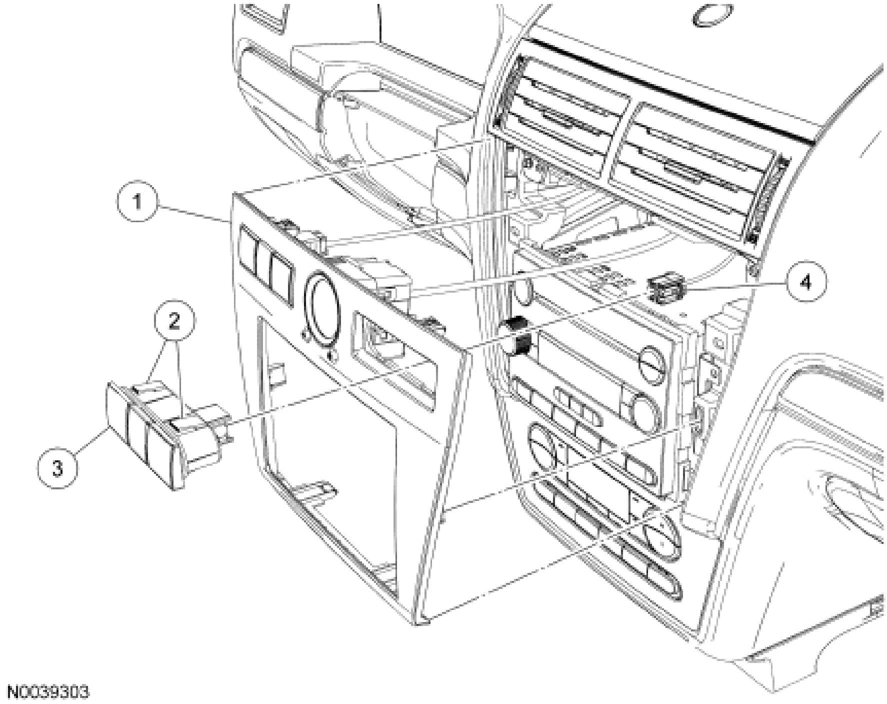


Fig. 170: Exploded View Of Passenger Air Bag Deactivation (PAD) Indicator - Fusion, Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	04338	Instrument panel center finish panel
2	-	Passenger Air Bag Deactivation (PAD) indicator locking tabs (4 required) (part of 13D734)
3	13D734	PAD indicator (part of the hazard switch/traction control switch assembly)
4	-	Electrical connector (part of 14401)

NOTE: A DTC will set in the Restraints Control Module (RCM) if the Passenger Air Bag Deactivation (PAD) electrical connector is disconnected with the ignition ON. The RCM memory must be cleared before releasing the vehicle.

1. Turn the ignition OFF and wait one minute.
2. Remove the instrument panel center trim panel. For additional information, refer to **INSTRUMENT PANEL AND CONSOLE** article.

3. Disconnect the PAD indicator electrical connector.
4. Release the 4 locking tabs (2 upper and 2 lower) and remove the PAD indicator assembly.
5. To install, reverse the removal procedure.

PASSENGER AIR BAG MODULE

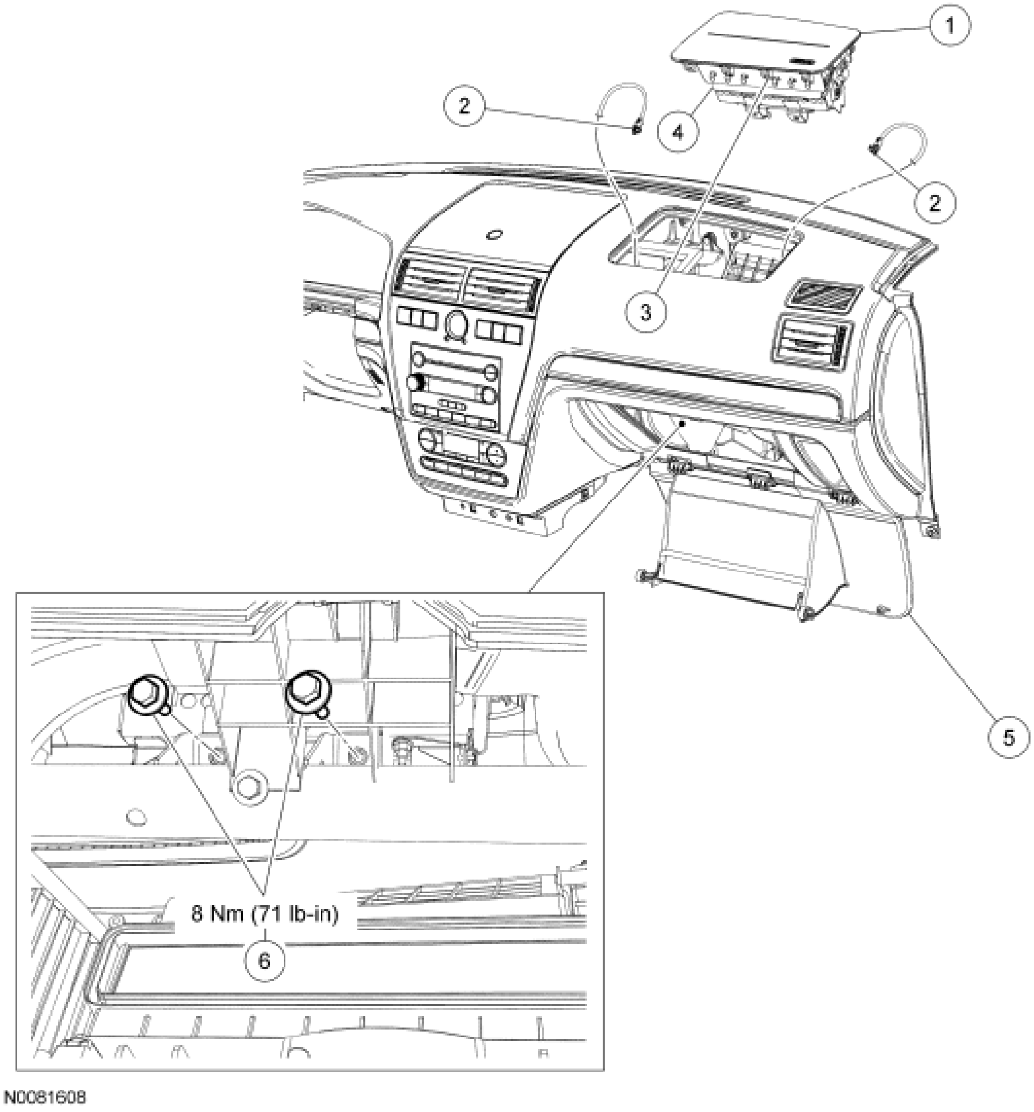


Fig. 171: Exploded View Of Passenger Air Bag Module - Fusion/Milan
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	04338	Air bag trim cover
2	-	Passenger air bag module electrical connectors (part of 14401)
3	-	Passenger air bag cover clip

4	044A74	Passenger air bag module assembly
5	060T10	Glove compartment door
6	W505422	Passenger air bag module bolts (2 required)

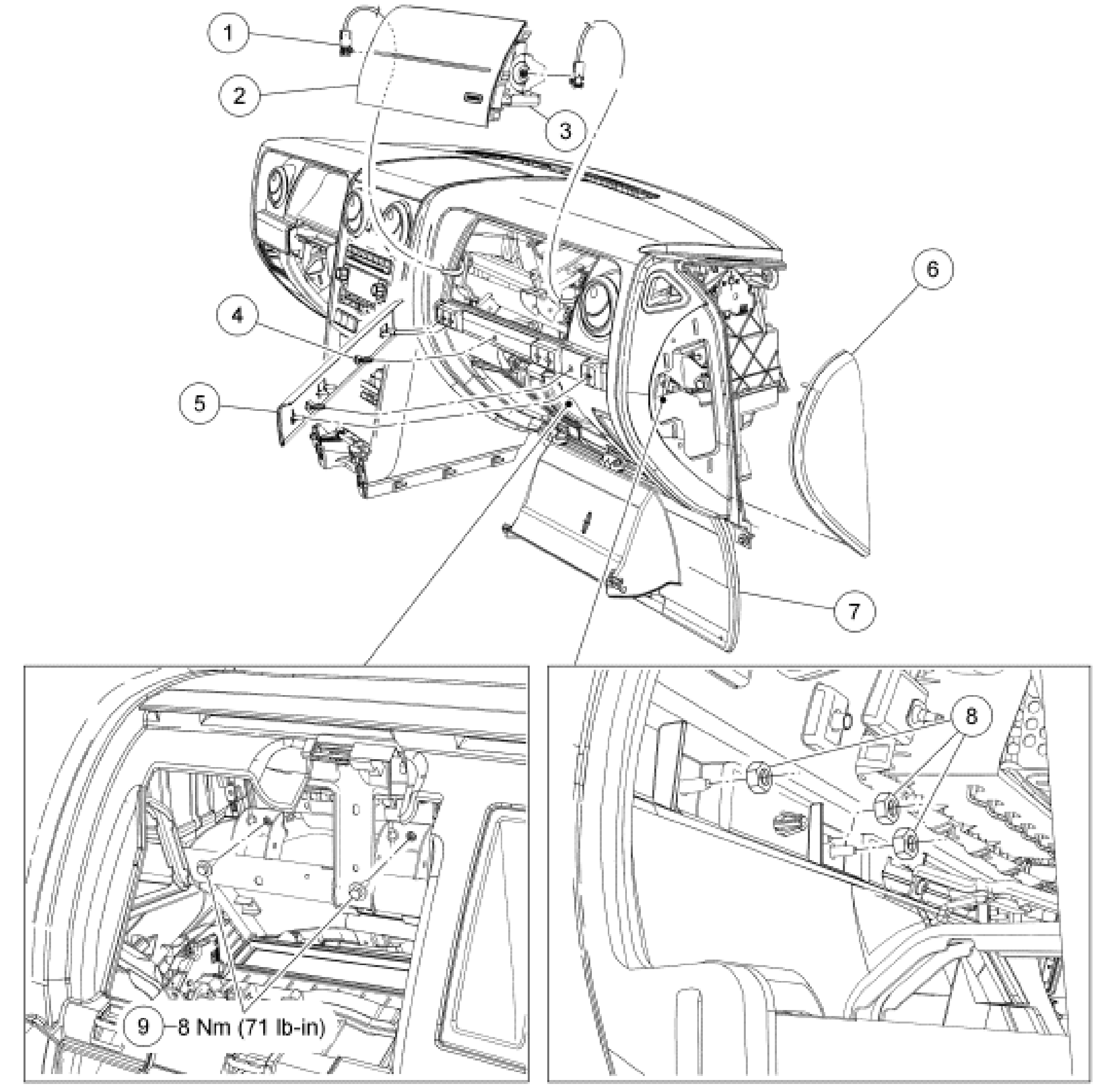


Fig. 172: Exploded View Of Passenger Air Bag Module With Torque Specification - MKZ
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Passenger air bag module electrical connector (2 required) (part of 14401)
2	04338	Air bag trim cover
3	044A74	Passenger air bag module assembly
4	-	RH instrument panel trim panel clip (2 required) (part of 044K54)

5	044K54	RH instrument panel trim panel
6	04480	Instrument panel end panel
7	060T10	Glove compartment door
8	-	RH instrument panel trim panel nuts (5 required) (044K54)
9	W505422	Passenger air bag module bolts (2 required)

REMOVAL

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

All vehicles

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Open the glove compartment door, release the door damper cable and fully lower the door.

   MKZ

3. Remove the instrument panel end panel.
4. Through the glove compartment opening, remove the 5 RH instrument panel trim panel nuts.
5. Pull out on the RH instrument panel trim panel, releasing the 2 clips, then remove the RH instrument panel trim panel.

   All vehicles

6. Remove the 2 passenger air bag module bolts.

NOTE: Do not handle the passenger air bag module by grabbing the edges of the passenger air bag cover. Damage to the air bag module may occur.

7. Through the glove compartment opening, release the passenger air bag cover clips from the instrument panel and then lift the passenger air bag module out of the instrument panel.

NOTE: RH shown, LH similar.

8. Using a small screwdriver as shown, lift up and release the locking buttons on the 2 passenger air bag module electrical connectors.

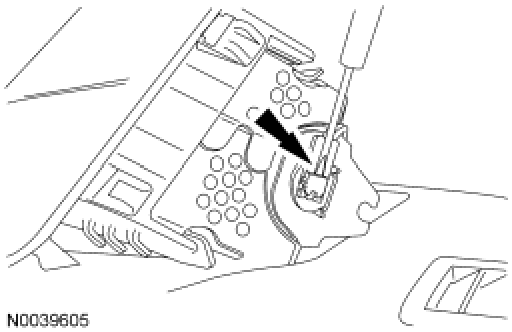


Fig. 173: Locating Passenger Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: Do not pull the passenger air bag module electrical connectors out by the locking buttons. Damage to the locking buttons can occur.

NOTE: RH shown, LH similar.

9. With the locking buttons released, remove the 2 electrical connectors and the passenger air bag module.

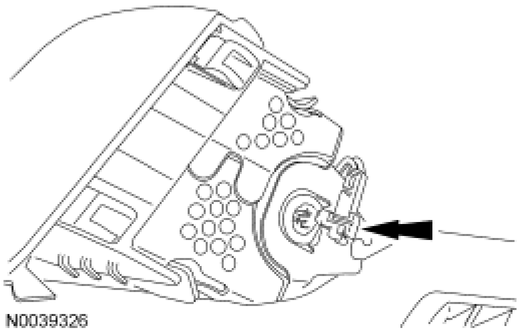


Fig. 174: Locating Passenger Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

INSTALLATION

All vehicles

NOTE: The passenger air bag module electrical connector locking buttons must

be in the released position when connected. Do not install the passenger air bag module electrical connectors by the locking buttons. Failure to follow these instructions may cause connector damage.

1. With the locking buttons released, install the 2 passenger air bag module electrical connectors fully into the passenger air bag module and seat the locking buttons.

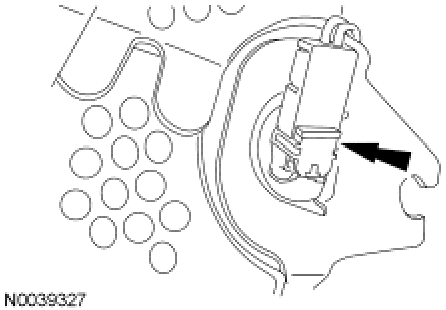


Fig. 175: Locating Passenger Air Bag Module Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE:	**Do not handle the passenger air bag module by grabbing the edges of the passenger air bag cover. Damage to the air bag module may occur.**

NOTE:	**During air bag module installation, make sure all the passenger air bag cover clips are fully seated in the instrument panel.**

2. Install the passenger air bag module in the instrument panel.
3. Install the 2 passenger air bag module bolts.
   - Tighten to 8 Nm (71 lb-in).

MKZ

4. Align the 2 clips and install the instrument panel trim panel.
5. Install the 5 RH instrument panel trim panel nuts.
6. Install the instrument panel end panel.

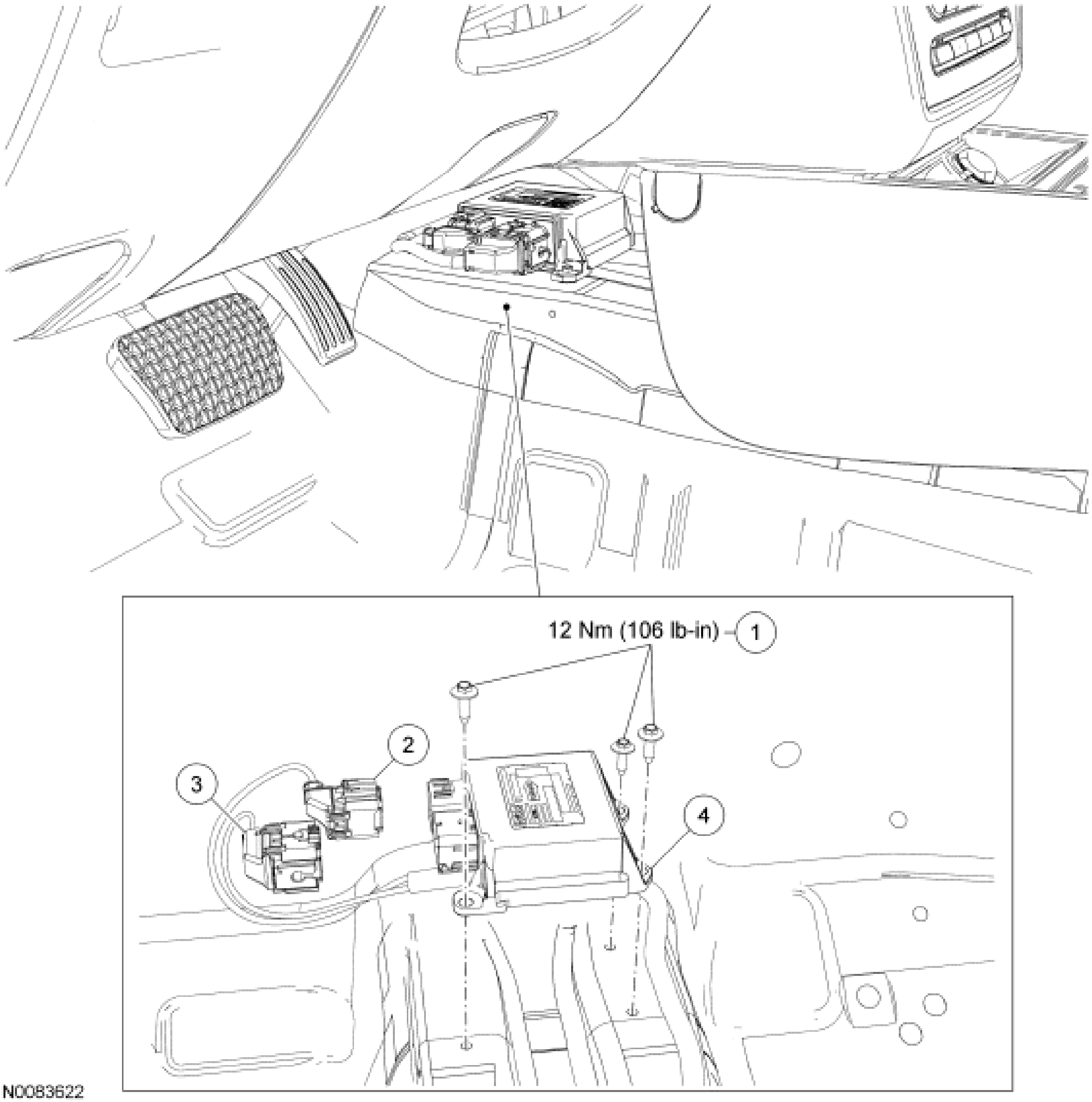
All vehicles

7. Attach the door damper cable and close the glove compartment door.
8. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

RESTRAINTS CONTROL MODULE (RCM)

Special Tools

Illustration	Tool Name	Tool Number
 ST1385-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool



N0083622

Fig. 176: Exploded View Of Restraints Control Module (RCM) With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W707722	Restraints Control Module (RCM) bolts (3 required)
2	-	RCM small connector (part of 14A005)

3	-	RCM large connector (part of 14A005)
4	14B321	RCM

REMOVAL

WARNING: **Do not handle, move or change the original horizontal mounting position of the restraints control module (RCM) while the RCM is connected and the ignition switch is ON. Failure to follow this instruction may result in the accidental deployment of the safety canopy and cause serious personal injury or death.**

WARNING: **If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.**

NOTE: **When installing a new Restraints Control Module (RCM), it is necessary to carry out Programmable Module Installation (PMI). System failure may occur if PMI is not performed. For additional information, refer to MODULE CONFIGURATION article.**

NOTE: **The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **When installing a new RCM, always make sure the correct RCM is being installed. If an incorrect RCM is installed, erroneous DTCs will result.**

NOTE: **The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

1. If installing a new RCM, carry out the steps necessary to prepare for Programmable Module Installation (PMI). For additional information, refer to **MODULE CONFIGURATION** article.
2. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
3. Remove the 2 RH side RCM bolts.
   - Position the carpet back at the RH side of the center tunnel area under the instrument panel and remove the 2 bolts.
4. Disconnect the large RCM electrical connector.
   1. Pinch the thumb tab and pivot the connector position assurance lever all the way back until it stops.
   2. Pull out and disconnect the RCM electrical connector.

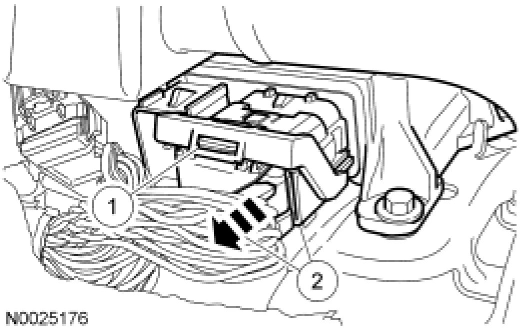


Fig. 177: Disconnecting RCM Electrical Connector
Courtesy of FORD MOTOR CO.

5. Remove the RCM.
    1. Disconnect the small RCM electrical connector.
    2. Remove the LH bolt.
    3. Remove the RCM.

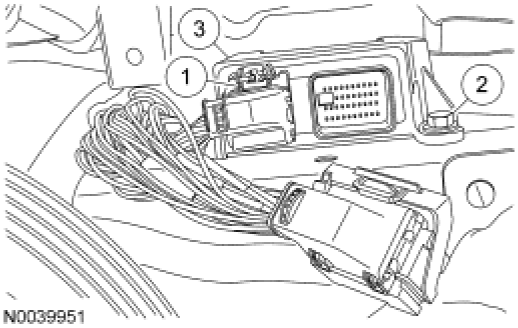


Fig. 178: Identifying RCM, Electrical Connector And Bolt
Courtesy of FORD MOTOR CO.

INSTALLATION

WARNING: **Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.**

1. Position the RCM.
    - Install the 2 RH side RCM bolts.
        - Tighten to 12 Nm (106 lb-in).
    - Position the carpet back at the RH side of the center tunnel area under the instrument panel.
2. Install the RCM.
    - Install the LH side RCM bolt.
        - Tighten to 12 Nm (106 lb-in).

- Connect the small RCM electrical connector.

3. Make sure the large RCM connector position assurance lever is in the full release position before attempting to connect the connector.

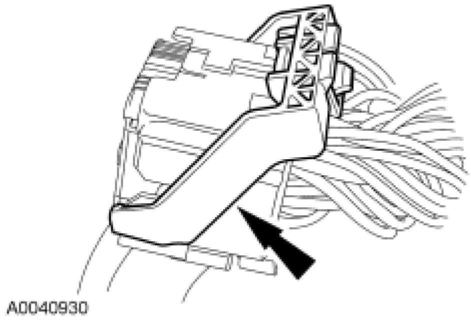


Fig. 179: View Of Connector Position Assurance Lever
Courtesy of FORD MOTOR CO.

NOTE: **Placing the large Restraints Control Module (RCM) electrical wiring connector into the RCM on an angle, can cause bad electrical connections and damaged components.**

NOTE: **The RCM has been removed for clarity.**

4. Position the large RCM electrical connector into the RCM.

NOTE: **Do not push the connector to the point where the lever pivots and seats itself. Light pressure is needed to get the connector into position on the Restraints Control Module (RCM), before using the lever to fully seat the connector. Damage to the connector or component may occur.**

- With the large RCM electrical connector uniformly aligned to the RCM, lightly push in until a subtle audible click is heard and slight resistance is felt.

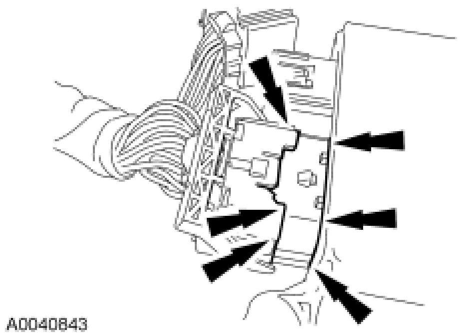


Fig. 180: Large RCM Electrical Wiring Connector
Courtesy of FORD MOTOR CO.

5. Connect the large RCM electrical connector.
    - Using the connector position assurance lever, pivot it toward the RCM, drawing the connector into the RCM.
        - Make sure the thumb tab is engaged to the retainer on the RCM and locked in place.

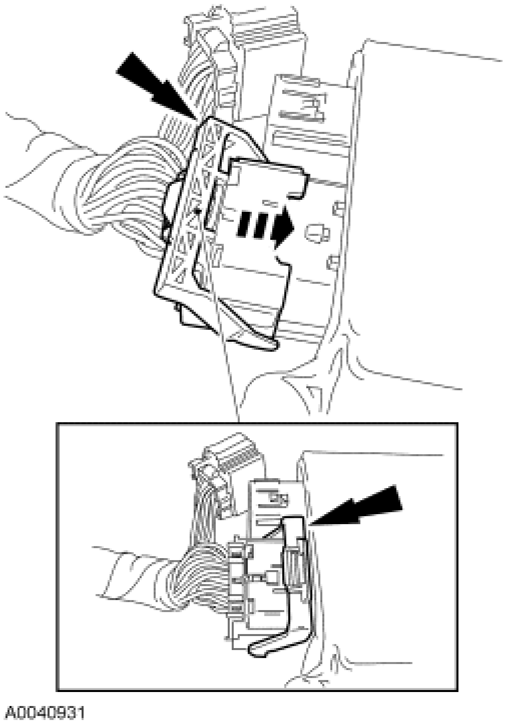


Fig. 181: Locating RCM Electrical Connector
Courtesy of FORD MOTOR CO.

6. Repower the SRS. **Do not prove out the SRS at this time.** For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
7. If installing a new RCM, Complete the PMI procedure. For additional information, refer to **MODULE CONFIGURATION** article.
8. Prove out the SRS as follows:

    Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn OFF. If an air bag SRS fault is present, the air bag warning indicator will:

    - fail to light.

    - remain lit continuously.

    - flash at a 5 Hz rate (RCM not configured).

The air bag warning indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous DTCs from the RCM and Occupant Classification System Module (OCSM) using a scan tool.

SIDE AIR CURTAIN MODULE

NOTE: **Right side shown, left side similar.**

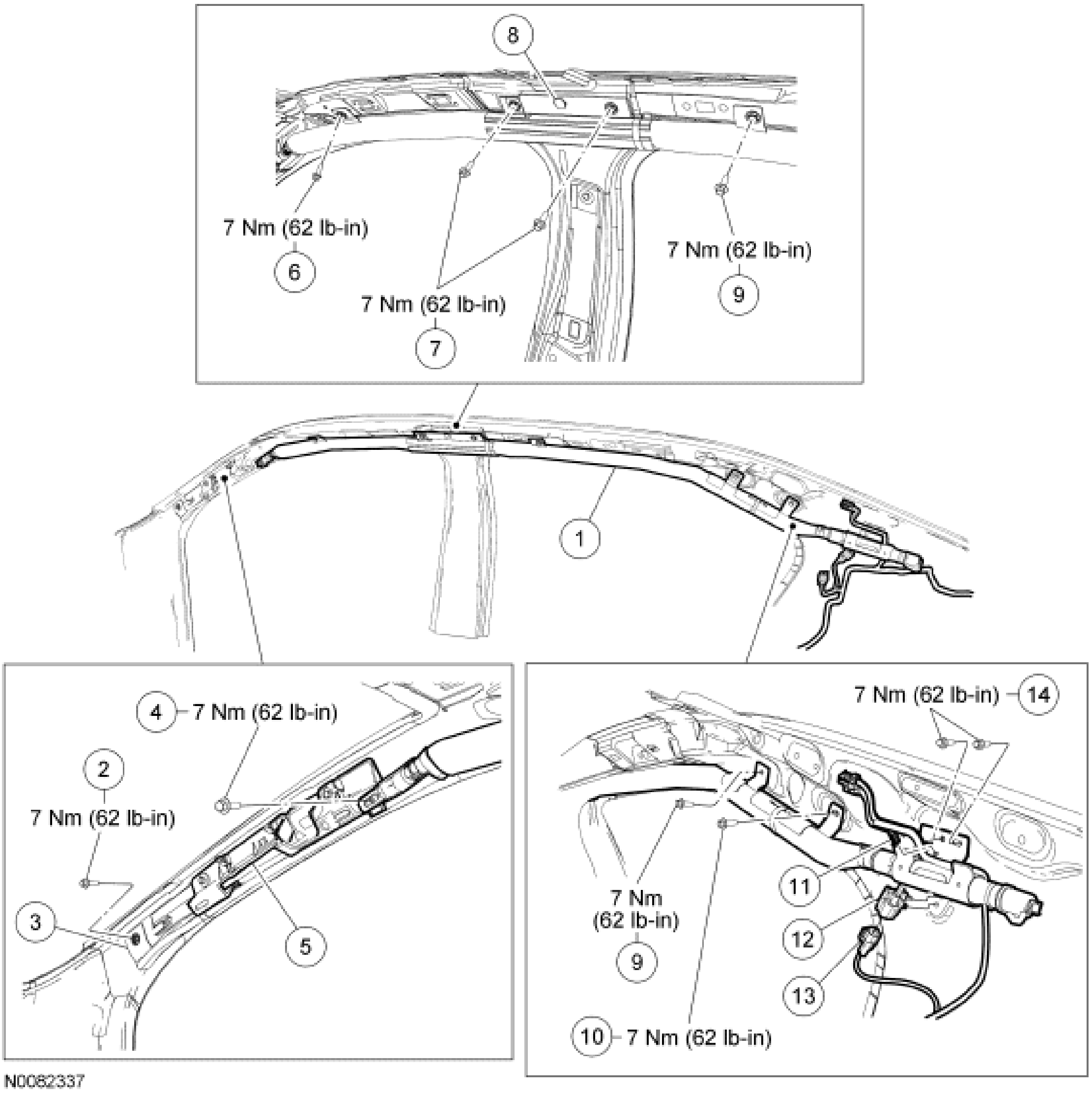


Fig. 182: Exploded View Of Side Air Curtain Module With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	042D94	Side air curtain module
2	W505254	Side air curtain module front tether bracket bolt
3	-	Side air curtain module front tether bracket (part of 042D94)
4	W505254	Side air curtain module A-pillar trim bracket bolt
5	026A53	A-pillar trim bracket
6	W505254	Side air curtain module bolt (rear of A-pillar)
7	W505254	Side air curtain module center guide bolts
8	-	Side air curtain center guide hook retainer (part of 042D94)
9	W505254	Side air curtain module middle rear bolt
10	W505254	Side air curtain module middle rear bolt (early build vehicles only)
11	-	Wiring retainer (part of 14A005) (RH only)
12	-	Side air curtain module electrical connector (part of 042D94)
13	-	Side air curtain module electrical connector (part of 14A005)
14	W505254	Side air curtain module rear bracket bolts

REMOVAL AND INSTALLATION

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Always carry or place a live safety canopy, or side air curtain module, with the module and tear seam pointed away from your body. Failure to follow this instruction may result in serious personal injury or death in the event of an accidental deployment.**

WARNING: **Before installing a safety canopy or side air curtain module, inspect the roofline for any damage. If necessary, the sheet metal must be reworked to its original condition and structural integrity. Install new fasteners if damaged and remove foreign material. Failure to follow these instructions may result in the safety canopy or side air curtain deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

WARNING: **When installing a new headliner on a vehicle equipped with safety canopy or side air curtain modules, make sure the headliner has the word AIRBAG on the headliner where it meets each B-pillar trim panel. Otherwise, you have the wrong headliner. Failure to follow this instruction may result in the safety canopy or side air curtain module not deploying or deploying incorrectly, increasing the risk of personal injury or death in**

a crash.

WARNING: **Anytime the safety canopy or side air curtain module has deployed, a new headliner and new A-, B- and C-pillar upper trim panels and attaching hardware must be installed. Remove any other damaged components and hardware and install new components and hardware as needed. Failure to follow these instructions may result in the safety canopy or side air curtain module deploying incorrectly and increases the risk of serious personal injury or death in a crash.**

WARNING: **Inspect a safety canopy or side air curtain module before installation. If the module is damaged, the cover has separated or the safety canopy/side air curtain material has been exposed, install a new module. Do not attempt to repair the module. Failure to follow these instructions may result in the safety canopy or side air curtain deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

WARNING: **Do not obstruct or place objects in the deployment path of the safety canopy or side air curtain module. Failure to follow this instruction may result in the safety canopy or side air curtain module deploying incorrectly and increases the risk of serious personal injury or death in a crash.**

WARNING: **Never put any type of fastener or tie strap around any part of a safety canopy module, side air curtain module or interior trim panel. This will prevent the safety canopy or side air curtain module from deploying correctly. Failure to follow this instruction may increase the risk of serious personal injury or death in a crash.**

WARNING: **Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.**

NOTE: **Early production vehicles require 2 side air curtain module middle rear bracket bolts; late production vehicles have a fabric tab and require 1 side air curtain module bolt. The side air curtain modules are NOT interchangeable between early and late production vehicles.**

NOTE: **The air bag warning indicator illuminates when the correct restraints control module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The supplemental restraint system (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

All side air curtain modules

1. Remove the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
2. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
3. Disconnect the side air curtain module electrical connector and detach the connector pin-type retainer from the C-pillar sheetmetal.

   RH side air curtain module

4. Detach the wiring retainer from the side air curtain module rear bracket.

   All side air curtain modules

5. Remove the bolt and side air curtain module front tether bracket.
   - To install, tighten to 7 Nm (62 lb-in).
6. Remove the side air curtain module bolt from the A-pillar trim bracket.
   - To install, tighten to 7 Nm (62 lb-in).
7. Remove the side air curtain module bolt, located to the rear of the A-pillar.
   - To install, tighten to 7 Nm (62 lb-in).
8. Remove the 3 side air curtain module middle rear bolts.
   - To install, tighten to 7 Nm (62 lb-in).

   NOTE: Note the position of the side air curtain module rear bracket hook for installation.

9. Remove the side air curtain module 2 rear bracket bolt(s).
   - To install, tighten to 7 Nm (62 lb-in).

   NOTE: Note the position of the side air curtain module center guide hook retainer for installation.

10. Remove the side air curtain module 2 center guide bolts. Detach the side air curtain module center guide hook retainer from the vehicle sheetmetal.
    - To install, tighten to 7 Nm (62 lb-in).

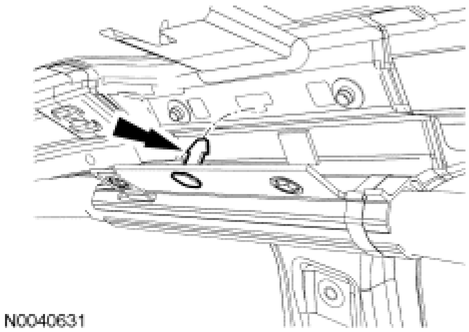


Fig. 183: Locating Side Air Curtain Module Center Guide Hook Retainer
Courtesy of FORD MOTOR CO.

11. Remove the side air curtain module.
    - Move the side air curtain module toward the front of the vehicle to release the rear bracket hook from the C-pillar sheetmetal.

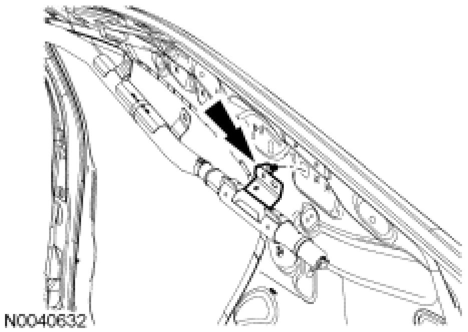


Fig. 184: Locating Rear Bracket Hook
Courtesy of FORD MOTOR CO.

WARNING: **Before installing a safety canopy or side air curtain module, inspect the roofline for any damage. If necessary, the sheet metal must be reworked to its original condition and structural integrity. Install new fasteners if damaged and remove foreign material. Failure to follow these instructions may result in the safety canopy or side air curtain deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

WARNING: **Inspect a safety canopy or side air curtain module before installation. If the module is damaged, the cover has separated or the safety canopy/side air curtain material has been exposed, install a new module. Do not attempt to repair the module. Failure to follow these instructions may result in the safety canopy or side air curtain deploying incorrectly, which increases the risk of serious personal injury or death in a crash.**

WARNING: **Never put any type of fastener or tie strap around any part of a safety canopy module, side air curtain module or interior trim panel. This will prevent the safety canopy or side air curtain module from deploying correctly. Failure to follow this instruction may increase the risk of serious personal injury or death in a crash.**

NOTE: Make sure all side air curtain module bolt holes line up with all the vehicles bolt holes .

12. To install, reverse the removal procedure.
13. Install the headliner. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
14. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

SEAT POSITION SENSOR

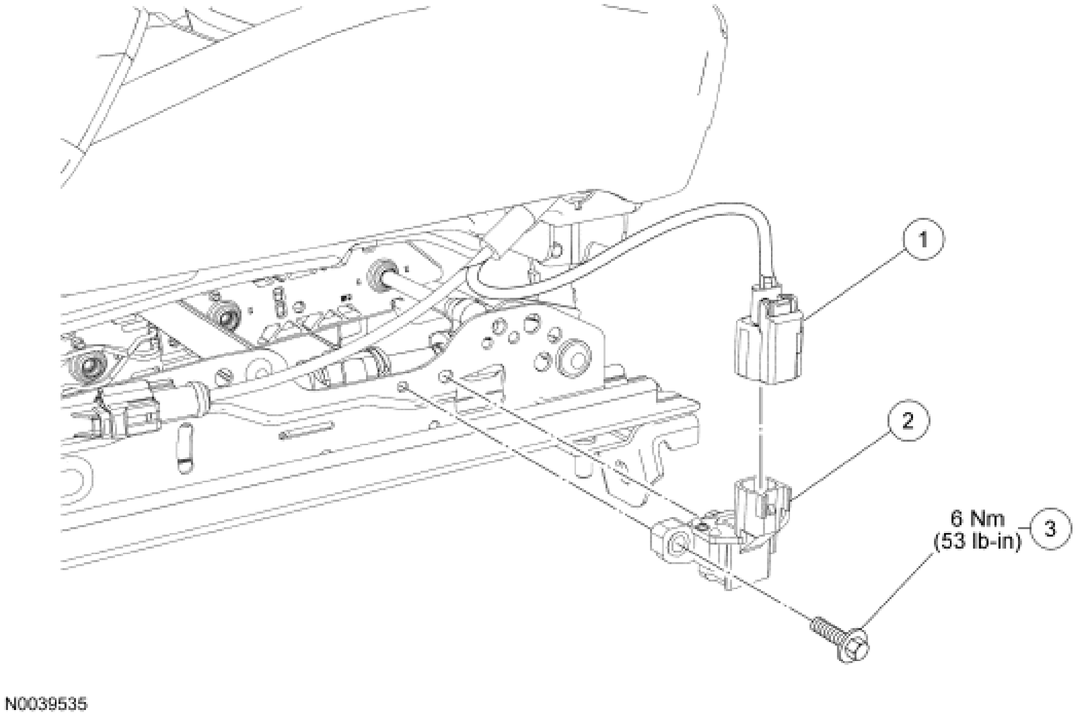


Fig. 185: Exploded View Of Seat Position Sensor With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Seat position sensor electrical connector (part of 14A699)
2	14B416	Seat position sensor
3	W505256	Seat position sensor bolt

NOTE: The air bag warning indicator illuminates when the Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

1. Position the front seat to the rearmost and upward position.
2. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
3. Disconnect the seat position sensor electrical connector.
4. Remove the bolt and seat position sensor.
    - To install, tighten to 6 Nm (53 lb-in).

    WARNING: Always tighten the seat position sensor retaining bolt to specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

5. To install, reverse the removal procedure.
6. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

SIDE AIR BAG MODULE

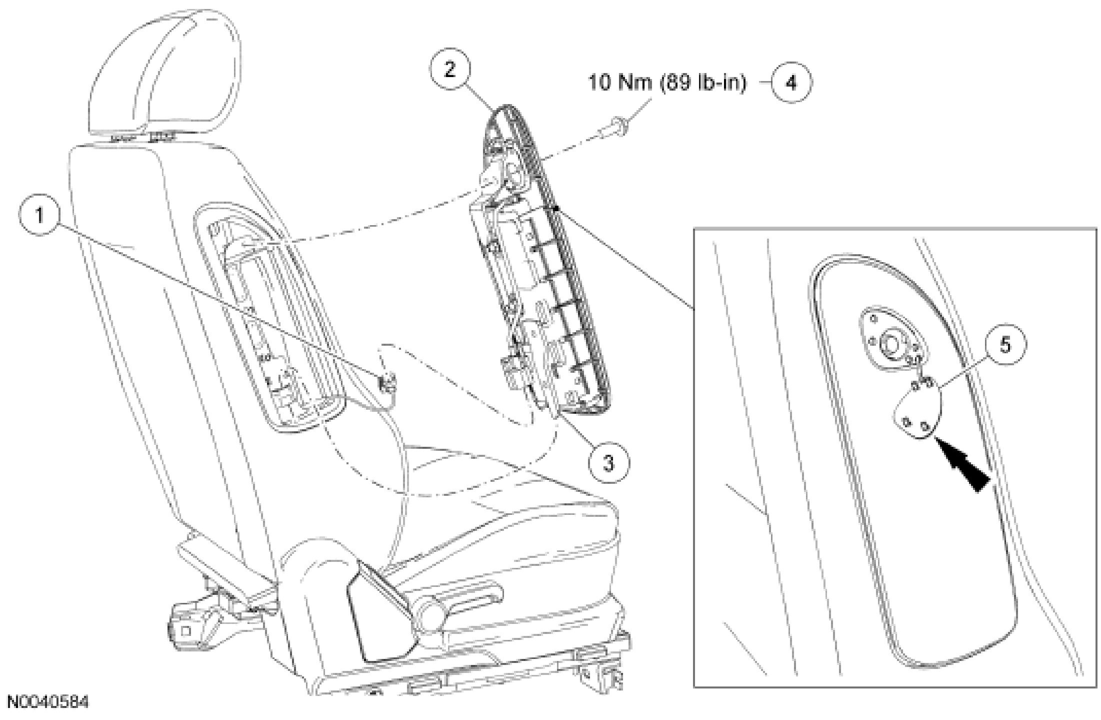


Fig. 186: Exploded View Of Side Air Bag Module With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Side air bag module electrical connector (part of 14K155)
2	611D10	Side air bag module
3	-	Side air bag module locator hook (part of 611D10)
4	N605892	Side air bag module bolt
5	-	Side air bag module bolt cover (part of 611D10)

REMOVAL AND INSTALLATION

WARNING: **Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.**

NOTE: The air bag warning indicator illuminates when the corect Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: RH shown, LH similar.

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Detach the side air bag module bolt cover.

   NOTE: Note the side air bag module locator hook (on the seat back frame) for correct installation.

3. Remove the bolt and lift up and out, to detach the side air bag module from the seat back.
   - To install, tighten to 10 Nm (89 lb-in).
4. Slide and disengage the side air bag module electrical connector locking clip, and then release the tab and disconnect the side air bag module electrical connector.

   WARNING: **Inspect the seat side air bag module cavity in the seat backrest foam pad for any foreign material. If any foreign material is found, remove it. Failure to follow these instructions may result in the seat side air bag module deploying incorrectly and increases the risk of serious personal injury or death in a crash.**

WARNING: If the seat side air bag cover has been damaged or separated from its mounting, or if the air bag material has been exposed, install a new seat side air bag module. Never try to repair the seat side air bag module. Failure to follow these instructions may result in the seat side air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

5. To install, reverse the removal procedure.
6. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

SIDE IMPACT SENSOR - B-PILLAR

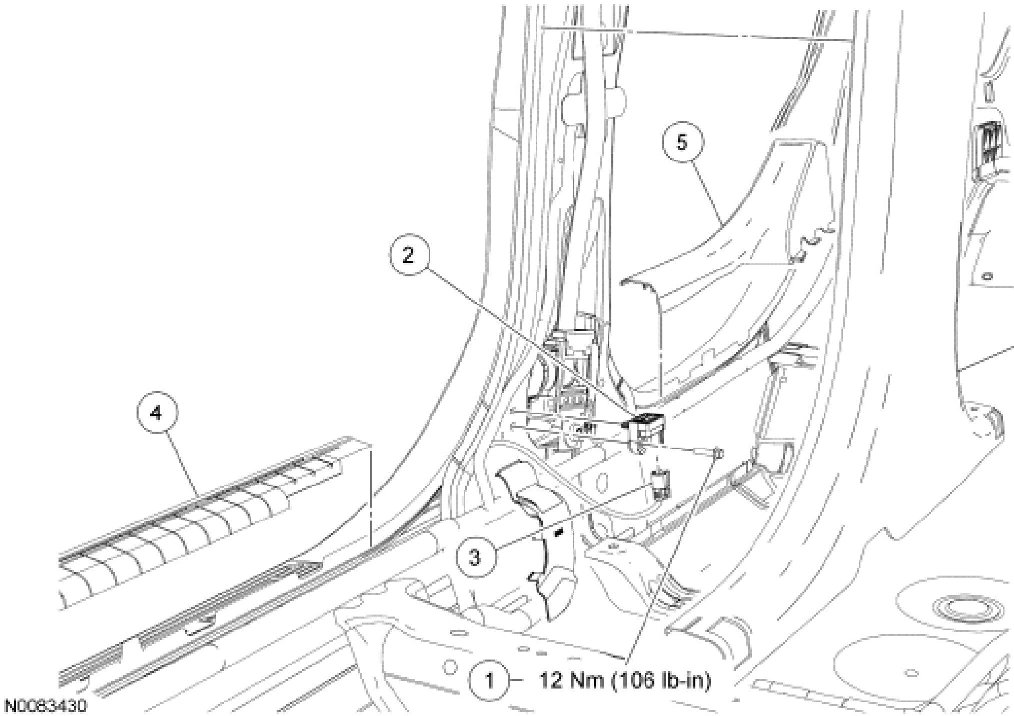


Fig. 187: Exploded View Of Side Impact Sensor With Torque Specification - B-Pillar
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505256	Side impact sensor bolt
2	14B345	Side impact sensor
3	-	Side impact sensor electrical connector (part of 14A005)
4	13208	Front door scuff plate
5	13228	Rear door scuff plate
6	24346	Lower B-pillar trim panel

NOTE: The air bag warning indicator illuminates when the correct Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.

NOTE: The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.

NOTE: RH shown, LH similar.

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Remove the lower B-pillar trim panel. For additional information, refer to **INTERIOR TRIM AND ORNAMENTATION** article.
3. Disconnect the side impact sensor electrical connector.
4. Remove the bolt and side impact sensor.
   - To install, tighten to 12 Nm (106 lb-in).

   WARNING: **Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.**

   NOTE: Make sure the B-pillar and side impact sensor mating surfaces are clean.

5. To install, reverse the removal procedure.
6. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

SIDE IMPACT SENSOR - C-PILLAR

NOTE: RH shown, LH similar.

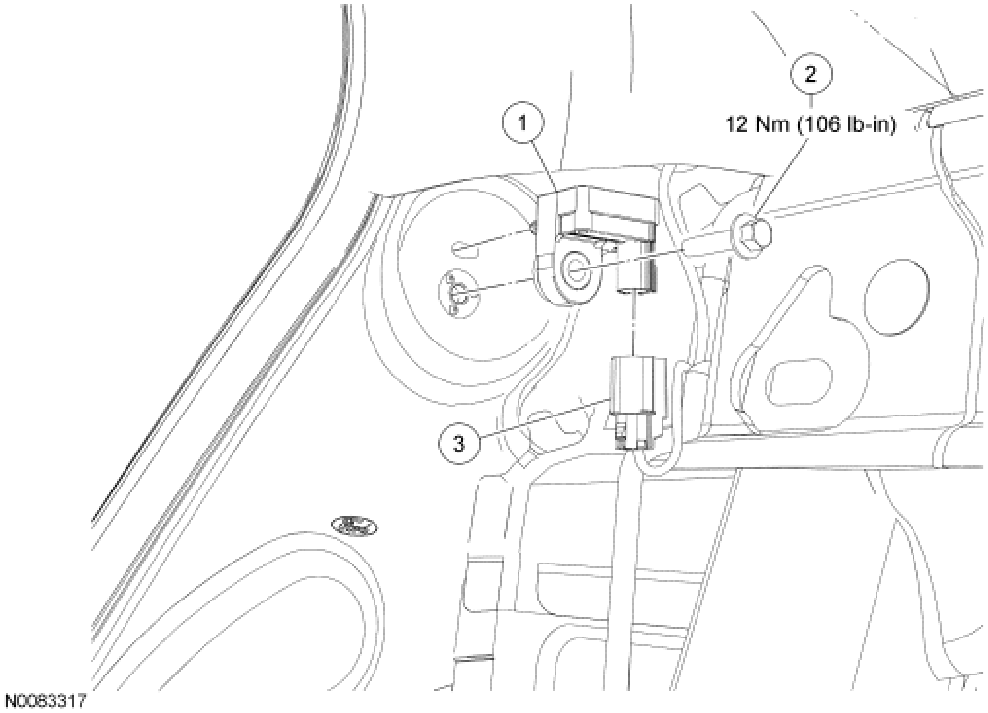


Fig. 188: Exploded View Of Side Impact Sensor With Torque Specification - C-Pillar
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14B345	Side impact sensor
2	W505256	Side impact sensor bolt
3	-	Side impact sensor electrical connector (part of 14A005)

NOTE: **The air bag warning indicator illuminates when the Restraints Control Module (RCM) fuse is removed and the ignition switch is ON.**

NOTE: **The Supplemental Restraint System (SRS) must be fully operational and free of faults before releasing the vehicle to the customer.**

1. Depower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.
2. Remove the rear seat bolster. For additional information, refer to **SEATING** article.
3. Disconnect the side impact sensor electrical connector.
4. Remove the bolt and side impact sensor.
   - To install, tighten to 12 Nm (106 lb-in).

WARNING: **Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do**

so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

NOTE: Make sure the C-pillar and side impact sensor mating surfaces are clean.

5. To install, reverse the removal procedure.
6. Repower the SRS. For additional information, refer to **Supplemental Restraint System (SRS) Depowering and Repowering**.

2008 GENERAL INFORMATION

Suspension System - General Information - Fusion, Milan & MKZ

SPECIFICATIONS

ALIGNMENT SPECIFICATIONS

ALIGNMENT SPECIFICATIONS

Item	LH	RH	Total/Split
Front			
Camber	-0.03° ± -0.75°	-0.03° ± -0.75°	0° ± 1°
Caster	4.0° ± 1°	4.0° ± 1°	0° ± 1.0°
Toe	-	-	0.20° ± 0.20°
Rear			
Camber	-1.25° ± 0.75°	-1.25° ± 0.75°	0°
Thrust angle	-	-	0° ± 0.10°
Toe	0.12° ± 0.12°	0.12° ± 0.12°	0.24° ± 0.20°

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Ball Joint Deflection	
Lower	0-0.4 mm (0-0.016 in)
Upper	0-0.2 mm (0-0.008 in)
Bushing Fastener Tightening Height	
Front[a]	402 mm (15.82 in)
Rear[a]	395 mm (15.55 in)
Ride Height	
Front - All Wheel Drive (AWD)	68 mm (2.67 in) ±19 mm (0.74 in)
Front - Front Wheel Drive (FWD)	68 mm (2.67 in) ± 19 mm (0.74 in)
Rear - AWD	52 mm (2.04 in) ±23 mm (0.9 in)
Rear - FWD	65 mm (2.55 in) ±23 mm (0.9 in)

[a] Curb conditioning, full fluids (including fuel).

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft
Front tie-rod jam nuts	80	59
Rear camber adjustment nuts	101	74
Rear toe link jam nuts	84	62

DESCRIPTION AND OPERATION

WHEEL ALIGNMENT ANGLES

Front toe is adjusted through the use of adjustable tie-rod ends. Front caster is adjusted by installing new upper control arms with offset bushings. The upper arms can adjust caster angles ± 0.4 degrees and have separate part numbers. Front camber is not adjustable on the vehicle. Rear toe is adjusted through the use of adjustable toe links. Rear caster is not adjustable on the vehicle. Rear camber is adjusted through the use of a cam bolt that attaches the rear lower control arm to the rear subframe.

Camber

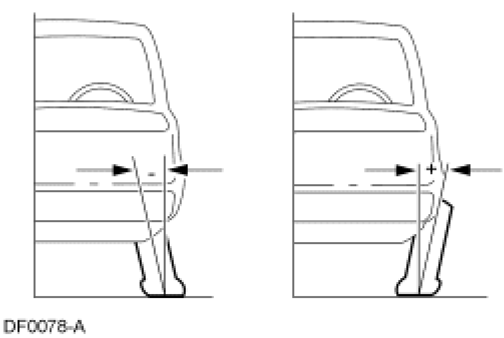


Fig. 1: Camber (Viewed from Front)
Courtesy of FORD MOTOR CO.

Camber is the vertical tilt of the wheel when viewed from the front. Camber can be positive or negative and has a direct affect on tire wear.

Caster

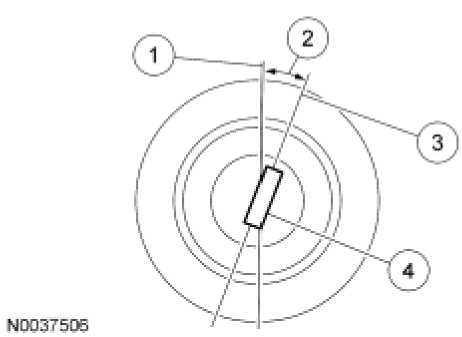


Fig. 2: Caster

Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	True vertical
2	-	Positive caster angle
3	-	Shock-to-ball joint centerline
4	-	Pivot centerline

Caster is the deviation from vertical of an imaginary line drawn through the ball joints when viewed from the side. The **Caster Adjustment - Front** will give the vehicle the best directional stability characteristics when loaded and driven. The caster setting is not related to tire wear.

Toe

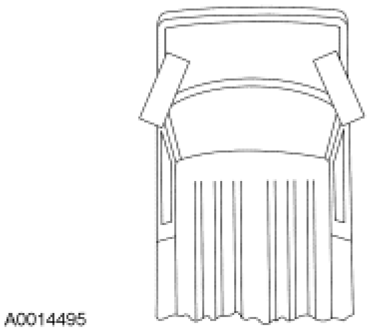


Fig. 3: Identifying Positive Toe (Toe In)
Courtesy of FORD MOTOR CO.

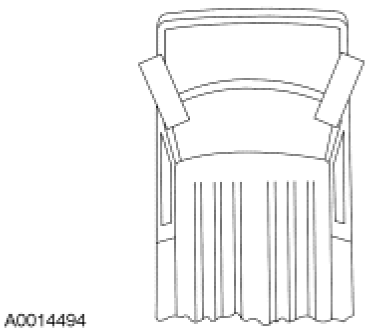


Fig. 4: Identifying Negative Toe (Toe Out)
Courtesy of FORD MOTOR CO.

The vehicle toe setting affects tire wear and directional stability.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Shimmy

Shimmy, as observed by the driver, is large, consistent, rotational oscillations of the steering wheel resulting from large, side-to-side (lateral) tire/wheel movements.

Shimmy is usually experienced near 64 km/h (40 mph), and can begin or be amplified when the tire contacts pot holes or irregularities in the road surface.

Nibble

Sometimes confused with shimmy, nibble is a condition resulting from tire interaction with various road surfaces and observed by the driver as small rotational oscillations of the steering wheel. For wheel and tire diagnosis, refer to **WHEELS AND TIRES** article.

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to describe poor return of the steering wheel to center after a turn or steering correction.

Drift/Pull

Pull is a tugging sensation, felt by the hands on the steering wheel, that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with hands off the steering wheel.

- A vehicle-related drift/pull, on a flat road, will cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.
- Drift/pull may be induced by conditions external to the vehicle (for example, wind, road crown).
- A drift or pull condition may exist even if the front alignment is within specifications. To aid in correcting this condition, there are 4 additional upper control arms available with off-set bushings (2 for LH, 2 for RH). These upper control arms will allow the caster to be adjusted ±0.4 degrees. Refer to **Caster Adjustment - Front**.

Poor Groove Feel - Poor groove feel is characterized by little or no buildup of turning effort felt in the steering wheel as the wheel is rocked slowly left and right within very small turns around center or straight-ahead (under 20 degrees of steering wheel turn). Efforts may be said to be "flat on center."

- Under 20 degrees of turn, most of the turning effort that builds up comes from the mesh of gear teeth in the steering gear. In this range, the steering wheel is not yet turned enough to feel the effort from the self-aligning forces at the road wheel or tire patch.
- In the diagnosis of a roadability problem, it is important to understand the difference between wander and poor groove feel.

DIAGNOSTIC TESTS

SUSPENSION SYSTEM

Inspection and Verification

1. Road test the vehicle.
    - If any suspension alignment or ride height concerns are present, go to **Symptom Chart - Suspension System**.
    - Verify the customer concern by carrying out a road test on a smooth road. If any vibrations are present, refer to Go to **Noise, Vibration and Harshness (NVH)**.
2. Inspect the tires.
    - Check the tire pressures with all normal loads in the vehicle and the tires cold. Refer to the vehicle certification (VC) label.
    - Verify that all tires are sized to specification. Refer to the VC label.
    - Inspect the tires for incorrect wear and damage. Install new tires as necessary.
3. Inspect the chassis and underbody.
    - Remove any excessive accumulation of mud, dirt or road deposits from the chassis and underbody.
4. Inspect for aftermarket equipment.
    - Check for aftermarket changes to the steering, suspension, and wheel and tire components (such as competition or heavy duty). The specifications shown in this article do not apply to vehicles equipped with aftermarket equipment.

VISUAL INSPECTION CHART

Mechanical
• Front or rear suspension components • Suspension fastener(s) • Incorrect spring usage • Spring(s) • Shock absorber(s) • Strut(s) • Suspension bushing(s) • Steering system components • Wheel bearing(s) • Non-OEM parts or modifications

5. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the next step.
6. If the fault is not visually evident, go to **Symptom Chart - Suspension System** or Go to **Noise, Vibration and Harshness (NVH)**.

Symptom Chart - Suspension System

Symptom Chart - Suspension System

Condition	Possible Sources	Action

• Drift/pull	• Unequal tire pressure	• ADJUST the tire pressure.
	• Caster total split is not within specification	• CHECK the wheel alignment. ADJUST as necessary.
	• Camber total split is not within specification	• CHECK the wheel alignment. ADJUST as necessary.
	• Tires	• ROTATE the tires front to rear. REFER to **WHEELS AND TIRES** article.
	• Unevenly loaded or overloaded vehicle	• NOTIFY the customer of incorrect vehicle loading.
	• Steering components	• INSPECT the steering system. INSTALL new components as necessary. REFER to **STEERING SYSTEM - GENERAL INFORMATION** article.
	• Brake drag	• REPAIR the base braking system as necessary. REFER to **FRONT DISC BRAKE** article or **REAR DISC BRAKE** article.
• Front bottoming or riding low	• Worn, damaged or incorrect springs	• MEASURE the ride height. REFER to **Ride Height Measurement**. INSTALL new springs as necessary. REFER to **FRONT SUSPENSION** article.
	• Worn front strut(s)	• INSTALL new struts as necessary. REFER to **FRONT SUSPENSION** article.
• Abnormal/incorrect tire wear	• Incorrect tire pressure (rapid center rib or inner and outer edge wear)	• ADJUST the tire pressure. REFER to the VC label. REFER to **WHEELS AND TIRES** article Diagnosis and Testing for further tire wear diagnosis.
	• Incorrect tire rotation intervals	• REFER to **MAINTENANCE SCHEDULE** article.
	• High-speed cornering • Excessive front or rear toe (inner or	• REFER to **WHEELS AND**

	outer edge wear) • Excessive negative or positive camber (inner or outer edge wear)	**TIRES** article Diagnosis and Testing for further tire wear diagnosis.
	• Front or rear suspension components	• INSPECT the front and rear suspension system. REPAIR or INSTALL new suspension components as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
• Sticky steering, poor returnability	• Damaged or worn front strut mount bearing(s)	• INSTALL a new front strut mount bearing(s) as necessary. REFER to **FRONT SUSPENSION** article.
	• Binding ball joints	• REFER to the **Ball Joint Inspection**.
	• Steering components	• INSPECT the steering system. INSTALL new components as necessary. REFER to **POWER STEERING** article.
	• Caster out of specification	• CHECK the wheel alignment. REFER to **Caster Adjustment - Front**. ADJUST as necessary.
• Steering wheel off-center	• Unequal front toe setting (side-to-side)	• CHECK the wheel alignment. REFER to **Toe Adjustment - Front**. ADJUST as necessary.
	• Steering components	• INSPECT the steering system. INSTALL new components as necessary. REFER to **STEERING SYSTEM - GENERAL INFORMATION** article.
• Sway or roll	• Overloaded, unevenly or incorrectly loaded vehicle	• NOTIFY the customer of incorrect vehicle loading.
	• Loose wheel nut(s)	• TIGHTEN the wheel nut(s) to specification. REFER to **WHEELS AND TIRES** article.

	• Strut(s) or shock absorber(s)	• INSTALL new struts or shock absorbers as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
	• Loose stabilizer bracket-to-frame bolts	• TIGHTEN the bolts to specification. REFER to **FRONT SUSPENSION** article.
	• Worn stabilizer bar bushings or links	• INSTALL new stabilizer bar bushings or links as necessary. REFER to **FRONT SUSPENSION** article.
	• Damaged or broken stabilizer bar	• INSTALL a new stabilizer bar as necessary. REFER to **FRONT SUSPENSION** article.
	• Damaged spring(s)	• INSTALL new springs as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
• Vehicle leans to one side	• Unevenly loaded or overloaded vehicle	• NOTIFY the customer of incorrect vehicle loading.
	• Front or rear suspension components	• INSPECT the front and rear suspension systems. INSTALL new suspension components as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
	• Incorrect drive axle (s) ride height. Side-to-side lean out of specification	• MEASURE the ride height. REFER to **Ride Height Measurement**. INSPECT the front and rear suspension systems. REPAIR or INSTALL new components as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear

		suspension.
• Wander	• Overloaded, unevenly or incorrectly loaded vehicle	• NOTIFY the customer of incorrect vehicle loading.
	• Ball joint(s)	• INSPECT the ball joints. REFER to the **Ball Joint Inspection**.
	• Damaged or missing front strut mount bearing(s)	• INSTALL a new front strut mount bearing(s) as necessary. REFER to **FRONT SUSPENSION** article.
	• Loose, worn or damaged front wheel bearing(s)	• INSPECT the wheel bearings. INSTALL new wheel bearings as necessary.
	• Loose, worn or damaged suspension component(s)	• INSTALL new suspension component(s) as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
	• Loose suspension fasteners	• INSPECT the suspension fasteners. TIGHTEN to specification. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
	• Steering components	• INSPECT the steering system. INSTALL new components as necessary. REFER to **STEERING SYSTEM - GENERAL INFORMATION** article.
	• Wheel alignment (excessive total front toe out)	• ADJUST as necessary. REFER to **Toe Adjustment - Front**.

Symptom Chart - Noise, Vibration and Harshness (NVH)

NOTE: **Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be**

the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

Symptom Chart - Noise/Vibration and Harshness (NVH)

Condition	Possible Sources	Action
• Squeak or grunt - noise from the front suspension, occurs more in cold ambient temperatures. More noticeable over rough roads or when turning	• Front stabilizer bar insulators	• Under these conditions, the noise is acceptable. CHECK TSBs.
• Clunk - noise from the front suspension, occurs in and out of turns	• Loose front suspension	• INSPECT for loose nuts or bolts. TIGHTEN to specifications. REFER to **FRONT SUSPENSION** article for front suspension and **REAR SUSPENSION** article for rear suspension.
• Clunk - noise from the rear suspension, occurs when shifting from REVERSE to drive	• Loose rear suspension components	• INSPECT for loose or damaged rear suspension components. REPAIR or INSTALL new components as necessary. REFER to **REAR SUSPENSION** article.
• Click or pop - noise from the front suspension. More noticeable over rough roads or over bumps	• Worn or damaged ball joint(s)	• CARRY OUT a ball joint inspection. INSTALL new ball joint(s) or control arm(s) as necessary. REFER to **Ball Joint Inspection**.
• Front suspension noise - a squeak, creak or rattle noise. Occurs mostly over bumps or rough roads	• Front suspension components • Loose or damaged front struts, shock absorber (s) or shock absorber bushing(s) • Damaged spring or spring mount(s) • Damaged or worn control/radius arm bushing(s) • Worn or damaged stabilizer bar bushings	• Inspect the front suspension. Install new components as necessary. REFER to **FRONT SUSPENSION** article.

	or link(s)	
• Rear suspension noise - a squeak, creak or rattle noise. Occurs mostly over bumps or rough roads	• Loose or damaged rear shock absorber(s) or shock absorber bushing (s) • Damaged spring or spring mount(s) • Damaged or worn control arm bushing(s) • Worn or damaged stabilizer bar bushing (s) or link(s)	• Inspect the rear suspension. Install new components as necessary. REFER to **REAR SUSPENSION** article.
• Shudder - occurs during acceleration from a slow speed or stop	• Incorrect ride height causing incorrect driveline angle	• REFER to **DRIVELINE SYSTEM - GENERAL INFORMATION** article for driveline angle diagnosis.
• Shimmy	• Loose wheel nut(s)	• TIGHTEN the nut(s) to specification. REFER to **WHEELS AND TIRES** article.
	• Loose front suspension fastener(s)	• TIGHTEN the fastener(s) to specification. REFER to **FRONT SUSPENSION** article.
	• Loose front wheel bearing(s)	• Inspect the front wheel bearing(s). Install new bearing (s) as necessary. REFER to **FRONT SUSPENSION** article.
	• Strut(s) or shock absorber(s)	• INSTALL new struts or shock absorbers as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
• Shimmy - most noticeable on coast/deceleration. Also hard steering condition	• Excessive positive caster	• CHECK the wheel alignment. REFER to **Caster Adjustment - Front**. ADJUST as necessary.
• Rough/harsh ride	• Incorrect tire pressure	• ADJUST the tire pressure. REFER to the VC label.
		• INSTALL new struts or shock

	• Strut(s) or shock absorber(s)	absorbers as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
	• Spring(s)	• MEASURE the ride height. REFER to **Ride Height Measurement**. INSTALL new springs as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.
	• Loose, worn or damaged suspension component(s)	• INSTALL new suspension component(s) as necessary. REFER to **FRONT SUSPENSION** article for front suspension or **REAR SUSPENSION** article for rear suspension.

Component Tests

Ball Joint Inspection

1. Prior to inspecting the ball joints for wear, inspect the wheel bearings. Install a new wheel bearing as necessary. Refer to **FRONT SUSPENSION** article.

NOTE: In order to obtain accurate measurements, the suspension must be in full rebound with the weight of the vehicle supported by the frame.

2. Raise and support the vehicle by the frame to allow the wheels to hang in the rebound position.
3. Inspect the ball joint and ball joint boot for damage.
   - If the ball joint or ball joint boot is damaged, install a new ball joint as necessary. Refer to **FRONT SUSPENSION** article.

CAUTION: Do not use any tools or equipment to move the wheel and tire assembly or suspension components while checking for relative movement. Suspension damage may occur. The use of tools or equipment will also create relative movement that may not exist when using hand force. Relative movement must be measured using hand force only.

NOTE: To avoid lateral movement of the steering linkage and steering components, make sure to apply hand force only at the 12 o'clock and 6 o'clock positions of the wheel and tire assembly.

4. Inspect the ball joint for relative movement by alternately pulling outward and pushing inward on the wheel and tire assembly, at the 12 o'clock and 6 o'clock positions, by hand. Note any relative movement between the wheel knuckle and both lower arms at the lower ball joints.
   - If relative movement is not felt or seen, the ball joints are OK. Do not install new ball joints.
   - If relative movement is found, continue with Step 5.

NOTE: In order to obtain an accurate measurement, the dial indicator should be aligned as close as possible with the center line of the forward front lower ball joint.

5. To measure ball joint deflection, attach a suitable dial indicator with a flexible arm between the forward front lower arm and the wheel knuckle at the forward front lower ball joint.

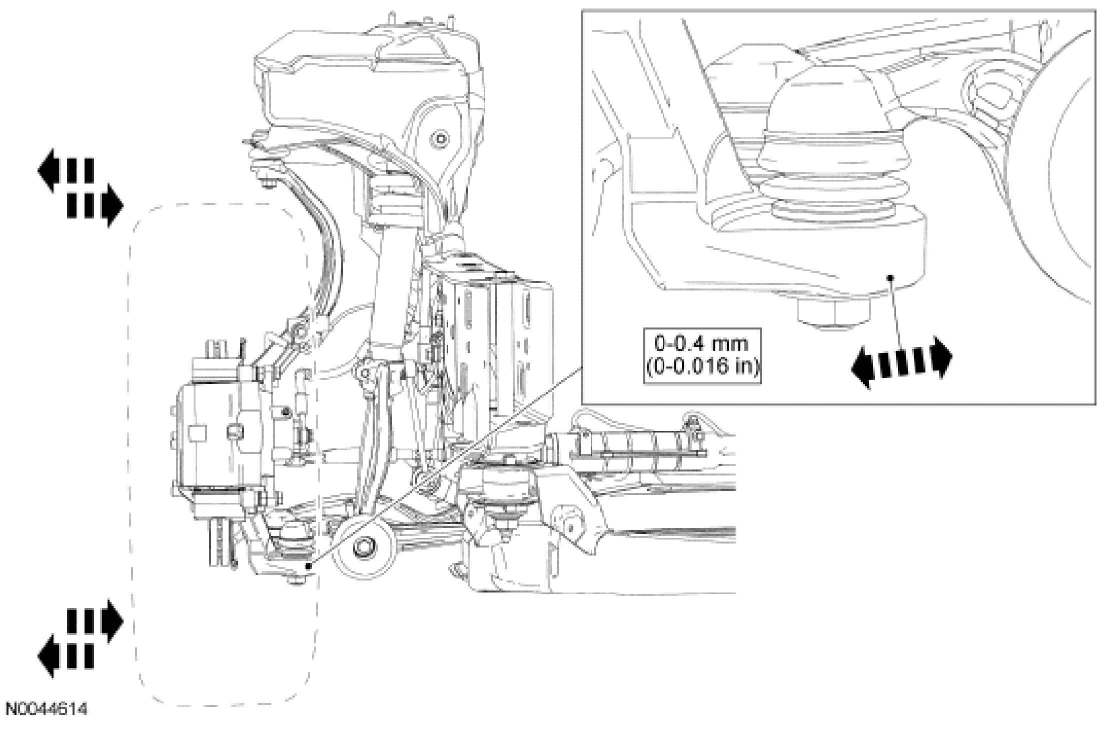


Fig. 5: Measuring Ball Joint Deflection
Courtesy of FORD MOTOR CO.

6. Measure the ball joint deflection while an assistant alternately pulls outward and pushes inward on the wheel and tire assembly, at the 12 o'clock and 6 o'clock positions, by hand.
   - If the deflection exceeds the specification, install a new forward and rearward lower ball joint. Refer to **FRONT SUSPENSION** article.
   - If the deflection meets the specification, continue with the procedure.

CAUTION: Do not use any tools or equipment to move the wheel and tire assembly or suspension components, while checking for relative movement. Suspension damage can occur. The use of tools or equipment will also create relative movement that may not exist when using hand force. Relative movement must be measured using hand force only.

7. Inspect the ball joint for relative movement by alternately pulling downward and pushing upward on the upper arm by hand. Note any relative vertical movement between the wheel knuckle and upper arm at the upper ball joint.
   - If relative movement is not felt or seen, the ball joint is OK. Do not install a new ball joint.
   - If relative movement is found, continue with Step 8.

NOTE: In order to obtain an accurate measurement, the dial indicator should be aligned as close as possible with the vertical axis of the ball joint.

8. To measure ball joint deflection, attach a suitable dial indicator with a flexible arm between the upper arm and the wheel knuckle or ball joint stud.
9. Measure the ball joint deflection while an assistant pushes up and then pulls down on the upper arm, by hand.
   - If the deflection exceeds the specification, a new ball joint must be installed. Refer to **FRONT SUSPENSION** article.
   - If the deflection meets the specification, no further action is required.

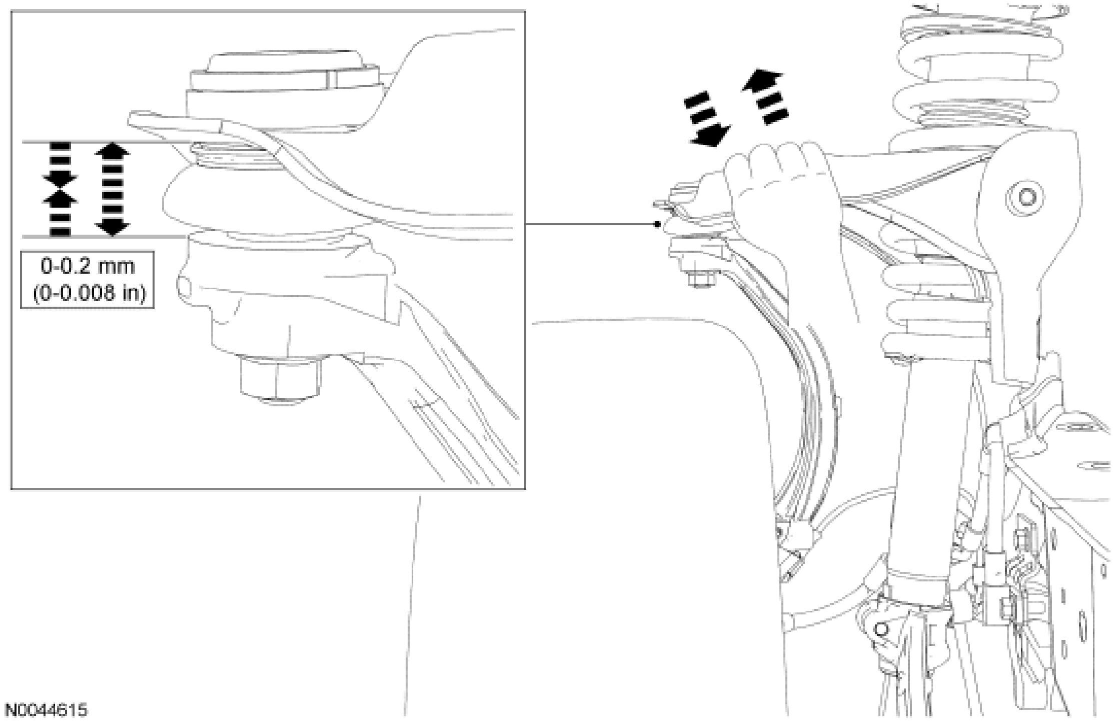


Fig. 6: Measuring Ball Joint Deflection

Courtesy of FORD MOTOR CO.

GENERAL PROCEDURES

RIDE HEIGHT MEASUREMENT

Front Ride Height Measurement

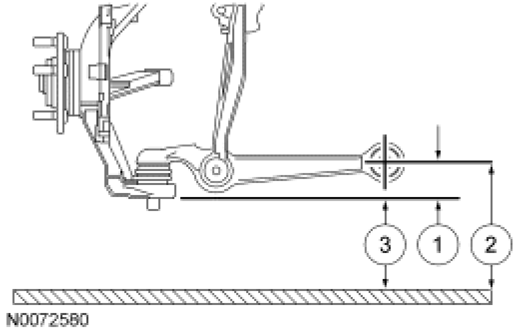


Fig. 7: Front Ride Height Measurement
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Ride height = A - B
2	-	Measurement A
3	-	Measurement B

NOTE: Make sure that the vehicle is positioned on a flat, level surface and the tires are inflated to the correct pressure. Vehicle should have a full tank of fuel.

1. Position a suitable surface gauge (such as Starrett 57D Surface Gauge), on a flat, level surface and adjust the gauge's arm until the scriber point is located in the center of the front lower arm-to-subframe bolt.
   - Lock the surface gauge in this position.

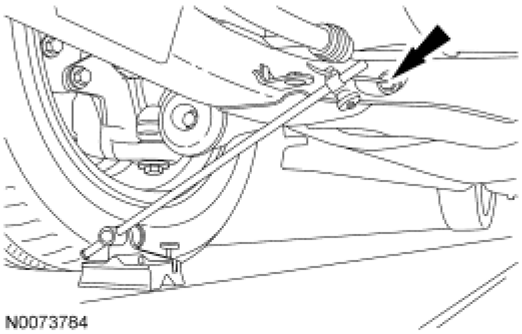


Fig. 8: Adjusting Gauge's Arm Until Scriber Point Is Located In Center Of Front Lower Arm-To-Subframe Bolt
Courtesy of FORD MOTOR CO.

2. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement A).

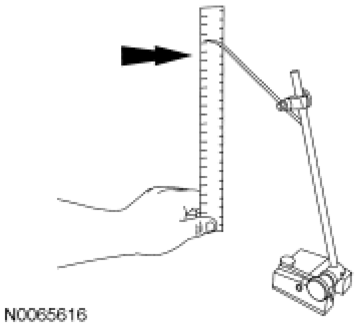


Fig. 9: Recording Measurement Of Surface Gauge Position
Courtesy of FORD MOTOR CO.

3. Position the surface gauge on the same flat, level surface as used in Step 1, adjust the gauge's arm until the scriber point is located at the wheel knuckle's lowest point, next to the front lower arm ball joint nut.
    - Lock the surface gauge in this position.

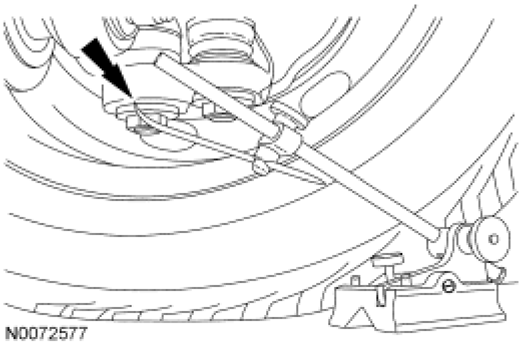


Fig. 10: Adjusting Gauge's Arm Until Scriber Point Is Located At Wheel Knuckle's Lowest Point
Courtesy of FORD MOTOR CO.

4. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement B).

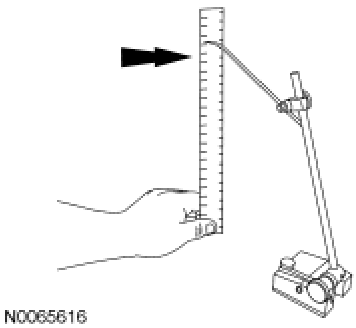


Fig. 11: Recording Measurement Of Surface Gauge Position

Courtesy of FORD MOTOR CO.

5. Subtract measurement B from measurement A to obtain the front ride height.
    - Refer to **SPECIFICATIONS**.

Rear Ride Height Measurement

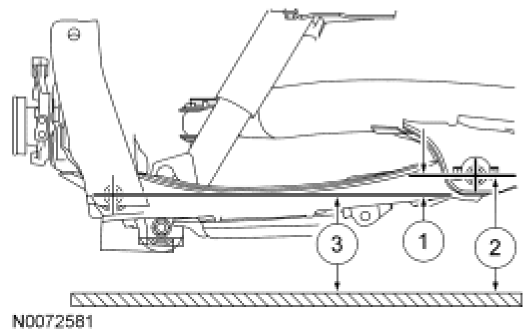


Fig. 12: Rear Ride Height Measurement
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Ride height = A - B
2	-	Measurement A
3	-	Measurement B

NOTE: Make sure that the vehicle is positioned on a flat, level surface and the tires are inflated to the correct pressure. Vehicle should have a full tank of fuel.

1. Measure the distance between the flat level surface and center of the lower arm inboard cam bolt (measurement A).
2. Measure the distance between the flat level surface and the center of the lower arm outboard bolt (measurement B).
3. Subtract measurement B from measurement A to obtain the rear ride height.

CASTER ADJUSTMENT - FRONT

NOTE: If caster adjustment is necessary to resolve a vehicle alignment issue, then installing a revised upper control arm(s) is an acceptable method. This procedure should not be routinely performed with all alignments and only after all other possible sources have been inspected and corrected as necessary.

1. Using alignment equipment and the manufacturer's instructions, measure the caster.

    NOTE: The revised upper control arms have the same base part number but they are identified by the amount of caster they change (for example, + 0.4

degrees or - 0.4 degrees)

2. Use the following table and the measurements taken in Step 1 to determine which front upper control arm should be installed.

Part Number	Degree of Change
3084 RH	+ 0.4 degree
3084 RH	- 0.4 degree
3091 LH	+ 0.4 degree
3091 LH	- 0.4 degree

3. Install a revised front upper control arm(s) as necessary. For additional information, refer to **FRONT SUSPENSION** article.
4. Recheck the front caster settings and adjust as necessary.
5. Check and, if necessary, adjust the front toe. For additional information, refer to **Toe Adjustment - Front**.

CAMBER ADJUSTMENT - REAR

NOTE: Before carrying out a camber adjustment, check the tires for the correct pressure. Inspect the tires for incorrect wear or damage. Inspect the front suspension components for wear or damage.

1. Using alignment equipment and the manufacturer's instructions, measure the rear camber.
2. Loosen the rear camber adjustment nut.

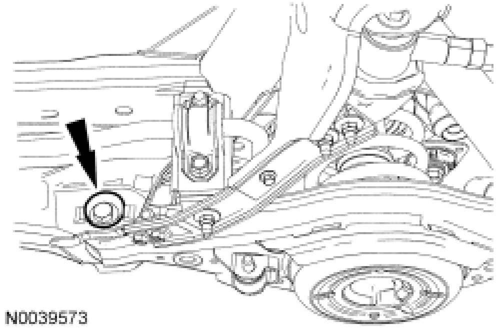


Fig. 13: Locating Rear Camber Adjustment Nut
Courtesy of FORD MOTOR CO.

3. Rotate the camber adjustment bolt until the camber setting is within specifications.

NOTE: Do not allow the camber adjustment bolt to rotate while tightening the nut.

4. Tighten the camber adjustment nut to 101 Nm (74 lb-ft).
5. Recheck the rear camber and adjust as necessary.

TOE ADJUSTMENT - FRONT

1. Start the engine and center the steering wheel.
2. Turn the engine OFF and, using a suitable steering wheel holding device, lock the steering wheel in the straight ahead position.
3. Using alignment equipment and the manufacturer's instructions, measure the front toe.
4. Remove the steering gear bellows clamps.

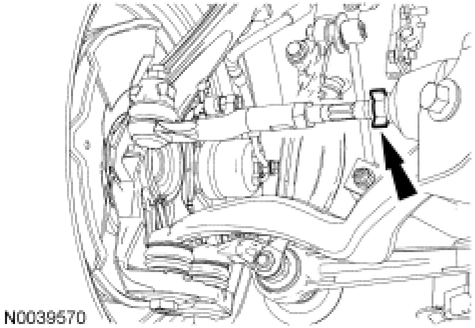


Fig. 14: Locating Steering Gear Clamps
Courtesy of FORD MOTOR CO.

5. Loosen the tie-rod jam nuts.

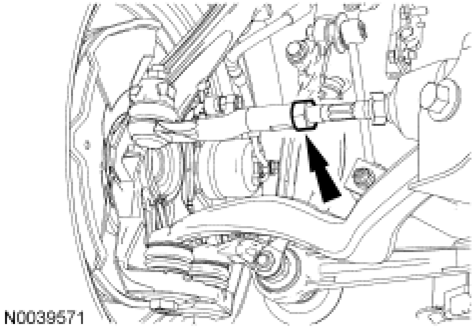


Fig. 15: Locating Tie-Rod Jam Nuts
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the steering gear bellows to twist when the tie rod is rotated.

6. Rotate the tie rods until the toe setting is within specifications.

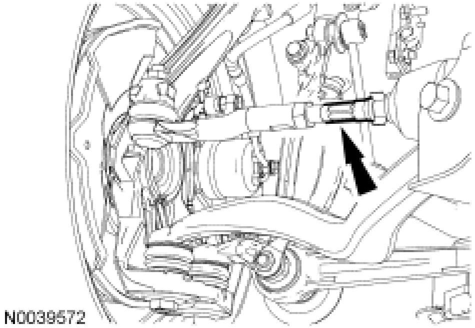


Fig. 16: Locating Tie Rods
Courtesy of FORD MOTOR CO.

7. Tighten the jam nuts to 80 Nm (59 lb-ft).
8. Install the steering gear bellows clamps.
9. Recheck the front toe settings and adjust as necessary.

TOE ADJUSTMENT - REAR

1. Using alignment equipment and the manufacturer's instructions, measure the rear toe.
2. Loosen the toe link jam nuts.

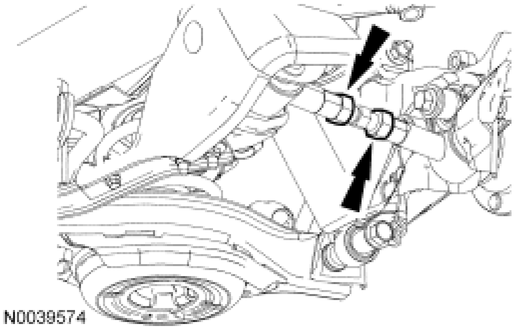


Fig. 17: Locating Toe Link Jam Nuts
Courtesy of FORD MOTOR CO.

3. Rotate the toe link adjusting rod until the toe setting is within specifications.

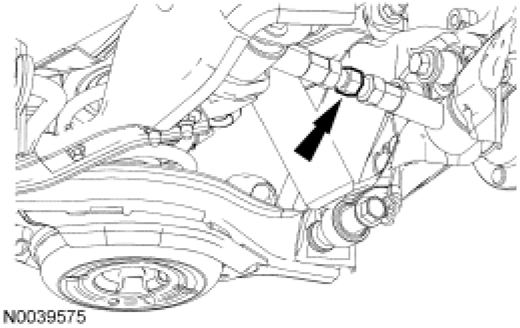


Fig. 18: Locating Toe Link Adjusting Rod
Courtesy of FORD MOTOR CO.

NOTE: **Do not allow the adjusting rod to rotate while tightening the jam nuts.**

4. Tighten the toe link jam nuts to 84 Nm (62 lb-ft).
5. Recheck the rear toe and adjust as necessary.

AIR CONDITIONING

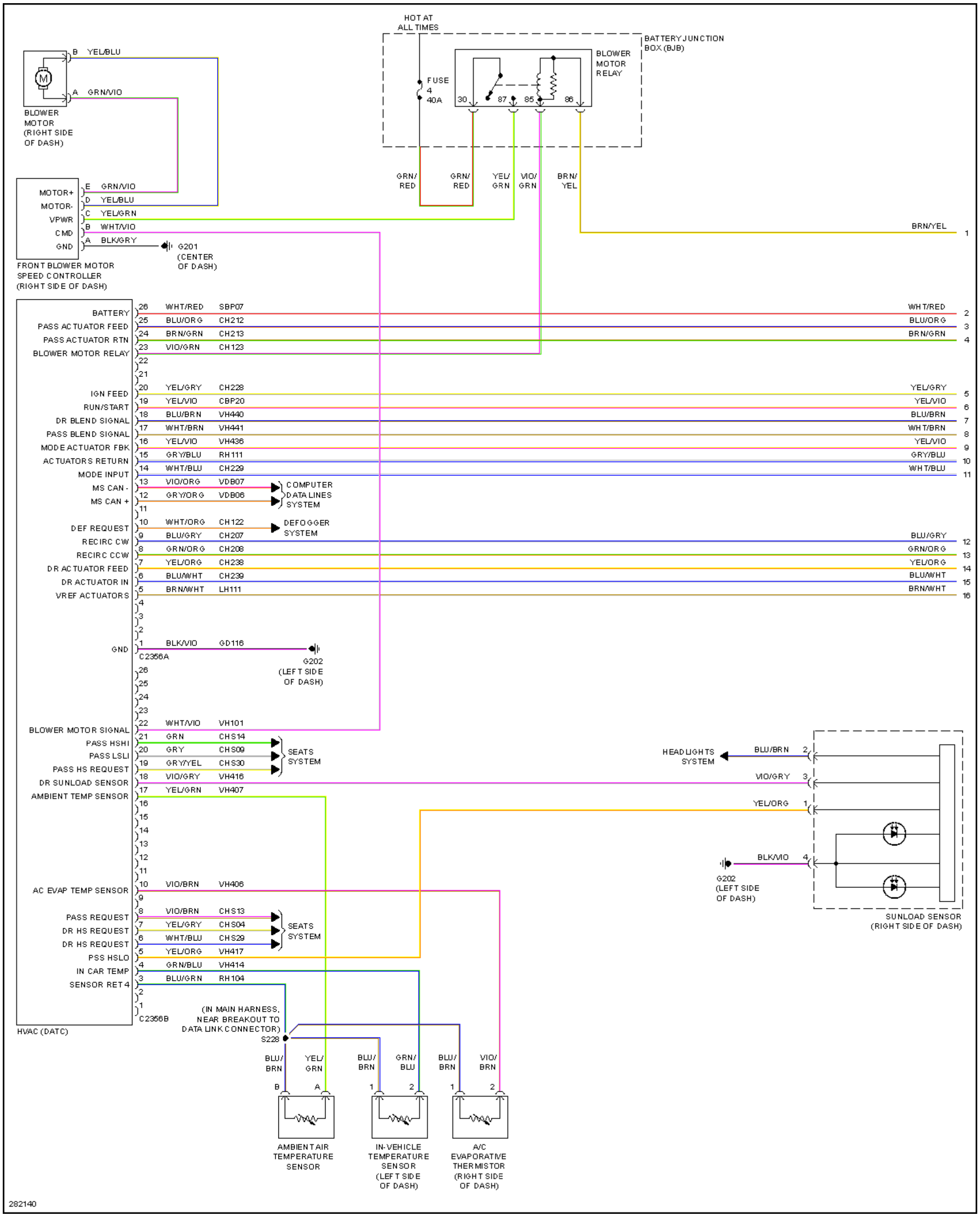


Fig. 1: Automatic A/C Circuit, Dual Zone A/C (1 of 3)

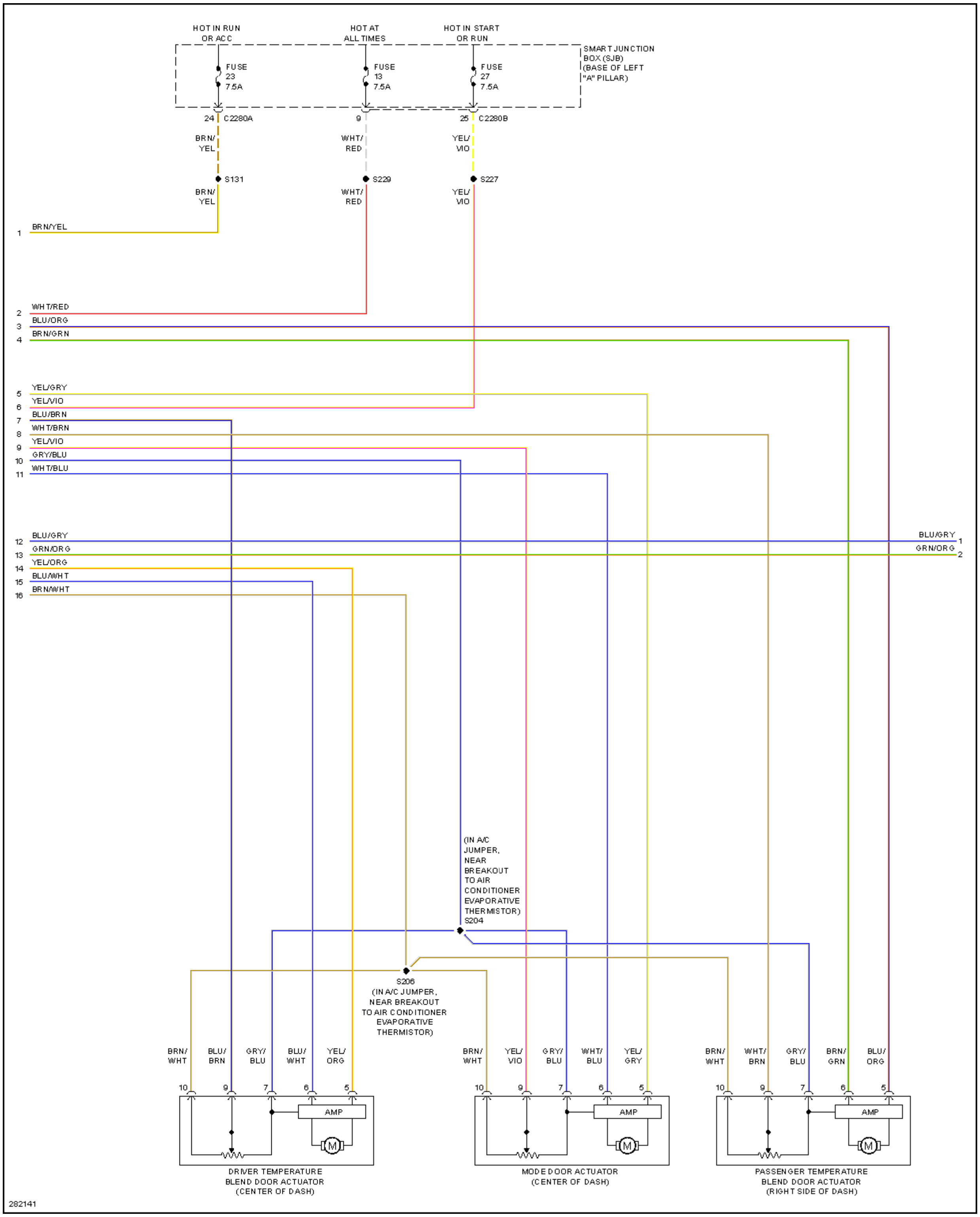


Fig. 2: Automatic A/C Circuit, Dual Zone A/C (2 of 3)

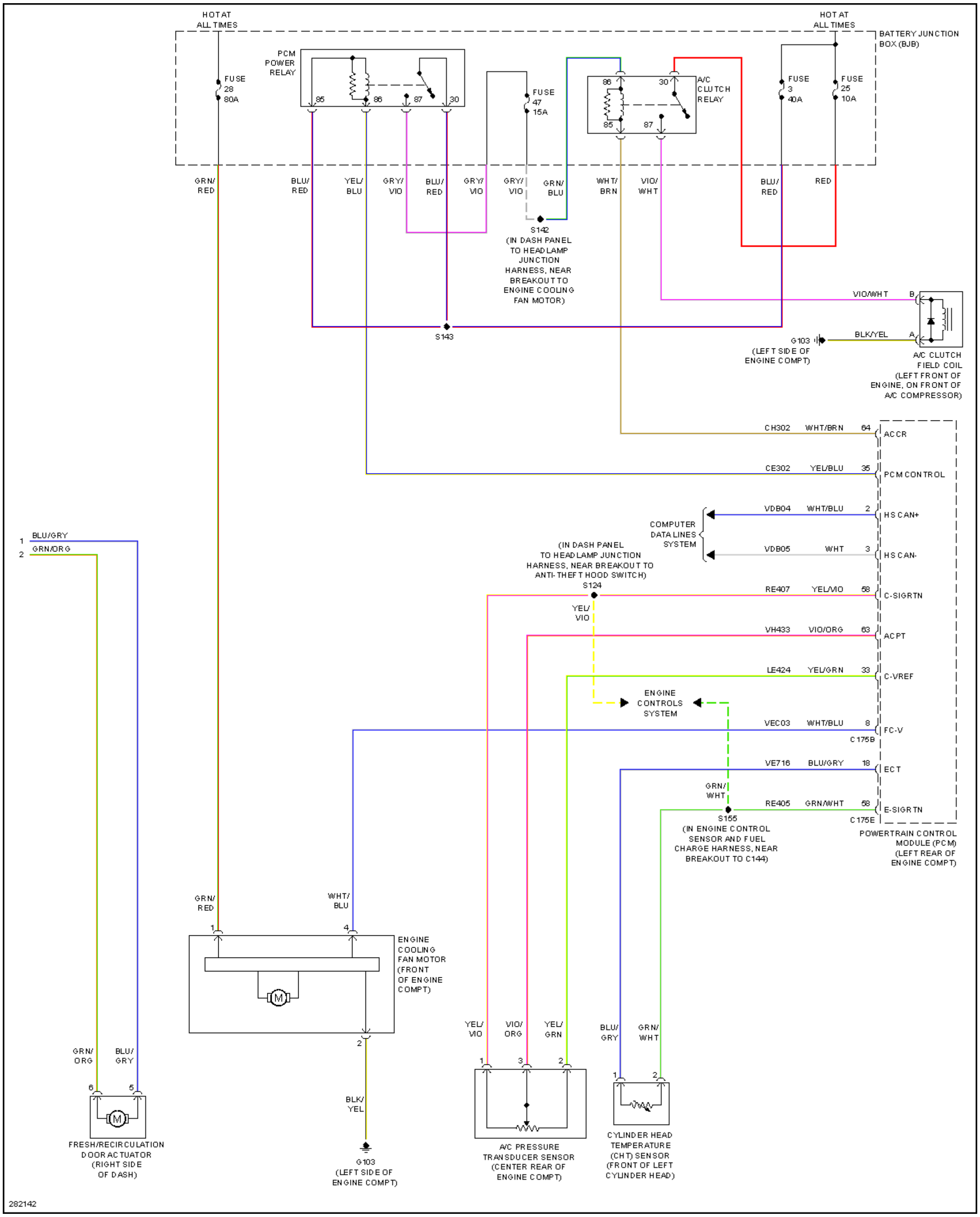


Fig. 3: Automatic A/C Circuit, Dual Zone A/C (3 of 3)

ANTI-LOCK BRAKES

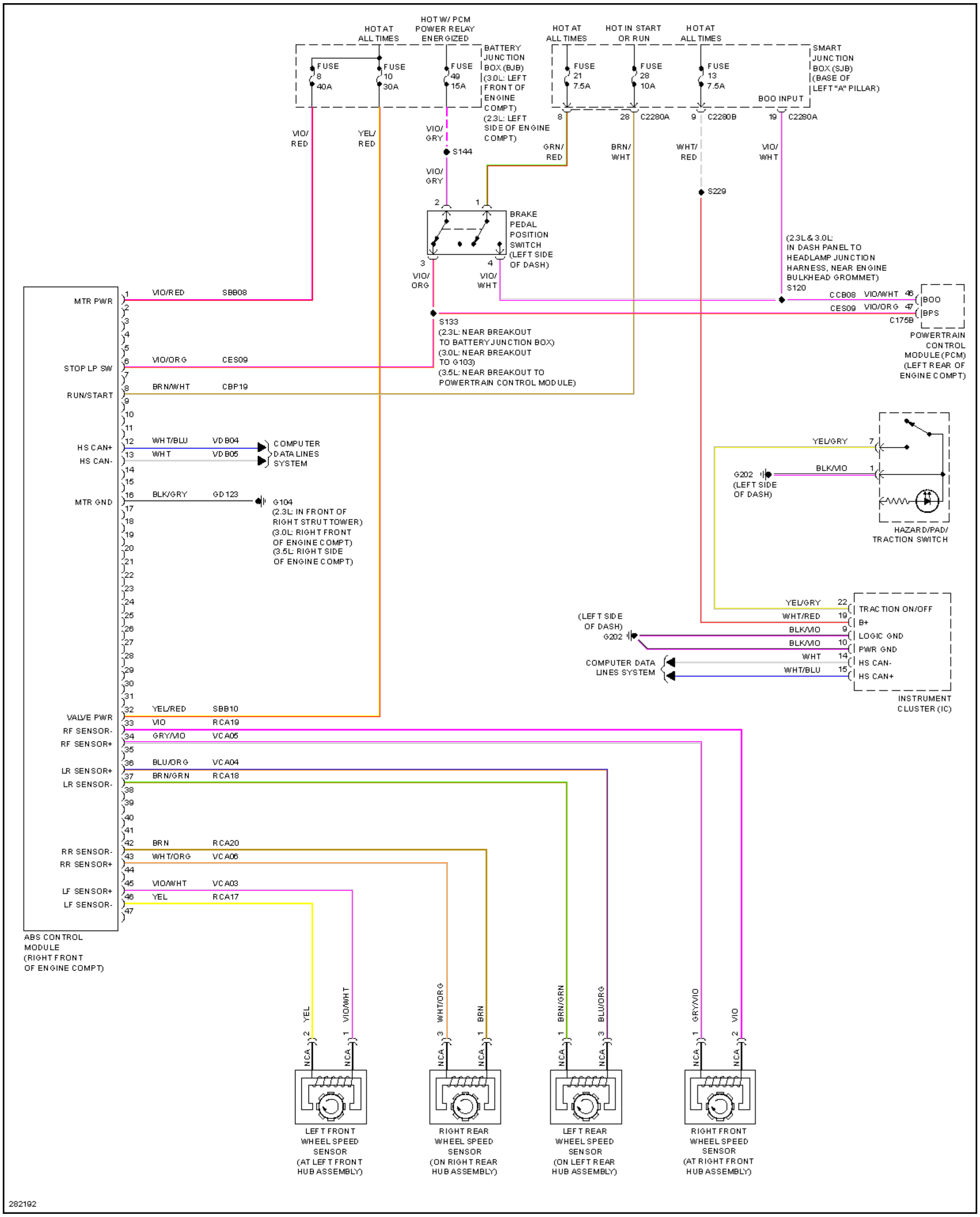


Fig. 4: Anti-lock Brakes Circuit

ANTI-THEFT

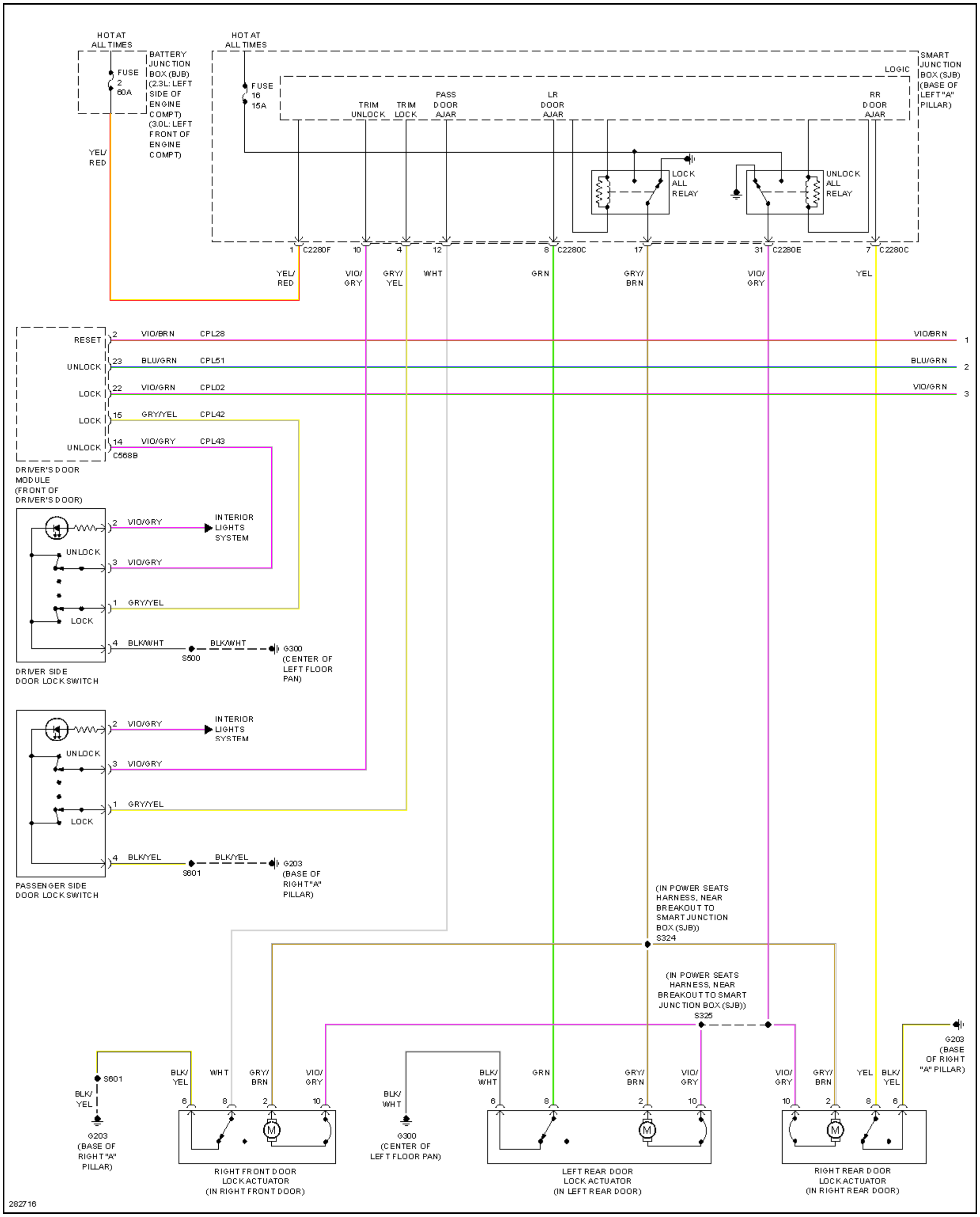


Fig. 5: Forced Entry Circuit, W/ Memory (1 of 2)

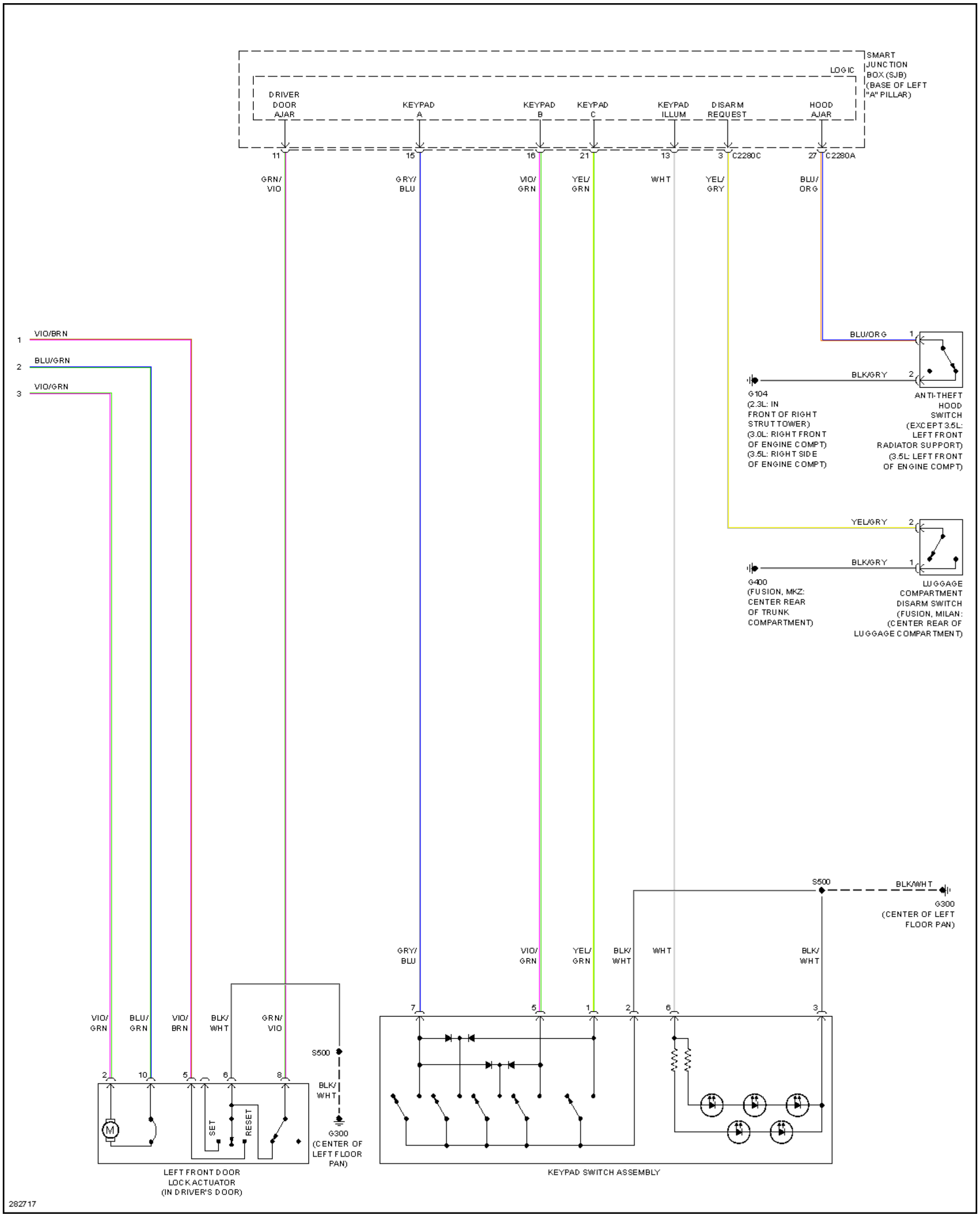


Fig. 6: Forced Entry Circuit, W/ Memory (2 of 2)

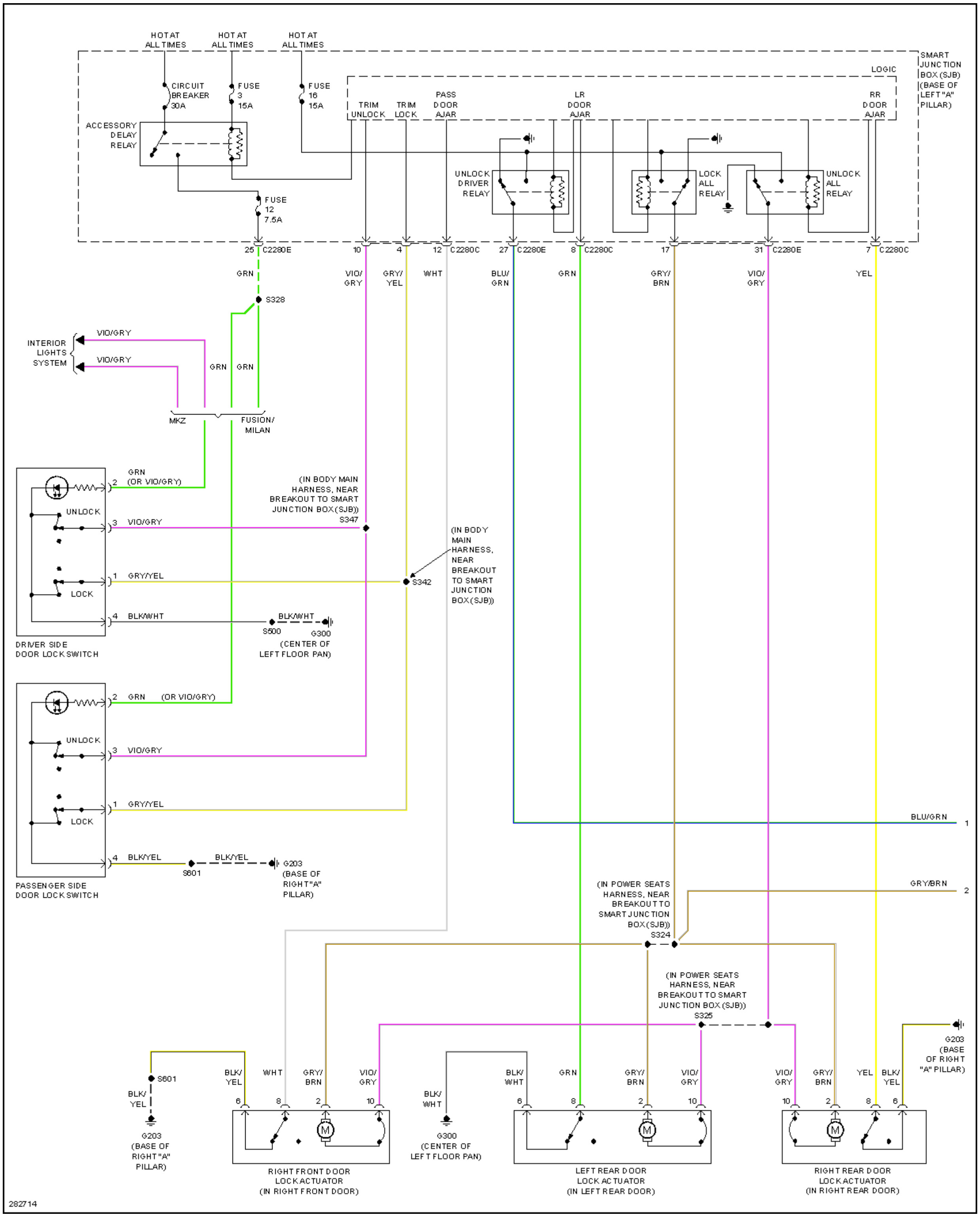


Fig. 7: Forced Entry Circuit, W/O Memory (1 of 2)

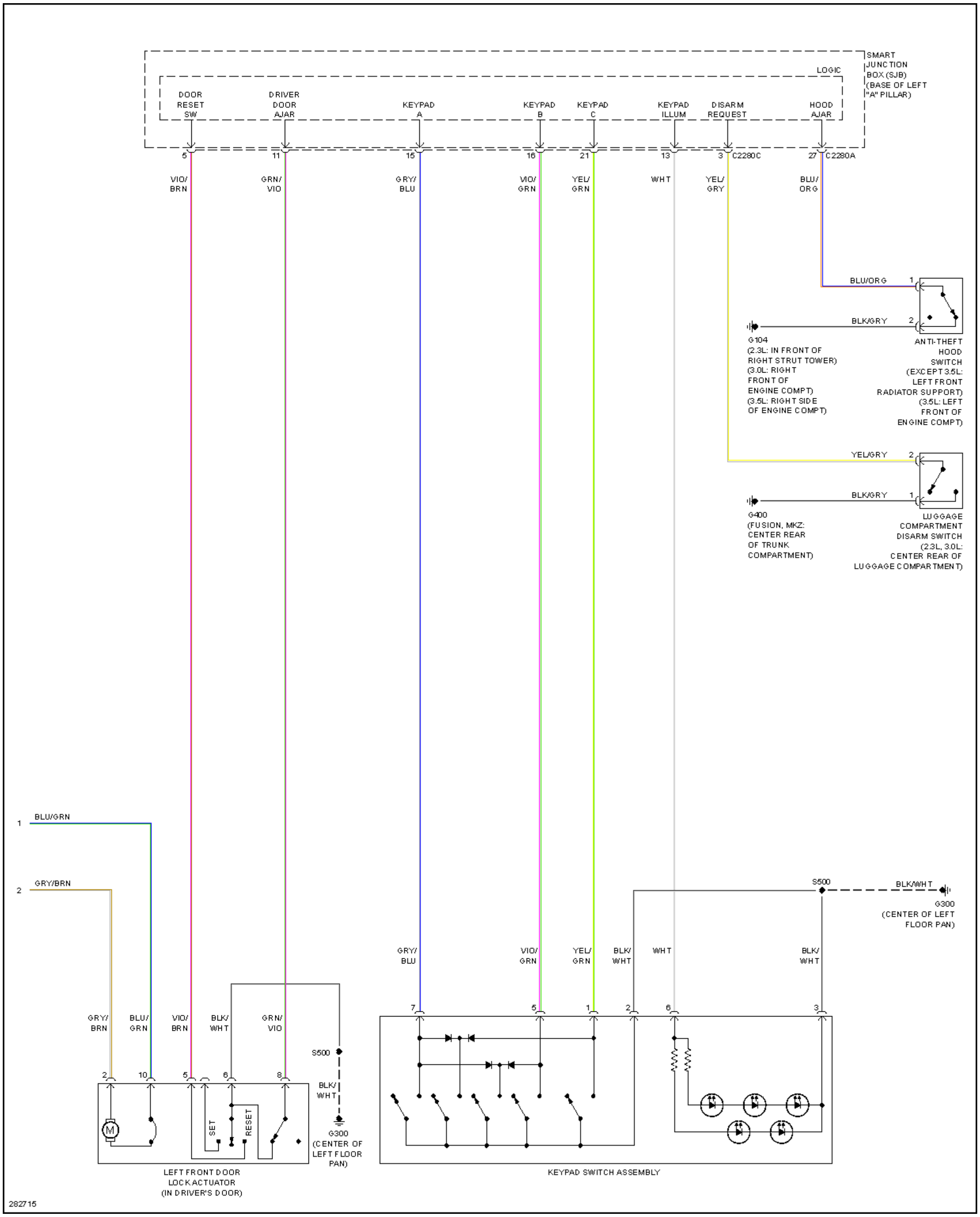


Fig. 8: Forced Entry Circuit, W/O Memory (2 of 2)

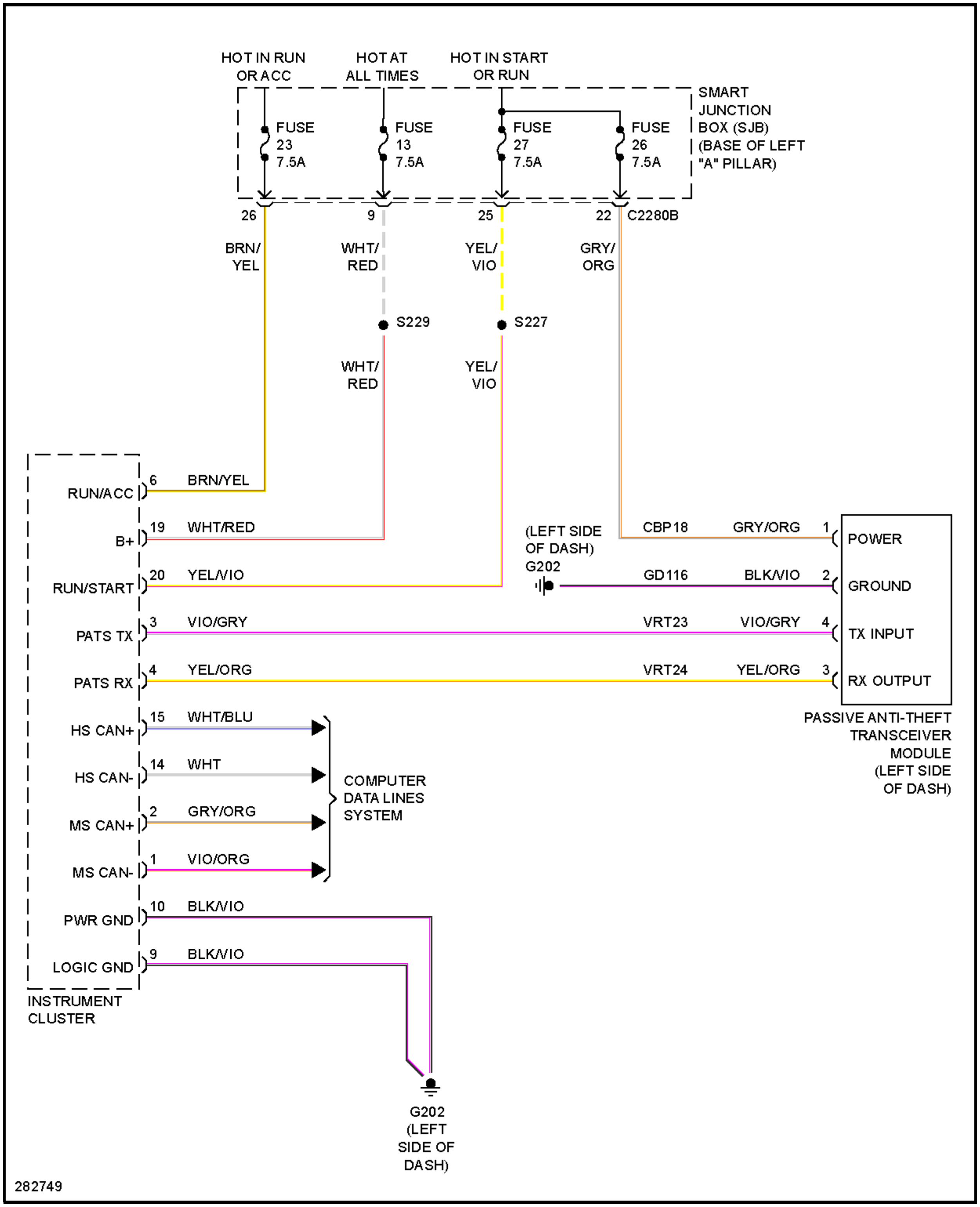


Fig. 9: Passive Anti-theft Circuit

BODY CONTROL MODULES

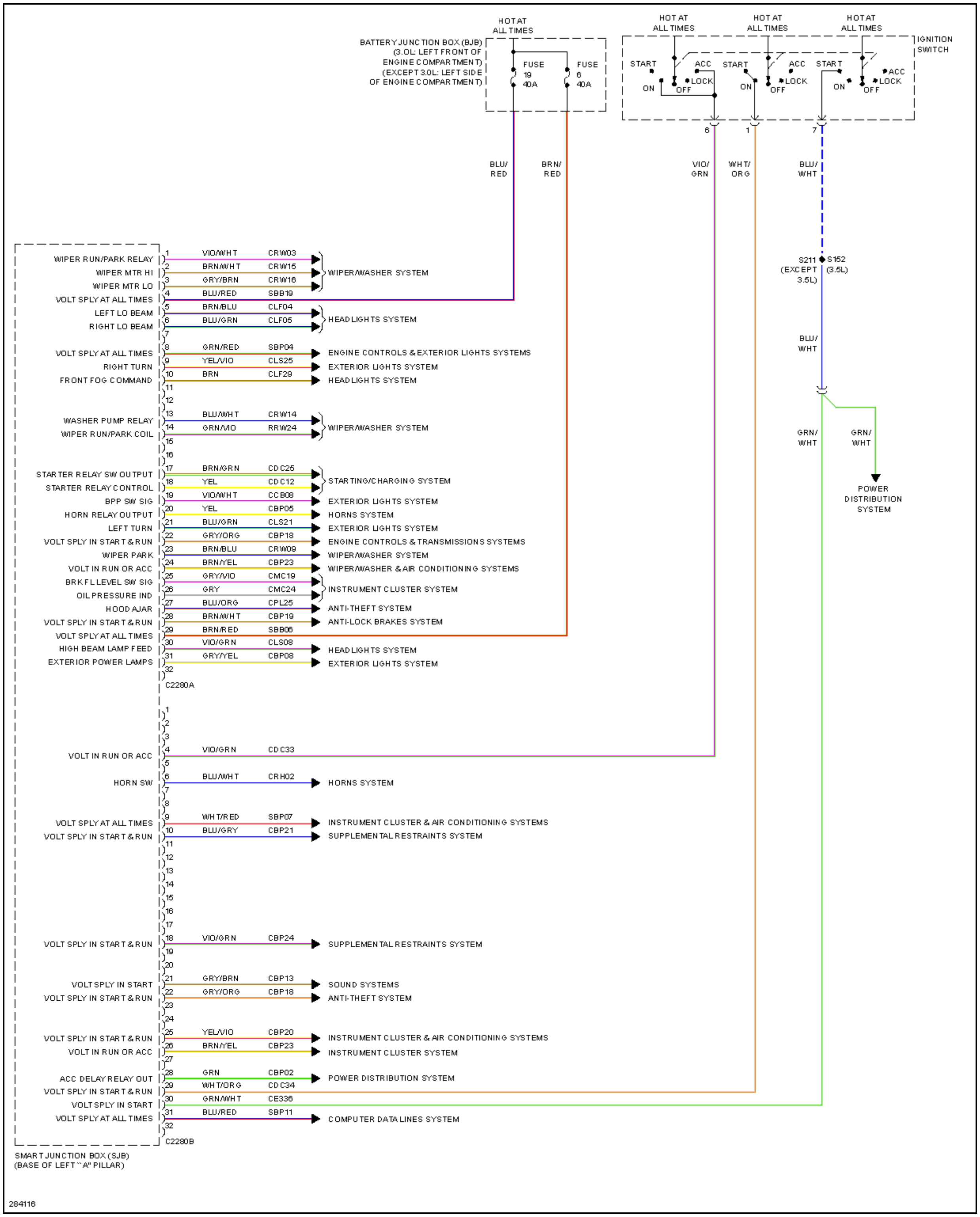


Fig. 10: Body Control Modules Circuit (1 of 2)

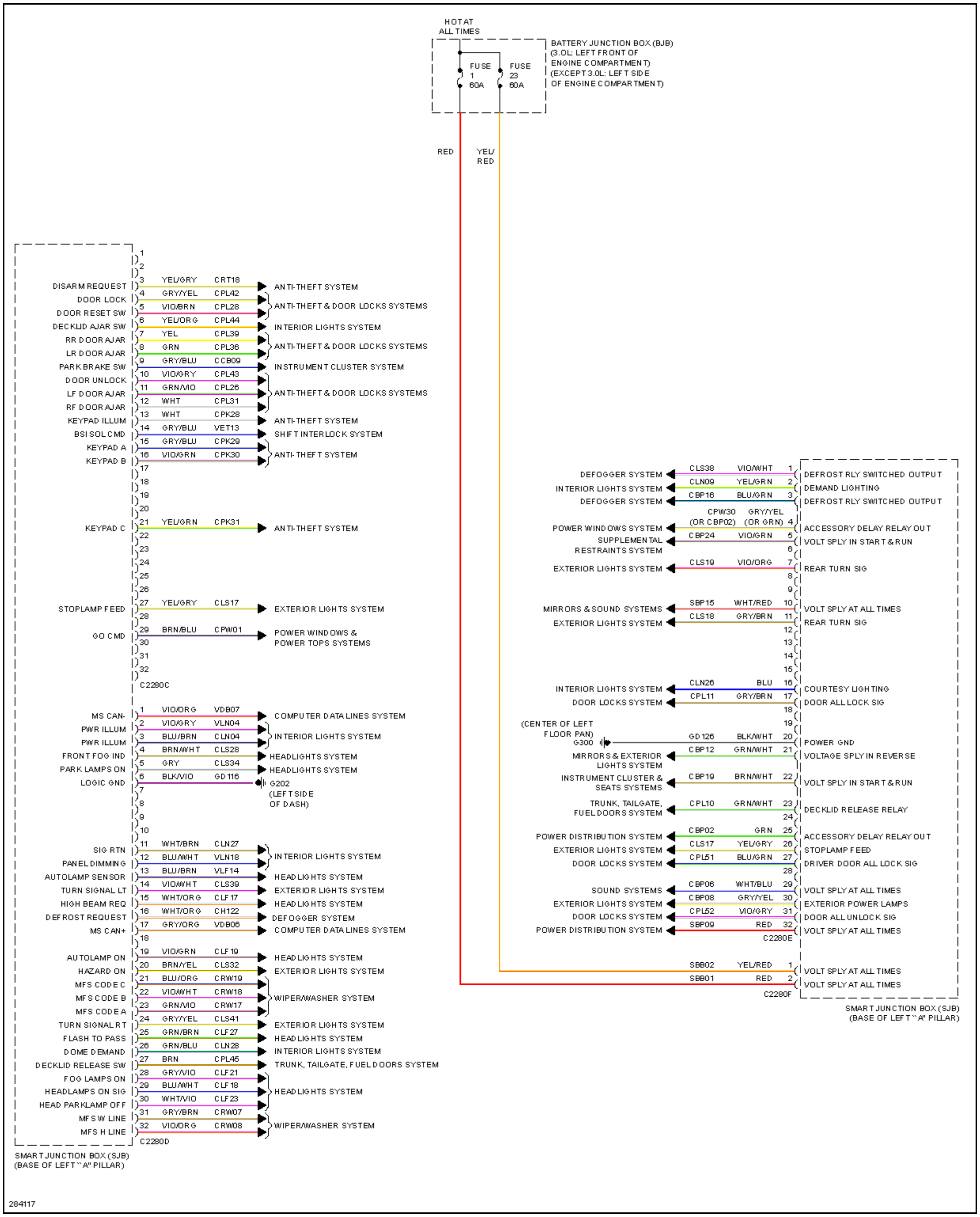


Fig. 11: Body Control Modules Circuit (2 of 2)

COMPUTER DATA LINES

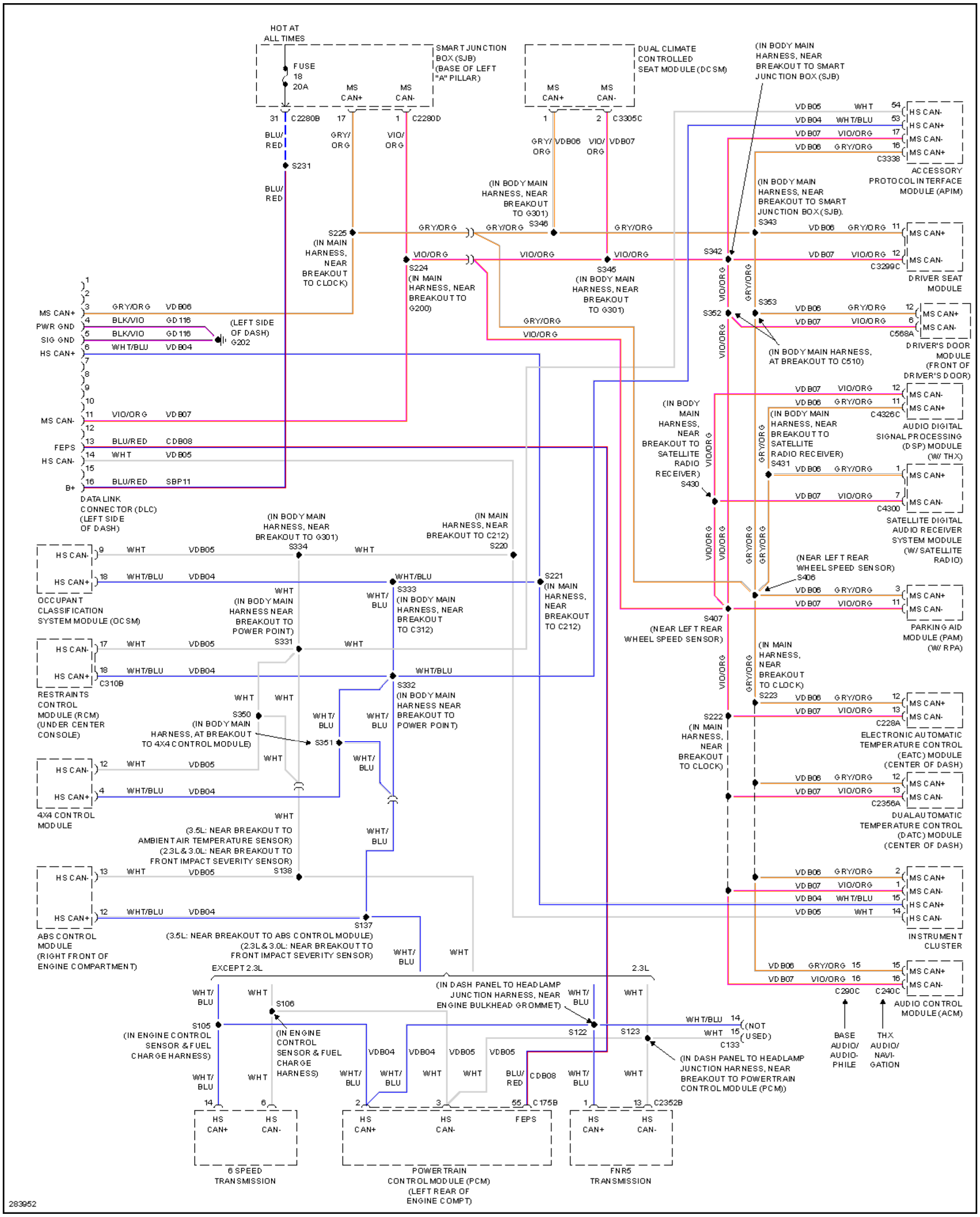


Fig. 12: Computer Data Lines Circuit, W/ Memory

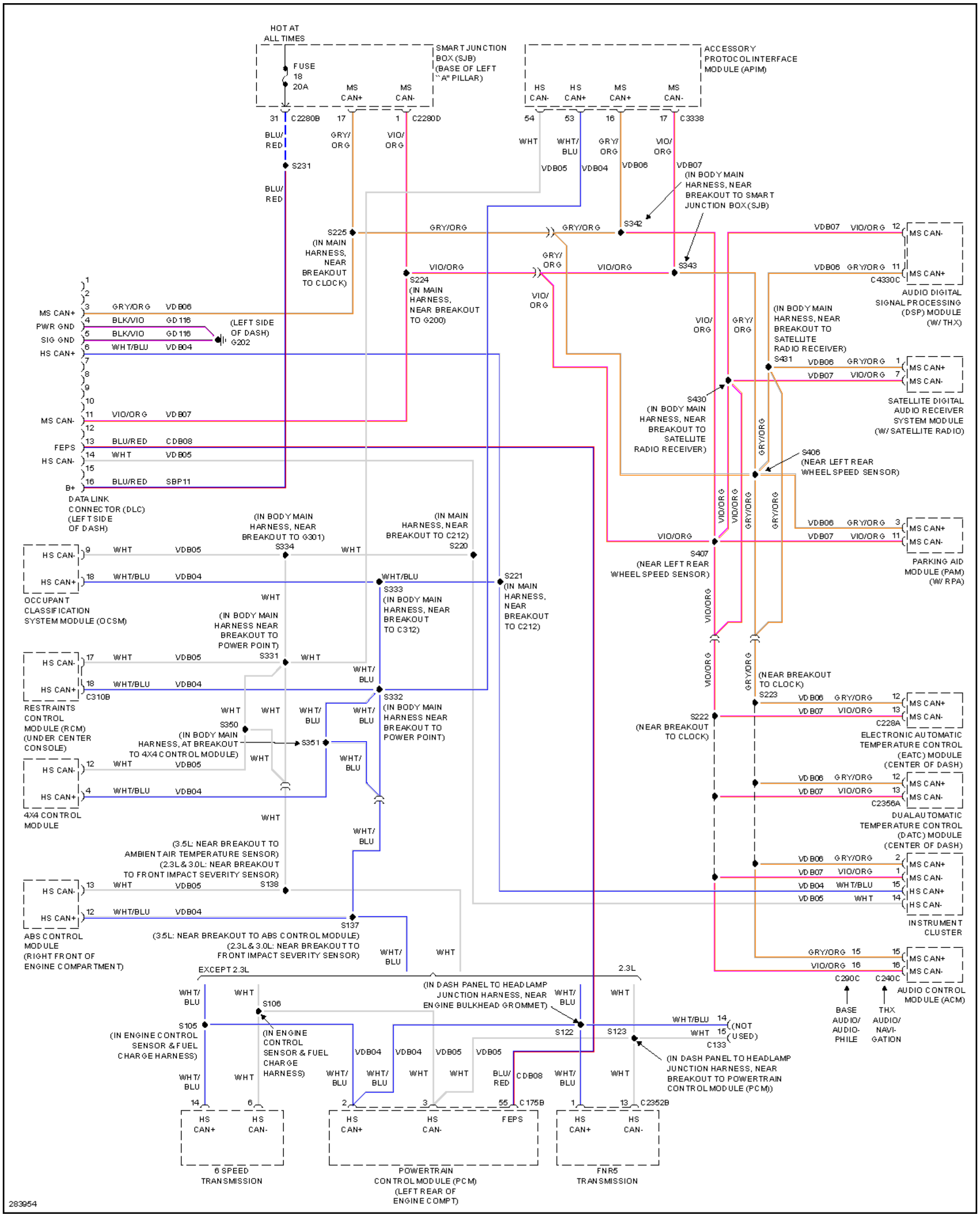


Fig. 13: Computer Data Lines Circuit, W/O Memory

COOLING FAN

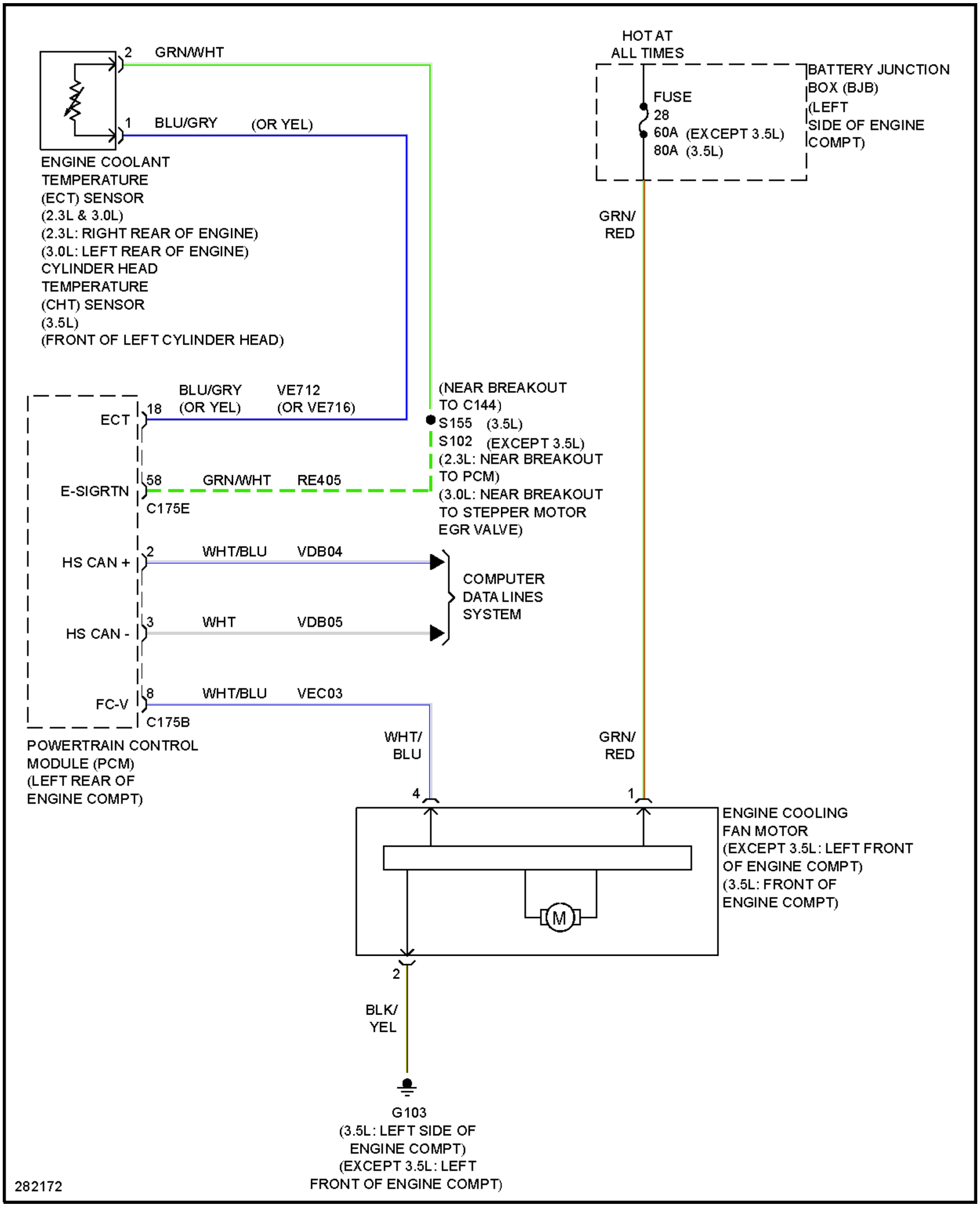


Fig. 14: Cooling Fan Circuit

CRUISE CONTROL

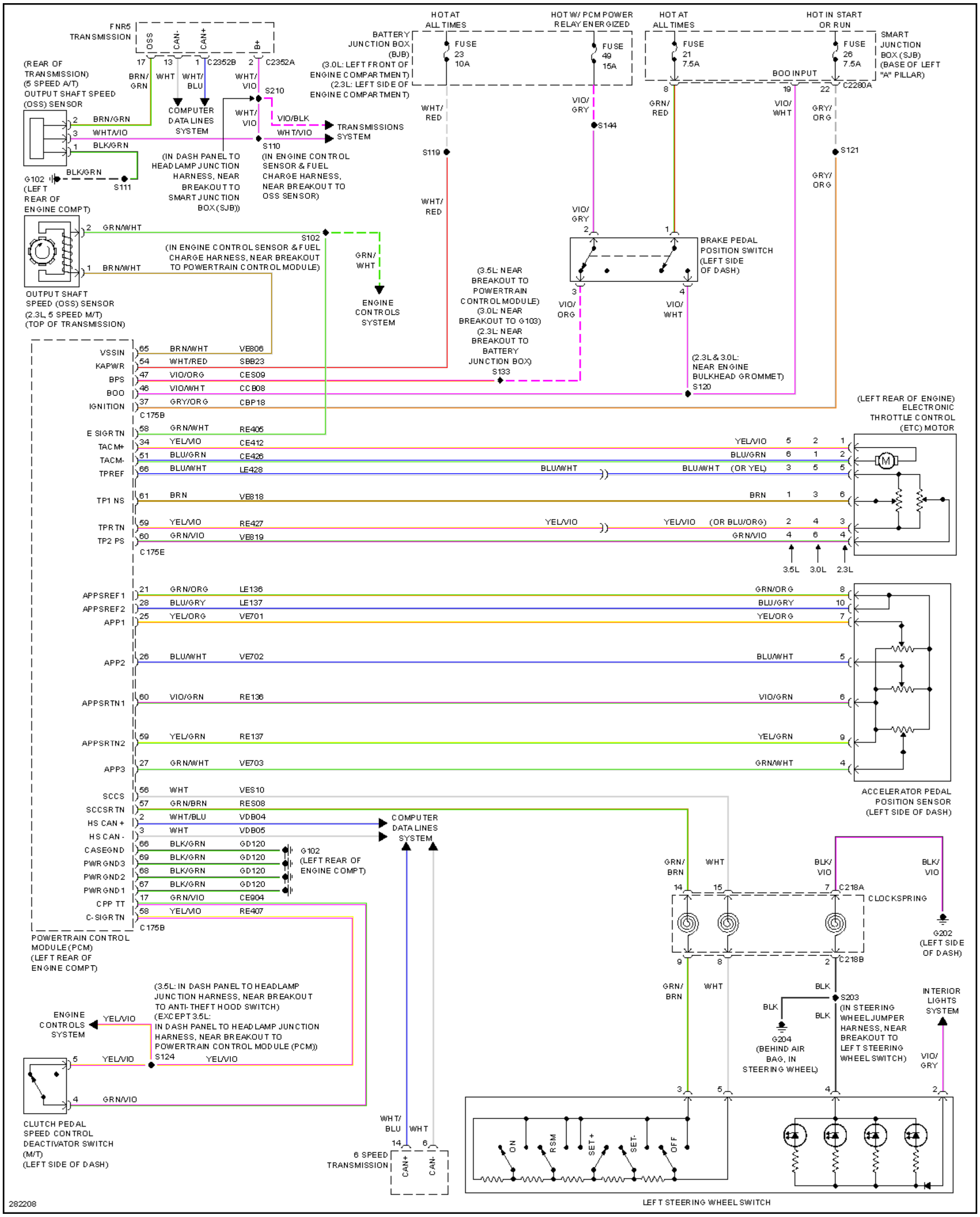


Fig. 15: Cruise Control Circuit

DEFOGGERS

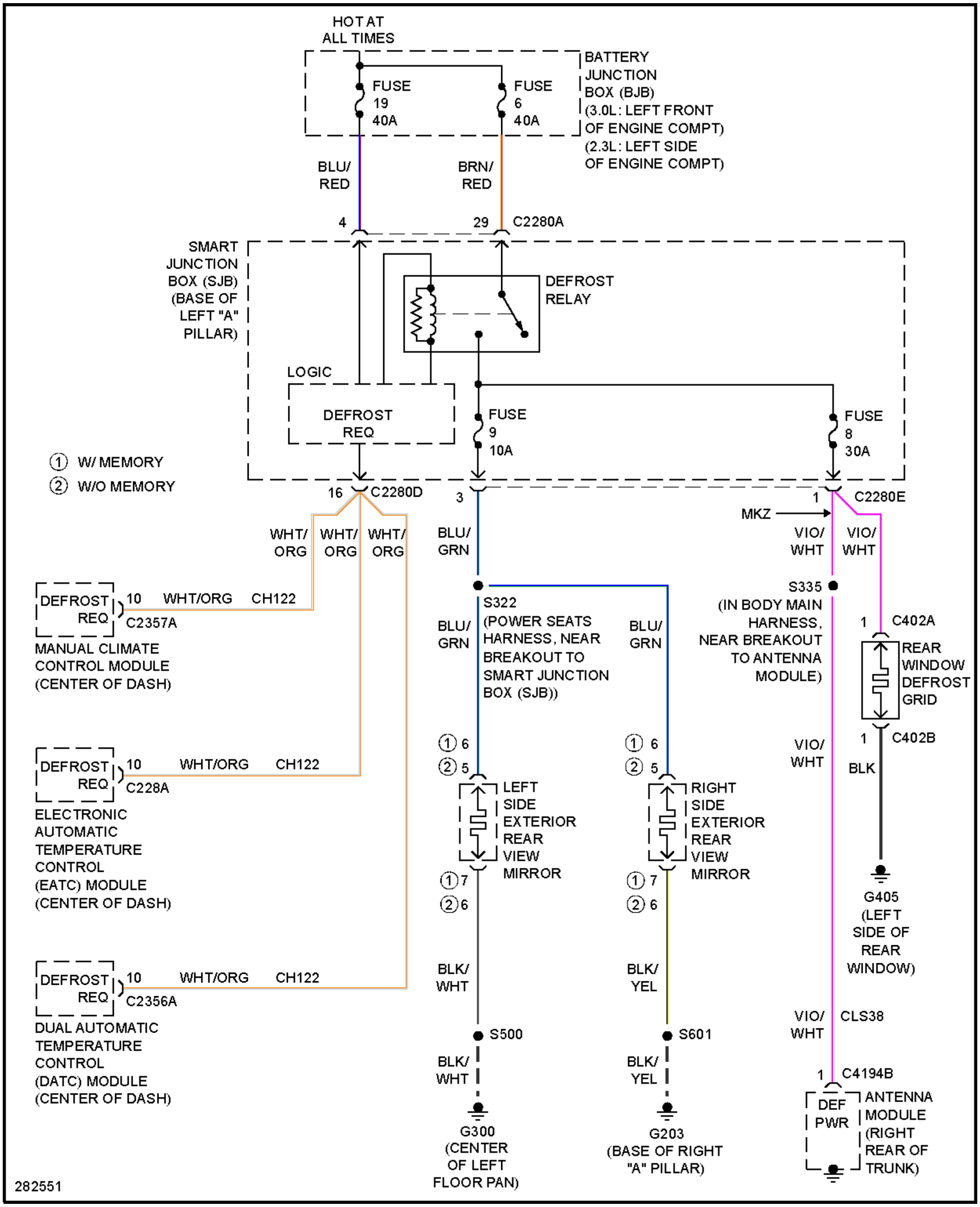


Fig. 16: Defoggers Circuit

ENGINE PERFORMANCE

3.5L

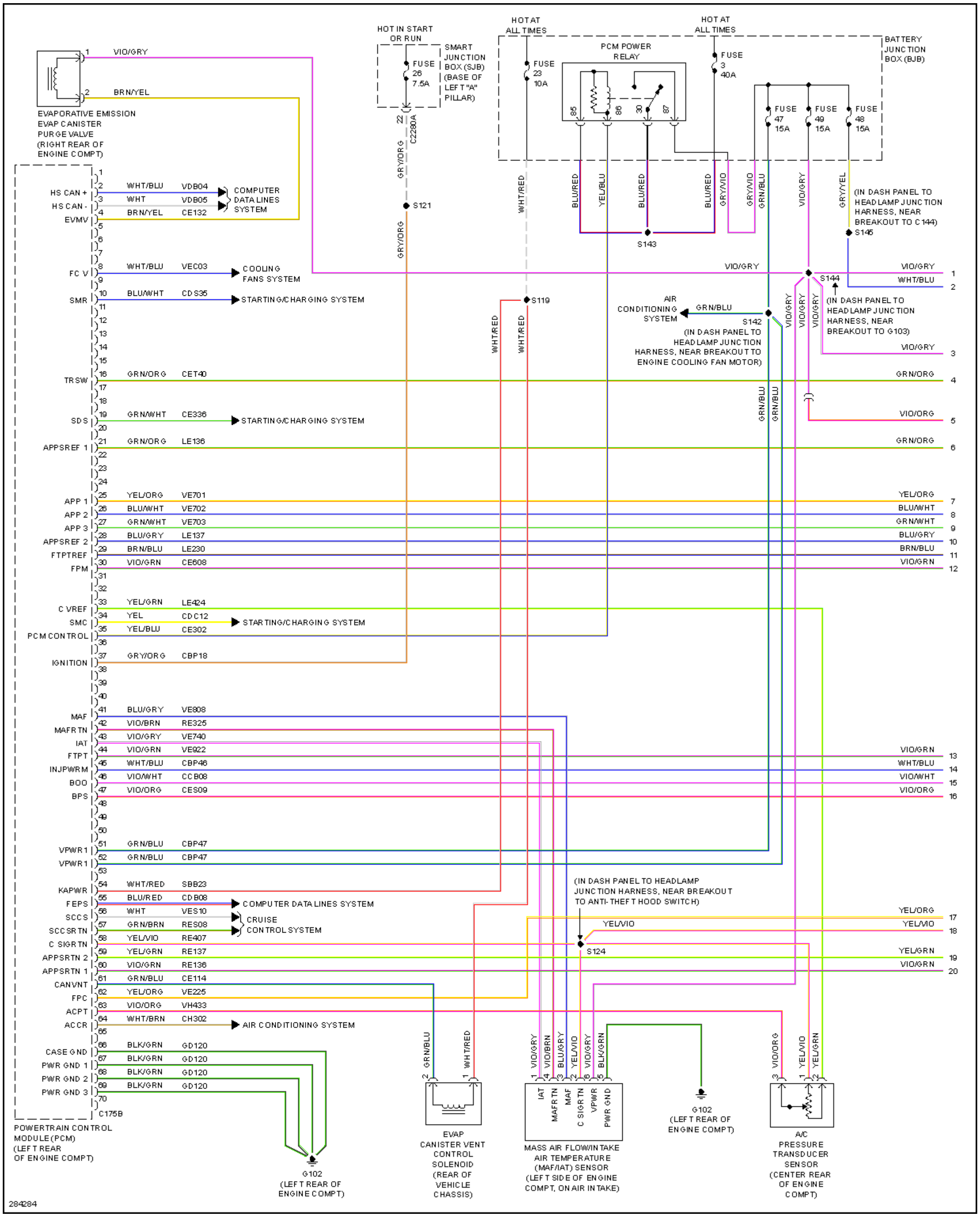


Fig. 17: 3.5L, Engine Performance Circuit (1 of 4)

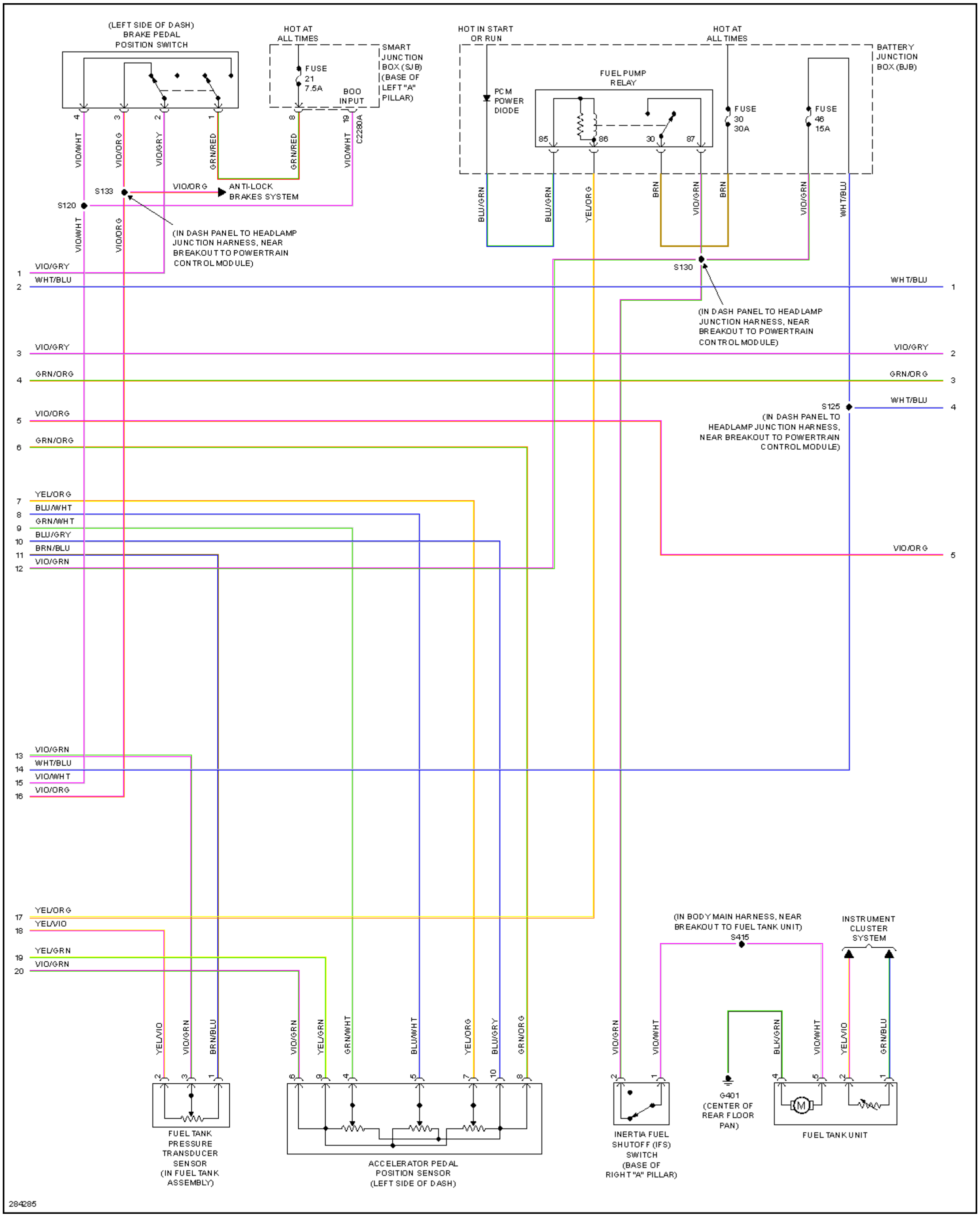


Fig. 18: 3.5L, Engine Performance Circuit (2 of 4)

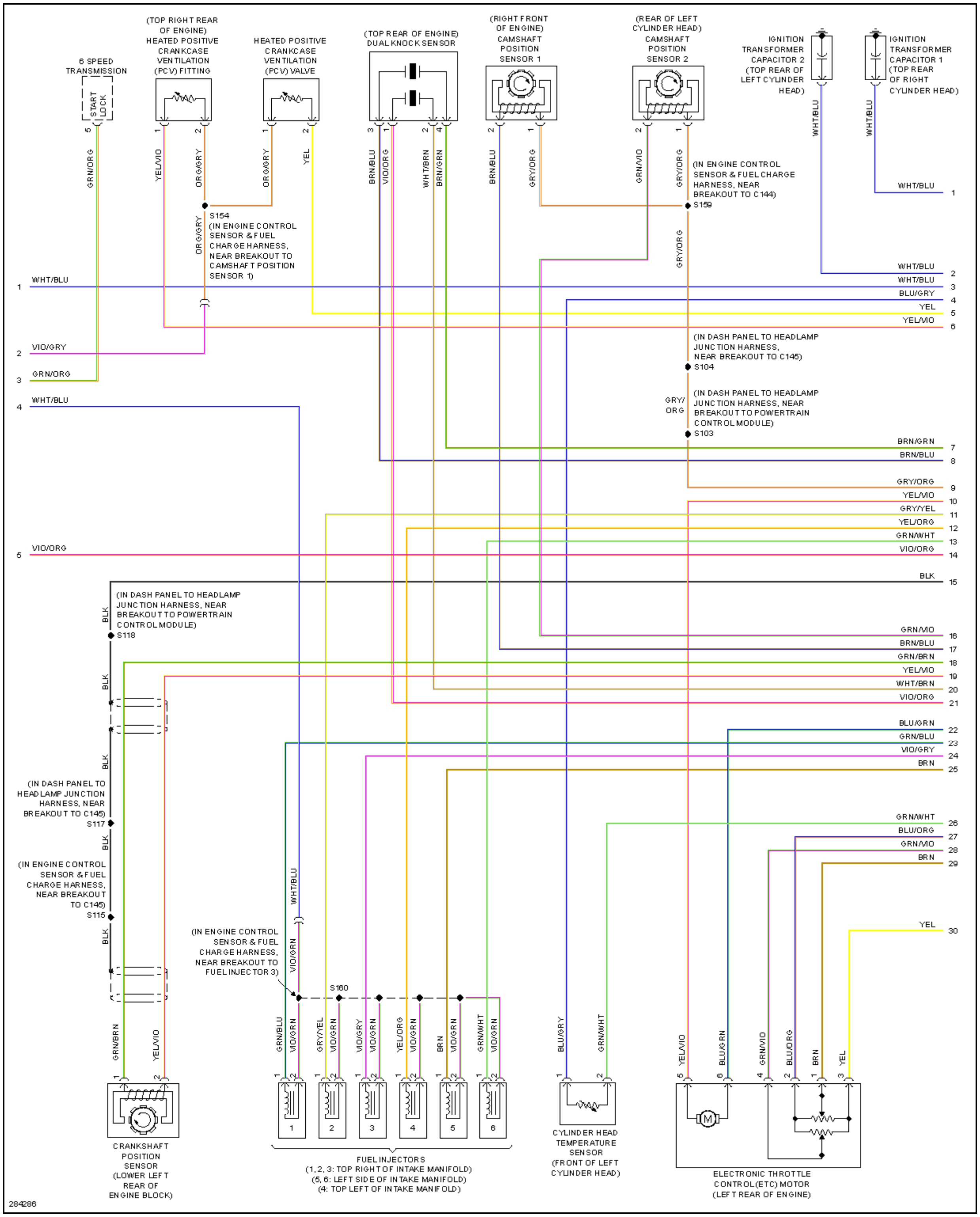


Fig. 19: 3.5L, Engine Performance Circuit (3 of 4)

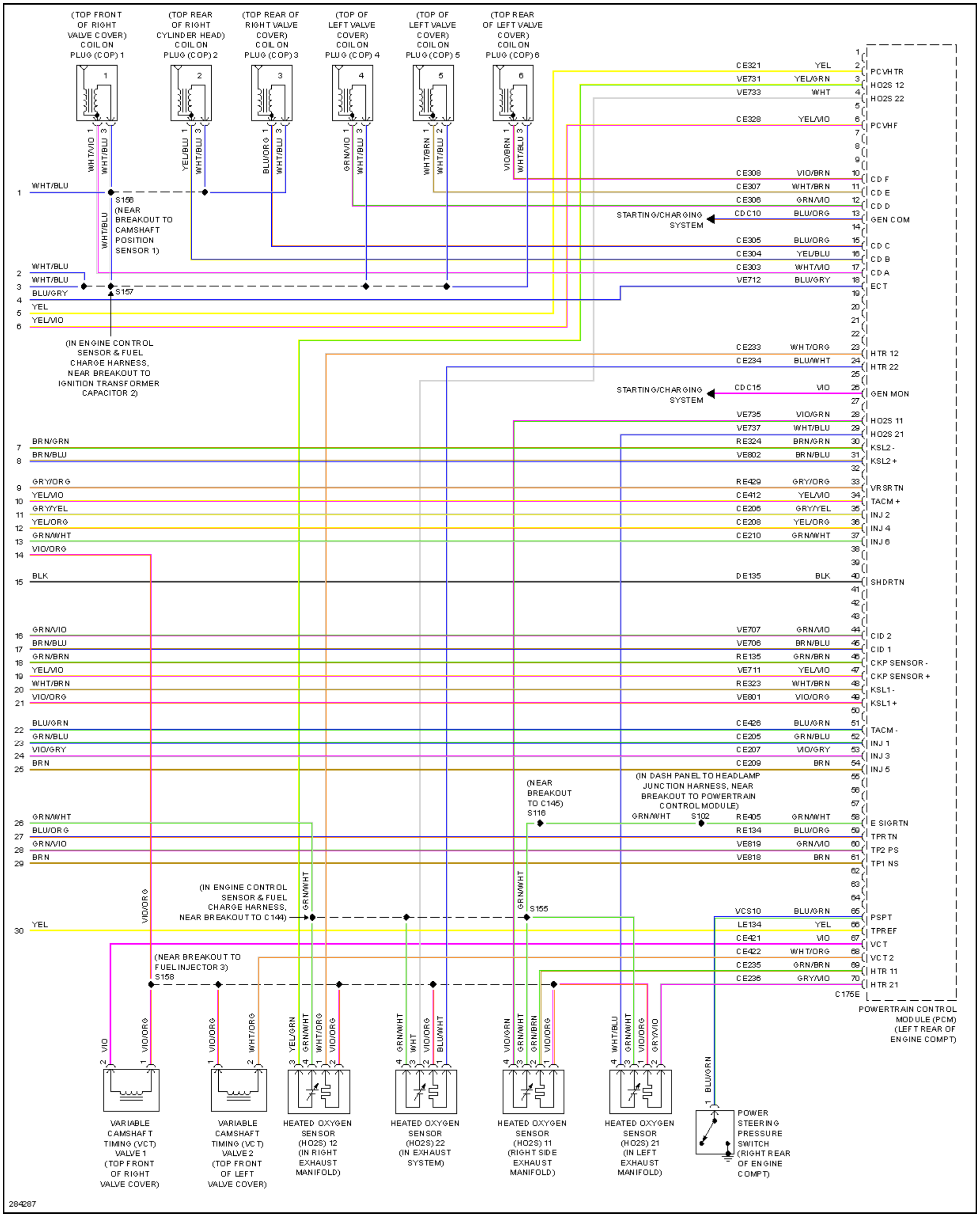


Fig. 20: 3.5L, Engine Performance Circuit (4 of 4)

EXTERIOR LIGHTS

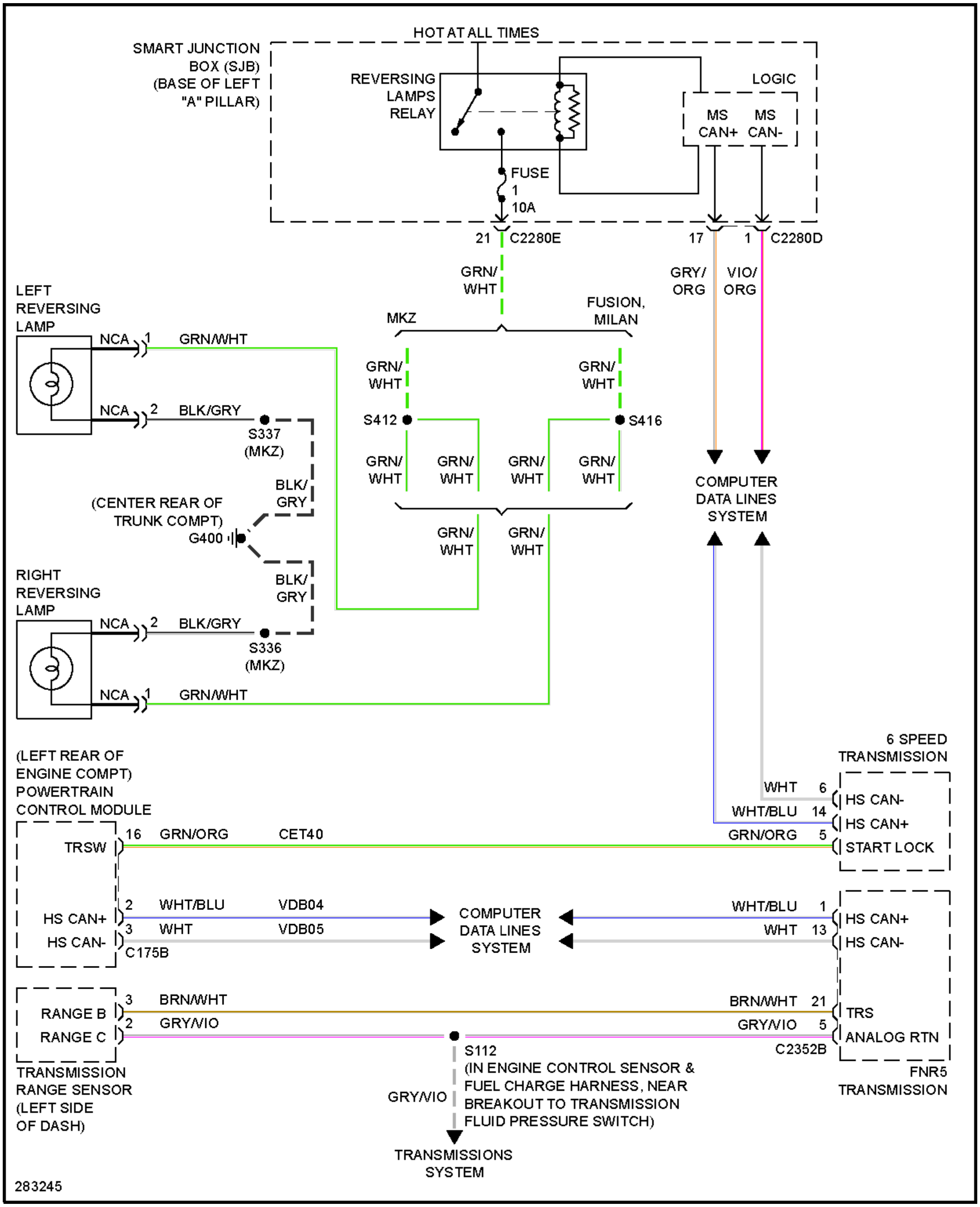


Fig. 21: Backup Lamps Circuit, A/T

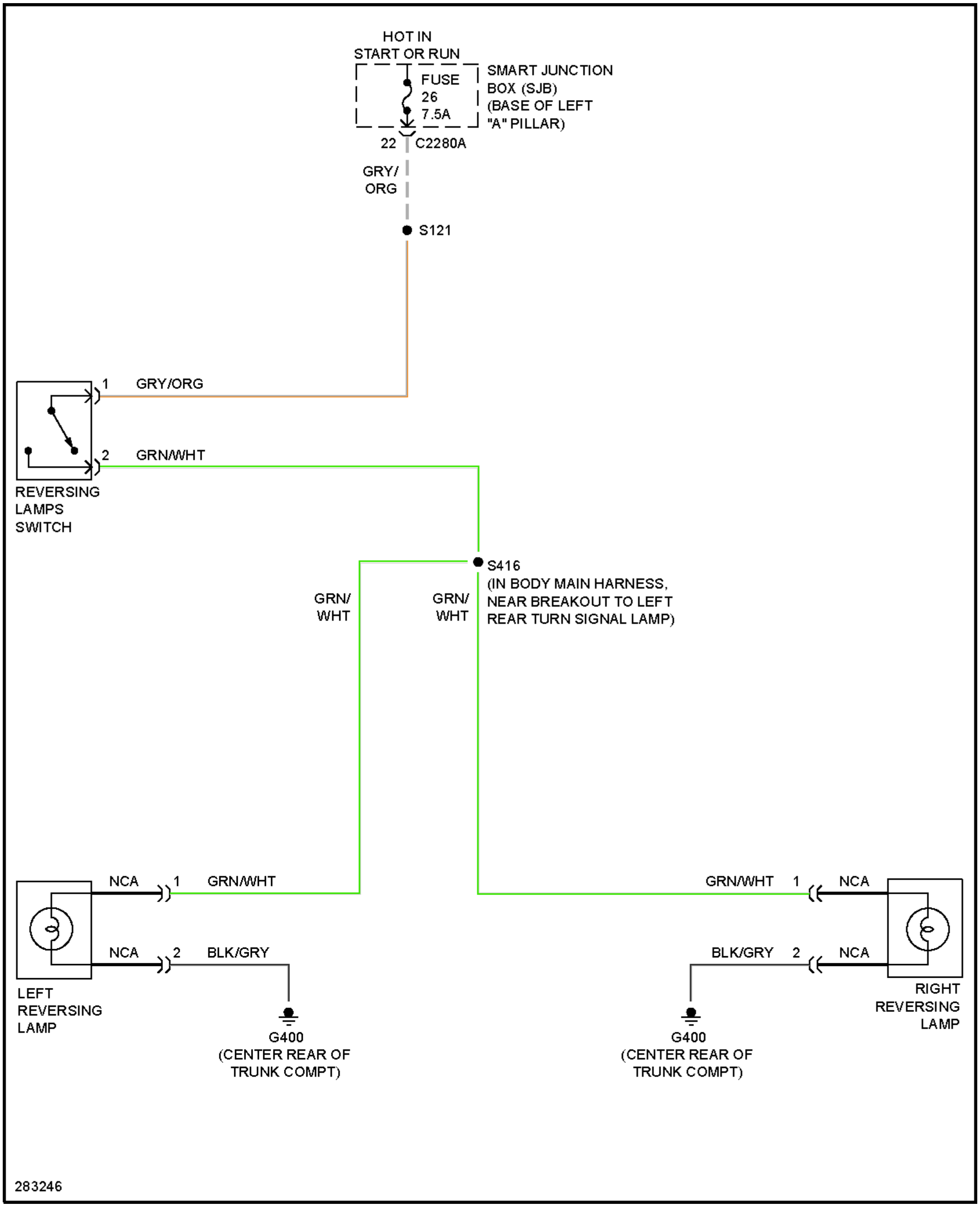


Fig. 22: Backup Lamps Circuit, M/T

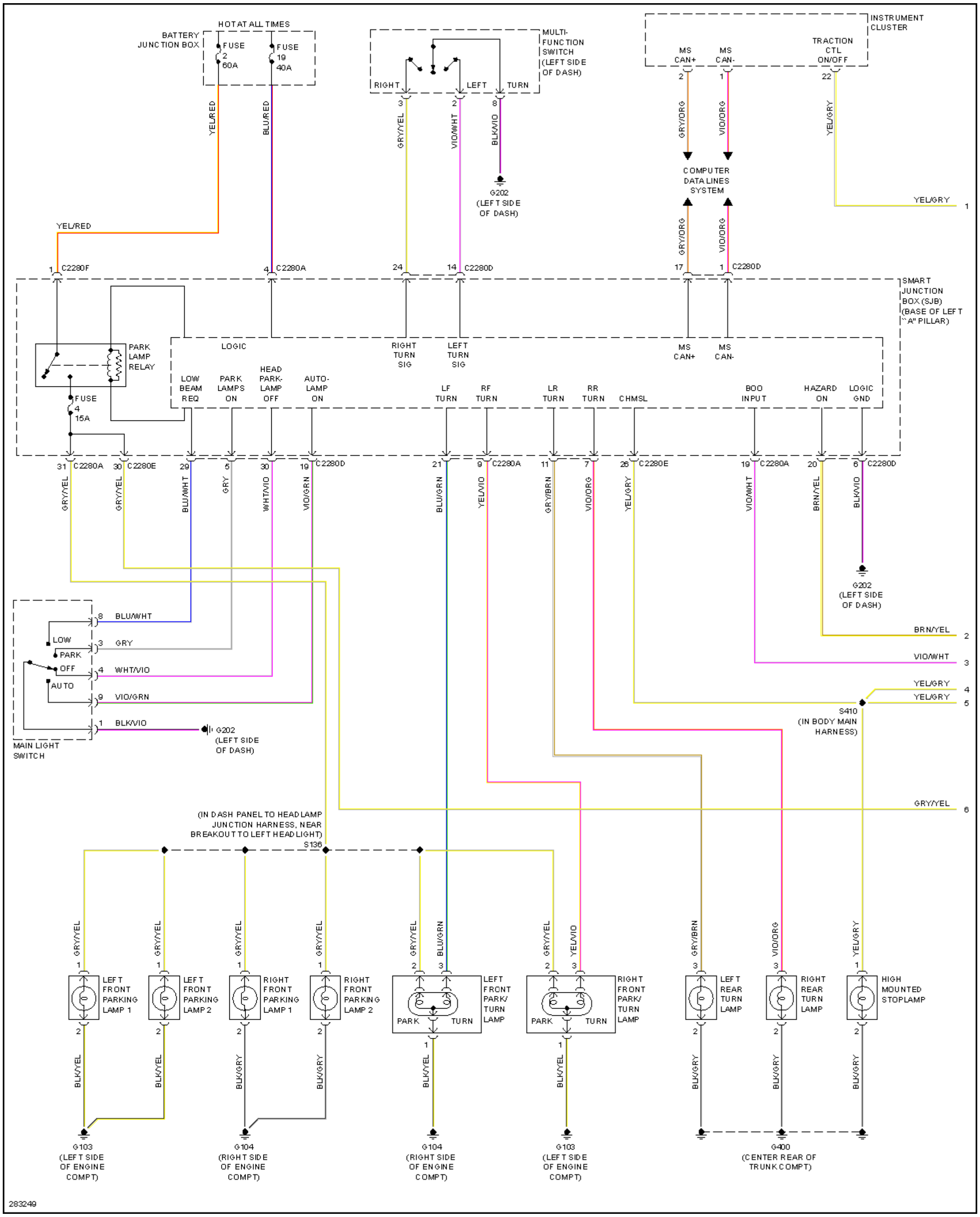


Fig. 23: Exterior Lamps Circuit (1 of 2)

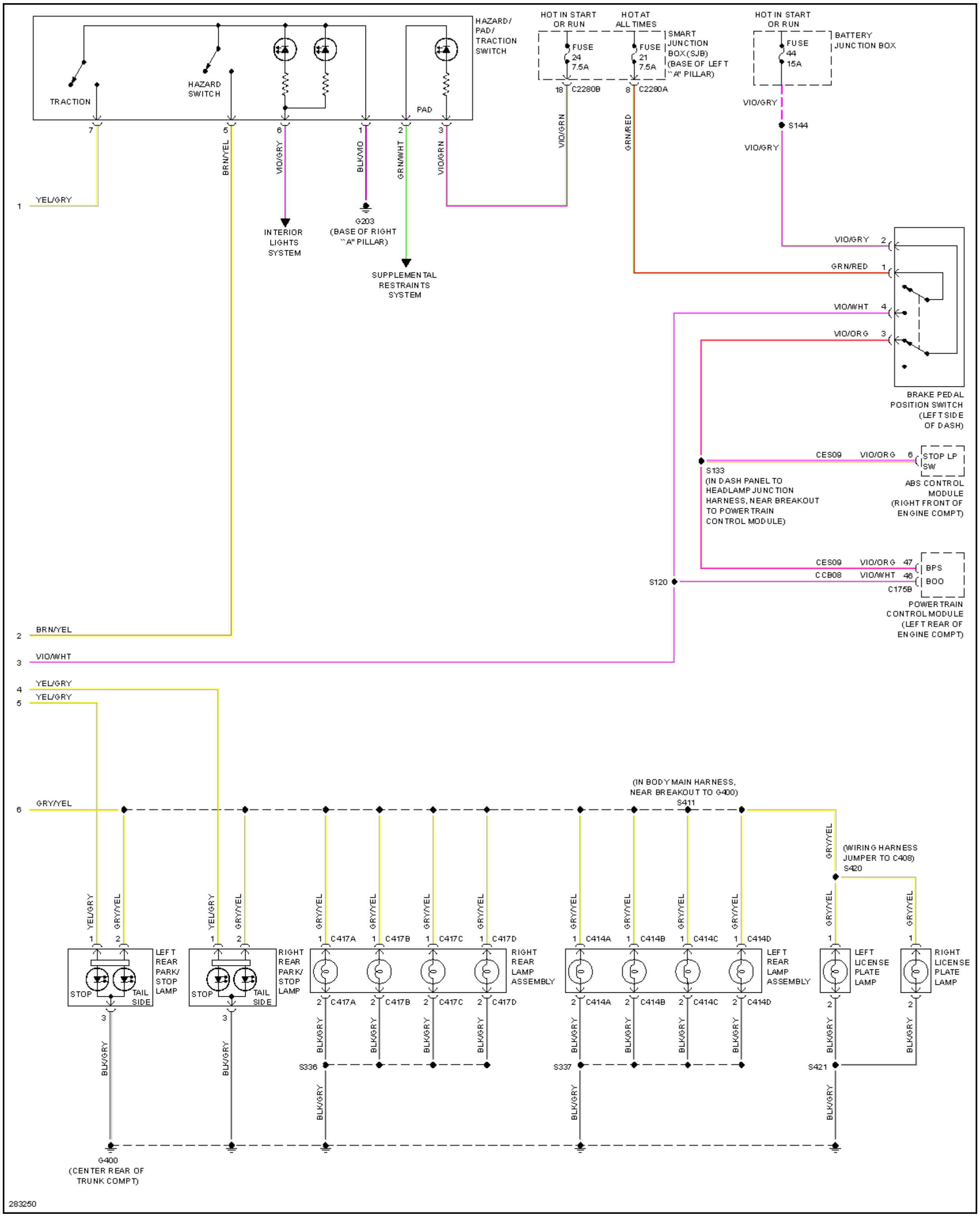


Fig. 24: Exterior Lamps Circuit (2 of 2)

GROUND DISTRIBUTION

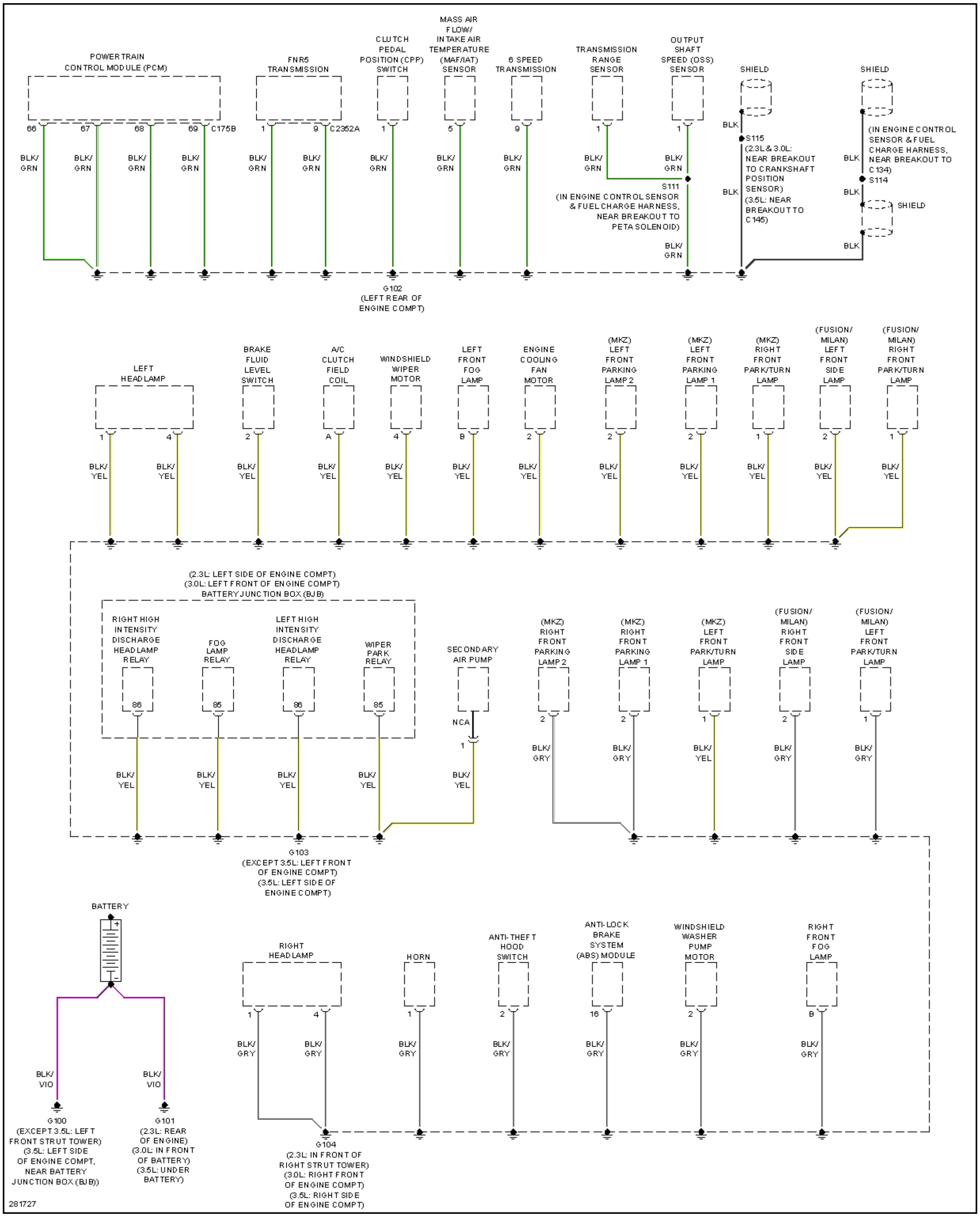


Fig. 25: Ground Distribution Circuit (1 of 4)

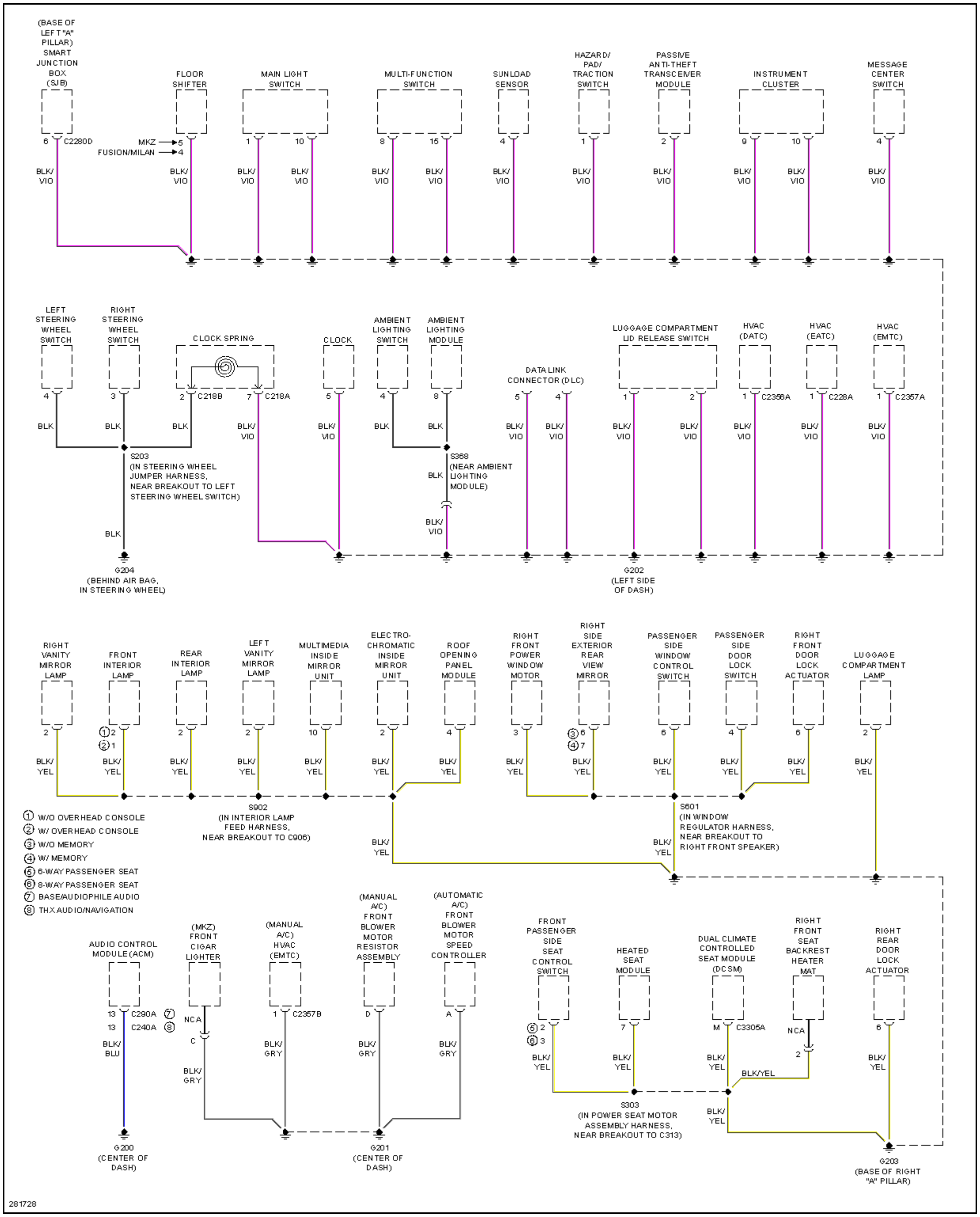


Fig. 26: Ground Distribution Circuit (2 of 4)

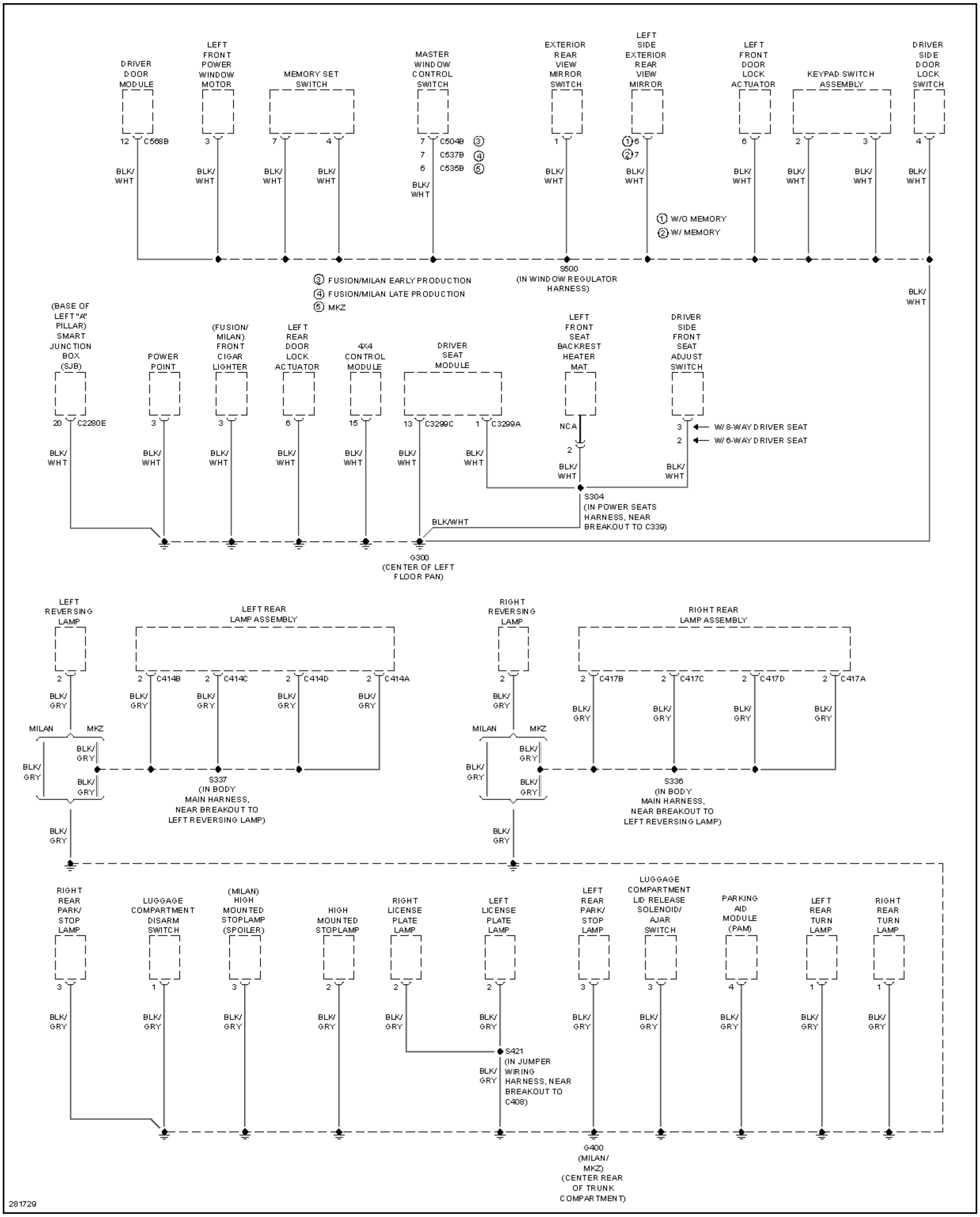


Fig. 27: Ground Distribution Circuit (3 of 4)

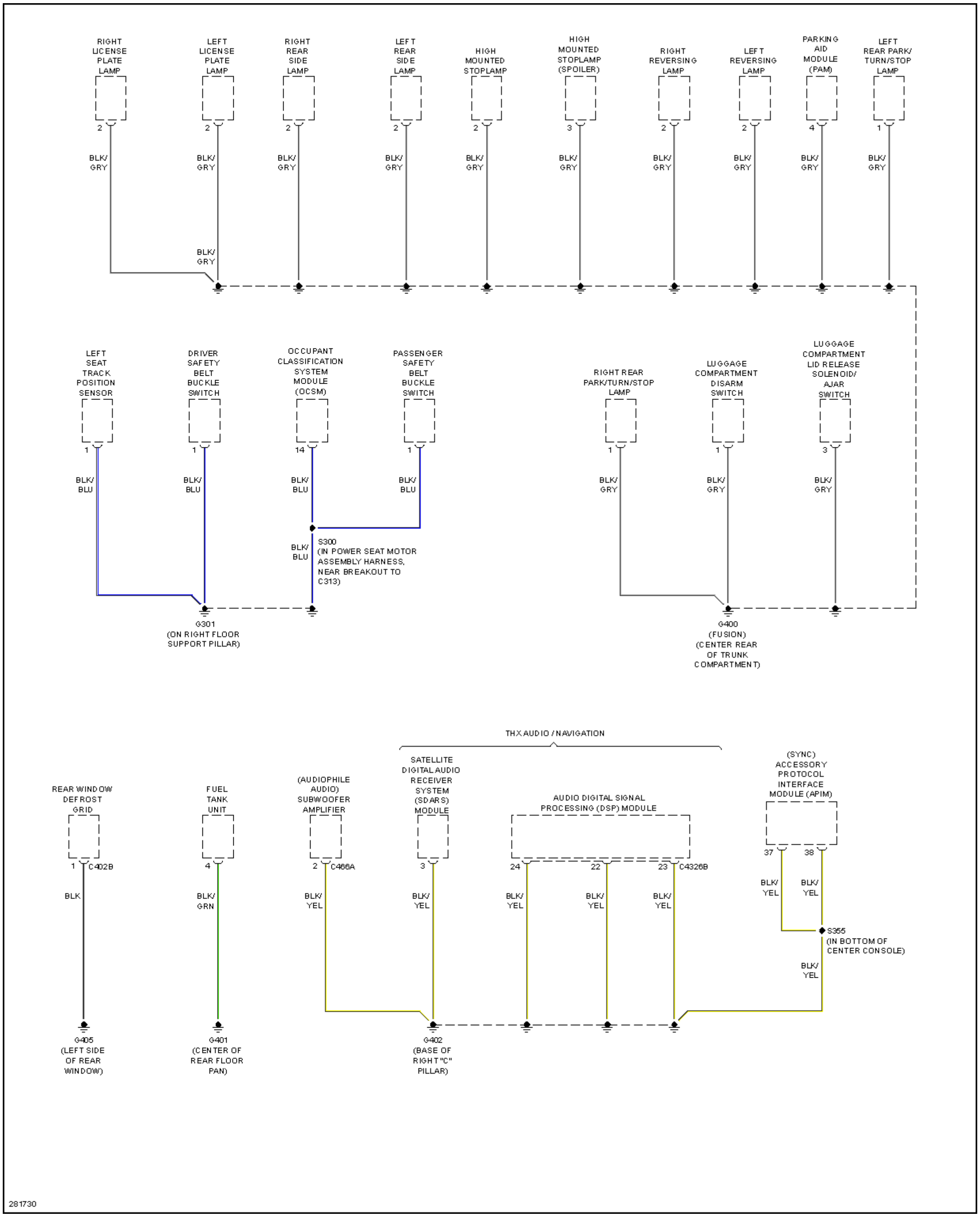


Fig. 28: Ground Distribution Circuit (4 of 4)

HEADLIGHTS

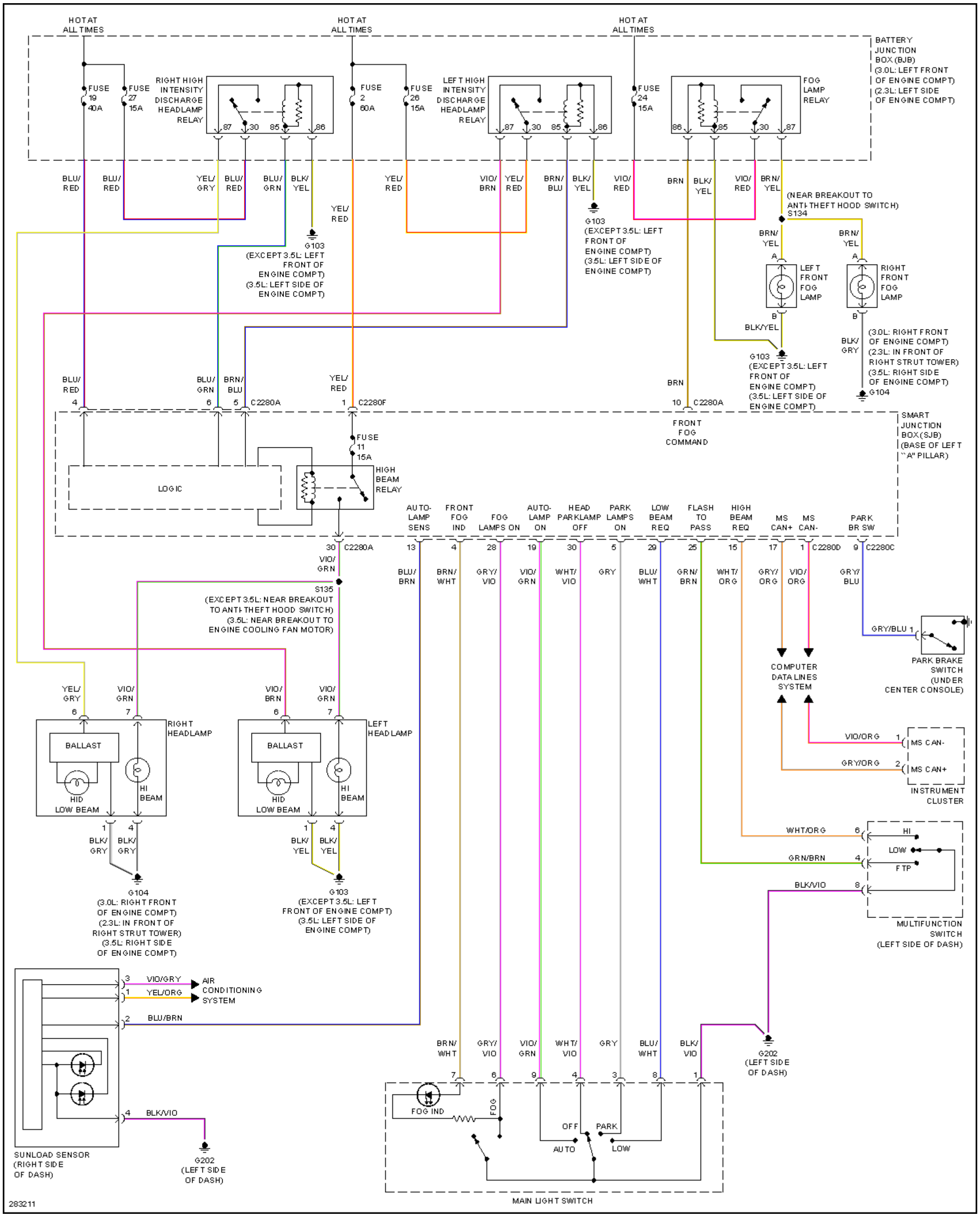


Fig. 29: Headlights Circuit, W/ High Intensity Gas Discharge Headlights

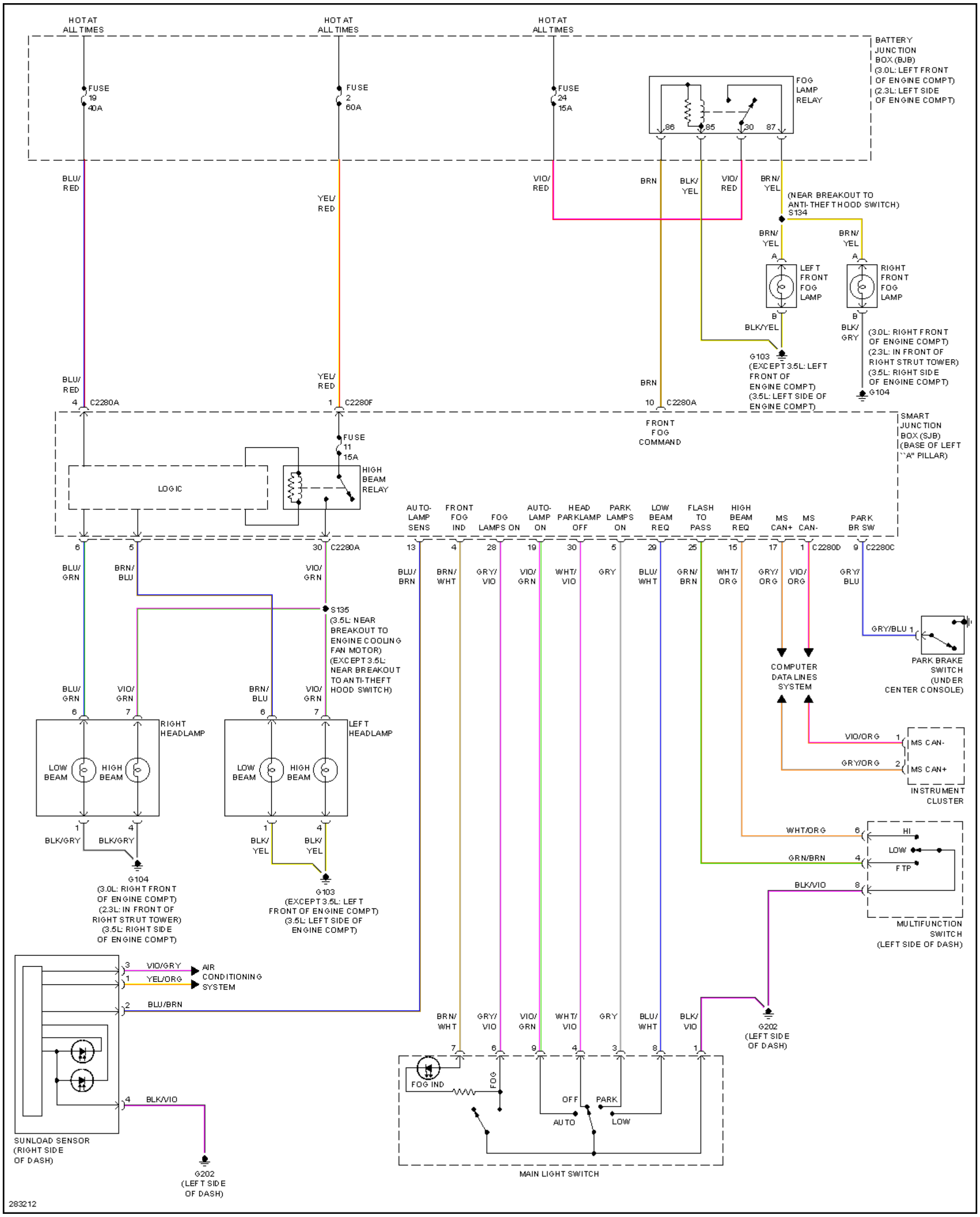


Fig. 30: Headlights Circuit, W/O High Intensity Gas Discharge Headlights

HORN

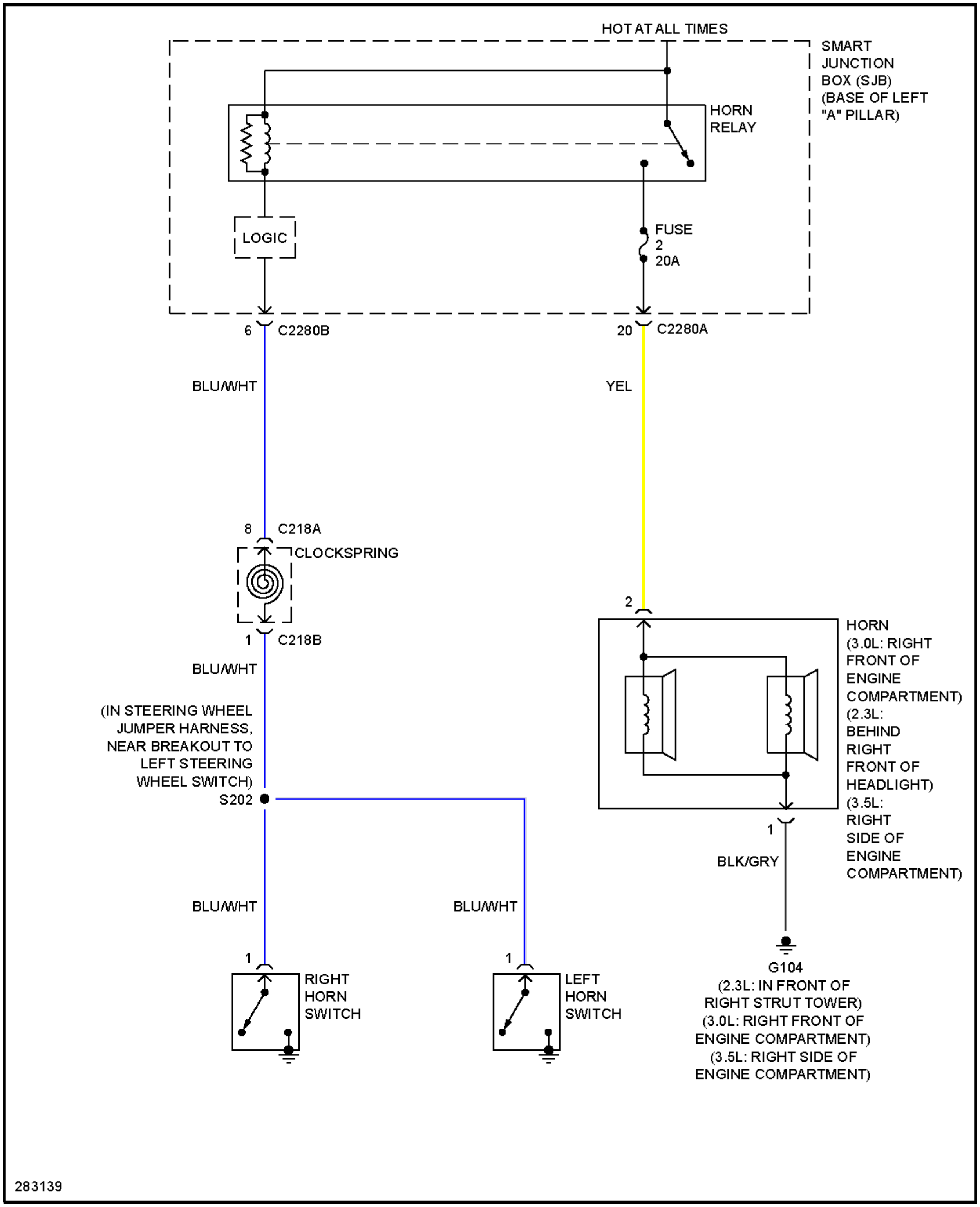


Fig. 31: Horn Circuit

INSTRUMENT CLUSTER

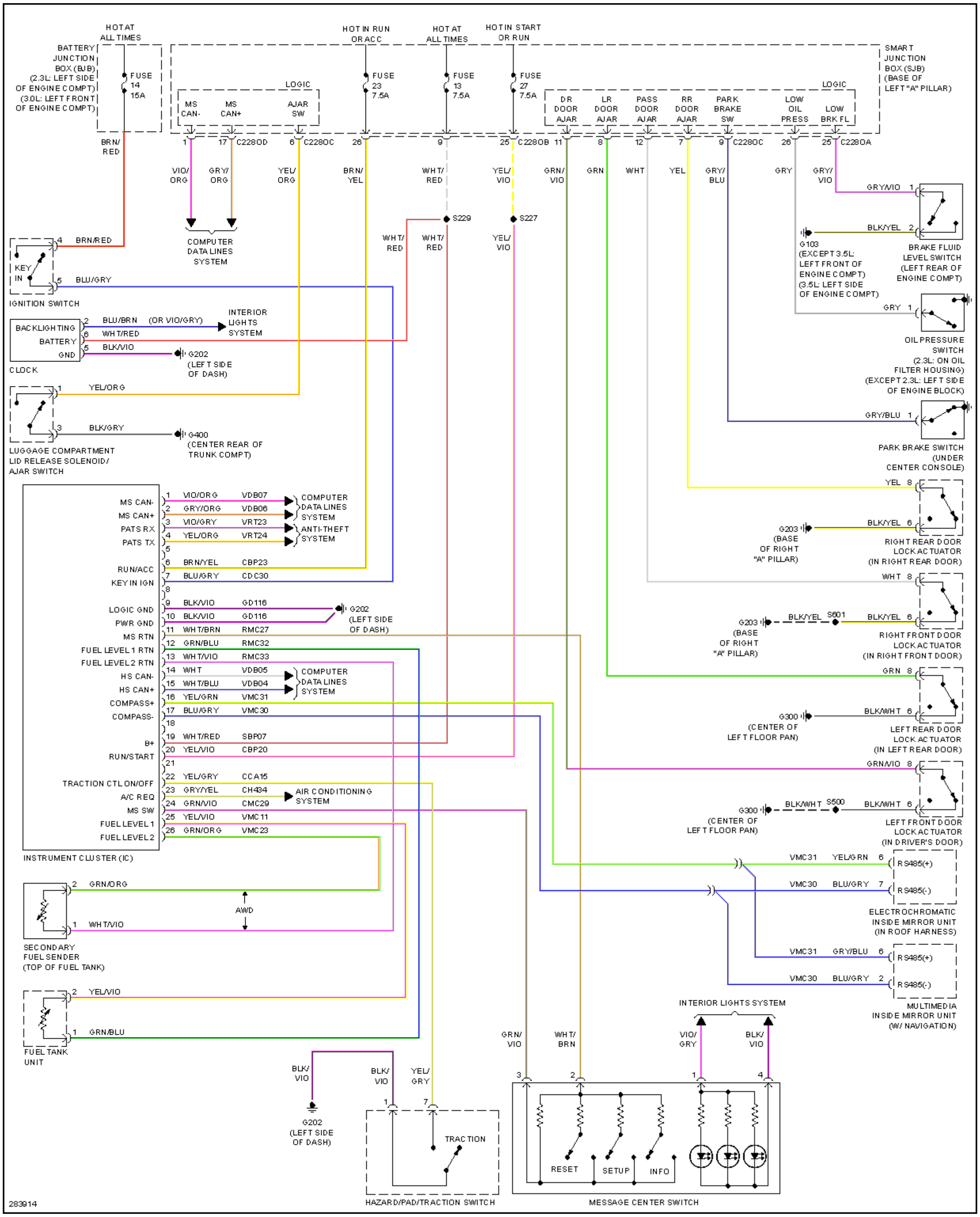


Fig. 32: Instrument Cluster Circuit

INTERIOR LIGHTS

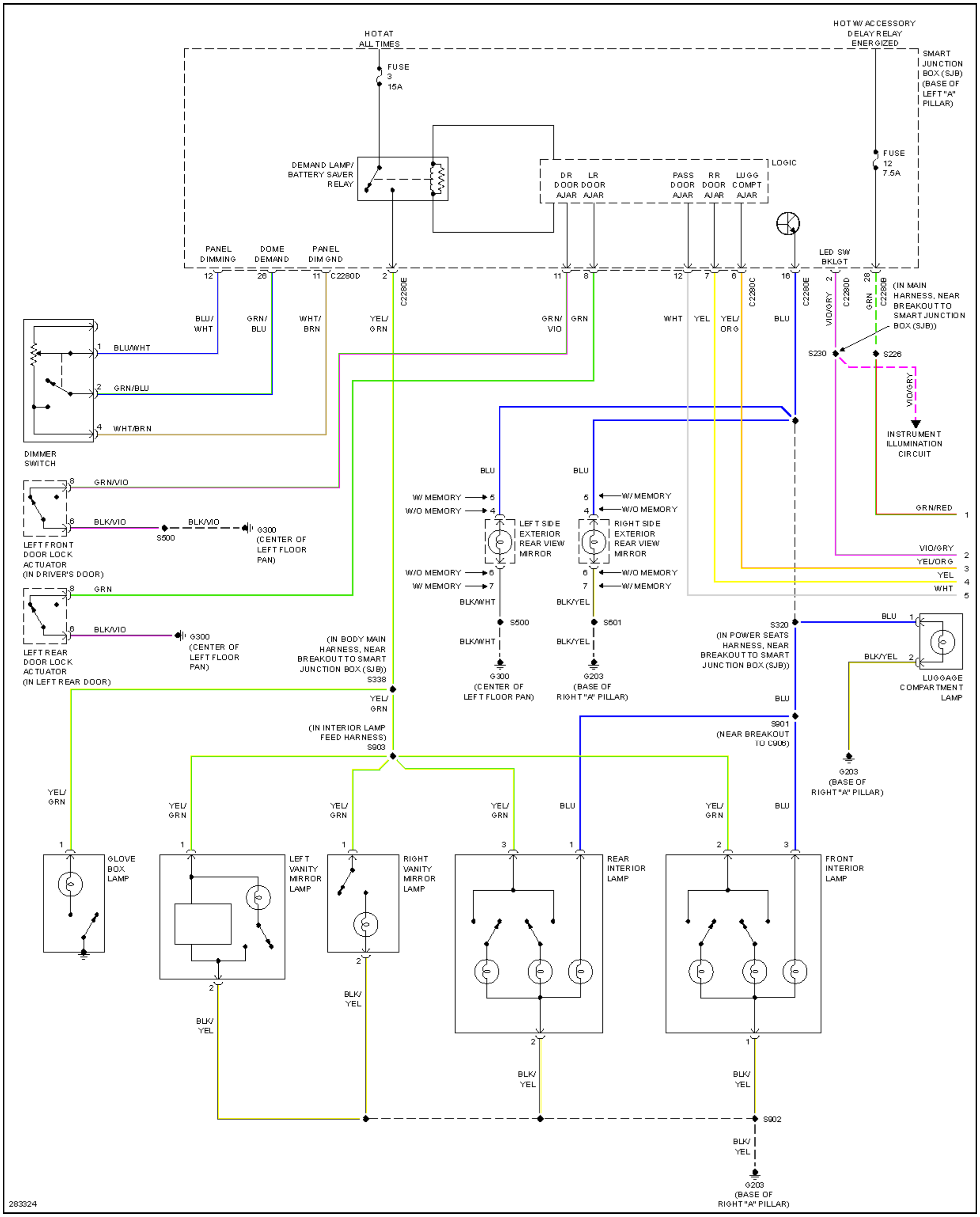


Fig. 33: Courtesy Lamps Circuit (1 of 2)

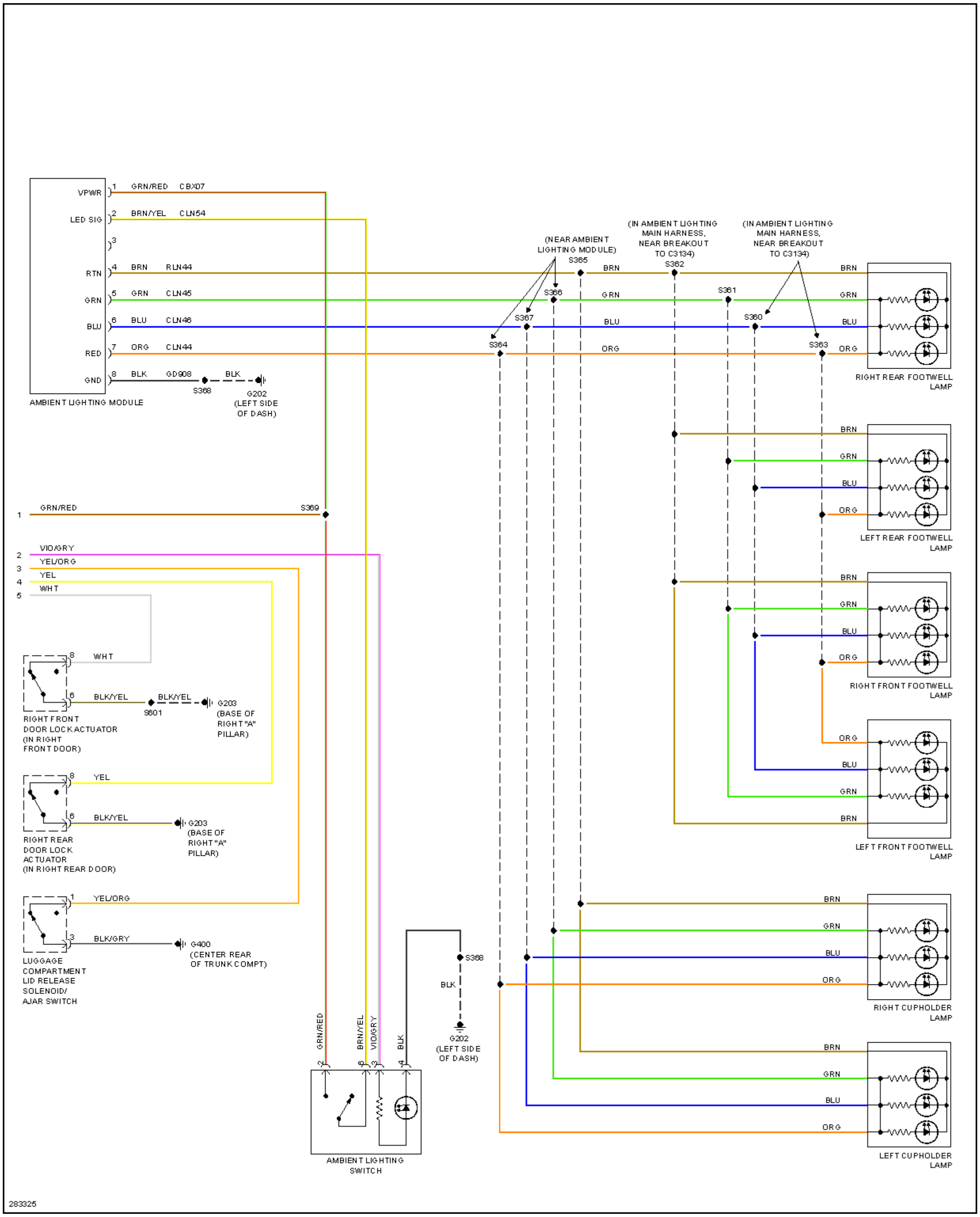


Fig. 34: Courtesy Lamps Circuit (2 of 2)

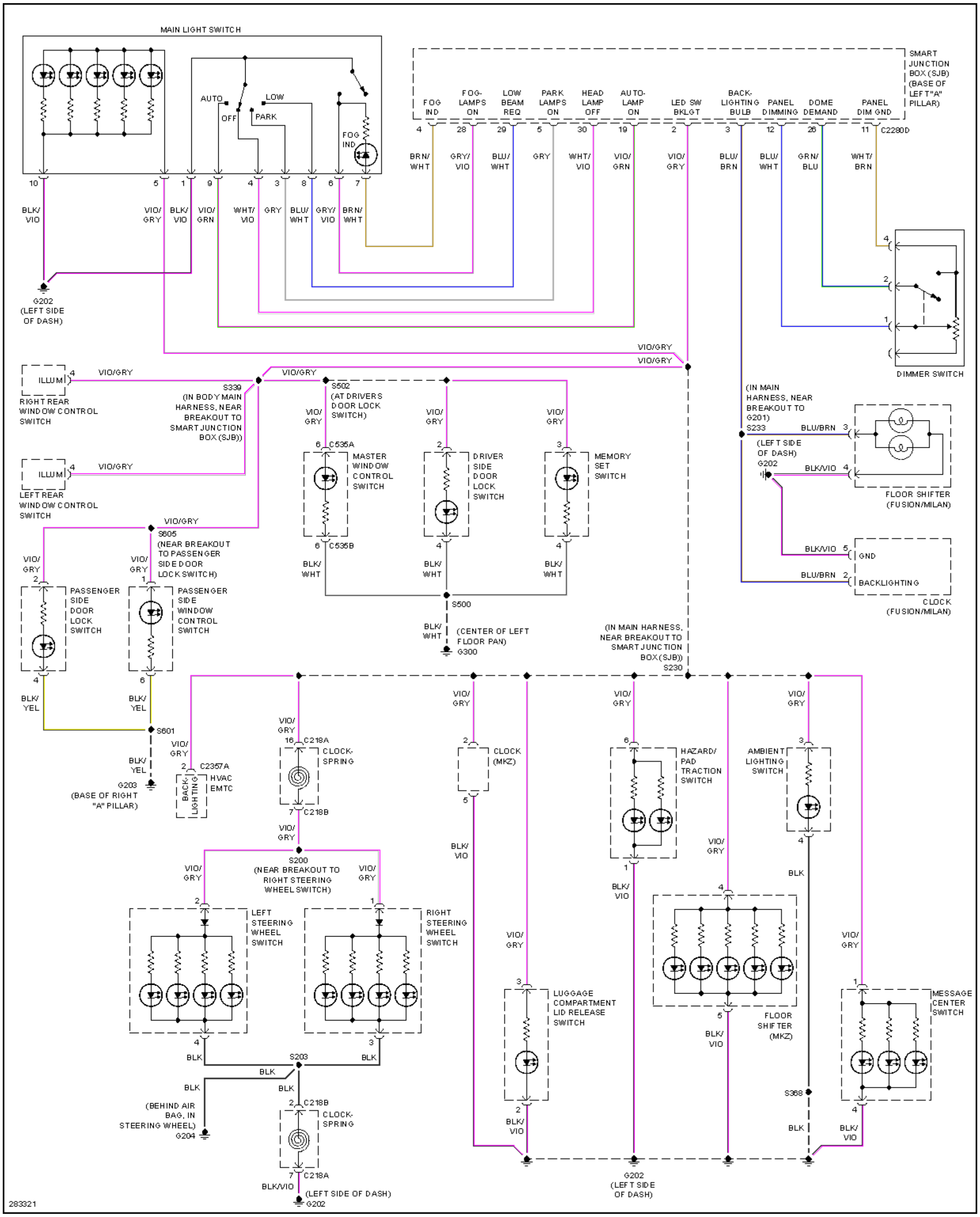


Fig. 35: Instrument Illumination Circuit

MEMORY SYSTEMS

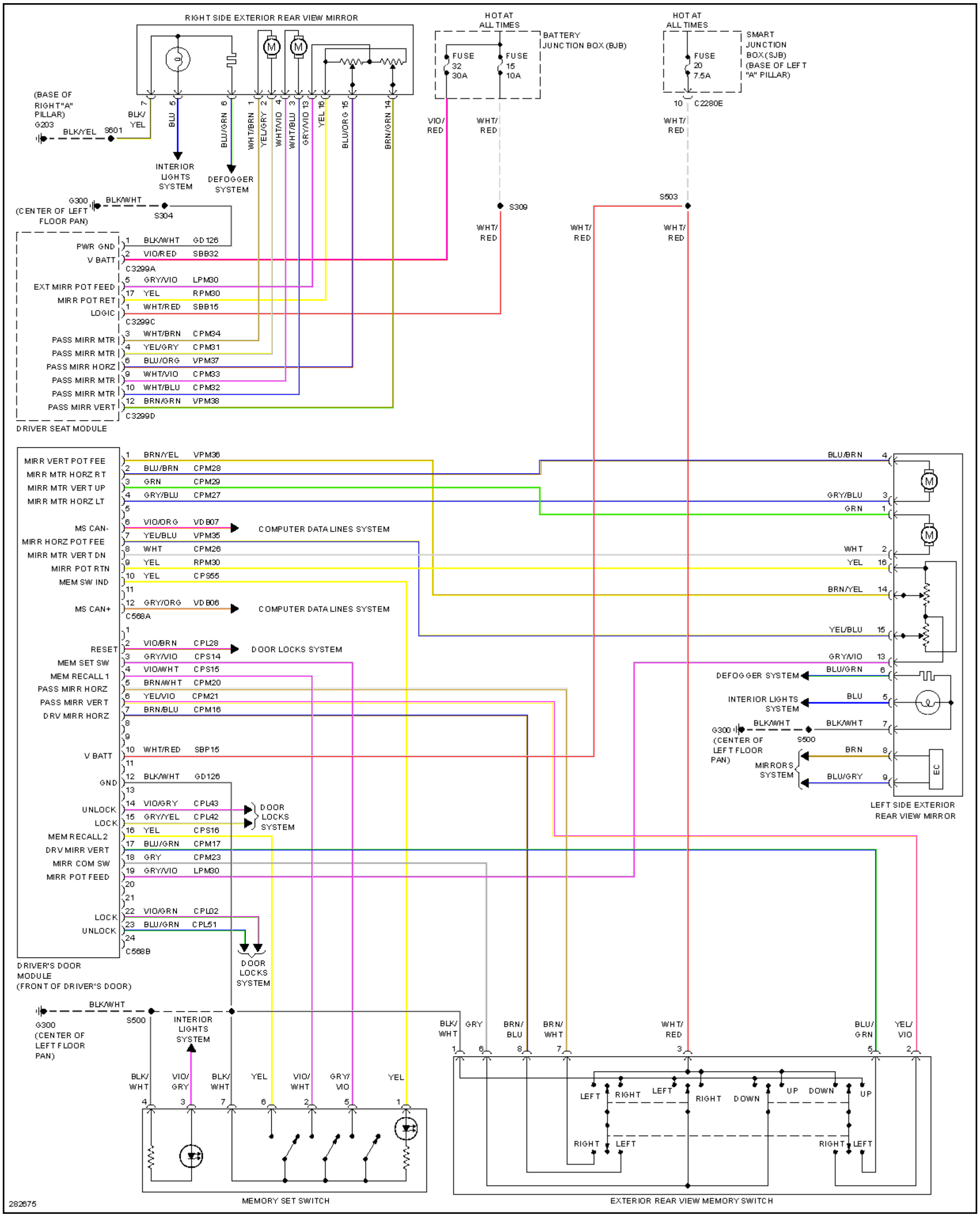


Fig. 36: Memory Mirrors Circuit

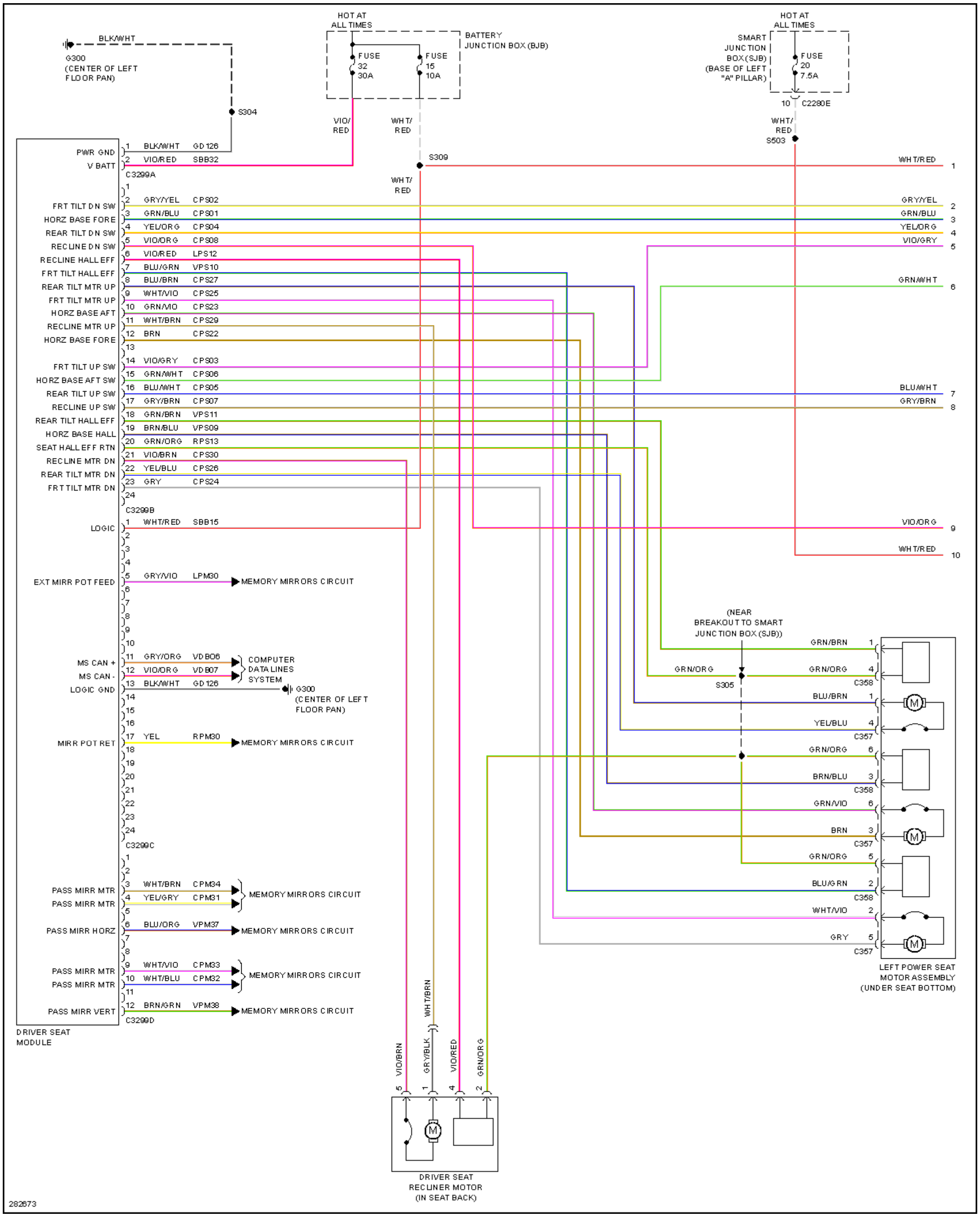


Fig. 37: Memory Seat Circuit (1 of 2)

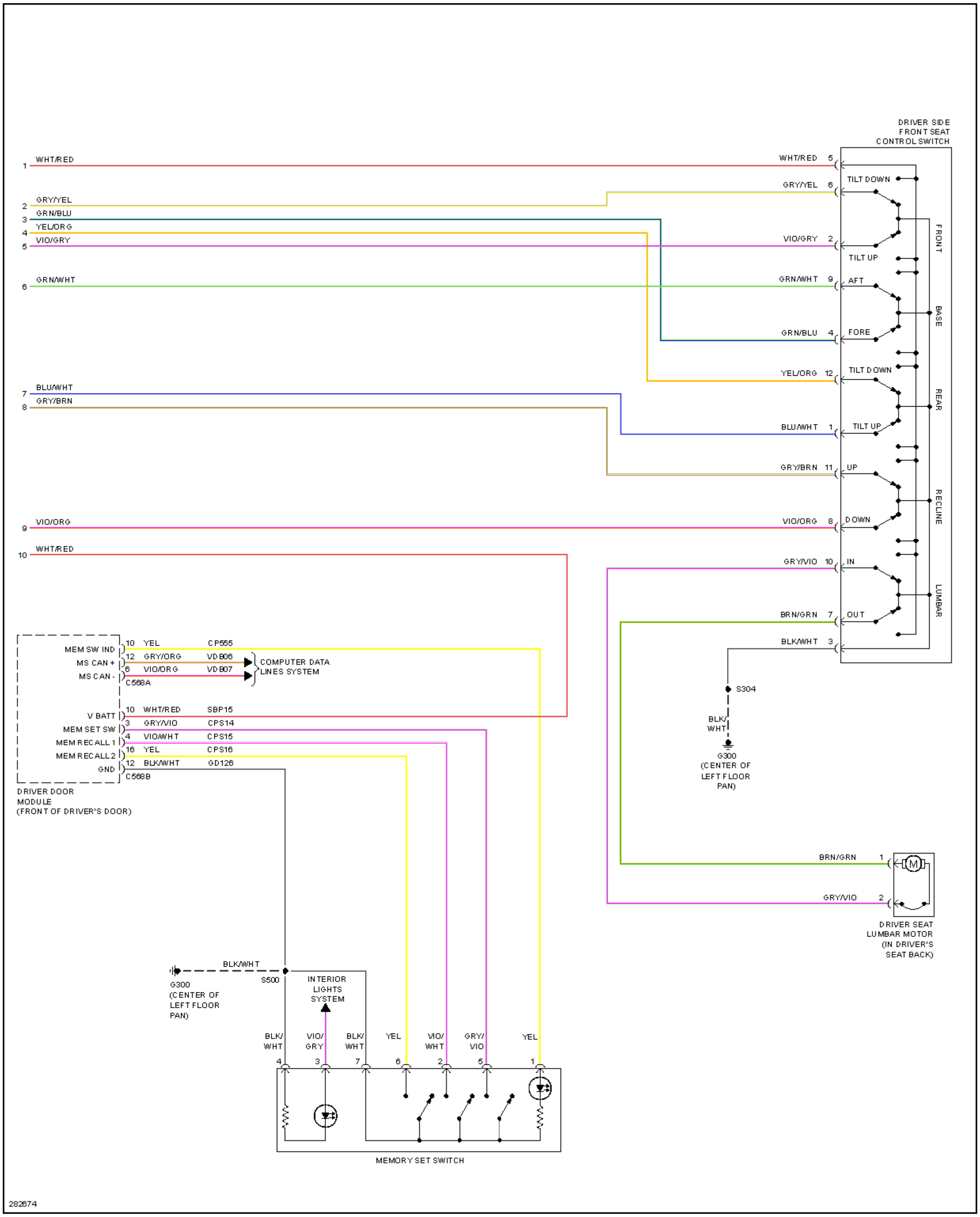


Fig. 38: Memory Seat Circuit (2 of 2)

NAVIGATION

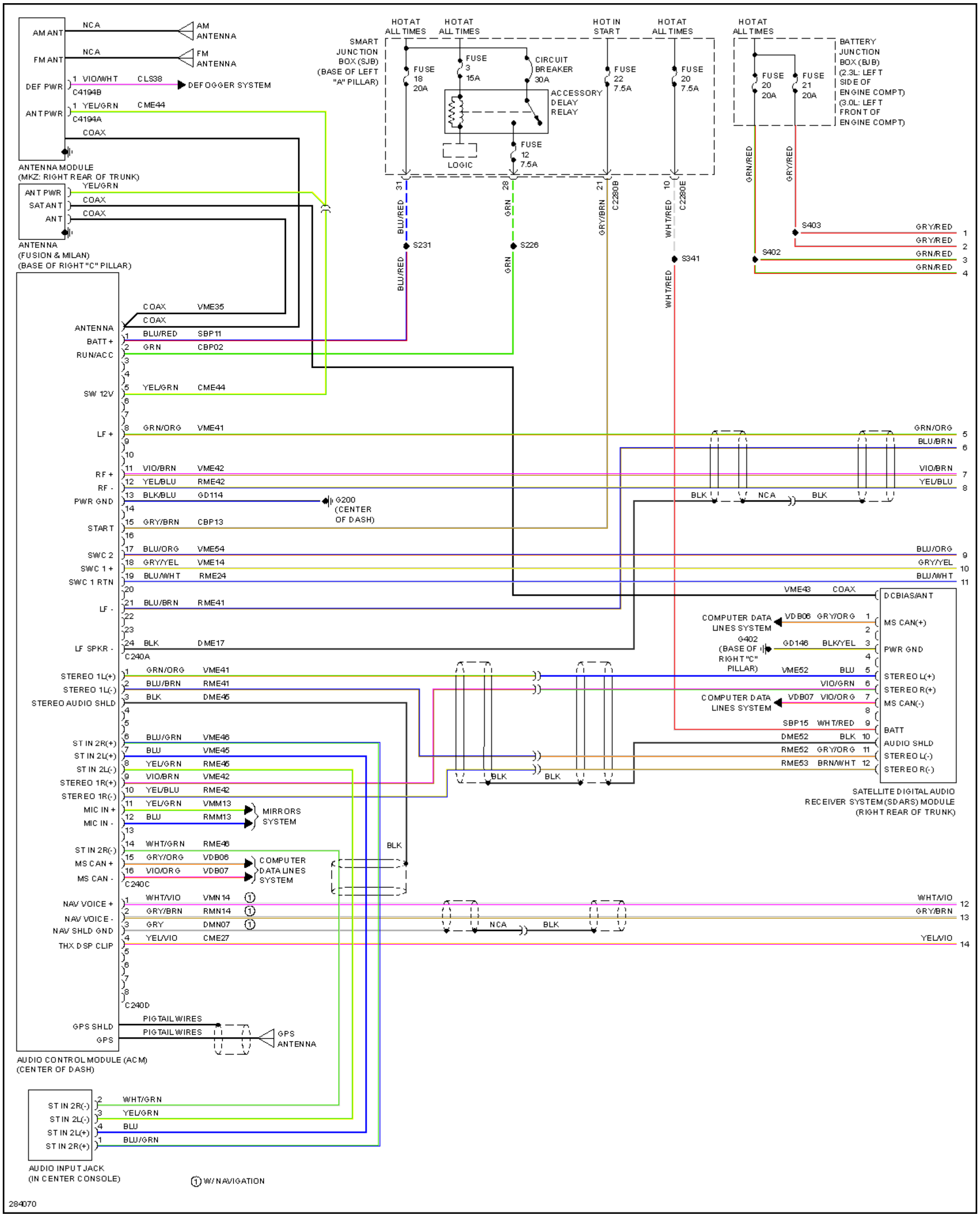


Fig. 39: Navigation Circuit (1 of 2)

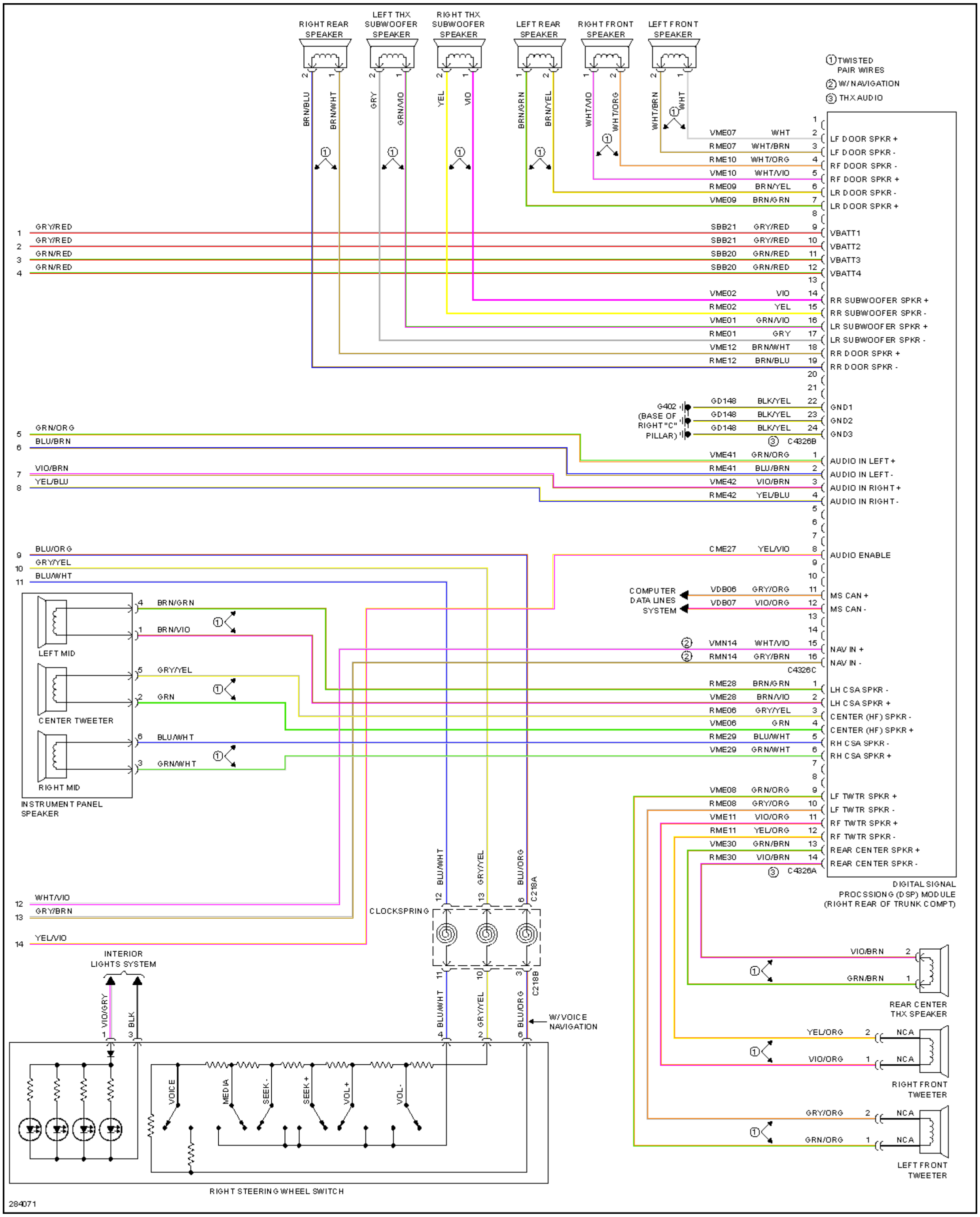


Fig. 40: Navigation Circuit (2 of 2)

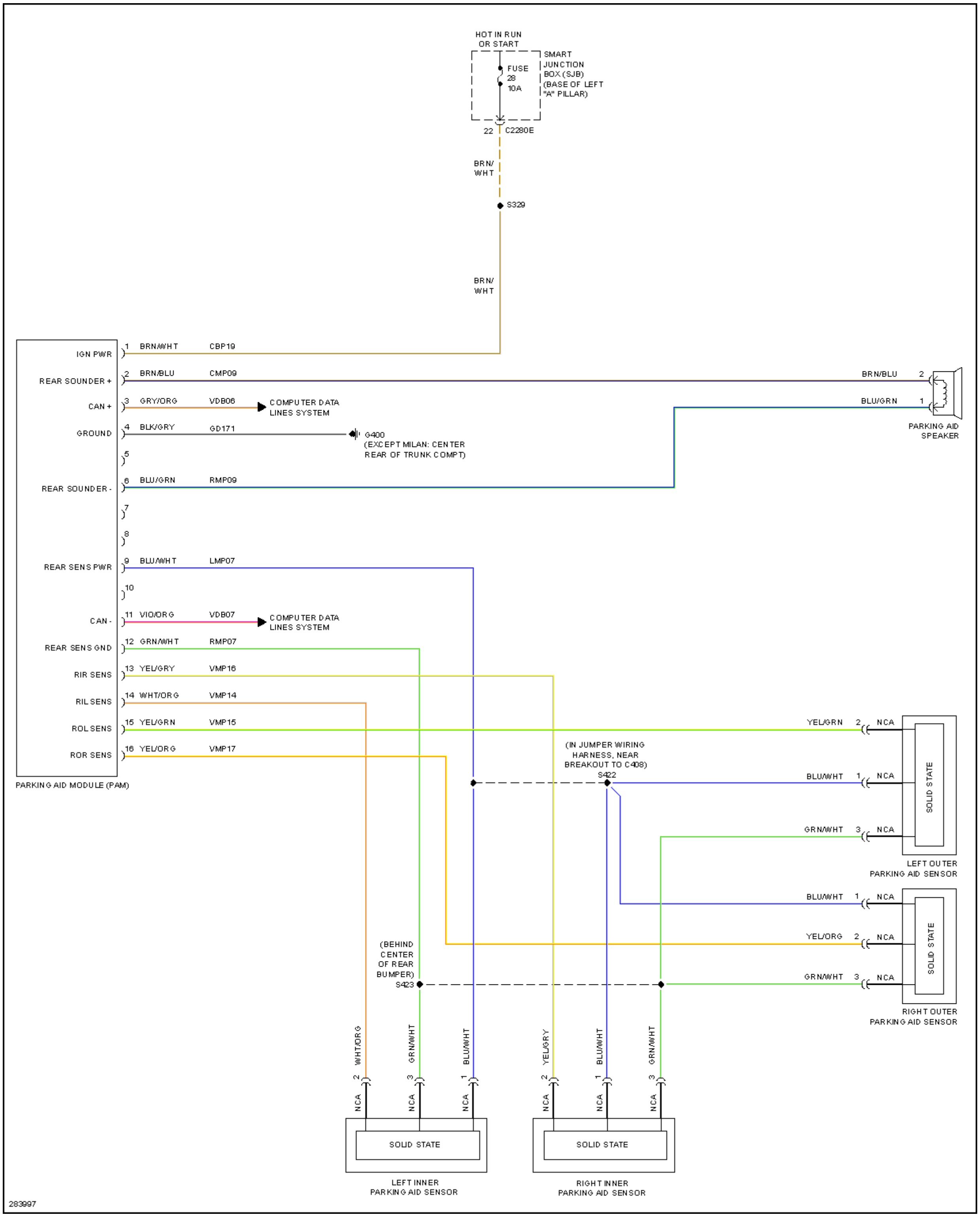


Fig. 41: Parking Assistant Circuit

POWER DISTRIBUTION

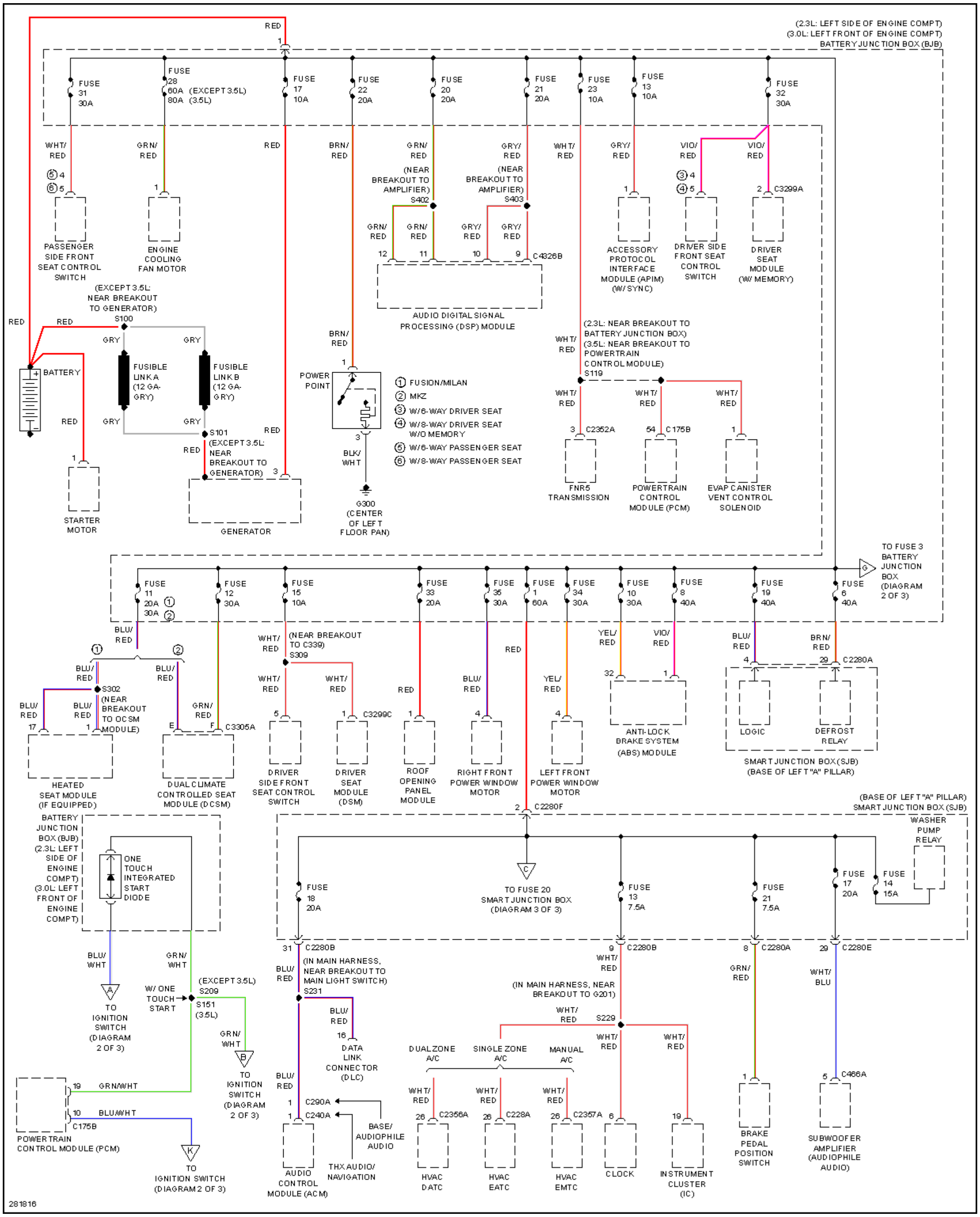


Fig. 42: Power Distribution Circuit (1 of 3)

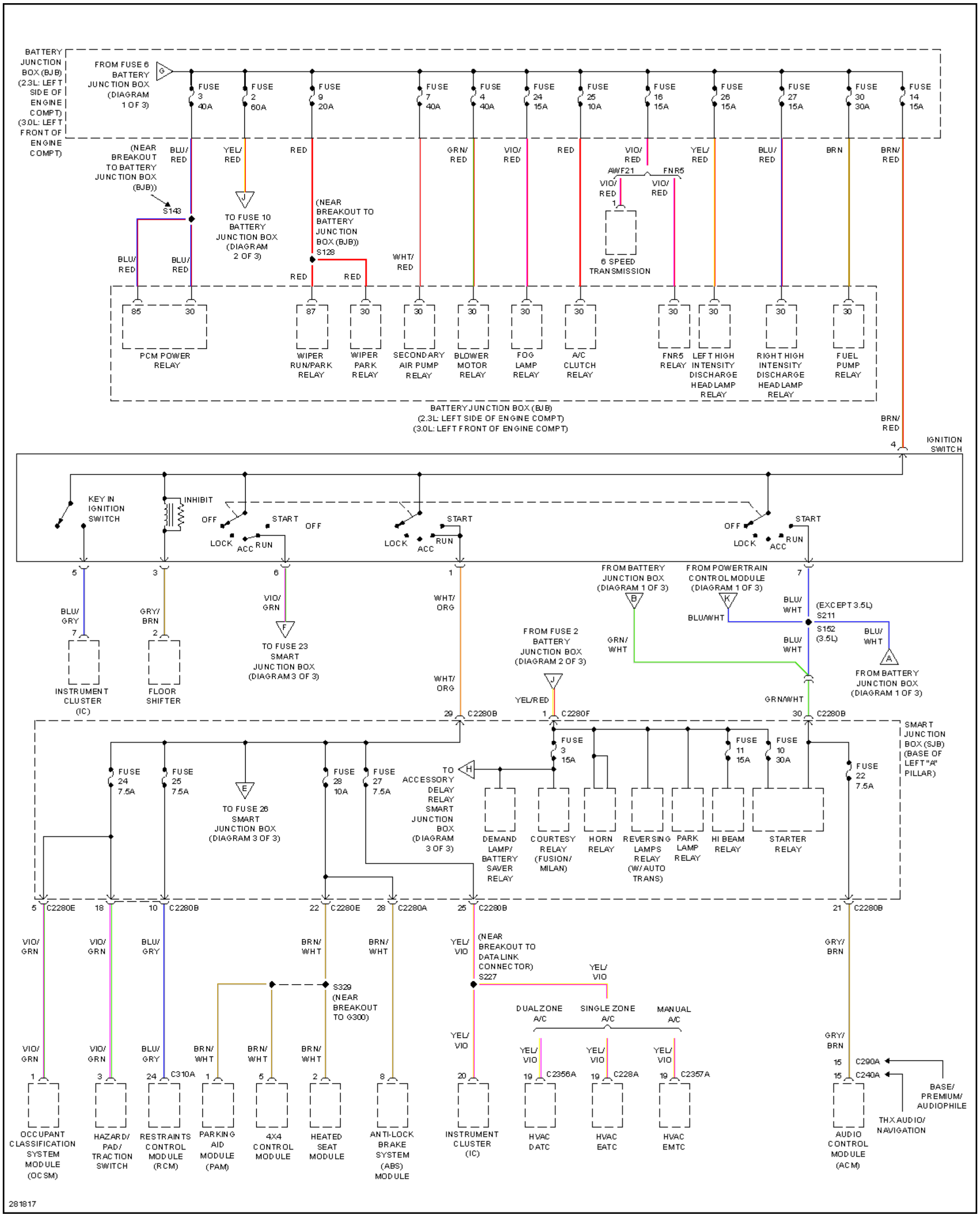


Fig. 43: Power Distribution Circuit (2 of 3)

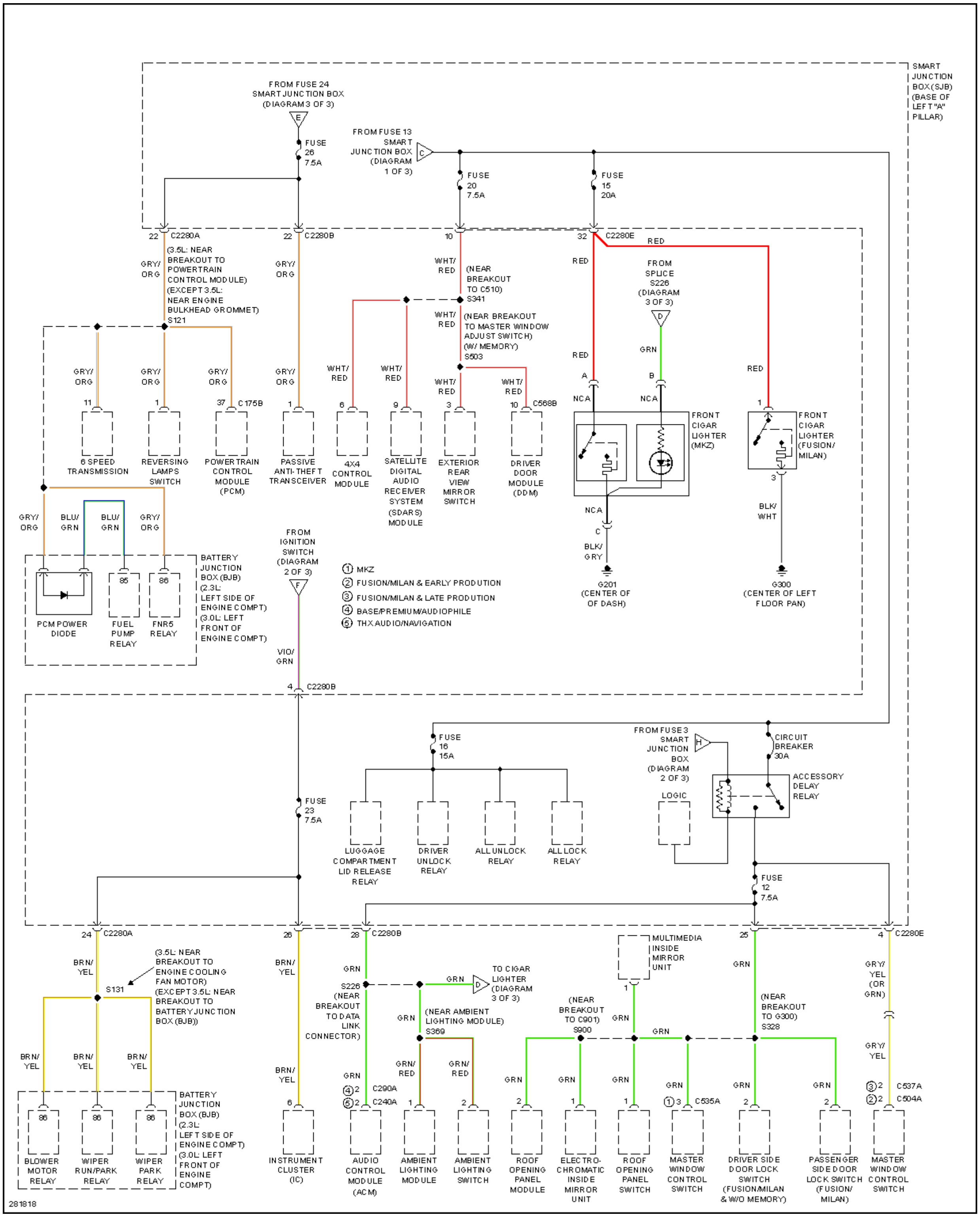


Fig. 44: Power Distribution Circuit (3 of 3)

POWER DOOR LOCKS

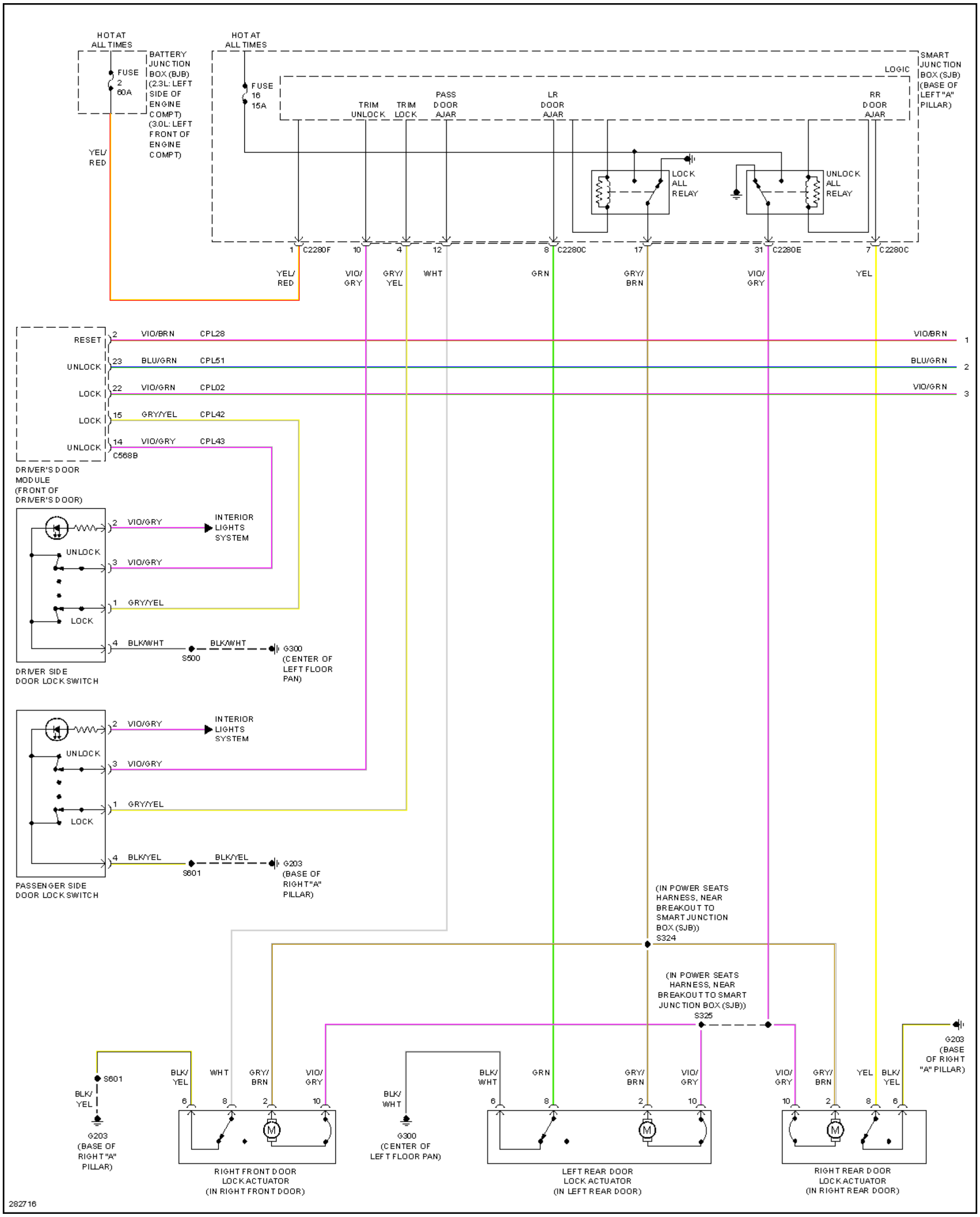
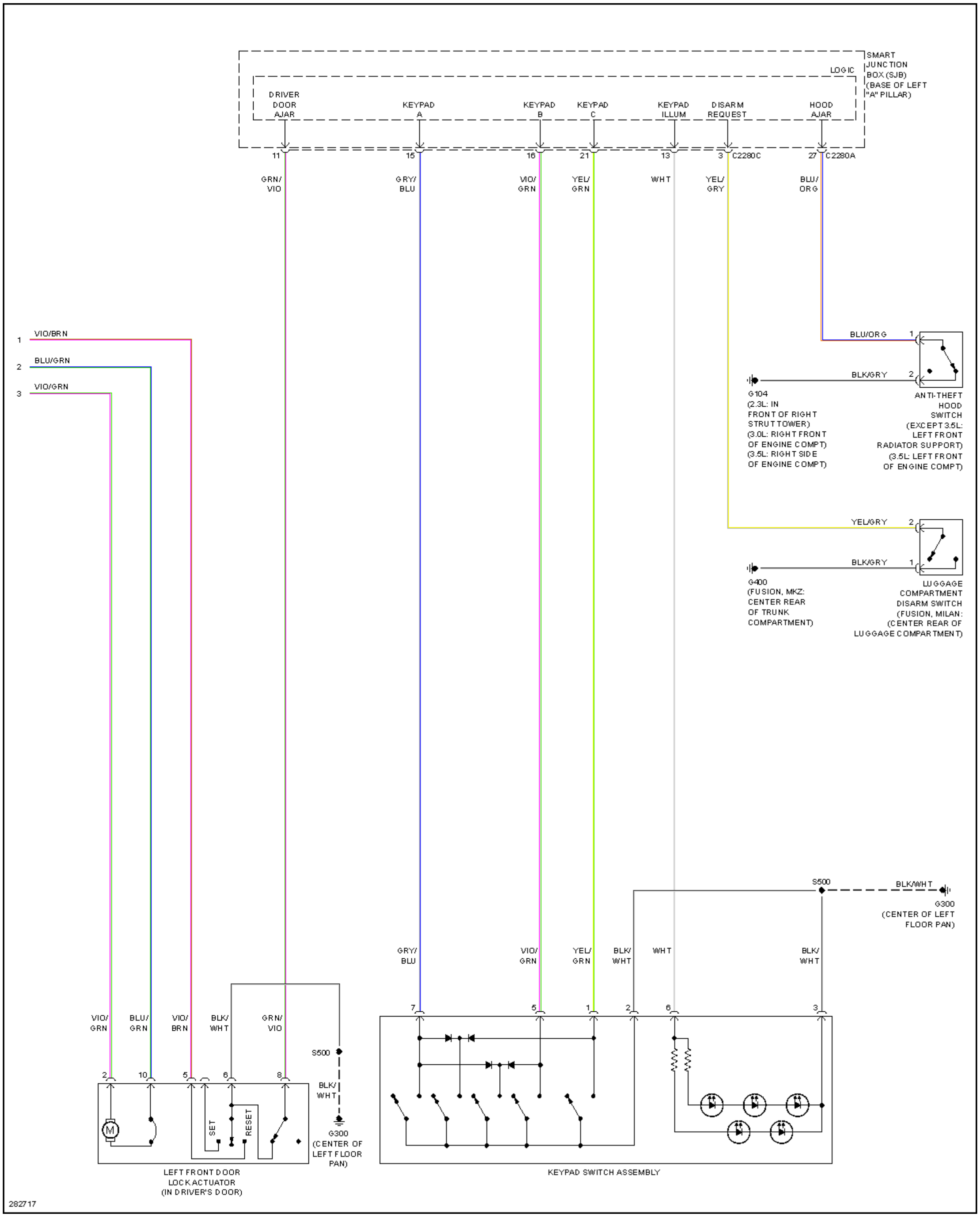


Fig. 45: Power Door Locks Circuit, W/ Memory (1 of 2)



<u>**Fig. 46: Power Door Locks Circuit, W/ Memory (2 of 2)**</u>

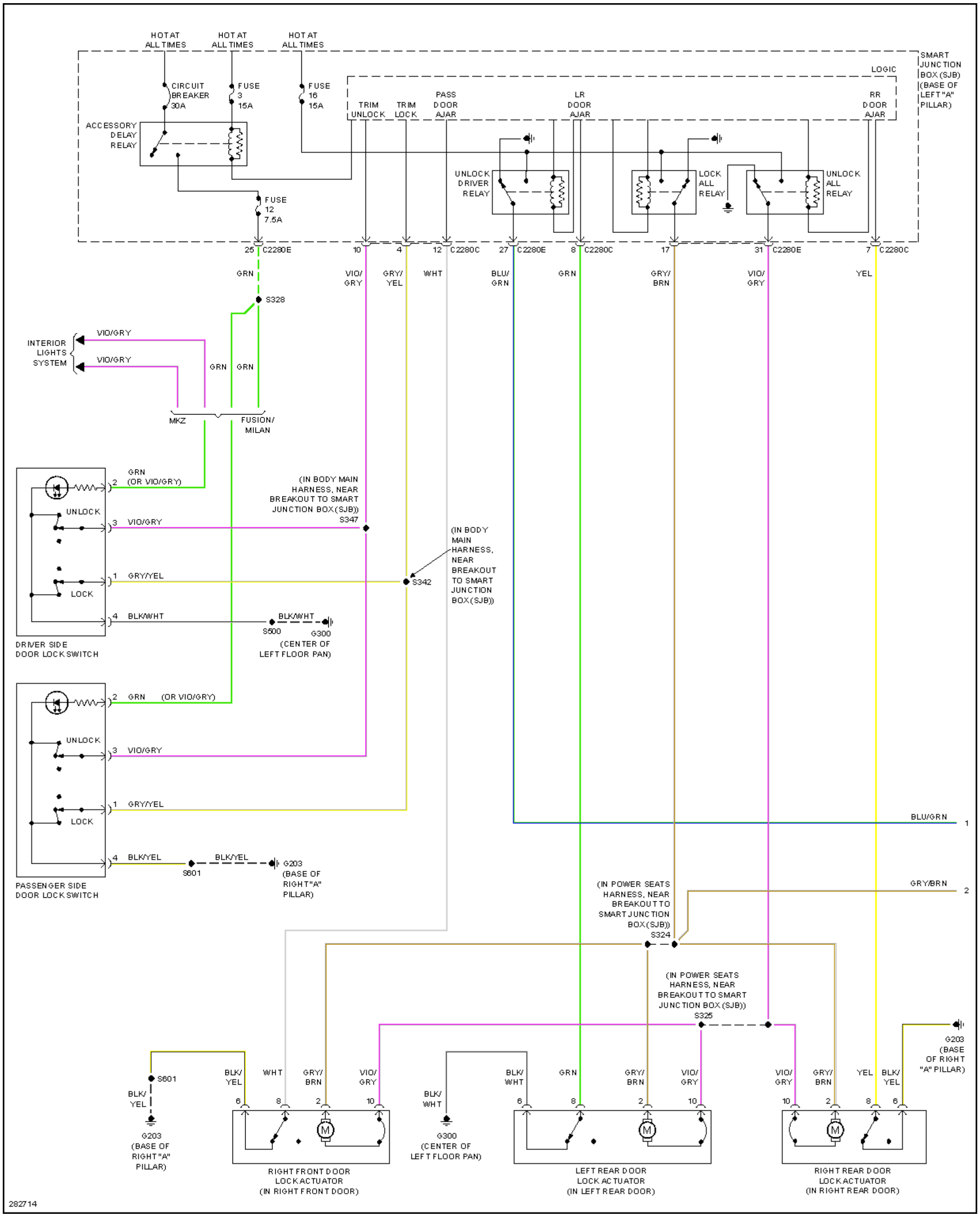


Fig. 47: Power Door Locks Circuit, W/O Memory (1 of 2)

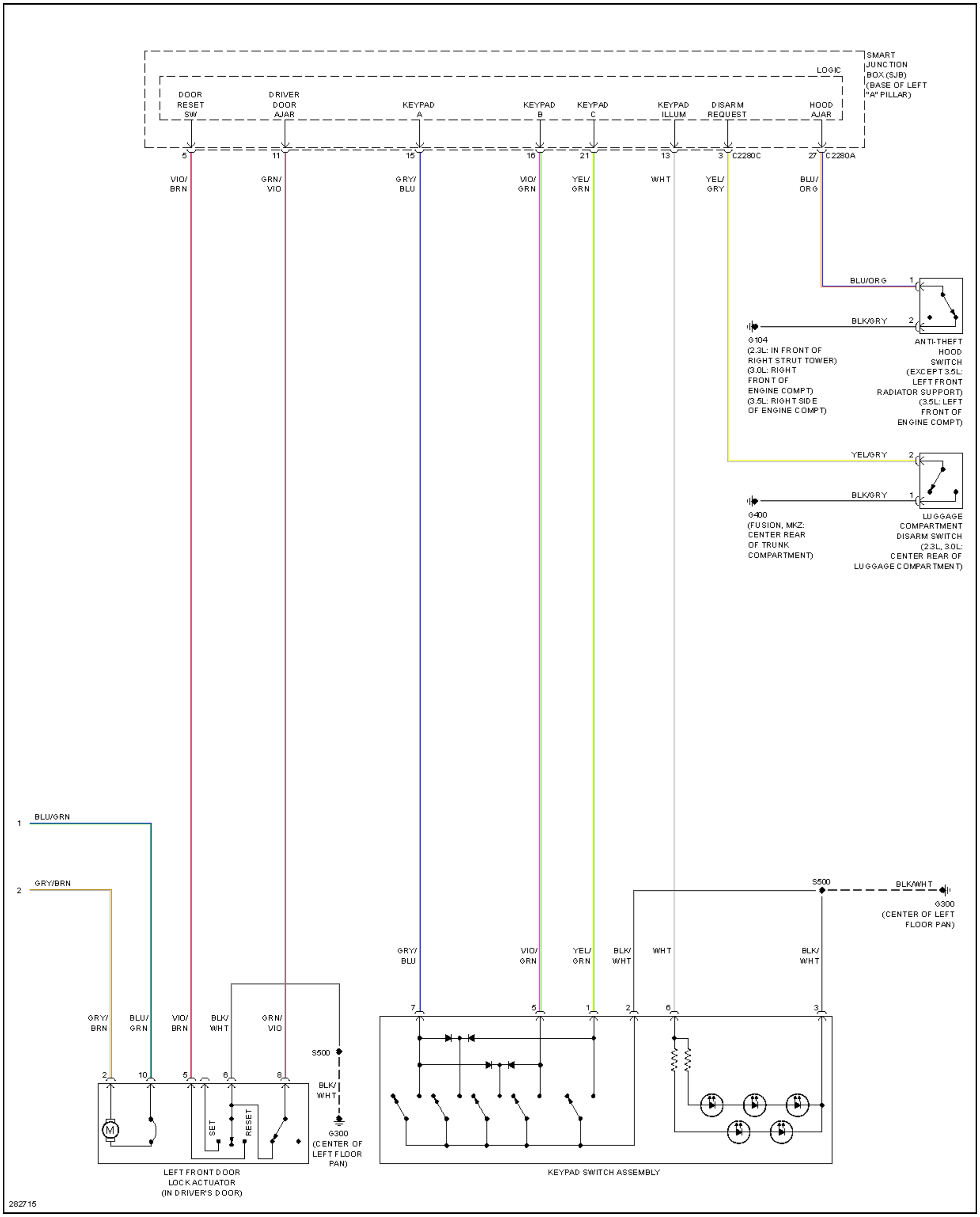


Fig. 48: Power Door Locks Circuit, W/O Memory (2 of 2)

POWER MIRRORS

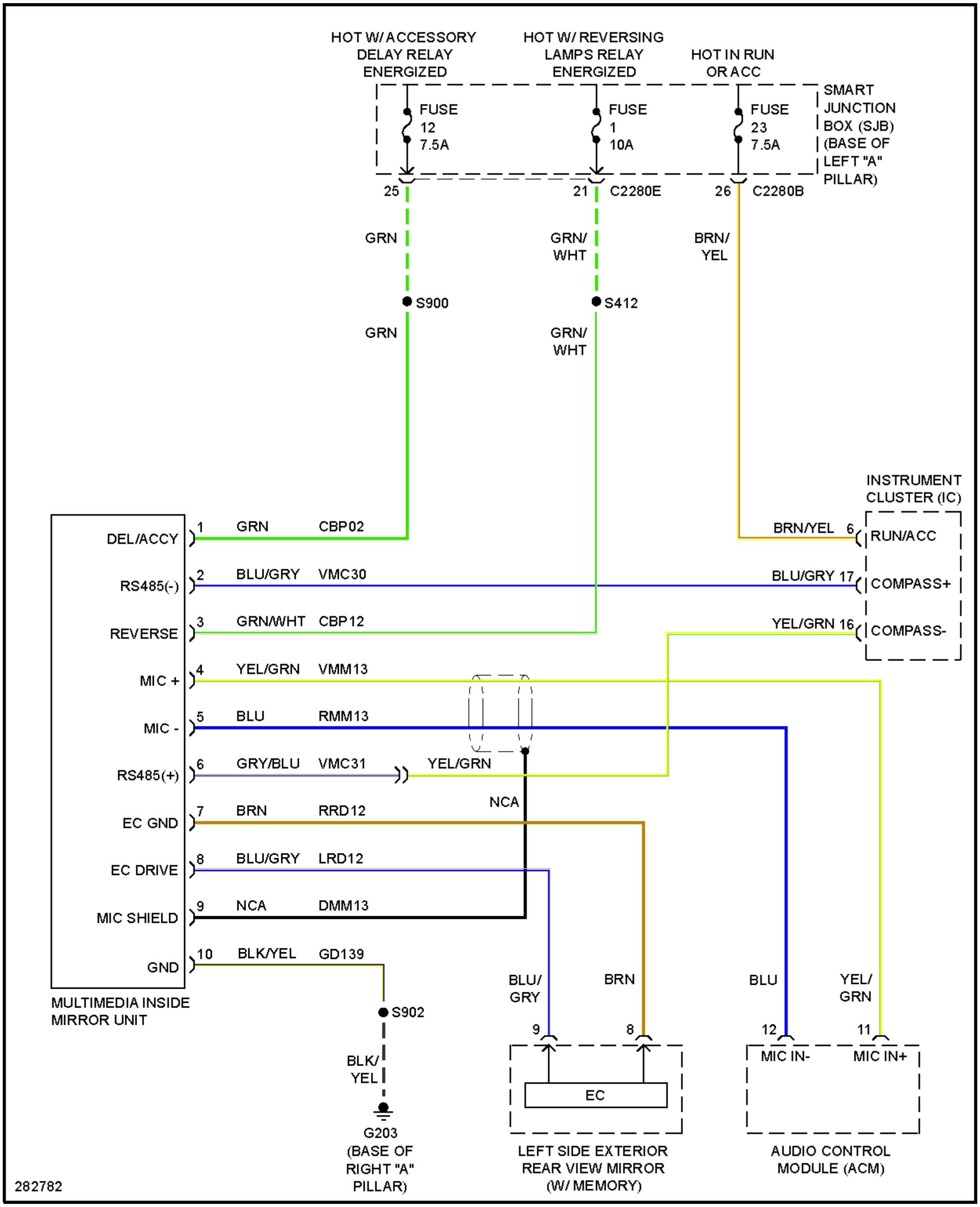


Fig. 49: Electrochromic Mirror Circuit, W/ Navigation

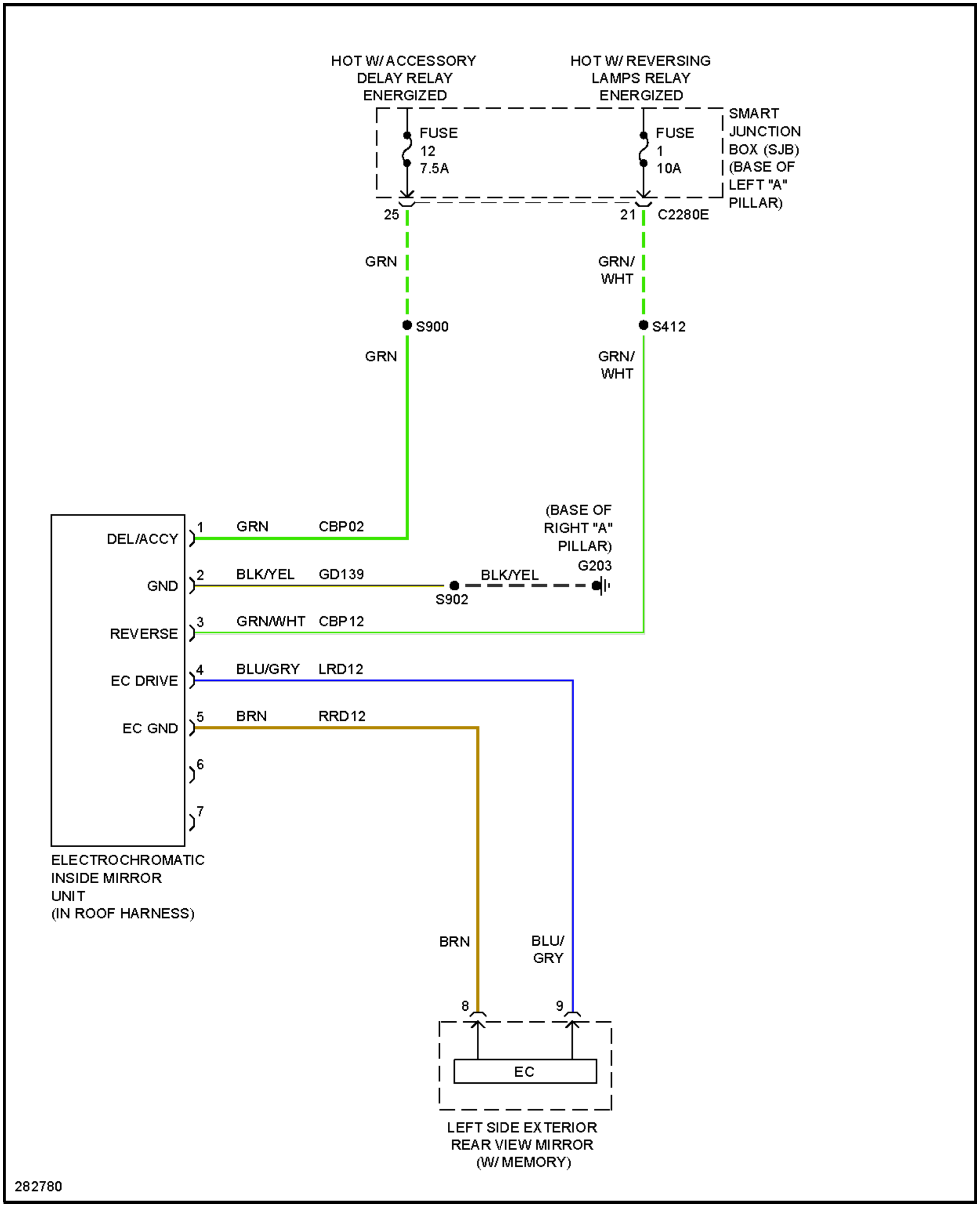


Fig. 50: Electrochromic Mirror Circuit, W/O Navigation

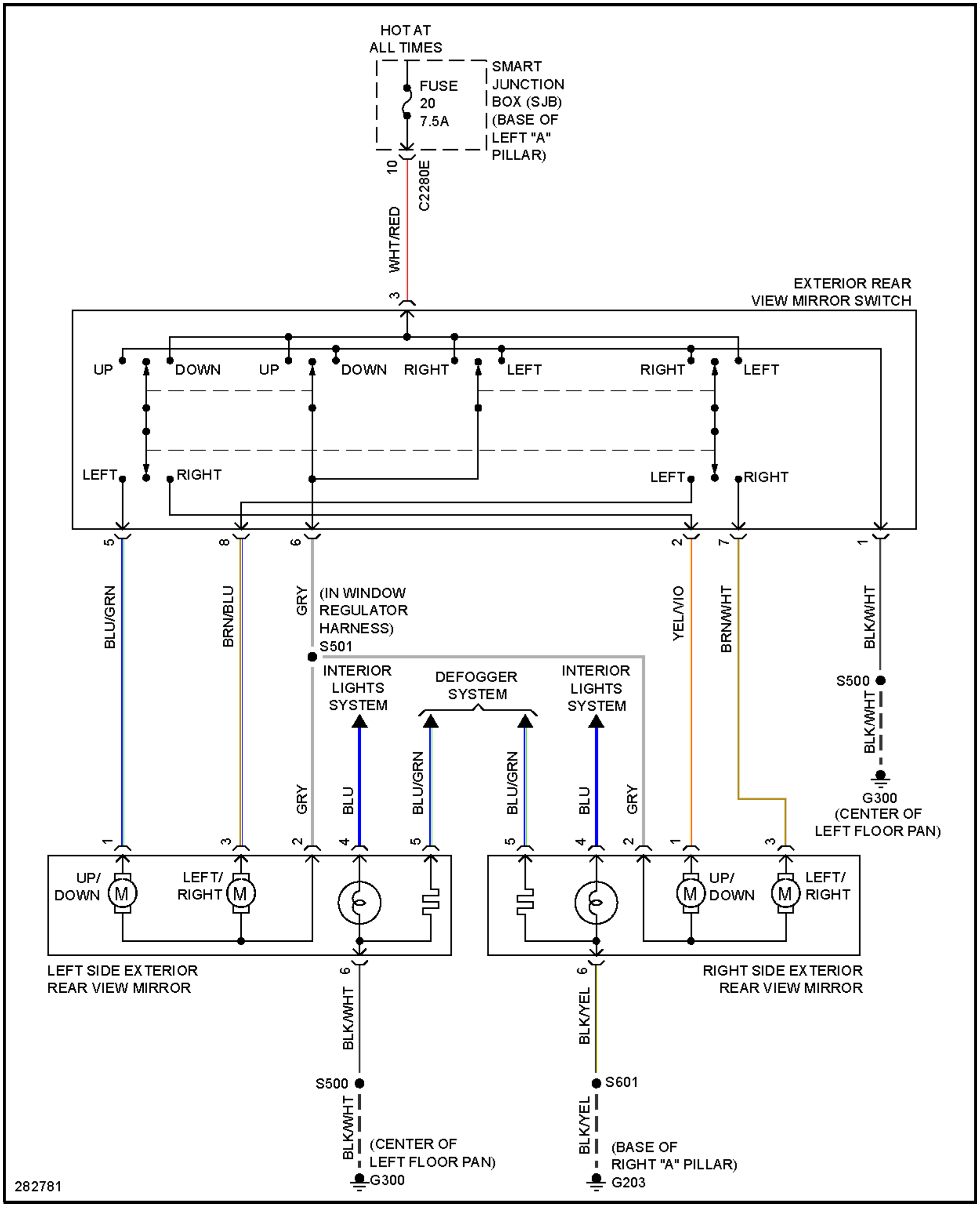


Fig. 51: Heated Mirrors Circuit

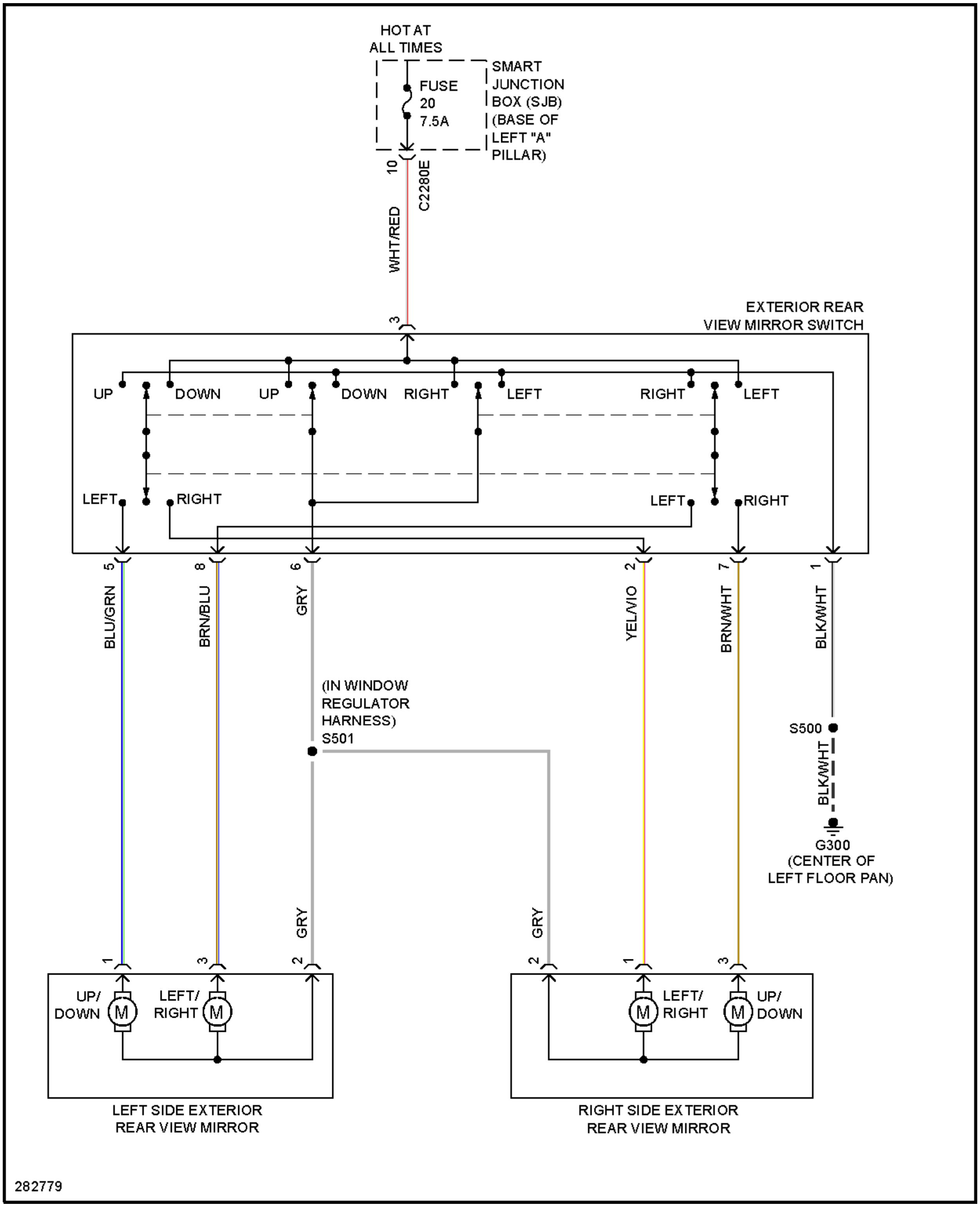


Fig. 52: Power Mirrors Circuit

POWER SEATS

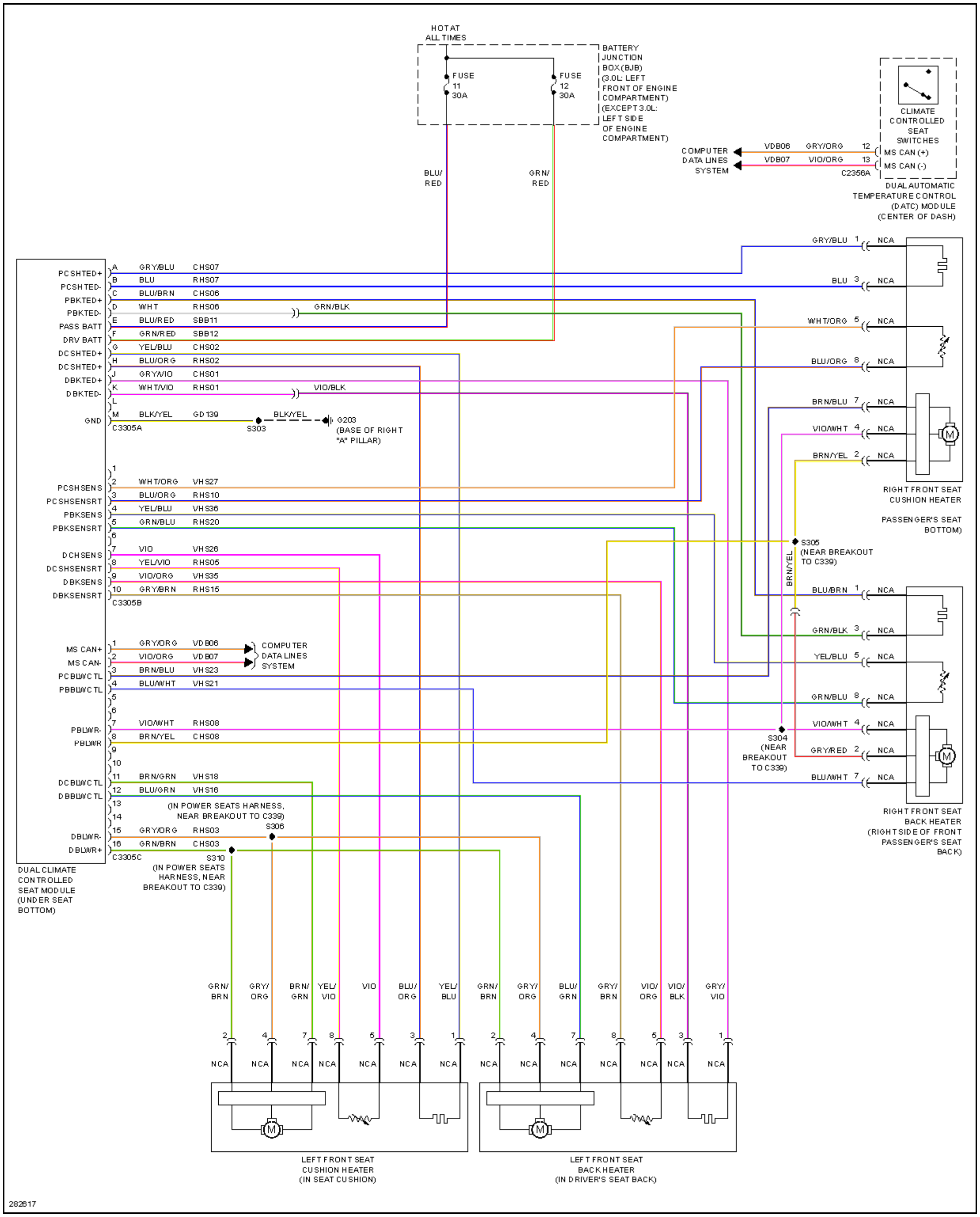


Fig. 53: Climate Control Seats Circuit

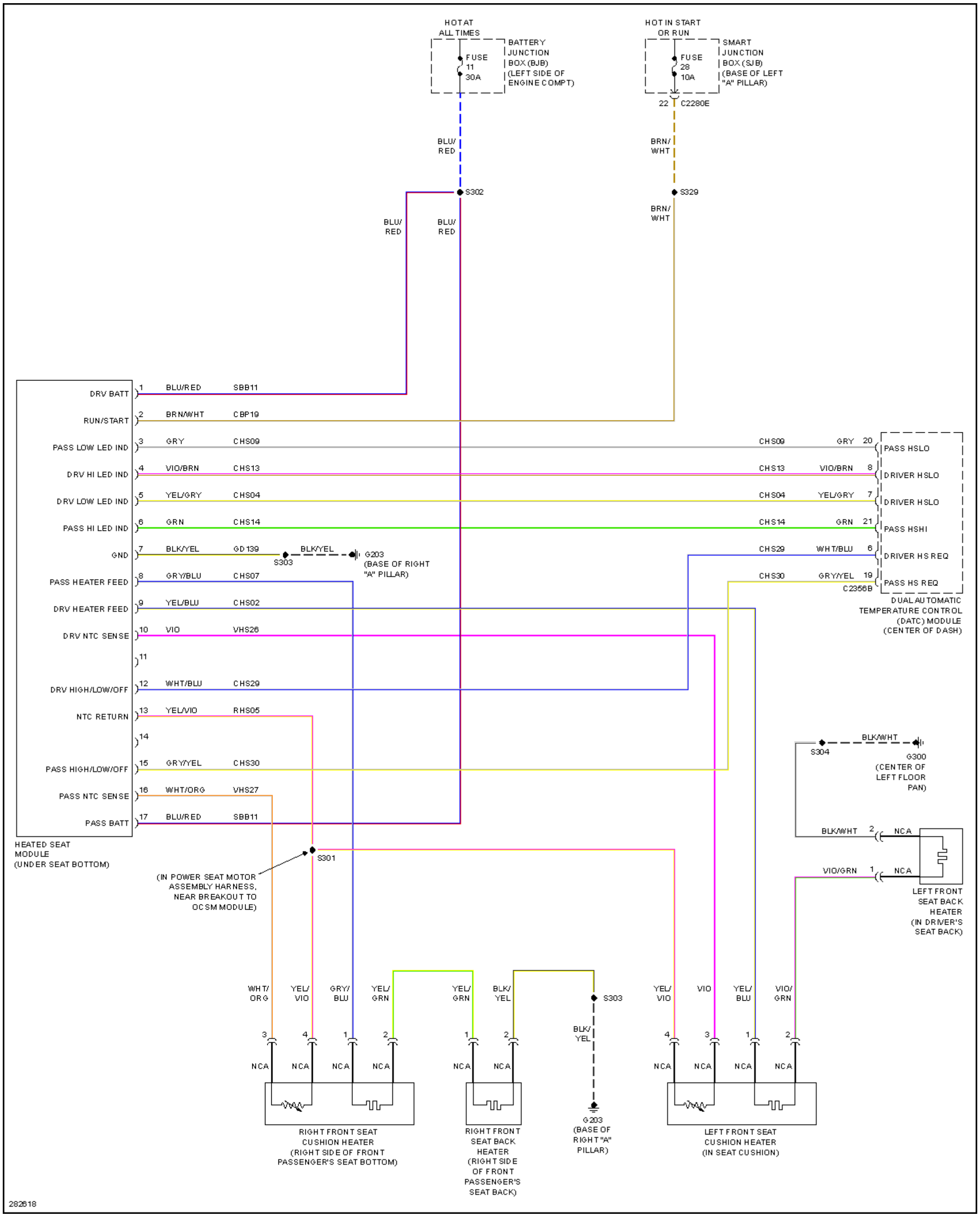


Fig. 54: Heated Seats Circuit

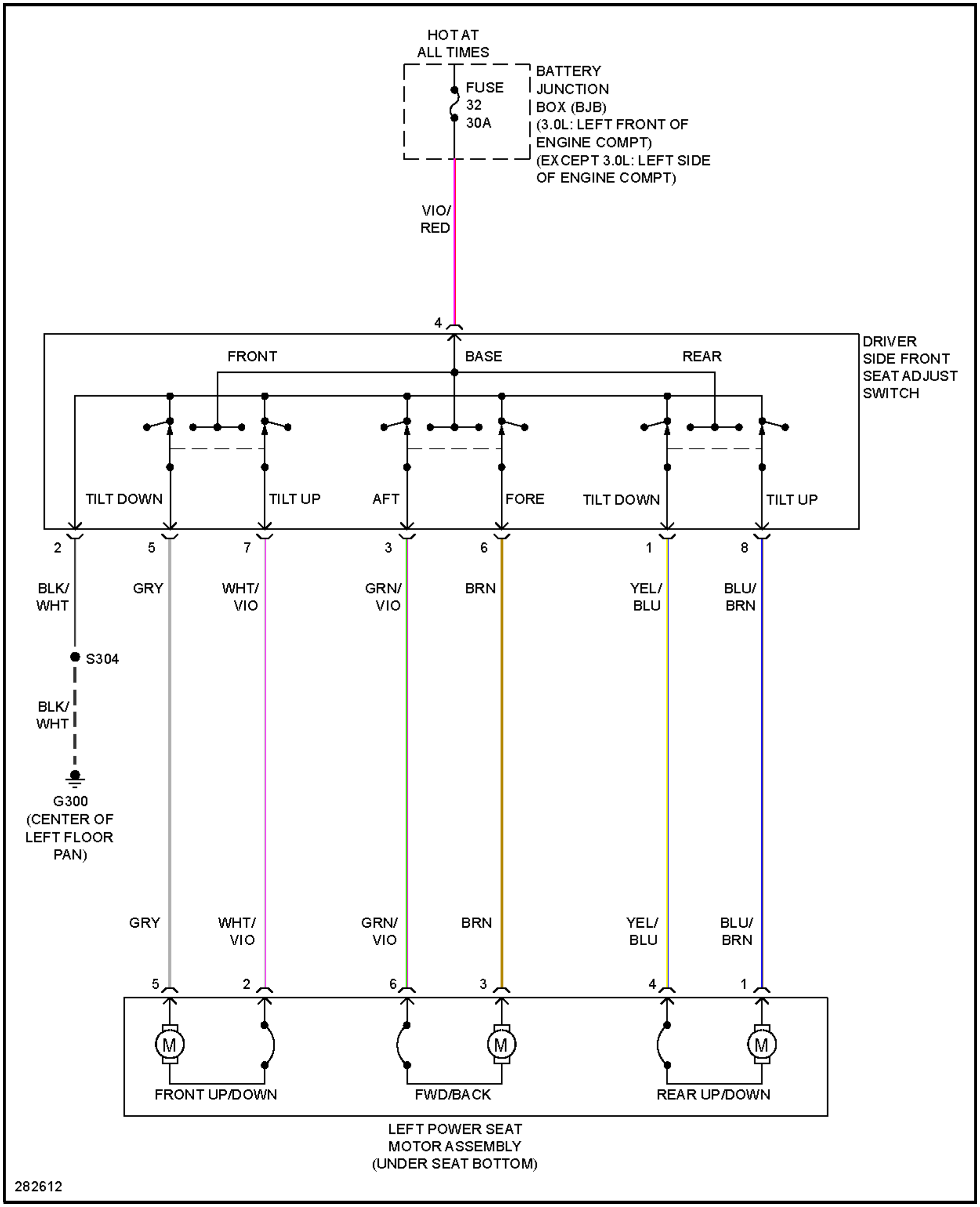


Fig. 55: Power Seat Circuit, 6-Way Driver Seat

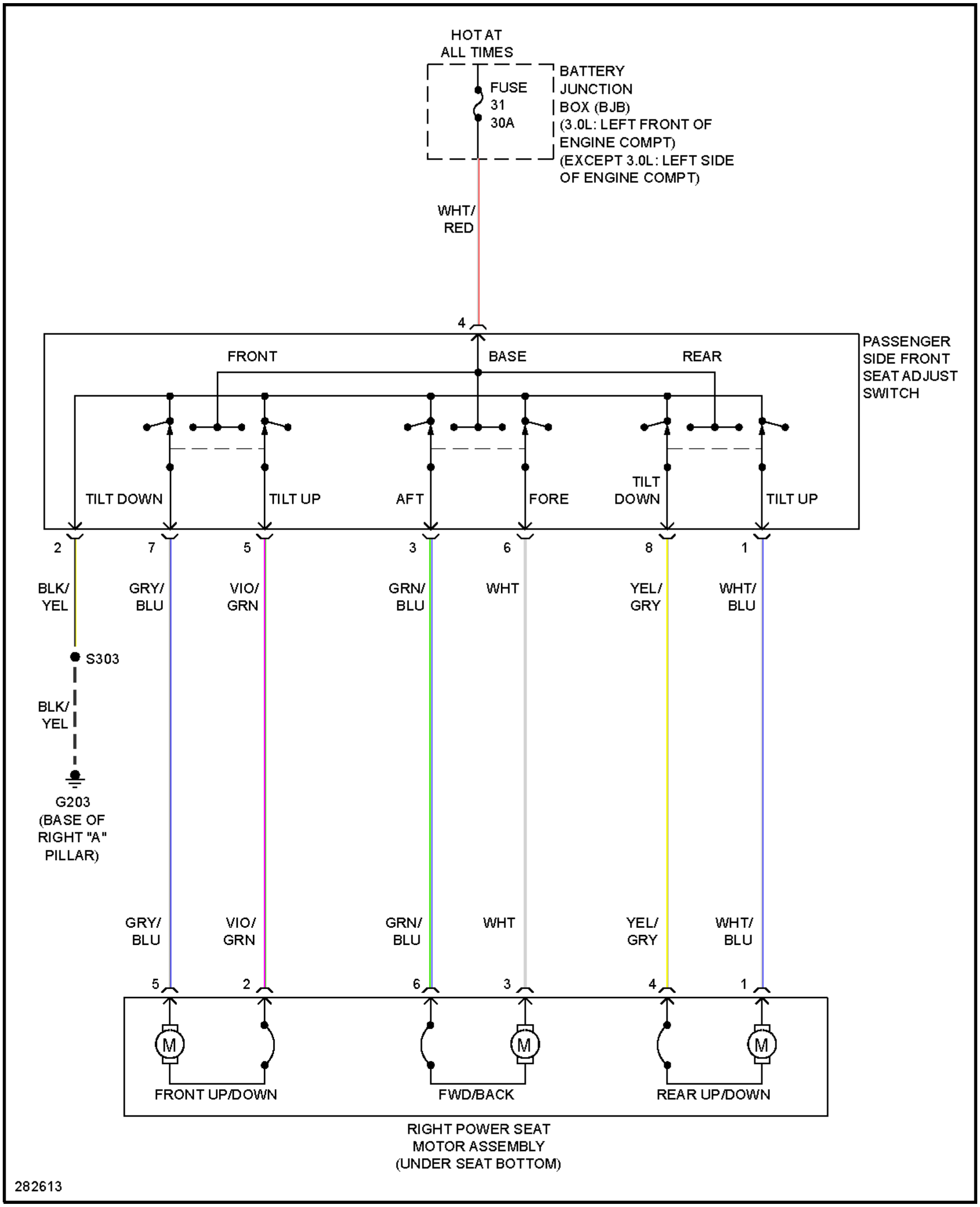


Fig. 56: Power Seat Circuit, 6-Way passenger Seat

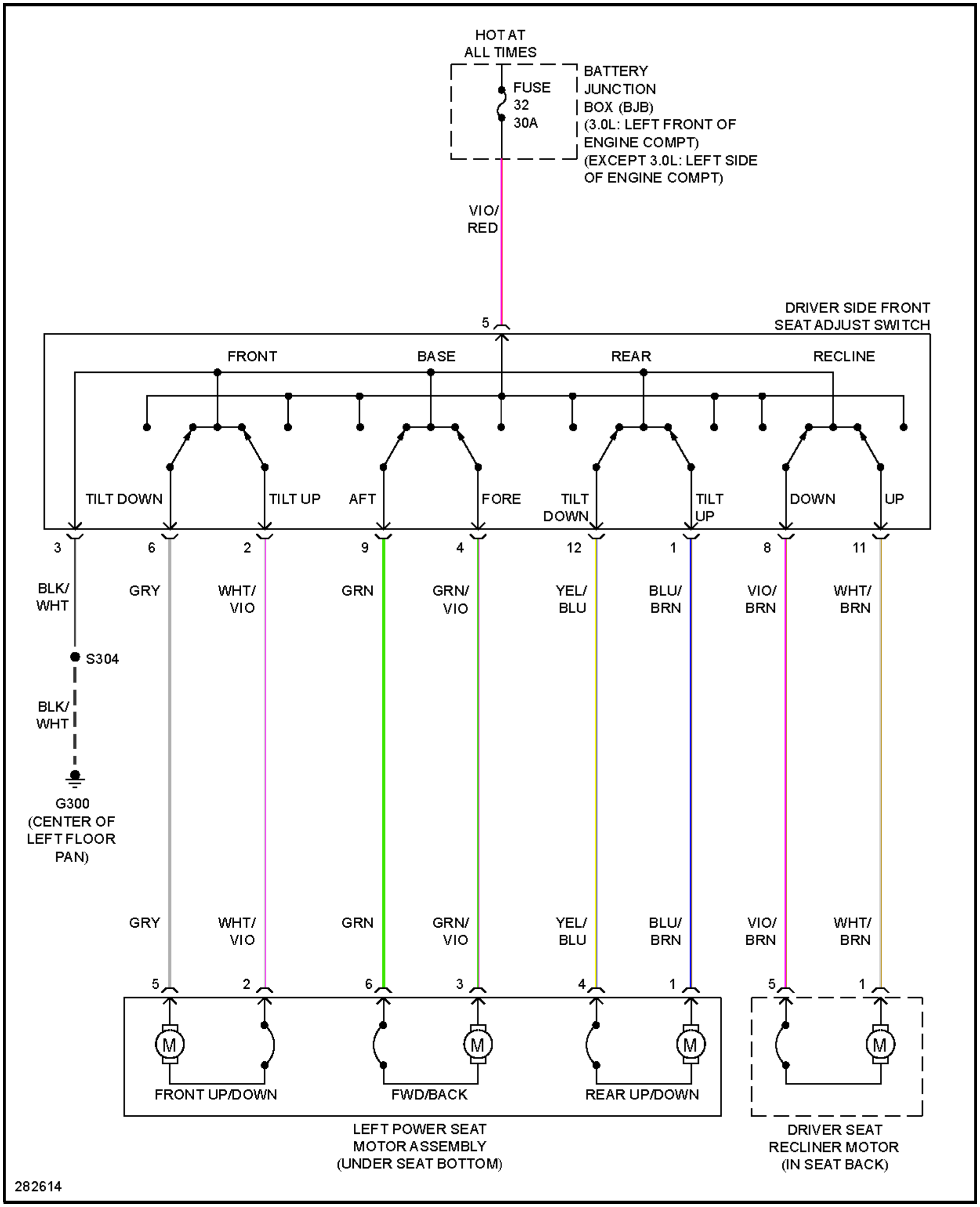


Fig. 57: Power Seat Circuit, 8-Way Driver Seat

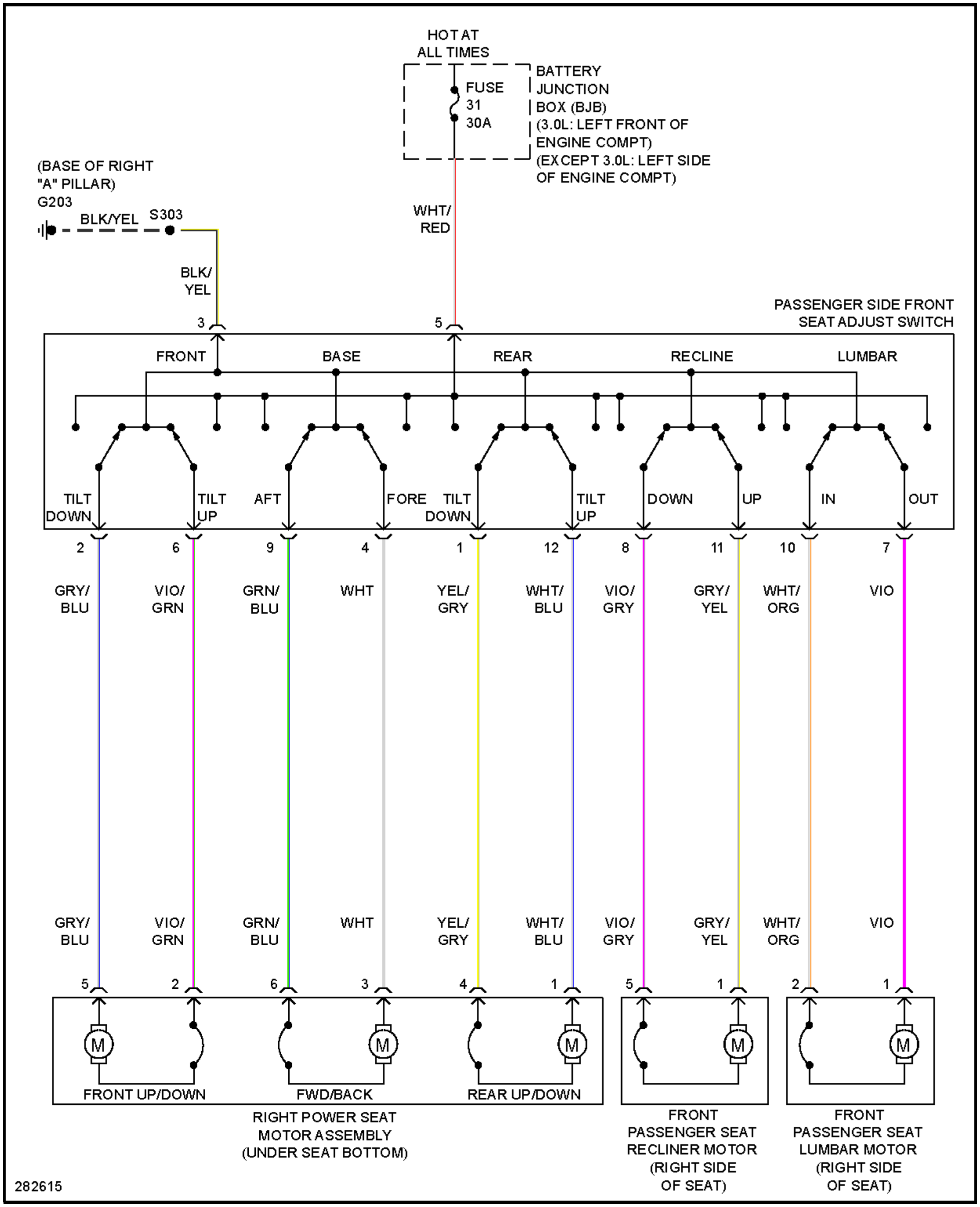


Fig. 58: Power Seat Circuit, 8-Way Passenger Seat

POWER TOP/SUNROOF

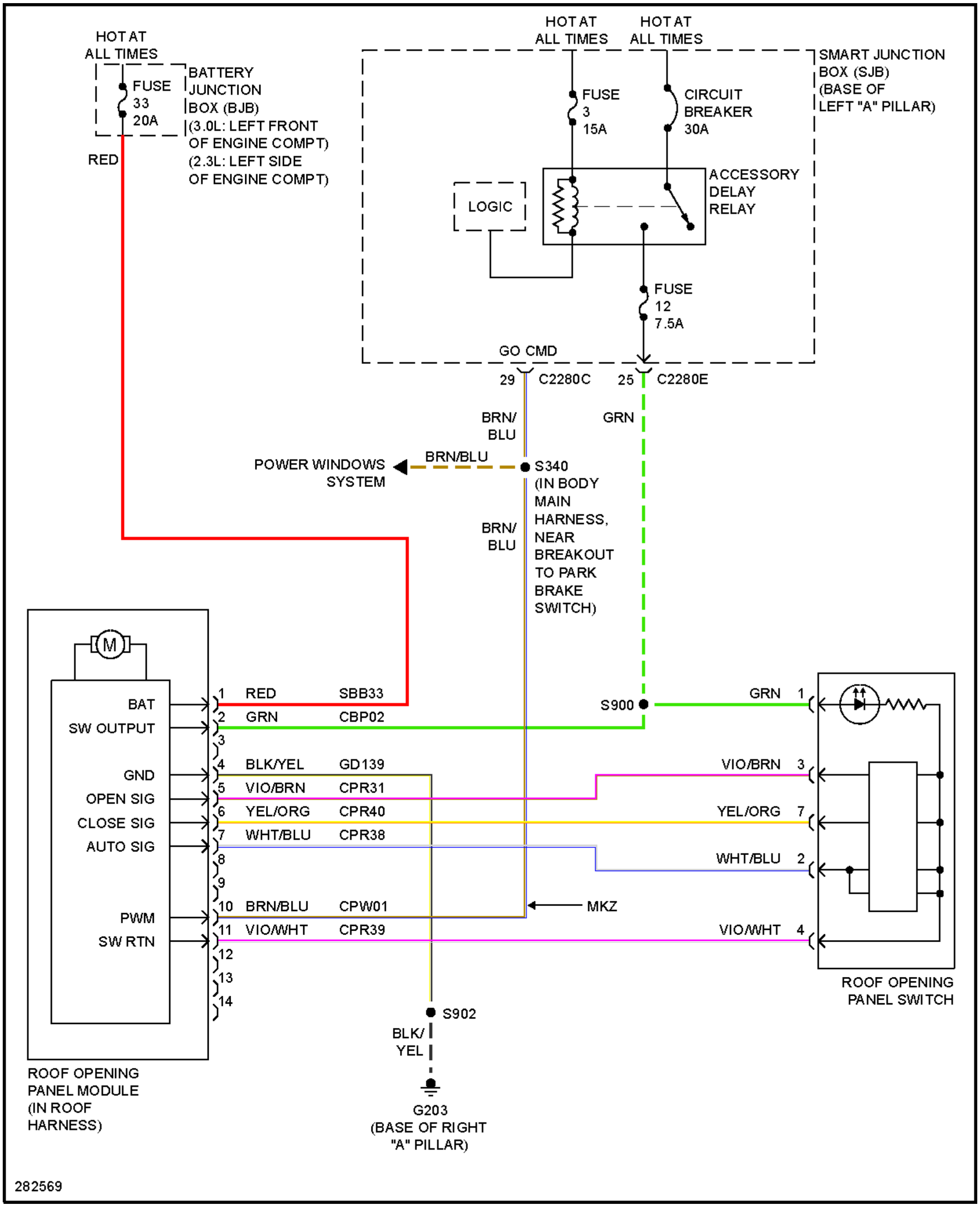


Fig. 59: Power Top/Sunroof Circuit

POWER WINDOWS

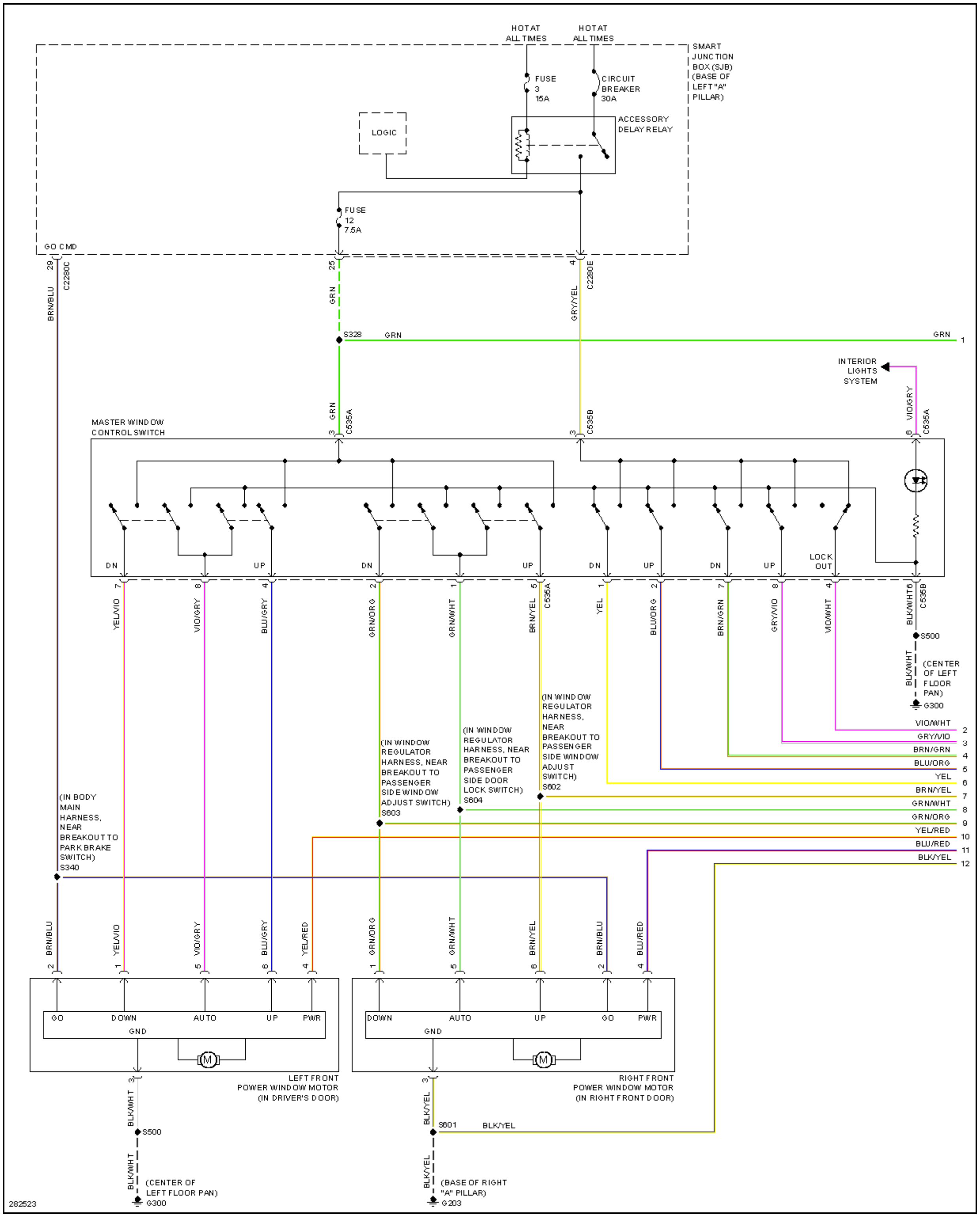


Fig. 60: Power Windows Circuit (1 of 2)

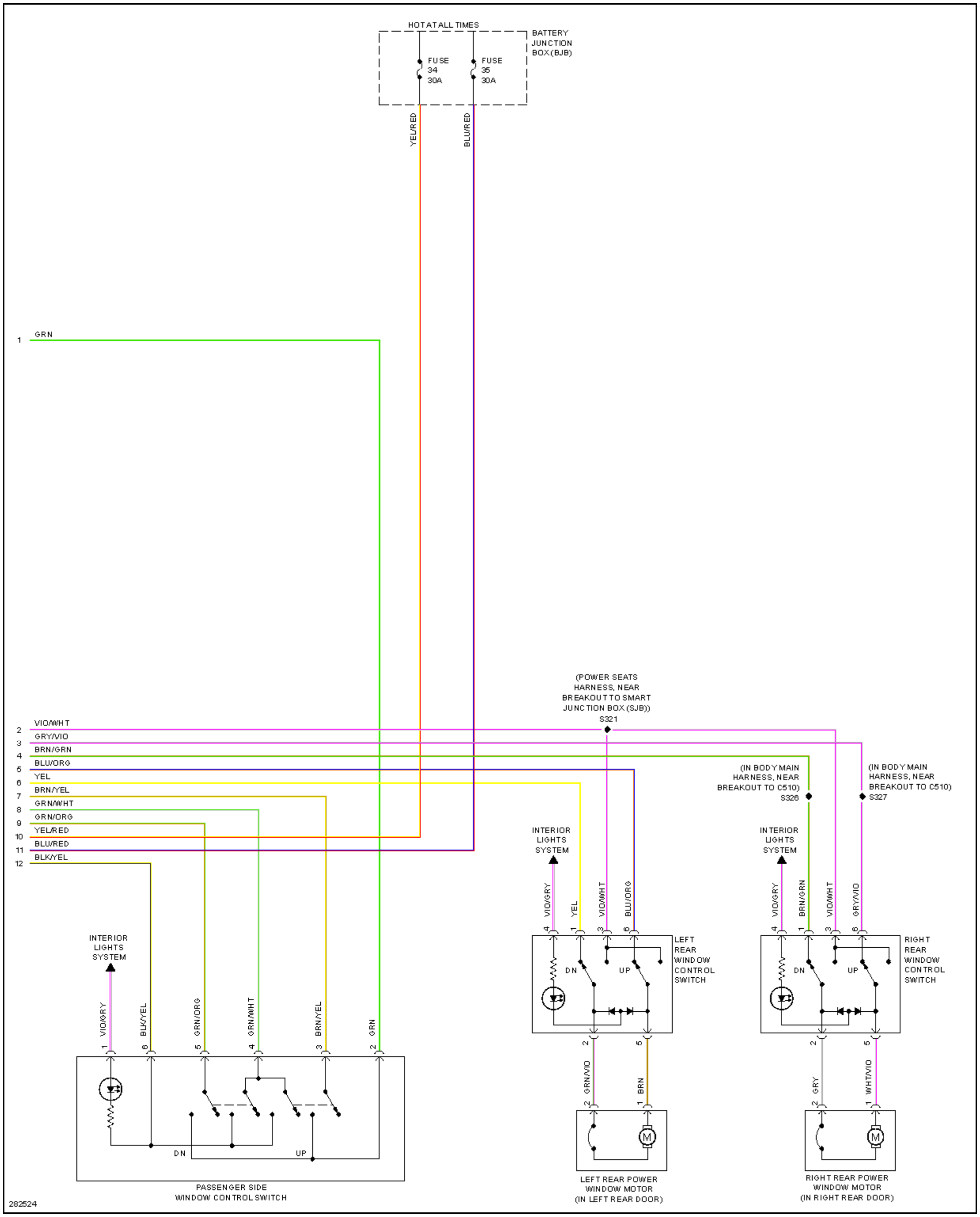


Fig. 61: Power Windows Circuit (2 of 2)

RADIO

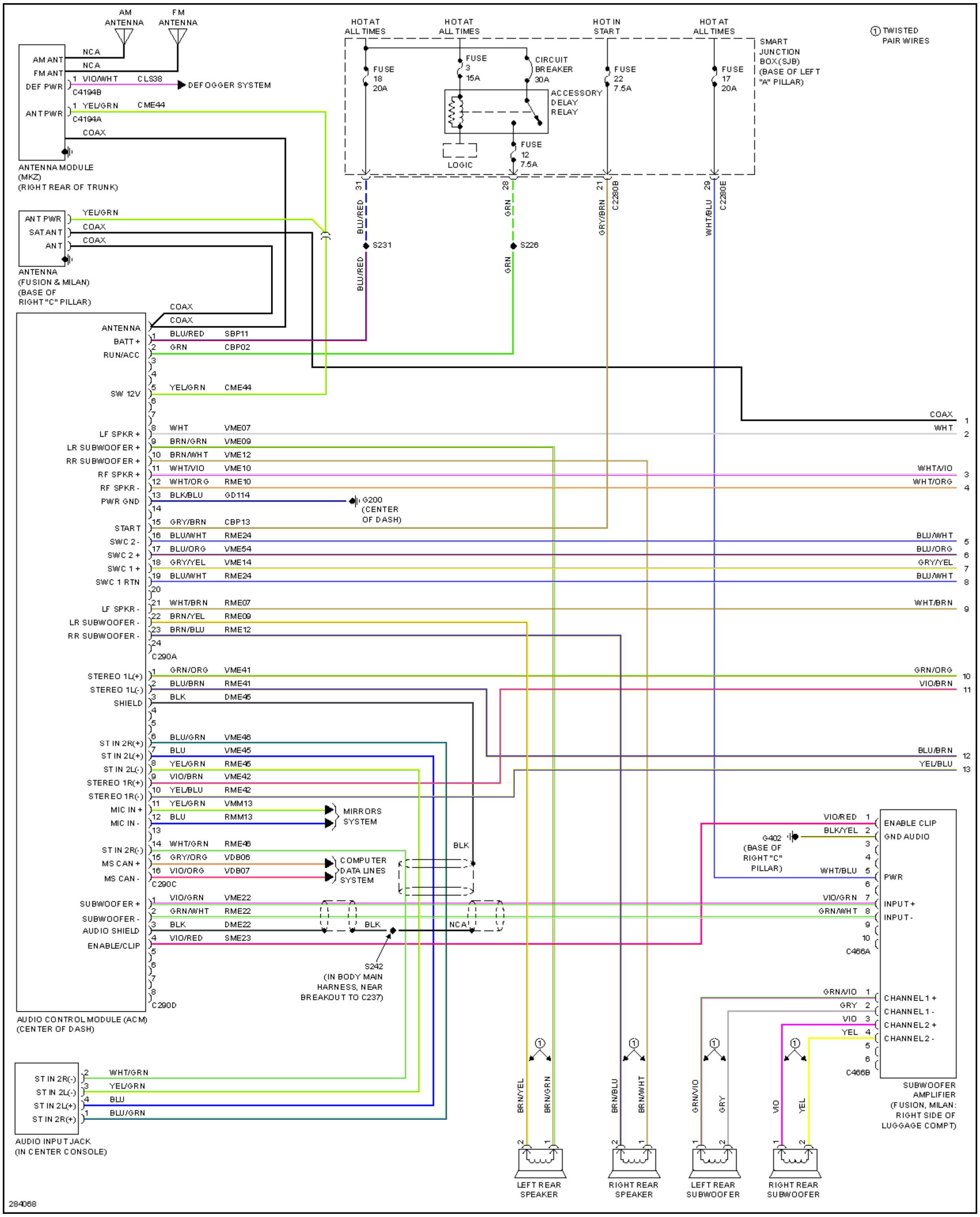


Fig. 62: Audiophile Sound Radio Circuit, W/ SYNC (1 of 2)

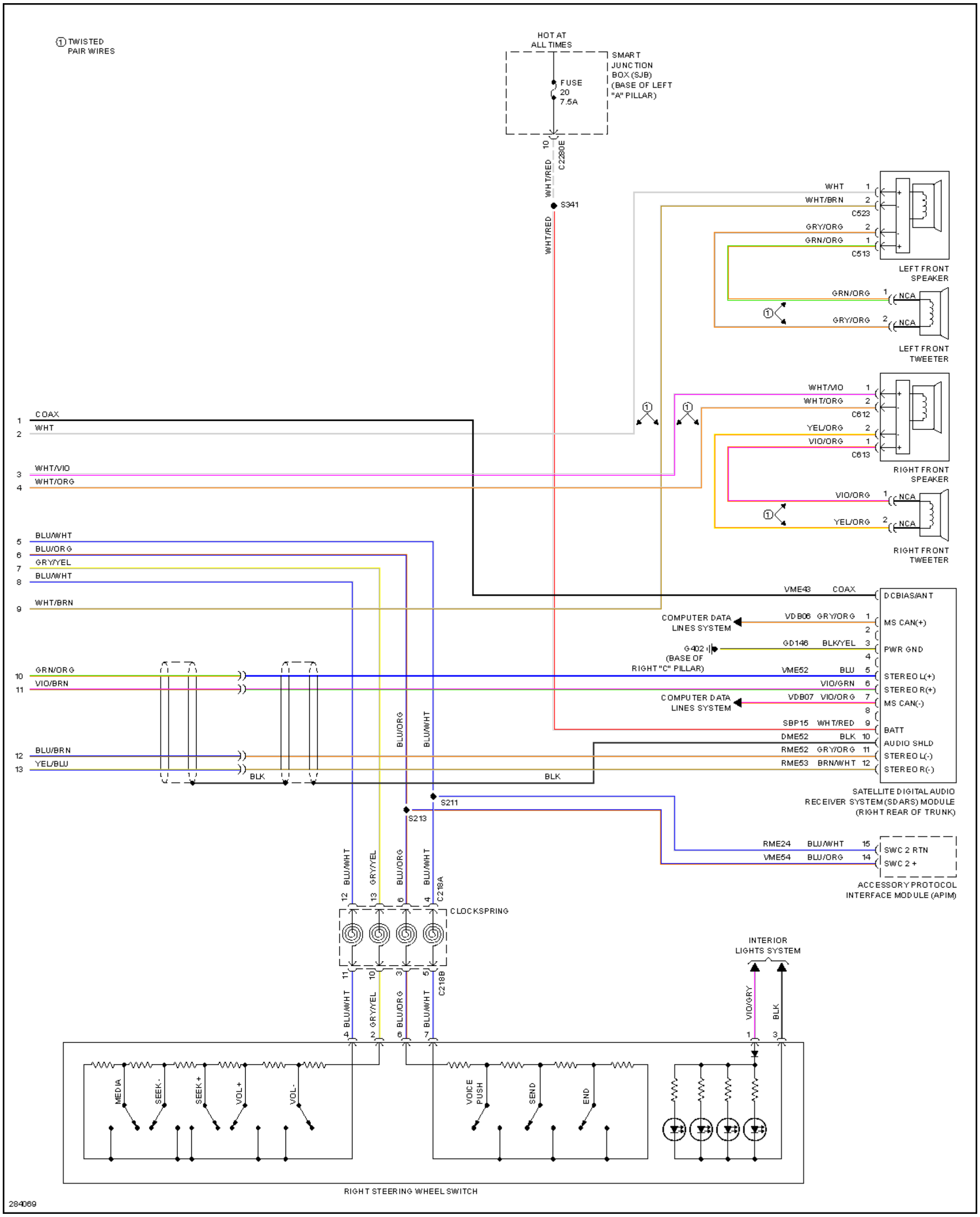


Fig. 63: Audiophile Sound Radio Circuit, W/ SYNC (2 of 2)

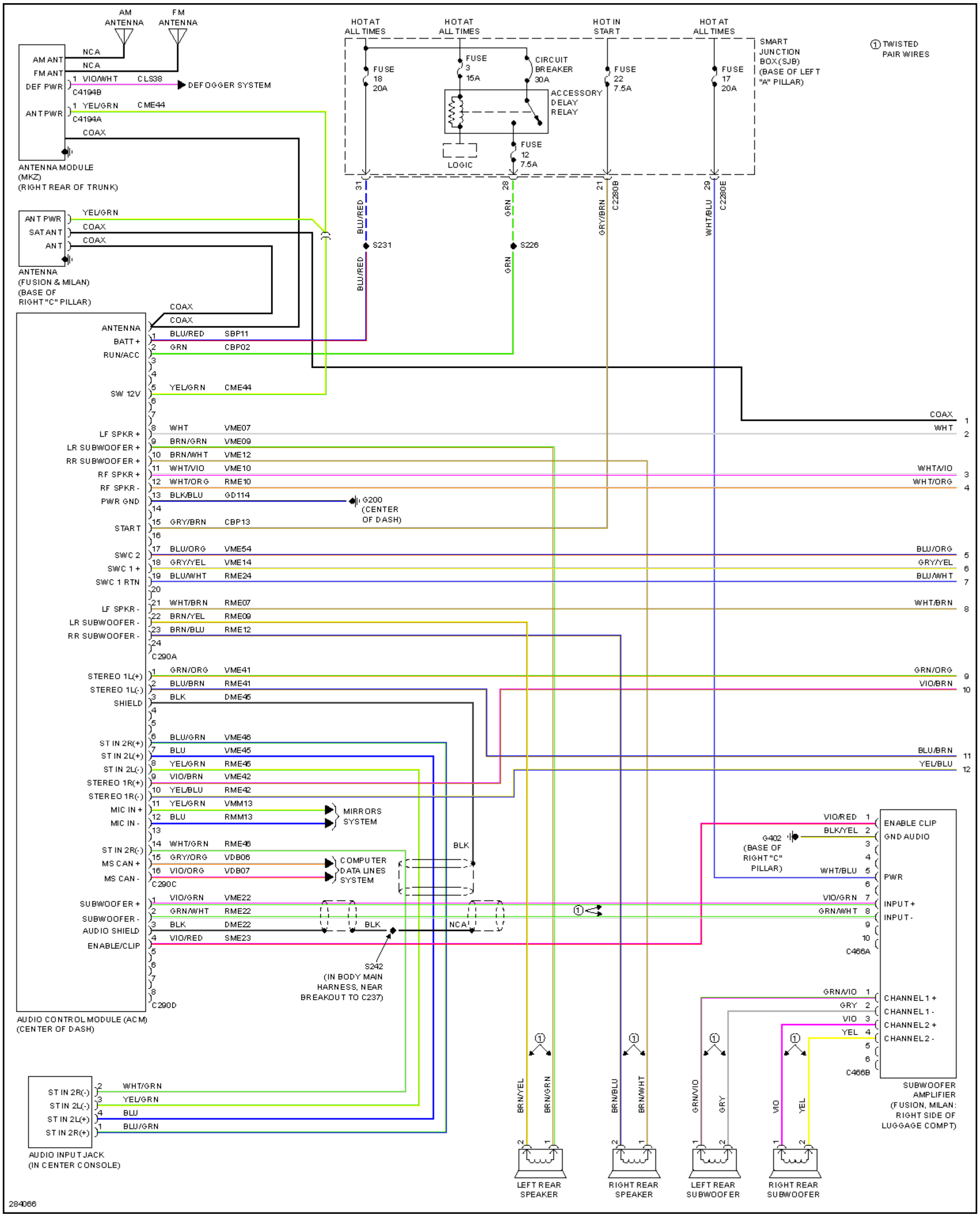


Fig. 64: Audiophile Sound Radio Circuit, W/O SYNC (1 of 2)

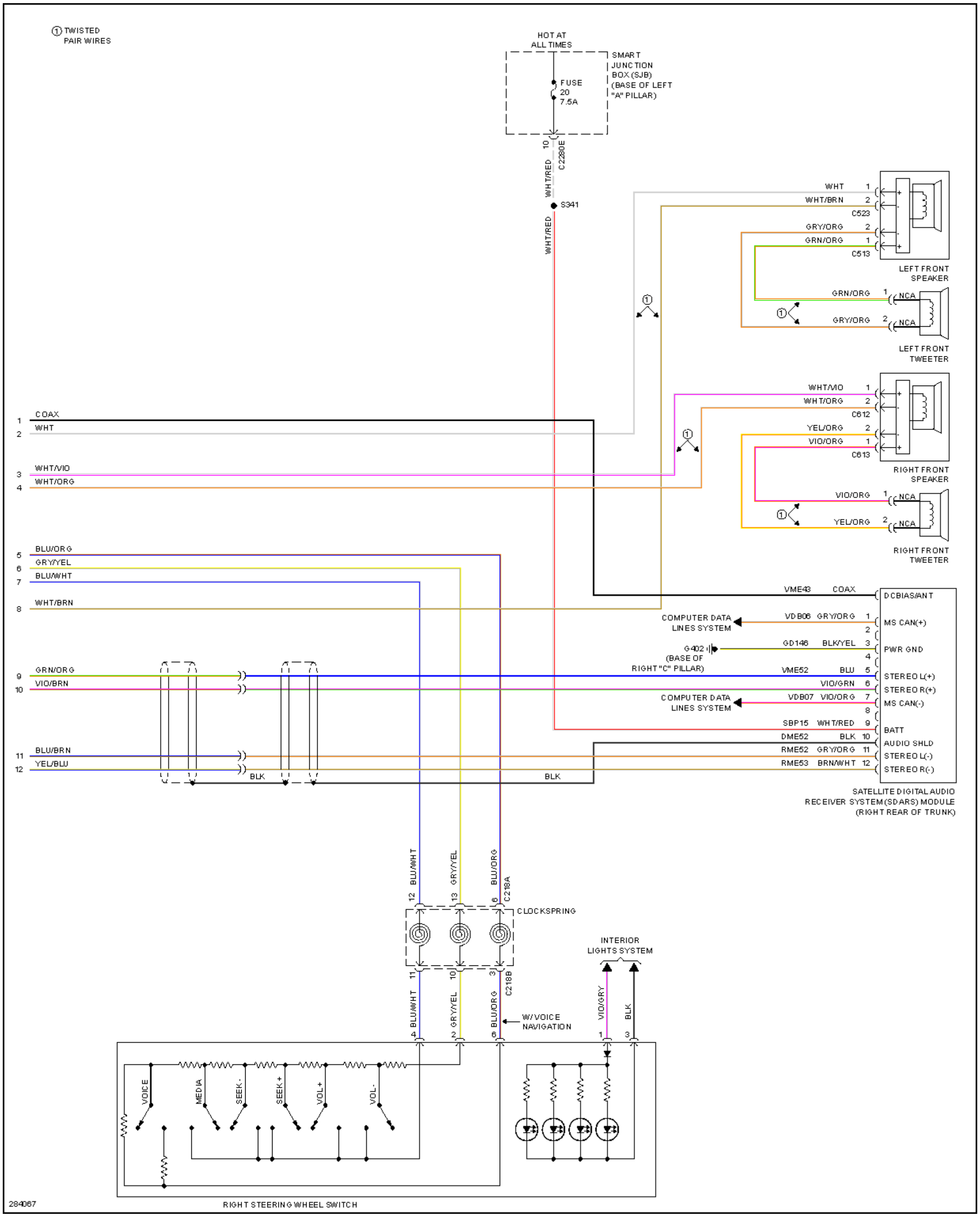


Fig. 65: Audiophile Sound Radio Circuit, W/O SYNC (2 of 2)

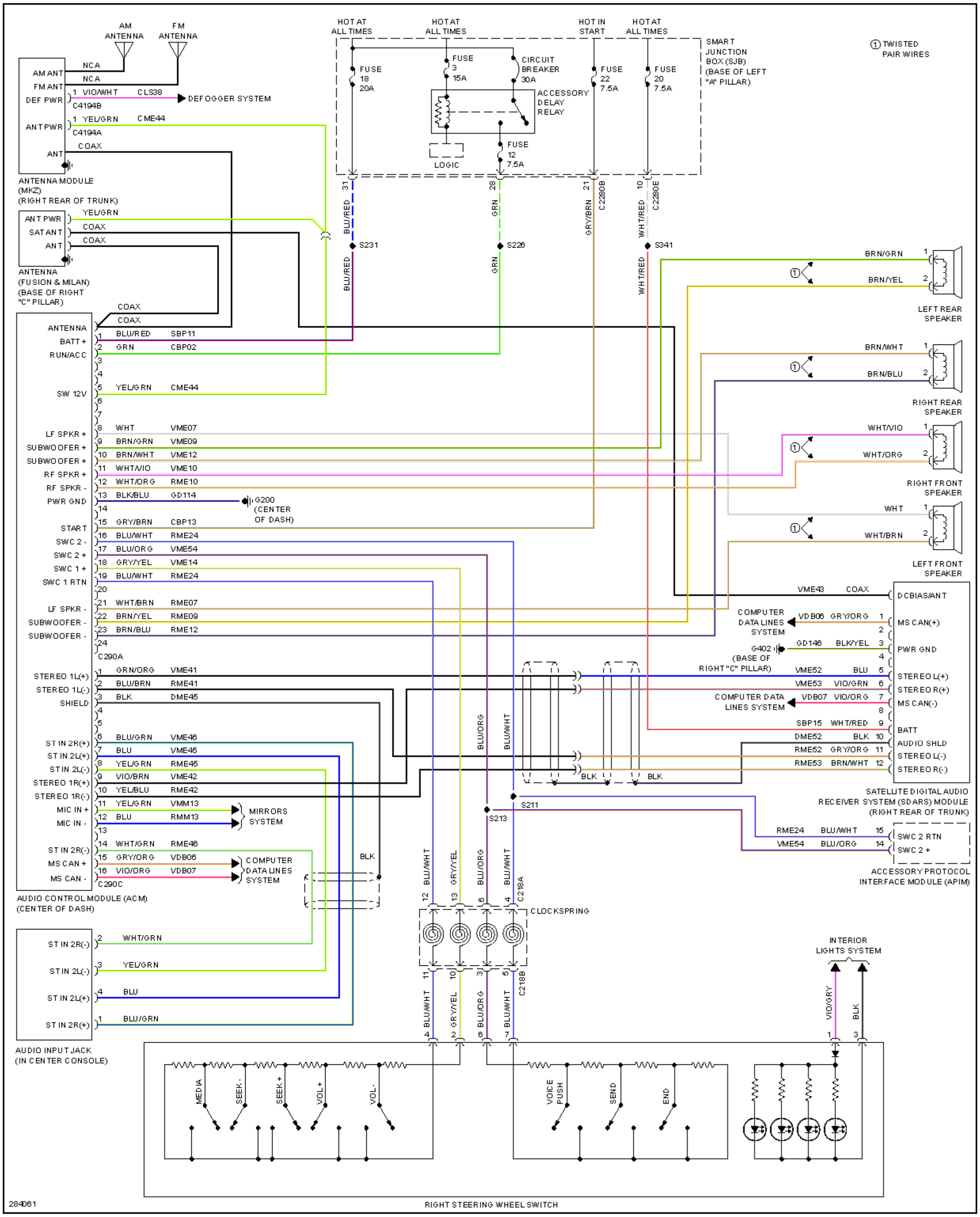


Fig. 66: Base Radio Circuit, W/ SYNC

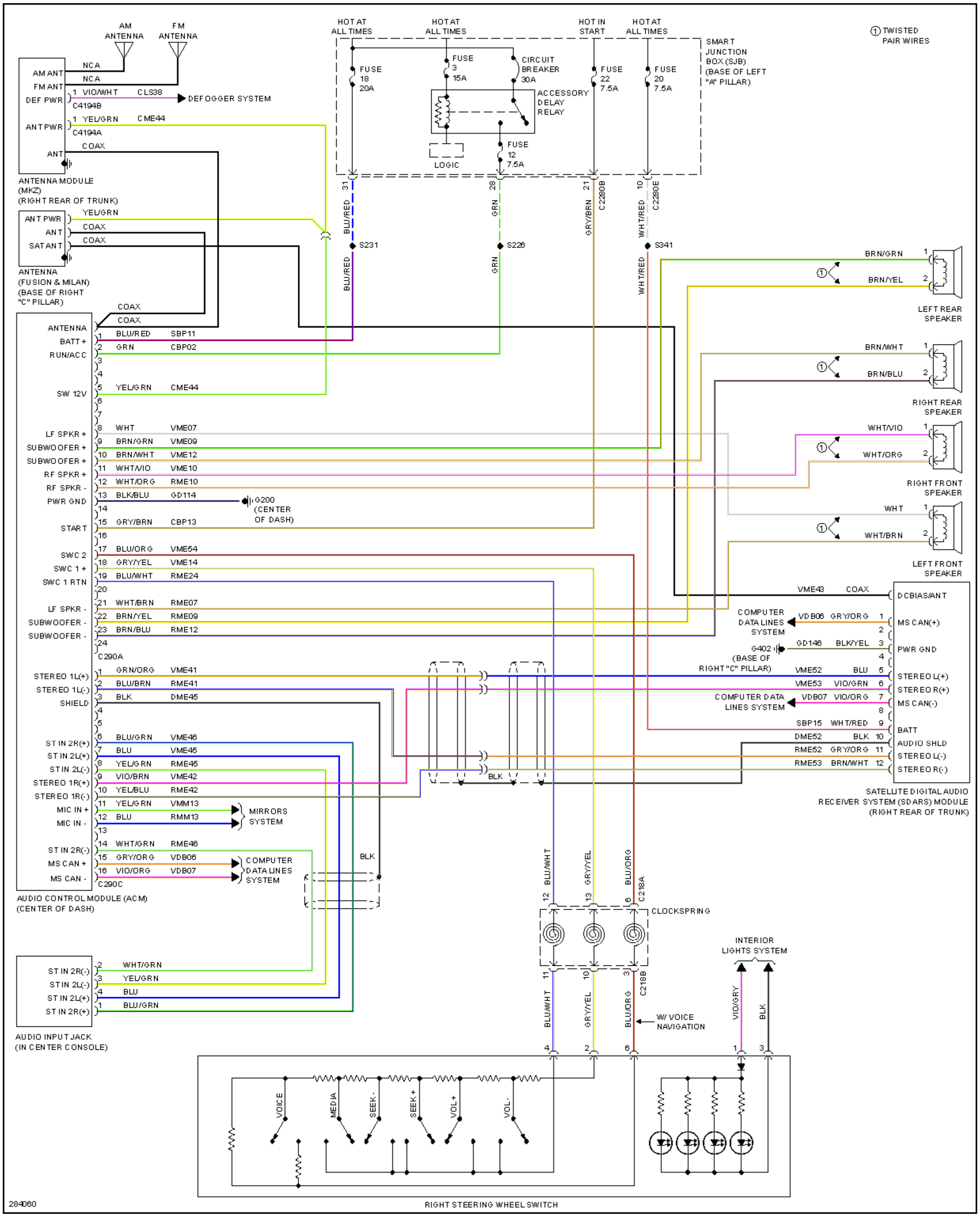


Fig. 67: Base Radio Circuit, W/O SYNC

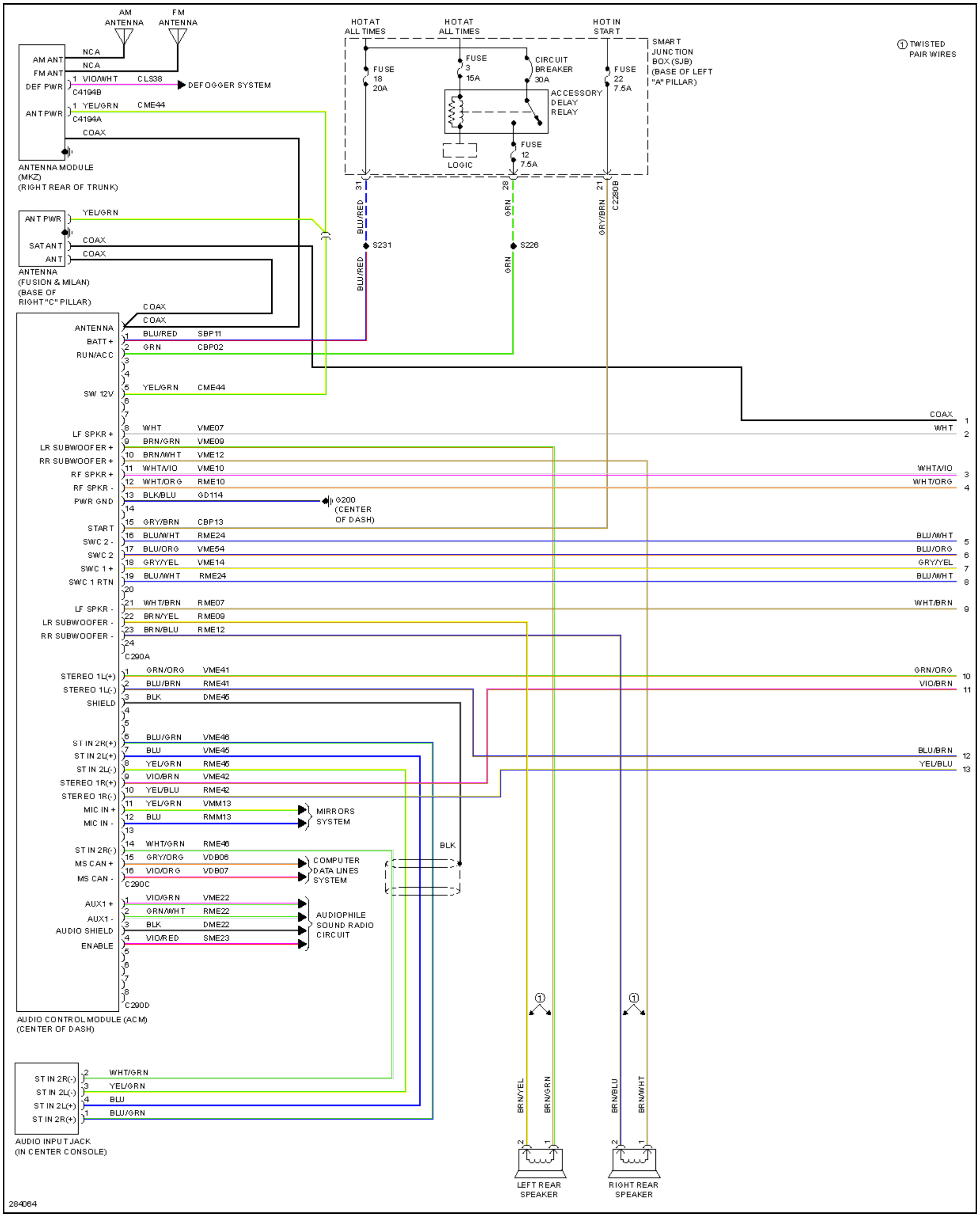


Fig. 68: Premium Radio Circuit, W/ SYNC (1 of 2)

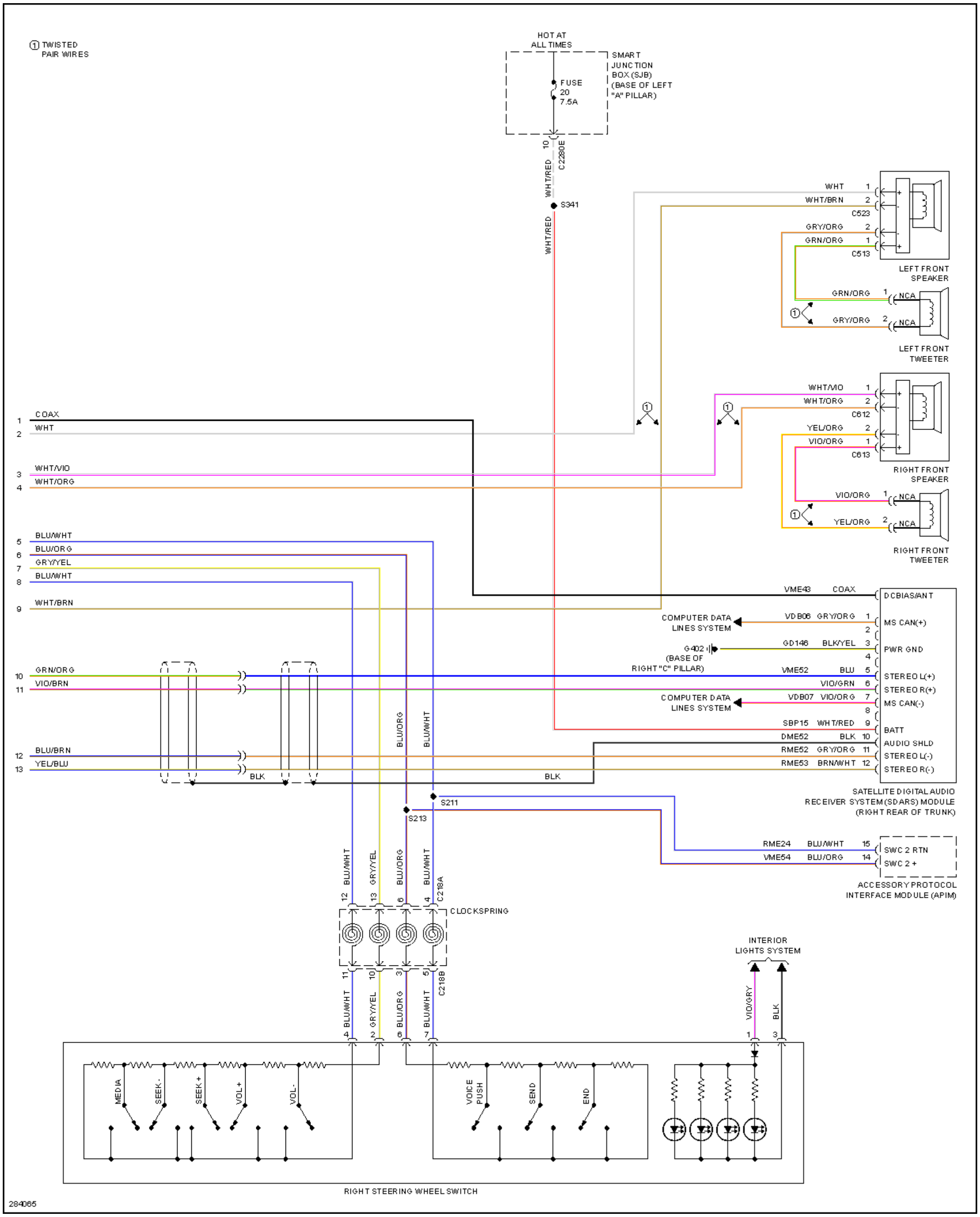


Fig. 69: Premium Radio Circuit, W/ SYNC (2 of 2)

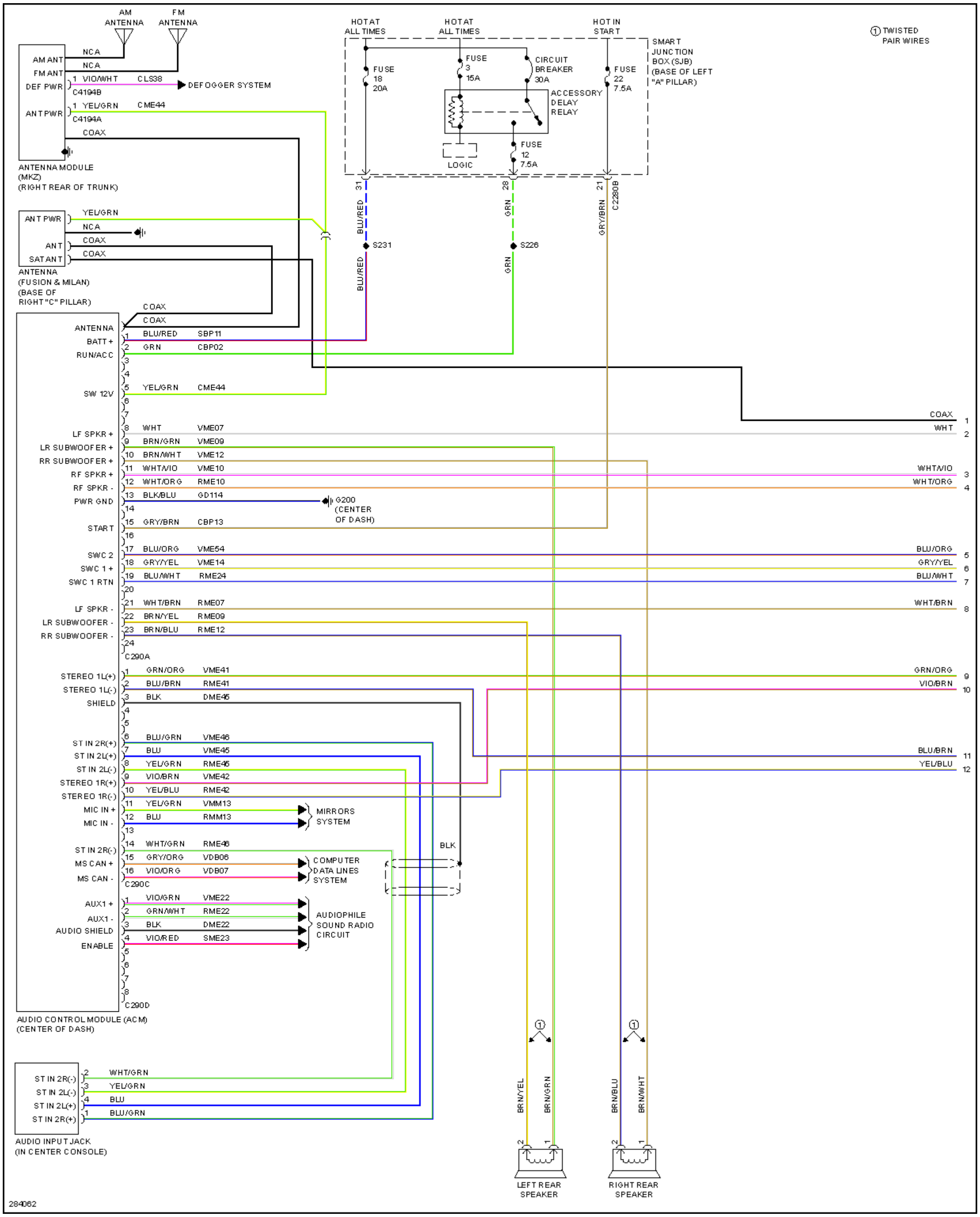


Fig. 70: Premium Radio Circuit, W/O SYNC (1 of 2)

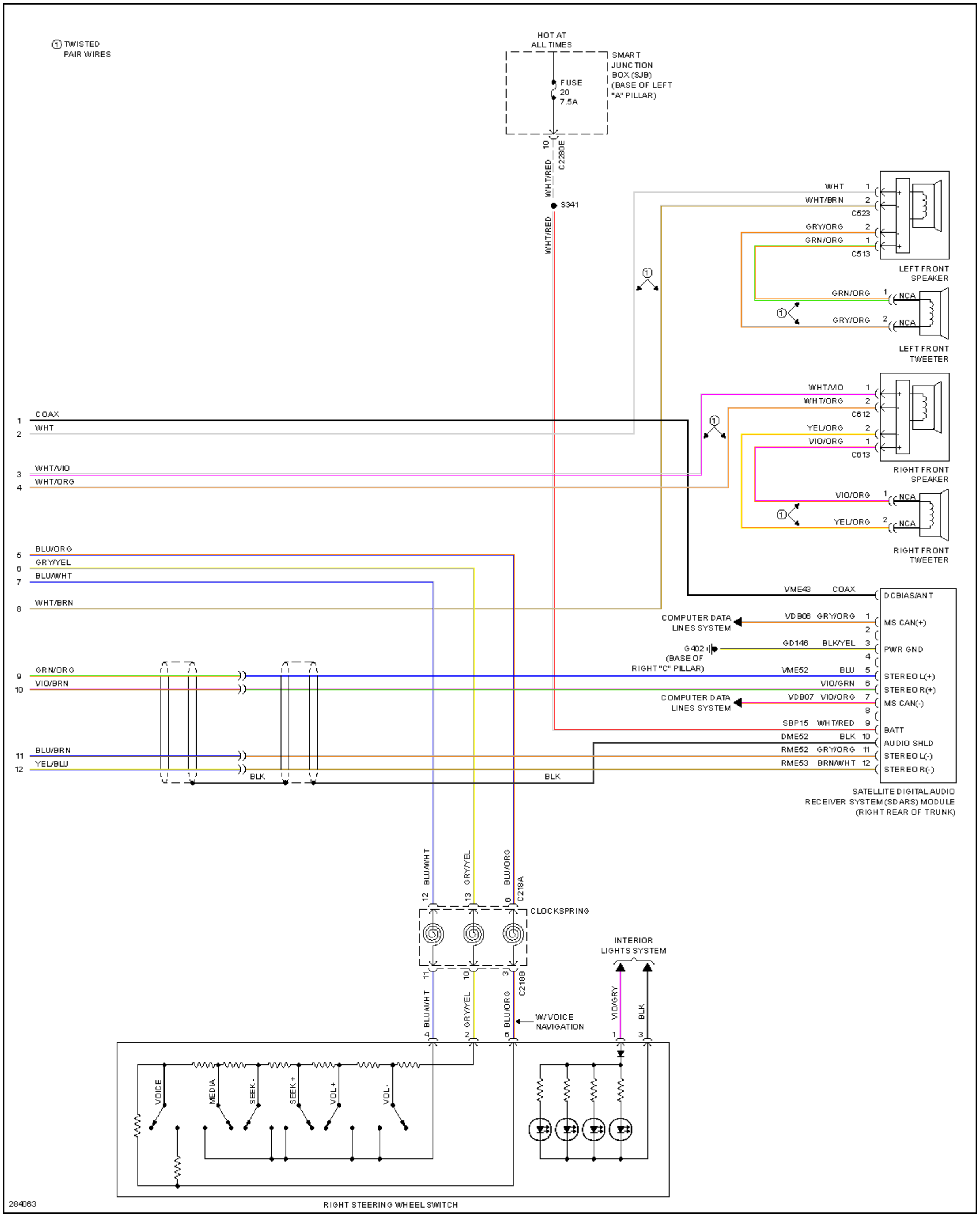


Fig. 71: Premium Radio Circuit, W/O SYNC (2 of 2)

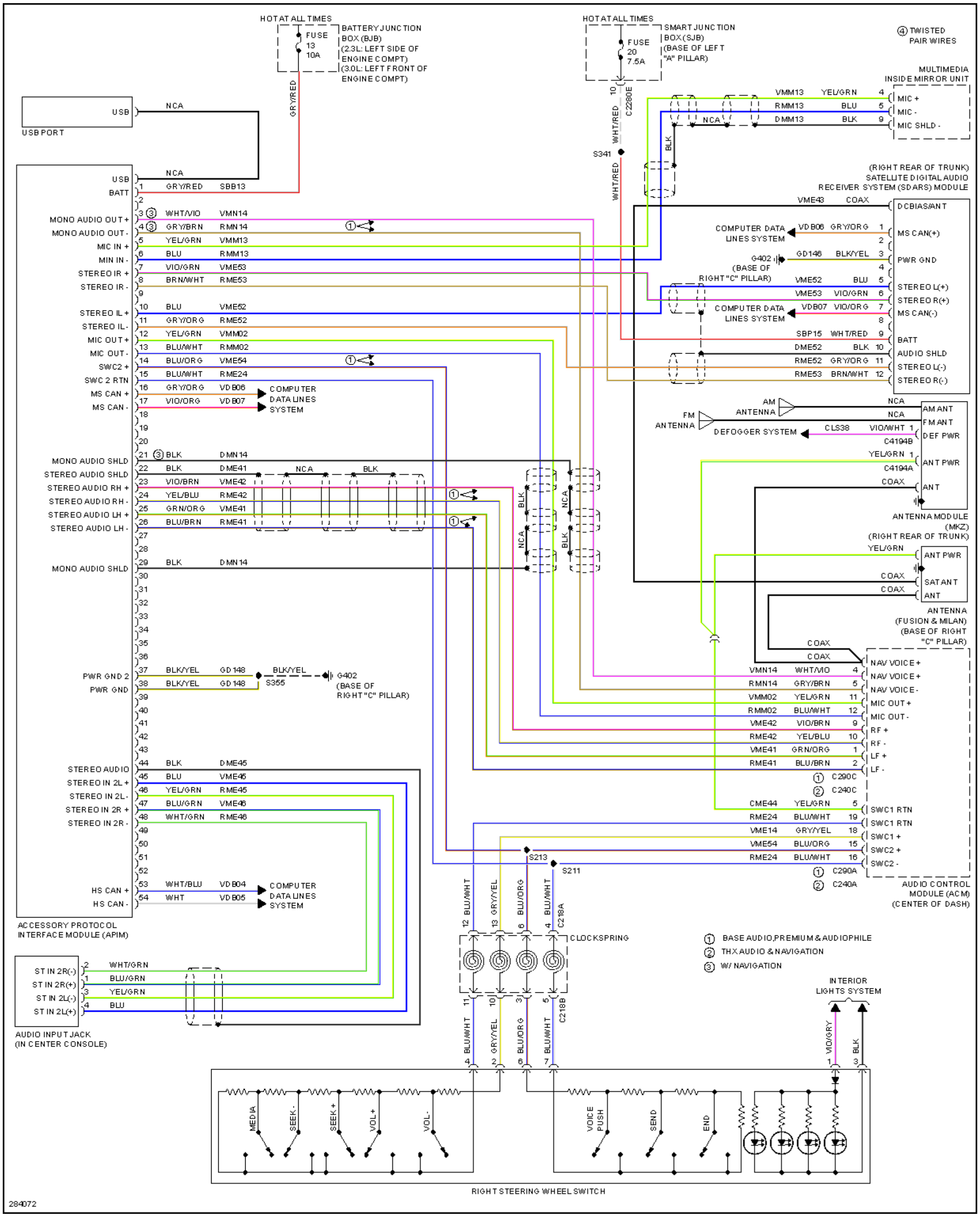


Fig. 72: SYNC Radio Circuit

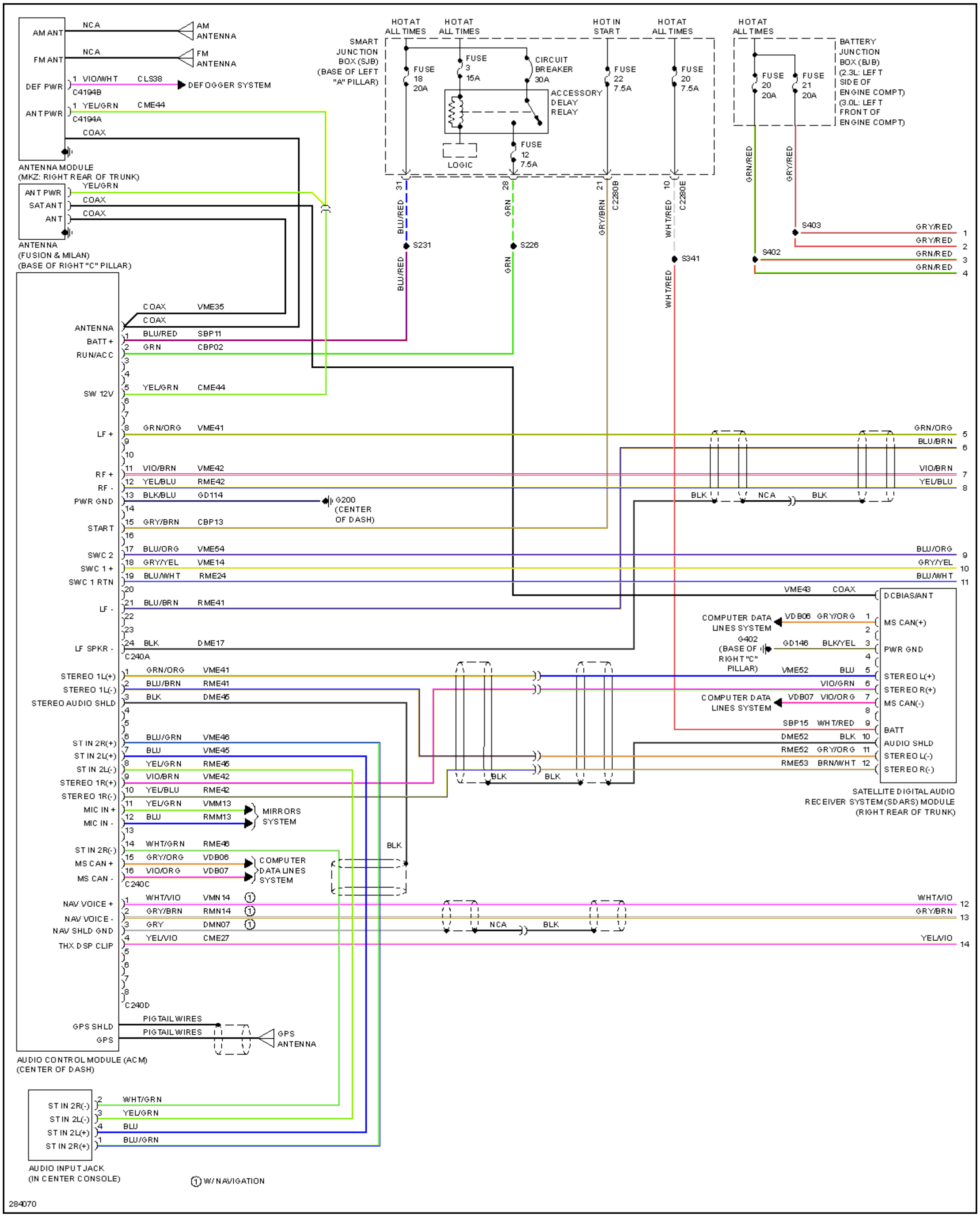


Fig. 73: THX Audio Radio Circuit (1 of 2)

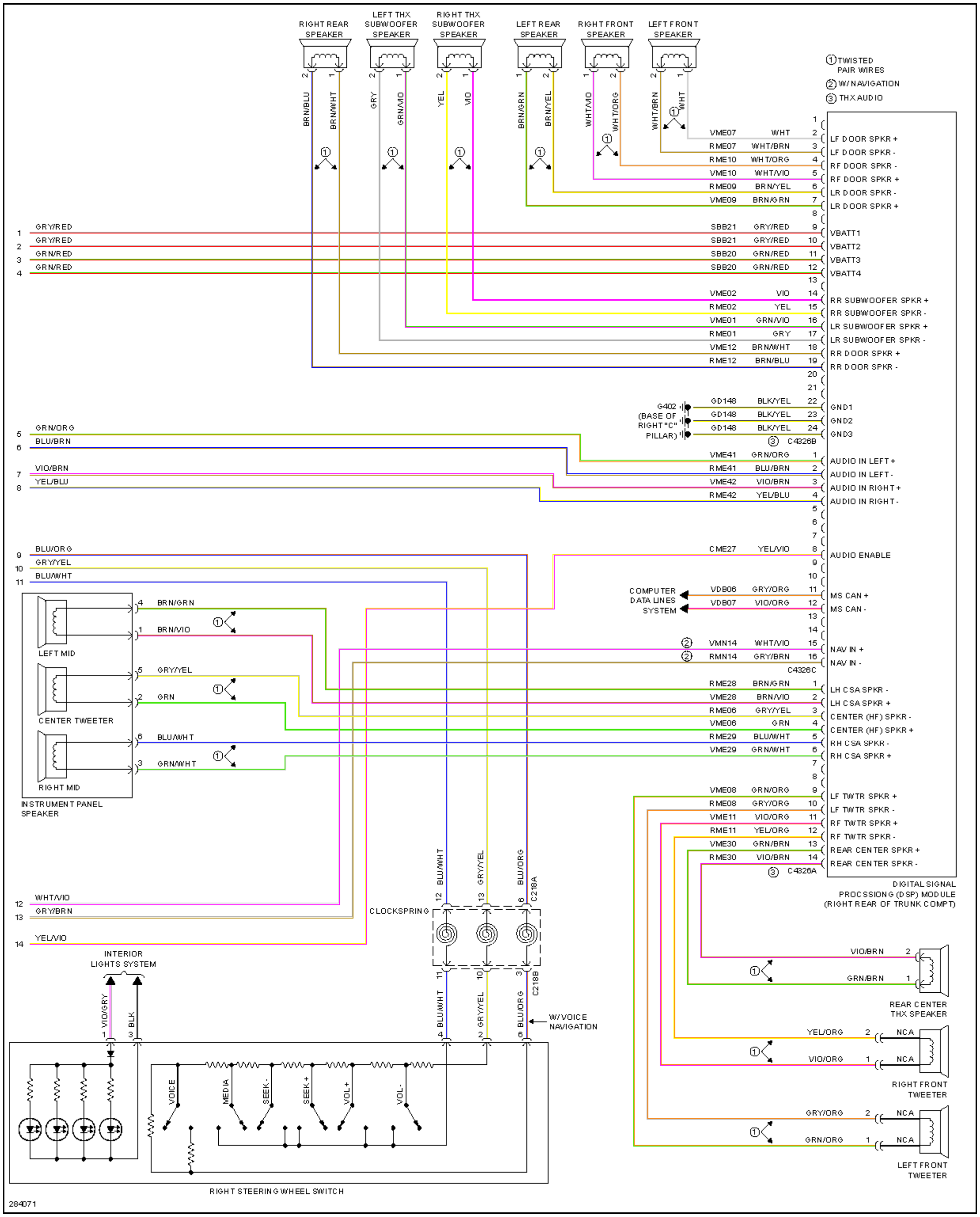


Fig. 74: THX Audio Radio Circuit (2 of 2)

SHIFT INTERLOCK

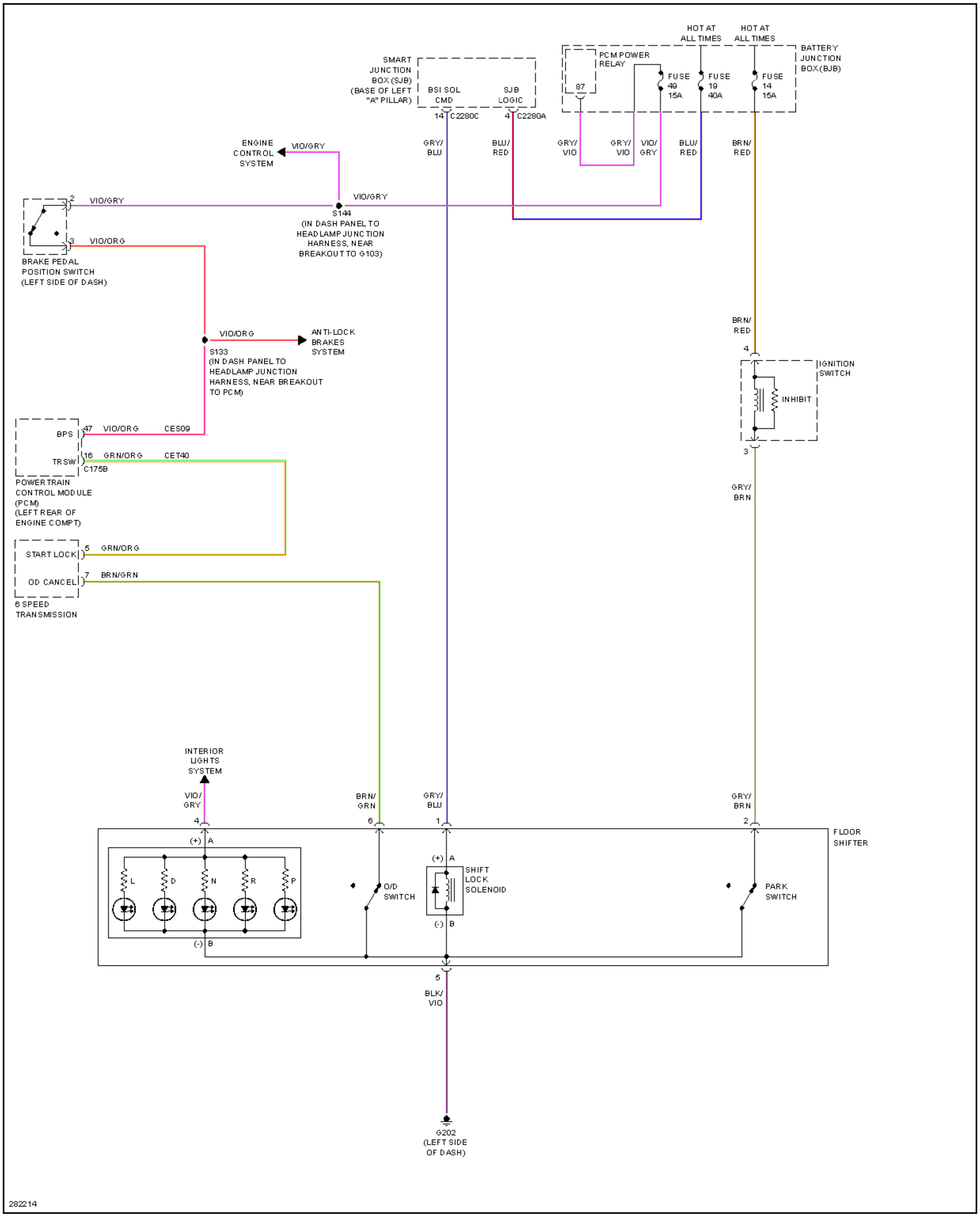


Fig. 75: Shift Interlock Circuit

STARTING/CHARGING

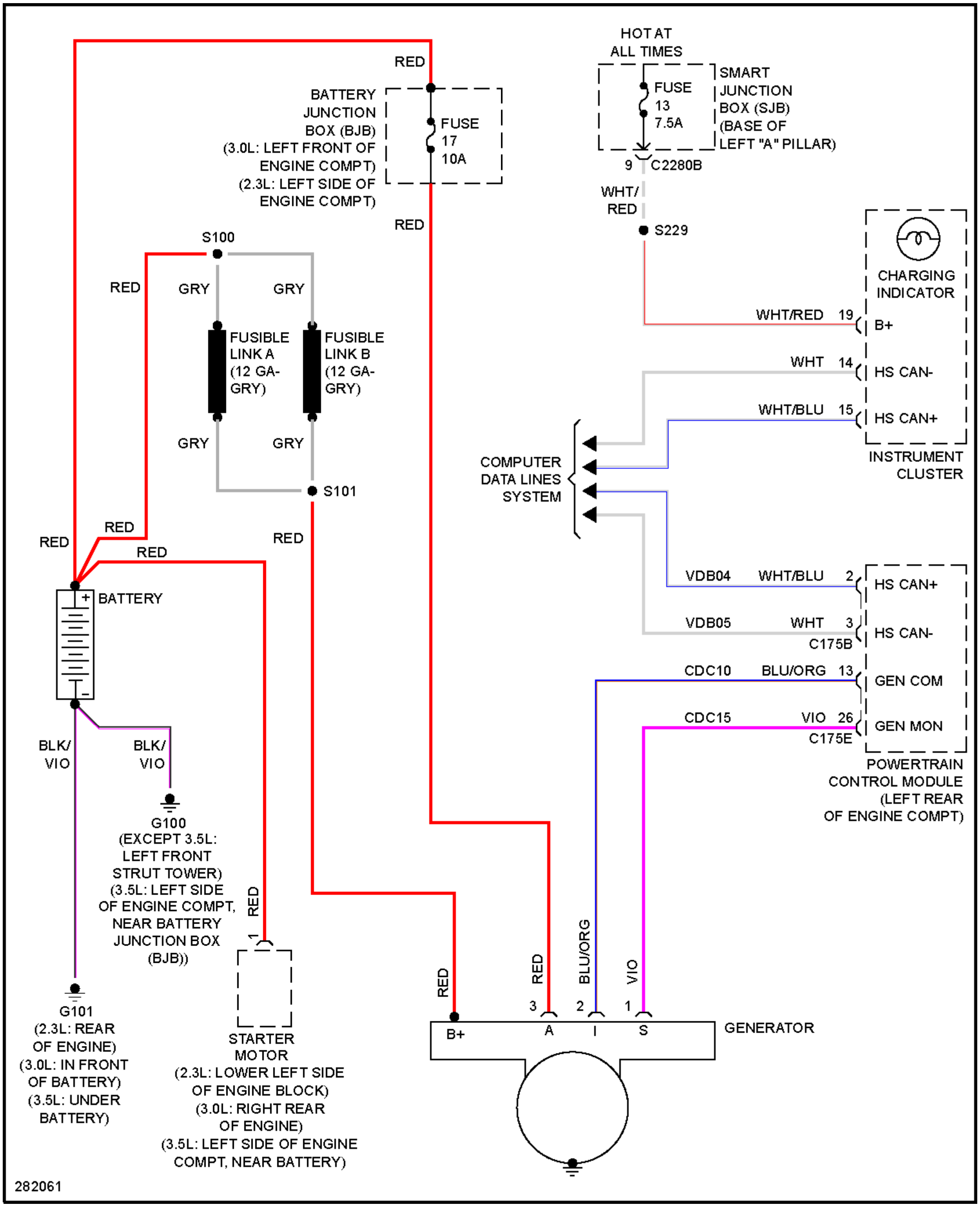


Fig. 76: Charging Circuit

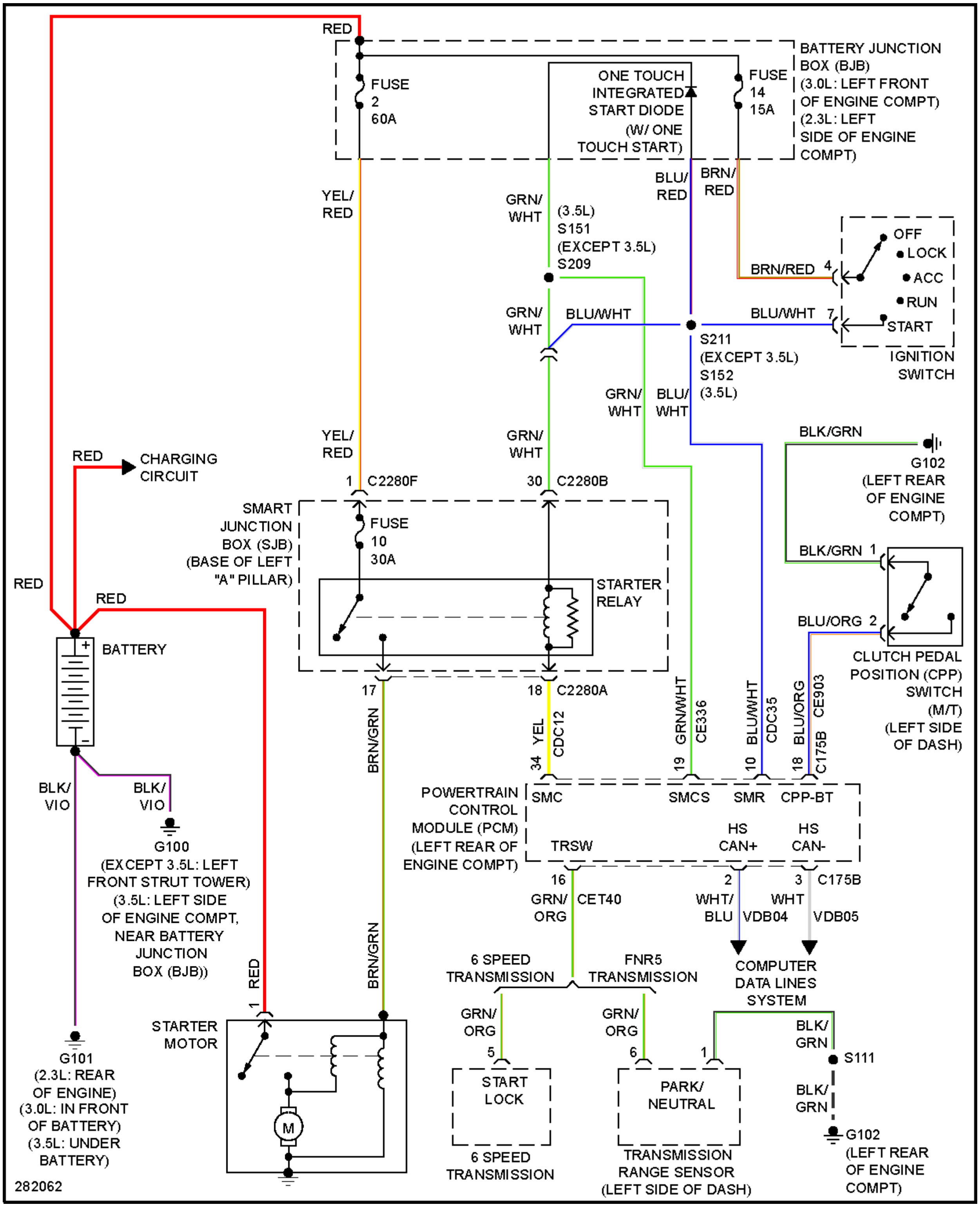


Fig. 77: Starting Circuit

SUPPLEMENTAL RESTRAINTS

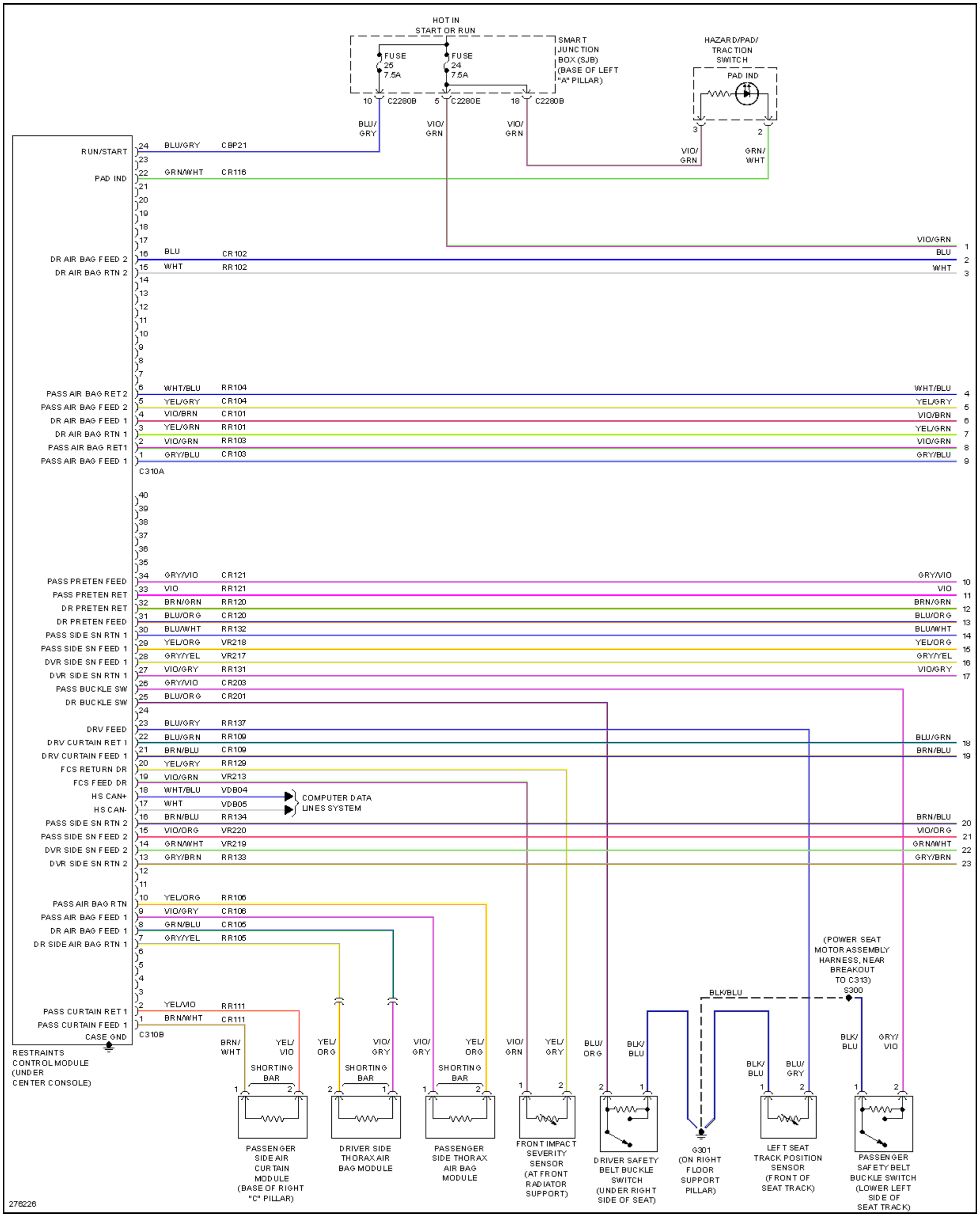


Fig. 78: Supplemental Restraints Circuit, Early Production (1 of 2)

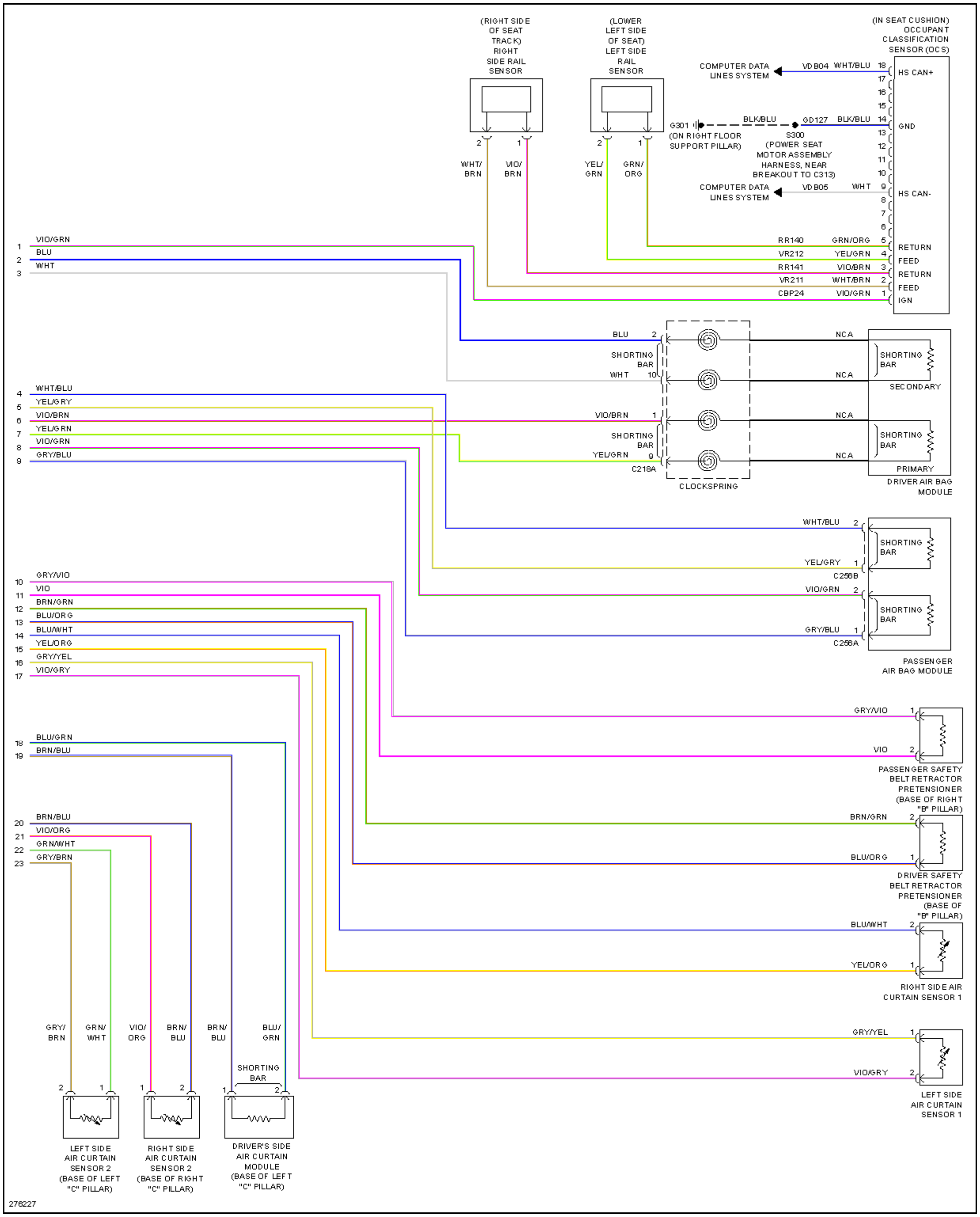


Fig. 79: Supplemental Restraints Circuit, Early Production (2 of 2)

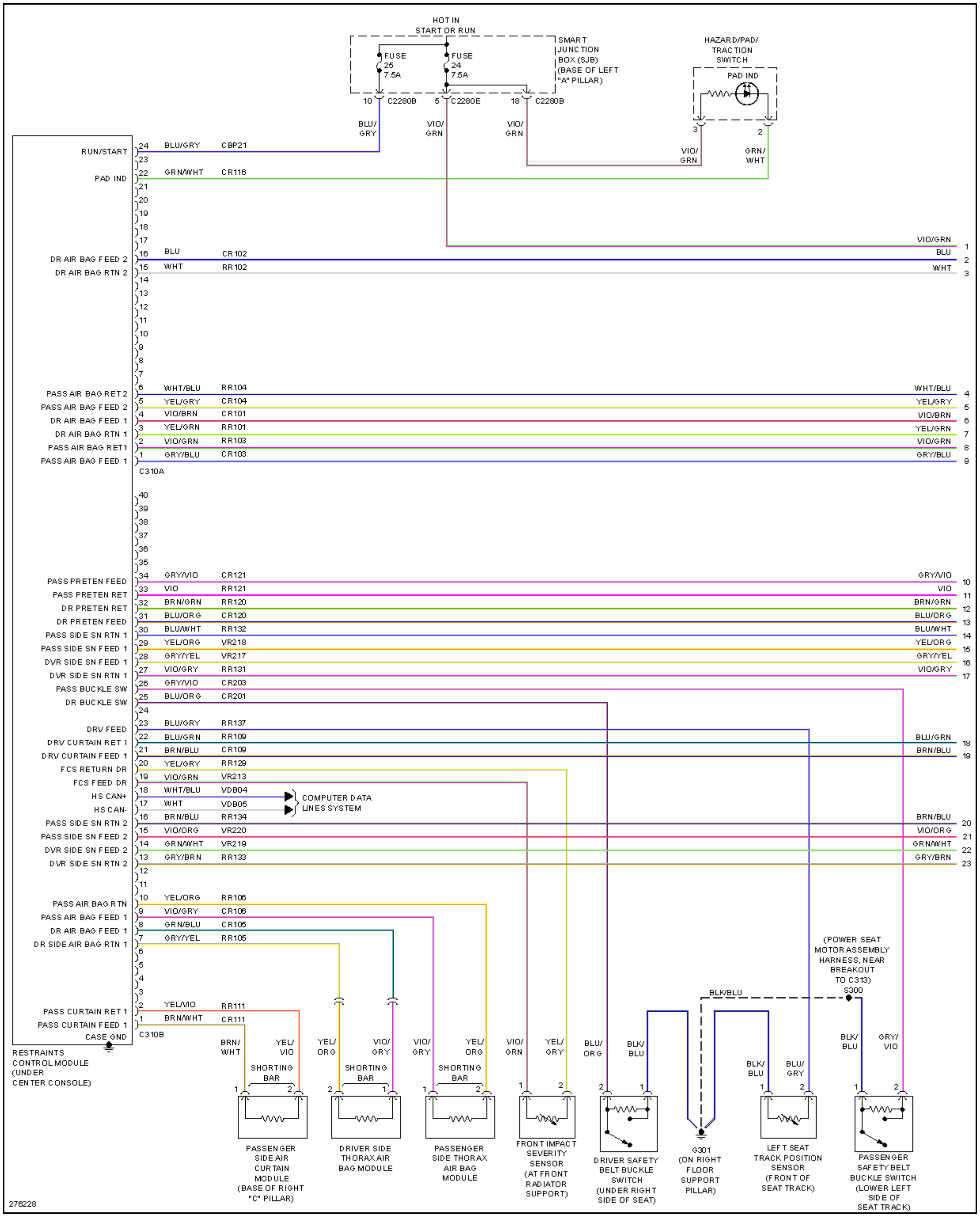


Fig. 80: Supplemental Restraints Circuit, Late Production (1 of 2)

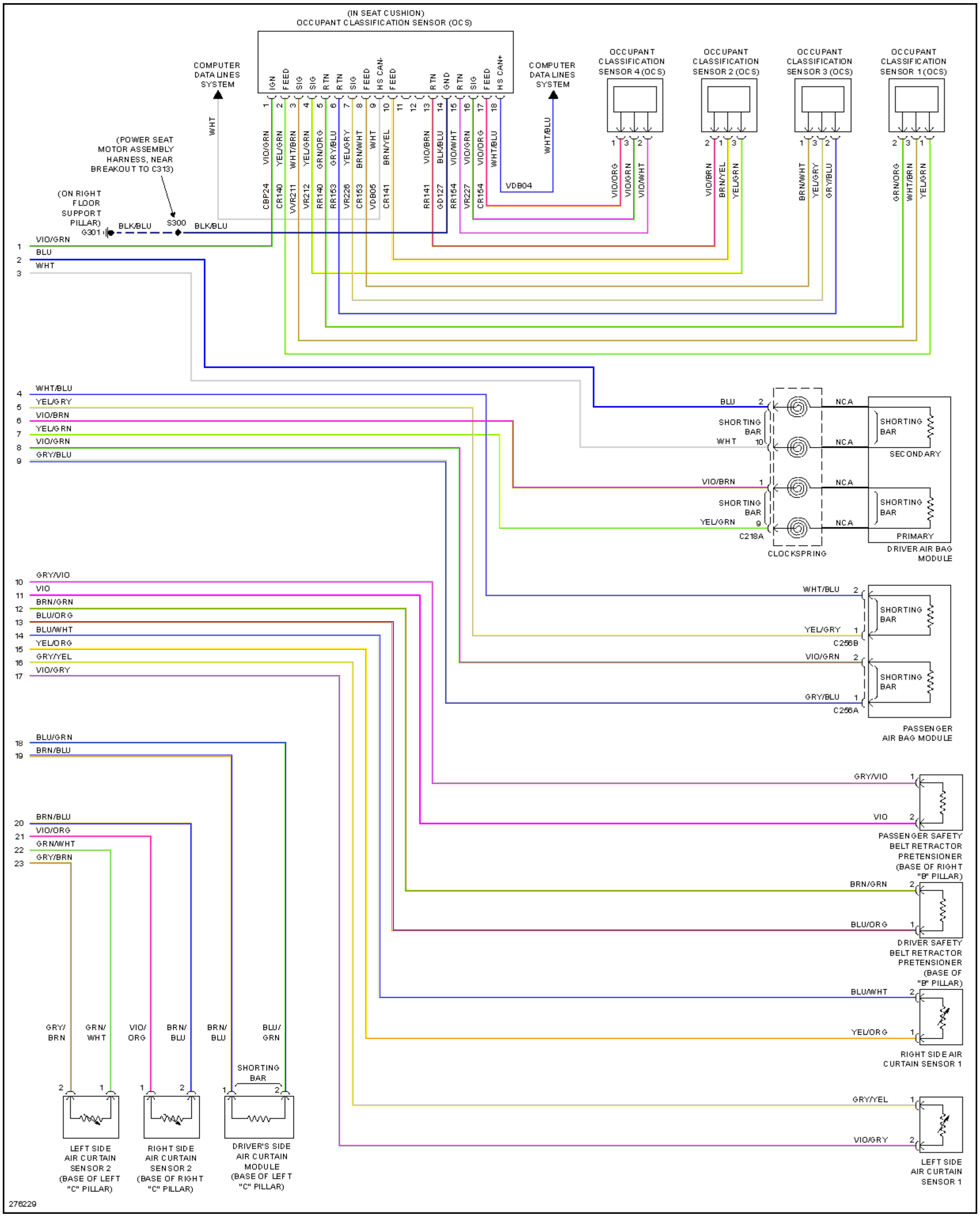


Fig. 81: Supplemental Restraints Circuit, Late Production (2 of 2)

TRANSMISSION

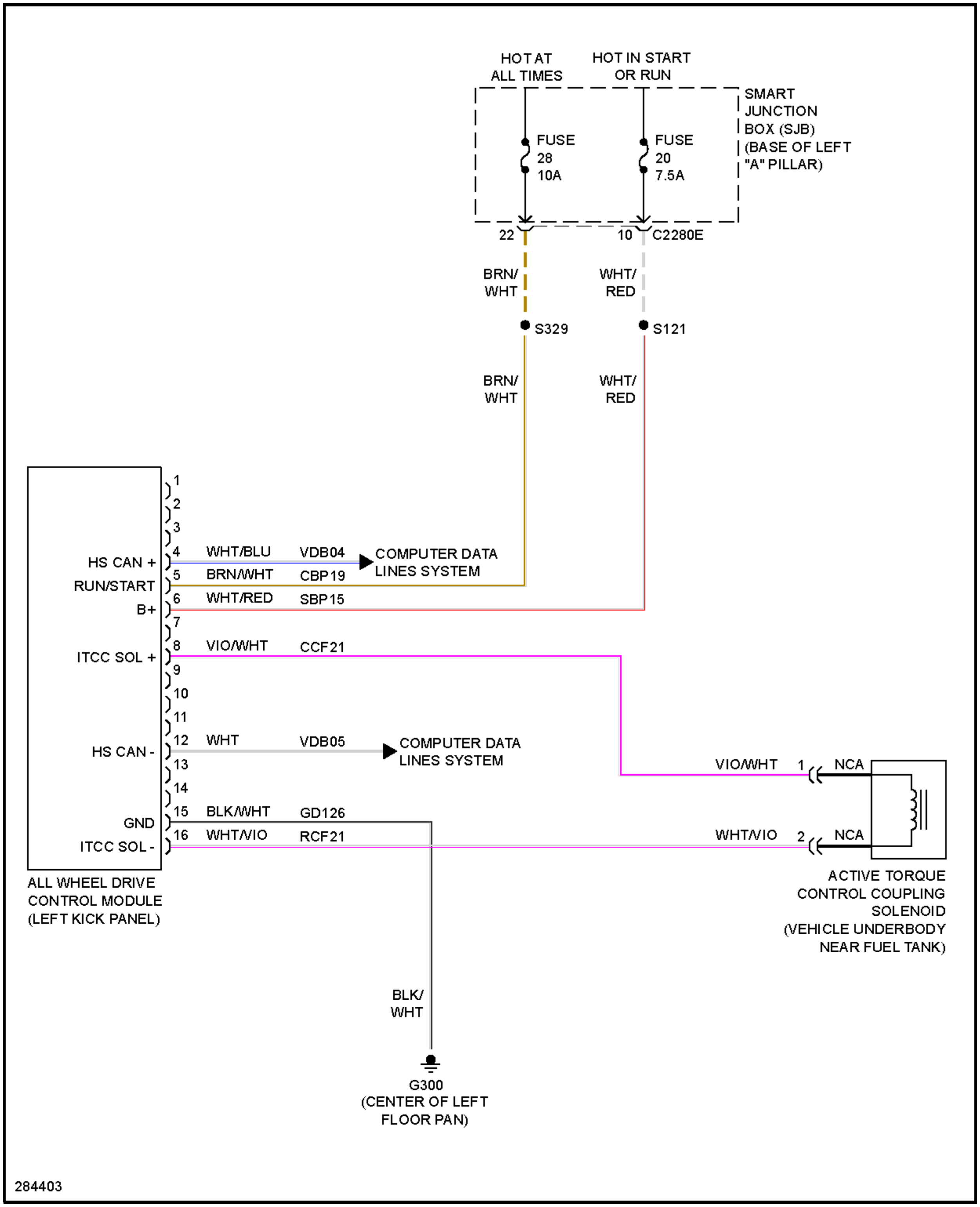


Fig. 82: 4WD Circuit

3.5L

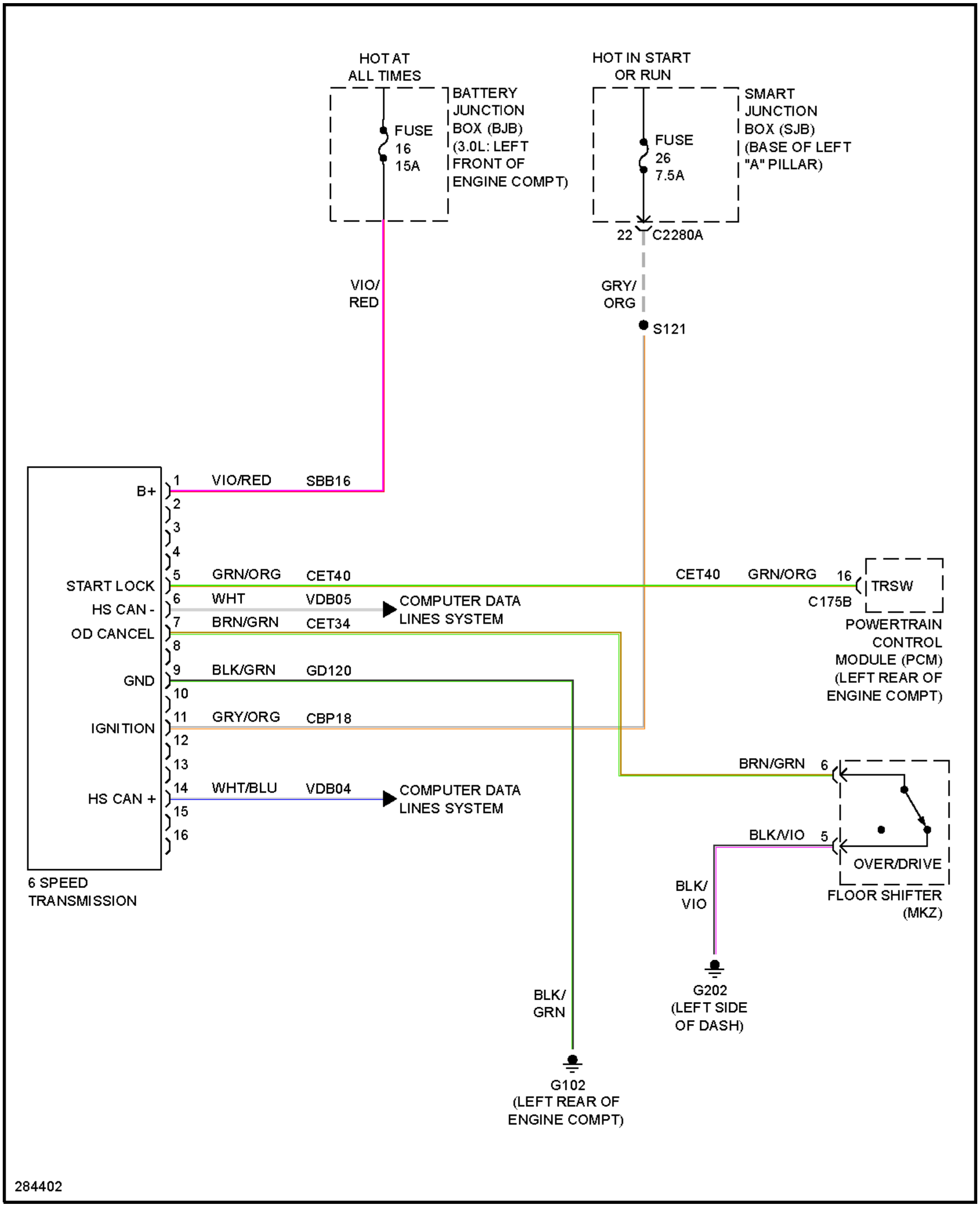


Fig. 83: 3.5L, A/T Circuit, 6 Speed A/T

TRUNK, TAILGATE, FUEL DOOR

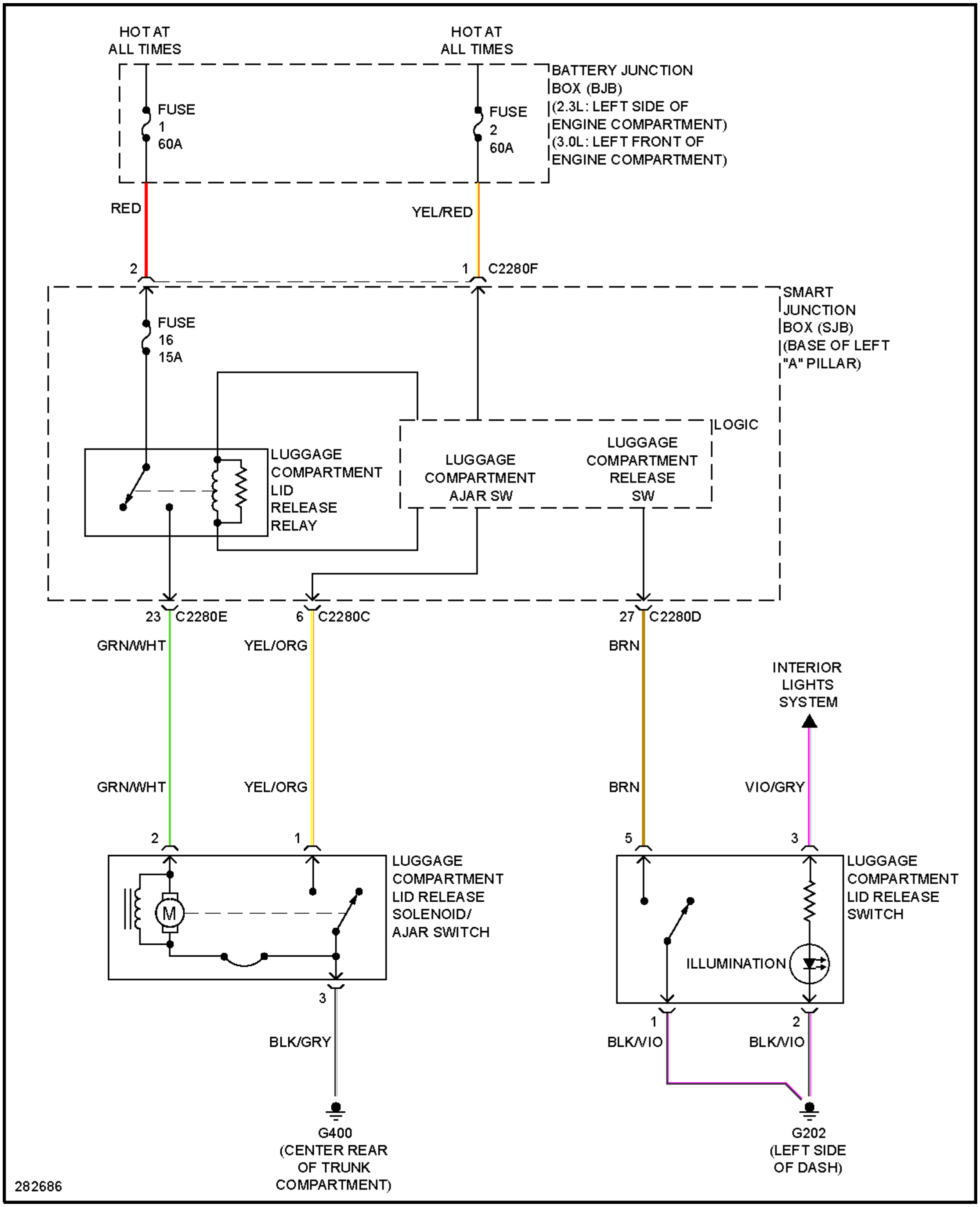


Fig. 84: Trunk Release Circuit

WARNING SYSTEMS

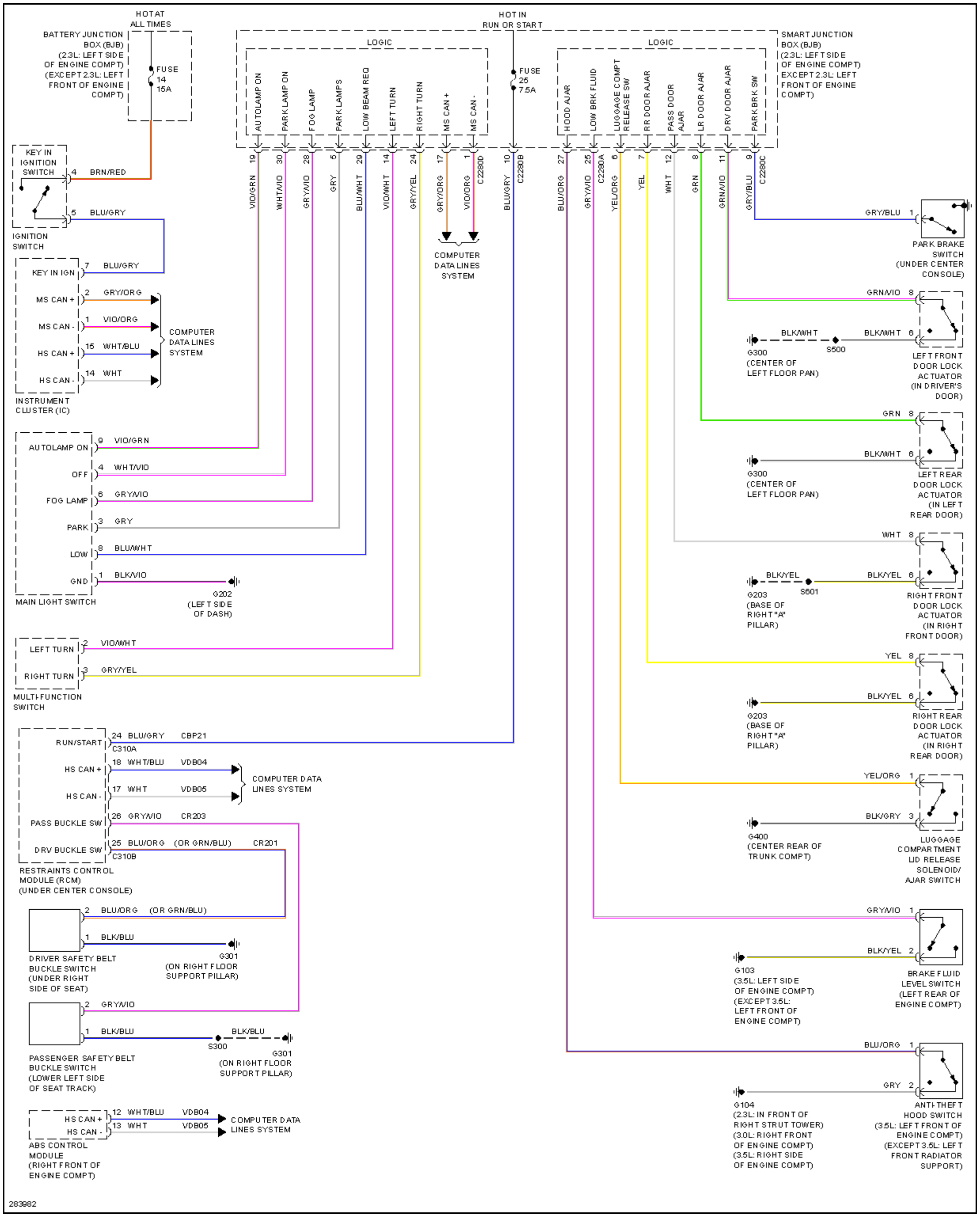


Fig. 85: Warning Systems Circuit

WIPER/WASHER

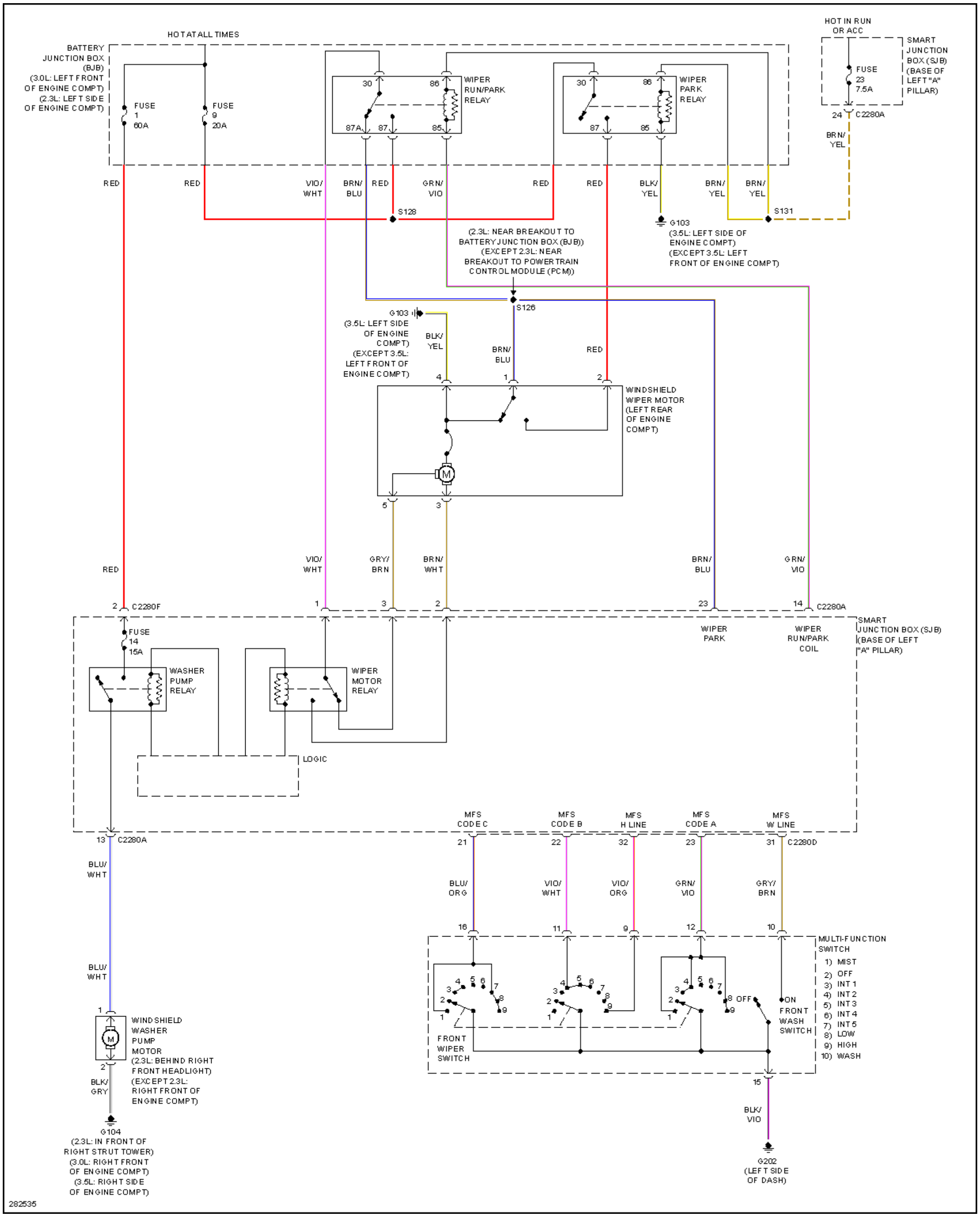


Fig. 86: Wiper/Washer Circuit

2008 TRANSMISSIONS

Transaxle/Transmission Cooling - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
FNR5 Automatic Transmission Fluid XT-9-QMM5	Mazda MES MN 117C (ATF-M V)	6.7L (7 qt)
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A	7.0L (7.4 qt)

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Fluid	
MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid, Motorcraft Continuously Variable Chain Type Transmission Fluid and FNR5 Automatic Transmission Fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage. Refer to the material specification for the correct fluid. The transmission fluid should be changed every 96,560 km (60,000 mi) regardless of normal or special operating conditions.	
NOTICE: The transmission fluid used for the FNR5 and the 6-speed transaxles are unique. Do not use water-based cleaners to clean or flush the transmission fluid cooler tubes or transmission damage will occur. Mineral spirits can be used to clean the transmission fluid cooler tubes, providing the transmission fluid cooler tubes are flushed with clean automatic transmission fluid and blown dry with shop air. Use only clean automatic transmission fluid designated for this transaxle and torque converter being serviced.	

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Transmission fluid cooler tubes	10	-	89
Transmission fluid cooler tubes (at the radiator)	30	22	-
Transmission fluid fill plug (6-speed)	39	29	-

DESCRIPTION AND OPERATION

TRANSAXLE COOLING - 6 SPEED

These vehicles are equipped with an internal transmission fluid cooler. The transmission fluid cooler is mounted in the engine radiator tank. During operation, transmission fluid travels from the transaxle to the transmission fluid cooler, then back to the transaxle. The transmission fluid cooler transfers heat from the transmission fluid to the engine coolant.

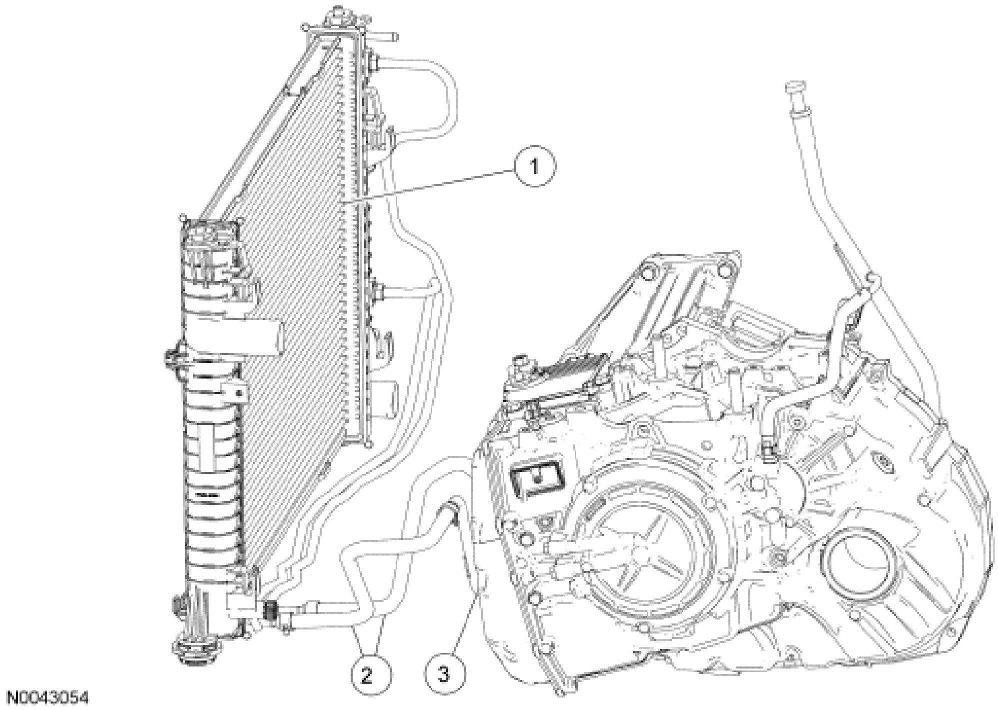


Fig. 1: Transaxle Cooling - 6-Speed
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8005	Radiator
2	7H420	Transmission fluid cooler tube assembly
3	19710-A	Transmission mounted fluid cooler tube

TRANSAXLE COOLING - FNR5

These vehicles are equipped with an internal transmission fluid cooler. The transmission fluid cooler is mounted in the engine radiator tank. During operation, transmission fluid travels from the transaxle to the transmission fluid cooler, then back to the transaxle. The transmission fluid cooler transfers heat from the transmission fluid to the engine coolant.

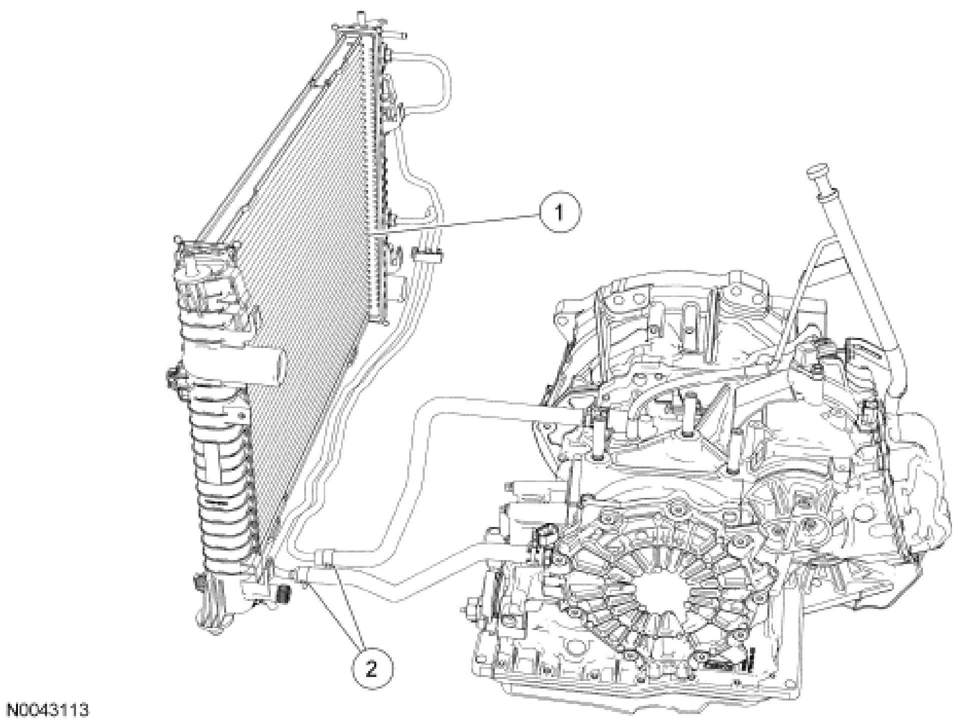


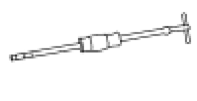
Fig. 2: Transaxle Cooling - FNR5
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8005	Radiator
2	7H420	Transmission fluid cooler tube assembly

DIAGNOSTIC TESTS

TRANSAXLE COOLING - 6 SPEED

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Material

Item	Specification
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A

Inspection and Verification

1. Verify the customer's concern by operating the vehicle to duplicate the condition.
2. If the inspection reveals an obvious concern(s) that can be readily identified, repair as necessary.
3. Install new components if a transmission fluid leak is found in any of the transaxle cooling components.
4. If the concern(s) remains after the inspection, determine the symptom(s). Go to **Symptom Chart - Transaxle Cooling** or Go to **Symptom Chart - NVH**.

Symptom Chart - Transaxle Cooling

Symptom Chart - Transaxle Cooling

Condition	Possible Sources	Action
• Transaxle overheating	• Clogged transmission fluid coolers or tubes	• INSPECT the transmission fluid cooler and transmission fluid cooler tubes for damage or plugging.
	• Bent or crushed transmission fluid cooler tubes	• INSTALL a new transmission fluid cooler or transmission fluid cooler tubes as necessary.
	• System leaks	• INSPECT transmission fluid cooler and transmission fluid cooler tubes for leaks. REPAIR as required.
	• Internal transmission concerns	• REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.

Symptom Chart - NVH

NOTE: **NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.**

Symptom Chart - NVH

Condition	Possible Sources	Action
• Vibration - a high frequency (20-80 Hz) that is felt through the seat or selector lever. Changes with engine speed	• Transmission fluid cooler tubes grounded	• CHECK the transmission fluid cooler tubes. REPAIR as necessary.

Check Transmission Fluid Level and Condition

NOTE: The vehicle should not be driven if the transmission fluid level indicator shows the transmission fluid below the minimum fluid level mark or internal failure may result.

If the vehicle has been operated for an extended period of time at highway speeds, in city traffic, in hot weather or while pulling a trailer, the transmission fluid needs to cool down to obtain an accurate reading.

The transmission fluid level reading on the transmission fluid level indicator will differ depending on operating and ambient temperatures. The correct reading should be within the normal operating temperature range.

Transmission Fluid Level Check

NOTE: The transmission fluid should be checked at normal operating temperature 60°C-70°C (140°F-158°F) on a level surface. Normal operating temperature can be reached after approximately 32 km (20 mi) of driving and can be checked using the scan tool.

Under normal circumstances the transmission fluid level should be checked during normal maintenance. If the transaxle starts to slip, shifts slowly or shows signs of transmission fluid leaking, the transmission fluid level should be checked.

1. With the transaxle in PARK, the engine at idle, foot pressed on the brake, move the selector lever through each gear and allow engagement of each gear. Place the selector lever in the PARK position.
2. Wipe the transmission fluid level indicator cap and remove the transmission fluid level indicator.
3. Wipe the transmission fluid level indicator with a clean cloth.
4. Install the transmission fluid level indicator back in the fluid indicator tube until it is fully seated, then remove the indicator. The transmission fluid level should be within the normal operating range.

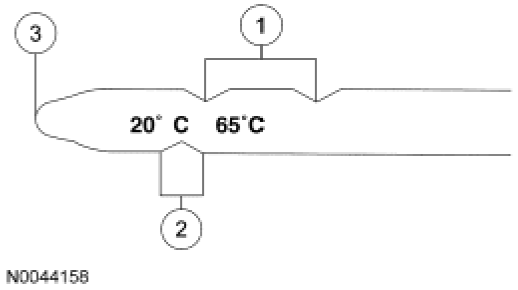


Fig. 3: Transmission Fluid Level Check
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Transmission fluid level at operating temperature 60°C-70°C (140°F-158°F)

2	-	Transmission fluid level cool 15°C-25°C (59°F-77°F)
3	-	Do not drive mark

High Transmission Fluid Level

A transmission fluid level that is too high may cause the transmission fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of transmission fluid from the vent tube and possible transaxle malfunction and/or damage. If an overfill reading is indicated, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.

Low Transmission Fluid Level

A low transmission fluid level could result in poor transaxle engagement, slipping, malfunction and/or damage. This could also indicate a leak in one of the transaxle seals or gaskets.

Adding Transmission Fluid

NOTE: **MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid, Motorcraft Continuously Variable Chain Type Transmission Fluid and FNR5 Automatic Transmission Fluid are not interchangeable transmission fluids. The use of any fluid other than what is recommended for this transaxle will cause transaxle damage.**

If transmission fluid needs to be added, add transmission fluid in 0.25L (1/2 pt) increments through the indicator tube. Do not overfill the transaxle. For transmission fluid type, refer to the **SPECIFICATIONS**.

Transmission Fluid Condition Check

1. Check the transmission fluid level.
2. Observe the color and the odor. The color under normal circumstances should be a dark red color, not brown or black or have a burnt odor.
3. Hold the transmission fluid level indicator over a white facial tissue and allow the transmission fluid to drip onto the facial tissue and examine the stain.
4. If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.
5. If the stain is a foamy pink color, this may indicate coolant in the transaxle. The engine cooling system should also be inspected at this time.
6. If transmission fluid contamination or transaxle failure is confirmed by the sediment in the bottom of the fluid pan, install a new transaxle. If installing a new transaxle, the transmission fluid cooler and transmission fluid cooler tubes should be cleaned.
7. If the transaxle is to be overhauled or if installing a new transaxle, the fluid cooler must be back flushed. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article.

TRANSAXLE COOLING - FNR5

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Material

Item	Specification
FNR5 Automatic Transmission Fluid XT-9-QMM5	Mazda MES MN 117C (ATF-M V)

Inspection and Verification

1. Verify the customer's concern by operating the vehicle to duplicate the condition.
2. If the inspection reveals an obvious concern(s) that can be readily identified, repair as necessary.
3. Install new components if a transmission fluid leak is found in any of the transaxle cooling components.
4. If the concern(s) remains after the inspection, determine the symptom(s). Go to **Symptom Chart - Transaxle Cooling** or Go to **Symptom Chart - NVH**.

Symptom Chart - Transaxle Cooling

Symptom Chart - Transaxle Cooling

Condition	Possible Sources	Action
• Transaxle overheating	• Clogged transmission fluid cooler or transmission fluid cooler tubes	• INSPECT the transmission fluid cooler and transmission fluid cooler tubes for damage or plugging.
	• Bent or crushed transmission fluid cooler tubes	• INSTALL a new transmission fluid cooler or cooler tubes as necessary.
	• System leaks	• INSPECT transmission fluid cooler and transmission fluid cooler tubes for leaks. REPAIR as required.
	• Internal transmission concerns	• REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.

Symptom Chart - NVH

NOTE: **NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of**

common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.

Symptom Chart - NVH

Condition	Possible Sources	Action
• Vibration - a high frequency (20-80 Hz) that is felt through the seat or selector lever. Changes with engine speed	• Transmission fluid cooler tubes grounded	• CHECK the transmission fluid cooler tubes. REPAIR as necessary.

Check Transmission Fluid Level and Condition

NOTE: The vehicle should not be driven if the transmission fluid level indicator shows the transmission fluid below the minimum fluid level mark or internal failure may result.

If the vehicle has been operated for an extended period of time at highway speeds, in city traffic, in hot weather or while pulling a trailer, the transmission fluid needs to cool down to obtain an accurate reading.

The transmission fluid level reading on the transmission fluid level indicator will differ depending on operating and ambient temperatures. The correct reading should be within the normal operating temperature range.

Transmission Fluid Level Check

NOTE: The transmission fluid should be checked at normal operating temperature 60° C-70°C (140°F-158°F) on a level surface. Normal operating temperature can be reached after approximately 32 km (20 mi) of driving and can be checked using the scan tool.

Under normal circumstances the transmission fluid level should be checked during normal maintenance. If the transaxle starts to slip, shifts slowly or shows signs of transmission fluid leaking, the transmission fluid level should be checked.

1. With the transaxle in PARK, the engine at idle, foot pressed on the brake, move the selector lever through each gear and allow engagement of each gear. Place the selector lever in the PARK position.
2. Wipe the transmission fluid level indicator cap and remove the transmission fluid level indicator.
3. Wipe the transmission fluid level indicator with a clean cloth.
4. Install the transmission fluid level indicator back in the transmission fluid indicator tube until it is fully seated, then remove the transmission fluid level indicator. The transmission fluid level should be within

the normal operating range.

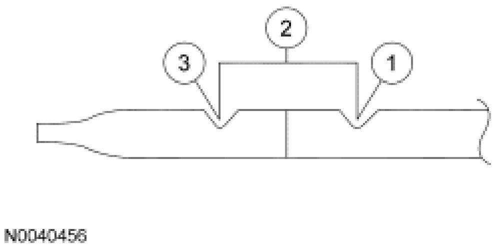


Fig. 4: Transmission Fluid Level Indicator
Courtesy of FORD MOTOR CO.

Item	Description
1	Maximum transmission fluid level
2	Normal transmission fluid level range 60°C-70°C (140°F-158°F)
3	Minimum transmission fluid level

High Transmission Fluid Level

A transmission fluid level that is too high may cause the transmission fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of transmission fluid from the vent tube and possible transaxle malfunction and/or damage. If an overfill reading is indicated, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - FNR5** article.

Low Transmission Fluid Level

A low transmission fluid level could result in poor transaxle engagement, slipping, malfunction and/or damage. This could also indicate a leak in one of the transaxle seals or gaskets.

Adding Transmission Fluid

NOTE: **MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid, Motorcraft Continuously Variable Chain Type Transmission Fluid and FNR5 Automatic Transmission Fluid are not interchangeable transmission fluids. The use of any fluid other than what is recommended for this transmission will cause transmission damage.**

If transmission fluid needs to be added, add transmission fluid in 0.25L (1/2 pt) increments through the indicator tube. Do not overfill the transmission fluid. For transmission fluid type, refer to the **SPECIFICATIONS**.

Transmission Fluid Condition Check

1. Check the transmission fluid level.

2. Observe the color and the odor. The color under normal circumstances should be a dark red color, not brown or black or have a burnt odor.
3. Hold the transmission fluid level indicator over a white facial tissue and allow the transmission fluid to drip onto the facial tissue and examine the stain.
4. If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.
5. If the stain is a foamy pink color, this may indicate coolant in the transaxle. The engine cooling system should also be inspected at this time.
6. If transmission fluid contamination or transaxle failure is confirmed by the sediment in the bottom of the transmission fluid pan, install a new transaxle. If installing a new transaxle, the transmission fluid cooler and transmission fluid cooler tubes should be cleaned.
7. If the transaxle is to be overhauled or if installing a new transaxle, install a new transmission fluid cooler. Refer to **Transmission Fluid Cooler**.

REMOVAL AND INSTALLATION

TRANSMISSION FLUID COOLER

NOTE: The transmission fluid cooler is mounted in the radiator tank and cannot be serviced separately.

1. Install a new radiator. For additional information, refer to **ENGINE COOLING** article.

TRANSMISSION FLUID COOLER TUBES - 6 SPEED

Material

Item	Specification
Motorcraft Premium Automatic Transmission Fluid XT-8-QAW (US); CXT-8-LAW12 (Canada)	WSS-M2C924-A

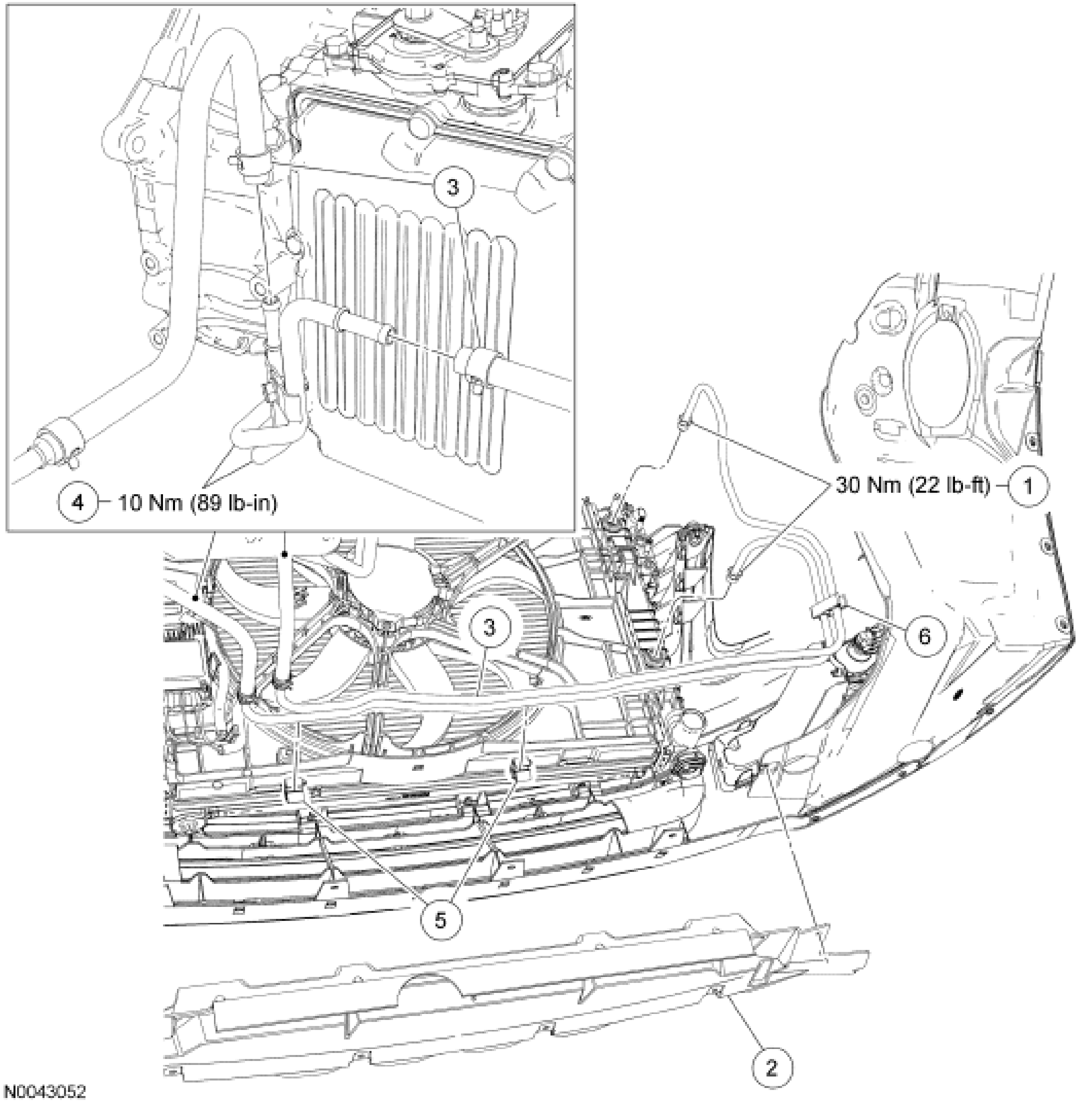


Fig. 5: Exploded View Of Transmission Fluid Cooler Tubes With Torque Specifications - 6-Speed
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	M52923	Transmission fluid cooler tube radiator fittings
2	8B407	Radiator splash shield
3	7H420	Transmission fluid cooler tube assembly
4	19710-A	Transmission fluid cooler tube fittings at the transaxle
5	256844	Transmission fluid cooler tube retaining clips
6	256679	Transmission fluid cooler tube retaining clip

REMOVAL

NOTE: MERCON®, MERCON® V, MERCON® SP, Motorcraft Premium Automatic

Transmission Fluid, Motorcraft Continuously Variable Chain Type Transmission Fluid and FNR5 Automatic Transmission Fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the upper transmission fluid cooler tube from the radiator.

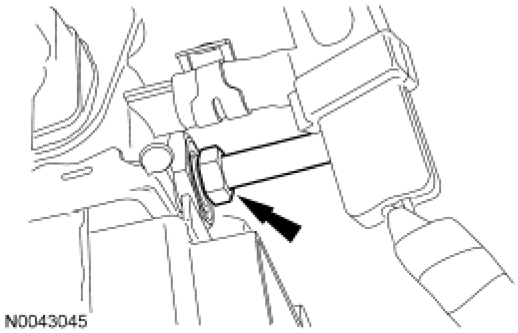


Fig. 6: Locating Upper Transmission Fluid Cooler Tube
Courtesy of FORD MOTOR CO.

3. If equipped, remove the bolts and the splash shield.

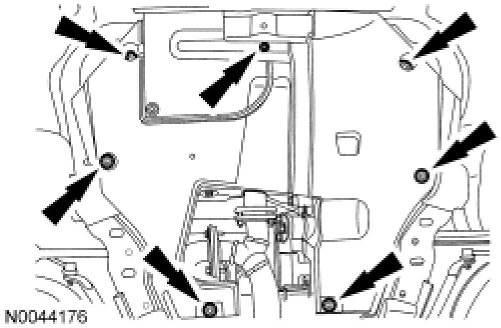


Fig. 7: Locating Underbody Cover Screws
Courtesy of FORD MOTOR CO.

4. Remove the front splash shield.
    1. Remove the 2 screws.
    2. Remove the 4 retainers.
    3. Remove the 4 bolts and the splash shield.

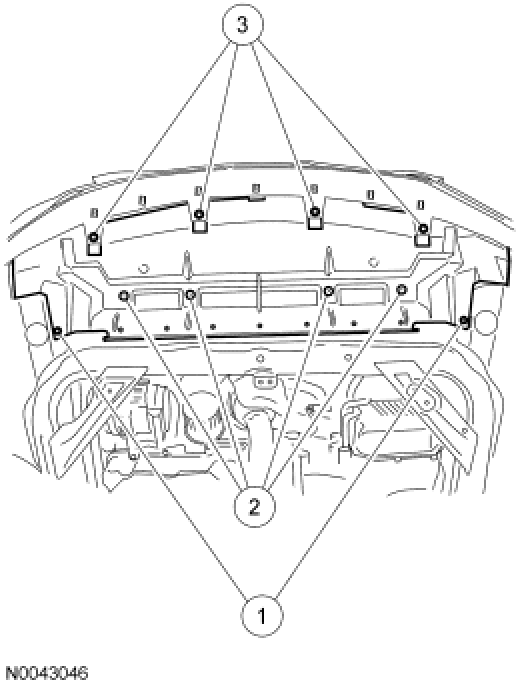


Fig. 8: Identifying Front Splash Shield Screws, Bolts And Retainers
Courtesy of FORD MOTOR CO.

5. Disconnect the lower transmission fluid cooler tube from the radiator.

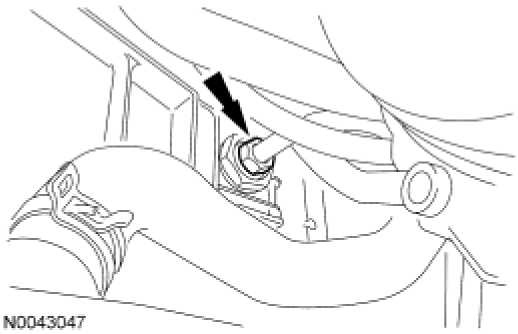


Fig. 9: Locating Lower Transmission Fluid Cooler Tube
Courtesy of FORD MOTOR CO.

NOTE:	**Use care not to overstretch or extend the hose clamps as damage may occur to the hose clamp and cause a leak.**

NOTE:	**The hose clamps are held on the hose with a special epoxy. Damage may occur to the hose if the clamp is removed from the hose. If the clamp or hose is damaged, install a new fluid cooler tube.**

6. Disconnect the transmission fluid cooler hoses from the transmission fluid cooler tubes.

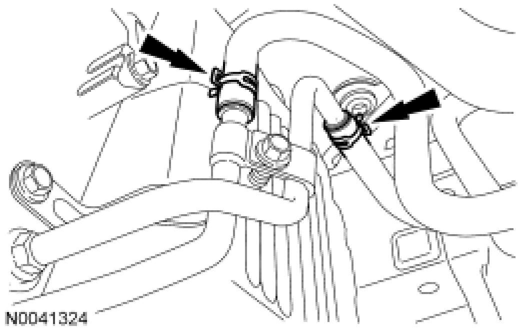


Fig. 10: Locating Transmission Fluid Cooler Hoses
Courtesy of FORD MOTOR CO.

7. Remove the 2 bolts and remove the transmission fluid cooler tubes.

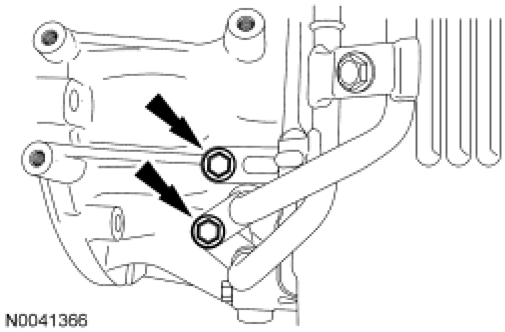


Fig. 11: Locating Transmission Fluid Cooler Tube Bolts
Courtesy of FORD MOTOR CO.

NOTE: When removing the transmission fluid cooler tubes from the retainers, do not remove the retainers from the shroud.

8. Remove the transmission fluid cooler tubes from the retainers.

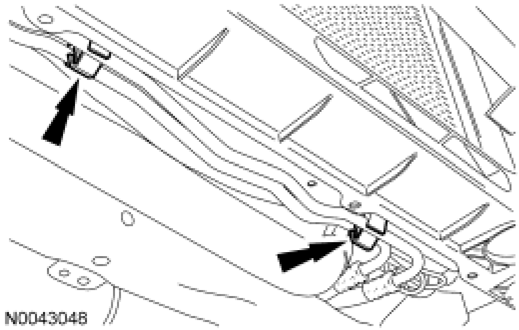


Fig. 12: Locating Transmission Fluid Cooler Tubes Retainers
Courtesy of FORD MOTOR CO.

9. Remove the transmission fluid cooler tube retainer and remove the transmission fluid cooler tubes.

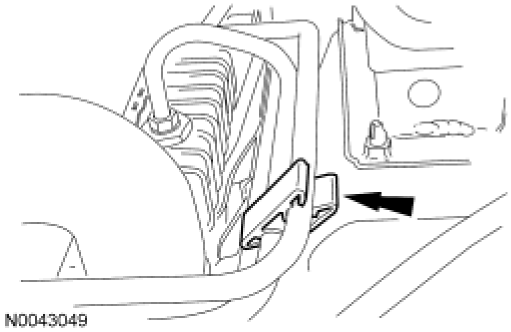


Fig. 13: Locating Transmission Fluid Cooler Tubes Retainers
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install new O-rings on the transmission fluid cooler tubes.

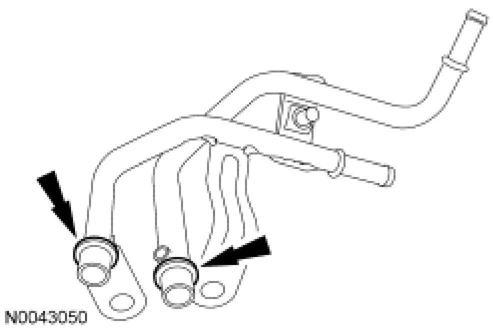


Fig. 14: Locating O-Rings
Courtesy of FORD MOTOR CO.

2. Install the transmission fluid cooler tubes.
   - Tighten to 10 Nm (89 lb-in).

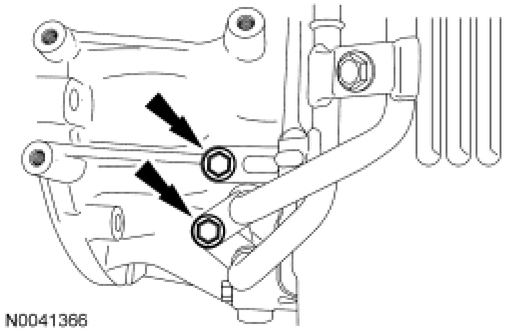


Fig. 15: Locating Transmission Fluid Cooler Tube Bolts
Courtesy of FORD MOTOR CO.

3. Position the transmission fluid cooler tubes in place and install the retainer.

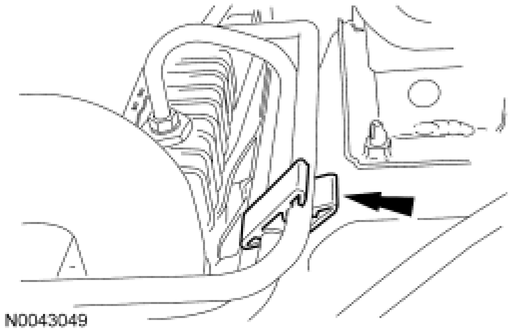


Fig. 16: Locating Transmission Fluid Cooler Tubes Retainers
Courtesy of FORD MOTOR CO.

4. Install the transmission fluid cooler tubes in the retainers.

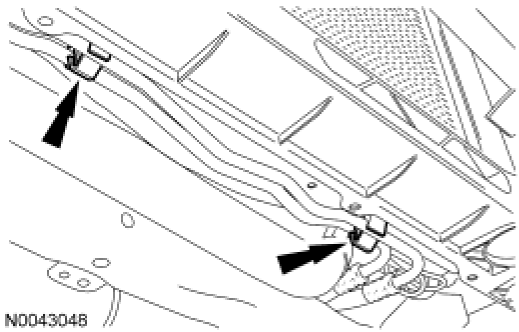


Fig. 17: Locating Transmission Fluid Cooler Tubes Retainers
Courtesy of FORD MOTOR CO.

NOTE: **The power steering hose is routed between the 2 transmission fluid cooler hoses.**

5. Position the transmission fluid cooler hoses in place.

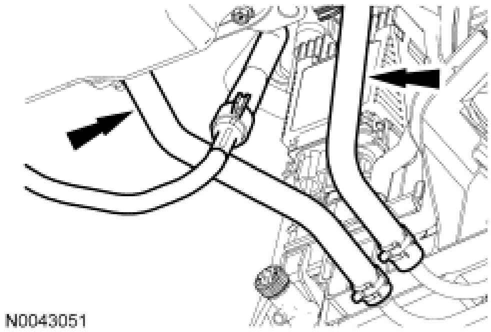


Fig. 18: Locating Transmission Fluid Cooler Hoses
Courtesy of FORD MOTOR CO.

NOTE: **Use care not to overstretch or extend the hose clamps as damage may**

occur to the hose clamp and cause a leak.

NOTE: The hose clamps are held on the hose with a special epoxy. Damage may occur to the hose if the clamp is removed from the hose. If the clamp or hose is damaged, install a new fluid cooler tube.

6. Connect the transmission fluid cooler hoses to the transmission fluid cooler tubes.

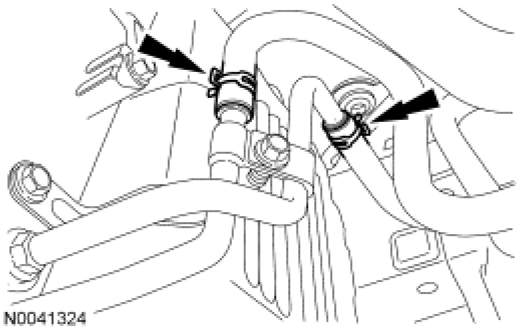


Fig. 19: Locating Transmission Fluid Cooler Hoses
Courtesy of FORD MOTOR CO.

7. Install the lower transmission fluid cooler tube in the radiator.
   - Tighten to 30 Nm (22 lb-ft).

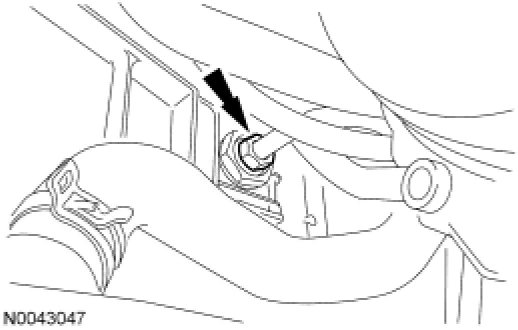


Fig. 20: Locating Lower Transmission Fluid Cooler Tube
Courtesy of FORD MOTOR CO.

8. Install the front splash shield.
   1. Position the splash shield in place and install the 2 screws.
   2. Install the 4 retainers.
   3. Install the 4 bolts.

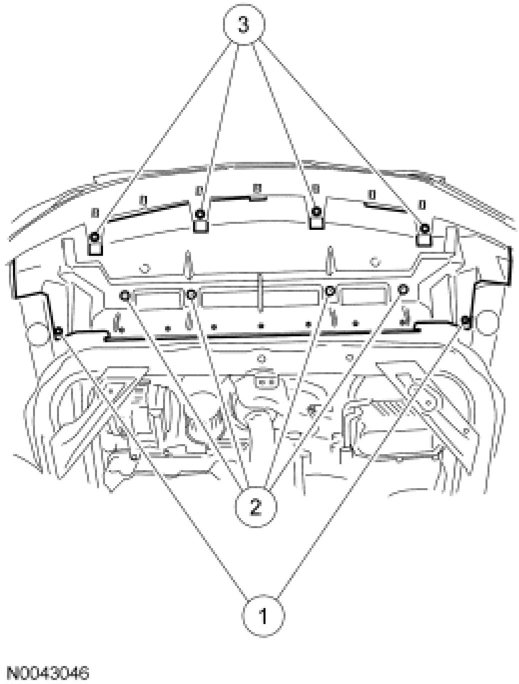


Fig. 21: Identifying Front Splash Shield Screws, Bolts And Retainers
Courtesy of FORD MOTOR CO.

9. If equipped, install the bolts and the splash shield.

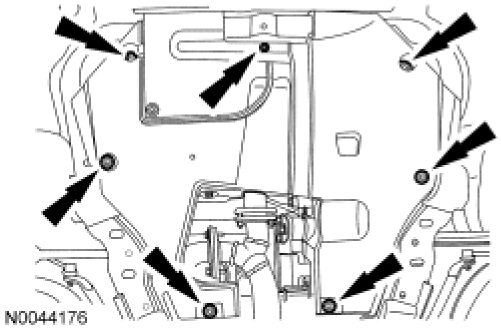
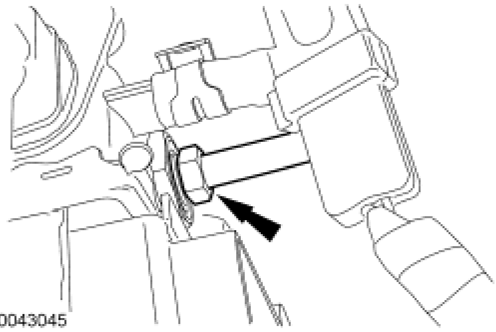


Fig. 22: Locating Underbody Cover Screws
Courtesy of FORD MOTOR CO.

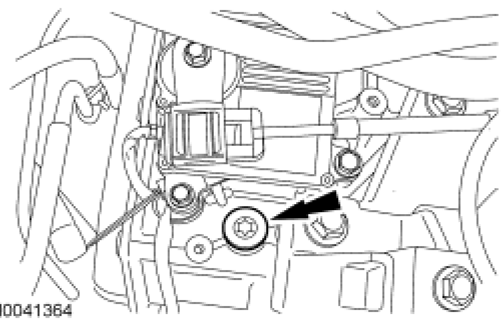
10. Install the upper transmission fluid cooler tube in the radiator.
    - Tighten to 30 Nm (22 lb-ft).



N0043045

Fig. 23: Locating Upper Transmission Fluid Cooler Tube
Courtesy of FORD MOTOR CO.

11. Remove the transmission fluid fill plug.

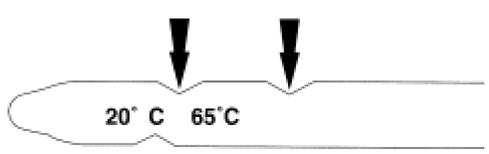


N0041364

Fig. 24: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

NOTE: Transmission fluid level at normal operating temperature is between the top 2 marks on the fluid level indicator.

12. Check the transmission fluid level and add transmission fluid as necessary.



N0044164

Fig. 25: Locating Temperature Marks On Fluid Level Indicator
Courtesy of FORD MOTOR CO.

13. Install the transmission fluid fill plug.

- Tighten to 39 Nm (29 lb-ft).

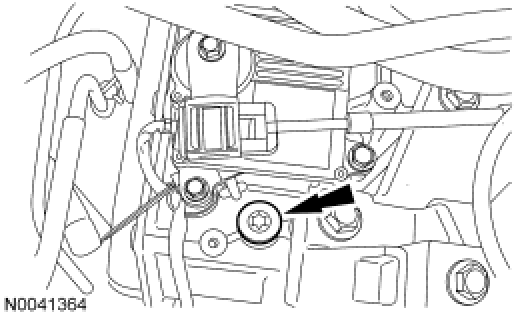


Fig. 26: Locating Fluid Fill Plug
Courtesy of FORD MOTOR CO.

TRANSMISSION FLUID COOLER TUBES - FNR5

Material

Item	Specification
FNR5 Automatic Transmission Fluid XT-9-QMM5	Mazda MES MN 117C (ATF-M V)

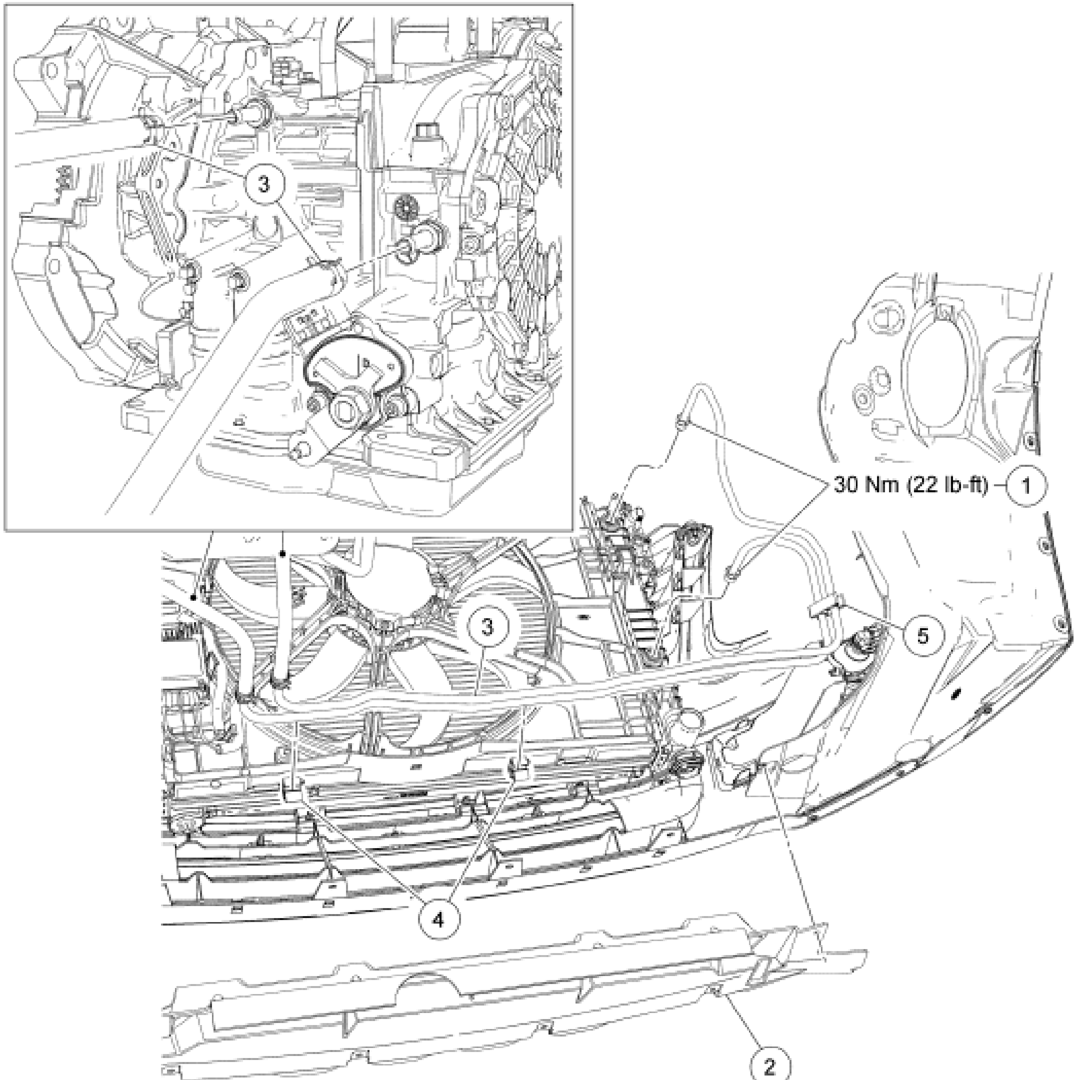


Fig. 27: Exploded View Of Transmission Cooler Tubes With Torque Specification - FNR5
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	M52923	Transmission fluid cooler tube radiator fittings
2	8B407	Radiator splash shield
3	7H420	Transmission fluid cooler tube assembly
4	256844	Transmission fluid cooler tube retaining clips
5	256679	Transmission fluid cooler tube retaining clip

REMOVAL

NOTE: MERCON®, MERCON® V, MERCON® SP, Motorcraft Premium Automatic Transmission Fluid, Motorcraft Continuously Variable Chain Type Transmission Fluid and FNR5 Automatic Transmission Fluid are not interchangeable transmission fluids. The use of any transmission fluid other than what is recommended for this transaxle will cause transaxle damage.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the upper transmission fluid cooler tube from the radiator.

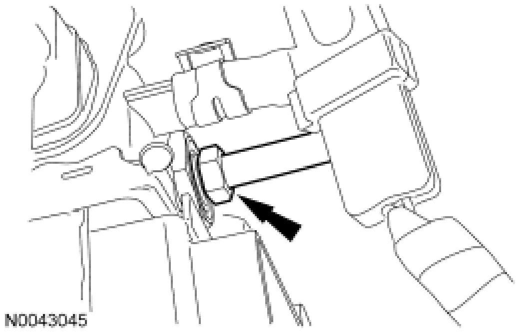


Fig. 28: Locating Upper Transmission Fluid Cooler Tube
Courtesy of FORD MOTOR CO.

3. Remove the bolts and the splash shield.

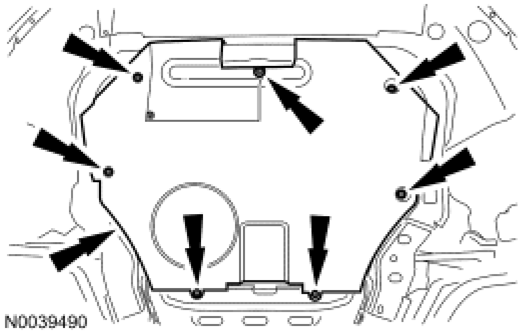


Fig. 29: Locating Splash Shield Bolts
Courtesy of FORD MOTOR CO.

4. Remove the front splash shield.
   1. Remove the 2 screws.
   2. Remove the 4 retainers.
   3. Remove the 4 bolts and the splash shield.

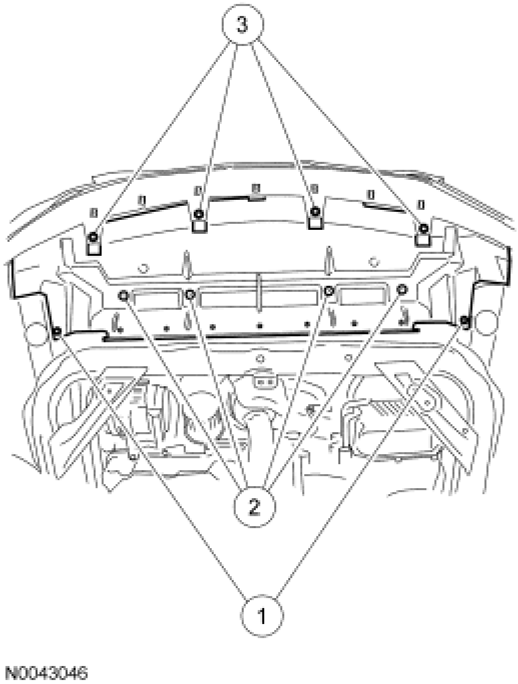


Fig. 30: Identifying Front Splash Shield Screws, Bolts And Retainers
Courtesy of FORD MOTOR CO.

5. Disconnect the lower transmission fluid cooler tube from the radiator.

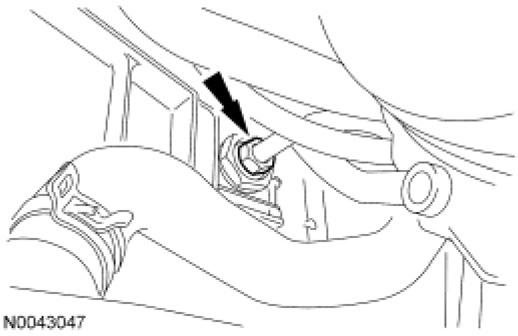


Fig. 31: Locating Lower Transmission Fluid Cooler Tube
Courtesy of FORD MOTOR CO.

NOTE:	**Use care not to overstretch or extend the hose clamps as damage may occur to the hose clamp and cause a leak.**
NOTE:	**The hose clamps are held on the hose with a special epoxy. Damage may occur to the hose if the clamp is removed from the hose. If the clamp or hose is damaged, install a new fluid cooler tube.**

6. Disconnect the transmission fluid cooler hoses from the transmission.

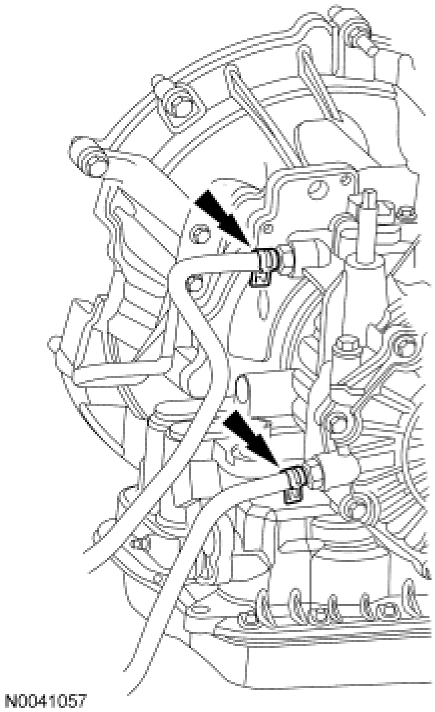


Fig. 32: Locating Transmission Fluid Cooler Hoses
Courtesy of FORD MOTOR CO.

NOTE: When removing the transmission fluid cooler tubes from the retainers, do not remove the retainers from the shroud.

7. Remove the transmission fluid cooler tubes from the retainers.

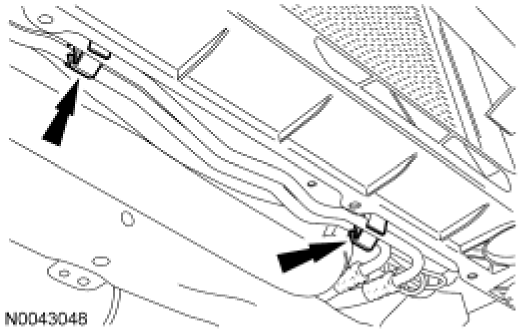


Fig. 33: Locating Transmission Fluid Cooler Tubes Retainers
Courtesy of FORD MOTOR CO.

8. Remove the transmission fluid cooler tube retainer and remove the transmission fluid cooler tubes.

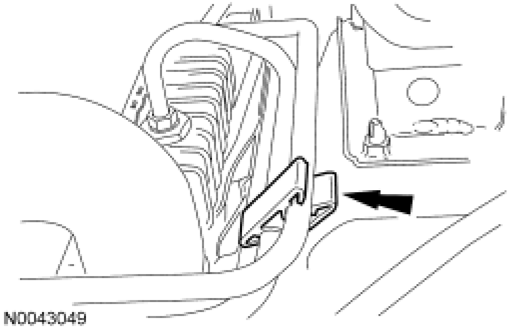


Fig. 34: Locating Transmission Fluid Cooler Tubes Retainers
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Position the transmission fluid cooler tubes in place and install the retainer.

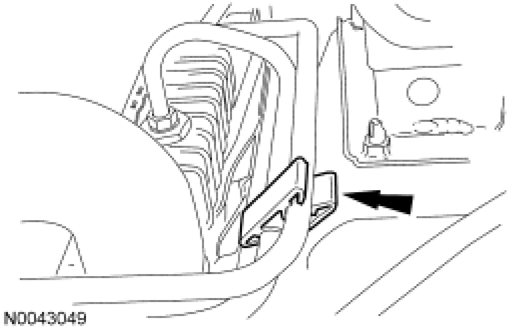


Fig. 35: Locating Transmission Fluid Cooler Tubes Retainers
Courtesy of FORD MOTOR CO.

2. Install the transmission fluid cooler tubes in the retainers.

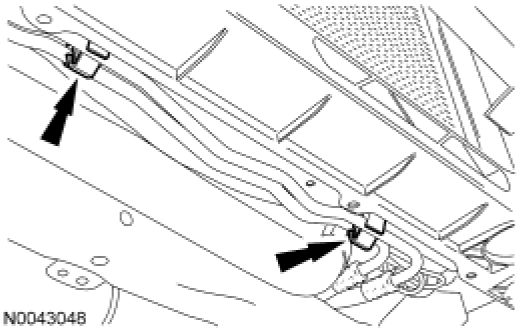


Fig. 36: Locating Transmission Fluid Cooler Tubes Retainers
Courtesy of FORD MOTOR CO.

NOTE: The power steering hose is routed between the 2 transmission fluid cooler hoses.

3. Position the transmission fluid cooler hoses in place.

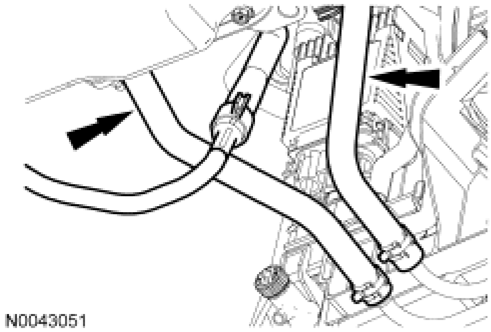


Fig. 37: Locating Transmission Fluid Cooler Hoses
Courtesy of FORD MOTOR CO.

NOTE: **Use care not to overstretch or extend the hose clamps as damage may occur to the hose clamp and cause a leak.**

NOTE: **The hose clamps are held on the hose with a special epoxy. Damage may occur to the hose if the clamp is removed from the hose. If the clamp or hose is damaged, install a new fluid cooler tube.**

4. Connect the transmission fluid cooler hoses to the transaxle.

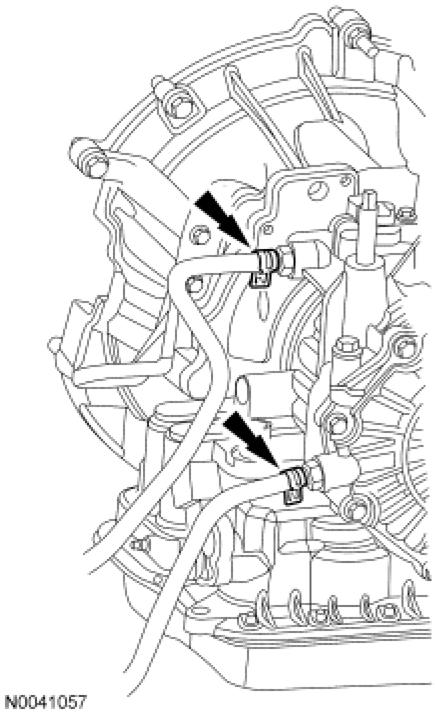


Fig. 38: Locating Transmission Fluid Cooler Hoses
Courtesy of FORD MOTOR CO.

5. Install the lower transmission fluid cooler tube to the radiator.
    - Tighten to 30 Nm (22 lb-ft).

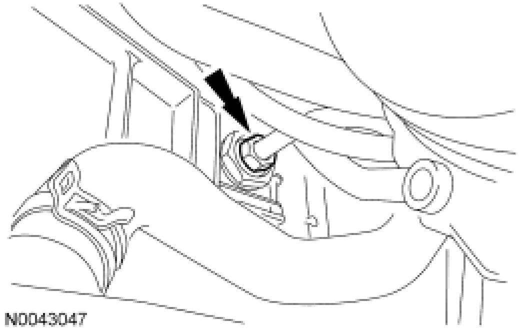


Fig. 39: Locating Lower Transmission Fluid Cooler Tube
Courtesy of FORD MOTOR CO.

6. Install the front splash shield.
    1. Position the splash shield in place and install the 2 screws.
    2. Install the 4 retainers.
    3. Install the 4 bolts.

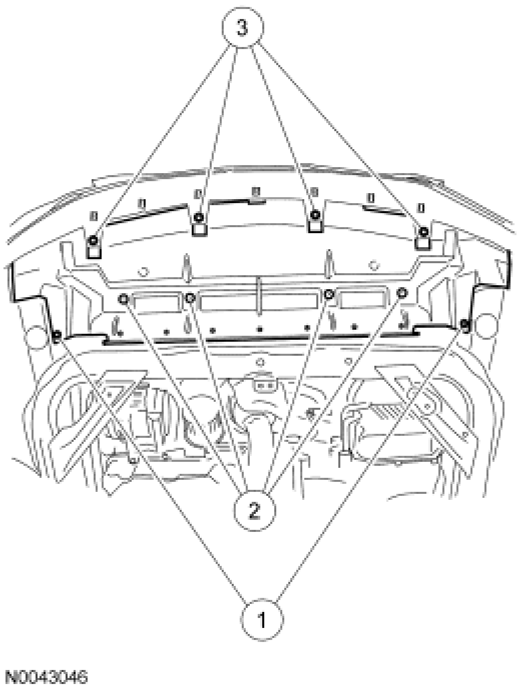


Fig. 40: Identifying Front Splash Shield Screws, Bolts And Retainers
Courtesy of FORD MOTOR CO.

7. Install the splash shield and the bolts.

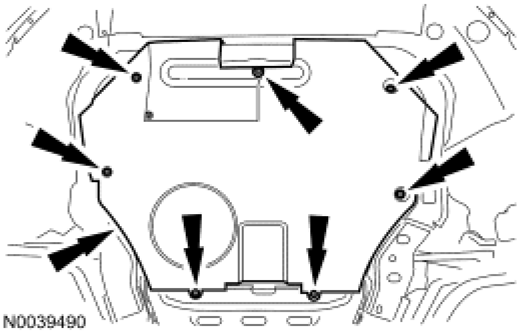


Fig. 41: Locating Splash Shield Bolts
Courtesy of FORD MOTOR CO.

8. Install the upper transmission fluid cooler tube to the radiator.
   - Tighten to 30 Nm (22 lb-ft).

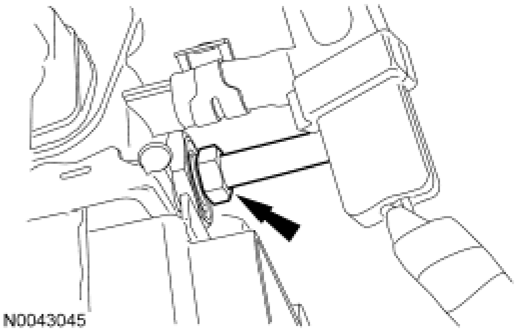


Fig. 42: Locating Upper Transmission Fluid Cooler Tube
Courtesy of FORD MOTOR CO.

9. Check the transmission fluid level and add transmission fluid as necessary.

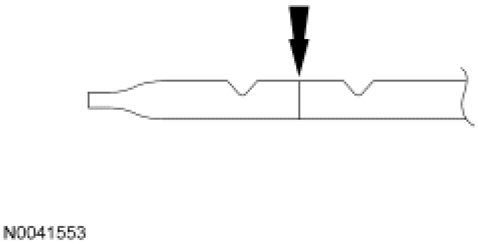


Fig. 43: Locating Transmission Fluid Level
Courtesy of FORD MOTOR CO.

2008 TRANSMISSIONS

Transfer Case - Power Transfer Unit (PTU) - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V	-
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A	0.53L (18 oz)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Driveshaft-to-output flange bolts	70	52	-
Filler plug	20	-	177
Pinion flange nut[a]	-	-	-
Power Transfer Unit (PTU) support bracket bolts	70	52	-
PTU-to-transaxle bolts	90	66	-

[a] Refer to the procedure.

DESCRIPTION AND OPERATION

POWER TRANSFER UNIT (PTU)

The All-Wheel Drive (AWD) system consists of the following:

- Power Transfer Unit (PTU)
- Rear driveshaft
- 4X4 control module
- Rear axle with coupling device

The PTU is a gearbox that attaches to the transaxle. The RH intermediate shaft passes through the PTU and engages the differential side gear as in normal Front Wheel Drive (FWD) applications. The PTU directs power to the rear driveshaft through a helical gear spline coupled to the transaxle differential case, a helical gear drop

(idler gear) and hypoid/helical ring gear assembly and pinion set. The PTU is sealed from the transaxle and has its own oil sump.

Serviceable components of the PTU are limited to the output shaft seal and flange, intermediate shaft seal and deflector, the cover seal and the PTU-transaxle compression seal. The internal components are not serviced. Do not remove the cover of the PTU. If any of the geared components, bearings, case cover or internal shafts are worn or damaged, a new PTU must be installed.

DIAGNOSTIC TESTS

POWER TRANSFER UNIT (PTU)

Principles of Operation

The Power Transfer Unit (PTU) is a gearbox that attaches to the transaxle. The RH intermediate shaft passes through the PTU and engages the differential side gear as in normal Front Wheel Drive (FWD) applications. The PTU directs power to the rear driveshaft through a helical gear spline coupled to the transaxle differential case, a helical gear drop (idler gear) and hypoid/helical ring gear assembly and pinion set. The PTU is sealed from the transaxle and has its own oil sump.

Serviceable components of the PTU are limited to the output shaft seal and flange, intermediate shaft seal and deflector, the cover seal and the PTU-transaxle compression seal. The internal components are not serviced. Do not remove the cover of the PTU. If any of the geared components, bearings, case cover or internal shafts are worn or damaged, a new PTU must be installed.

Heat Protection Mode - During very extreme off-road operation, the All-Wheel Drive (AWD) system utilizes a heat protection mode to protect the Active Torque Coupling (ATC) solenoid (part of rear axle) from damage. If the system detects an overheat condition, it enters a locked mode. If the heat in the system continues to rise once in the locked mode, the 4X4 control module disables the ATC solenoid. Allow the system to cool down at least 10 minutes with the ignition switch in the ON position.

For concerns with the 4X4 control module or ATC, refer to **FOUR WHEEL DRIVE (4WD) SYSTEMS** article.

Inspection and Verification

1. Verify the customer concern.
2. Inspect for obvious signs of mechanical damage.

VISUAL INSPECTION CHART

Mechanical
• Power Transfer Unit (PTU) • Halfshafts and CV joints • Driveshaft and U-joints • Wheel/tire size and brand

- Matching tire size and brand
- Tire pressure

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and Go to **Symptom Chart - Power Transfer Unit (PTU)**.

Symptom Chart - Power Transfer Unit (PTU)

Symptom Chart - Power Transfer Unit (PTU)

Condition	Possible Sources	Action
• The Power Transfer Unit (PTU) makes noise	• Tire inflation pressure • Tire and wheel size	• MAKE SURE all tires and wheels are the same size and brand and the inflation pressures are correct.
	• Fluid level	• FILL with the correct type and amount of lubricant. REFER to **Power Transfer Unit (PTU) Draining and Filling**.
	• Internal components	• OPERATE the vehicle in all gears. If there is noise in the transaxle in NEUTRAL, or in some gears and not in others, REMOVE and REPAIR the transaxle. Refer to the appropriate Automatic Transmission article for the procedure. If there is noise in all gears, INSTALL a new PTU. REFER to **Power Transfer Unit (PTU)**.
• Leaking fluid from the PTU vent	• PTU over filled	• REFER to **Analysis of Leakage**.
• Leaking automatic transmission fluid	• PTU intermediate shaft seal • PTU compression seal	• REFER to **Analysis of Leakage**.
• Leaking gear lubricant from the seals	• The PTU vent is plugged (located on top of the PTU)	• INSTALL a new PTU. REFER to **Power Transfer Unit (PTU)**.
	• Damaged seals	• REFER to **Analysis of Leakage**.
• Vehicle has no or inadequate torque at rear wheels	• Rear axle	• REFER to **REAR DRIVE AXLE/DIFFERENTIAL** article.

• Vehicle binds in a turn or resists turning/pulsates or shudders in a straight line	• PTU mechanical failure	• REFER to **Power Transfer Unit (PTU)**.
	• Wheels/tires	• REFER to **WHEELS AND TIRES** article.
	• Brake system	• REFER to **BRAKE SYSTEM - GENERAL INFORMATION** article.
	• Wheel bearings	• REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.
	• Halfshafts	• REFER to **DRIVELINE SYSTEM - GENERAL INFORMATION** article.
	• Wheel speed sensor (s)	• REFER to **VEHICLE DYNAMIC SYSTEMS** article.
	• ABS module	• REFER to **VEHICLE DYNAMIC SYSTEMS** article.

Analysis of Leakage

The PTU may leak different color fluids, red oil leak for an automatic transmission fluid and brown/black gear lube for PTU fluid. The PTU seals prevent these types of fluids from leaking. It is important to note which color of fluid is leaking to conduct the most appropriate service procedure.

PTU Leaks From the RH Side

NOTE: **Remove and replace leaking seals using the information found in the Intermediate Shaft Seal and Deflector or Cover Seal replacement procedure. The specified tools called out in this procedure will allow seal replacement without causing damage to the Power Transfer Unit (PTU) casing/drive gear.**

If the leak is red automatic transmission fluid, this indicates the differential seals in the transaxle are also leaking and need to be replaced along with the intermediate shaft seal. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21** article to replace the differential seals before replacing the intermediate shaft seal. Refer to the **Intermediate Shaft Seal and Deflector** procedure to replace the intermediate seal.

If the leak is brown/black gear lube, then the PTU larger cover seal needs replacement. This is located on the PTU cover behind the deflector. Refer to **Cover Seal** procedure.

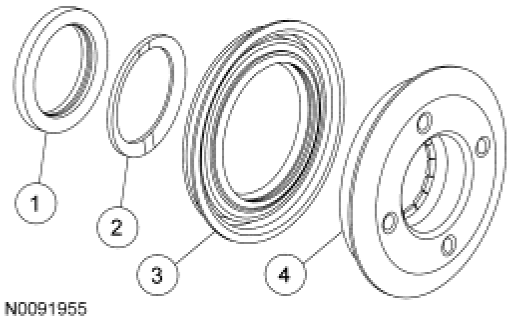


Fig. 1: Identifying Intermediate Shaft Seal
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Intermediate shaft seal (part of kit 7275)
2	-	Alignment washer (part of kit 7275)
3	-	Cover seal (part of kit 7275)
4	-	Seal deflector (part of kit 7275)

PTU Leaks From the LH Side

If the leak is the red automatic transmission fluid, the compression seal needs replacement. This is between the PTU and transmission. Refer to **Power Transfer Unit (PTU)** in the Removal portion of this section.

If the leak is brown/black, the PTU is overfilled and venting fluid from the top of the PTU. Flush and fill the PTU. Refer to **Power Transfer Unit (PTU) Draining and Filling**.

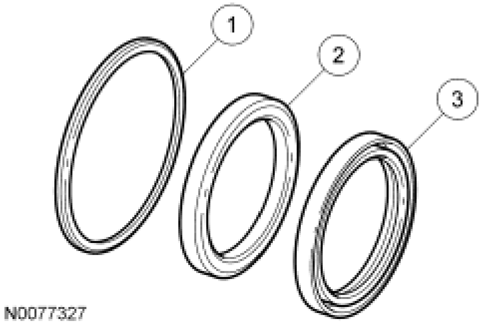


Fig. 2: PTU Leaks From LH Side
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Power Transfer Unit (PTU)-to-transaxle compression seal (7086)
2	-	Transfer case driver gear seal (not serviceable)
3	-	Transfer case driver gear seal (not serviceable)

GENERAL PROCEDURES

POWER TRANSFER UNIT (PTU) DRAINING AND FILLING

Material

Item	Specification
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A

NOTE: **A new Power Transfer Unit (PTU) must be installed any time the PTU has been submerged in water.**

NOTE: **The Power Transfer Unit (PTU) is not to be drained unless contamination is suspected. To drain the PTU fluid, the PTU must be removed from the vehicle. The fluid that is drained may appear black and have a pungent odor. Do not mistake this for contaminated fluid. For additional information, refer to Power Transfer Unit (PTU) in the Removal portion of this section.**

NOTE: **Fill level checks are done in-vehicle only. Let the vehicle sit 10 minutes after the road test before checking the fluid level.**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Clean the area around the filler plug before removing.

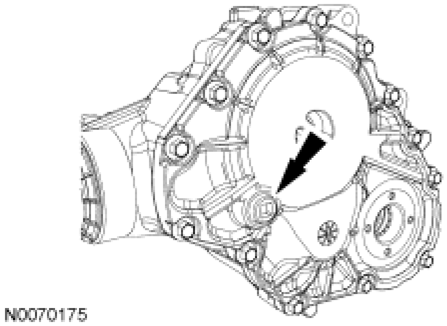


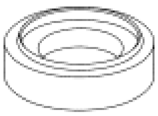
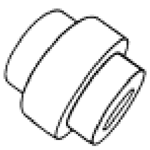
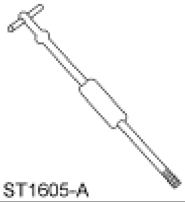
Fig. 3: Locating Fill Plug
Courtesy of FORD MOTOR CO.

3. Remove and discard the filler plug.
4. With the vehicle on a flat, level surface, fill the PTU with lubricant. The fluid must be even with the bottom of the fill opening.
   - Fluid capacity is 0.53L (18 oz).
5. Install a new filler plug.
   - Tighten to 20 Nm (177 lb-in).

IN-VEHICLE SERVICING

COVER SEAL

Special Tools

Illustration	Tool Name	Tool Number
 ST3082-A	Handle, Driver 32 in	205-907
 ST2572-A	Installer, Halfshaft Oil Seal	308-431
 ST1164-A	Installer, Shaft Bearing Cup	308-221 (T94P-7025-BH)
 ST2446-A	Remover, Halfshaft	205-241
 ST1605-A	Slide Hammer	100-01 (T50T-100-A)

REMOVAL

NOTE: **The Power Transfer Unit (PTU) may leak different color fluids, red oil leak for automatic transmission fluid and brown/black gear lube for PTU fluid. The PTU seals prevent these types of fluids from leaking. It is important to note which color fluid is leaking to conduct the most appropriate service procedure. This procedure will correct a brown/black (gear lube) leak from the RH side of the PTU. For additional information, refer to Analysis of Leakage.**

NOTE: **This procedure is to be performed through the RH wheel opening. It is not necessary to remove the exhaust components to complete this repair.**

1. Remove the intermediate shaft seal and deflector. For additional information, refer to **Intermediate Shaft Seal and Deflector**.

NOTE: There is a bearing inside the PTU directly behind the cover seal. The bearing is not serviced.

2. Remove the cover seal using the Slide Hammer, the extension from the Halfshaft Remover and a suitable seal puller inserted into the groove of the seal.

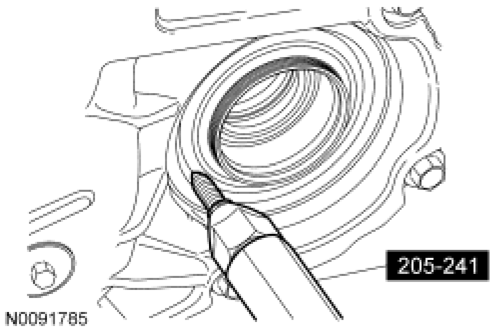


Fig. 4: Removing Cover Seal Using Slide Hammer
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Assemble the Driver Handle, the Halfshaft Oil Seal Installer and the Shaft Bearing Cup Installer as shown.

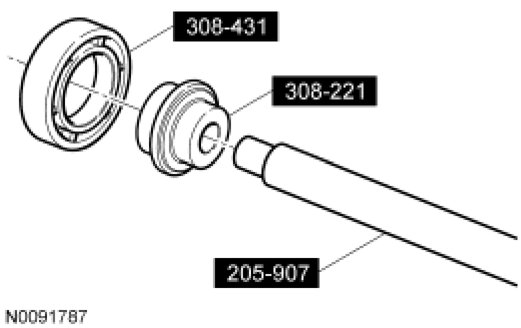


Fig. 5: Assembling Driver Handle, Halfshaft Oil Seal Installer & Shaft Bearing Cup Installer
Courtesy of FORD MOTOR CO.

2. Using the Driver Handle, the Halfshaft Oil Seal Installer and the Shaft Bearing Cup Installer, install the cover seal in the PTU.

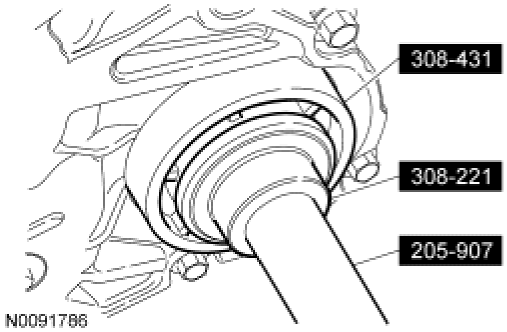
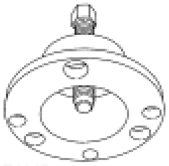


Fig. 6: Installing Cover Seal In PTU
Courtesy of FORD MOTOR CO.

3. Install the intermediate shaft seal and deflector. For additional information, refer to **Intermediate Shaft Seal and Deflector**.
4. Fill the PTU fluid as necessary. For additional information, refer to **Power Transfer Unit (PTU) Draining and Filling** in this section.

OUTPUT SHAFT SEAL

Special Tools

Illustration	Tool Name	Tool Number
 ST1185-A	Holding Fixture, Drive Pinion Flange	205-126 (T78P-4851-A)
 ST2571-A	Installer, PTU Drive Gear Outer Oil Seal	308-430
 ST2937A	Remover, Output Flange	307-523

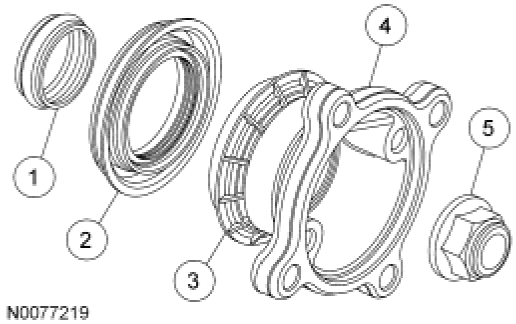


Fig. 7: Output Shaft Seal and Flange
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Collapsible spacer (part of 7275 kit)
2	-	Output shaft seal (part of 7275 kit)
3	-	Output shaft seal deflector (part of 7275 kit)
4	-	Output pinion flange (part of 7275 kit)
5	-	Pinion flange nut (part of 7275 kit)

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the exhaust flexible pipe. For additional information, refer to **EXHAUST SYSTEM** article.

NOTE: Index-mark both the driveshaft flanges for installation.

3. Remove the 4 driveshaft-to-Power Transfer Unit (PTU) output flange bolts. Disconnect the driveshaft from the PTU and position it aside.
   - Using mechanic's wire, support the driveshaft.

NOTE: Rotational torque of the PTU rear output shaft flange must be measured and recorded using a Nm (lb-in) torque wrench for correct pinion bearing preload when reassembled. This will be the torque-to-turn measurement.

4. Using a suitable torque wrench, measure and record the rotational torque.

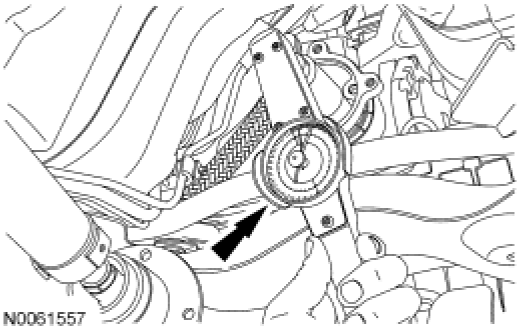


Fig. 8: Measuring Rotational Torque Using A Suitable Torque Wrench
Courtesy of FORD MOTOR CO.

5. Using the Drive Pinion Flange Holding Fixture, hold the output pinion flange. Remove and discard the pinion nut.

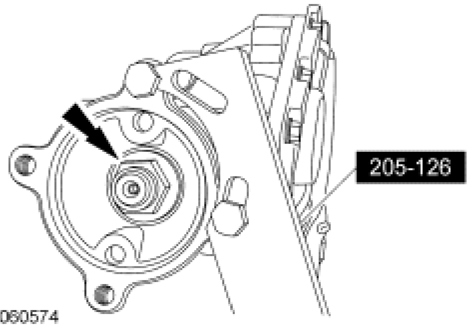


Fig. 9: Holding Output Pinion Flange Using Special Tool (205-126)
Courtesy of FORD MOTOR CO.

NOTE: Index-mark the output pinion flange to the pinion shaft.

6. Using the Output Flange Remover, remove the output pinion flange.

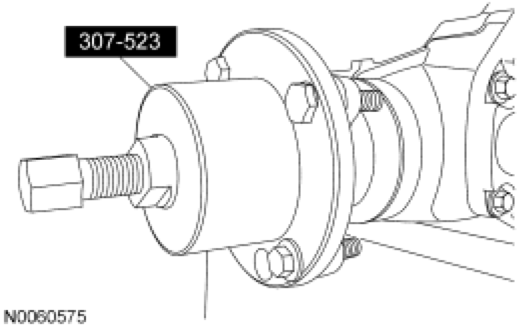


Fig. 10: Removing Output Pinion Flange Using Special Tool (307-523)
Courtesy of FORD MOTOR CO.

7. Remove and discard the output shaft seal deflector.

8. Remove and discard the output shaft seal.
9. Remove and discard the collapsible spacer.

INSTALLATION

1. Install the new collapsible spacer.
2. Using the PTU Drive Gear Outer Oil Seal Installer, install the output shaft seal.

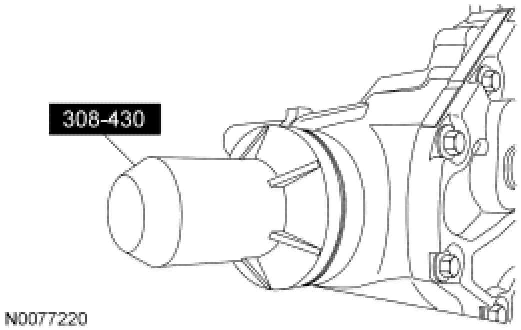


Fig. 11: Installing Output Shaft Seal Using Special Tool (308-430)
Courtesy of FORD MOTOR CO.

3. Using the PTU Drive Gear Outer Oil Seal Installer, install the output shaft seal deflector.

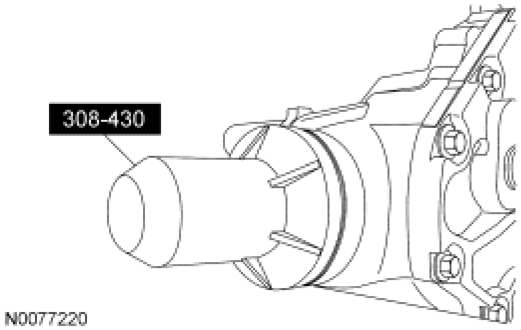


Fig. 12: Installing Output Shaft Seal Using Special Tool (308-430)
Courtesy of FORD MOTOR CO.

NOTE: **Install the output pinion flange to engage the spline as previously marked.**

4. Install the output pinion flange.

NOTE: **Refer to the rotational torque previously recorded with the Nm (lb-in) torque wrench. Tighten the pinion nut in small increments until it is within 0.3 Nm (3 lb-in) of the reference measurement. If 0.3 Nm (3 lb-in) is exceeded, then the collapsible spacer will be damaged and a new collapsible spacer will be required.**

5. Using the Drive Pinion Flange Holding Fixture to hold the output pinion flange, install and tighten the new pinion flange nut.

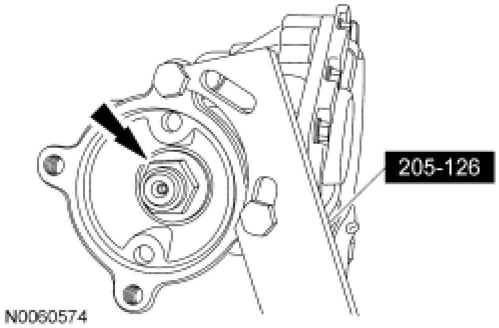
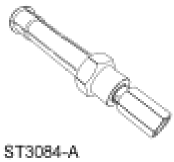


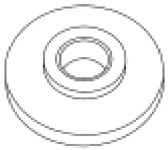
Fig. 13: Holding Output Pinion Flange Using Special Tool (205-126)
Courtesy of FORD MOTOR CO.

6. Position the driveshaft using the index mark and install the 4 driveshaft-to-PTU output flange bolts. Tighten bolts in a star pattern.
   - Tighten to 70 Nm (52 lb-ft).
7. Install the exhaust flexible pipe. For additional information, refer to **EXHAUST SYSTEM** article.
8. Fill the PTU, if necessary. For additional information, refer to **Power Transfer Unit (PTU) Draining and Filling**.

INTERMEDIATE SHAFT SEAL AND DEFLECTOR

Special Tools

Illustration	Tool Name	Tool Number
	Bearing Cup Remover	308-125 (T87P-7120-D)
	Handle, Driver 32 in	205-907
	Installer, PTU Link shaft Seal	205-883

 ST3053-A	Installer, PTU Link shaft Seal Dust Shield	205-882
 ST2446-A	Remover, Halfshaft	205-241

General Equipment

5/8 in (16 mm) washer (used with 308-125)

Material

Item	Specification
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	-
Motorcraft MERCON® LV Automatic Transmission Fluid XT-10-QLV	MERCON® LV
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

REMOVAL

NOTE: **The Power Transfer Unit (PTU) may leak different color fluids, red oil leak for automatic transmission fluid and brown/black gear lube for PTU fluid. The PTU seals prevent these types of fluids from leaking. It is important to note which color fluid is leaking to conduct the most appropriate service procedure. This procedure will correct a red oil leak (automatic transmission fluid) from the intermediate shaft seal on the RH side of the PTU. If the leak is red automatic transmission fluid, this indicates that the differential seals in the transaxle are also leaking and need to be replaced along with the intermediate shaft seal. Refer to AUTOMATIC TRANSAXLE/TRANSMISSION - AISIN AW21 article to replace the differential seals before replacing the intermediate shaft seal. For additional information, refer to Analysis of Leakage.**

NOTE: **This procedure is to be performed through the RH wheel opening. It is not necessary to remove the exhaust components to complete this repair.**

1. Remove the intermediate shaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.

NOTE: The following instruction will prevent the Bearing Cup Remover from opening too far which would make removing the intermediate shaft seal deflector difficult.

2. Place a 16 mm (5/8 in) washer between the components of the Bearing Cup Remover as shown.

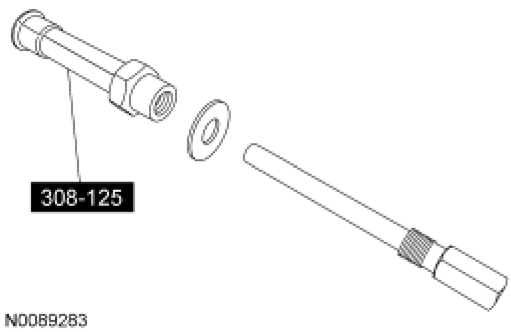


Fig. 14: Placing Washer Between Components Of Bearing Cup Remover
Courtesy of FORD MOTOR CO.

NOTE: Using a 5-pound or larger slide hammer eases the removal of the seal deflector.

3. Using the Bearing Cup Remover, the extension from the Halfshaft Remover, and a suitable slide hammer, remove the seal deflector.
   - The seal deflector will have been damaged during removal. Remove all foreign material from the PTU before continuing with the repair.

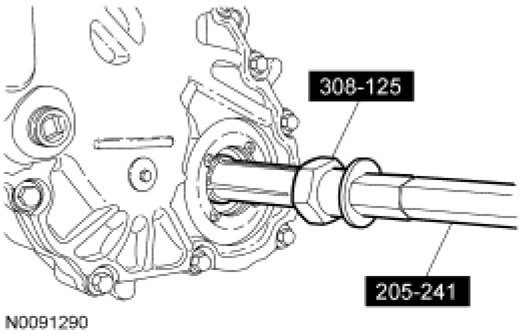


Fig. 15: Removing Seal Deflector
Courtesy of FORD MOTOR CO.

4. Using the Bearing Cup Remover, the extension from the Halfshaft Remover, and a suitable slide hammer, remove the intermediate shaft seal, and if equipped, the alignment washer.

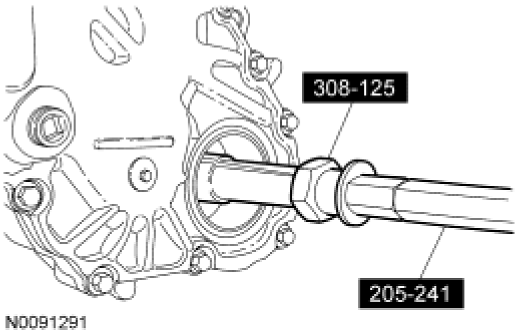


Fig. 16: Removing Intermediate Shaft Seal
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: **The following illustration shows the correct orientation of the seal components when installed in the vehicle.**

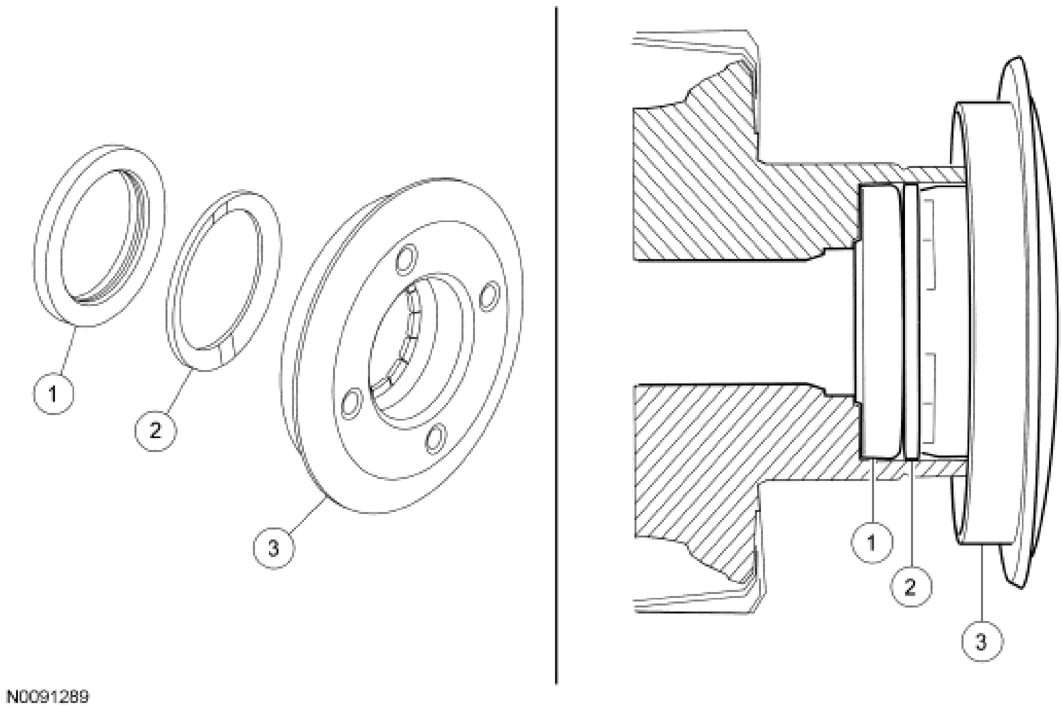


Fig. 17: View Of Correct Orientation Of Seal Components When Installed In Vehicle
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Intermediate shaft seal (part of 7275 kit)
2	-	Alignment washer (part of 7275 kit)
3	-	Seal deflector (part of 7275 kit)

1. Place the intermediate shaft seal on the PTU Link shaft Seal Installer and Driver Handle with the spring side facing away from the tool.

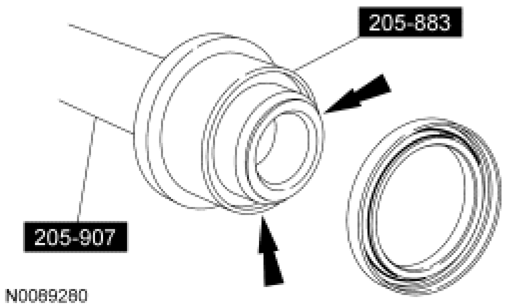


Fig. 18: Placing Intermediate Shaft Seal On PTU Link shaft Seal Installer
Courtesy of FORD MOTOR CO.

2. Using the PTU Link shaft Seal Installer and Driver Handle, install the intermediate shaft seal.

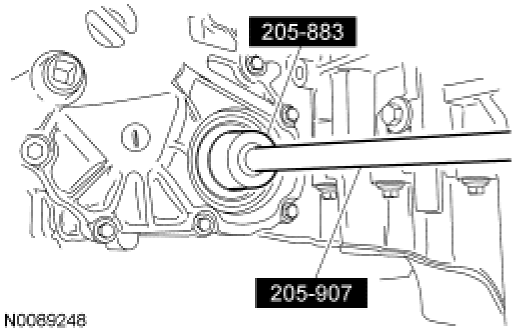


Fig. 19: Installing Intermediate Shaft Seal
Courtesy of FORD MOTOR CO.

3. Place the alignment washer on the PTU Link shaft Seal Installer and Driver Handle with the beveled edge (white-striped side) facing towards the tool.

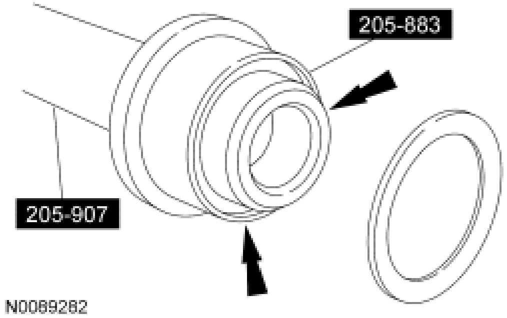


Fig. 20: Placing Intermediate Shaft Seal On PTU Link shaft Seal Installer
Courtesy of FORD MOTOR CO.

NOTE: **Do not use force when installing the alignment washer or damage to the washer can occur.**

4. Using the PTU Link shaft Seal Installer and Driver Handle, install the alignment washer by hand, pushing it in until it bottoms against the seal.
   - When installed, the white-striped side should be facing out.

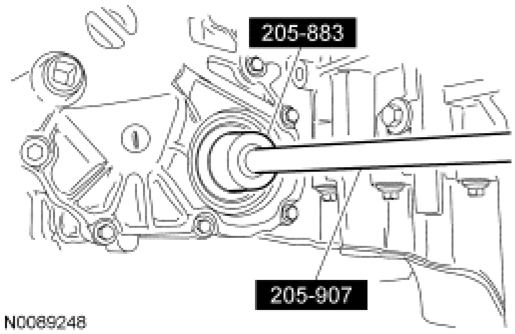


Fig. 21: Installing Alignment Washer By Hand
Courtesy of FORD MOTOR CO.

NOTE: **Do not overheat (melt) the seal deflector. Monitor the temperature of the deflector with a suitable temperature measuring device, such as a digital temperature laser or infrared thermometer, while heating. Do not allow the temperature to exceed 100°C (212°F). Overheating will damage the deflector. If the deflector is damaged, a new deflector must be used.**

NOTE: **Apply a small amount of silicone brake caliper grease and dielectric compound to the inner lip of the deflector where it installs on the tube inside the PTU before heating. This will ease the installation of the deflector.**

5. Position the deflector on the PTU Link shaft Seal Dust Shield Installer using silicone brake caliper grease and dielectric compound to retain it to the installer. Using a suitable heat gun, heat the deflector to a minimum of 66°C (150°F) and a maximum of 100°C (212°F) by concentrating the heat across the back of the installer while rotating, not directly on the deflector itself.
   - As an alternative method to heating the seal deflector, place the deflector in boiling water for 3 to 5 minutes. Dry off the deflector and install.

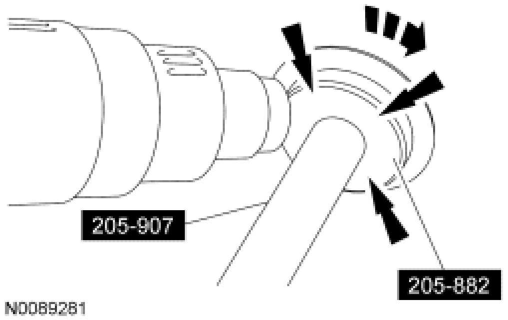


Fig. 22: Applying Small Amount Of Silicone Brake Caliper Grease & Dielectric Compound To Inner Lip Of Deflector
Courtesy of FORD MOTOR CO.

6. Install the seal deflector immediately after heating using the PTU Link shaft Seal Dust Shield Installer and Driver Handle.

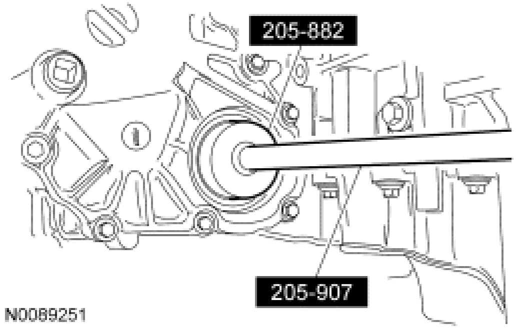


Fig. 23: Installing Seal Deflector
Courtesy of FORD MOTOR CO.

7. Make sure the deflector is completely seated all the way around and there are no cracks on the face or inner diameter white-colored tab. The deflector is correctly installed when the face of the deflector is recessed 3-5 mm (0.12-0.20 in) into the pocket all the way around.

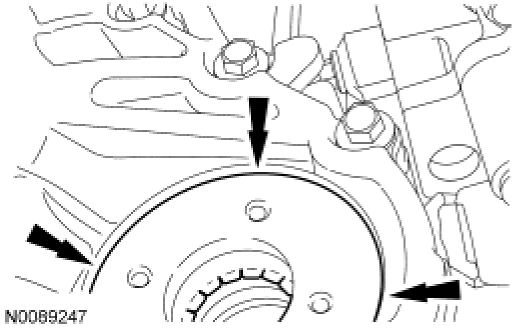


Fig. 24: Making Sure Deflector Is Completely Seated All The Way Around
Courtesy of FORD MOTOR CO.

NOTE: Some residual fluid will collect between the seal and deflector during this

repair. This is a normal condition and should not be misinterpreted as a leak after the repair is complete.

8. Using brake parts cleaner, thoroughly clean the deflector and intermediate shaft area of any residual fluid that may have accumulated during the repair.
9. Install the intermediate shaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** article.
10. Top off the transmission fluid as necessary.

REMOVAL

POWER TRANSFER UNIT (PTU)

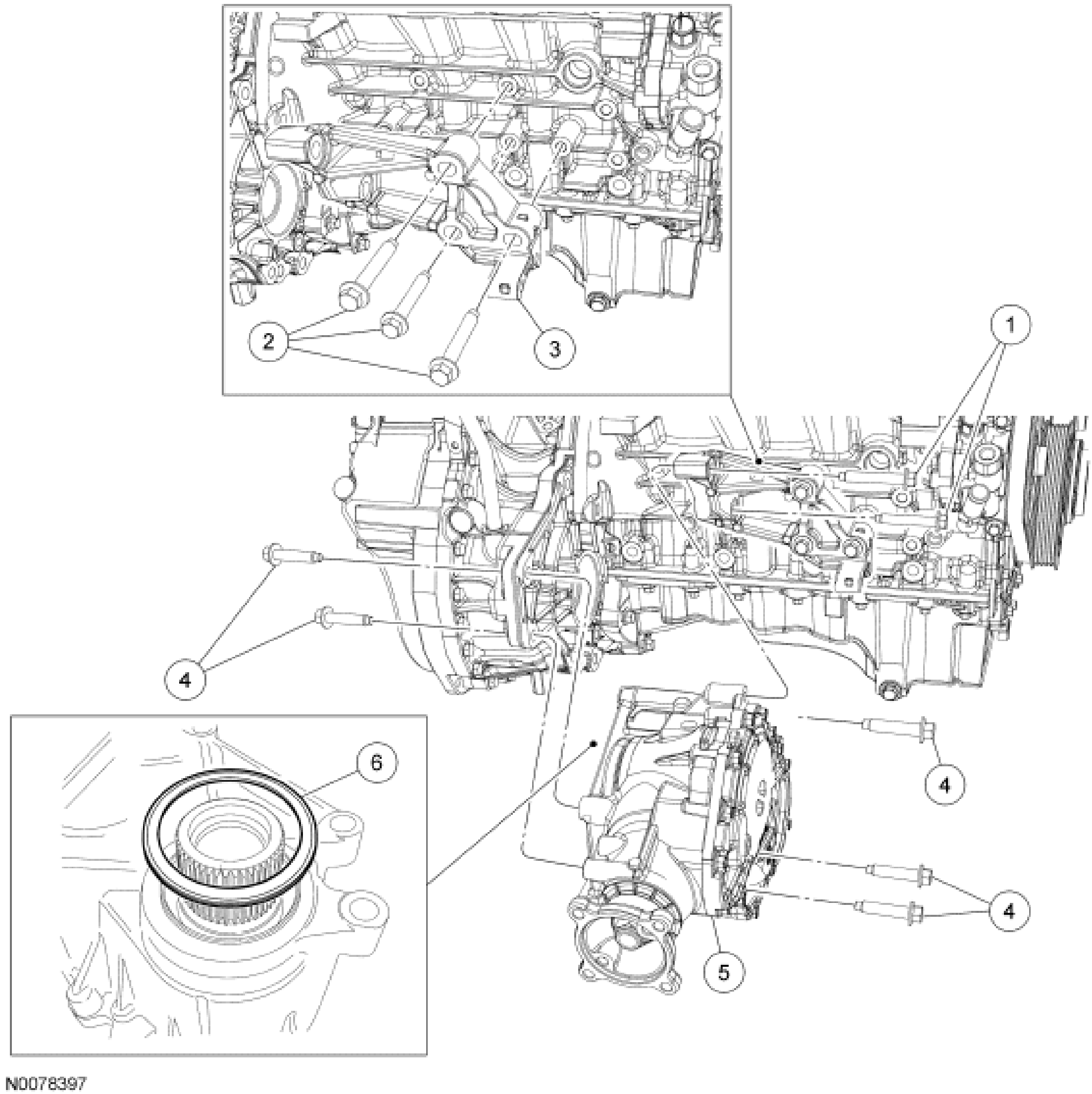


Fig. 25: Exploded View Of Power Transfer Unit (PTU)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W500724	Power Transfer Unit (PTU)-to-support bracket bolts (2 required)
2	W500724	PTU support bracket-to-engine block bolts (3 required)
3	7A444	PTU support bracket
4	W500741	PTU-to-transaxle bolts (3 required)
5	7251	PTU
6	7087	Compression seal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the driveshaft. For additional information, refer to **DRIVESHAFT** article.
3. Remove the RH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.
4. Remove the 2 Power Transfer Unit (PTU)-to-support bracket bolts, then remove the 3 PTU support bracket bolts and the PTU support bracket.

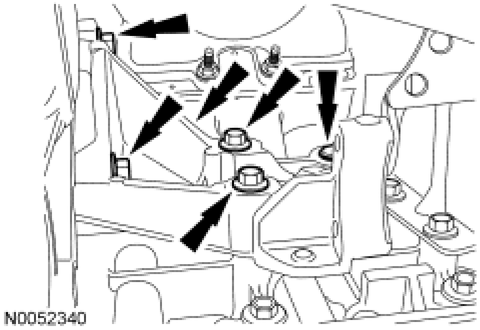


Fig. 26: Locating Power Transfer Unit (PTU) Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

5. Remove the 5 PTU-to-transaxle bolts.

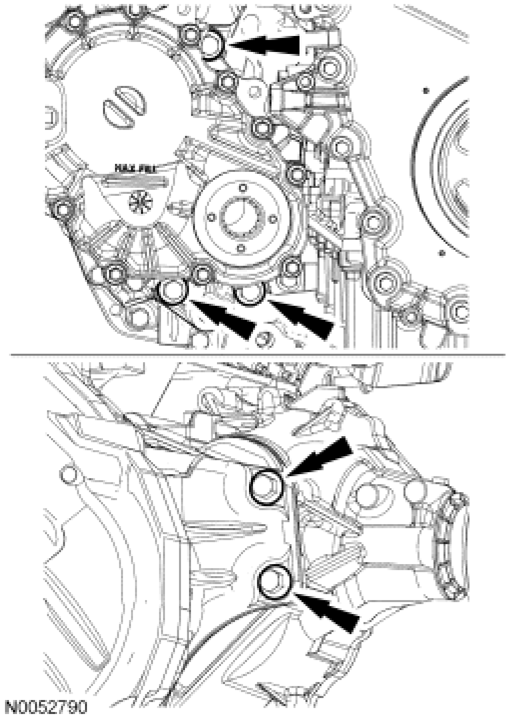


Fig. 27: Locating PTU Bolts
Courtesy of FORD MOTOR CO.

6. Separate the PTU from the transaxle. Remove the PTU from the vehicle.

NOTE: **A new compression seal must be installed whenever the PTU is removed from the vehicle.**

7. Using a suitable tool, remove the compression seal and discard.

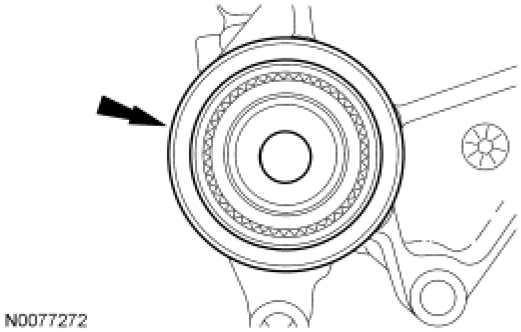


Fig. 28: Identifying Compression Seal
Courtesy of FORD MOTOR CO.

INSTALLATION

POWER TRANSFER UNIT (PTU)

Material

Item	Specification
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A

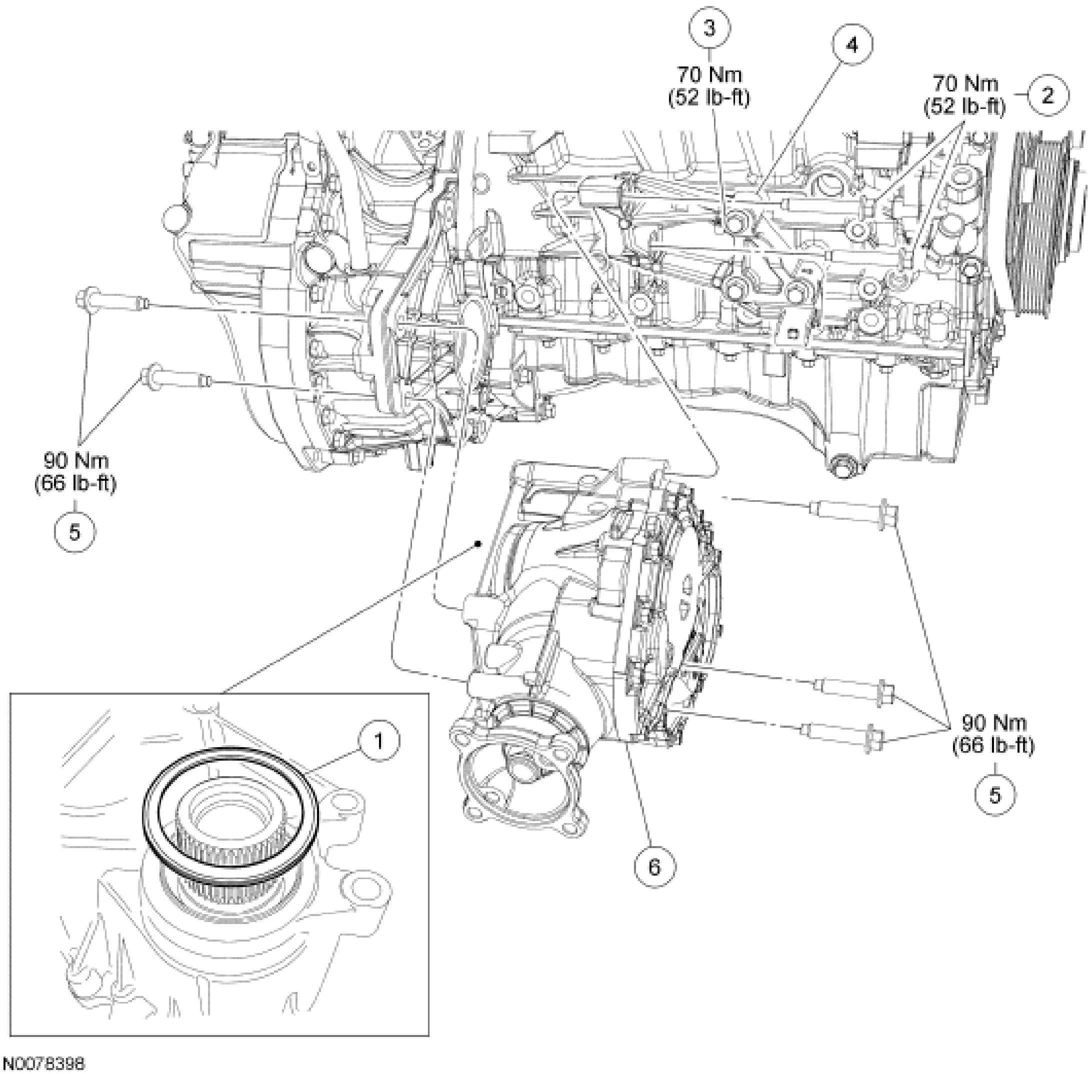


Fig. 29: Exploded View Of Power Transfer Unit (PTU) With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7087	Compression seal
2	W500724	Power Transfer Unit (PTU)-to-support bracket bolts (2 required)
3	W500724	PTU support bracket-to-engine block bolt (3 required)
4	7A444	PTU support bracket

5	W500741	PTU-to-transaxle bolts (5 required)
6	7251	PTU

NOTE: A new compression seal must be installed whenever the Power Transfer Unit (PTU) is removed from the vehicle.

1. Using a suitable tool, install the new compression seal.

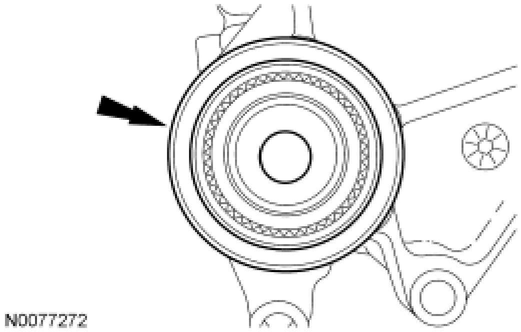


Fig. 30: Identifying Compression Seal
Courtesy of FORD MOTOR CO.

NOTE: A new PTU intermediate shaft seal and deflector must be installed whenever the intermediate shaft or PTU is removed from the vehicle.

2. Position the PTU to the transaxle. Install the 5 PTU-to-transaxle bolts.
   - Tighten to 90 Nm (66 lb-ft).

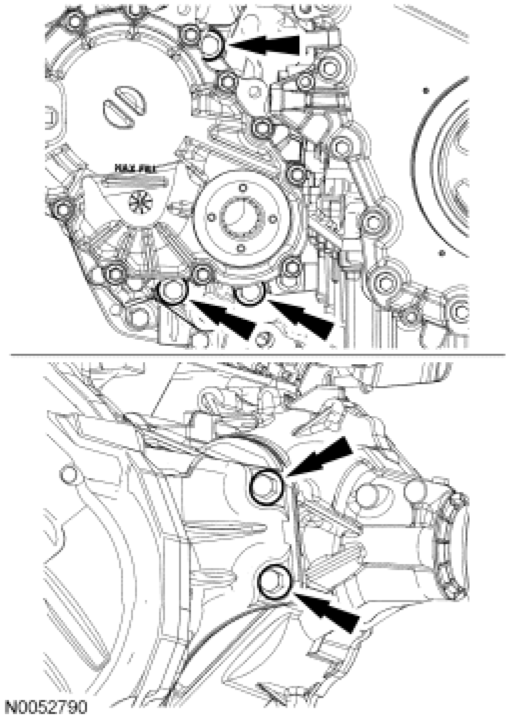


Fig. 31: Locating PTU Bolts
Courtesy of FORD MOTOR CO.

3. Position the PTU support bracket into place and install the 5 PTU support bracket bolts.
    1. Tighten the bolts to the transaxle to 70 Nm (52 lb-ft).
    2. Tighten the bolts to the engine to 70 Nm (52 lb-ft).

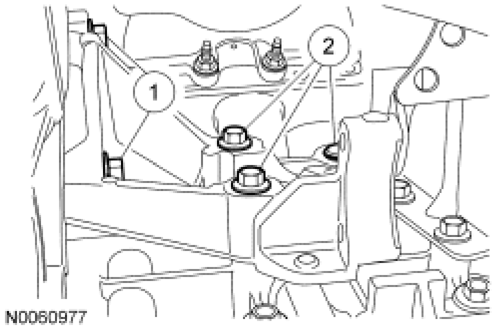


Fig. 32: Identifying Transaxle Bolts & Engine Bolts
Courtesy of FORD MOTOR CO.

4. Install the driveshaft. For additional information, refer to **DRIVESHAFT** article.
5. Install the RH catalytic converter. For additional information, refer to **EXHAUST SYSTEM** article.
6. Top off all fluids as necessary.

GENERAL INFORMATION

Trouble Shooting - Basic Procedures

* PLEASE READ THIS FIRST *

NOTE: **This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.**

ACCESSORIES & ELECTRICAL

CHARGING SYSTEM TROUBLE SHOOTING

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BASIC CHARGING SYSTEM TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Vehicle Will Not Start	
Dead battery	Check battery cells, alternator belt tension and alternator output
Loose or corroded battery connections	Check all charging system connections
Ignition circuit or switch malfunction	Check and replace as necessary
Alternator Light Stays On With Engine Running	
Loose or worn alternator drive belt	Check alternator drive tension and condition, See Belt Adjustment in TUNE-UP article in the TUNE-UP section
Loose alternator wiring connections	Check all charging system connections

Short in alternator light wiring	See Indicator Warning Lights in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
Defective alternator stator or diodes	See Bench Tests in ALTERNATOR article
Defective regulator	See Regulator Check in ALTERNATOR article
Alternator Light Stays Off With Ignition Switch ON	
Blown fuse	See WIRING DIAGRAMS
Defective alternator	See Testing in ALTERNATOR article
Defective indicator light bulb or socket	See Indicator Warning Lights in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
Alternator Light Stays OFF With Ignition Switch ON	
Short in alternator wiring	See On-Vehicle Tests in ALTERNATOR article
Defective rectifier bridge	See Bench Tests in ALTERNATOR article
Lights or Fuses Burn Out Frequently	
Defective alternator wiring	See On-Vehicle Tests in ALTERNATOR article
Defective regulator	See Regulator Check in ALTERNATOR article
Defective battery	Check and replace as necessary
Ammeter Gauge Shows Discharge	
Loose or worn drive belt	Check alternator drive belt tension and condition. See Belt Adjustment in TUNE-UP article in the TUNE-UP section
Defective wiring	Check all wires and wire connections
Defective alternator or regulator	See Bench Tests and On-Vehicle Tests in ALTERNATOR article
Defective ammeter, or improper ammeter wiring connection	See Testing in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
Noisy Alternator	
Loose drive pulley	Tighten drive pulley attaching nut

Loose mounting bolts	Tighten all alternator mounting bolts
Worn or dirty bearings	See Bearing Replacement ALTERNATOR article
Defective diodes or stator	See Bench Test in ALTERNATOR article
Battery Does Stay Charged	
Loose or worn drive belt	Check alternator drive belt tension and condition. See Belt Adjustment in appropriate TUNE-UP article in the TUNE-UP section
Loose or corroded battery connections	Check all charging system connections
Loose alternator connections	Check all charging system connections
Defective alternator or battery	See On-Vehicle Tests and Bench Tests in ALTERNATOR article
Add-on electrical accessories exceeding alternator capacity	Install larger alternator
Battery Overcharged-Uses Too Much Water	
Defective battery	Check alternator output and repair as necessary
Defective alternator	See On-Vehicle Test and Bench Tests in ALTERNATOR article
Excessive alternator voltage	Check alternator output and repair as necessary

IGNITION SYSTEM TROUBLE SHOOTING

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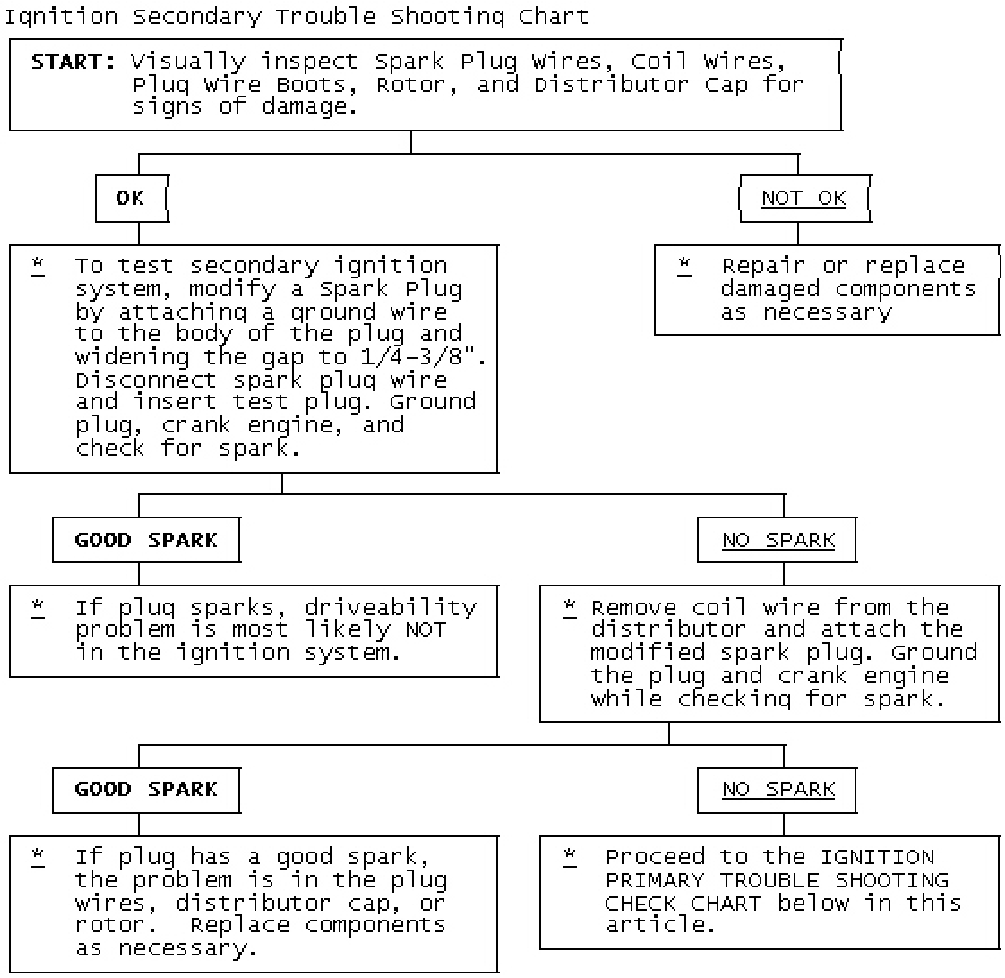

Fig. 1: Ignition Secondary Trouble Shooting Chart

Ignition Primary Trouble Shooting Chart

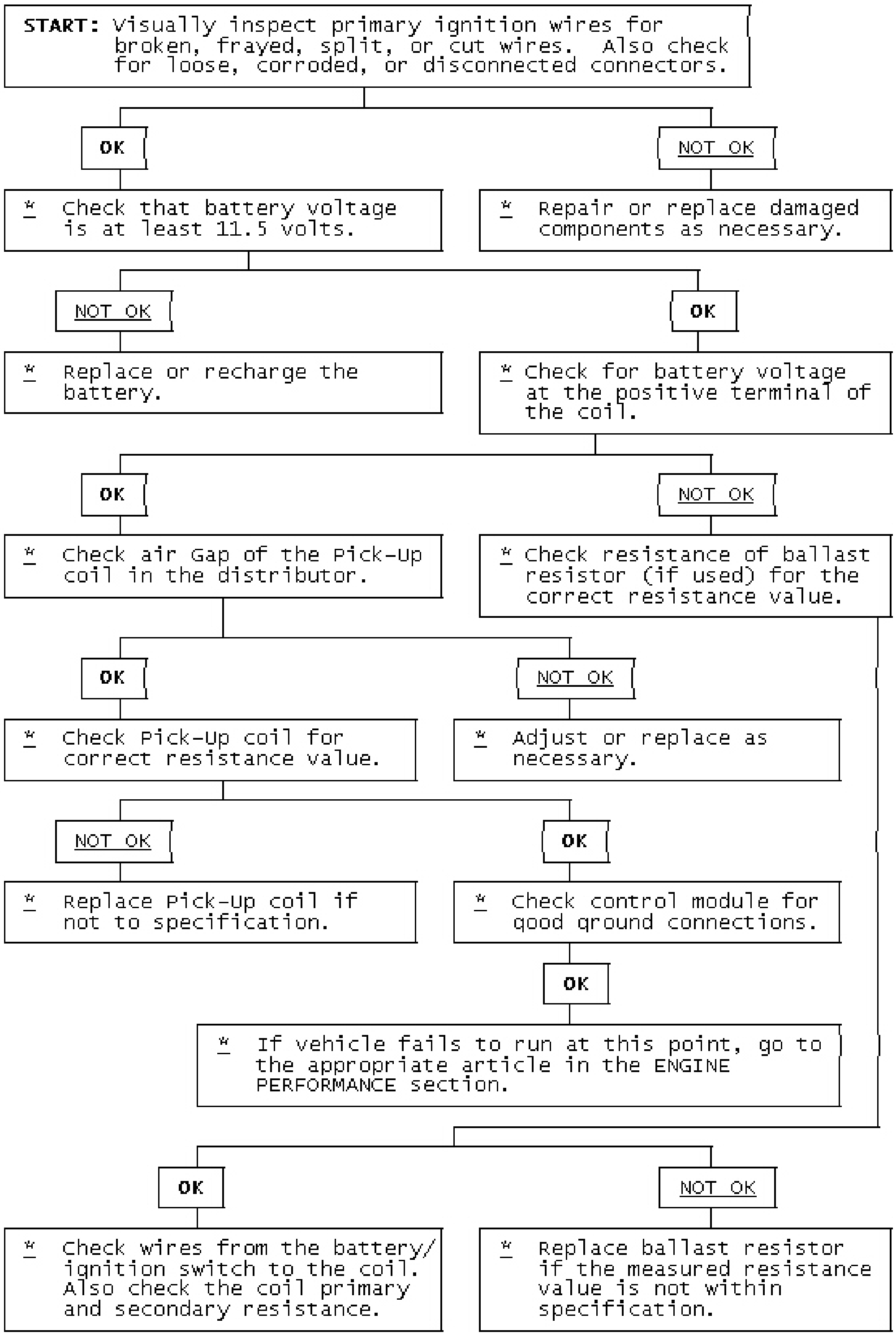

Fig. 2: Ignition Primary Trouble Shooting Chart

STARTER TROUBLE SHOOTING

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BASIC STARTER TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Starter Fails to Operate	
Dead battery or bad connections between starter and battery	Check battery charge and all wires and connections to starter
Ignition switch faulty or misadjusted	Adjust or replace ignition switch
Open circuit between starter switch ignition terminal on starter relay	Check and repair wires and connections as necessary
Starter relay or starter defective	See Testing in STARTER article
Open solenoid pull-in wire	Testing in STARTER article
Starter Does Not Operate and Headlights Dim	
Weak battery or dead cell	Charge or replace battery as necessary
Loose or corroded battery connections	Check that battery connections are clean and tight
Internal ground in starter windings	See Testing in STARTER article
Grounded starter fields	See Testing in STARTERS
Armature rubbing on pole	See STARTER article shoes
Starter Turns but Engine Does Not Rotate	
Starter clutch slipping	See STARTER article
Broken clutch housing	See STARTER article
Pinion shaft rusted or dry	See STARTER article
Engine basic timing incorrect	See Ignition Timing in TUNE-UP article
Broken teeth on engine flywheel	Replace flywheel and check for starter pinion gear damage
Starter Will Not Crank Engine	
Faulty overrunning clutch	See STARTER article
Broken clutch housing	See STARTER article
Broken flywheel teeth	Replace flywheel and check

	for starter pinion gear damage
Armature shaft sheared or reduction gear teeth stripped	See STARTER article
Weak battery	Charge or replace battery as necessary
Faulty solenoid	See On-Vehicle Tests in STARTER article
Poor grounds	Check all ground connections for tight and clean connections
Ignition switch faulty or misadjusted	Adjust or replace ignition switch as necessary
Starter Cranks Engine Slowly	
Battery weak or defective	Charge or replace battery as necessary
Engine overheated	See ENGINE COOLING SYSTEM article
Engine oil too heavy	Check that proper viscosity oil is used
Poor battery-to-starter connections	Check that all between battery and starter are clean and tight
Current draw too low or too high	See Bench Tests in STARTER article
Bent armature, loose pole shoes screws or worn bearing	See STARTER article
Burned solenoid contacts	Replace solenoid
Faulty starter	Replace starter
Starter Engages Engine Only Momentarily	
Engine timing too far advanced	See Ignition Timing in TUNE-UP article
Overrunning clutch not engaging properly	Replace overrunning clutch. See STARTER article
Broken starter clutch	See STARTER article
Broken teeth on engine flywheel	Replace flywheel and check starter pinion gear for damage
Weak drive assembly thrust spring	See STARTER article
Weak hold-in coil	See Bench Tests in STARTER article
Starter Drive Will Not Engage	
Defective point assembly	See Testing in STARTER article
Poor point assembly ground	See Testing in STARTER article
Defective pull-in coil	Replace starter solenoid
Starter Relay Does Not Close	
Dead battery	Charge or replace battery as

	necessary
Faulty wiring	Check all wiring and connections leading to relay
Neutral safety switch faulty	Replace neutral safety switch
Starter relay faulty	Replace starter relay
Starter Drive Will Not Disengage	
Starter motor loose on mountings	Tighten starter attach bolts
Worn drive end bushing	See STARTER article
Damaged engine flywheel teeth	Replace flywheel and starter pinion gear for damage
Drive yolk return spring broken or missing	Replace return spring
Faulty ignition switch	Replace ignition switch
Insufficient clearance between winding leads to solenoid terminal and main contact in solenoid	Replace starter solenoid
Starter clutch not disengaging	Replace starter clutch
Ignition starter switch	Replace ignition switch contacts sticking
Starter Relay Operates but Solenoid Does Not	
Faulty solenoid switch, switch connections or relay	Check all wiring between relay and solenoid or replace relay or solenoid as necessary
Broken lead or loose soldered connections	Repair wire or wire connections as necessary
Solenoid Plunger Vibrates When Switch is Engaged	
Weak battery	Charge or replace battery as necessary
Solenoid contacts corroded	Clean contacts or replace solenoid
Faulty wiring	Check all wiring leading to solenoid
Broken connections inside switch cover	Repair connections or replace solenoid
Open hold-in wire	solenoid
Low Current Draw	
Worn brushes or weak brush springs	Replace brushes or brush springs as necessary
High Pitched Whine During Cranking Before Engine Fires but Engine Fires and Cranks Normally	
Distance too great between starter pinion and flywheel	Align starter or check that correct starter and flywheel are being used
High Pitched Whine After Engine Fires With Key released. Engine Fires and Cranks Normally	
Distance too small between starter pinion and flywheel	Flywheel runout contributes to the intermittent nature

AIR CONDITIONING & HEAT

AIR CONDITIONING TROUBLE SHOOTING

WARNING: **This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.**

BASIC AIR CONDITIONING TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Compressor Not Working	Compressor clutch circuit open.
.....	Compressor clutch coil inoperative.
.....	Poor clutch ground connection.
.....	Fan belts loose.
.....	Thermostatic switch inoperative.
.....	Thermostatic switch not adjusted.
.....	Ambient temperature switch open.
.....	Superheat fuse blown.
Excessive Noise or Vibration	Missing or loose mounting bolts.
.....	Bad idler pulley bearings.
.....	Fan belts not tightened correctly.
.....	Compressor clutch contacting body.
.....	Excessive system pressure.
.....	Compressor oil level low.
.....	Damaged clutch bearings.
.....	Damaged reed valves.
.....	Damaged compressor.
Insufficient or No Cooling; Compressor Working	Expansion valve inoperative.
.....	Heater control valve stuck open.
.....	Low system pressure.
.....	Blocked condenser fins.
.....	Blocked evaporator fins.
.....	Vacuum system leak.
.....	Vacuum motors inoperative.
.....	Control cables improperly adjusted.
.....	Restricted air inlet.
.....	Mode doors binding.
.....	Blower motor inoperative.

.....	Temperature above system capacity.

HEATER SYSTEM TROUBLE SHOOTING

NOTE: **This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.**

BASIC HEATER SYSTEM TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Insufficient, Erratic, or No Heat	Low Coolant Level
.....	Incorrect thermostat.
.....	Restricted coolant flow through core.
.....	Heater hoses plugged.
.....	Misadjusted control cable.
.....	Sticking heater control valve.
.....	Vacuum hose leaking.
.....	Vacuum hose blocked.
.....	Vacuum motors inoperative.
.....	Blocked air inlet.
.....	Inoperative heater blower motor.
.....	Oil residue on heater core fins.
.....	Dirt on heater core fins.
Too Much Heat	Improperly adjusted cables.
.....	Sticking heater control valve.
.....	No vacuum to heater control valve.
.....	Temperature door stuck open.
Air Flow Changes During Acceleration	Vacuum system leak.
.....	Bad check valve or reservoir.
Air From Defroster At All Times	Vacuum system leak.
.....	Improperly adjusted control cables.
.....	Inoperative vacuum motor.
Blower Does Not Operate Correctly	Blown fuse.
.....	Blower motor windings open.
.....	Resistors burned out.
.....	Motor ground connection loose.
.....	Wiring harness connections loose.
.....	Blower motor switch inoperative.
.....	Blower relay inoperative.

.....	Fan binding or foreign object in housing.
.....	Fan blades broken or bent.

BRAKES

BRAKE SYSTEM TROUBLE SHOOTING

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BRAKE SYSTEM TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Brakes Pull Left or Right	
Incorrect tire pressure	Inflate tires to proper pressure
Front end out of alignment	See WHEEL ALIGNMENT
Mismatched tires	Check tires sizes
Restricted brake lines or hoses	Check hose routing
Loose or malfunctioning caliper	See DISC BRAKES or BRAKE SYSTEM
Bent shoe or oily linings	See DRUM BRAKES or BRAKE SYSTEM
Malfunctioning rear brakes	See DRUM, DISC BRAKES or BRAKE SYSTEM
Loose suspension parts	See SUSPENSION
Noises Without Brakes Applied	
Front linings worn out	Replace linings
Dust or oil on drums or rotors	See DRUM, DISC BRAKES or BRAKE SYSTEM
Noises With Brakes Applied	
Insulator on outboard shoe damaged	See DISC BRAKES or BRAKE SYSTEM
Incorrect pads or linings	Replace pads or linings
Brake Rough, Chatters or Pulsates	
Excessive lateral runout	Check rotor runout
Parallelism not to specifications	Reface or replace rotor
Wheel bearings not adjusted	See SUSPENSION
Rear drums out-of-round	Reface or replace drums
Disc pad reversed, steel against rotor	Remove and reinstall pad
Excessive Pedal Effort	
Malfunctioning power unit	See POWER BRAKES or

	BRAKE SYSTEM
Partial system failure	Check fluid and pipes
Worn disc pad or lining	Replace pad or lining
Caliper piston stuck or sluggish	See DISC BRAKES or BRAKE SYSTEM
Master cylinder piston stuck	See MASTER CYLINDERS or BRAKE SYSTEM
Brake fade due to incorrect pads for linings	Replace pads or linings
Linings or pads glazed	Replace pads or linings
Worn drums	Reface or replace drums
Excessive Pedal Travel	
Partial brake system failure	Check fluid and pipes
Insufficient fluid in master cylinder	See MASTER CYLINDERS or BRAKE SYSTEM
Air trapped in system	See BRAKE BLEEDING or BRAKE SYSTEM
Rear brakes not adjusted	See Adjustments in DRUM BRAKES or BRAKE SYSTEM
Bent shoe or lining	See DRUM BRAKES or BRAKE SYSTEM
Plugged master cylinder cap	See MASTER CYLINDERS or BRAKE SYSTEM
Improper brake fluid	Replace brake fluid
Pedal Travel Decreasing	
Compensating port plugged	See MASTER CYLINDERS or BRAKE SYSTEM
Swollen cup in master cylinder	See MASTER CYLINDERS or BRAKE SYSTEM
Master cylinder piston not returning	See MASTER CYLINDERS or BRAKE SYSTEM
Weak shoe retracting springs	See DRUM BRAKES BRAKE SYSTEM
Wheel cylinder piston sticking	See DRUM BRAKES or BRAKE SYSTEM
Dragging Brakes	
Master cylinder pistons not returning	See MASTER CYLINDERS BRAKE SYSTEM
Restricted brake lines or hoses	Check line routing
Incorrect parking brake adjustment	See DRUM BRAKES BRAKE SYSTEM
Parking Brake cables frozen	See DRUM BRAKES BRAKE SYSTEM

Incorrect installation of inboard disc pad	Remove and replace correctly
Power booster output rod too long	See POWER BRAKE UNITS BRAKE SYSTEM
Brake pedal not returning freely	See DISC, DRUM BRAKES BRAKE SYSTEM
Brakes Grab or Uneven Braking Action	
Malfunction of combination valve	See CONTROL VALVE or BRAKE SYSTEM
Malfunction of power brake unit	See POWER BRAKE UNITS or BRAKE SYSTEM
Binding brake pedal	See DISC, DRUM BRAKES or BRAKE SYSTEM
Pulsation or Roughness	
Uneven pad wear caused by caliper	See DISC BRAKES or BRAKE SYSTEM
Uneven rotor wear	See DISC BRAKES or BRAKE SYSTEM
Drums out-of-round	Reface or replace drums

ENGINE MECHANICAL

COOLING SYSTEM TROUBLE SHOOTING

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COOLING SYSTEM TROUBLE SHOOTING

CONDITION & POSSIBLE CAUSE	CORRECTION
Overheating	
Coolant Leak	Fill/Pressure Test System
A/C Condenser Fins Clogged	Remove/Clean Condenser
Radiator Fins Clogged	Remove/Clean Radiator
Thermostat Stuck Closed	Replace Thermostat
Clogged Cooling System Passages	Clean/Flush Cooling System
Water Pump Malfunction	Replace Water Pump
Fan Clutch Malfunction	Replace Fan Clutch
Retarded Ignition Timing	Reset Ignition Timing
Cooling Fan Malfunction	Test Cooling Fan/Circuit
Cooling Fan Motor Malfunction	Test Fan Motor
Cooling Fan Relay Malfunction	Test Fan Relay

Faulty Radiator Cap	Replace Radiator Cap
Broken/Slipping Fan Belt	Replace Fan Belt
Restricted Exhaust	Repair Exhaust System
Corrosion	
Impurities In Coolant	Clean/Flush System
Coolant Leakage	
Damaged hose	Replace Hose
Leaky Water Pump	Replace Water Pump
Damaged Radiator Seam	Replace/Repair Radiator
Leaky Thermostat Cover	Replace Thermostat Cover
Cylinder Head Problem	Check Head/Head Gasket
Leaky Freeze Plugs	Replace Freeze Plugs
Recovery System Inoperative	
Loose and/or Defective Radiator Cap	Replace Radiator Cap
Overflow Tube Clogged and/or Leaking	Repair Tube
Recovery Bottle Vent Restricted	Clean Vent
No Heater Core Flow	
Collapsed Heater Hose	Replace Heater Hose
Plugged Heater Core	Clean/Replace Heater Core
Faulty Heater Valve	Replace Heater Valve

GASOLINE ENGINE - MECHANICAL TROUBLE SHOOTING

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BASIC GASOLINE ENGINE - MECHANICAL TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Engine Lopes At Idle	
Intake manifold-to-head leaks	Replace manifold gasket, See ENGINES
Blown head gasket	Replace head gasket, See ENGINES
Worn timing gears, chain or sprocket	Replace gears, chain or sprocket
Worn camshaft lobes	Replace camshaft, See ENGINES
Overheated engine	Check cooling system, See COOLING
Blocked crankcase vent valve	Remove restriction

Leaking EGR valve	Repair leak and/or replace valve
Faulty fuel pump	Replace fuel pump
Engine Has Low Power	
Leaking fuel pump	Repair leak and/or replace fuel pump
Excessive piston-to-bore clearance	Install larger pistons, See ENGINES
Sticking valves or weak valve springs	Check valve train components, See ENGINES
Incorrect valve timing	Reset valve timing, See ENGINES
Worn camshaft lobes	Replace camshaft, See ENGINES
Blown head gasket	Replace head gasket. See ENGINES.
Clutch slipping	Adjust pedal and/or replace components, See ENGINES
Engine overheating	Check cooling system, See COOLING
Auto. Trans. pressure regulator valve faulty	Replace pressure regulator valve
Auto. Trans. fluid level too low	Add fluid as necessary
Improper vacuum diverter valve operation	Replace vacuum diverter valve
Vacuum leaks	Inspect vacuum system and repair as required
Leaking piston rings	Replace piston rings, See ENGINES
Faulty High Speed Operation	
Low fuel pump volume	Replace fuel pump
Leaking valves or worn	Replace valves and/or springs, See ENGINES
Incorrect valve timing	Reset valve timing,See ENGINES
Intake manifold restricted	Remove restriction
Worn distributor shaft	Replace distributor
Faulty Acceleration	
Improper fuel pump stroke	Remove pump and reset pump stroke
Incorrect ignition timing	Reset ignition timing, See TUNE-UP
Leaking valves	Replace valves, See ENGINES

Worn fuel pump diaphragm or piston	Replace diaphragm or piston
Intake Backfire	
Improper ignition timing	Reset ignition timing, See TUNE-UP
Faulty accelerator pump discharge	Replace accelerator pump
Improper choke operation	Check choke and adjust as required
Defective EGR valve	Replace EGR valve
Fuel mixture too lean	Reset air/fuel mixture, See TUNE-UP
Choke valve initial clearance too large	Reset choke valve initial clearance
Exhaust Backfire	
Vacuum leak	Inspect and repair vacuum system
Faulty vacuum diverter valve	Replace vacuum diverter valve
Faulty choke operation	Check choke and adjust as required
Exhaust system leak	repair exhaust system leak
Engine Detonation	
Ignition timing too far advanced	Reset ignition timing, See TUNE-UP
Faulty ignition system	Check ignition timing, See TUNE-UP
Spark plugs loose or faulty	Retighten or replace plugs
Fuel delivery system clogged	Inspect lines, pump and filter for clog
EGR valve inoperative	Replace EGR valve
PCV system inoperative	Inspect and/or replace hoses or valve
Vacuum leaks	Check vacuum system and repair leaks
Excessive combustion chamber deposits	Remove built-up deposits
Leaking, sticking or broken valves	Inspect and/or replace valves
External Oil Leakage	
Fuel pump improperly seated or worn gasket	Remove pump, replace gasket and seat properly
Oil pan gasket broken or pan bent	Straighten pan and replace gasket
Timing chain cover gasket broken	Replace timing chain cover gasket
Rear main oil seal worn	Replace rear main oil seal

Oil pan drain plug not seated properly	Remove and reinstall drain plug
Camshaft bearing drain hole blocked	Remove restriction
Oil pressure sending switch leaking	Remove and reinstall sending switch
Excessive Oil Consumption	
Worn valve stems or guides	Replace stems or guides, See ENGINES
Valve "O" ring seals damaged	Replace "O" ring seals, See ENGINES
Plugged oil drain back holes	Remove restrictions
Improper PCV valve operation	Replace PCV valve
Engine oil level too high	Remove excess oil
Engine oil too thin	Replace thicker oil
Valve stem oil deflectors damaged	Replace oil deflectors
Incorrect piston rings	Replace piston rings, See ENGINES
Piston ring gaps not staggered	Reinstall piston rings, See ENGINES
Insufficient piston ring tension	Replace rings, See ENGINES
Piston ring grooves or oil return	slots clogged Replace piston rings, See ENGINES
Piston rings sticking in grooves	Replace piston rings, See ENGINES
Piston ring grooves excessively worn	Replace piston and rings, See ENGINES
Compression rings installed upside down	Replace compression rings correctly, See ENGINES
Worn or scored cylinder walls	Rebore cylinders or replace block
Mismatched oil ring expander and rail	Replace oil ring expander and rail, See ENGINES
Intake gasket dowels too long	Replace intake gasket dowels
Excessive main or connecting rod bearing clearance	Replace main or connecting rod bearings, See ENGINES
No Oil Pressure	
Low oil level	Add oil to proper level
Oil pressure sender or gauge broken	Replace sender or gauge
Oil pump malfunction	Remove and overhaul oil pump, See ENGINES
Oil pressure relief valve sticking	Remove and reinstall valve
Oil pump passages blocked	Overhaul oil pump, See ENGINES

Oil pickup screen or tube blocked	Remove restriction
Loose oil inlet tube	Tighten oil inlet tube
Loose camshaft bearings	Replace camshaft bearings, See ENGINES
Internal leakage at oil passages	Replace block or cylinder head
Low Oil Pressure	
Low engine oil level	Add oil to proper level
Engine oil too thin	Remove and replace with thicker oil
Excessive oil pump clearance	Reduce oil pump clearance, See ENGINES
Oil pickup tube or screen blocked	Remove restrictions
Main, rod or cam bearing clearance excessive	Replace bearing to reduce clearance, See ENGINES
High Oil Pressure	
Improper grade of oil	Replace with proper oil
Oil pressure relief valve stuck closed	Eliminate binding
Oil pressure sender or gauge faulty	Replace sender or gauge
Noisy Main Bearings	
Inadequate oil supply	Check oil delivery to main bearings
Excessive main bearing clearance	Replace main bearings, See ENGINES
Excessive crankshaft end play	Replace crankshaft, See ENGINES
Loose flywheel or torque converter	Tighten attaching bolts
Loose or damaged vibration damper	Tighten or replace vibration damper
Crankshaft journals out-of-round	Re-grind crankshaft journals
Excessive belt tension	Loosen belt tension
Noisy Connecting Rods	
Excessive bearing clearance or missing bearing	Replace bearing, See ENGINES
Crankshaft rod journal out-of-round	Re-grind crankshaft journal
Misaligned connecting rod or cap	Remove rod or cap and realign
Incorrectly tightened rod bolts	Remove and re-tighten rod bolts
Noisy Pistons and Rings	
Excessive piston-to-bore clearance	Install larger pistons, See ENGINES
Bore tapered or out-of-round	Rebore block

Piston ring broken	Replace piston rings, See ENGINES
Piston pin loose or seized	Replace piston pin, See ENGINES
Connecting rods misaligned	Realign connecting rods
Ring side clearance too loose or tight	Replace with larger or smaller rings
Carbon build-up on piston	Remove carbon
Noisy Valve Train	
Worn or bent push rods	Replace push rods, See ENGINES
Worn rocker arms or bridged pivots	Replace push rods, See ENGINES
Dirt or chips in valve lifters	Remove lifters and remove dirt/chips
Excessive valve lifter leak-down	Replace valve lifters, See ENGINES
Valve lifter face worn	Replace valve lifters, See ENGINES
Broken or cocked valve springs	Replace or reposition springs
Too much valve stem-to-guide clearance	Replace valve guides, See ENGINES
Valve bent	Replace valve, See ENGINES
Loose rocker arms	Retighten rocker arms, See ENGINES
Excessive valve seat run-out	Reface valve seats, See ENGINES
Missing valve lock	Install new valve lock
Excessively worn camshaft lobes	Replace camshaft, See ENGINES
Plugged valve lifter oil holes	Eliminate restriction or replace lifter
Faulty valve lifter check ball	Replace lifter check ball, See ENGINES
Rocker arm nut installed upside down	Remove and reinstall correctly
Valve lifter incorrect for engine	Remove and replace valve lifters
Faulty push rod seat or lifter plunger	Replace plunger or push rod
Noisy Valves	
Improper valve lash	Re-adjust valve lash, See ENGINES
Worn or dirty valve lifters	Clean and/or replace lifters
Worn valve guides	Replace valve guides, See ENGINES

Excessive valve seat or face run-out	Reface seats or valve face
Worn camshaft lobes	Replace camshaft, See ENGINES
Loose rocker arm studs	Re-tighten rocker arm studs, See ENGINES
Bent push rods	Replace push rods, See ENGINES
Broken valve springs	Replace valve springs, See ENGINES
Burned,Sticking or Broken Valves	
Weak valve springs or warped valves	Replace valves and/or springs, See ENGINES
Improper lifter clearance	Re-adjust clearance or replace lifters
Worn guides or improper guide clearance	Replace valve guides, See ENGINES
Out-of-round valve seats or improper seat width	Re-grind valve seats
Gum deposits on valve stems, seats or guide	Remove deposits
Improper spark timing	Re-adjust spark timing
Broken Pistons/Rings	
Undersize pistons	Replace with larger pistons, See ENGINES
Wrong piston rings	Replace with correct rings, See ENGINES
Out-of-round cylinder bore	Re-bore cylinder bore
Improper connecting rod alignment	Remove and realign connecting rods
Excessively worn ring grooves	Replace pistons, See ENGINES
Improperly assembled piston pins	Re-assemble pin-to-piston, See ENGINES
Insufficient ring gap clearance	Install new rings, See ENGINES
Engine overheating	Check cooling system
Incorrect ignition timing	Re-adjust ignition timing, See TUNE-UP
Excessive Exhaust Noise	
Leaks at manifold to head, or to pipe	Replace manifold or pipe gasket
Exhaust manifold cracked or broken	Replace exhaust manifold, See ENGINES

ENGINE PERFORMANCE

CARBURETOR TROUBLE SHOOTING:

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BASIC COLD START SYMPTOMS TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Engine Won't Start	
Choke not closing	Check choke operation, see FUEL SYSTEMS
Choke linkage bent	Check linkage, see FUEL SYSTEM
Engine Starts, Then Dies	
Choke vacuum kick setting too wide	Check setting and adjust see, FUEL SYSTEMS
Fast idle RPM too low	Reset RPM to specification, see TUNE-UP
Fast idle cam index incorrect	Reset fast idle cam index, see FUEL SYSTEMS
Vacuum leak	Inspect vacuum system for leaks
Low fuel pump outlet	Repair or replace pump, see FUEL SYSTEMS
Low carburetor fuel level	Check float setting see FUEL SYSTEM
Engine Quits Under Load	
Choke vacuum kick setting incorrect	Reset vacuum kick setting,see FUEL SYSTEMS
Fast idle cam index incorrect	Reset fast idle cam index, see FUEL SYSTEM
Incorrect hot fast idle speed RPM	Reset fast idle RPM, see TUNE-UP
Engine Starts, Runs Up, Then Idles, Slowly With Black Smoke	
Choke vacuum kick set too narrow	Reset vacuum kick, see FUEL SYSTEMS
Fast idle cam index incorrect	Reset fast idle cam index, see FUEL SYSTEMS
Hot fast idle RPM too low	Reset fast idle RPM, see TUNE-UP

BASIC HOT START SYMPTOMS TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Engine Won't Start	
Engine flooded	Allow fuel to evaporate

BASIC COLD ENGINE DRIVEABILITY SYMPTOMS TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Engine Stalls in Gear	
Choke vacuum kick setting incorrect	Reset choke vacuum kick, see FUEL SYSTEMS
Fast idle RPM incorrect	Reset fast idle RPM, see TUNE-UP
Fast idle cam index incorrect	Reset fast idle cam see FUEL SYSTEMS
Acceleration Sag or Stall	
Defective choke control switch	Replace choke control switch
Choke vacuum kick setting incorrect	Reset choke vacuum kick see, FUEL SYSTEMS
Float level incorrect (too low)	Adjust float level, FUEL SYSTEMS
Accelerator pump defective	Repair or replace pump see FUEL SYSTEMS
Secondary throttles not closed	Inspect lockout adjustment, see FUEL SYSTEMS
Sag or Stall After Warmup	
Defective choke control switch	Replace choke control switch, see FUEL SYSTEMS
Defective accelerator pump	Replace pump, see FUEL SYSTEMS
Float level incorrect (too low)	Adjust float level, see FUEL SYSTEMS
Backfiring & Black Smoke	
Plugged heat crossover system	Remove restriction

BASIC WARM ENGINE DRIVEABILITY SYMPTOMS TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Hesitation With Small Amount of Gas Pedal Movement	
Vacuum leak	Inspect vacuum lines
Accelerator pump weak or inoperable	Replace pump, see FUEL SYSTEMS
Float level setting too low	Reset float level, see,FUEL SYSTEMS
Metering rods sticking or binding	Inspect and/or replace rods, see FUEL SYSTEMS

Carburetor idle or transfer system plugged	Inspect system and remove restriction
Frozen or binding heated air inlet	Inspect heated air door for binding
Hesitation With Heavy Gas Pedal Movement	
Defective accelerator pump	Replace pump, see FUEL SYSTEMS
Metering rod carrier sticking or binding	Remove restriction
Large vacuum leak	Inspect vacuum system and repair leak
Float level setting too low	Reset float level, see FUEL SYSTEMS
Defective fuel pump, lines or filter	Inspect pump, lines and filter
Air door setting incorrect	Adjust air door setting, see FUEL

DIESEL ENGINE TROUBLE SHOOTING

NOTE: This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

NOTE: Diesel engines mechanical diagnosis is the same as gasoline engines for items such as noisy valves, bearings, pistons, etc. The following trouble shooting covers only items pertaining to diesel engines.

BASIC DIESEL ENGINE TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Engine Won't Crank	
Bad battery connections or dead batteries	Check connections and/or replace batteries
Bad starter connections or bad starter	Check connections and/or replace starter
Engine Cranks Slowly, Won't Start	
Bad battery connections or dead batteries	Check connections and/or replace batteries
Engine oil too heavy	Replace engine oil
Engine Cranks Normally, But Will Not Start	
Glow plugs not functioning	Check glow plug system, see FUEL SYSTEMS
Glow plug control not functioning	Check controller, see FUEL SYSTEMS

Fuel not injected into cylinders	Check fuel injectors, see FUEL SYSTEMS
No fuel to injection pump	Check fuel delivery system
Fuel filter blocked	Replace fuel filter
Fuel tank filter blocked	Replace fuel tank filter
Fuel pump not operating	Check pump operation and/or replace pump
Fuel return system blocked	Inspect system and remove restriction
No voltage to fuel solenoid	Check solenoid and connections
Incorrect or contaminated fuel	Replace fuel
Incorrect injection pump timing	Re-adjust pump timing, see FUEL SYSTEMS
Low compression	Check valves, pistons, rings, see ENGINES
Injection pump malfunction	Inspect and/or replace injection pump
Engine Starts, Won't Idle	
Incorrect slow idle adjustment	Reset idle adjustment, see TUNE-UP
Fast idle solenoid malfunctioning	Check solenoid and connections
Fuel return system blocked	Check system and remove restrictions
Glow plugs go off too soon	See glow plug diagnosis in FUEL SYSTEMS
Injection pump timing incorrect	Reset pump timing, see FUEL SYSTEMS
No fuel to injection pump	Check fuel delivery system
Incorrect or contaminated fuel	Replace fuel
Low compression	Check valves, piston, rings, see ENGINES
Injection pump malfunction	Replace injection pump, see FUEL SYSTEMS
Fuel solenoid closes in RUN position	Check solenoid and connections
Engines Starts/Idles Rough W/out Smoke or Noise	
Incorrect slow idle adjustment	Reset slow idle, see TUNE-UP
Injection line fuel leaks	Check lines and connections
Fuel return system blocked	Check lines and connections
Air in fuel system	Bleed air from system
Incorrect or contaminated fuel	Replace fuel

Injector nozzle malfunction	Check nozzles, see FUEL SYSTEMS
Engines Starts and Idles Rough W/out Smoke or Noise, But Clears After Warm-Up	
Injection pump timing incorrect	Reset pump timing, see FUEL SYSTEMS
Engine not fully broken in	Put more miles on engine
Air in system	Bleed air from system
Injector nozzle malfunction	Check nozzles, see FUEL SYSTEMS
Engine Idles Correctly, Misfires Above Idle	
Blocked fuel filter	Replace fuel filter
Injection pump timing incorrect	Reset pump timing, see FUEL SYSTEMS
Incorrect or contaminated fuel	Replace fuel
Engine Won't Return To Idle	
Fast idle adjustment incorrect	Reset fast idle, see TUNE-UP
Internal injection pump malfunction	Replace injection pump, see FUEL SYSTEMS
External linkage binding	Check linkage and remove binding
Fuel Leaks On Ground	
Loose or broken fuel line	Check lines and connections
Internal injection pump seal leak	Replace injection pump, see FUEL SYSTEMS
Cylinder Knocking Noise	
Injector nozzles sticking open	Test injectors, see FUEL SYSTEMS
Very low nozzle opening pressure	Test injectors and/or replace
Loss of Engine Power	
Restricted air intake	Remove restriction
EGR valve malfunction	Replace EGR valve
Blocked or damaged exhaust system	Remove restriction and/or replace components
Blocked fuel tank filter	Replace filter
Restricted fuel filter	Remove restriction and/or replace filter
Block vent in gas cap	Remove restriction and/or replace cap
Tank-to-injection pump fuel supply blocked	Check fuel lines and connections
Blocked fuel return system	Remove restriction
Incorrect or contaminated fuel	Replace fuel
Blocked injector nozzles	Check nozzle for blockage, see

	FUEL SYSTEMS
Low compression	Check valves, rings, pistons, see ENGINES
Loud Engine Noise With Black Smoke	
Basic timing incorrect	Reset timing, see FUEL SYSTEMS
EGR valve malfunction	Replace EGR valve
Internal injection pump malfunction	Replace injection pump, see FUEL SYSTEMS
Incorrect injector pump housing pressure	Check pressure, see FUEL SYSTEMS
Engine Overheating	
Cooling system leaks	Check cooling system and repair leaks
Belt slipping or damaged	Check tension and/or replace belt
Thermostat stuck closed	Remove and replace thermostat, see ENGINE COOLING
Head gasket leaking	Replace head gasket
Oil Light on at Idle	
Low oil pump pressure	Check oil pump operation, see ENGINES
Oil cooler or line restricted	Remove restriction and/or replace cooler
Engine Won't Shut Off	
Injector pump fuel solenoid does not return fuel valve to OFF position	Remove and check solenoid and replace if needed

VACUUM PUMP DIAGNOSIS

CONDITION & POSSIBLE CAUSE	**CORRECTION**
Excessive Noise	
Loose pump-to-drive assembly screws	Tighten screws
Loose tube on pump assembly	Tighten tube
Valves not functioning properly	Replace valves
Oil Leakage	
Loose end plug	Tighten end plug
Bad seal crimp	Remove and re-crimp seal

FUEL INJECTION TROUBLE SHOOTING

NOTE: **This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble**

Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

BASIC FUEL INJECTION TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Engine Won't Start (Cranks Normally)	
Cold start valve inoperative	Test valve and circuit
Poor connection;vacuum or wiring	Check vacuum and electrical connections
Contaminated fuel	Test fuel for water or alcohol
Defective fuel pump relay or circuit	Test relay and wiring
Battery too low	Charge and test battery
Low fuel pressure	Test pressure regulator and fuel pump, check for restricted lines and filters
No distributor reference pulses	Repair ignition system as necessary
Open coolant temperature sensor circuit	Test sensor and wiring
Shorted W.O.T. switch in T.P.S.	Disconnect W.O.T. switch, engine should start
Defective ECM	Replace ECM
Fuel tank residual pressure valve leaks	Test for fuel pressure drop after shut down
Hard Starting	
Disconnected hot air tube to air cleaner	Reconnect tube and test control valve
Defective Idle Air Control (IAC) valve	Test valve operation and circuit
Shorted, open or misadjusted T.P.S.	Test and adjust or replace T.P.S.
EGR valve open	Test EGR valve and control circuit
Poor Oxygen sensor signal	Test for shorted or circuit
Incorrect mixture from PCV system	Test PCV for flow, check sealing of oil filter cap
Poor High Speed Operation	
Low fuel pump volume	Faulty pump or restricted fuel lines or filters
Poor MAP sensor signal	Test MAP sensor, vacuum hose and wiring
Poor Oxygen sensor signal	Test for shorted or open sensor or circuit

Open coolant temperature sensor circuit	Test sensor and wiring
Faulty ignition operation	Check wires for cracks or poor con- nections, test secondary voltage with oscilloscope
Contaminated fuel	Test fuel for water or alcohol
Intermittent ECM ground	Test ECM ground connection for resistance
Restricted air cleaner	Replace air cleaner
Restricted exhaust system	Test for exhaust manifold back pressure
Poor MAF sensor signal	Check leakage between sensor and manifold
Poor VSS signal	If tester for ALCL hook-up is available check that VSS reading matches speedometer
Ping or Knock on Acceleration	
Poor Knock sensor signal	Test for shorted or open sensor or circuit
Poor Baro sensor signal	Test for shorted or open sensor or circuit
Improper ignition timing	See VEHICLE EMISSION CONTROL LABEL (where applicable)
Check for engine overheating problems	Low coolant, loose belts or electric cooling fan inoperative

NOTE: For additional electronic fuel injection trouble shooting information, see the appropriate article in the ENGINE PERFORMANCE section (not all vehicles have Computer Engine Control articles). Information is provided there for diagnosing fuel system problems on vehicles with electronic fuel injection.

IGNITION SYSTEM TROUBLE SHOOTING

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Ignition Secondary Trouble Shooting Chart

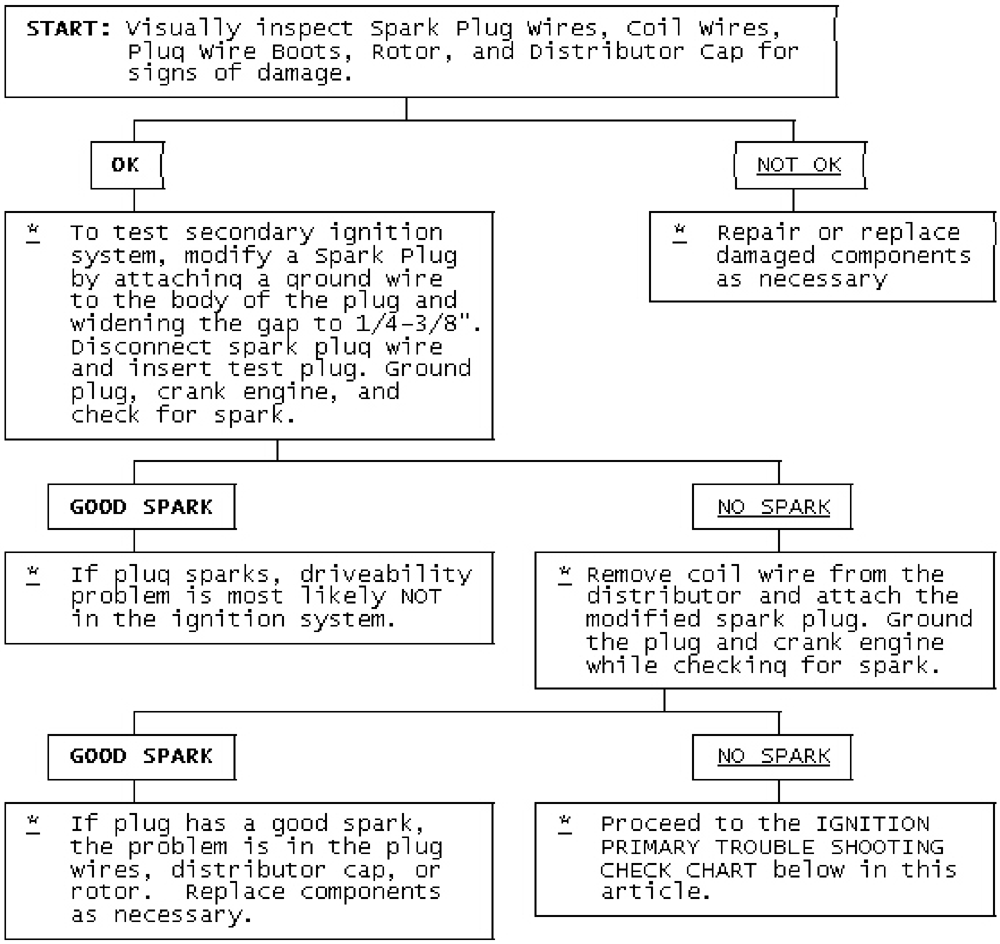

Fig. 3: Ignition Secondary Trouble Shooting Chart

Ignition Primary Trouble Shooting Chart

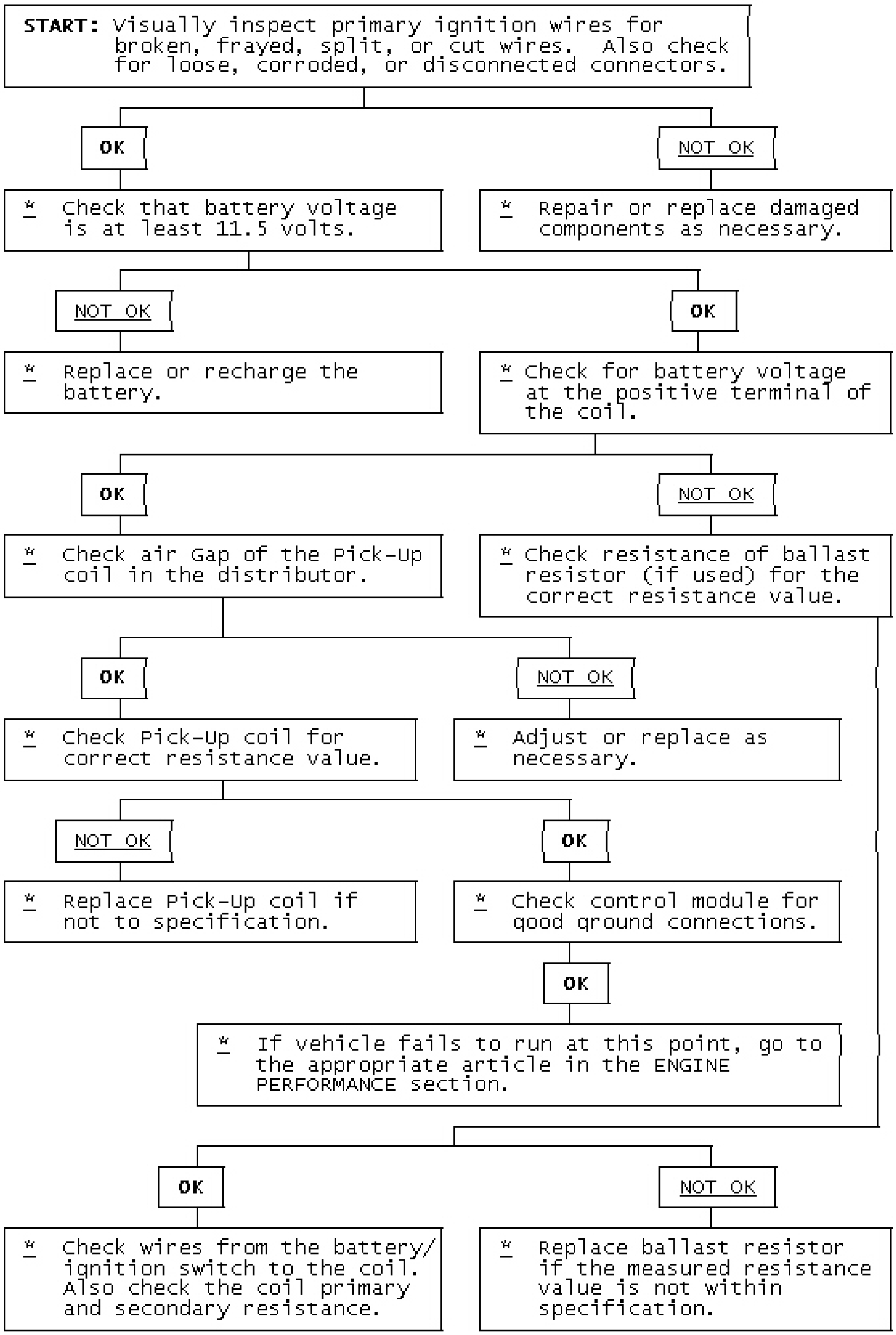

Fig. 4: Ignition Primary Trouble Shooting Chart

STARTER TROUBLE SHOOTING

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BASIC STARTER TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Starter Fails to Operate	
Dead battery or bad connections between starter and battery	Check battery charge and all wires and connections to starter
Ignition switch faulty or misadjusted	Adjust or replace ignition switch
Open circuit between starter switch ignition terminal on starter relay	Check and repair wires and connections as necessary
Starter relay or starter defective	See Testing in STARTER article
Open solenoid pull-in wire	See Testing in STARTER article
Starter Does Not Operate and Headlights Dim	
Weak battery or dead cell	Charge or replace battery as necessary
Loose or corroded battery connections	Check that battery connections are clean and tight
Internal ground in starter windings	See Testing in STARTER article
Grounded starter fields	See Testing in STARTERS
Armature rubbing on pole shoes	See STARTER article
Starter Turns but Engine Does Not Rotate	
Starter clutch slipping	See STARTER article
Broken clutch housing	See STARTER article
Pinion shaft rusted or dry	See STARTER article
Engine basic timing incorrect	See Ignition Timing in TUNE-UP article
Broken teeth on engine flywheel	Replace flywheel and check for starter pinion gear damage
Starter Will Not Crank Engine	

Faulty overrunning clutch	See STARTER article
Broken clutch housing	See STARTER article
Broken flywheel teeth	Replace flywheel and check for starter pinion gear damage
Armature shaft sheared or reduction gear teeth stripped	See STARTER article
Weak battery	Charge or replace battery as necessary
Faulty solenoid	See On-Vehicle Tests in STARTER article
Poor grounds	Check all ground connections for tight and clean connections
Ignition switch faulty or misadjusted	Adjust or replace ignition switch as necessary
Starter Cranks Engine Slowly	
Battery weak or defective	Charge or replace battery as necessary
Engine overheated	See ENGINE COOLING SYSTEM article
Engine oil too heavy	Check that proper viscosity oil is used
Poor battery-to-starter connections	Check that all between battery and starter are clean and tight
Current draw too low or too high	See Bench Tests in STARTER article
Bent armature, loose pole shoes screws or worn bearings	See STARTER article
Burned solenoid contacts	Replace solenoid
Faulty starter	Replace starter
Starter Engages Engine Only Momentarily	
Engine timing too far advanced	See Ignition Timing in TUNE-UP article
Overrunning clutch not engaging properly	Replace overrunning clutch. See STARTER article
Broken starter clutch	See STARTER article
Broken teeth on engine flywheel	Replace flywheel and check starter pinion gear for damage
Weak drive assembly thrust spring	See STARTER article
Weak hold-in coil	See Bench Tests in STARTER article
Starter Drive Will Not Engage	
Defective point assembly	See Testing in STARTER

	article
Poor point assembly ground	See Testing in STARTER article
Defective pull-in coil	Replace starter solenoid
Starter Relay Does Not Close	
Dead battery	Charge or replace battery as necessary
Faulty wiring	Check all wiring and connections leading to relay
Neutral safety switch faulty	Replace neutral safety switch
Starter relay faulty	Replace starter relay
Starter Drive Will Not Disengage	
Starter motor loose on mountings	Tighten starter attach bolts
Worn drive end bushing	See STARTER article
Damaged engine flywheel teeth	Replace flywheel and starter pinion gear for damage
Drive yolk return spring broken or missing	Replace return spring
Faulty ignition switch	Replace ignition switch
Insufficient clearance between winding leads to solenoid terminal and main contact in solenoid	Replace starter solenoid
Starter clutch not disengaging	Replace starter clutch
Ignition starter switch contacts sticking	Replace ignition switch
Starter Relay Operates but Solenoid Does Not	
Faulty solenoid switch, switch connections or relay	Check all wiring between relay and solenoid or replace relay or solenoid as necessary
Broken lead or loose soldered connections	Repair wire or wire connections as necessary
Solenoid Plunger Vibrates When Switch is Engaged	
Weak battery	Charge or replace battery as necessary
Solenoid contacts corroded	Clean contacts or replace solenoid
Faulty wiring	Check all wiring leading to solenoid
Broken connections inside switch cover	Repair connections or replace solenoid
Open hold-in wire	Replace solenoid
Low Current Draw	
Worn brushes or weak	Replace brushes or brush springs as necessary
High Pitched Whine During Cranking Before Engine Fires but Engine Fires and Cranks Normally	
Distance too great between starter pinion and flywheel	Align starter or check that

	correct starter and flywheel are being used
High Pitched Whine After Engine Fires With Key released. Engine Fires and Cranks Normally	
Distance too small between starter pinion and flywheel	Flywheel runout contributes to the intermittent nature

TUNE-UP TROUBLE SHOOTING - GAS ENGINE VEHICLES

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BASIC SPARK PLUG TROUBLE SHOOTING CHARTS

CONDITION & POSSIBLE CAUSE	CORRECTION
Normal Spark Plug Condition	
Light Tan or Gray deposits	No Action
Electrode not burned or fouled	No Action
Gap tolerance not changed	No Action
Cold Fouling or Carbon Deposits	
Overrich air/fuel mixture	Adjust air/fuel mixture, see ENGINE PERFORMANCE section
Faulty choke	Replace choke assembly, see ENGINE PERFORMANCE section
Clogged air filter	Clean and/or replace air filter
Incorrect idle speed or dirty carburetor	Reset idle speed and/ or clean carburetor
Faulty ignition wires	Replace ignition wiring
Prolonged operation at idle	Shut engine off during long idle
Sticking valves or worn valve guide seals	Check valve train
Wet Fouling or Oil Deposits	
Worn rings and pistons	Install new rings and pistons
Excessive cylinder wear	Rebore or replace block
Excessive valve guide clearance	Worn or loose bearing
Gap Bridged	
Deposits in combustion chamber becoming fused to electrode	Clean combustion chamber of deposits
Blistered Electrode	
Engine overheating	Check cooling system

Wrong type of fuel	Replace with correct fuel
Loose spark plugs	Retighten spark plugs
Over-advanced ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Pre-Ignition or Melted Electrodes	
Incorrect type of fuel	Replace with correct fuel
Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Burned valves	Replace valves
Engine Overheating	Check cooling system
Wrong type of spark plug, too hot	Replace with correct spark plug, see ENGINE PERFORMANCE
Chipped Insulators	
Severe detonation	Check for over-advanced timing or combustion
Improper gapping procedure	Re-gap spark plugs
Rust Colored Deposits	
Additives in unleaded fuel	Try different fuel brand
Water In Combustion Chamber	
Blown head gasket or cracked head	Repair or replace head or head gasket

NOTE: **Before diagnosing an electronic ignition system, ensure that all wiring is connected properly between distributor, wiring connector and spark plugs. Ignition problem will show up either as: Engine Will Not Start or Engine Runs Rough.**

BASIC ELECTRONIC IGNITION TROUBLE SHOOTING CHARTS

CONDITION & POSSIBLE CAUSE	CORRECTION
Engine Won't Start	
Open circuit between distributor and bulkhead connector	Repair circuit
Open circuit between bulkhead connector and ignition switch	Repair circuit
Open circuit between ignition switch and starter solenoid	Repair circuit
Engine Runs Rough	
Fuel lines leaking or clogged	Tighten fitting, remove restriction
Initial timing incorrect	Reset ignition timing see ENGINE PERFORMANCE
Centrifugal advance malfunction	Repair distributor advance
Defective spark plugs or wiring	Replace plugs or plug wiring
Component Failure	
Spark arc-over on cap, rotor or coil	Replace cap, rotor or or coil

Defective pick-up coil	Replace pick-up coil
Defective ignition coil	Replace ignition coil
Defective vacuum unit	Replace vacuum unit
Defective control module	Replace control module

BASIC ELECTRONIC IGNITION TROUBLE SHOOTING CHARTS - USING OSCILLOSCOPE PATTERNS

CONDITION & POSSIBLE CAUSE	CORRECTION
Firing Voltage Lines are the Same, but Abnormally High	
Retarded ignition timing	Reset ignition timing, see ENGINE PERFORMANCE section
Fuel mixture too lean	Readjust carburetor, see ENGINE PERFORMANCE
High resistance in coil wire	Replace coil wire
Corrosion in coil tower terminal	Clean and/or replace coil
Corrosion in distributor coil terminal	Clean and/or replace distributor cap
Firing Voltage Lines are the Same but Abnormally Low	
Fuel mixture too rich	Readjust carburetor, see ENGINE PERFORMANCE
Breaks in coil wire causing arcing	Replace coil wire
Cracked coil tower causing arcing	Replace coil
Low coil output	Replace coil
Low engine compression	Determine cause and repair
One or More, But Not All Firing Voltage Lines are Higher Than Others	
Carburetor idle mixture not balanced	Readjust carburetor, see ENGINE PERFORMANCE
EGR valve stuck open	Clean and/or replace valve
High resistance in spark plug wires	Replace spark plug wires
Cracked or broken spark plug insulator	Replace spark plugs
Intake vacuum leak	Repair leak
Defective spark plugs	Replace spark plugs
Corroded spark plug terminals	Replace spark plugs
One or More, But Not All Firing Voltage Lines Are Lower Than Others	
Curb idle mixture not balanced	Readjust carburetor, see ENGINE PERFORMANCE
Breaks in plug wires	Replace plug wires causing arcing
Cracked coil tower causing arcing	Replace coil
Low compression	Determine cause and repair
Defective spark plugs	Replace spark plugs

Corroded spark plugs	Replace spark plugs
Cylinders Not Firing	
Cracked distributor cap terminals	Replace distributor cap
Shorted spark plug wire	Determine cause and repair
Mechanical problem in engine	Determine cause and repair
Defective spark plugs	Replace spark plugs
Spark plugs fouled	Replace spark plugs

BASIC DRIVEABILITY PROBLEMS TROUBLE SHOOTING

CONDITION & POSSIBLE CAUSE	CORRECTION
Hard Starting	
Binding carburetor linkage	Eliminate binding
Binding choke linkage	Eliminate binding
Binding choke piston	Eliminate binding
Restricted choke vacuum	Check vacuum lines for blockage
Worn or dirty needle valve and seat	Clean carburetor, see ENGINE PERFORMANCE
Float sticking	Readjust or replace float see the ENGINE PERFORMANCE section
Incorrect choke adjustment	Reset choke adjustment see ENGINE PERFORMANCE
Defective coil	Replace coil
Improper spark plug gap	Regap spark plugs
Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Detonation	
Over-advanced ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Defective spark plugs	Replace spark plugs
Fuel lines clogged	Clean fuel lines
EGR system malfunction	Check and repair EGR system
PCV system malfunction	Repair PCV system
Vacuum leaks	Check and repair vacuum system
Loose fan belts	Tighten or replace fan belts, see ENGINE PERFORMANCE
Restricted airflow	Remove restriction
Vacuum advance malfunction	Check distributor operation
Dieseling	
Binding carburetor linkage	Eliminate binding

Binding throttle linkage	Eliminate blinding
Binding choke linkage or fast idle cam	Eliminate binding
Defective idle solenoid	Replace idle solenoid see ENGINE PERFORMANCE
Improper base idle speed	Reset idle speed, see see ENGINE PERFORMANCE
Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Incorrect idle mixture setting	Reset idle mixture, see ENGINE PERFORMANCE
Faulty Acceleration	
Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Engine cold and choke too lean	Adjust choke and allow engine to warm-up
Defective spark plugs	Replace spark plugs
Defective coil	Replace coil
Faulty Low Speed Operation	
Clogged idle transfer slots	Clean idle transfer slots, see FUEL
Restricted idle air bleeds and passages	Disassemble and clean carburetor, see FUEL
Clogged air cleaner	Replace air filter
Defective spark plugs	Replace spark plugs
Defective ignition wires	Replace ignition wire see ENGINE PERFORMANCE
Defective distributor cap	Replace distributor cap
Faulty High Speed Operation	
Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Defective distributor centrifugal advance	Replace advance mechanism
Defective distributor vacuum advance	Replace advance unit
Incorrect spark plugs or plug gap	Check gap and/or replace spark plugs
Faulty choke operation	Check choke and repair as required
Clogged vacuum passages	Remove restrictions
Improper size or clogged main jet	Check jet size and clean, see FUEL
Restricted air cleaner	Check filter and replace as necessary
Defective distributor cap, rotor or coil	Replace cap, rotor or coil
Misfire at All Speeds	

Defective spark plugs	Replace spark plugs
Defective spark plug wires	Replace spark plug wires
Defective distributor cap, rotor, or coil	Replace cap, rotor, or coil
Cracked or broken vacuum hoses	Replace vacuum hoses
Vacuum leaks	Repair vacuum leaks
Fuel lines clogged	Remove restriction
Hesitation	
Cracked or broken vacuum	Replace vacuum hoses hoses
Vacuum leaks	Repair Vacuum leaks
Binding carburetor linkage	Eliminate binding
Binding throttle linkage	Eliminate binding
Binding choke linkage or fast idle cam	Eliminate binding
Improper float setting	Readjust float setting, see FUEL
Cracked or broken ignition wires	Replace ignition wires
Rough Idle, Missing or Stalling	
Incorrect curb idle or fast idle speed	Reset idle speed, see see ENGINE PERFORMANCE
Incorrect basic timing	Reset ignition timing see ENGINE PERFORMANCE
Improper idle mixture adjustment	Reset idle mixture, see ENGINE PERFORMANCE
Improper feedback system operation	Check feedback system see ENGINE PERFORMANCE
Incorrect spark plug gap	Reset spark plug gap, see ENGINE PERFORMANCE
Moisture in ignition components	Dry components
Loose or broken ignition wires	Replace ignition wires
Damaged distributor cap or or rotor	Replace distributor cap or rotor
Faulty ignition coil	Replace ignition coil
Fuel filter clogged or worn	Replace fuel filter
Damaged idle mixture screw	Replace idle mixture screw, see FUEL
Improper fast idle cam adjustment	Reset fast idle cam adjustment, see TUNE- see ENGINE PERFORMANCE
Improper EGR valve operation	Replace EGR valve
Faulty PCV valve air flow	Replace PCV valve
Choke binding or improper choke setting	Reset choke or eliminate binding
Vacuum leak	Repair vacuum leak
Improper float bowl fuel level	Reset float adjustment, see

	FUEL
Clogged air bleed or idle passages	Clean carburetor passages, see FUEL
Clogged or worn air cleaner filter	Replace air filter
Faulty choke vacuum diaphragm	Replace diaphragm, see ENGINE PERFORMANCE
Exhaust manifold heat valve inoperative	Replace heat valve
Improper distributor spark advance	Check distributor operation
Leaking valves or valve components	Check and repair valvetrain
Improper carburetor mounting	Remove and remount carburetor
Excessive play in distributor shaft	Replace distributor
Loose or corroded wiring connections	Repair or replace as required
Engine Surges	
Improper PCV valve airflow	Replace PCV valve
Vacuum leaks	Repair vacuum leaks
Clogged air bleeds	Remove restriction
EGR valve malfunction	Replace EGR valve
Restricted air cleaner filter	Replace air filter
Cracked or broken vacuum hoses	Replace vacuum hoses
Cracked or broken ignition wires	Replace ignition wires
Vacuum advance malfunction	Check unit and replace as necessary
Defective or fouled spark plugs	Replace spark plugs
Ping or Spark Knock	
Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Distributor centrifugal or vacuum advance malfunction	Check operation and replace as necessary
Carburetor setting too lean	Readjust mixture setting, see ENGINE PERFORMANCE
Vacuum leak	Eliminate vacuum leak
EGR valve malfunction	Replace EGR valve
Poor Gasoline Mileage	
Cracked or broken vacuum	Replace vacuum hoses hoses
Vacuum leaks	Repair vacuum leaks
Defective ignition wires	Replace wires
Incorrect choke setting	Readjust setting, see ENGINE PERFORMANCE
Defective vacuum advance	Replace vacuum advance
Defective spark plugs	Replace spark plugs
Binding carburetor power piston	Eliminate binding

Dirt in carburetor jets	Clean and/or replace jets
Incorrect float adjustment	Readjust float setting, see FUEL
Defective power valve	Replace power valve, see ENGINE PERFORMANCE
Incorrect idle speed	Readjust idle speed
Engine Stalls	
Improper float level	Readjust float level
Leaking needle valve and seat	Replace needle valve and seat
Vacuum leaks	Eliminate vacuum leaks

VACUUM PUMP - DIESEL TROUBLE SHOOTING

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NOTE: **Diesel engines mechanical diagnosis is the same as gasoline engines for items such as noisy valves, bearings, pistons, etc. The following trouble shooting covers only items pertaining to diesel engines.**

VACUUM PUMP (DIESEL) TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Excessive Noise	
Loose pump-to-drive assembly screws	Tighten screws
Loose tube on pump assembly	Tighten tube
Valves not functioning properly	Replace valves
Oil Leakage	
Loose end plug	Tighten end plug
Bad seal crimp	Remove and re-crimp seal

MANUAL TRANSMISSION

MANUAL TRANSMISSION TROUBLE SHOOTING

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MANUAL TRANSMISSION/TRANSAXLE TROUBLE SHOOTING

Condition	Possible Cause
Noisy In Forward Gears	Low gear oil level, Loose bell housing bolts, Worn bearings or gears
Clunk On Deceleration (FWD Only)	Loose engine mounts, Worn inboard CV joints, Worn differential pinion shaft, Side gear hub counterbore in case worn oversize
Gear Clash When Shifting Forward Gears	Clutch Out Of Adjustment, Shift linkage damaged or out of adjustment, Gears or synchronizers damaged, Low gear oil level
Transmission Noisy When Moving (RWD Only) Quiet In Neutral With Clutch Engaged	Worn rear outputshaft bearing
Gear Rattle	Worn bearings, Wrong gear oil, Low gear oil, Worn gears
Steady Ticking At Idle (Increases With RPM)	Broken tooth on gear
Gear Clash When Shifting Forward Gears	Worn or broken synchronizers
Loud Whine In Reverse	Normal condition (1)
Noise When Stepping On Clutch	Bad release bearing, Worn pilot bearing
Ticking Or Screeching As Clutch Is Engaged	Faulty release bearing, Uneven pressure plate fingers
Click Or Snap When Clutch Is Engaged	Worn clutch fork, Worn or broken front bearing retainer
Transmission Shifts Hard	Clutch not releasing, Shift mechanism binding, Clutch installed backwards
Will Not Shift Into One Gear, Shifts Into All Others	Bent shift fork, Worn detent balls
Locked Into Gear, Cannot Shift	Clutch adjustment, Worn detent balls
Transmission Jumps Out Of Gear	Pilot bearing worn, Bent shift fork, Worn gear teeth or face, Excessive gear train end play, Worn synchronizers, Missing detent ball spring, Shift mechanism worn or out of adjustment, Engine or transmission mount bolts loose or out of adjustment, Transmission not aligned
Shift Lever Rattle	Worn shift lever or detents, Worn shift forks, Worn synchronizers sleeve
Shift Lever Hops Under Acceleration	Worn engine or transmission mounts
(1) Most units use spur cut gears in reverse and are noisy	

POWERTRAIN

CLUTCH TROUBLE SHOOTING

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BASIC CLUTCH TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Chattering or Grabbing	
Incorrect clutch adjustment	Adjust clutch
Oil, grease or glaze on facings	Disassemble and clean or replace
Loose "U" joint flange	See DRIVE AXLES article
Worn input shaft spline	Replace input shaft
Binding pressure plate	Replace pressure plate
Binding release lever	See CLUTCH article
Binding clutch disc hub	Replace clutch disc
Unequal pressure plate contact	Replace worn/misaligned components
Loose/bent clutch disc	Replace clutch disc
Incorrect transmission alignment	Realign transmission
Worn pressure plate, disc or flywheel	Replace damaged components
Broken or weak pressure springs	Replace pressure plate
Sticking clutch pedal	Lubricate clutch pedal & linkage
Incorrect clutch disc facing	Replace clutch disc
Engine loose in chassis	Tighten all mounting bolts
Failure to Release	
Oil or grease on clutch facings	Clean or replace clutch clutch disc
Incorrect release lever or pedal adjustment	See CLUTCH article
Worn or broken clutch facings	Replace clutch disc
Bent clutch disc or pressure plate	Replace damaged components
Clutch disc hub binding on input shaft	Clean or replace clutch disc and/or input shaft
Binding pilot bearing	Replace pilot bearing
Sticking release bearing sleeve	Replace release bearing and/or sleeve
Binding clutch cable	See CLUTCH article
Defective clutch master	Replace master cylinder
Defective clutch slave	Replace slave cylinder
Air in hydraulic system	Bleed hydraulic system
Rattling	
Weak or broken release lever spring	Replace spring and check alignment
Damaged pressure plate	Replace pressure plate

Broken clutch return spring	Replace return spring
Worn splines on clutch disc or input shaft	Replace clutch disc and/or input shaft
Worn clutch release bearing	Replace release bearing
Dry or worn pilot bearing	Lubricate or replace pilot bearing
Unequal release lever contact	Align or replace release lever
Incorrect pedal free play	Adjust free play
Warped or damaged clutch disc	Replace damaged components
Slipping	
Pressure springs worn or	Release pressure plate
Oily, greasy or worn facings	Clean or replace clutch disc
Incorrect clutch alignment	Realign clutch assembly
Warped clutch disc or pressure plate	Replace damaged components
Binding release levers or clutch pedal	Lubricate and/or replace release components
Squeaking	
Worn or damaged release	Replace release bearing
Dry or worn pilot or release bearing	Lubricate or replace assembly
Pilot bearing turning in crankshaft	Replace pilot bearing and/or crankshaft
Worn input shaft bearing	Replace bearing and seal
Incorrect transmission alignment	Realign transmission
Dry release fork between pivot	Lubricate release fork and pivot
Heavy and/or Stiff Pedal	
Sticking release bearing sleeve	Replace release bearing and/or sleeve
Dry or binding clutch pedal hub	Lubricate and align components
Floor mat interference with pedal	Lay mat flat in proper area
Dry or binding ball/fork pivots	Lubricate and align components
Faulty clutch cable	Replace clutch cable
Noisy Clutch Pedal	
Faulty interlock switch	Replace interlock switch
Self-adjuster ratchet noise	Lubricate or replace self-adjuster
Speed control interlock switch	Lubricate or replace interlock switch
Clutch Pedal Sticks Down	
Binding clutch cable	See CLUTCH article
Springs weak in pressure plate	Replace pressure plate
Binding in clutch linkage	Lubricate and free linkage
Noisy	
Dry release bearing	Lubricate or replace release bearing

Dry or worn pilot bearing	Lubricate or replace bearing
Worn input shaft bearing	Replace bearing
Transmission Click	
Weak springs in pressure	Replace pressure plate plate
Release fork loose on ball stud	Replace release fork and/or ball stud
Oil on clutch disc damper	Replace clutch disc
Broken spring in slave cylinder	Replace slave cylinder

DRIVE AXLE - NOISE DIAGNOSIS

Unrelated Noises

Some driveline trouble symptoms are also common to the engine, transmission, wheel bearings, tires, and other parts of the vehicle. Ensure cause of trouble actually is in the drive axle before adjusting, repairing, or replacing any of its parts.

Non-Drive Axle Noises

A few conditions can sound just like drive axle noise and have to be considered in pre-diagnosis. The 4 most common noises are exhaust, tires, CV/universal joints and wheel trim rings.

In certain conditions, the pitch of the exhaust gases may e gear whine. At other times, it may be mistaken for a wheel bearing rumble.

Tires, especially radial and snow, can have a high-pitched tread whine or roar, similar to gear noise. Also, some non-standard tires with an unusual tread construction may emit a roar or whine.

Defective CV/universal joints may cause clicking noises or excessive driveline play that can be improperly diagnosed as drive axle problems.

Trim and moldings also can cause a whistling or whining noise. Ensure none of these components are causing the noise before disassembling the drive axle.

Gear Noise

A "howling" or "whining" noise from the ring and pinion gear can be caused by an improper gear pattern, gear damage, or improper bearing preload. It can occur at various speeds and driving conditions, or it can be continuous.

Before disassembling axle to diagnose and correct gear ke sure that tires, exhaust, and vehicle trim have been checked as possible causes.

Chuckle

This is a particular rattling noise that sounds like a stick against the spokes of a spinning bicycle wheel. It occurs while decelerating from 40 MPH and usually can be heard until vehicle comes to a complete stop. The

frequency varies with the speed of the vehicle.

A chuckle that occurs on the driving phase is usually caused ive clearance due to differential gear wear, or by a damaged tooth on the coast side of the pinion or ring gear. Even a very small tooth nick or a ridge on the edge of a gear tooth is enough the cause the noise.

This condition can be corrected simply by cleaning the gear tooth nick or ridge with a small grinding wheel. If either gear is damaged or scored badly, the gear set must be replaced. If metal has broken loose, the carrier and housing must be cleaned to remove particles that could cause damage.

Knock

This is very similar to a chuckle, though it may be louder, and occur on acceleration or deceleration. Knock can be caused by a gear tooth that is damaged on the drive side of the ring and pinion gears. Ring gear bolts that are hitting the carrier casting can cause knock. Knock can also be due to excessive end play in the axle shafts.

Clunk

Clunk is a metallic noise heard when an automatic transmission is engaged in Reverse or Drive, or when throttle is applied or released. It is caused by backlash somewhere in the driveline, but not necessarily in the axle. To determine whether driveline clunk is caused by the axle, check the total axle backlash as follows:

1. Raise vehicle on a frame or twinpost hoist so that drive wheels are free. Clamp a bar between axle companion flange and a part of the frame or body so that flange cannot move.
2. On conventional drive axles, lock the left wheel to keep it from turning. On all models, turn the right wheel slowly until it is felt to be in Drive condition. Hold a chalk marker on side of tire about 12" from center of wheel. Turn wheel in the opposite direction until it is again felt to be in Drive condition.
3. Measure the length of the chalk mark, which is the total axle backlash. If backlash is one inch or less, drive axle is not the source of clunk noise.

Bearing Whine

Bearing whine is a high-pitched sound similar to a whistle. It is usually caused by malfunctioning pinion bearings. Pinion bearings operate at drive shaft speed. Roller wheel bearings may whine in a similar manner if they run completely dry of lubricant. Bearing noise will occur at all driving speeds. This distinguishes it from gear whine, which usually comes and goes as speed changes.

Bearing Rumble

Bearing rumble sounds like marbles being tumbled. It is usually caused by a malfunctioning wheel bearing. The lower pitch is because the wheel bearing turns at only about 1/3 of drive shaft speed.

Chatter On Turns

This is a condition where the entire front or rear of vehicle vibrates when vehicle is moving. The vibration is plainly felt as well as heard. Extra differential thrust washers installed during axle repair can cause a condition of partial lock-up that creates this chatter.

Axle Shaft Noise

Axle shaft noise is similar to gear noise and pinion bearing whine. Axle shaft bearing noise will normally distinguish itself from gear noise by occurring in all driving modes (Drive, cruise, coast and float), and will persist with transmission in Neutral while vehicle is moving at problem speed.

If vehicle displays this noise condition, remove suspect parts, replace wheel seals and install a new set of bearings. Re-evaluate vehicle for noise before removing any internal components.

Vibration

Vibration is a high-frequency trembling, shaking or grinding condition (felt or heard) that may be constant or variable in level and can occur during the total operating speed range of the vehicle.

The types of vibrations that can be felt in the vehicle can d into 3 main groups:

- Vibrations of various unbalanced rotating parts of the vehicle.
- Resonance vibrations of the body and frame structures caused by rotating of unbalanced parts.
- Tip-in moans of resonance vibrations from stressed engine or exhaust system mounts or driveline flexing modes.

DRIVE AXLE - RWD TROUBLE SHOOTING

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DRIVE AXLE (RWD) TROUBLE SHOOTING

CONDITION & POSSIBLE CAUSE	**CORRECTION**
Knocking or Clunking	
Differential Side Gear Clearance	Check Clearance
Worn Pinion Shaft	Replace Pinion Shaft
Axle Shaft End Play	Check End Play
Missing Gear Teeth	Check Differential/Replace Gear
Wrong Axle Backlash	Check Backlash
Misaligned Driveline	Realign Driveline
Clinking During Engagement	
Side Gear Clearance	Check Clearance
Ring and Pinion Backlash	Check Backlash
Worn/Loose Pinion Shaft	Replace Shaft/Bearing

Bad "U" Joint	Replace "U" Joint
Sticking Slip Yoke	Lube Slip Yoke
Broken Rear Axle Mount	Replace Mount
Loose Drive Shaft Flange	Check Flange
Click/Chatter On Turns	
Differential Side Gear Clearance	Check Clearance
Wrong Turn On Plates [1]	Replace Clutch Plates
Wrong Differential Lubricant [1]	Change Lubricant
Knock Or Click	
Flat Spot on Rear Wheel Bearing	Replace Wheel Bearing
Low Vibration At All Speeds	
Faulty Wheel Bearing	Replace Wheel Bearing
Faulty "U" Joint	Replace "U" Joint
Faulty Drive Shaft	Balance Drive Shaft
Faulty Companion Flange	Replace Flange
Faulty Slip Yoke Flange	Replace Flange
(1) Limited slip differential only.	

FWD AXLE SHAFTS & CV JOINTS TROUBLE SHOOTING

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BASIC FWD AXLE SHAFTS & CV JOINTS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Grease Leaks	CV boot torn or cracked
Clicking Noise on Cornering	Damaged outer CV
Clunk Noise on Acceleration	Damaged inner CV
Vibration or Shudder on Acceleration	Sticking, damaged or worn CV Misalignment or spring height

STEERING & SUSPENSION

MANUAL STEERING GEAR TROUBLE SHOOTING

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DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

BASIC MANUAL STEERING GEAR TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Rattle or Chucking Noise in Rack and Pinion	
Rack and pinion mounting bracket loose	Tighten all mounting bolts
Lack of/or incorrect lubricant	Correct as necessary
Steering gear mounting bolts loose	Tighten all mounting bolts
Excessive Play	
Front wheel bearing improperly adjusted	See FRONT SUSPENSION article
Loose or worn steering linkage	See STEERING LINKAGE article
Loose or worn steering gear shift	See MANUAL STEERING GEAR article
Steering arm loose on gear shaft	See MANUAL STEERING GEAR article
Steering gear housing bolts loose	Tighten all mounting bolts
Steering gear adjustment too loose	See MANUAL STEERING GEAR article
Steering arms loose on knuckles	Tighten and check steering linkage
Rack and pinion mounting loose	Tighten all mounting bolts
Rack and pinion out of adjustment	See adjustment in STEERING article
Tie rod end loose	Tighten and check steering linkage
Excessive Pitman shaft-to-ball nut lash	Repair as necessary
Poor Returnability	
Lack of lubricant in ball joint or linkage	Lubricate and service systems
Binding in linkage or ball joints	See STEERING LINKAGE and SUSPENSION article
Improper front end alignment	See WHEEL ALIGNMENT article
Improper tire pressure	Inflate to proper pressure
Tie rod binding	Inflate to proper pressure
Shaft seal rubbing shaft	See STEERING COLUMN article
Excessive Vertical Motion	
Improper tire pressure	Inflate to proper pressure
Tires, wheels or rotors out of balance	Balance tires then check wheels and rotors
Worn or faulty shock absorbers	Check and replace if necessary

Loose tie rod ends or steering	Tighten or replace if necessary
Loose or worn wheel bearings	See SUSPENSION article
Steering Pulls to One Side	
Improper tire pressure	Inflate to proper pressure
Front tires are different sizes	Rotate or replace if necessary
Wheel bearings not adjusted properly	See FRONT SUSPENSION article
Bent or broken suspension components	See FRONT SUSPENSION article
Improper wheel alignment	See WHEEL ALIGNMENT article
Brakes dragging	See BRAKES article
Instability	
Low or uneven tire pressure	Inflate to proper pressure
Loose or worn wheel bearings	See FRONT SUSPENSION article
Loose or worn idler arm bushing	See FRONT SUSPENSION article
Loose or worn strut bushings	See FRONT SUSPENSION article
Incorrect front wheel alignment	See WHEEL ALIGNMENT article
Steering gear not centered	See MANUAL STEERING GEARS article
Springs or shock	Check and replace if necessary
Improper cross shaft	See MANUAL STEERING GEARS article

POWER STEERING TROUBLE SHOOTING

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BASIC POWER STEERING TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Rattle or Chucking Noise	
Pressure hoses touching engine parts	Adjust to proper clearance
Loose Pitman shaft	Adjust or replace if necessary
Tie rods ends or Pitman arm loose	Tighten and check system
Rack and pinion mounts loose	Tighten all mounting bolts

Free play in worm gear	See POWER STEERING GEAR article
Loose sector shaft or thrust bearing adjustment	See POWER STEERING GEAR
Free play in pot coupling	See STEERING COLUMN article
Worn shaft serrations	See STEERING COLUMN article
Growl in Steering Pump	
Excessive pressure in hoses	Restricted hoses, see POWER STEERING GEAR article
Scored pressure plates	See POWER STEERING GEAR article
Scored thrust plates or rotor	See POWER STEERING GEAR article
Extreme wear of cam ring	See POWER STEERING GEAR article
Rattle in Steering Pump	
Vanes not installed	See POWER STEERING PUMP article
Vanes sticking in rotor	See POWER STEERING PUMP article
Swish noise in Pump	
Defective flow control valve	See POWER STEERING PUMP article
Groan in Steering Pump	
Air in fluid	See POWER STEERING PUMP article
Poor pressure hose connection	Tighten and check, replace if necessary
Squawk When Turning	
Damper "O" ring on valve spool cut	See POWER STEERING PUMP article
Moan or Whine in Pump	
Pump shaft bearing scored	Replace bearing and fluid
Air in fluid or fluid level low	See POWER STEERING PUMP article
Hose or column grounded	Check and replace if necessary
Cover "O" ring missing or damaged	See POWER STEERING PUMP article
Valve cover baffle missing or damaged	See POWER STEERING PUMP article
Interference of components in pump	See POWER STEERING

	PUMP article
Loose or poor bracket alignment	Correct or replace if necessary
Hissing When Parking	
Internal leakage in steering gear	Check valved assembly first
Chirp in Steering Pump	
Loose or worn power steering belt	Adjust or replace if necessary
Buzzing When Not Steering	
Noisy pump	See POWER STEERING PUMP article
Free play in steering shaft bearing	See STEERING COLUMN article
Bearing loose on shaft serrations	See STEERING COLUMN article
Clicking Noise in Pump	
Pump slippers too long	See POWER STEERING PUMP article
Broken slipper springs	See POWER STEERING PUMP article
Excessive wear or nicked rotors	See POWER STEERING PUMP article
Damaged cam contour	See POWER STEERING PUMP article
Poor Return of Wheel	
Wheel rubbing against turn signal	See STEERING COLUMN SWITCHES article
Flange rubbing steering gear adjuster	See STEERING COLUMN article
Tight or frozen steering shaft bearing	See STEERING COLUMN article
Steering gear out of adjustment	See POWER STEERING GEAR article
Sticking or plugged spool valve	See POWER STEERING PUMP article
Improper front end alignment	See WHEEL ALIGNMENT article
Wheel bearings worn or loose	See FRONT SUSPENSION article
Ties rods or ball joints binding	Check and replace if necessary
Intermediate shaft joints binding	See STEERING COLUMN article
Kinked pressure hoses	Correct or replace if necessary
Loose housing head spanner nut	See POWER STEERING GEAR article

Damaged valve lever	See POWER STEERING GEAR article
Sector shaft adjusted too tight	See ADJUSTMENTS in POWER STEERING GEAR article
Worm thrust bearing adjusted too tight	See ADJUSTMENTS in POWER STEERING GEAR article
Reaction ring sticking in cylinder	See POWER STEERING GEAR article
Reaction ring sticking in housing head	See POWER STEERING GEAR article
Steering pump internal leakage	See POWER STEERING PUMP article
Steering gear-to-column misalignment	See STEERING COLUMN article
Lack of lubrication in linkage	Service front suspension
Lack of lubrication in ball joints	Service front suspension
Increased Effort When Turning Wheel Fast Foaming, Milky Power Steering Fluid, Low Fluid Level or Low Pressure	
High internal pump leakage	See POWER STEERING PUMP article
Power steering pump belt slipping	Adjust or replace if necessary
Low fluid level	Check and fill to proper level
Engine idle speed to low	Adjust to correct setting
Air in pump fluid system	See POWER STEERING PUMP article
Pump output low	See POWER STEERING PUMP article
Steering gear malfunctioning	See POWER STEERING GEAR article
Wheel Surges or Jerks	
Low fluid level	Check and fill to proper level
Loose fan belt	Adjust or replace if necessary
Insufficient pump pressure	See POWER STEERING PUMP article
Sticky flow control valve	See POWER STEERING PUMP article
Linkage hitting oil pan at full turn	Replace bent components
Kick Back or Free Play	
Air in pump fluid system	See POWER STEERING PUMP article
Worn poppet valve in steering gear	See POWER STEERING PUMP article

Excessive over center lash	See POWER STEERING GEAR article
Thrust bearing out of adjustment	See POWER STEERING GEAR article
Free play in pot coupling	See POWER STEERING PUMP article
Steering gear coupling loose on shaft	See POWER STEERING PUMP article
Steering disc mounting bolts loose	Tighten or replace if necessary
Coupling loose on worm shaft	Tighten or replace if necessary
Improper sector shaft adjustment	See POWER STEERING GEAR article
Excessive worm piston side play	See POWER STEERING GEAR article
Damaged valve lever	See POWER STEERING GEAR article
Universal joint loose	Tighten or replace if necessary
Defective rotary valve	See POWER STEERING GEAR article
No Power When Parking	
Sticking flow control valve	See POWER STEERING PUMP article
Insufficient pump pressure output	See POWER STEERING PUMP article
Excessive internal pump leakage	See POWER STEERING PUMP article
Excessive internal gear leakage	See POWER STEERING PUMP article
Flange rubs against gear adjust plug	See STEERING COLUMN article
Loose pump belt	Adjust or replace if necessary
Low fluid level	Check and add proper amount of fluid
Engine idle too low	Adjust to correct setting
Steering gear-to-column misaligned	See STEERING COLUMN article
No Power, Left Turn	
Left turn reaction seal "O" ring worn	See POWER STEERING GEAR article
Left turn reaction seal damaged/missing	See POWER STEERING GEAR article

Cylinder head "O" ring damaged	See POWER STEERING PUMP article
No Power, Right Turns	
Column pot coupling bottomed	See STEERING COLUMN article
Right turn reaction seal "O" ring worn	See POWER STEERING GEAR article
Right turn reaction seal damaged	See POWER STEERING GEAR article
Internal leakage through piston end plug	See POWER STEERING GEAR article
Internal leakage through side plugs	See POWER STEERING GEAR article
Lack of Effort in Turning	
Left and/or right reaction seal sticking in cylinder head	Replace, see POWER STEERING GEAR article
Wanders to One Side	
Front end alignment incorrect	See WHEEL ALIGNMENT article
Unbalanced steering gear valve	See POWER STEERING GEAR article
Low Pressure Due to Steering Pump	
Flow control valve stuck or inoperative	See POWER STEERING PUMP article
Pressure plate not flat against cam ring	See POWER STEERING PUMP article
Extreme wear of cam ring	Replace and check adjustments
Scored plate, thrust plate or rotor	See POWER STEERING PUMP article
Vanes not installed properly	See POWER STEERING PUMP article
Vanes sticking in rotor slots	See POWER STEERING PUMP article
Cracked/broken thrust or pressure plate	See POWER STEERING PUMP article

STEERING COLUMN TROUBLE SHOOTING

NOTE: **This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.**

BASIC STEERING COLUMN TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Noise in Steering	
Coupling pulled apart	See STEERING COLUMNS article
Column not correctly aligned	See STEERING COLUMNS article
Broken lower joint	Replace joint
Horn contact ring not	See STEERING COLUMN article
Bearing not lubricated	See STEERING COLUMN article
Shaft snap ring not properly seated	Reseat or replace snap ring
Plastic spherical joint not lubricated	See STEERING COLUMN article
Shroud or housing loose	Tighten holding screws
Lock plate retaining ring not seated	See STEERING COLUMN article
Loose sight shield	Tighten holding screws
High Steering Shaft Effort	
Column assembly misaligned	See STEERING COLUMN article
Improperly installed dust shield	Adjust or replace
Tight steering universal joint	See STEERING COLUMN article
High Shift Effort	
Column is out of alignment	See STEERING COLUMN article
Improperly installed dust shield	Adjust or replace
Seals or bearings not lubricated	See STEERING COLUMNS article
Mounting bracket screws too long	Replace with new shorter screws
Burrs on shift tube	Remove burrs or replace tube
Lower bowl bearing assembled wrong	See STEERING COLUMN article
Shift tube bent or broken	Replace as necessary
Improper adjustment of shift levers	See STEERING COLUMN article
Improper Trans. Shifting	
Sheared shift tube joint	Replace as necessary
Sheared lower shaft lever	Replace as necessary
Improper shift lever adjustment	See STEERING COLUMN

	article
Improper gate plate adjustment	See STEERING COLUMN article
Excess Play in Column	
Instrument panel bracket bolts loose	Tighten bolts and check bracket
Broken weld nut on jacket	See STEERING COLUMN article
Instrument bracket capsule sheared	See STEERING COLUMN article
Column bracket/jacket bolts loose	Tighten bolts and check bracket
Steering Locks in Gear	
Release lever mechanism	See STEERING COLUMN article

SUSPENSION TROUBLE SHOOTING

NOTE: **This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.**

BASIC SUSPENSION TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Front End Noise	
Loose or worn wheel	See Wheel Bearing Adjustment in SUSPENSION
Worn shocks or shock mountings	Replace struts or strut mountings
Worn struts or strut mountings	Replace struts or strut mountings
Loose or worn lower control arm	See SUSPENSION
Loose steering gear-to-frame bolts	See STEERING
Worn control arm bushings	See SUSPENSION
Ball joints not lubricated	Lubricate ball joints & see Ball Joint Checking in SUSPENSION
Front Wheel Shake, Shimmy, or Vibration	
Tires or wheels out of balance	Check tire balance
Incorrect wheel alignment	See WHEEL ALIGNMENT
Drive shaft unbalanced	Check drive shaft balance
Loose or worn wheel bearings	See WHEEL ALIGNMENT

Loose or worn tie rod ends	See SUSPENSION
Worn upper ball joints	See Ball Joint Checking in SUSPENSION
Worn shock absorbers	Replace shock absorbers
Worn strut bushings	Replace strut bushings
Car Pulls to One Side	
Mismatched or uneven tires	Check tire condition
Broken or sagging springs	See SUSPENSION
Loose or worn strut bushings	See SUSPENSION
Improper wheel alignment	See WHEEL ALIGNMENT
Improper rear axle alignment	Check rear axle alignment
Power steering gear unbalanced	See STEERING
Front brakes dragging	See BRAKES
Abnormal Tire Wear	
Unbalanced tires	Check tire balance & rotation
Sagging or broken springs	See SUSPENSION
Incorrect front end alignment	See WHEEL ALIGNMENT
Faulty shock absorbers	Replace chock absorbers
Scuffed Tires	
Toe-In incorrect	See WHEEL ALIGNMENT
Suspension arm bent or twisted	See appropriate SUSPENSION article
Springs Bottom or Sag	
Bent or broken springs	See SUSPENSION
Leaking or worn shock absorbers	Replace shock absorbers
Frame misalignment	Check frame for damage
Spring Noises	
Loose "U" Bolts	See SUSPENSION
Loose or worn bushings	See SUSPENSION
Worn or missing interliners	See SUSPENSION
Shock Absorber Noise	
Loose shock mountings	Check & tighten mountings
Worn bushings	Replace bushings
Air in system	Bleed air from system
Undercoating on shocks	Remove undercoating
Car Leans or Sways on Corners	
Loose stabilizer bar	See SUSPENSION
Faulty shocks or mountings	Replace shocks or mountings
Broken or sagging springs	See SUSPENSION
Shock Absorbers Leaking	
Worn seals or reservoir tube crimped	See SUSPENSION

Broken Springs	
Loose "U" bolts	See SUSPENSION
Inoperative shock absorbers	Replace shock absorbers

WHEEL ALIGNMENT TROUBLE SHOOTING

NOTE: This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

BASIC WHEEL ALIGNMENT TROUBLE SHOOTING CHART

CONDITION & POSSIBLE CAUSE	CORRECTION
Premature Tire Wear	
Improper tire inflation	Check tire pressure
Front alignment out of tolerance	See ALIGNMENT SPECS in WHEEL ALIGNMENT section
Suspension components worn	See SUSPENSION section
Steering system components worn	See STEERING section
Improper standing height	See WHEEL ALIGNMENT
Uneven or sagging springs	See SUSPENSION section
Bent wheel	See WHEEL ALIGNMENT
Improper torsion bar adjustment	See SUSPENSION section
Loose or worn wheel bearings	See WHEEL BEARING ADJ. in SUSPENSION section
Worn or defective shock	Replace shock absorbers
Tires out of balance	Check tire balance
Pulls to One Side	
Improper tire inflation	Check tire pressure
Brake dragging	See BRAKE section
Mismatched tires	See WHEEL ALIGNMENT
Broken or sagging spring	See SUSPENSION section
Broken torsion bar	See SUSPENSION section
Power steering valve not centered	See STEERING section
Front alignment out of tolerance	See WHEEL ALIGNMENT section
Defective wheel bearing	See WHEEL BEARINGS in SUSPENSION section
Uneven sway bar links	See SUSPENSION section
Frame bent	Check for frame damage
Steering system bushing worn	See STEERING section

Hard Steering	
Idler arm bushing too tight	See STEERING LINKAGE in STEERING section
Ball joint tight or seized	See SUSPENSION section
Steering linkage too tight	See STEERING LINKAGE in STEERING section
Power steering fluid low	Add proper amount of fluid
Power steering drive belt loose	See STEERING section
Power steering pump defective	See STEERING section
Steering gear out of adjustment	See STEERING section
Incorrect wheel alignment	See WHEEL ALIGNMENT
Damaged steering gear	See STEERING section
Damaged suspension	See SUSPENSION section
Bent steering knuckle or supports	See SUSPENSION section
Vehicle "Wanders"	
Strut rod or control arm bushing worn	See SUSPENSION section
Loose or worn wheel bearings	See WHEEL BEARINGS in SUSPENSION section
Improper tire inflation	Check tire pressure
Stabilizer bar missing or defective	See SUSPENSION section
Wheel alignment out of tolerance	See Adjustment in WHEEL ALIGNMENT section
Broken spring	See SUSPENSION section
Defective shock absorber	Replace shock absorbers
Worn steering & suspension components	See SUSPENSION section
Front End Shimmy	
Tire out of balance/round	Check tire balance
Excessive wheel runout	See WHEEL ALIGNMENT
Insufficient or improper caster	See WHEEL ALIGNMENT section
Worn suspension or steering components	See SUSPENSION section
Defective shock absorbers	Replace shock absorber
Wheel bearings worn or loose	See WHEEL BEARING ADJ. in SUSPENSION section
Power steering reaction Bracket loose	See STEERING section
Steering gear box (rack) mounting loose	See STEERING section
Steering gear adjustment loose	See STEERING section
Worn spherical joints	See SUSPENSION section
Toe-In Not Adjustable	
Lower control arm bent	See SUSPENSION section
Frame bent	Check frame for damage
Camber Not Adjustable	

Control arm bent	See SUSPENSION section
Frame bent	Check frame for damage
Hub & bearing not seated properly	See SUSPENSION section

2008 ACCESSORIES & BODY, CAB

Unibody, Subframe & Mounting System - Fusion, Milan & MKZ

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Crossmember-to-front subframe nuts	65	48	-
Driveshaft bolts	83	61	-
Front bushing brace-to-body bolts	25	18	-
Front subframe mounting nuts	150	111	-
Front subframe support bracket bolts	103	76	-
Lower control arm ball joint lower nuts	200	148	-
Lower control arm-to-strut through bolts	103	76	-
Parking brake cable-to-trailing link bracket bolts	22	16	-
Power steering pressure line bracket bolt	9	-	80
Power steering return line bolts	9	-	80
Rear hub spindle-to-brake caliper bolts	59	44	-
Rear shock-to-trailing link lower bolts	115	85	-
Rear subframe front mounting nuts	115	85	-
Roll restrictor bolt	90	66	-
Stabilizer bar link nuts	42	31	-
Steering gear mounting bolts	107	79	-
Trailing links-to-vehicle body	103	76	-
Underbody shield bolts	7	-	62

DESCRIPTION AND OPERATION

SUBFRAME AND MOUNTING SYSTEMS

Front Subframe - The front subframe is bolted to the body and is used to:

- aid in structural support.
- provide mounting surfaces for the front suspension control arms.
- provide a mounting point for the engine isolators.
- provide the mounting surface for the steering gear.
- provide the mounting surface for the sway bar.

Rear Subframe - The rear subframe is bolted to the body and is used to:

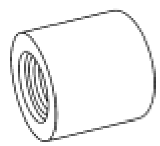
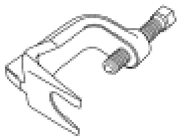
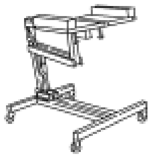
- aid in structural support.
- provide the mounting surface for the rear suspension upper control arms, rear suspension lower control arms and (if equipped) a mounting location for the rear differential.

Underbody misalignment can affect front and rear wheel alignment, the operation of the suspension parts and drivetrain operation. Window glass cracks, door and window opening concerns and air or water leaks at the doors are often caused by incorrectly tightened bolts and body misalignment. For information on underbody dimensions, refer to **BODY REPAIRS** article.

REMOVAL AND INSTALLATION

SUBFRAME - FRONT

Special Tools

Illustration	Tool Name	Tool Number
 ST2646-A	Adapter for 204-592	204-592/1
 ST2945-A	Ball Joint Separator	204-592
 ST1682-A	Powertrain Lift Table	014-00765

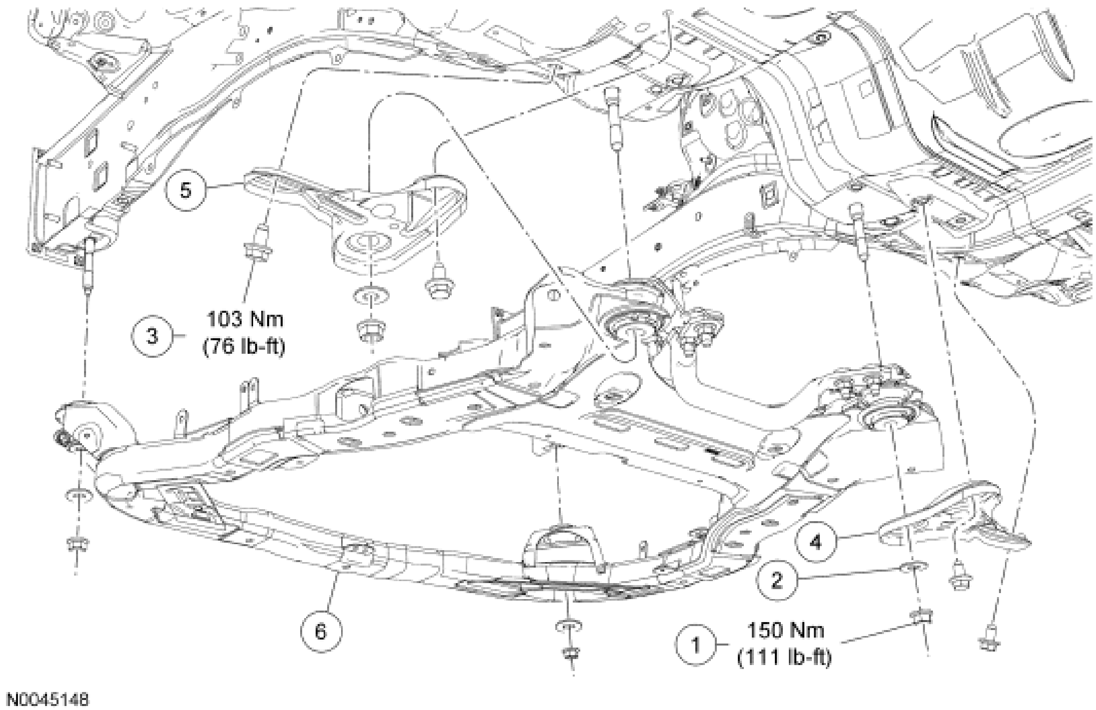


Fig. 1: Exploded View Of Front Subframe With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W520416	Front subframe nut (4 required)
2	5A552	Front subframe washer (4 required)
3	3C496	Front subframe support bracket bolt (4 required)
4	3B154	RH front subframe support bracket
5	3B155	LH front subframe support bracket
6	5C145	Front subframe

REMOVAL AND INSTALLATION

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.

   NOTE: MKZ shown, all other vehicles similar.

2. Remove the bolts and the underbody shield, if equipped.
   - To install, tighten to 7 Nm (62 lb-in).

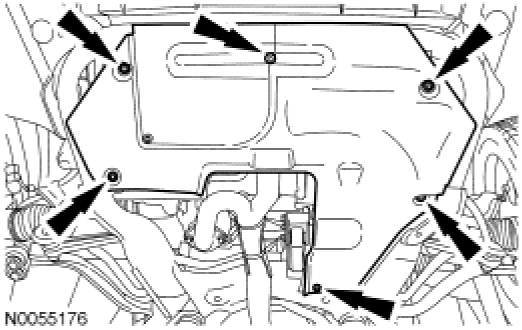


Fig. 2: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

Vehicles with 3.0L

3. Remove the exhaust flexible pipe. For additional information, refer to **EXHAUST SYSTEM** article.
4. Remove the 2 bolts and the heat shield.

All vehicles

5. Remove the bolt from the engine roll restrictor.
   - To install, tighten to 90 N.m (66 lb-ft).

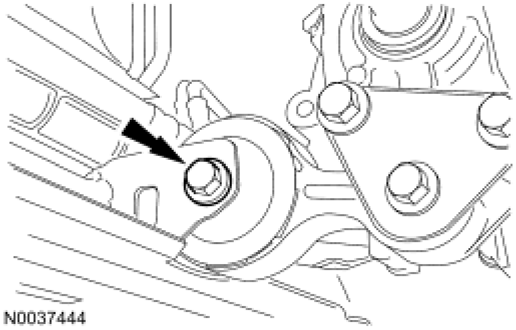


Fig. 3: Locating Engine Roll Restrictor Bolt
Courtesy of FORD MOTOR CO.

6. Remove the 4 screws and position the RH fender splash shield aside.

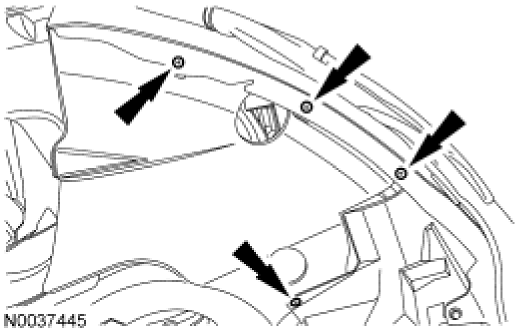


Fig. 4: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

7. Remove the 6 pin-type retainers and the RH front structure-to-subframe splash shield.

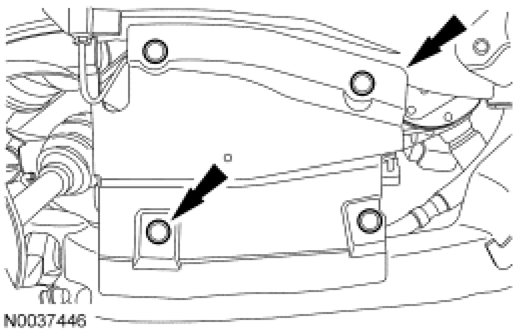


Fig. 5: Locating Splash Shield Pin-Type Retainers
Courtesy of FORD MOTOR CO.

8. Remove the 4 screws and position the LH fender splash shield aside.

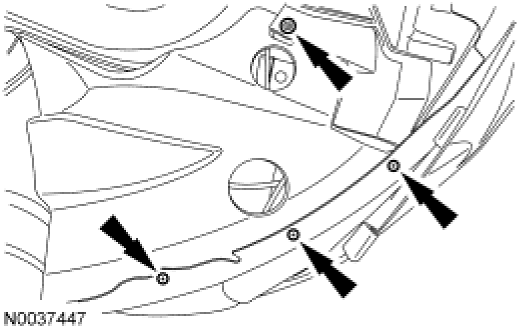


Fig. 6: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

9. Remove the 6 pin-type retainers and the LH front structure-to-subframe splash shield.

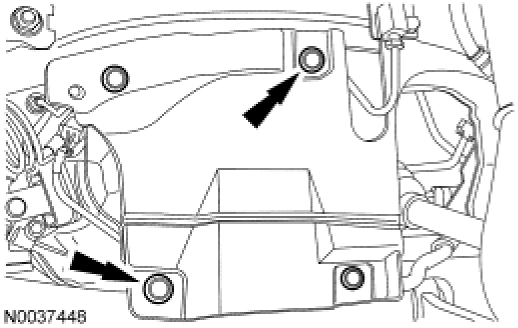


Fig. 7: Locating LH Splash Shield And Pin-Type Retainers
Courtesy of FORD MOTOR CO.

10. Remove the 3 power steering return line bolts.
    - To install, tighten to 9 N.m (80 lb-in).

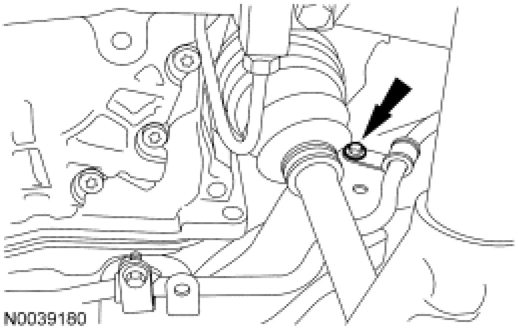


Fig. 8: Locating Power Steering Return Line Bolts
Courtesy of FORD MOTOR CO.

Vehicles with 2.3L

11. Remove the power steering pressure line bracket bolt.
    - To install, tighten to 9 N.m (80 lb-in).

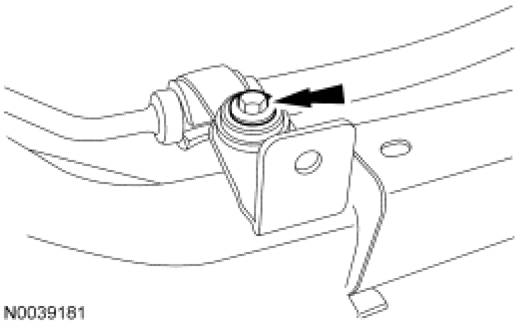


Fig. 9: Locating Power Steering Pressure Line Bracket Bolt
Courtesy of FORD MOTOR CO.

All vehicles

12. Remove the 3 steering gear mounting bolts.
    - To install, tighten to 107 N.m (79 lb-ft).

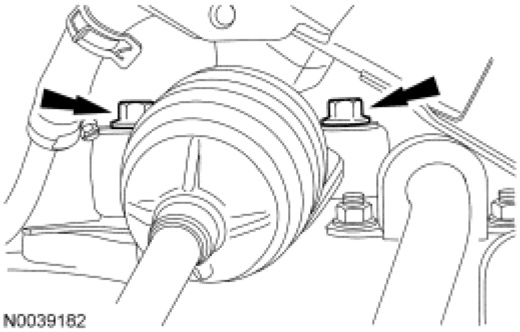


Fig. 10: Locating Steering Gear Mounting Bolts
Courtesy of FORD MOTOR CO.

NOTE: The steering gear is not removed with the front subframe and must be positioned aside.

13. Position the steering gear aside using mechanic's wire.
14. Remove the 2 (one each side) lower stabilizer bar link nuts and separate from the stabilizer bar.
    - To install, tighten to 42 N.m (31 lb-ft).

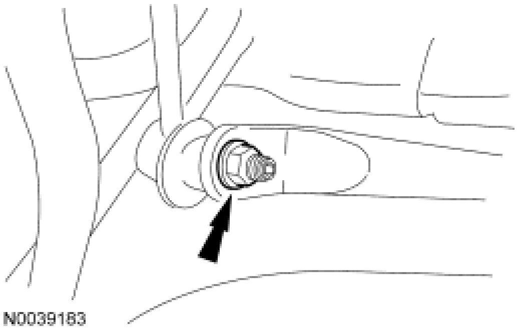


Fig. 11: Locating Lower Stabilizer Bar Link Nuts
Courtesy of FORD MOTOR CO.

15. Remove the RH and LH lower ball joint nuts.
    - To install, tighten to 200 N.m (148 lb-ft).

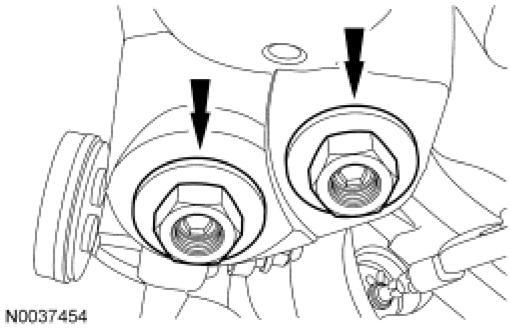


Fig. 12: Locating Lower Ball Joint Nuts
Courtesy of FORD MOTOR CO.

CAUTION: When the lower ball joint is separated from the wheel knuckle, the lower arm may strike the outer constant velocity (CV) joint boot with enough force to damage the boot clamp. This will result in a loss of grease from the outer CV joint. Place a block of wood, or similar item, between the lower arm and the outer CV joint to prevent the lower arm from striking the outer CV joint.

NOTE: Once pressure is applied to the ball joint with the Ball Joint Separator and the Adapter, it may be necessary to tap the wheel knuckle at the ball joint area to separate the ball joint from the wheel knuckle.

16. Using the Ball Joint Separator and the Adapter, separate the RH and LH ball joints.

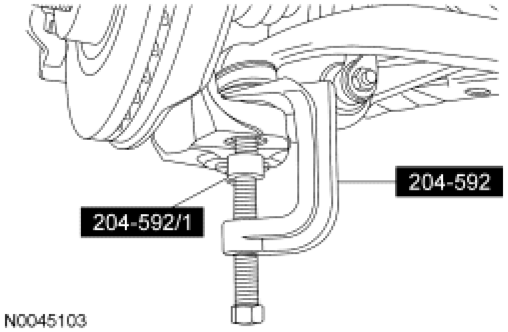


Fig. 13: Identifying Special Tools (204-592/1, 204-592)
Courtesy of FORD MOTOR CO.

17. Remove the lower control arm-to-strut through bolts and flag nuts.
    - To install, tighten to 103 N.m (76 lb-ft).

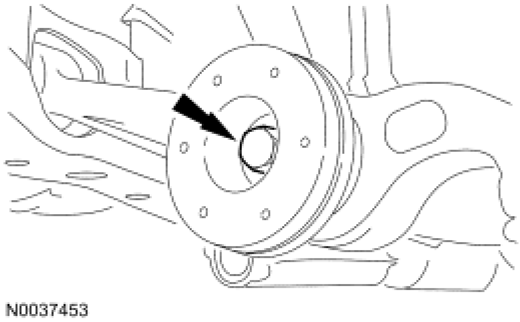


Fig. 14: Locating Lower Control Arms Through Bolt
Courtesy of FORD MOTOR CO.

18. Position the Powertrain Lift Table under the subframe.

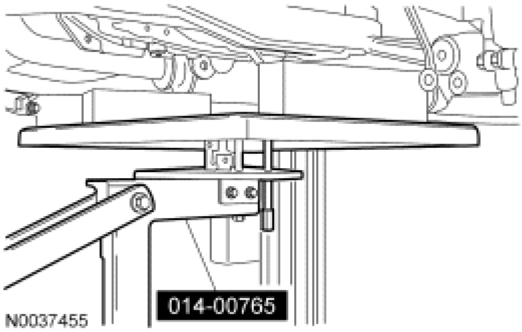


Fig. 15: Positioning Special Tool (014-00765) Under Subframe Assembly
Courtesy of FORD MOTOR CO.

19. Remove the 2 rear mounting nuts and washers from the front subframe.
    - To install, tighten to 150 N.m (111 lb-ft).

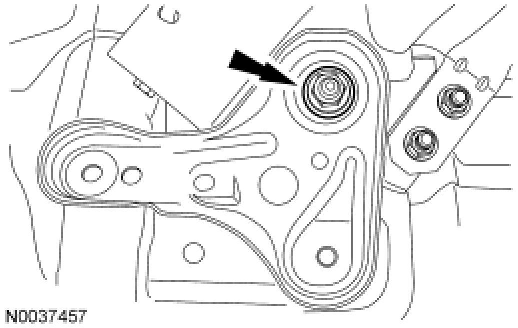


Fig. 16: Locating Subframe Nuts
Courtesy of FORD MOTOR CO.

20. Remove the 4 bolts and the 2 subframe support brackets.
    - To install, tighten to 103 N.m (76 lb-ft).

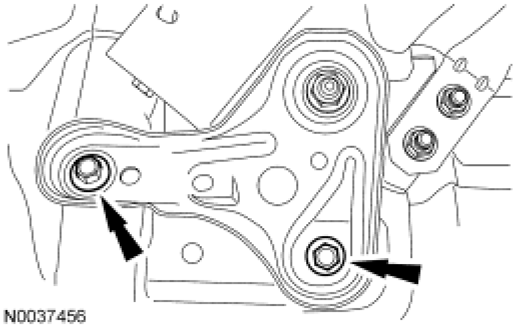


Fig. 17: Locating Subframe Bracket-To-Body Bolts
Courtesy of FORD MOTOR CO.

21. Remove the 2 front mounting nuts and washers from the front subframe.
    - To install, tighten to 150 N.m (111 lb-ft).

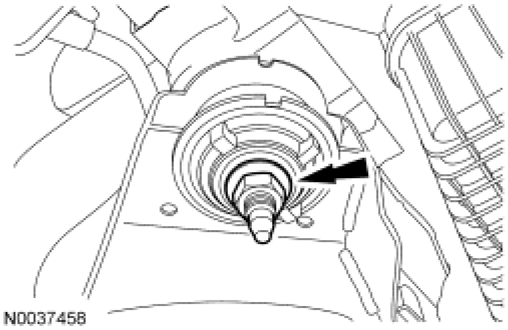


Fig. 18: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

22. Lower the subframe from the vehicle.
    - To install, reverse the removal procedure.

SUBFRAME - REAR

Special Tools

Illustration	Tool Name	Tool Number
	Powertrain Lift Table	014-00765

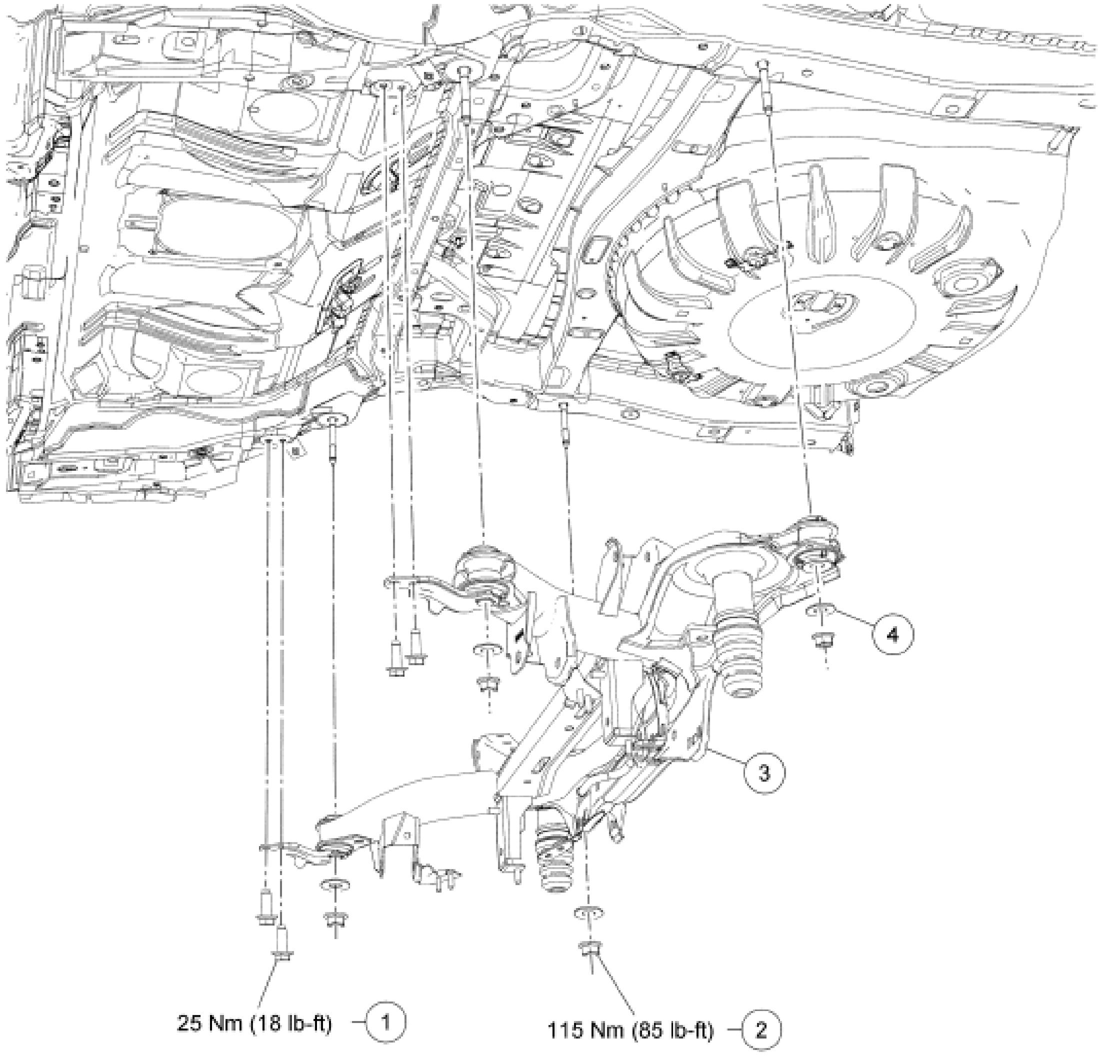


Fig. 19: Exploded View Of Rear Subframe With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	5E118	Front bushing brace-to-body bolt (4 required)
2	W520515	Rear subframe nut (4 required)
3	5K067	Rear subframe
4	5E028	Rear subframe washer (4 required)

CAUTION: Suspension fasteners are critical parts because they affect performance of vital parts and systems and their failure can result in major service expense. A new part with the same part number must be installed if installation becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified

during reassembly to make sure of correct retention of these parts.

All vehicles

1. Remove the rear wheels. For additional information, refer to **WHEELS AND TIRES** article.
2. With a wax pencil, mark the relationship alignment of the rear subframe to the underbody at the mounting locations.

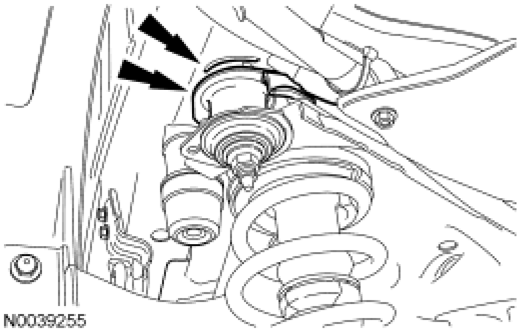


Fig. 20: Locating Rear Subframe Mark
Courtesy of FORD MOTOR CO.

3. Remove the LH and RH rear lower control arms. For additional information, refer to **REAR SUSPENSION** article.
4. Remove the catalytic converter, muffler and tailpipe as an assembly.

All wheel drive (AWD) only

NOTE: Index-mark the rear axle pinion flange and the driveshaft yoke.

5. Remove the 4 driveshaft bolts.
   - To install, tighten to 83 Nm (61 lb-ft).

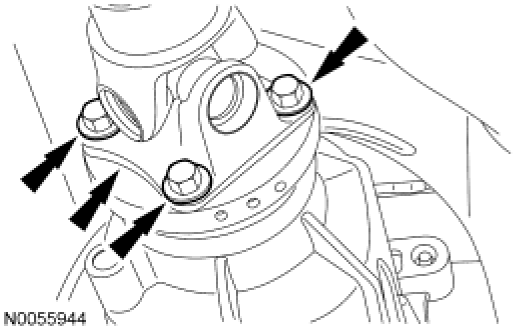


Fig. 21: Identifying Driveshaft Bolts
Courtesy of FORD MOTOR CO.

All vehicles

6. Remove the bolt from the LH and RH wheel speed sensors.

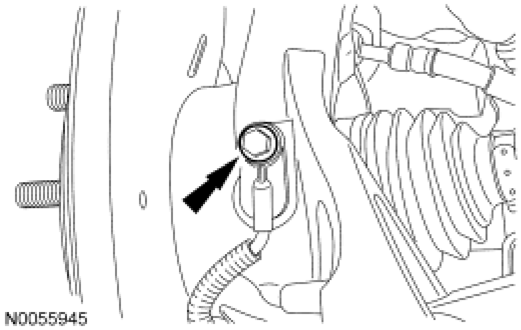


Fig. 22: Identifying LH & RH Wheel Speed Sensors Bolt
Courtesy of FORD MOTOR CO.

7. Remove the RH and LH wheel speed sensor nuts from the stud and position aside.

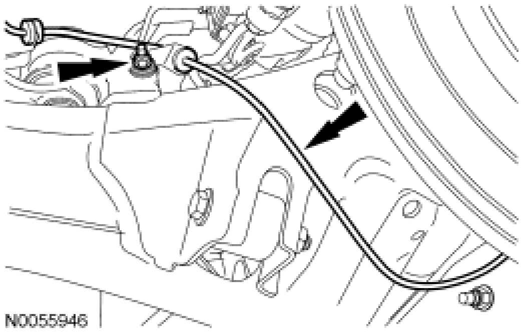


Fig. 23: Identifying LH & RH Wheel Speed Sensors Nuts
Courtesy of FORD MOTOR CO.

AWD only

8. Disconnect the differential electrical connector on the LH of the subframe.

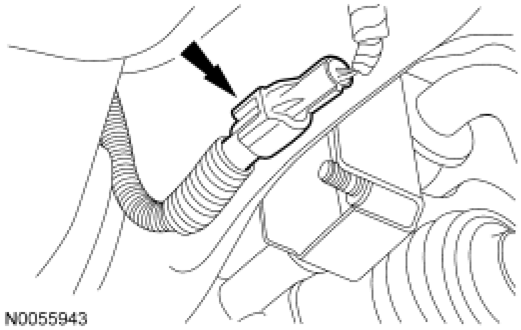


Fig. 24: Identifying Differential Electrical Connector On LH Of Subframe
Courtesy of FORD MOTOR CO.

All vehicles

9. Remove the 4 bolts (2 each side) from the rear hub spindle-to-brake caliper.
   - To install, tighten to 59 N.m (44 lb-ft).

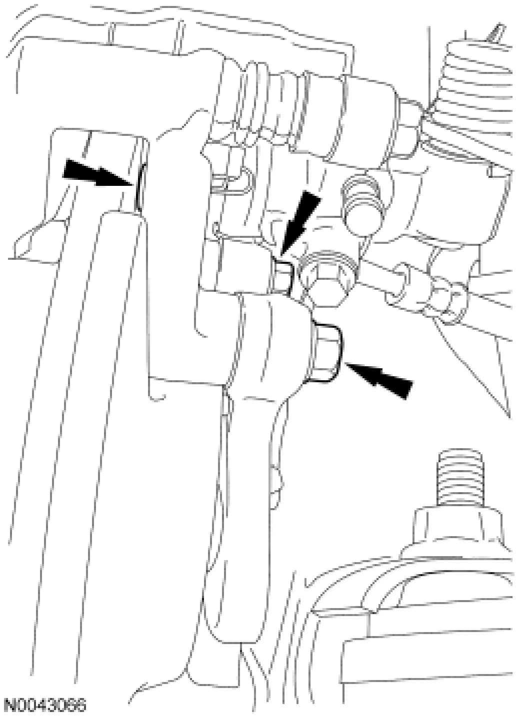


Fig. 25: Locating Rear Hub Spindle-To-Brake Caliper Bolts
Courtesy of FORD MOTOR CO.

10. Position the brake calipers aside using mechanic's wire. It is not necessary to disconnect the hydraulic brake lines.

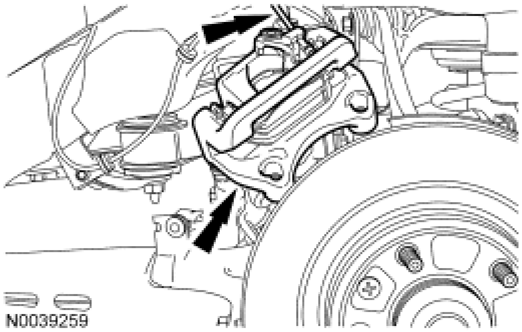


Fig. 26: Locating Hydraulic Brake Lines
Courtesy of FORD MOTOR CO.

11. Remove the bolts from the parking brake cable-to-trailing link bracket.
    - To install, tighten to 22 N.m (16 lb-ft).

Fig. 27: Locating Parking Brake Cable-To-Trailing Link Bracket Bolt
Courtesy of FORD MOTOR CO.

12. Remove and discard the rear shock-to-trailing link lower bolts and flag nuts.
    - To install, tighten to 115 N.m (85 lb-ft) with the suspension at the bushing fastener tightening position.

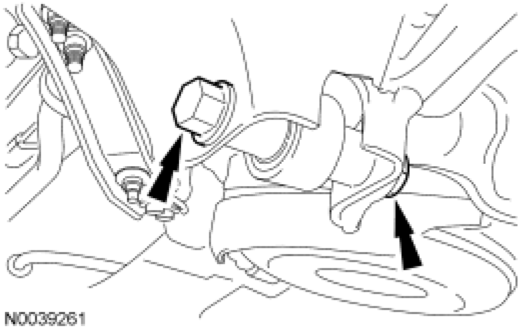


Fig. 28: Locating Rear Shock-To-Trailing Link Lower Bolts
Courtesy of FORD MOTOR CO.

13. Remove the 4 bolts and cone washers (2 each side) from the trailing links-to-vehicle body.
    - To install, tighten to 103 N.m (76 lb-ft).

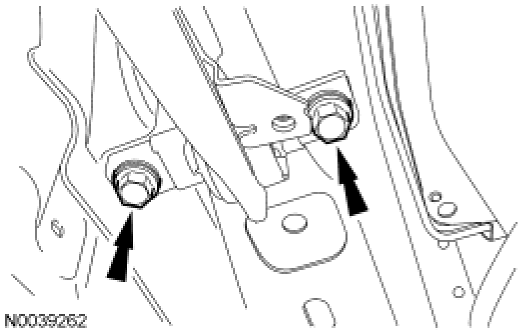


Fig. 29: Locating Trailing Links-To-Vehicle Body Bolts
Courtesy of FORD MOTOR CO.

CAUTION: The rear subframe must be secured to the lifting table. The rear

subframe can become unstable and fall from the lifting table.

NOTE: **For all wheel drive (AWD) vehicles, the rear differential is removed with the rear subframe.**

14. Position the Powertrain Lift Table under the rear subframe.

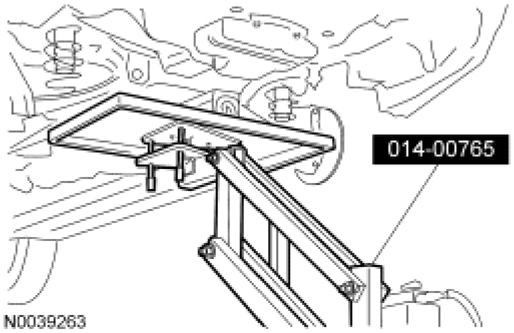


Fig. 30: Positioning Lifting Table Under Rear Subframe Using Special Tool (014-00765)
Courtesy of FORD MOTOR CO.

15. Remove the 4 front (2 each side) bushing brace-to-body bolts.
    - To install, tighten to 25 N.m (18 lb-ft).

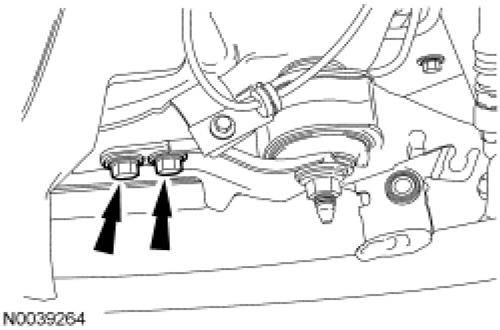


Fig. 31: Locating Bushing Brace-To-Body Bolts
Courtesy of FORD MOTOR CO.

16. Remove the 2 front (1 each side) mounting nuts and washers.
    - To install, tighten to 115 N.m (85 lb-ft).

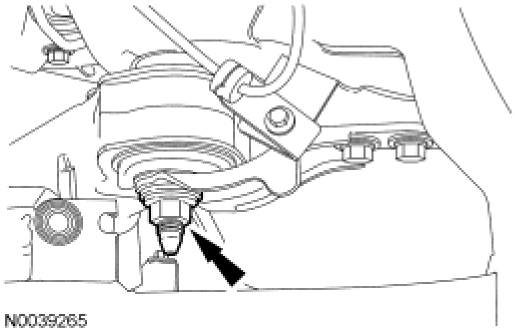


Fig. 32: Locating Front Mounting Nuts
Courtesy of FORD MOTOR CO.

17. Remove the 2 rear mounting nuts.
    - To install, tighten to 115 N.m (85 lb-ft).

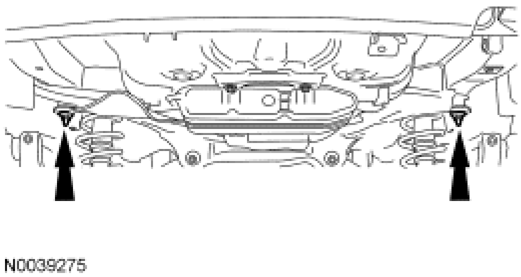


Fig. 33: Locating Rear Mounting Nuts
Courtesy of FORD MOTOR CO.

18. Remove the rear subframe.
19. Transfer the components as necessary.

CAUTION: Before tightening any suspension bushing fasteners, the suspension must be at the bushing fastener tightening position. Use a suitable jack to raise the suspension until the distance between the center of the hub and the lip of the fender is equal to 395 mm (15.55 in).

20. To install, reverse the removal procedure.

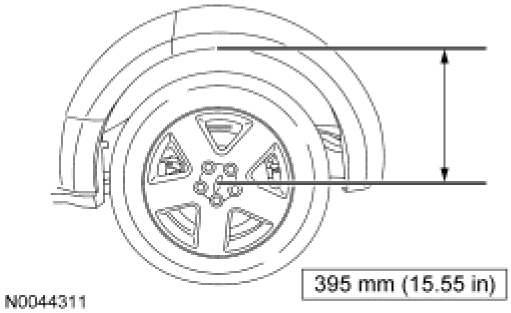


Fig. 34: Identifying Distance Between Center Of Hub And Lip Of Fender With Specification
Courtesy of FORD MOTOR CO.

2008 BRAKES

Vehicle Dynamic Systems - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1	227.5 ml (0.48 pt)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
ABS module screws	2	-	18
Brake tube fittings	17	-	150
Front wheel speed sensor bolt	23	17	-
Front wheel speed sensor harness bracket-to-body bolt	7	-	62
Front wheel speed sensor harness bracket-to-wheel knuckle bolt	23	17	-
Hydraulic control unit (HCU) bracket bolt	23	17	-
HCU bracket nut	23	17	-
HCU bracket stud bolt	23	17	-
HCU bracket-to-HCU bolt	9	-	80
HCU guide pins	9	-	80
Rear wheel speed sensor bolt (front wheel drive [FWD])	23	17	-
Rear wheel speed sensor harness bolt (all wheel drive [AWD])	23	17	-
Rear wheel speed sensor harness nut (AWD)	23	17	-

DESCRIPTION AND OPERATION

ANTI-LOCK CONTROL

ABS

The ABS consists of the following components:

- ABS module
- Front wheel speed sensor
- Front wheel speed sensor ring (integral to the front axle halfshaft)

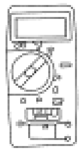
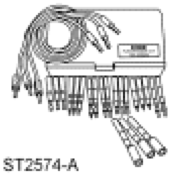
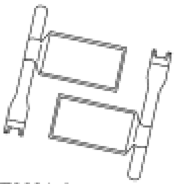
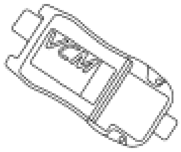
- Hydraulic control unit (HCU)
- Rear wheel speed sensor
- Rear wheel speed sensor ring (integral to the wheel bearing/hub assembly)
- Traction control switch (TCS) (PCM controlled)

The ABS prevents wheel lock-up by monitoring the wheel speed sensors and actuating the valves in the HCU which modulates the brake pressure to the brake calipers. By preventing the wheels from locking up, the driver is able to maintain steering control and stop in the shortest possible distance under most conditions. The traction control system utilizes the same components as the ABS to prevent wheel spin and help maintain vehicle control during acceleration.

DIAGNOSTIC TESTS

ANTI-LOCK CONTROL

Special Tools

Illustration	Tool Name	Tool Number
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST2574-A	Flex Probe Kit	105-R025B or equivalent
 ST2621-A	Rotunda Active Wheel Speed Sensor Tester	105-R0110
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

Principles of Operations

Anti-Lock Control

The ABS module receives wheel speed readings from each wheel speed sensor and processes this information

to determine if an ABS event is necessary. The wheel speed sensor electrically senses each tooth of the wheel speed sensor indicators as it passes through the wheel speed sensor magnetic field.

The active wheel speed sensor generates a signal that is sent to the ABS module. The wheel speed sensor circuitry connects to the ABS module through 2 wires and a connector at each wheel speed sensor. When the ignition is turned to the RUN position, the ABS module carries out a self-test by sending a reference voltage to all of the wheel speed sensors through their circuitry to determine if they are functional.

The ABS module continuously monitors and compares the rotational speed of each wheel and when it detects an impending wheel lock, modulates brake pressure to the appropriate brake caliper. This is accomplished by triggering the hydraulic control unit (HCU) to open and close the appropriate solenoid valves. Once the affected wheel returns to normal speed, the ABS module returns the solenoid valves to their normal position, and normal (base) braking resumes.

The HCU has additional internal solenoid valves incorporated to enable control modulation of the wheel brake pressures.

The ABS module is self-monitoring. When the ignition switch is turned to the RUN position, the ABS module will do a preliminary electrical check of the wheel speed sensors by sending voltage through the sensor and checking for the voltage to return. At speeds above 20 km/h (12 mph), without the brake pedal being pressed, the pump motor will be commanded ON for approximately 1/2 second to check pump motor operation. Also, during all phases of operation the ABS module, with the vehicle in motion, checks for correct operation of the wheel speed sensors. Any malfunction of the ABS will cause the ABS to deactivate. Normal power assisted braking, however, remains.

Traction Control System - Front Wheel Drive (FWD)

The traction control system is designed to limit wheel spin by modulating engine torque, in order to achieve maximum traction, when driving on slippery or loose surfaces. On front wheel drive (FWD) vehicles, the ABS module sends the PCM wheel speed information over the high-speed controller area network (HS-CAN) bus. The PCM uses this information to determine if traction control is necessary. When the drive wheels lose traction and begin to spin at different speeds than the non-drive wheels, the PCM reduces engine torque to maintain vehicle traction by minor incremental timing changes and fewer fuel injector pulses until the speed of the driven wheels return to the desired speed. The PCM also sends a request to the instrument cluster to flash the traction control indicator.

The traction control system can be disabled by pressing the traction control switch and is indicated by the traction control indicator in the instrument cluster. The traction control system will reset and return to normal operation when the ignition switch is cycled or when the traction control switch is pressed and released a second time during the same ignition cycle.

Traction Control System - All Wheel Drive (AWD)

The traction control system is designed to limit wheel spin by modulating engine torque, in order to achieve maximum traction, when driving on slippery or loose surfaces. On all wheel drive (AWD) vehicles, the ABS module communicates with the PCM to assist with traction control. When the drive wheels lose traction and begin to spin at different speeds than the non-drive wheels, with vehicle speed under 100 km/h (62 mph), the ABS module requests the PCM to reduce engine torque while simultaneously activating the HCU to apply and

release the appropriate brake caliper(s) to maintain vehicle traction. The PCM reduces engine torque by minor incremental timing changes and fewer fuel injector pulses until the ABS module ends the traction control request. The request ends when the speed of the driven wheels return to the desired speed. After the vehicle speed exceeds 100 km/h (62 mph), traction control is accomplished only through the PCM torque control.

The traction control system can be disabled by pressing the traction control switch and is indicated by the traction control light in the instrument cluster. The traction control system will reset and return to normal operation when the ignition switch is cycled or when the traction control switch is pressed and released a second time during the same ignition cycle.

ABS Module Configuration

ABS module configuration is not required on this vehicle.

Traction Control System Configuration - Front Wheel Drive (FWD)

The traction control system, for front wheel drive (FWD) vehicles, is contained in the PCM and is configured when the PCM is configured. Refer to Programmable Module Installation in **MODULE CONFIGURATION** article.

Traction Control System Configuration - All Wheel Drive (AWD)

Traction control system configuration is not required on all wheel drive (AWD) vehicles.

Inspection and Verification

1. Verify the customer concern.
2. Verify the stoplamps operate correctly by pressing and releasing the brake pedal with the ignition switch in the ON position. If the stoplamps do not operate correctly, refer to **EXTERIOR LIGHTING** article. If the stoplamps operate correctly, proceed to the next step.
3. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical

• Incorrectly inflated tires
• Mismatched wheels or tires on vehicle
• Base brake system
• Wheel speed sensor
• Wheel speed sensor tone ring
• Hydraulic control unit (HCU)
	• Battery junction box (BJB) fuse(s):
	  ○ 8 (40A)
	  ○ 10 (20A)
	  ○ 49 (15A)
	• Smart junction box (SJB) fuse 28 (10A)
	• Wiring, terminals or connectors
	• Stoplamp switch
	• Traction control switch

	• Wheel speed sensors • ABS module

4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

5. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

6. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
7. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
8. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
9. Clear the continuous DTCs and carry out the self-test diagnostics for the ABS module.
10. If the DTCs retrieved are related to the concern, go to the ABS Module DTC Chart or the Instrument Cluster DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
11. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

ABS MODULE DTC CHART

DTCs	Description	Source	Action
B1342	ECU is Faulted	ABS Module	CLEAR the DTCs. RETRIEVE the DTCs. REPEAT the self-test. If other DTCs are retrieved, ADDRESS those DTCs before addressing DTC B1342. If only DTC B1342 is retrieved, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. REPEAT the self-test.

B1483	Brake Pedal Input Open Circuit	ABS Module	Go to **Pinpoint Test A**.
B1676	Battery Pack Voltage Out of Range	ABS Module	Go to **Pinpoint Test B**.
B2900	VIN Mismatch	ABS Module	If DTC U1900 is also present, REPAIR that DTC before repairing B2900. VERIFY the vehicle information number (VIN) information retrieved by the scan tool matches the VIN tag on the vehicle. If the VIN does not match, RECONFIGURE the PCM. CLEAR the DTC. REPEAT the self-test. If the VIN matches, INSTALL a new ABS module. CLEAR the DTC. REPEAT the self-test.
C1095	ABS Hydraulic Pump Motor Circuit Failure	ABS Module	Go to **Pinpoint Test E**.
C1145	Wheel Speed Sensor RF Input Circuit Failure	ABS Module	Go to **Pinpoint Test C**.
C1155	Wheel Speed Sensor LF Input Circuit Failure	ABS Module	Go to **Pinpoint Test C**.
C1165	Wheel Speed Sensor RR Input Circuit Failure	ABS Module	Go to **Pinpoint Test C**.
C1175	Wheel Speed Sensor LR Input Circuit Failure	ABS Module	Go to **Pinpoint Test C**.
C1233	Wheel Speed LF Signal Fault	ABS Module	Go to **Pinpoint Test D**.
C1234	Wheel Speed RF Signal Fault	ABS Module	Go to **Pinpoint Test D**.
C1235	Wheel Speed RR Signal Fault	ABS Module	Go to **Pinpoint Test D**.
C1236	Wheel Speed LR Signal Fault	ABS Module	Go to **Pinpoint Test D**.
C1288	Pressure Sensor Main/Primary Input Circuit Failure	ABS Module	CLEAR the DTCs. REPEAT the self-test. If DTC C1288 is present, make sure all HCU and ABS module fasteners are tightened to their correct torque specification. If all fasteners are tightened to their correct torque specification, INSTALL a new HCU. REFER to **Hydraulic Control Unit (HCU)**.
C1440	Pressure Sensor Main/Primary Signal Faulted	ABS Module	CLEAR the DTCs. REPEAT the self-test. If DTC C1440 is present, make sure all HCU and ABS module fasteners are tightened to their correct torque specification. If all fasteners are tightened to their correct torque specification, INSTALL a new HCU. REFER to **Hydraulic Control Unit (HCU)**.
C1805	Mismatched PCM and/or ABS Module	ABS Module	If DTC U1900 is also present, REPAIR that DTC before repairing C1805. The messages received by the ABS module from the PCM do not match what the ABS module is expecting. VERIFY that the ABS module

			installed is the correct module for the vehicle configuration. If the ABS module is OK, RECONFIGURE the PCM as necessary. FOLLOW the scan tool directions. CLEAR the DTC. REPEAT the self-test.
U1900	CAN communication Bus Fault - Receive Error	ABS Module	REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the high-speed controller area network (HS-CAN) bus.
U2050	No Application Present	ABS Module	VERIFY that the ABS module installed is the correct module for the vehicle configuration. If the ABS module is OK, CLEAR the DTCs. CARRY OUT the self-test, RETRIEVE and RECORD any DTCs. If DTC U2050 is retrieved again, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CLEAR the DTC. REPEAT the self-test.
U2023	One or More Calibration Files Missing or Corrupt	ABS Module	Invalid data has been received by the ABS module from another module. REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the HS-CAN bus.

INSTRUMENT CLUSTER DTC CHART

DTC	Description	Source	Action
C1093	Traction Control Disable Switch Circuit Failure	Instrument Cluster	Go to **Pinpoint Test G**.
-	All Other Instrument Cluster DTCs	Instrument Cluster	REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• No communication with the ABS module	• Fuse • Wiring, terminals or connectors • ABS module	• REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the no communication problem.
• No communication with the instrument cluster	• Wiring, terminals or connectors • Instrument cluster	• REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the no communication problem.
	• Wiring, terminals or	• REFER to Diagnosis and Testing in

• The red brake warning indicator is always/never on	connectors • Brake fluid level switch • Parking brake switch • Instrument cluster	**INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
• The yellow ABS warning indicator is always/never on	• Wiring, terminals or connectors • Instrument cluster • ABS module	• RETRIEVE and RECORD any ABS module DTCs. If DTCs are present, go to the ABS Module DTC Chart. If no DTCs are present, REFER to Diagnosis and Testing in **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
• Spongy brake pedal with no warning indicator	• Air in the brake hydraulic system	• INSPECT the brake pedal and bracket for damage or incorrect installation. REPAIR or INSTALL new as necessary. If the brake pedal and bracket are OK, BLEED the brake system and hydraulic control unit (HCU). REFER to Brake System Bleeding in **BRAKE SYSTEM - GENERAL INFORMATION** article.
• Poor vehicle tracking during anti-lock function	• Air in the hydraulic brake system • HCU	• Go to **Pinpoint Test F**.
	• Base brake system	• REFER to **BRAKE SYSTEM - GENERAL INFORMATION** article.
• Unintended ABS activation with no DTCs present	• Incorrect or worn tires • Underinflated tire(s) • Suspension components • Missing, damaged or misaligned wheel speed sensor tone rings	• INSPECT the wheels and tires, front and rear suspension and the wheel speed sensor tone rings. REPAIR or INSTALL new as necessary.
• The traction control indicator is always/never on	• Traction control system • PCM • Instrument cluster	• REFER to Diagnosis and Testing in **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.
• The traction control system is inoperative	• Traction control system is turned off	• VERIFY that the system is turned on. CARRY OUT the ABS module and instrument cluster self-tests. RETRIEVE and RECORD any DTCs. REFER to the ABS Module

		DTC Chart and/or the Instrument Cluster DTC Chart.
	• PCM not configured for traction control (front wheel drive [FWD] only)	• VERIFY that the PCM is configured correctly. REFER to Programmable Module Installation in **MODULE CONFIGURATION** article.
	• ABS wheel speed sensor fault	• CARRY OUT the ABS module self-test. RETRIEVE and RECORD any DTCs. REFER to the ABS Module DTC Chart.
	• High-speed controller area network (HS-CAN) communication bus	• REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the no communication problem.
• The traction control system cannot be disabled	• Wiring, terminals or connectors • Traction control switch • Instrument cluster	• Go to **Pinpoint Test G**.

Pinpoint Tests

Pinpoint Test A: DTC B1483 - Brake Pedal Input Open Circuit

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

Battery junction box (BJB) fuse 49 (15A) supplies fused ignition voltage to the brake pedal position (BPP) switch, along circuit CBP49 (VT/GY), with the ignition switch in the RUN/START position. With the brake pedal released, the switch is closed and voltage is supplied to the ABS module along circuit CES09 (VT/OG). When the brake pedal is applied, the switch opens and the voltage supply is interrupted.

- DTC B1483 Brake Pedal Input Open Circuit - If during normal operation or the on-demand self test, the ABS module detects an open circuit on the BPP switch circuit, DTC B1483 will be set.

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- BPP switch
- ABS module

PINPOINT TEST A: DTC B1483 - BRAKE PEDAL INPUT OPEN CIRCUIT

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

A1 CHECK THE STOPLAMPS

- Apply the brake pedal while observing the stoplamps.
- **Do the stoplamps illuminate?**

  YES : Go to A2.

  NO : REFER to **EXTERIOR LIGHTING** article to continue diagnosis of the stoplamps.

A2 CHECK THE VOLTAGE TO THE ABS MODULE

- Key in OFF position.
- Disconnect: ABS Module C135
- Key in ON position.

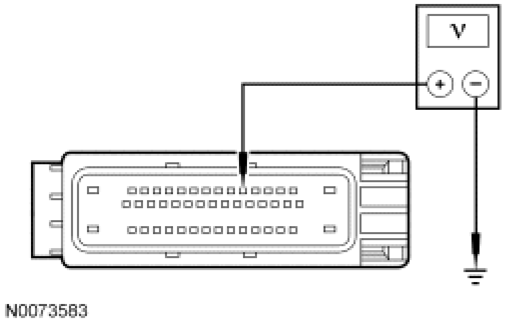


Fig. 1: Checking Voltage To ABS Module
Courtesy of FORD MOTOR CO.

- Measure the voltage between ABS module C135-6, circuit CES09 (VT/OG), harness side and ground with the brake pedal not pressed.
- **Is the voltage greater than 10 volts?**

  YES : Go to A6.

  NO : Go to A3.

A3 CHECK CIRCUIT CES09 (VT/OG) FOR AN OPEN

- Key in OFF position.
- Disconnect: BPP Switch C278

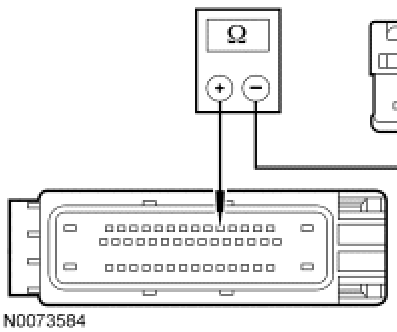


Fig. 2: Checking Circuit CES09 (VT/OG) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between ABS module C135-6, circuit CES09 (VT/OG), harness side and BPP switch C278-3, circuit CES09 (VT/OG), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A4.

  NO : REPAIR circuit CES09 (VT/OG). CLEAR the DTC. REPEAT the self-test.

A4 ISOLATE THE BPP SWITCH

- Measure the resistance between BPP switch C278 pin-2 and pin-3, component side, while pressing and releasing the brake pedal.
- **Is the resistance greater than 10,000 ohms with the pedal pressed and less than 5 ohms with the pedal released?**

  YES : Go to A5.

  NO : INSTALL a new BPP switch. REFER to Stoplamp Switch in **EXTERIOR LIGHTING** article. CLEAR the DTC. REPEAT the self-test.

A5 CHECK THE VOLTAGE TO THE BPP SWITCH

- Key in ON position.

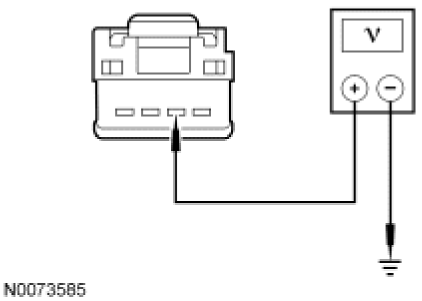


Fig. 3: Checking Voltage To BPP Switch
Courtesy of FORD MOTOR CO.

- Measure the voltage between BPP C278-2, circuit CBP49 (VT/GY), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A6.

NO : VERIFY BJB fuse 49 (15A) is OK. If OK, REPAIR circuit CES09 (VT/OG). CLEAR the DTCs. REPEAT the self-test.

A6 CHECK FOR CORRECT ABS MODULE OPERATION

- Check ABS module C135 for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect: ABS Module C135
- Make sure the connector seats correctly, then operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: DTC B1676 - Battery Pack Voltage Out of Range

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The operating voltage required to supply the ABS module, hydraulic pump and isolation valves is in a range between 10 and 16 volts.

Fused battery voltage is supplied to the ABS module from battery junction box (BJB) fuse 10 (30A) along circuit SBB10 (YE/RD) and fuse 8 (40A) along circuit SBB08 (VT/RD). Fused ignition voltage is supplied to the ABS module from smart junction box (SJB) fuse 28 (10A) along CBP19 (BN/WH) and ground is provided to the module along circuit GD123 (BK/GY).

- DTC B1676 Battery Pack Voltage Out of Range - If during normal operation, the vehicle battery voltage becomes less than 9.7 volts for more than 210 ms with vehicle speed greater than 20 km/h (12 mph), or the vehicle battery voltage becomes greater than 18 volts, DTC B1676 will be set. Also, if during the ABS module self-test the vehicle battery voltage becomes higher than 18 volts, DTC B1676 will be set.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- Charging system
- ABS module

PINPOINT TEST B: DTC B1676 - BATTERY PACK VOLTAGE OUT OF RANGE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

B1 CHECK THE BATTERY VOLTAGE

- Measure the battery voltage between the positive and negative battery terminals with the key ON engine OFF (KOEO), and with the engine running.
- **Is the battery voltage between 10 and 13 volts with KOEO, and between 13 and 16 volts with the engine running?**

  YES : Go to B2.

  NO : REFER to **CHARGING SYSTEM - GENERAL INFORMATION** article to continue diagnosis of the charging system. CLEAR the DTCs. REPEAT the self-test.

B2 CHECK THE VOLTAGE TO THE ABS MODULE

- Key in OFF position.
- Disconnect: ABS Module C135
- Key in ON position.

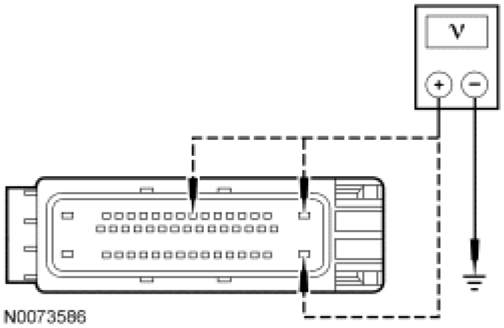


Fig. 4: Measuring Voltage Between ABS Module C155-1, C155-8 & C155-32
Courtesy of FORD MOTOR CO.

- Measure the voltage between ground and:
  - ABS module C135-1, SBB36 (GN/RD), harness side.
  - ABS module C135-8, CBP19 (BN/WH), harness side.
  - ABS module C135-32, SBB10 (YE/RD), harness side.
- **Are the voltages greater than 10 volts?**

  YES : Go to B3.

  NO : VERIFY BJB fuse 8 (40A) is OK. If OK, REPAIR circuit SBB08 (VT/RD).

  VERIFY SJB fuse 28 (10A) is OK. If OK, REPAIR circuit CBP19 (BN/WH).

  VERIFY BJB fuse 10 (20A) is OK. If OK, REPAIR circuit SBB10 (YE/RD).

CLEAR the DTCs. REPEAT the self-test.

B3 CHECK CIRCUIT GD123 (BK/GY) FOR AN OPEN

- Key in OFF position.

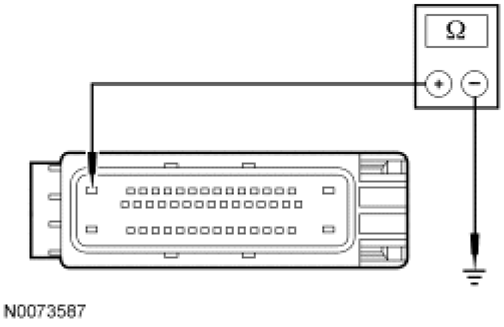


Fig. 5: Measuring Resistance Between ABS Module C155-16, Circuit GD120 (BK/GN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ABS module C135-16, circuit GD123 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : CLEAR the DTCs. REPEAT the self-test. If DTC B1676 is retrieved again, go to B4.

  NO : REPAIR circuit GD123 (BK/GY). CLEAR the DTCs. REPEAT the self-test.

B4 CHECK FOR CORRECT ABS MODULE OPERATION

- Check ABS module C135 for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect: ABS Module C135
- Make sure the connector seats correctly, then operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: DTCs C1145, C1155, C1165 and C1175 - Wheel Speed Sensor Input Circuit Failure

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

Active wheel speed sensors generate a square wave signal that is sent to the ABS module. The wheel speed sensor circuitry connects to the ABS module through 2 wires and a connector at each wheel speed sensor. When the ignition switch is turned to the RUN position, the ABS module carries out a self-test by sending a reference voltage through the wheel speed sensors and their circuitry to determine if they are functional.

Voltage and ground signals are supplied to the wheel speed sensors from the ABS module.

DTC Description	Fault Trigger Condition
• DTC C1145 RF Wheel Speed Sensor Input Circuit Failure • DTC C1155 LF Wheel Speed Sensor Input Circuit Failure • DTC C1165 RR Wheel Speed Sensor Input Circuit Failure • DTC C1175 LR Wheel Speed Sensor Input Circuit Failure	When the vehicle speed exceeds 5 km/h (3 mph), if the ABS module detects an open, short to ground or voltage or a defective wheel speed sensor input circuit, the appropriate DTC will be set.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Wheel speed sensor ring (part of the wheel bearing and hub assembly)
- Wheel speed sensors
- ABS module

PINPOINT TEST C: DTCs C1145, C1155, C1165 AND C1175 - WHEEL SPEED SENSOR INPUT CIRCUIT FAILURE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

C1 CHECK FOR FAULT REPEATABILITY

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: Clear the Continuous DTCs
- Drive the vehicle at least 16 km/h (10 mph).
- Retrieve and document continuous DTCs.
- **Is DTC C1145, C1155, C1165 or C1175 retrieved?**

  YES : If the active wheel speed sensor tool is available, go to C2. If the active wheel speed sensor tool is not available, go to C4.

  NO : INSPECT the wheel speed sensors, wheel speed sensor wiring and wheel speed sensor tone

rings. REPAIR or INSTALL new as necessary. If any other DTCs are retrieved, go to the ABS Module DTC Chart.

C2 CHECK THE ABS MODULE OUTPUT USING THE SPECIAL TOOL

- Key in OFF position.
- Disconnect: Suspect Wheel Speed Sensor
- Connect the special tool to the wheel speed sensor connectors.
- Key in ON position.
- Select the correct system polarity on the special tool and turn the special tool power switch to the ON position.
- **Is the module output LED illuminated?**

  YES : Go to C3.

  NO : Go to C6.

C3 CHECK THE WHEEL SPEED SENSOR OUTPUT WITH THE SPECIAL TOOL

- Raise the suspect wheel until it can spin freely. Refer to **JACKING AND LIFTING** article.
- While monitoring the special tool, slowly spin the suspect wheel.
- **Do the sensor output LEDs illuminate and flash and is the current overload LED not illuminated?**

  YES : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

  NO : If the current level LED is not illuminated and the sensor output LEDs do not illuminate or if the current level LED is illuminated red, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to **Wheel Speed Sensor - Front**. For the rear wheel speed sensor, REFER to **Wheel Speed Sensor - Rear, Front Wheel Drive (FWD)** or **Wheel Speed Sensor - Rear, All Wheel Drive (AWD)**. CLEAR the DTCs. REPEAT the self-test.

  If the current level LED is not illuminated and the sensor output LEDs illuminate green but do not flash, INSPECT the wheel speed sensor tone ring and INSTALL new if necessary. If the tone ring is OK, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to **Wheel Speed Sensor - Front**. For the rear wheel speed sensor, REFER to **Wheel Speed Sensor - Rear, Front Wheel Drive (FWD)** or **Wheel Speed Sensor - Rear, All Wheel Drive (AWD)**. CLEAR the DTCs. REPEAT the self-test.

C4 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR A SHORT TO VOLTAGE

CAUTION: No measurements should be taken with the wheel speed sensor connected. Damage to the wheel speed sensor will result.

NOTE: Both circuits must be checked for each DTC.

- Key in OFF position.
- Disconnect: ABS Module C135
- Disconnect: Suspect Wheel Speed Sensor

- Key in ON position.
- **For DTC C1145** , measure the voltage between ground and:
  - ABS module C135-34, circuit VCA05 (GY/VT), harness side.
  - ABS module C135-33, circuit RCA19 (VT), harness side.
- **For DTC C1155** , measure the voltage between ground and:
  - ABS module C135-45, circuit VCA03 (VT/WH), harness side.
  - ABS module C135-46, circuit RCA17 (YE), harness side.
- **For DTC C1165** , measure the voltage between ground and:
  - ABS module C135-43, circuit VCA06 (WH/OG), harness side.
  - ABS module C135-42, circuit RCA20 (BN), harness side.
- **For DTC C1175** , measure the voltage between ground and:
  - ABS module C135-36, circuit VCA04 (BU/OG), harness side.
  - ABS module C135-37, circuit RCA18 (BN/GN), harness side.
- **Is voltage present?**

  YES : REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

  NO : Go to C5.

C5 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR A SHORT TO GROUND

NOTE: Both circuits must be checked for each DTC.

- Key in OFF position.
- **For DTC C1145** , measure the resistance between ground and:
  - ABS module C135-34, circuit VCA05 (GY/VT), harness side.
  - ABS module C135-33, circuit RCA19 (VT), harness side.
- **For DTC C1155** , measure the resistance between ground and:
  - ABS module C135-45, circuit VCA03 (VT/WH), harness side.
  - ABS module C135-46, circuit RCA17 (YE), harness side.
- **For DTC C1165** , measure the resistance between ground and:
  - ABS module C135-43, circuit VCA06 (WH/OG), harness side.
  - ABS module C135-42, circuit RCA20 (BN), harness side.
- **For DTC C1175** , measure the resistance between ground and:
  - ABS module C135-36, circuit VCA04 (BU/OG), harness side.
  - ABS module C135-37, circuit RCA18 (BN/GN), harness side.
- **Are the resistances greater than 10,000 ohms?**

  YES : Go to C6.

  NO : REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

C6 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR AN OPEN

NOTE: Both circuits must be checked for each DTC.

- Key in OFF position.
- Disconnect: ABS Module C135
- Disconnect: Suspect Wheel Speed Sensor
- **For DTC C1145** , measure the resistance between:
  - ABS module C135-34, circuit VCA05 (GY/VT), harness side and RF wheel speed sensor C160-1, circuit VCA05 (GY/VT), harness side.
  - ABS module C135-33, circuit RCA19 (VT), harness side and RF wheel speed sensor C160-2, circuit RCA19 (VT), harness side.
- **For DTC C1155** , measure the resistance between:
  - ABS module C135-45, circuit VCA03 (VT/WH), harness side and LF wheel speed sensor C150-1, circuit VCA03 (VT/WH), harness side.
  - ABS module C135-46, circuit RCA17 (YE), harness side and LF wheel speed sensor C150-2, circuit RCA17 (YE), harness side.
- **For DTC C1165** , measure the resistance between:
  - ABS module C135-43, circuit VCA06 (WH/OG), harness side and RR wheel speed sensor C426-3, circuit VCA06 (WH/OG), harness side.
  - ABS module C135-42, circuit RCA20 (BN), harness side and RR wheel speed sensor C426-1, circuit RCA20 (BN), harness side.
- **For DTC C1175** , measure the resistance between:
  - ABS module C135-36, circuit VCA04 (BU/OG), harness side and LR wheel speed sensor C440-3, circuit VCA04 (BU/OG), harness side.
  - ABS module C135-37, circuit RCA18 (BN/GN), harness side and LR wheel speed sensor C440-1, circuit RCA18 (BN/GN), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to C7.

  NO : REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the ABS self-test.

C7 CHECK FOR SHORTED WHEEL SPEED SENSOR CIRCUITS

- **For DTC C1145** , measure the resistance between:
  - RF wheel speed sensor C160-1, circuit VCA05 (GY/VT), harness side and RF wheel speed sensor C160-2, circuit RCA19 (VT), harness side.
- **For DTC C1155** , measure the resistance between:
  - LF wheel speed sensor C150-1, circuit VCA03 (VT/WH), harness side and LF wheel speed sensor C150-2, circuit RCA17 (YE), harness side.
- **For DTC C1165** , measure the resistance between:
  - RR wheel speed sensor C426-3, circuit VCA06 (WH/OG), harness side and RR wheel speed sensor C426-1, circuit RCA20 (BN), harness side.
- **For DTC C1175** , measure the resistance between:
  - LR wheel speed sensor C440-3, circuit VCA04 (BU/OG), harness side and LR wheel speed sensor C440-1, circuit RCA18 (BN/GN), harness side.

- **Are the resistances greater than 10,000 ohms?**

  YES : Go to C8.

  NO : REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

C8 CHECK THE ABS MODULE OUTPUT

- Connect: ABS Module C135
- Key in ON position.
- **For DTC C1145** , measure the voltage between:
  - RF wheel speed sensor C160-1, circuit VCA05 (GY/VT), harness side and RF wheel speed sensor C160-2, circuit RCA19 (VT), harness side.
- **For DTC C1155** , measure the voltage between:
  - LF wheel speed sensor C150-1, circuit VCA03 (VT/WH), harness side and LF wheel speed sensor C150-2, circuit RCA17 (YE), harness side.
- **For DTC C1165** , measure the voltage between:
  - RR wheel speed sensor C426-3, circuit VCA06 (WH/OG), harness side and RR wheel speed sensor C426-1, circuit RCA20 (BN), harness side.
- **For DTC C1175** , measure the voltage between:
  - LR wheel speed sensor C440-3, circuit VCA04 (BU/OG), harness side and LR wheel speed sensor C440-1, circuit RCA18 (BN/GN), harness side.
- **Are the voltages greater than 10 volts?**

  YES : INSTALL a new wheel speed sensor. REFER to **Wheel Speed Sensor - Front**, **Wheel Speed Sensor - Rear, All Wheel Drive (AWD)** or **Wheel Speed Sensor - Rear, Front Wheel Drive (FWD)**. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to C9.

C9 CHECK FOR CORRECT ABS MODULE OPERATION

- Key in OFF position.
- Disconnect: ABS Module C135
- Check the connector for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect: ABS Module C135
- Make sure the connector seats correctly, then operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: DTCs C1233, C1234, C1235 and C1236 - Wheel Speed Sensor Signal Fault

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The wheel speed sensor and sensor ring generate a square wave signal to the ABS module that is proportional to the wheel speed. The ABS module compares the wheel speed inputs from all the wheel speed sensors to determine an impending wheel lockup.

DTC Description	Fault Trigger Condition
• DTC C1233 LF Wheel Speed Sensor Signal Fault • DTC C1234 RF Wheel Speed Sensor Signal Fault • DTC C1235 RR Wheel Speed Sensor Signal Fault • DTC C1236 LR Wheel Speed Sensor Signal Fault	When the vehicle speed exceeds 15 km/h (9 mph), if the ABS module does not receive a signal from the wheel speed sensor, the appropriate DTC will be set. These DTCs can also be set by an excessive wheel speed sensor-to-tone ring air gap or a damaged tone ring

This pinpoint test is intended to diagnose the following:

- Mismatched tire sizes
- Wheel speed sensor ring (part of the wheel bearing and hub assembly)
- Wheel speed sensor
- ABS module

PINPOINT TEST D: DTCs C1233, C1234, C1235 AND C1236 - WHEEL SPEED SENSOR SIGNAL FAULT

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

D1 CHECK THE DTCs FROM THE SELF-TEST

- Using the recorded results from the ABS module self-test:
- **Are DTCs C1145, C1155, C1165 or C1175 present?**

YES : Go to **Pinpoint Test C**.

NO : Go to D2.

D2 MONITOR THE WHEEL SPEED SENSOR PIDs

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: ABS DataLogger

- Using the scan tool, monitor the following PIDS while driving the vehicle at a constant speed.
  - Left front wheel speed sensor (LF_WSPD)
  - Right front wheel speed sensor (RF_WSPD)
  - Left rear wheel speed sensor (LR_WSPD)
  - Right rear wheel speed sensor (RR_WSPD)
- **Are all wheel speed sensor PID values similar?**

  YES : CLEAR the DTCs. DRIVE the vehicle. RETRIEVE the DTCs. If DTC C1233, C1234, C1235 or C1236 is present, go to D12.

  NO : If the active wheel speed sensor is available, go to D3.

  If the active wheel speed sensor tool is not available, go to D6.

D3 CHECK THE ABS MODULE OUTPUT USING THE SPECIAL TOOL

- Key in OFF position.
- Disconnect: Suspect Wheel Speed Sensor
- Connect the special tool to the wheel speed sensor connectors.
- Key in ON position.
- Select the correct system polarity on the special tool and turn the special tool power switch to the ON position.
- **Is the module output LED illuminated?**

  YES : Go to D5.

  NO : Go to D4.

D4 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR AN OPEN

NOTE: Both circuits must be checked for each DTC.

- Key in OFF position.
- Disconnect: ABS Module C135
- **For DTC C1233** : measure the resistance between:
  - ABS module C135-45, circuit VCA03 (VT/WH), harness side and LF wheel speed sensor C150-1, circuit VCA03 (VT/WH), harness side.
  - ABS module C135-46, circuit RCA17 (YE), harness side and LF wheel speed sensor C150-2, circuit RCA17 (YE), harness side.
- **For DTC C1234** : measure the resistance between:
  - ABS module C135-34, circuit VCA05 (GY/VT), harness side and RF wheel speed sensor C160-1, circuit VCA05 (GY/VT), harness side.
  - ABS module C135-33, circuit RCA19 (VT), harness side and RF wheel speed sensor C160-2, circuit RCA19 (VT), harness side.
- **For DTC C1235** : measure the resistance between:
  - ABS module C135-43, circuit VCA06 (WH/OG), harness side and RR wheel speed sensor

C426-3, circuit VCA06 (WH/OG), harness side.
    - ABS module C135-42, circuit RCA20 (BN), harness side and RR wheel speed sensor C426-1, circuit RCA20 (BN), harness side.
- **For DTC C1236** : measure the resistance between:
    - ABS module C135-36, circuit VCA04 (BU/OG), harness side and LR wheel speed sensor C440-3, circuit VCA04 (BU/OG), harness side.
    - ABS module C135-37, circuit RCA18 (BN/GN), harness side and LR wheel speed sensor C440-1, circuit RCA18 (BN/GN), harness side.
- **Are the resistances less than 5 ohms?**

  YES : Go to D12.

  NO : REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

D5 CHECK THE WHEEL SPEED SENSOR OUTPUT WITH THE SPECIAL TOOL

- Raise the suspect wheel until it can spin freely. Refer to **JACKING AND LIFTING** article.
- While monitoring the special tool, slowly spin the suspect wheel.
- **Do the sensor output LEDs illuminate and flash and is the current overload LED not illuminated?**

  YES : INSPECT the wheel speed sensor tone ring for damage and looseness. INSTALL new components as necessary. If the tone ring is OK, the concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

  NO : If the current level LED is not illuminated and the sensor output LEDs do not illuminate or if the current level LED is illuminated red, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to **Wheel Speed Sensor - Front**. For the rear wheel speed sensor, REFER to **Wheel Speed Sensor - Rear, Front Wheel Drive (FWD)** or **Wheel Speed Sensor - Rear, All Wheel Drive (AWD)**. CLEAR the DTCs. REPEAT the self-test.

  If the current level LED is not illuminated and the sensor output LEDs illuminate green but do not flash, INSPECT the wheel speed sensor tone ring and INSTALL new if necessary. If the tone ring is OK, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to **Wheel Speed Sensor - Front**. For the rear wheel speed sensor, REFER to **Wheel Speed Sensor - Rear, Front Wheel Drive (FWD)** or **Wheel Speed Sensor - Rear, All Wheel Drive (AWD)**. CLEAR the DTCs. REPEAT the self-test.

D6 CHECK FOR CORRECT ABS MODULE OUTPUT

- Key in OFF position.
- Disconnect: Suspect Wheel Speed Sensor
- Key in ON position.
- **For DTC C1233** , measure the voltage between:
    - RF wheel speed sensor C160-1, circuit VCA05 (GY/VT), harness side and RF wheel speed sensor C160-2, circuit RCA19 (VT), harness side.
- **For DTC C1234** , measure the voltage between:
    - LF wheel speed sensor C150-1, circuit VCA03 (VT/WH), harness side and LF wheel speed sensor C150-2, circuit RCA17 (YE), harness side.

- **For DTC C1235** , measure the voltage between:
  - RR wheel speed sensor C426-3, circuit VCA06 (WH/OG), harness side and RR wheel speed sensor C426-1, circuit RCA20 (BN), harness side.
- **For DTC C1236** , measure the voltage between:
  - LR wheel speed sensor C440-3, circuit VCA04 (BU/OG), harness side and LR wheel speed sensor C440-1, circuit RCA18 (BN/GN), harness side.
- **Are the voltages greater than 10 volts?**

  YES : INSTALL a new wheel speed sensor. REFER to **Wheel Speed Sensor - Front**, **Wheel Speed Sensor - Rear, All Wheel Drive (AWD)** or **Wheel Speed Sensor - Rear, Front Wheel Drive (FWD)**. CLEAR the DTCs. REPEAT the self-test.

  NO : Go to D7.

D7 INSPECT THE WHEEL SPEED SENSOR MOUNTING

- Key in OFF position.
- With the vehicle in NEUTRAL, position it on a hoist. Refer to **JACKING AND LIFTING** article.
- Inspect the suspect wheel speed sensor(s) for looseness.
- **Is the wheel speed sensor(s) loose?**

  YES : TIGHTEN the wheel speed sensor bolt to specification. REFER to **SPECIFICATIONS**.

  NO : Go to D8.

D8 INSPECT THE WHEEL SPEED SENSOR FOR DAMAGE

CAUTION: **Inspect the wheel speed sensor wire carefully with a good light source. Failure to verify damage in the wheel speed sensor wire can lead to unnecessary installation of a new component.**

- Inspect the suspect wheel speed sensor(s) for general damage.
- **Is the wheel speed sensor(s) OK?**

  YES : Go to D9.

  NO : INSTALL a new wheel speed sensor. REFER to **Wheel Speed Sensor - Front**, **Wheel Speed Sensor - Rear, All Wheel Drive (AWD)** or **Wheel Speed Sensor - Rear, Front Wheel Drive (FWD)**. CLEAR the DTCs. REPEAT the self-test.

D9 INSPECT THE WHEEL SPEED SENSOR RING FOR DAMAGE

- Remove the suspect wheel speed sensor(s). Refer to **Wheel Speed Sensor - Front**, **Wheel Speed Sensor - Rear, All Wheel Drive (AWD)** or **Wheel Speed Sensor - Rear, Front Wheel Drive (FWD)**.
- Inspect the suspect wheel speed sensor ring(s) for damage or missing teeth. Rotate the wheel to verify that no teeth are missing.
- **Is the wheel speed sensor ring(s) OK?**

  YES : Go to D10.

  NO : INSTALL new wheel bearing and wheel hubs as necessary. REFER to **FRONT SUSPENSION** article for the front wheel bearing and wheel hub or **REAR SUSPENSION** article for the rear wheel bearing and wheel hub.

D10 INSPECT THE WHEEL BEARINGS FOR DAMAGE

- Inspect the wheel bearings for damage.
- **Are the wheel bearings OK?**

  YES : Go to D11.

  NO : INSTALL new wheel bearing and wheel hubs as necessary. REFER to **FRONT SUSPENSION** article for the front wheel bearing and wheel hub or **REAR SUSPENSION** article for the rear wheel bearing and wheel hub.

D11 RECHECK THE WHEEL SPEED SENSOR PIDs

- Connect: Suspect Wheel Speed Sensor
- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: ABS DataLogger
- Using the scan tool, monitor the following PIDS while driving the vehicle at a constant speed.
  - Left front wheel speed sensor (LF_WSPD)
  - Right front wheel speed sensor (RF_WSPD)
  - Left rear wheel speed sensor (LR_WSPD)
  - Right rear wheel speed sensor (RR_WSPD)
- **Are all wheel speed sensor PID values similar?**

  YES : The vehicle is OK. The concern may have been caused by a loose or damaged wheel speed sensor, a damaged wheel speed sensor ring or a damaged wheel bearing.

  NO : Go to D9.

D12 CHECK FOR CORRECT ABS MODULE OPERATION

- Key in OFF position.
- Disconnect: ABS Module C135
- Check the connector for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect: ABS Module C135
- Make sure the connector seats correctly, then operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSPECT the wheel speed sensor tone ring for damage and looseness. INSTALL new components as necessary. If the tone ring is OK, INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: DTC C1095 - ABS Hydraulic Pump Motor Circuit Failure

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Vehicle Dynamic Systems for schematic and connector information.

Normal Operation

The operating voltage required to supply the hydraulic pump motor is in a range between 10 and 16 volts. Fused battery voltage for the hydraulic pump is supplied to the ABS module from battery junction box (BJB) fuse 8 (40A) SBB08 (VT/RD) along circuit SBB08 (VT/RD). Ground for the hydraulic pump is provided through the ABS module along circuit GD123 (BK/GY).

- DTC C1095 ABS Hydraulic Pump Motor Circuit Failure - If the ABS module detects an open circuit, a short to voltage or ground or a defective internal power transistor during normal operation or the ABS module self-test, DTC C1095 will be set. The ABS module will command the pump motor ON for 100 ms (±6 ms), then command the motor OFF and measure the voltage produced by the motor after 6 ms. If the voltage indicates that the motor is spinning at less than 500 rpm there may be a locked motor. If this condition is detected 4 times, then DTC C1095 will be set. The pump motor is also checked for an open circuit 2 seconds after the most recent successful pump motor off command. If the pump motor feedback remains greater than 0.75 volt for more than 50 ms (±6 ms) after these conditions have been met, then DTC C1095 will be set

This pinpoint test is intended to diagnose the following:

- Fuse
- Wiring, terminals or connectors
- ABS module

PINPOINT TEST E: DTC C1095 - ABS HYDRAULIC PUMP MOTOR CIRCUIT FAILURE

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

E1 CHECK THE ABS PUMP MOTOR

- Key in ON position.
- **Is the ABS pump motor running all the time?**

  YES : Go to E5.

  NO : Go to E2.

E2 CHECK THE PUMP MOTOR OUTPUT COMMAND (PMP_MOTOR)

- Key in OFF position.
- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: ABS DataLogger
- Toggle the PMP_MOTOR output command ON.
- **Does the ABS pump motor run for approximately 3 seconds?**

YES : TOGGLE the PMP_MOTOR output command OFF. CLEAR the DTCs.

CHECK the yellow ABS warning indicator while driving the vehicle (brakes must not be applied) above 20 km/h (12 mph). If the yellow ABS warning indicator illuminates, RETRIEVE the DTCs.

If DTC C1095 is retrieved, go to E5.

If a different DTC is retrieved, refer to the ABS Module DTC Chart.

If the yellow ABS warning indicator does not illuminate, the system is OK.

NO : TOGGLE the PMP_MOTOR output command OFF. Go to E3 .

E3 CHECK THE VOLTAGE TO THE ABS MODULE

- Key in OFF position.
- Disconnect: ABS Module C135
- Key in ON position.

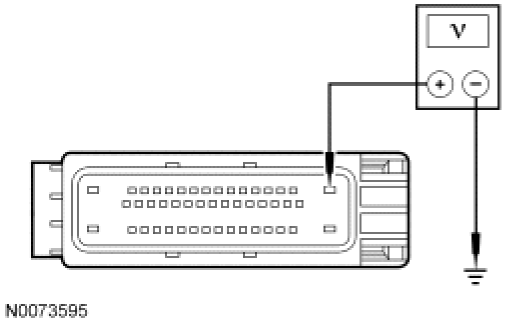


Fig. 6: Measuring Voltage Between ABS Module C155-1, Circuit SBB06 (BN/RD) & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between ABS module C135-1, circuit SBB08 (VT/RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to E4.

  NO : VERIFY BJB fuse 8 (40A) is OK. If OK, REPAIR circuit SBB08 (VT/RD). CLEAR the DTCs. REPEAT the self-test.

E4 CHECK CIRCUIT GD123 (BK/GY) FOR AN OPEN

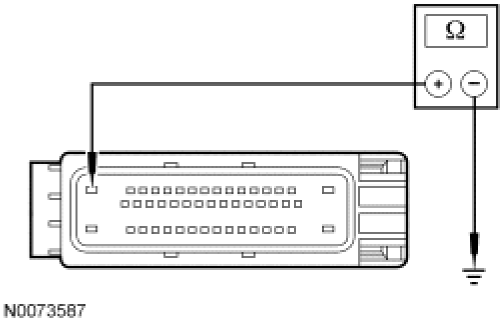


Fig. 7: Measuring Resistance Between ABS Module C155-16, Circuit GD120 (BK/GN) & Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between ABS module C135-16, circuit GD123 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to E5.

  NO : REPAIR circuit GD123 (BK/GY). CLEAR the DTCs. REPEAT the self-test.

E5 CHECK FOR CORRECT ABS MODULE OPERATION

- Key in OFF position.
- Disconnect: ABS Module C135
- Check the connector for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect: ABS Module C135
- Make sure the connector seats correctly, then operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new ABS module. REFER to **Anti-Lock Brake System (ABS) Module**. CLEAR the DTCs. REPEAT the self-test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: Poor Vehicle Tracking During Anti-Lock Function

Normal Operation

The operating voltage required to supply the ABS module, hydraulic pump and isolation valves is in a range between 10 and 16 volts.

Fused battery voltage is supplied to the ABS module from battery junction box (BJB) fuse 10 (30A) along circuit SBB10 (YE/RD) and fuse 8 (40A) along circuit SBB08 (VT/RD). Fused ignition voltage is supplied to

the ABS module from smart junction box (SJB) fuse 28 (10A) along CBP19 (BN/WH) and ground is provided to the module along circuit GD123 (BK/GY).

This pinpoint test is intended to diagnose the following:

- Base brake system
- Hydraulic control unit (HCU)

PINPOINT TEST F: POOR VEHICLE TRACKING DURING ANTI-LOCK FUNCTION

F1 BLEED THE BRAKE SYSTEM

- Bleed the brake system using the scan tool. Refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.
- Test drive the vehicle.
- **Does the vehicle still track poorly?**

  YES : Go to F2.

  NO : The brake system is operating correctly. The concern may have been caused by air in the hydraulic system or a sticky valve.

F2 CHECK THE ABS INLET VALVE (CLOSED POSITION)

- With the vehicle in NEUTRAL, position it on a hoist. Refer to **JACKING AND LIFTING** article.
- Rotate all the wheels to make sure they rotate freely (the transaxle must be in NEUTRAL).
- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: ABS DataLogger: Left Front Inlet Valve (LF_INLET) Output Command
- Toggle the LF_INLET output command ON.
- Apply moderate brake pedal effort.
- Have an assistant attempt to rotate the LF wheel.
- **Does the LF wheel rotate?**

  YES : TOGGLE the LF_INLET output command OFF. Go to F3.

  NO : TOGGLE the LF_INLET output command OFF. INSTALL a new HCU. REFER to **Hydraulic Control Unit (HCU)**. TEST the system for normal operation.

F3 CHECK THE ABS INLET VALVE (OPEN POSITION)

- Apply moderate brake pedal effort.
- Have an assistant attempt to rotate the LF wheel.
- **Does the LF wheel rotate?**

  YES : INSTALL a new HCU. REFER to **Hydraulic Control Unit (HCU)**. TEST the system for normal operation.

  NO : Go to F4.

F4 CHECK THE ABS OUTPUT VALVE (OPEN POSITION)

- Apply moderate brake pedal effort.

- Enter the following diagnostic mode on the diagnostic tool: ABS DataLogger
- Toggle the left front inlet valve (LF_INLET) output command ON.

NOTE: Each activation of the output command will run the pump for 2 seconds.

- Toggle the hydraulic pump motor (PMP_MOTOR) output command ON for 6 seconds (the trigger must be pressed 3 times).
- Toggle the left front inlet valve (LF_OUTLET) output command ON, then toggle the LF_OUTLET output command. Repeat 3 times.
- Have an assistant attempt to rotate the LF wheel.
- **Does the LF wheel rotate?**

  YES : TOGGLE all output commands OFF. Go to F5.

  NO : TOGGLE all output commands OFF. INSTALL a new HCU. REFER to **Hydraulic Control Unit (HCU)**. TEST the system for normal operation.

F5 CHECK THE ABS INLET AND OUTLET VALVE (CLOSED POSITION)

- Apply moderate brake pedal effort.
- Have an assistant attempt to rotate the LF wheel.
- **Does the LF wheel rotate?**

  YES : INSTALL a new HCU. REFER to **Hydraulic Control Unit (HCU)**. TEST the system for normal operation.

  NO : Beginning with Step F2, REPEAT this procedure for the RF, LR and RR wheels using the appropriate output commands. If no failure occurs the system is operating normally.

Pinpoint Test G: The Traction Control System Cannot Be Disabled

The traction control system can be disabled by pressing the traction control switch located on the instrument panel. When the system is disabled, the traction control system indicator in the instrument cluster will illuminate solidly.

The instrument cluster sends 5 volts to the traction control switch along circuit CCA15 (YE/GY). When the traction control switch is pressed, this voltage is sent through the switch and to ground along circuit GD116 (BK/VT).

When the instrument cluster receives input from the traction control switch, it will send a message over the high-speed controller area network (HS-CAN) bus to the ABS module disabling the traction control. The traction assist system will reset and return to normal operation when the ignition switch is cycled or when the switch is pressed and released a second time during the same ignition cycle.

- DTC C1093 Traction Control Disable Switch Circuit Failure - If the traction control switch closed for more than 2 minutes or if there is a short to ground on circuit CCA15 (YE/GY) during normal operation, DTC C1093 will be set. If the traction control switch closed during the instrument cluster self-test and for more than 2 minutes in during normal operation, DTC C1093 will be set.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Hazard/PAD/traction switch
- Instrument cluster

PINPOINT TEST G: THE TRACTION CONTROL SYSTEM CANNOT BE DISABLED

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multi-meter probes.

G1 CHECK FOR ANY COMMUNICATION DTCs

- Connect the diagnostic tool.
- Key in ON position.
- Check the instrument cluster, the PCM and the ABS module for any communication DTCs.
- **Are any communication DTCs present?**

  YES : For ABS DTCs, go to the ABS Module DTC Chart.

  For instrument cluster and PCM DTCs, REFER to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.

  NO : Go to G2.

G2 CHECK FOR ANY INSTRUMENT CLUSTER NON-COMMUNICATION DTCs

- Check the instrument cluster for any non-communication DTCs.
- **Is DTC C1093 present?**

  YES : Go to G6.

  NO : If no DTCs are present, go to G3.

  For all other instrument cluster DTCs, REFER to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.

G3 CHECK FOR VOLTAGE AT THE TRACTION CONTROL SWITCH

- Key in OFF position.
- Disconnect: Hazard/PAD/Traction Switch C2355
- Key in ON position.

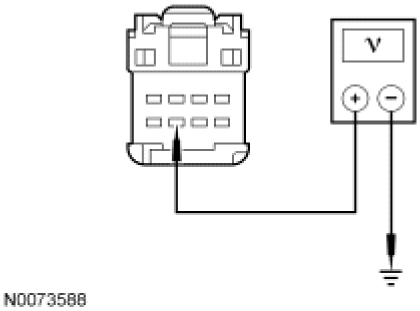


Fig. 8: Checking Voltage At Traction Control Switch
Courtesy of FORD MOTOR CO.

- Measure the voltage between hazard/PAD/traction switch C2355-7, circuit CCA15 (YE/GY), harness side and ground.
- **Is the voltage approximately 5 volts?**

  YES : Go to G4.

  NO : Go to G5.

G4 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

- Key in OFF position.

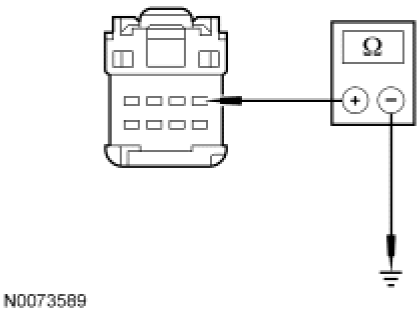


Fig. 9: Checking Circuit GD116 (BK/VT) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between hazard/PAD/traction switch C2355-1, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to G7.

  NO : REPAIR circuit GD116 (BK/VT). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

G5 CHECK CIRCUIT CCA15 (YE/GY) FOR AN OPEN

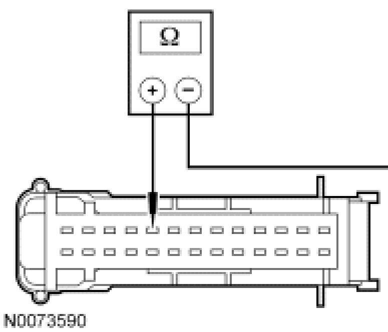


Fig. 10: Checking Circuit CCA15 (YE/GY) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between hazard/PAD/traction switch C2355-7, circuit CCA15 (YE/GY), harness side and instrument cluster C220-22, circuit CCA15 (YE/GY), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to G6.

  NO : REPAIR circuit CCA15 (YE/GY). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

G6 CHECK CIRCUIT CCA15 (YE/GY) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: Instrument Cluster C220

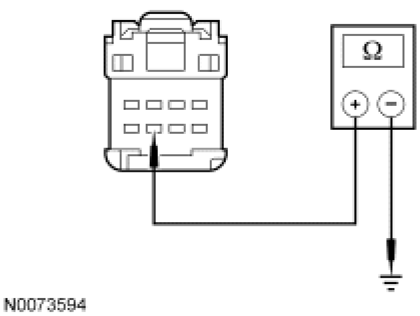


Fig. 11: Checking Circuit CCA15 (YE/GY) For A Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between hazard/PAD/traction switch C2355-7, circuit CCA15 (YE/GY), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to G7.

  NO : REPAIR circuit CCA15 (YE/GY). CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

G7 CHECK THE TRACTION CONTROL SWITCH

- Measure the resistance between hazard/PAD/traction switch C2355-7, component side and hazard/PAD/traction switch C2355-1, component side, while pressing and releasing the traction

control switch.

- **Is the resistance less than 5 ohms with the switch pressed and greater than 10,000 ohms with the switch released?**

  YES : Go to G8.

  NO : INSTALL a new hazard/PAD/traction switch. REFER to **EXTERIOR LIGHTING** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

G8 CHECK THE INSTRUMENT CLUSTER CONNECTORS

- Key in OFF position.
- Disconnect: Instrument Cluster C220
- Check the connector for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.
- Connect: Instrument Cluster C220
- Make sure the connector is seated correctly then operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new instrument cluster. REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article. CLEAR the DTCs. REPEAT the self-test. TEST the system for normal operation.

  NO : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector.

REMOVAL AND INSTALLATION

HYDRAULIC CONTROL UNIT (HCU)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A or WSS-M6C65-A1

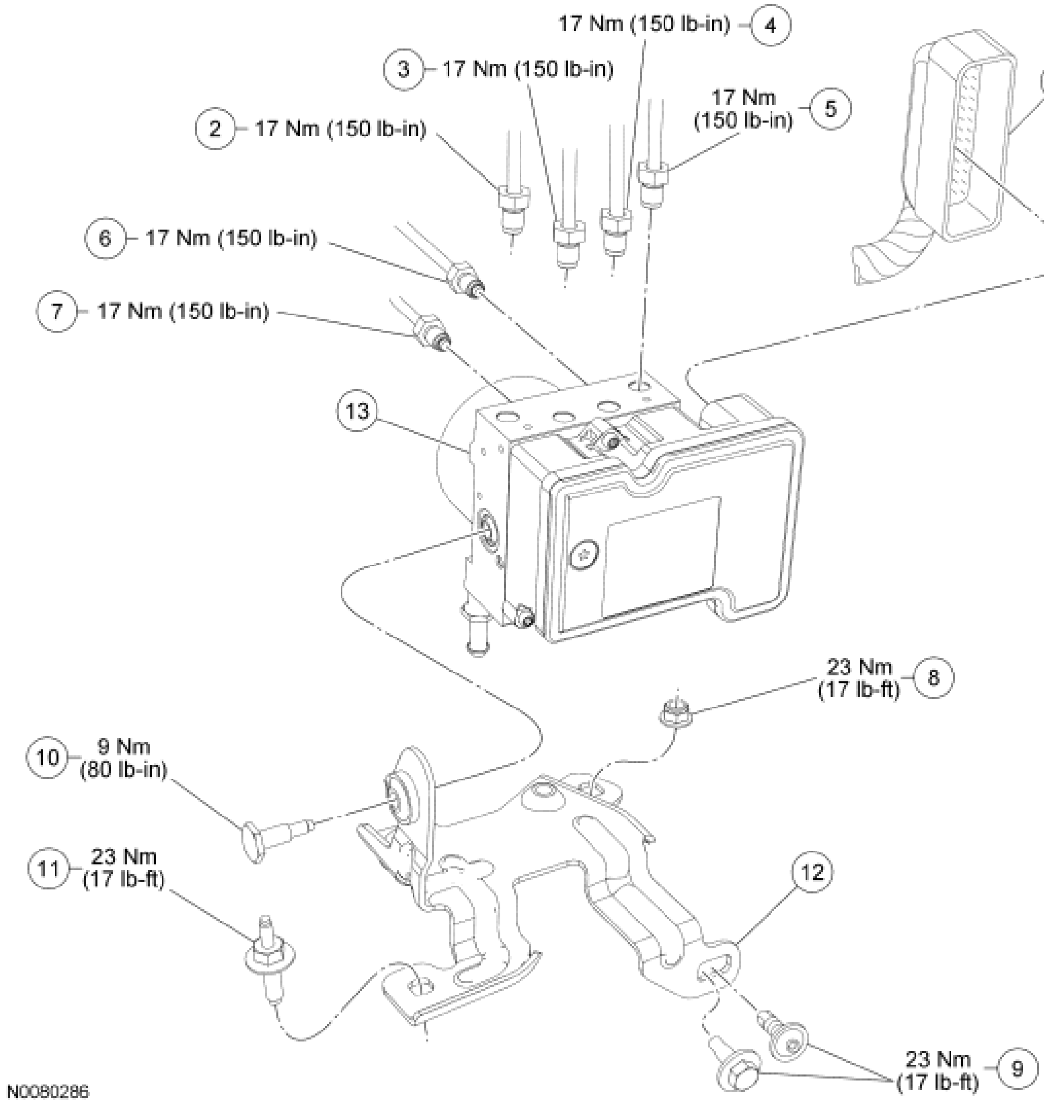


Fig. 12: Exploded View Of Hydraulic Control Unit (HCU) With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	ABS module electrical connector (part of 14290)
2	-	Master cylinder secondary brake tube fitting (part of 2C360)
3	-	RH front brake tube fitting (part of 2263)
4	-	Rear back pressure valve brake tube fitting (part of 2C360)
5	-	Master cylinder primary brake tube fitting (part of 2C360)
6	-	Rear back pressure valve brake tube fitting (part of 2C360)
7	-	LH front brake tube fitting (part of 2C360)
8	W520102	Hydraulic control unit (HCU) bracket-to-frame nut
9	W505433	HCU bracket-to-frame bolt (hex head) (2.3L and 3.0L)
9	W712710	HCU bracket-to-frame bolt (Torx head) (3.5L only)

10	2C398	HCU bracket-to-HCU bolt
11	W704925	HCU bracket-to-frame stud bolt
12	2C304	HCU bracket
13	2C346	HCU

REMOVAL AND INSTALLATION

WARNING: **Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.**

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the degas bottle. For additional information, refer to **ENGINE COOLING** article.
2. Disconnect the ABS module electrical connector.
3. Disconnect the brake tube fittings.
   - To install, tighten to 17 Nm (150 lb-in).
4. Remove the hydraulic control unit (HCU) bracket-to-frame nut.
   - To install, tighten to 23 Nm (17 lb-ft).

NOTE: If installing a new bolt, use only the Torx head type for vehicles equipped with a 3.5L engine.

5. Remove the HCU bracket-to-frame bolt.
   - To install, tighten to 23 Nm (17 lb-ft).
6. Remove the HCU bracket-to-frame stud.
   - To install, tighten to 23 Nm (17 lb-ft).
7. Remove the HCU and bracket.
8. Remove the HCU bracket-to-HCU bolt and remove the bracket.
   - To install, tighten to 9 Nm (80 lb-in).

NOTE: Make sure the HCU and ABS module are clean and free of any brake fluid or foreign material before separating the components.

9. To install, reverse the removal procedure.
   - Bleed the brake system. For additional information, refer to **BRAKE SYSTEM - GENERAL INFORMATION** article.

ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

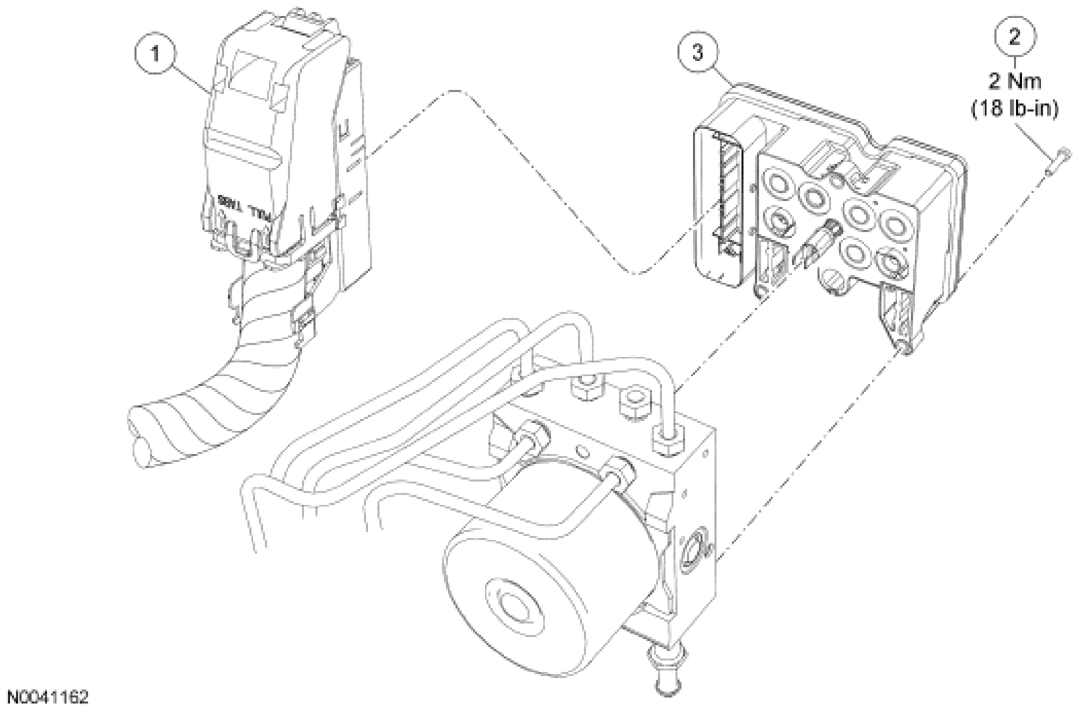


Fig. 13: Exploded View Of Anti-Lock Brake System (ABS) Module With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	ABS module electrical connector (part of 14290)
2	2M101	ABS module screw (3 required)
3	2C219	ABS module

REMOVAL AND INSTALLATION

CAUTION: Electronic modules are sensitive to electrical charges. The anti-lock brake system (ABS) module can be damaged if exposed to these charges.

CAUTION: Do not allow any brake fluid or foreign material to enter the mating side of the anti-lock brake system (ABS) module or damage to the solenoids can occur.

1. Remove the degas bottle. For additional information, refer to **ENGINE COOLING** article.
2. Disconnect the ABS module electrical connector.
3. Remove the 3 ABS module screws and the ABS module.
   - To install, tighten to 2 Nm (18 lb-in).

NOTE: Visually inspect the ABS module terminals for damage before installation.

4. To install, reverse the removal procedure.

WHEEL SPEED SENSOR - FRONT

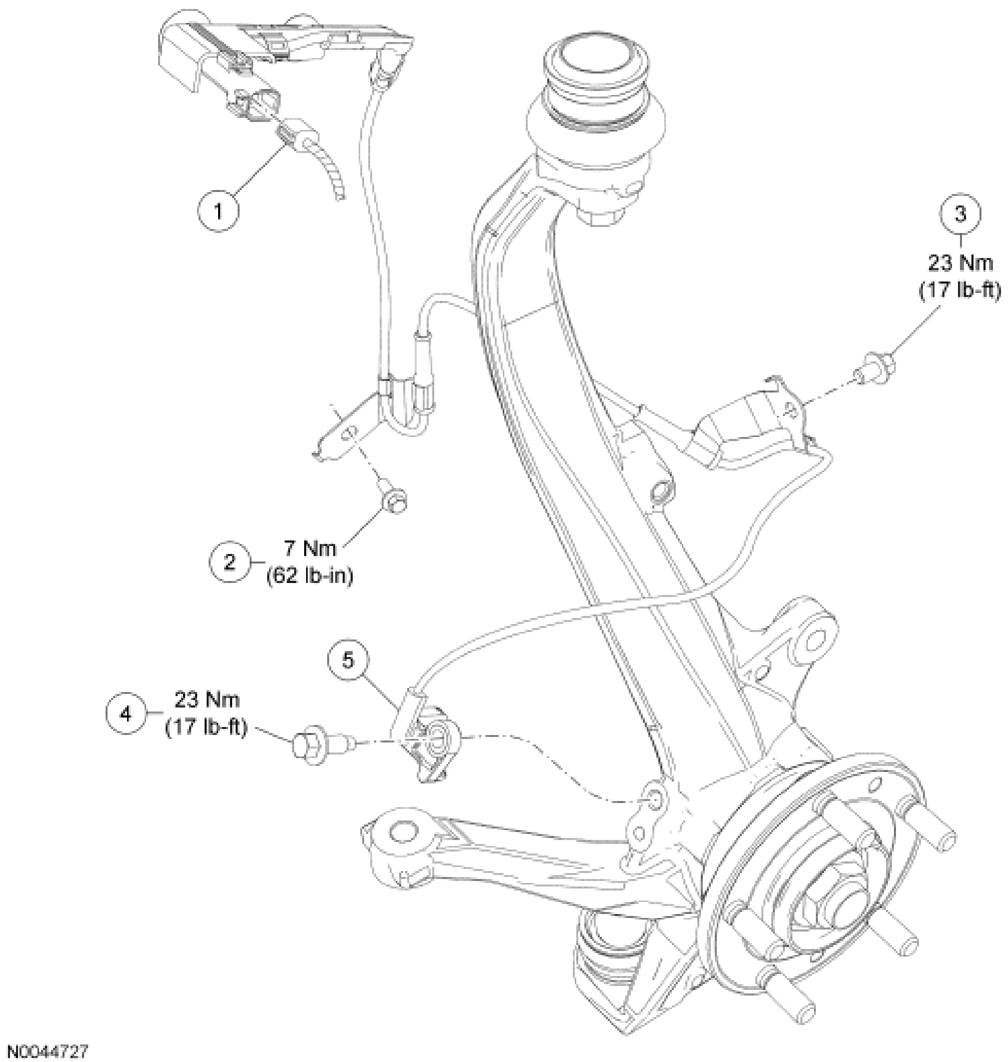


Fig. 14: Exploded View Of Front Wheel Speed Sensor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Wheel speed sensor electrical connector (part of 14A227)
2	W500020	Wheel speed sensor harness bracket-to-body bolt
3	-	Wheel speed sensor harness bracket-to-wheel knuckle bolt
4	W500222	Wheel speed sensor bolt
5	2C204 RH/ 2C205 LH	Wheel speed sensor

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the retainers and position the fender splash shield aside.
3. Disconnect the wheel speed sensor electrical connector.
4. Remove the 2 wheel speed sensor harness bracket bolts.
   - To install:
     - Tighten the bracket-to-wheel knuckle bolt to 23 Nm (17 lb-ft).
     - Tighten the bracket-to-body bolt to 7 Nm (62 lb-in).
5. Remove the front wheel speed sensor bolt from the knuckle and remove the wheel speed sensor.
   - To install, tighten to 23 Nm (17 lb-ft).
6. To install, reverse the removal procedure.

WHEEL SPEED SENSOR - REAR, FRONT WHEEL DRIVE (FWD)

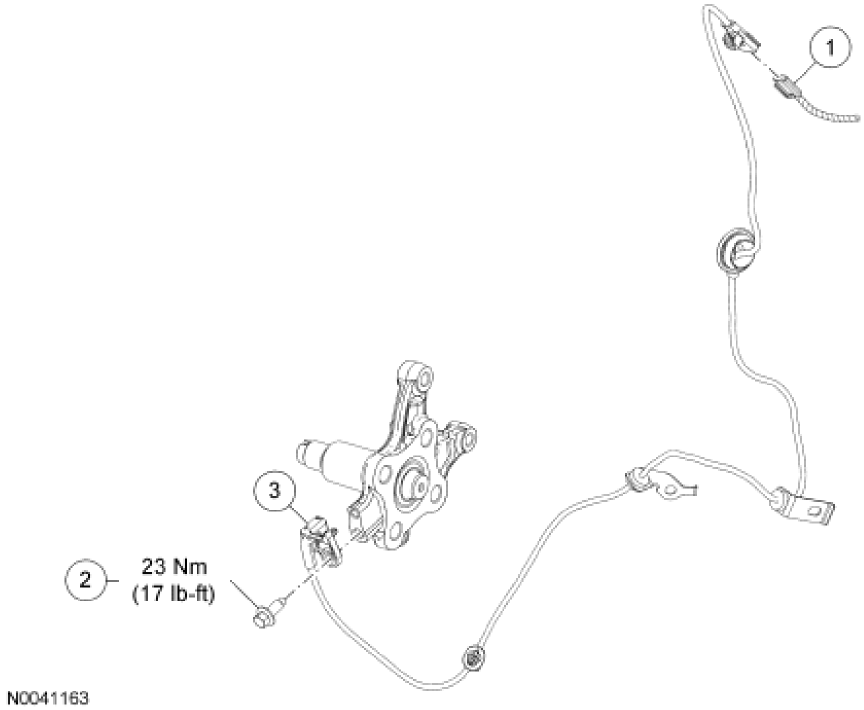


Fig. 15: Exploded View Of Rear Wheel Speed Sensor With Torque Specification - Front Wheel Drive (FWD)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Wheel speed sensor electrical connector (part of 14A227)
2	W500222	Wheel speed sensor bolt
3	2C186 RH/ 2C187 LH	Wheel speed sensor

REMOVAL AND INSTALLATION

1. Remove the rear seat bolster. For additional information, refer to **SEATING** article.
2. Disconnect the wheel speed sensor electrical connector.
3. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
4. Using a suitable tool, disconnect the grommet from the body.

NOTE: It is not necessary to remove the harness routing brackets.

5. Disconnect the wheel speed sensor harness from the brackets.
6. Remove the wheel speed sensor wire bolt and the wheel speed sensor.
   - To install, tighten to 23 Nm (17 lb-ft).
7. To install, reverse the removal procedure.

WHEEL SPEED SENSOR - REAR, ALL WHEEL DRIVE (AWD)

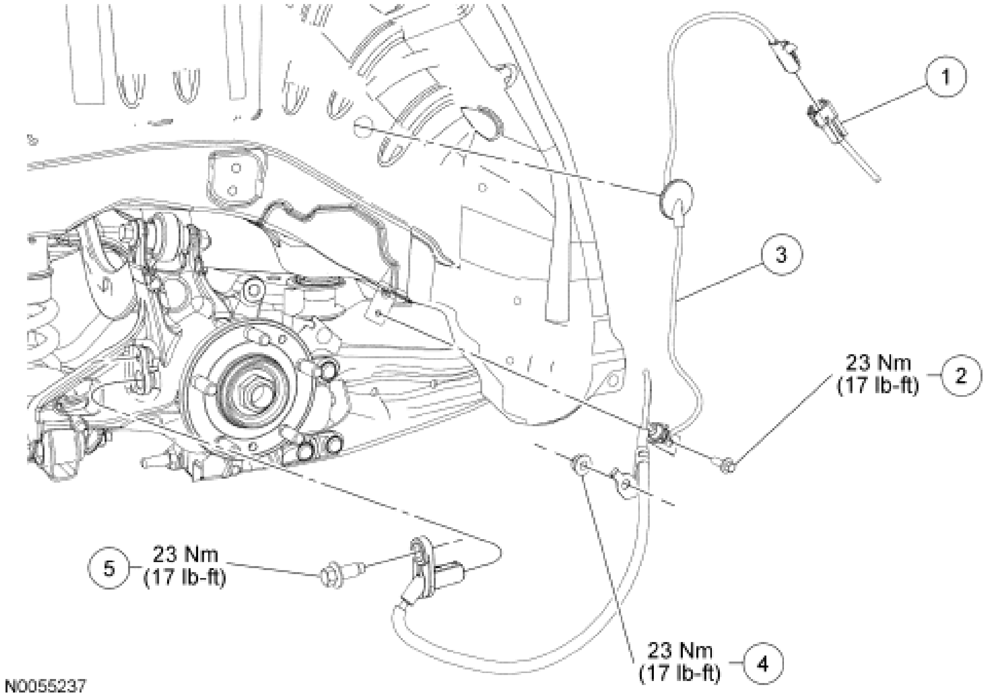


Fig. 16: Exploded View Of Rear Wheel Speed Sensor With Torque Specifications - All Wheel Drive (AWD)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Wheel speed sensor electrical connector (part of 14A227)
2	W505253	Wheel speed sensor harness bolt
3	2C186 RH/ 2C187 LH	Wheel speed sensor
4	W520102	Wheel speed sensor harness nut
5	W500222	Wheel speed sensor bolt

REMOVAL AND INSTALLATION

1. Remove the rear seat bolster. For additional information, refer to **SEATING** article.
2. Disconnect the wheel speed sensor electrical connector.
3. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
4. Using a suitable tool, disconnect the grommet from the body.
5. Remove the wheel speed sensor harness nut and bolt.
   - To install, tighten to 23 Nm (17 lb-ft).
6. Remove the wheel speed sensor wire bolt and the wheel speed sensor.
   - To install, tighten to 23 Nm (17 lb-ft).
7. To install, reverse the removal procedure.

2008 SUSPENSION

Wheels & Tires - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A	-
Wheel and Tire Cleaner ZC-37-A	-	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Tire Balance Weight	
Maximum balance weight (total of inner and outer wheel flange)	180 g (6.4 oz.) per wheel inner 110 g (3.9 oz.) per outer, with tape weights
Tire Inflation	
Tires	See safety certification sticker on driver door jamb

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Sensor strap (worm gear)	3	-	27
Wheel nuts[a] [b]	133	98	-

[a] Torque specifications are for clean, dry bolt and nut threads. Never use oil or grease on wheel bolts or nuts.

[b] Refer to the procedure.

DESCRIPTION AND OPERATION

WHEELS AND TIRES

Safety Precautions

WARNING: **Vehicle may have multiple drive wheels. Do not use engine to power the**

driveline unless all drive wheels are elevated off the ground. Drive wheels in contact with ground could cause unexpected vehicle movement. Failure to follow this instruction may result in serious personal injury.

WARNING: **Always match the tire size to the wheel size during assembly. Incorrect matching can result in tire bead damage or tire separation from the wheel. Failure to follow this instruction may result in serious personal injury to technician or vehicle occupant(s).**

WARNING: **Before servicing any tire, ask the customer if anyone injected a tire sealant into the tire. Tire sealants may be flammable and can burn or explode if exposed to an ignition source. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Replacement wheels must be equivalent to the original equipment wheels in:**

- **load carrying capacity.**
- **diameter, width and offset.**
- **pilot hole and bolt circle.**

Combined load carrying capacity of replacement wheels for a given axle, must be equal to or greater than that axle's gross axle weight rating (GAWR) identified on the vehicle's Safety Compliance Certification label. All other specifications should be evaluated by measurement of both the original wheel and the replacement wheel. If specifications are not equivalent, the safety and handling of the vehicle may be degraded, which may result in serious injury to the vehicle occupant(s).

WARNING: **Never use wheels different than the original equipment. Additionally, never use wheel nuts different than the original equipment. Failure to follow these instructions may result in damage to the wheel or mounting system. This damage could cause the wheel to come off while the vehicle is being driven, which could result in serious personal injury or death to vehicle occupant(s).**

WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

WARNING: **Keep eyes away from valve stem when deflating tires. Reduce air pressure in tire as much as possible by pushing in valve core plunger prior to removing the core. Escaping air can carry particles that can injure the eyes. Failure to follow these instructions may result in serious personal injury.**

WARNING: Only use replacement tires that are the same size, load index, speed rating and type (such as P-metric versus LT-metric or all-season versus all-terrain) as those originally provided by Ford. The recommended tire and wheel size may be found on either the Safety Compliance Certification Label or the Tire Label, which is located on the B-pillar or edge of the driver's door. If the information is not found on these labels, consult a Ford dealer. Use of any tire or wheel not recommended by Ford can affect the safety and performance of the vehicle, which could result in an increased risk of loss of vehicle control, vehicle rollover, personal injury and death. Additionally, the use of non-recommended tires and wheels could cause steering, suspension, axle or transfer case/power transfer unit failure.

NOTE: Do not clean aluminum wheels with steel wool, abrasive-type cleaners or strong detergents or damage to the wheel finish may occur. Use Wheel and Tire Cleaner ZC-27-A or -B or equivalent.

Factory-installed tires and wheels are designed to operate satisfactorily with loads up to and including full-rated load capacity when inflated to recommended inflation pressures.

Correct tire pressure and driving techniques have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase tire wear.

To equalize tire wear, the tires should be rotated at recommended intervals.

Tire Pressure Monitoring System (TPMS)

NOTE: The Smart Junction Box (SJB) is also identified as the Generic Electronic Module (GEM).

The Tire Pressure Monitoring System (TPMS) includes:

- the SJB, TPMS functionality is integrated within the SJB.
- four tire pressure sensors.
- four tire pressure sensor cradles.
- four tire pressure sensor straps.
- an instrument cluster indicator.
- a message center (if equipped).

Tire Pressure Monitoring System (TPMS) Module

The SJB contains the TPMS functionality. Refer to **Tire Pressure Monitoring System** in Diagnosis and Testing for TPMS fault diagnosis and repair.

The SJB compares the information of each tire pressure sensor transmission against a pressure limit. If the SJB

determines that the tire pressure has fallen below the low limit, the SJB communicates this to the instrument cluster on the vehicle communication bus.

Tire Pressure Monitoring System (TPMS) Pressure Sensor

The SJB monitors the air pressure in the 4 road tires with tire pressure sensors. The sensors transmit radio frequency signals to the SJB approximately every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph).

The tire pressure sensors are battery operated and are mounted to metal brackets (called cradles) on the wheels inside the tires. The sensors are mounted 180 degrees from the valve stem.

The tire pressure sensor can be serviced separately from the cradle and the strap.

Tire Pressure Monitoring System (TPMS) Pressure Sensor Cradle

The tire pressure sensor cradles are mounted to the wheels with metal straps and have an adhesive strip to aid in their retention to the wheel.

The sensor cradle is available with the strap in a kit. To service the sensor cradle, the strap must be removed and discarded.

Tire Pressure Monitoring System (TPMS) Pressure Sensor Strap

The sensor strap keeps the sensor and the cradle retained to the wheel. A factory-installed strap is joined together with a one-time-use buckle and a dealer-installed strap is joined together with a worm gear (similar to a radiator hose clamp). Both straps should be discarded after removal and should not be reused.

The cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter.

Instrument Cluster and Message Center

The instrument cluster illuminates the TPMS indicator when it receives a message from the SJB to do so and displays the appropriate message(s) in the message center (if equipped).

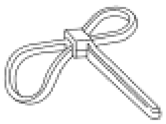
The instrument cluster and message center are diagnosed and serviced in their own respective workshop article parts. Refer to the appropriate Instrumentation and Warning Systems article for the procedure.

DIAGNOSTIC TESTS

WHEELS AND TIRES

Special Tools

Illustration	Tool Name	Tool Number
	Activation Tool, Tire Pressure	

 ST1385-A	Monitor	204-363
 ST1438-A	Digital Tire Gauge	204-354

Inspection and Verification

WARNING: **Vehicle may have multiple drive wheels. Do not use engine to power the driveline unless all drive wheels are elevated off the ground. Drive wheels in contact with ground could cause unexpected vehicle movement. Failure to follow this instruction may result in serious personal injury.**

Be sure to follow all warnings when carrying out Inspection and Verification.

Verify the customer concern by carrying out a road test on a smooth road. If any vibrations are apparent, go to **NVH**.

To maximize tire performance, inspect for signs of incorrect inflation and uneven wear, which may indicate a need for balancing, rotation or front suspension alignment.

Correct tire pressure and driving techniques have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase tire wear.

Replacement tires must follow the recommended:

- tire sizes.
- speed rating.
- load range.
- tire construction type.

The use of any other tire/wheel size, load range or type can seriously affect:

- ride.
- handling.
- speedometer/odometer calibration.
- vehicle ground clearance.
- tire clearance between the body and chassis.

- wheel bearing life.
- braking performance.

New wheels need to be installed when the vehicle wheels:

- are bent.
- are cracked.
- are dented.
- are heavily corroded.
- are leaking.
- have elongated wheel hub bolt holes.
- have excessive lateral or radial runout.

It is mandatory to use only the tire sizes recommended on the tire label located on the driver door or door pillar attached to the vehicle. Larger or smaller tires can damage the vehicle, affect durability and require changing the speedometer calibration. Make sure wheel size and offsets match those recommended for the tire in use.

1. Inspect the tires for signs of uneven wear. Refer to the following descriptions to identify the type of wear and Go to **Tire Wear** for the appropriate repair action to be carried out.
2. Check the tires for:
   - cuts.
   - stone bruises.
   - abrasions.
   - blisters.
   - embedded objects.
3. Tread wear indicators are molded into the bottom of the tread grooves. Install a new tire when the indicator bands become less than 1.58 mm (0.062 in).

Tire Wear

Tire wear is commonly defined as a loss of tread depth. Tire tread wear occurs due to friction with the contact surface (road/pavement). The tread should wear down uniformly all the way around the circumference of the tire and all the way across the tread face. When this does not occur, the tire may have abnormal/incorrect wear.

Normal Tire Wear

Normal tire wear is identified as even wear around and across the tread. Because there are many factors (driving style, road surfaces, type of vehicle, type of tire) that can affect tire wear, there is no absolute mileage expectation for a normal wear condition. A tire is considered worn-out when the tread has worn to the level of the tread-wear indicators.

Abnormal/Incorrect Tire Wear

Abnormal/incorrect tire wear is identified as tire wear that is not even around or across the tread and that creates

performance-related issues.

Abnormal/incorrect wear can be caused by numerous factors, some of which include driving style (aggressive, passive), climate (hot, cold), road conditions, vehicle loading and maintenance (correct tire pressure, rotation intervals and balance). It is important to determine the root cause of wear on a vehicle before carrying out repair. Tires exhibiting abnormal/incorrect tire wear may still be serviceable provided that the minimum tread depth is greater than 1.58 mm (0.062 in) and the tire is not causing a vehicle performance (noise/vibration) concern.

Some abnormal/incorrect wear patterns look the same all the way around the tread of the tire, other wear patterns are not consistent and can occur in various spots on the tread area. The underlying causes of the 6 wear categories are different. Refer to the following descriptions to identify the type of wear and Go to **Tire Wear** for the appropriate repair action to be carried out.

Inner Edge/Shoulder Wear

Inner edge (or shoulder) wear occurs on the inside edge of the tire and is usually caused by excessive toe-out and/or excessive negative camber. If the tread depth of the outer shoulder is at least 50% greater than the tread depth of the inner shoulder, the tire is experiencing inner edge/shoulder wear. To determine whether tires have this type of wear, visually inspect the tires. In some instances, it may be necessary to measure the tread depth of each rib and compare it to that of the shoulder.

NOTE: **RF tire shown, others similar.**

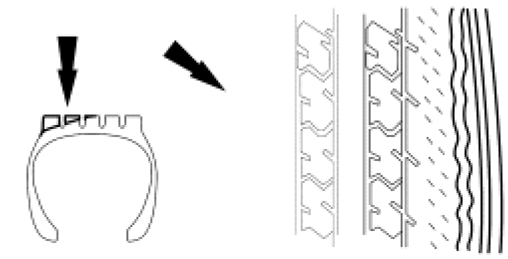


Fig. 1: Identifying Inner Edge/Shoulder Wear
Courtesy of FORD MOTOR CO.

Outer Edge/Shoulder Wear

Outer edge (or shoulder) wear occurs on the outside edge of the tire and is usually caused by excessive toe-in and/or excessive positive camber. If the tread depth of the inner shoulder is at least 50% greater than the tread depth of the outer shoulder, the tire is experiencing outer edge/shoulder wear. To determine whether tires have this type of wear, visually inspect the tires. In some instances, it may be necessary to measure the tread depth of each rib and compare it to that of the shoulder.

NOTE: **RF tire shown, others similar.**

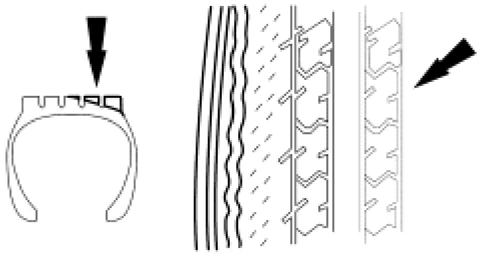

N0046312

Fig. 2: Identifying Outer Edge/Shoulder Wear
Courtesy of FORD MOTOR CO.

Heel/Toe Wear

Heel/toe wear (also known as feathering) occurs along the outside or inside edge/shoulder of the tire. To determine whether tires have this type of wear, visually inspect the tires in both the inside and outside shoulder ribs. In some instances, it may be necessary to measure the difference in tread depth of leading versus trailing edge of each lug in the inside and outside shoulder rib.

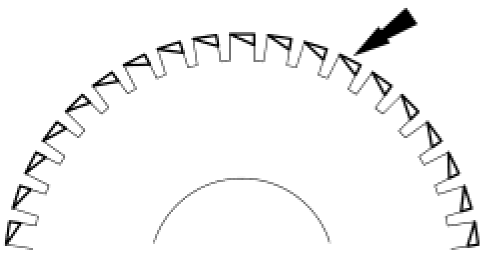

N0046118

Fig. 3: Identifying Heel/Toe Wear
Courtesy of FORD MOTOR CO.

Diagonal Wear

Diagonal wear occurs diagonally across the tread area and around the circumference of the tire. To determine whether tires have this type of wear, visually inspect the tires to determine if the wear pattern runs diagonally across the tread and around the circumference of the tire. In some instances, the difference in tread depth along the diagonal wear pattern may need to be measured.

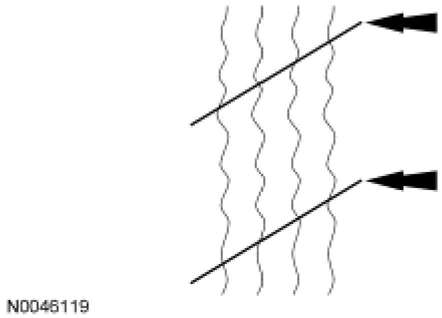


Fig. 4: Identifying Diagonal Wear
Courtesy of FORD MOTOR CO.

Symptom Chart - Tire Wear

NOTE: For suspension system and additional alignment diagnosis, refer to SUSPENSION SYSTEM - GENERAL INFORMATION article.

Symptom Chart - Tire Wear

Condition	Possible Sources	Action
• Inner edge/shoulder wear	• Excessive toe out and/or negative camber • Incorrect wheel and tire assembly rotation intervals • High-speed cornering	• Go to **Pinpoint Test A**. • Go to **Pinpoint Test A**. • Go to **Pinpoint Test A**.
• Outer edge/shoulder wear	• Excessive toe in and/or positive camber • Incorrect wheel and tire assembly rotation intervals • High-speed cornering	• Go to **Pinpoint Test B**. • Go to **Pinpoint Test B**. • Go to **Pinpoint Test B**.
• Heel/toe wear	• Excessive toe in/out • Incorrect wheel and tire assembly rotation intervals	• ROTATE the wheel and tire assemblies. CHECK the alignment, ADJUST as necessary.
• Diagonal wear	• Excessive toe in/out • Incorrect tire rotation intervals • Loose, worn or damaged suspension components	• Go to **Pinpoint Test C**. • Go to **Pinpoint Test C**. • REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

Symptom Chart - NVH

NOTE: **NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to NOISE, VIBRATION AND HARSHNESS article. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to NOISE, VIBRATION AND HARSHNESS article for the next likely system and continue diagnosis.**

Symptom Chart - NVH

Condition	Possible Sources	Action
• Wobble or shimmy	• Bent wheel • Damaged tire • Loose wheel nuts	• INSTALL a new wheel as necessary. • INSTALL a new tire as necessary. • TIGHTEN to specification.
• High-speed shake	• Tires/wheels	• REFER to Wheel and Tire Runout **Component Tests**.
• Vehicle vibration	• Tires/wheels	• REFER to Wheel and Tire Runout **Component Tests**.

Pinpoint Tests

For a description of the various tire wear patterns, refer to Inspection and Verification.

Pinpoint Test A: Inner Edge/Shoulder Wear

This pinpoint test is intended to diagnose the following:

- Excessive toe out
- Incorrect wheel and tire rotation

PINPOINT TEST A: INNER EDGE/SHOULDER WEAR

A1 MEASURE THE TREAD DEPTH

- Using a tread depth gauge or similar tool, measure the inside edge/shoulder tread depth.
- **Is the tread depth greater than 1.58 mm (0.062 in)?**

  YES : ROTATE the wheel and tire assemblies.

  CHECK and ADJUST the toe to nominal +0.15 degrees (toe in). CHECK and ADJUST caster and camber to nominal. REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

NO : INSTALL a new tire(s). CHECK and ADJUST the toe to nominal. CHECK and ADJUST caster and camber to nominal. REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

Pinpoint Test B: Outer Edge/Shoulder Wear

This pinpoint test is intended to diagnose the following:

- Excessive toe in
- Incorrect wheel and tire rotation

PINPOINT TEST B: OUTER EDGE/SHOULDER WEAR

B1 MEASURE THE TREAD DEPTH

- Using a tread depth gauge or similar tool, measure the outside edge/shoulder tread depth.
- **Is the tread depth greater than 1.58 mm (0.062 in)?**

YES : ROTATE the wheel and tire assemblies.

CHECK and ADJUST the toe to nominal -0.15 degrees (toe out). CHECK and ADJUST caster and camber to nominal. REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

NO : INSTALL a new tire(s). CHECK and ADJUST the toe to nominal. CHECK and ADJUST caster and camber to nominal. REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

Pinpoint Test C: Diagonal Wear

This pinpoint test is intended to diagnose the following:

- Incorrect wheel and tire rotation
- Excessive toe in/out
- Incorrect tire inflation
- Loose, worn or damaged suspension components

PINPOINT TEST C: DIAGONAL WEAR

C1 MEASURE THE TREAD DEPTH

- Using a tread depth gauge or similar tool, measure the tread depth of the wear pattern.
- **Is the tread depth greater than 1.58 mm (0.062 in)?**

YES : If no performance concerns (noise/vibration) are present, the tire can remain in service. CHECK the air pressure in the tires, ADJUST as necessary. ROTATE the wheel and tire assemblies. INSPECT for loose, worn or damaged suspension components. INSTALL new components as necessary. CHECK the alignment and ADJUST as necessary. REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

NO : INSTALL a new tire(s). CHECK the air pressure in the tires, ADJUST as necessary.

ROTATE the wheel and tire assemblies. INSPECT for loose, worn or damaged suspension components. INSTALL new components as necessary. CHECK the alignment and ADJUST as necessary. REFER to **SUSPENSION SYSTEM - GENERAL INFORMATION** article.

Component Tests

Some vehicles may exhibit a wheel and tire vibration caused by excessive runout. Runout measurements of the wheel and tire assembly can be taken both on and off the vehicle. Runout measurements can be taken both radially and laterally using a runout gauge. The runout gauge is a delicate, precision instrument and should be handled as such. The runout gauge should be mounted on a heavy solid base to eliminate gauge movement when measuring run outs. The measurements are taken using a runout gauge, which defines total runout in 64th or thousandths of an inch (depending on the brand of gauge used) and locates the high and low points of the runout.

Radial Runout

Radial runout is the egg-shaped deviation from a perfect circle and is measured perpendicular on a circumference. On a wheel and tire assembly, this usually means measuring the center tire tread rib, although other tread ribs can be measured as well. The center rib is usually a solid rib, easy to measure and normally indicative of the condition of the tire as a whole. It is important to keep in mind that any rib with excessive runout can cause a concern. Total runout is the reading from the gauge. The high spot is the location of maximum runout.

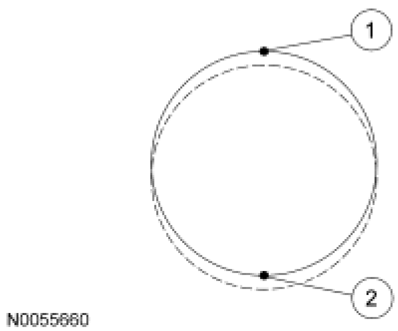


Fig. 5: Identifying Radial Runout
Courtesy of FORD MOTOR CO.

Item	Description
1	High spot
2	Low spot

NOTE: Warm up the tires prior to taking any measurements, this will eliminate slight flat spotting. This is done during a road test.

NOTE: Place the air chuck straight on the valve stem to inflate the tire. Do not cock the air chuck during the inflation cycle. Doing so may damage the valve stem and cause air leaks.

NOTE: **Use only the Digital Tire Gauge any time tire pressures are measured to be sure that accurate values are obtained.**

1. Make sure that the tire pressures are set to the correct pressure as indicated on the vehicle label.
2. With the vehicle in NEUTRAL, position it on a hoist. Refer to **JACKING AND LIFTING** article.
3. Make sure that all 4 positions can be measured. If measurements are to be taken with the wheel and tire assembly off the vehicle, mount each assembly on a suitable dynamic balancing machine.
4. For future reference of the original wheel and tire assembly's position on the wheel hub, index-mark the wheel and a wheel stud.
5. Position the runout gauge to take a radial measurement.
   - Rotate the wheel and tire assembly (or wheel) to locate the low spot.
   - Adjust the runout gauge to read 0.
   - Rotate the wheel and tire assembly (or wheel) one complete revolution to make sure that the low spot has been found and that the runout gauge dial returns to a 0 reading.

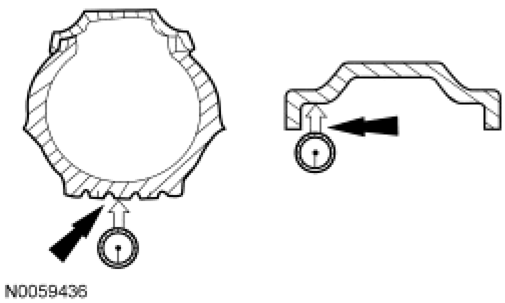


Fig. 6: Measuring Radial Runout
Courtesy of FORD MOTOR CO.

NOTE: **If there is a vast difference in measurements taken from a wheel and tire assembly checked on the vehicle compared to readings taken off the vehicle, check for excessive bolt circle runout, excessive hub runout or a fitting concern between the hub and wheel.**

6. While slowly and constantly rotating the wheel and tire assembly (or wheel), measure the radial runout.
   - Note the variance (runout) from 0 on the dial of the gauge.
   - If the runout reading of a wheel and tire assembly is not within 1.27 mm (0.050 in), locate and mark the high spot and proceed to Match Mounting Step 1 to correct the concern.
   - If the runout reading of a wheel is not within 1.27 mm (0.050 in), install a new wheel.

Lateral Runout

Lateral runout is a sideways variation causing a twist or wobble and is measured on a side surface. On the wheel and tire assembly, the lateral runout measurement should be taken as close to the tread shoulder as possible. Total runout is the reading from the gauge.

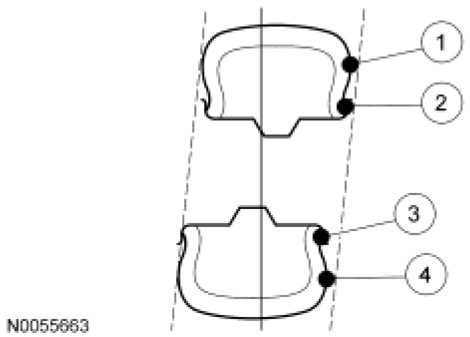


Fig. 7: Positioning Runout Gauge To Take Lateral Measurement
Courtesy of FORD MOTOR CO.

Item	Description
1	Tire high spot
2	Wheel high spot
3	Tire low spot
4	Wheel low spot

1. Position the runout gauge to take a lateral measurement.
    - Rotate the wheel and tire assembly (or wheel) to locate the low spot.
    - Adjust the runout gauge to read 0.
    - Rotate the wheel and tire assembly (or wheel) one complete revolution to make sure that the low spot has been found and that the dial returns to a 0 reading.

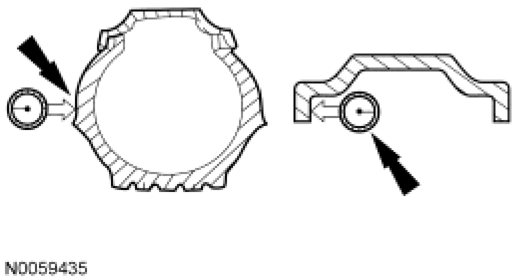


Fig. 8: Measuring Lateral Runout
Courtesy of FORD MOTOR CO.

NOTE: **If there is a vast difference in measurements taken from a wheel and tire assembly checked (on the vehicle) compared to readings taken (off the vehicle), check for excessive bolt circle runout, excessive hub runout or a fitting concern between the hub and wheel.**

2. While slowly and constantly rotating the wheel and tire assembly (or wheel), measure the lateral runout.
    - Note the variance (runout) from 0 on the dial of the gauge.

- If the runout reading of a wheel and tire assembly is not within 1.27 mm (0.050 in), locate and mark the high spot and proceed to Match Mounting Step 1 to correct the concern.
- If the runout reading of a wheel is not within 1.27 mm (0.050 in), install a new wheel.

Match Mounting

Match mounting is a technique used to reduce radial and lateral run outs on wheel and tire assemblies. Excessive runout is a source of ride quality complaints and match mounting can be used to minimize the runout. Match mounting can be accomplished by changing the position of the tire on the wheel or by changing the position of the wheel and tire assembly on the hub.

1. Remove the wheel and tire. Refer to **Wheel and Tire**.
2. Position the wheel and tire assembly on a suitable tire machine and put a reference mark on the tire sidewall at the valve stem position.

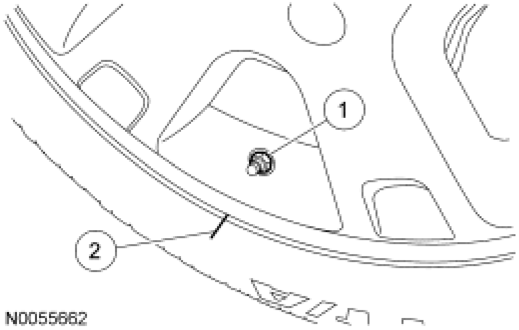


Fig. 9: Locating Mark On Tire Side Wall At Valve Stem Position
Courtesy of FORD MOTOR CO.

Item	Description
1	Valve stem
2	Reference mark

NOTE: For tires equipped with a Tire Pressure Monitoring System (TPMS), the sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Dismount the tire from the wheel as instructed in the Disassembly and Assembly procedure. Failure to follow these instructions may result in TPMS component damage.

3. Using a suitable tire machine, break the tire down from the wheel.
   - Position the tire 180 degrees (half-way around) on the rim so the tire reference mark made in Step 2 is opposite the valve stem.
4. Re-inflate the wheel and tire assembly to the specified air pressure and measure the assembly runout again. Mark the second high spot on the tire.
   - If the runout is reduced to within specifications, the runout concern has been solved.
5. If the second runout measurement is still not within specification and both measurements are close to

each other (within 101.6 mm [4 in]), the root cause is probably the tire.

NOTE: To be SURE that the tire is causing the high runout, there must be 2 runout measurements that are not within specification and the high spots must be in approximately the same location on the tire's sidewall. In other words, the high spot followed the tire when it was repositioned 180 degrees on the wheel.

- If the second high spot is not within 101.6 mm (4 in) of the first high spot, proceed to the next step.

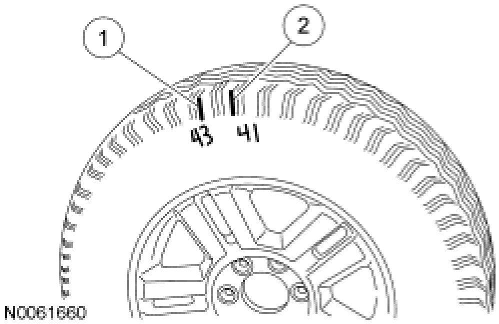


Fig. 10: High Spotting On Tire
Courtesy of FORD MOTOR CO.

Item	Description
1	First high spot on the tire
2	Second high spot on the tire

6. If the second high spot is still above specification and is within 101.6 mm (4 in) of being opposite the first high spot on the wheel, the root cause is probably the wheel (the high spot followed the wheel). Dismount the tire from the wheel, mount the wheel on a balancer and check the wheel runout. Install a new wheel if the wheel runout exceeds 1.27 mm (0.050 in).

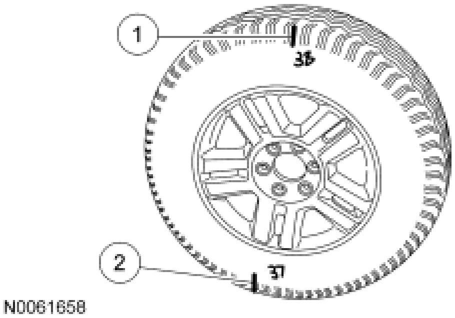


Fig. 11: High Spotting On Each End Of Tire
Courtesy of FORD MOTOR CO.

Item	Description

1	First high spot on the tire
2	Second high spot on the tire

NOTE: If the second high spot did not follow the wheel or the tire and the runout is still not within specification, improvements may be made by rotating the tire 90 degrees (one-fourth turn).

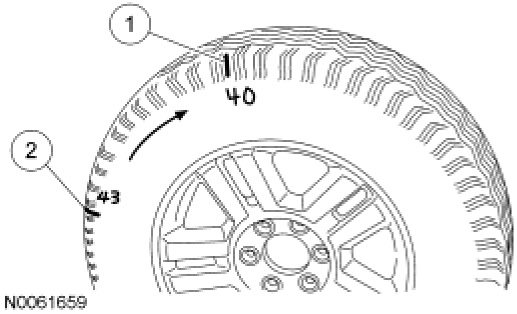


Fig. 12: Drawing Arrow On Tire Side Wall From Second High Spot Towards First High Spot
Courtesy of FORD MOTOR CO.

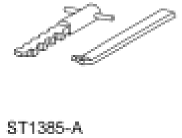
7. Draw an arrow on the tire sidewall from the second high spot towards the first high spot (in the shortest direction).
   - Rotate the tire 90 degrees (one-fourth turn) in the direction of the arrow.

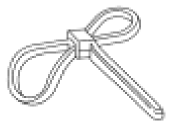
Item	Description
1	First high spot on the tire
2	Second high spot on the tire

8. Install the wheel and tire. Refer to **Wheel and Tire**.
   - Align the wheel and tire assembly using the index mark made on the wheel and wheel stud during removal.

TIRE PRESSURE MONITORING SYSTEM

Special Tools

Illustration	Tool Name	Tool Number
	Activation Tool, Tire Pressure Monitor	204-363
	Digital Tire Gauge	204-354

 ST1438-A		
 ST1185-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

Principles of Operation

NOTE: The Smart Junction Box (SJB) is also referred to as the Generic Electronic Module (GEM).

The Tire Pressure Monitoring System (TPMS) monitors the air pressure of all 4 road tires. The wheel-mounted tire pressure sensors transmit via radio frequency signals, to the SJB. TPMS functionality is integral to the SJB. These transmissions are sent approximately every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph). The TPMS function compares each tire pressure sensor transmission against a low-pressure limit. If it has been determined that the tire pressure has fallen below this limit, the SJB communicates this on the vehicle communication bus to the instrument cluster. The instrument cluster then illuminates the TPMS indicator and displays the appropriate message(s) in the message center (if equipped).

For vehicles with different front and rear tire pressures (such as the E-Series and certain F-Series), the tire pressures must be adjusted and the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate.

For vehicles with the same tire pressures for front and rear tires, tire rotation will not affect the system.

Ambient Temperature Change and Tire Pressure

WARNING: **The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.**

Tire pressures fluctuate with temperature changes. For this reason, tire pressure must be set to specification when tires are at outdoor ambient temperatures. If the vehicle is allowed to warm up to shop temperatures, and the outside temperature is less than shop temperature, the tire inflation pressure must be adjusted accordingly.

If the tires are inflated to specification at shop temperatures, and the vehicle is moved outdoors when the

outdoor ambient temperature is significantly lower, the tire pressure may drop enough to be detected by the TPMS and activate the TPMS warning lamp.

As the ambient temperature decreases by 6°C (10°F), tire pressure decreases 7 kPa (1 psi). Adjust the tire pressure by 7 kPa (1 psi) for each 6°C (10°F) ambient temperature drop as necessary to keep the tire at the specified Vehicle Certification (VC) label pressure. Refer to the following tables to adjust the tire pressure indoors for colder outside temperatures.

Table 1. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature[1]

** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. **

Table is based on a Garage Temperature of 70°F. Max Pressure Adjustment is 7 psi.

Outside Temperature (°F)	Tire Placard Pressure (PSI)																	
	30	32	34	35	38	40	41	42	45	50	55	60	65	70	75	80	85	90
70	30	32	34	35	38	40	41	42	45	50	55	60	65	70	75	80	85	90
60	31	33	35	36	39	41	42	43	46	51	56	61	67	72	77	82	87	92
50	32	34	36	37	40	42	43	44	47	53	58	63	68	73	79	84	89	94
40	33	35	37	38	41	43	44	45	49	54	59	64	70	75	80	86	91	96
30	34	36	38	39	42	44	46	47	50	55	61	66	72	77	82	87	92	97
20	35	37	39	40	43	46	47	48	51	57	62	67	72	77	82	87	92	97
10	36	38	40	41	45	47	48	49	52	57	62	67	72	77	82	87	92	97
0	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-10	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-20	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-30	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97
-40	37	39	41	42	45	47	48	49	52	57	62	67	72	77	82	87	92	97

Table 2. Use Table to Adjust Tire Pressure Inside Garage for Colder Outside Temperature (Metric Units)[1]

** Do Not Inflate Tire Higher than Maximum Pressure Stamped on Tire Sidewall. **

Table is based on a Garage Temperature of 21°C. Max Pressure Adjustment is 50 kPa.

Outside Temperature (°C)	Tire Placard Pressure (kPa)																	
	205	220	235	240	260	275	285	290	310	345	380	415	450	485	515	550	585	620
21	205	220	235	240	260	275	285	290	310	345	380	415	450	485	515	550	585	620
16	215	230	240	250	270	285	290	295	315	350	385	420	460	495	530	565	600	635
10	220	235	250	255	275	290	295	305	325	365	400	435	470	505	545	580	615	650
4	230	240	255	260	285	295	305	310	340	370	405	440	485	515	550	595	625	660
-1	235	250	260	270	290	305	315	325	345	380	420	455	495	530	565	600	635	670
-7	240	255	270	275	295	315	325	330	350	395	425	460	495	530	565	600	635	670
-12	250	260	275	285	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-18	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-23	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-29	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-34	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670
-40	255	270	285	290	310	325	330	340	360	395	425	460	495	530	565	600	635	670

[1] When Outside (Ambient) Temperature is greater than 21°C (70°F), Inflate tires to placard pressure.

[1] Use the table to adjust tire pressure for P-metric and LT tires only.

[1] Do NOT use table for Commercial Truck Tires (i.e. 19.5 inch tires for F450 & F550). See F-Super Duty Service Manual for tire inflation procedure.

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Fig. 13: Tire Pressure Table
Courtesy of FORD MOTOR CO.

Tire Pressure Monitoring System (TPMS) Indicator and Message Center Messages

The TPMS indicator and vehicle message center (if equipped) sometimes displays faults that cannot be resolved by the customer. Treat these messages as TPMS faults that must be serviced.

Tire Pressure Monitoring System (TPMS) Indicator Illuminates Continuously

NOTE: If the spare tire is in use, the damaged road tire must be repaired and installed on the vehicle to restore complete TPMS functionality before carrying out any diagnosis.

NOTE: For vehicles with different front and rear tire pressures (such as E-Series and certain F-Series), the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will result in a false low tire pressure event, which will cause the TPMS indicator to illuminate.

1. The TPMS indicator remains on continuously for the following condition:
    - Low Tire Pressure - The TPMS indicator is illuminated solid and the message center displays LOW TIRE PRESSURE (if equipped). This is displayed when any of the tire pressures are low. When this condition exists, the tire pressure must be adjusted to the recommended cold pressure as indicated on the VC label.

    NOTE: The TPMS sensors do not transmit when the vehicle is stationary. If the vehicle has been stationary for more than 30 minutes, it will be necessary to wake up the sensors so they will transmit the latest tire pressure information to the SJB.

2. If the vehicle has been stationary for more than 30 minutes, carry out the **Tire Pressure Monitoring System (TPMS) Sensor Activation** procedure.

Tire Pressure Monitoring System (TPMS) Indicator Flashes

The TPMS indicator flashes for 70 seconds, then remains ON solid when the ignition switch is turned to the ON position, for the following conditions:

1. Tire Pressure Sensor Fault - If equipped, the message center will display TIRE PRESSURE SENSOR FAULT when a tire pressure sensor is malfunctioning. Go to **Symptom Chart**.
2. No communication with the SJB (TPMS is integral to the SJB) - The TPMS indicator is illuminated when the instrument cluster has not received any signals from the SJB for more than 5 seconds. If equipped, the message center displays TIRE PRESSURE MONITOR FAULT. Go to **Symptom Chart**.
3. Tire Pressure Monitor Fault - If equipped, the message center will display TIRE PRESSURE MONITOR FAULT when the tire pressure monitoring system is malfunctioning or communication with the instrument cluster has been lost. Go to **Symptom Chart**.

Inspection and Verification

NOTE: The tire pressure sensors are not designed to be used with aftermarket wheels.

NOTE: The use of run-flat tires (tires with steel body cord plies in the tire sidewall) where not originally equipped, may cause the TPMS to malfunction and is

therefore not recommended.

1. Verify the customer concern by inspecting the vehicle and observing the message center (if equipped) and the TPMS indicator.

NOTE: **The valve-mounted TPMS sensors and the strap-mounted TPMS sensors are not compatible. Swapping wheels from one vehicle to another with the different systems will set a TPMS fault.**

NOTE: **Swapping wheels between vehicles with the same TPMS will cause a TPMS fault to be set if the sensors are not trained. Refer to Tire Pressure Monitoring System (TPMS) Sensor Training.**

NOTE: **Non-OEM modifications made to the vehicle may result in false TPMS warnings.**

2. Inspect to determine if one of the following mechanical or electrical concerns apply:

VISUAL INSPECTION CHART

Mechanical	Electrical
• Low tire pressure • Tire Pressure Monitoring System (TPMS) sensor damaged or missing • Spare tire installed as a road wheel • Incorrect TPMS sensor installed • TPMS sensor installed incorrectly • Sensors not trained after a tire rotation on vehicles with different front and rear tire pressures • Non-OEM wheels installed (aftermarket rims) • Non-OEM equipped run-flat tires installed • Other non-OEM modifications (roll	• Wiring, terminals or connectors • Smart Junction Box (SJB) damaged • Aftermarket electronic accessories

cages, service barriers, part racks, ladder racks)	

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

NOTE: The Vehicle Communication Module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no power to the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the PCM.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self test diagnostics for the SJB (the TPMS is part of the SJB).
9. If the DTCs retrieved are related to the concern, go to the Tire Pressure Monitoring System (TPMS) DTC Chart. For all other DTCs, refer to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

TIRE PRESSURE MONITORING SYSTEM (TPMS) DTC CHART

DTC	Description	Source	Action
B106A	Pressure Sensor Range Bit Incorrect State	Smart Junction Box (SJB)	Go to **Pinpoint Test G**.
B106B	Tire Pressure Sensor Low Battery	SJB	DTC B106B can be set during SJB configuration. Go to **Pinpoint Test H**.
B106D	Tire Pressure Monitoring System	SJB	DTC B106D is only present when a new SJB

	(TPMS) Initiators Not Configured		is installed, the SJB is incorrectly flashed or the SJB is incorrectly configured. Successfully configuring the SJB is the only way to clear this DTC. VERIFY the SJB is correctly configured. If DTC B106D is still present, REFER to **MODULE CONFIGURATION** article.
B2477	Module Configuration Failure/Mismatch	SJB	DTC B2477 is only present when a new SJB is installed, the SJB is incorrectly flashed or the SJB is incorrectly configured. Successfully configuring the SJB is the only way to clear this DTC. MAKE SURE the SJB is configured correctly. If DTC B2477 is still present, REFER to **MODULE CONFIGURATION** article.
B2868	LF Tire Pressure Sensor Fault	SJB	DTC B2868 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
B2869	RF Tire Pressure Sensor Fault	SJB	DTC B2869 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
B2870	RR Tire Pressure Sensor Fault	SJB	DTC B2870 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
B2871	LR Tire Pressure Sensor Fault	SJB	DTC B2871 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
B2872	Tire Pressure Sensor Fault	SJB	**NOTE:** **If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the SJB.**

			ACTIVATE the TPMS sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Activation**. Go to **Pinpoint Test F**.
B287A	Tire Pressure System Fault	SJB	Go to **Pinpoint Test F**.
C2780	ECU in Manufacturing Mode	SJB	DTC C2780 is only present when a new SJB is installed, the SJB is flashed or the SJB is reconfigured. TRAIN the tire pressure sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
U0155	Lost Communication with Instrument Cluster	SJB	REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the no communication problem.
All other SJB DTCs	-	SJB	REFER to the Master DTC Chart in **MULTIFUNCTION ELECTRONIC MODULES** article.

Symptom Chart

NOTE: **For vehicles with different front and rear tire pressure (such as E-Series and certain F-Series), the tire pressures must be adjusted and the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will result in a false low tire pressure event, which will cause the Tire Pressure Monitoring System (TPMS) indicator to illuminate.**

For vehicles with the same tire pressure for front and rear tires, tire rotation will not affect the system.

Failure of a TPMS component may not cause the message center to display a fault message or a DTC to be stored. The Symptom Chart is a starting point to begin diagnosis of these concerns.

Symptom Chart

Condition	Possible Sources	Action
• Tire Pressure Monitoring System (TPMS) indicator ON solid and message center (if equipped) displays LOW TIRE PRESSURE	• Spare tire currently in use	• INSTALL the repaired road wheel/tire in place of the spare tire.
	• Air pressure not set to specifications listed on the Vehicle Certification (VC) label	• Go to **Pinpoint Test D**.

	• Sensors not trained following tire rotation	• ADVISE customer that on vehicles with different front and rear tire pressure, the sensors must be trained as directed in their Owner's Literature.
• Smart Junction Box (SJB) will not enter sensor training mode when using the TPMS sensor training procedure	• Brake ON/OFF switch • Ignition switch • Vehicle communication bus • SJB	• Go to **Pinpoint Test E**.
• TPMS indicator FLASHES for 70 seconds and then remains ON solid when the ignition key is turned to the ON position, the message center (if equipped) displays TIRE PRESSURE SENSOR FAULT and DTC B2872 is present	• TPMS sensor(s) • TPMS sensor(s) not trained to the SJB • SJB	**NOTE:** **If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the SJB.** • ACTIVATE the TPMS sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Activation**. Go to **Pinpoint Test F**.
• Tire Pressure Monitoring System (TPMS) indicator FLASHES for 70 seconds and then remains ON solid when the ignition key is turned to the ON position, the message center (if equipped) displays TIRE PRESSURE MONITOR FAULT and DTC B287A is present	• All TPMS sensors not trained to the SJB or all TPMS sensors are not installed	**NOTE:** **If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the SJB.** • ACTIVATE the TPMS sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Activation**. Go to **Pinpoint Test F**.
• TPMS indicator FLASHES for 70 seconds and then remains ON solid when the ignition key is turned to the ON position, the message center (if	• Vehicle communication issue between the SJB and the instrument cluster	• REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the no

equipped) displays TIRE PRESSURE MONITOR FAULT and there are no DTCs present		communication concern.
	• SJB	• REFER to **MULTIFUNCTION ELECTRONIC MODULES** article to diagnose the SJB.
• One or more sensors will not train	• TPMS sensor(s) • Vehicle communication issue • SJB	• RETRIEVE and RECORD DTCs. REFER to Tire Pressure Monitoring System (TPMS) DTC Chart.
• One or more sensors will not train and no DTCs are present	• TPMS sensor(s)	• TRAIN all 4 tire pressure sensors. REFER to **Tire Pressure Monitoring System (TPMS) Sensor Training**. • For any sensor(s) that did not train, ATTEMPT to activate the same sensor with the activation tool. If the sensor still does not respond, MOVE the vehicle to rotate the wheels at least one-fourth turn and ATTEMPT to activate the same sensor again. • If the sensor(s) fail to train a second time, INSTALL a new sensor(s). REFER to **Tire Pressure Monitoring System (TPMS) Sensor**.

Pinpoint Tests

Pinpoint Test D: Tire Pressure Monitoring System (TPMS) Indicator ON Solid and Message Center (if equipped) Displays LOW TIRE PRESSURE

Normal Operation

The Tire Pressure Monitoring System (TPMS) monitors the air pressure of all 4 road tires. The wheel-mounted tire pressure sensors transmit via radio frequency signals, to the Smart Junction Box (SJB). TPMS functionality is integral to the SJB. These transmissions are sent approximately every 60 seconds when the vehicle speed exceeds 32 km/h (20 mph). The TPMS function (integral to the SJB) compares each tire pressure sensor transmission against a low-pressure limit. If it has been determined that the tire pressure has fallen below this limit, the SJB communicates this on the vehicle communication bus to the instrument cluster. The instrument cluster then illuminates the TPMS indicator and displays the appropriate message(s) in the message center (if equipped).

This symptom can also be caused by a spare tire currently being used in place of a road tire. Make sure that the spare tire is not currently in use. On vehicles with different front and rear tire pressures, if the sensors are not trained following a tire rotation, this symptom will also be present. Advise the customer that on vehicles with

different front and rear tire pressures, the sensors must be trained as directed in the Owner's Literature.

This pinpoint test is intended to diagnose the following:

- Low air pressure in tire(s)
- Tire pressure sensor(s)

PINPOINT TEST D: Tire Pressure Monitoring System (TPMS) INDICATOR ON SOLID AND MESSAGE CENTER (IF EQUIPPED) DISPLAYS LOW TIRE PRESSURE

NOTE: **Use only the Digital Tire Gauge any time tire pressures are measured to be sure that accurate values are obtained.**

NOTE: **If a warranty case is opened for an actual TPMS fault, document and include the actual tire pressure data in all warranty communications.**

D1 CHECK THE TIRE PRESSURE

- Measure and record the air pressure in all 4 road tires.
- Adjust the air pressure for those found to be below the specification listed on the Vehicle Certification (VC) label.

  NOTE: **If the vehicle has been stationary for more than 30 minutes, activate each TPMS sensor. Refer to Tire Pressure Monitoring System (TPMS) Sensor Activation. The TPMS sensor does not transmit when the vehicle is stationary.**

- Verify system operation.
- **Have the TPMS indicator and the message center (if equipped) warnings gone out?**

  YES : The system is functioning normally, diagnosis is complete. INFORM the customer of correct tire pressure maintenance as instructed in the scheduled maintenance guide and the Owner's Literature.

  NO : Go to D2.

D2 CHECK THE SYSTEM COMPONENTS

- Train all 4 tire pressure sensors. Refer to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
- Connect the scan tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger SJB
- Read and record the following PIDs:
  - Left Front Tire Pressure (LF_PRES)
  - Right Front Tire Pressure (RF_PRES)
  - Left Rear Outer Tire Pressure (LRO_PRES)
  - Right Rear Outer Tire Pressure (RRO_PRES)

- Compare the air pressure readings recorded from the function test to those recorded in D1.
- **Do the compared tire pressure values match within ±5 psi, and have the TPMS indicator and the message center (if equipped) warnings gone out?**

  YES : The system is functioning normally, diagnosis complete.

  NO : **Before installing a new sensor(s):** If a sensor(s) does not respond to the Tire Pressure Monitor Activation Tool, ATTEMPT to activate the same sensor(s) with the Tire Pressure Monitor Activation Tool. If the sensor(s) still does not respond, MOVE the vehicle to rotate the wheels at least one-fourth turn and ATTEMPT to activate the same sensor(s) again.

  INSTALL new tire pressure sensors for those with discrepancies or those that fail to activate. REFER to **Tire Pressure Monitoring System (TPMS) Sensor**.

Pinpoint Test E: Smart Junction Box (SJB) Will Not Enter Sensor Training Mode When Using the Tire Pressure Monitoring System (TPMS) Sensor Training Procedure

Normal Operation

For the Smart Junction Box (SJB) to enter Tire Pressure Monitoring System (TPMS) sensor training mode, the SJB must receive valid inputs from the Brake Pedal Position (BPP) switch (OFF-ON-OFF) and ignition switch (both OFF and RUN), and it must receive valid vehicle speed sensor input (0 km/h [0 mph]). Refer to **Tire Pressure Monitoring System (TPMS) Sensor Training** for the complete sensor training procedure.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Brake ON/OFF switch
- Ignition switch
- SJB

PINPOINT TEST E: Smart Junction Box (SJB) WILL NOT ENTER SENSOR TRAINING MODE WHEN USING THE Tire Pressure Monitoring System (TPMS) SENSOR TRAINING PROCEDURE

E1 CHECK THE SJB BRAKE ON/OFF (GEM_BOO) PID

- Connect the scan tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger SJB
- Monitor the GEM_BOO PID (SJB reads the brake switch directly).
- Press and release the brake pedal while monitoring the PID.
- **Do the brake pedal PID values match the brake pedal positions?**

  YES : Go to E2.

  NO : REFER to **EXTERIOR LIGHTING** article to continue diagnosis of the stoplamp switch.

E2 CHECK THE SJB IGNITION SWITCH PIDs

- Monitor the following ignition switch PIDs:
  - Ignition Switch Off (IGN_O_ECU)

    - Ignition Switch RUN (IGN_R_ECU)
- Cycle the ignition switch to the RUN and OFF position while monitoring the PIDs (SJB reads the ignition switch directly).
- **Do the ignition switch status PID values match the ignition switch positions?**

  YES : Go to E3.

  NO : REFER to **STEERING COLUMN SWITCHES** article to continue diagnosis of the ignition switch.

E3 CHECK THE SJB VEHICLE SPEED (VSS_GEM) PID

- Monitor the VSS_GEM PID (SJB receives vehicle speed from the instrument cluster).
- **Does the vehicle speed PID value match the speed of the vehicle?**

  YES : Go to E4.

  NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article to diagnosis of the instrument cluster/vehicle speed concern.

E4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check the connectors for:
    - corrosion.
    - pushed-out pins.
    - spread terminals.
- Connect all the SJB connectors and make sure that they are seated correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CLEAR the DTCs. REPEAT the self test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self test.

Pinpoint Test F: Tire Pressure Monitoring System (TPMS) Indicator FLASHES for 70 Seconds and Then Remains ON Solid When the Ignition Key is Turned to the ON Position, the Message Center (if equipped) Displays TIRE PRESSURE SENSOR or MONITOR FAULT and DTC B2872 or B287A is Present

Normal Operation

If there is a fault with 1, 2 or 3 of the Tire Pressure Monitoring System (TPMS) sensors, DTC B2872 will be set, the TPMS warning indicator will flash for 70 seconds and then remain ON solid when the ignition switch is turned to the ON position and the message center (if equipped) will display TIRE PRESSURE SENSOR FAULT.

If the Smart Junction Box (SJB) does not get a response from all 4 of the TPMS sensors, DTC B287A will be set and the message center (if equipped) will display TIRE PRESSURE MONITOR FAULT.

- B2872 Tire Pressure Sensor Fault - When 1, 2 or 3 of the tire pressure sensors are faulted or not responding, the SJB will set DTC B2872.

- B287A Tire Pressure Monitor Fault - When **all** 4 of the tire pressure sensors are faulted, not responding or not heard by the SJB, the SJB will set DTC B287A.

This pinpoint test is intended to diagnose the following:

- TPMS sensor(s) missing
- TPMS sensor(s) not trained to the vehicle
- TPMS sensor(s) swapped due to wheel swap
- TPMS sensor(s) damaged
- Vehicle communication issue
- SJB

PINPOINT TEST F: Tire Pressure Monitoring System (TPMS) INDICATOR FLASHES FOR 70 SECONDS AND THEN REMAINS ON SOLID WHEN THE IGNITION KEY IS TURNED TO THE ON POSITION, THE MESSAGE CENTER (IF EQUIPPED) DISPLAYS TIRE PRESSURE SENSOR OR MONITOR FAULT AND DTC B2872 OR B287A IS PRESENT

NOTE: If a warranty case is opened for an actual TPMS fault, document and include the actual tire pressure data in all warranty communications.

F1 CHECK THE SENSOR IDs AND SYSTEM STATUS PIDs

- Connect the scan tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: DataLogger SJB
- Read and record the following PIDs:
  - Left Front Tire Transmitter Identifier (LF_ID)
  - Right Front Tire Transmitter Identifier (RF_ID)
  - Left Rear Tire Transmitter Identifier (LR_ID)
  - Right Rear Tire Transmitter Identifier (RR_ID)
- Monitor the TPMS system status (TP_STAT) PID.
- **Does the TP_STAT PID display SENSOR FAULT?**

  YES : Go to F2.

  NO : If the TP_STAT PID displays SYSTEM FAULT, go to F3.

F2 CARRY OUT THE SENSOR TRAINING PROCEDURE

- Train all 4 tire pressure sensors. Refer to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
- **Did all of the tire pressure sensors transmit correctly and did the horn sound when each tire pressure sensor transmitted to the SJB?**

  YES : Using the scan tool, LOCATE the updated TPMS sensor identifiers trained to the SJB module.

  COMPARE these values to those recorded prior to the TPMS sensor training procedure. Disregarding sensor position, any sensor identifiers that do not match those retrieved from the

module were changed, but not retrained. The sensors are now trained to the vehicle, diagnosis is complete.

DOCUMENT all TPMS sensor identifiers on the applicable warranty claim.

VERIFY system operation.

NO : **Before installing a new sensor(s)** : If a sensor(s) does not respond to the Tire Pressure Monitor Activation Tool, ATTEMPT to activate the same sensor(s) with the Tire Pressure Monitor Activation Tool. If the sensor(s) still does not respond, MOVE the vehicle to rotate the wheels at least one-fourth of a turn and ATTEMPT to activate the same sensor(s) again.

If the sensor(s) fails to train a second time, INSTALL a new tire pressure sensor(s). REFER to **Tire Pressure Monitoring System (TPMS) Sensor**.

F3 TP_STAT PID EQUALS SYSTEM FAULT WITH DTC B287A PRESENT

- Train all 4 tire pressure sensors. Refer to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
- **Did all of the tire pressure sensors transmit correctly and did the horn sound when each tire pressure sensor transmitted to the SJB?**

YES : Using the scan tool, LOCATE the updated TPMS sensor identifiers trained to the SJB module.

COMPARE these values to those recorded prior to the TPMS sensor training procedure. Disregarding sensor position, any sensor identifiers that do not match those retrieved from the module were changed, but not retrained. The sensors are now trained to the vehicle, diagnosis is complete.

DOCUMENT all TPMS sensor identifiers on the applicable warranty claim.

VERIFY system operation.

NO : **Before diagnosing the SJB** : If the sensors do not respond to the Tire Pressure Monitor Activation Tool, ATTEMPT to activate the same sensors with the Tire Pressure Monitor Activation Tool a second time. If the sensors still do not respond, MOVE the vehicle to rotate the wheels at least one-fourth of a turn and ATTEMPT to activate the same sensors again.

If the sensors fail to train a second time, go to F4.

F4 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB electrical connectors.
- Check the connectors for:
  - corrosion.
  - pushed-out pins.
  - spread terminals.

- Connect all the SJB connectors and make sure that they are seated correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : **NOTE:** The sensors may not be present. DISMOUNT the tire. REFER to **Wheel and Tire**. VERIFY that the sensors are present and mounted to the wheels. If missing, INSTALL new sensors.

  If the sensors are present, INSTALL a new SJB module. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. CLEAR the DTCs. REPEAT the self test.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self test.

Pinpoint Test G: DTC B106A - Pressure Sensor Range Bit Incorrect State

Normal Operation

This DTC may be encountered if a sensor designed for a different application is installed. Low pressure applications utilize a black- or blue-colored sensor, while heavy duty applications utilize a green-colored sensor. The Smart Junction Box (SJB) will only allow one type of sensor to be trained using the Tire Pressure Monitoring System (TPMS) sensor training procedure. Make sure the correct sensors are used to avoid compatibility issues.

- B106A Pressure Sensor Range Bit Incorrect State - When an attempt has been made to train a non-compatible sensor, the SJB will set DTC B106A.

This pinpoint test is intended to diagnose the following:

- Incorrect tire pressure sensor(s) installed

PINPOINT TEST G: DTC B106A - PRESSURE SENSOR RANGE BIT INCORRECT STATE

G1 DETERMINE IF THE VEHICLE IS EQUIPPED WITH AN INCORRECT SENSOR

- Train all 4 tire pressure sensors. Refer to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
- **Did all of the tire pressure sensors transmit correctly and did the horn sound when each tire pressure sensor transmitted to the SJB?**

  YES : CLEAR the DTCs. REPEAT the self test. VERIFY system operation.

  NO : **Before installing a new sensor(s)** : If a sensor(s) does not respond to the Tire Pressure Monitor Activation Tool, ATTEMPT to activate the same sensor(s) with the Tire Pressure Monitor Activation Tool. If the sensor(s) still does not respond, MOVE the vehicle to rotate the wheels at least one-fourth of a turn and ATTEMPT to activate the same sensor(s) again.

  If the sensor(s) fails to train a second time, INSTALL a new tire pressure sensor(s). REFER to **Tire Pressure Monitoring System (TPMS) Sensor**.

Pinpoint Test H: DTC B106B - Tire Pressure Sensor Low Battery

Normal Operation

If there is a fault in the Tire Pressure Monitoring System (TPMS), such as a damaged or missing sensor(s), damaged module or a communication issue within the vehicle, DTCs are set in the Smart Junction Box (SJB), the TPMS warning indicator will flash for 70 seconds and then remain ON solid when the ignition switch is turned to the ON position and the message center (if equipped) will display TIRE PRESSURE SENSOR FAULT.

The tire pressure sensor is battery powered.

This DTC may be set when attempting to train a tire pressure sensor(s) with a low battery.

This pinpoint test is intended to diagnose the following:

- Tire pressure sensor battery
- Tire pressure sensor(s)

PINPOINT TEST H: DTC B106B - TIRE PRESSURE SENSOR LOW BATTERY

H1 DETERMINE WHICH SENSOR HAS A LOW BATTERY

- Train all 4 tire pressure sensors. Refer to **Tire Pressure Monitoring System (TPMS) Sensor Training**.
- **Did all of the tire pressure sensors transmit correctly and did the horn sound when each tire pressure sensor transmitted to the SJB?**

  YES : CLEAR the DTCs. REPEAT the self test. VERIFY system operation.

  NO : **Before installing a new sensor(s)** : If a sensor(s) does not respond to the Tire Pressure Monitor Activation Tool, ATTEMPT to activate the same sensor(s) with the Tire Pressure Monitor Activation Tool. If the sensor(s) still does not respond, MOVE the vehicle to rotate the wheels at least one-fourth of a turn and ATTEMPT to activate the same sensor(s) again.

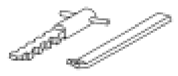
  If the sensor(s) fails to train a second time, INSTALL a new tire pressure sensor(s). REFER to **Tire Pressure Monitoring System (TPMS) Sensor**.

GENERAL PROCEDURES

TIRE PRESSURE MONITORING SYSTEM (TPMS) SENSOR TRAINING

Special Tools

Illustration	Tool Name	Tool Number
	Activation Tool, Tire Pressure Monitor	204-363

 ST1385-A		
 ST1185-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS)	software with appropriate hardware, or equivalent scan tool

NOTE: **If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the Smart Junction Box (SJB). For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation.**

NOTE: **The tire pressure sensor training procedure must be done on a single vehicle, in an area without radio frequency noise and at least 1 m (3 ft) away from other vehicles equipped with a Tire Pressure Monitoring System (TPMS).**

Radio frequency noise is generated by electrical motors and appliance operation, cellular telephones, remote transmitters, power inverters and portable entertainment equipment.

NOTE: **If a sensor does not respond to the Tire Pressure Monitor Activation Tool, attempt to activate the same sensor with the Tire Pressure Monitor Activation Tool. If the sensor still does not respond, move the vehicle to rotate the wheels at least one-fourth of a turn and attempt to activate the same sensor again.**

NOTE: **The SJB has a 2-minute time limit between sensor responses. If the SJB does not recognize any 1 of the 4 tire pressure sensors during this time limit, the horn will sound twice and the message center (if equipped) will display TIRE NOT TRAINED REPEAT and the entire procedure must be repeated.**

NOTE: **For vehicles with different front and rear tire pressures (such as the E-Series and certain F-Series), the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate. For vehicles with the same tire pressure for front and rear tires, tire rotation will not affect the system.**

NOTE:

1. Turn the ignition switch to the OFF position, then press and release the brake pedal.

2. Cycle the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.
3. Press and release the brake pedal.
4. Turn the ignition switch to the OFF position.
5. Turn the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.
    - The horn will sound once and the TPMS indicator will flash if the training mode has been entered successfully. If equipped, the message center will display TRAIN LF TIRE.

NOTE: It may take up to 6 seconds to activate a tire pressure sensor. During this time, the Tire Pressure Monitor Activation Tool must remain in place 180 degrees from the valve stem.

6. Place the Tire Pressure Monitor Activation Tool on the LF tire sidewall opposite (180 degrees) from the valve stem. Press and release the test button on the Tire Pressure Monitor Activation Tool. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the SJB.

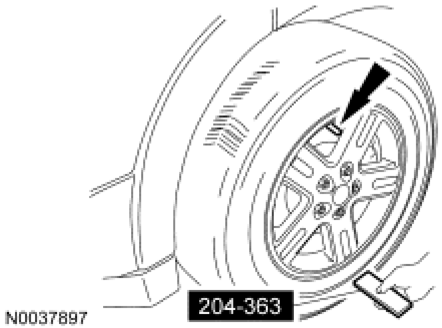


Fig. 14: Identifying Special Tool On LF Tire Side Wall Opposite (180 Degrees) From Valve Stem
Courtesy of FORD MOTOR CO.

7. Within 2 minutes of the horn sounding, place the Tire Pressure Monitor Activation Tool on the RF tire sidewall opposite (180 degrees) from the valve stem and press and release the test button to train the RF tire pressure sensor.

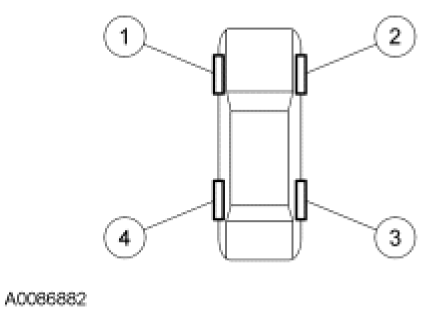


Fig. 15: Identifying Position Of Activation Tool
Courtesy of FORD MOTOR CO.

NOTE: Do not wait more than 2 minutes between training each sensor or the SJB will time out and the entire procedure must be repeated.

8. Repeat Step 7 for the RR and LR tires.

   The procedure is completed after the last tire has been trained. When the training procedure is complete, the message center (if equipped) will display TIRE TRAINING COMPLETE.

   For vehicles not equipped with a message center, successful completion of the training procedure will be verified by turning the ignition switch to the OFF position without the horn sounding. If the horn sounds twice when the switch is turned to the OFF position, the training procedure was not successful.

9. Using the scan tool, locate the updated TPMS sensor identifiers trained to the SJB and document them on the applicable warranty claim.

   NOTE: This step is required to clear DTC C2780, cause the SJB to exit the manufacturing mode and to make sure there are no other concerns with a newly programmed SJB.

10. If the sensors are being trained due to the installation of a new SJB, clear any DTCs and carry out the SJB On-Demand Self Test.

TIRE PRESSURE MONITORING SYSTEM (TPMS) SENSOR ACTIVATION

Special Tools

Illustration	Tool Name	Tool Number
 ST1385-A	Activation Tool, Tire Pressure Monitor	204-363

NOTE: The tire pressure sensors will go into a "sleep mode" after 30 minutes of inactivity to conserve battery power. The sensors do not transmit information while in sleep mode. It will be necessary to wake them up so they will transmit the latest tire pressure information.

1. Turn the ignition switch to the ON position.
2. Position the Tire Pressure Monitor Activation Tool against the LF tire sidewall, 180 degrees from the tire valve stem.

   NOTE: The Tire Pressure Monitor Activation Tool will provide feedback in the form of a flashing green light and a beep sound for each successful response from a tire pressure sensor.

3. Press the test button on the Tire Pressure Monitor Activation Tool to activate the sensor, activate the sensor at least 2 times.
4. Repeat Steps 2 and 3 for the remaining tires.
5. If the Tire Pressure Monitoring System (TPMS) indicator remains illuminated after adjusting and activating each sensor, refer to the **Symptom Chart**.

REMOVAL AND INSTALLATION

WHEEL AND TIRE

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

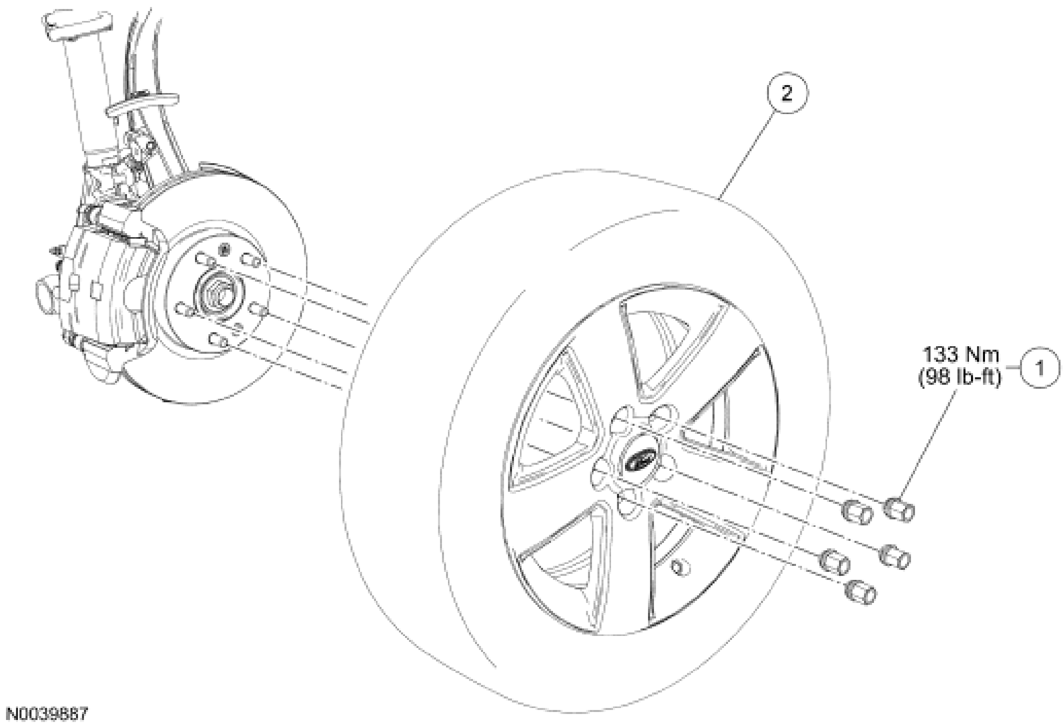


Fig. 16: Exploded View Of Wheel & Tire Assembly With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	1012	Wheel nut (5 required)
2	-	Wheel and tire assembly

REMOVAL

NOTE: Do not use heat to loosen a seized wheel nut or damage to the wheel and wheel bearing can occur.

1. With the weight of the vehicle on the wheels, loosen the wheel nuts.
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
3. Remove the 5 wheel nuts.
4. Remove the wheel and tire assembly.

INSTALLATION

WARNING: When a wheel is installed, always remove any corrosion, dirt or foreign material present on the mounting surface of the wheel and the mounting surface of the wheel hub, brake drum or brake disc. Make sure that any fasteners that attach the rotor to the hub are secured so they do not interfere with the mounting surfaces of the wheel. Failure to follow these instructions when installing wheels may result in the wheel nuts loosening and the wheel coming off while the vehicle is in motion, which could result in loss of control, leading to serious injury or death to vehicle occupant(s).

1. Clean the wheel mounting surfaces and apply a thin coat of silicone grease and dielectric compound to the wheel hub pilot surface (wheel only).
2. Install the wheel and tire assembly.

WARNING: Retighten wheel nuts within 160 km (100 mi) after a wheel is reinstalled. Wheels can loosen after initial tightening. Failure to follow this instruction may result in serious injury to vehicle occupant(s).

NOTE: Failure to tighten the wheel nuts in a star pattern can result in high brake disc runout, which will speed up the development of brake roughness, shudder and vibration.

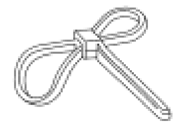
3. Install the 5 wheel nuts.
   - Tighten the wheel nuts in a star pattern.
   - Tighten to 133 Nm (98 lb-ft).

DISASSEMBLY AND ASSEMBLY

WHEEL AND TIRE

Special Tools

Illustration	Tool Name	Tool Number

	Digital Tire Gauge	204-354

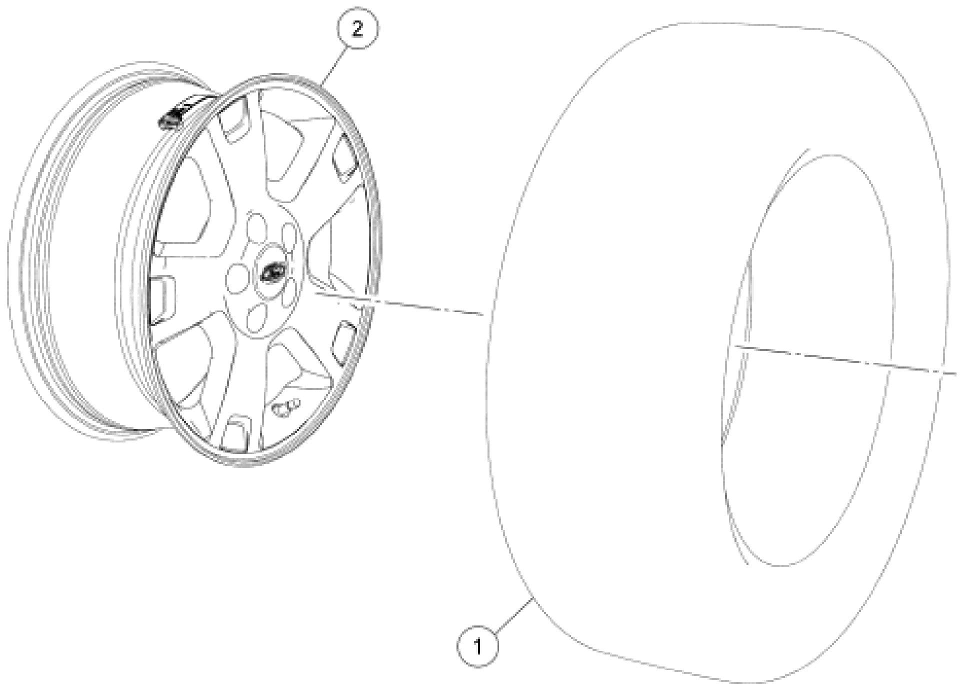


Fig. 17: Exploded View Of Wheel & Tire
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	1508	Tire
2	1007	Wheel

DISASSEMBLY

NOTE: **Failure to follow the instructions below may result in damage to the Tire Pressure Monitoring System (TPMS) sensor.**

NOTE: **Use only the Digital Tire Gauge any time tire pressures are measured to be sure that accurate values are obtained.**

NOTE: **A wheel and tire equipped with a Tire Pressure Monitoring System (TPMS) sensor will have the following verbiage stamped or cast on the wheel: SENSOR MAY BE INSIDE.**

NOTE: The TPMS sensor is mounted to the wheel 180 degrees opposite of the valve stem and is held in place by a stainless steel strap. The sensor is not mounted to the valve stem.

1. Remove the wheel and tire. For additional information, refer to **Wheel and Tire**.

NOTE: Do not allow the tire beads to move beyond the wheel mid-plane (middle of the wheel) when separating the beads from the wheels, damage to the Tire Pressure Monitoring System (TPMS) sensor may occur.

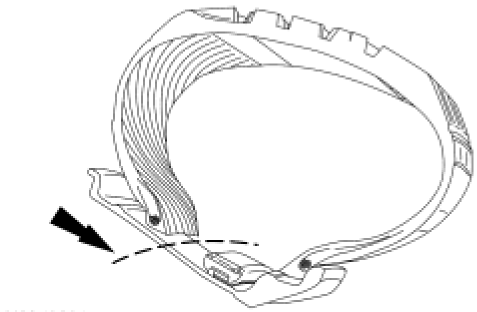


Fig. 18: Locating Tire Pressure Monitoring System (TPMS) Sensor
Courtesy of FORD MOTOR CO.

NOTE: Tire and valve stem position is critical to prevent damage to the Tire Pressure Monitoring System (TPMS) sensor when using a paddle-type bead separator.

NOTE: Some machines may have a nylon roller bead separator at the 12 o'clock position instead of the paddle-type bead separator at the 3 o'clock position.

2. Position the wheel and tire assembly on a suitable tire machine and separate both beads of the tire from the wheel.
   - For a paddle-type tire machine, position the valve stem at the 12 o'clock or 6 o'clock position and the paddle at the 3 o'clock position.
   - For a roller-type tire machine, align the valve stem with the roller at any position.

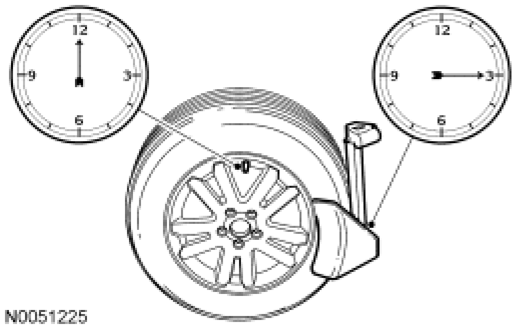


Fig. 19: Identifying Valve Stem And Paddle Position
Courtesy of FORD MOTOR CO.

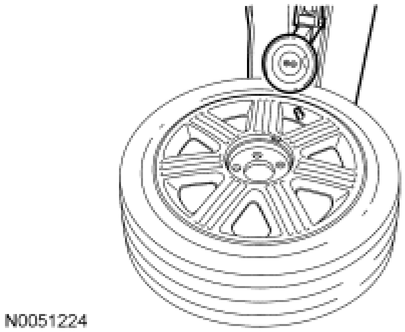


Fig. 20: Identifying Valve Stem And Roller
Courtesy of FORD MOTOR CO.

NOTE:

NOTE: **Index-mark the valve stem and wheel weight positions on the tire.**

3. Place the wheel and tire assembly on the turntable of the tire machine with the valve stem between the 5 o'clock and 6 o'clock positions and the machine arm at the 12 o'clock position and dismount the outer bead from the wheel.

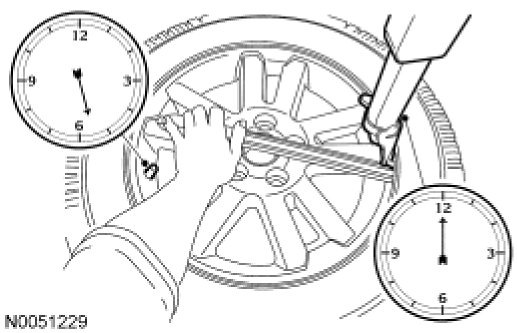


Fig. 21: Identifying Wheel And Tire Assembly On Turntable Tire Machine (Dismounting Outer Bead)
Courtesy of FORD MOTOR CO.

4. Reset the wheel and tire assembly on the turntable of the tire machine with the valve stem between the 5 o'clock and 6 o'clock positions and the machine arm at the 12 o'clock position and dismount the inner bead from the wheel.

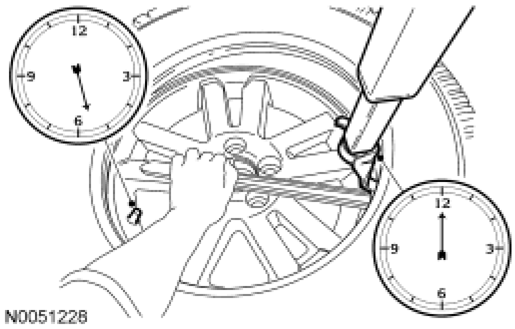


Fig. 22: Resetting Wheel And Tire Assembly On Turntable Of Tire Machine
Courtesy of FORD MOTOR CO.

5. Inspect the TPMS sensor, cradle and strap for damage. Install new parts as necessary.
   - For information on removal and installation of the TPMS sensor, refer to **Tire Pressure Monitoring System (TPMS) Sensor**.
   - When installing a new wheel, reuse the TPMS sensor from the previous wheel if possible. The TPMS will not have to be trained if the sensor is reused. The new wheel will not come with a sensor strap. A sensor strap kit will need to be ordered with the new wheel.

ASSEMBLY

NOTE: Damage to the Tire Pressure Monitoring System (TPMS) sensor may result if the tire mounting is not carried out as instructed.

NOTE: Use only a soap and water solution to lubricate the tire. Use of anything other than soap and water may result in damage to the Tire Pressure Monitoring System (TPMS) sensor.

NOTE: Do not mount the tire at this time.

NOTE:

1. Position the wheel on the turntable of the tire machine, then lubricate and position the bottom bead of the tire on the wheel.
2. Position the wheel to align the valve stem with the machine arm at the 12 o'clock position and mount the bottom bead of the tire.

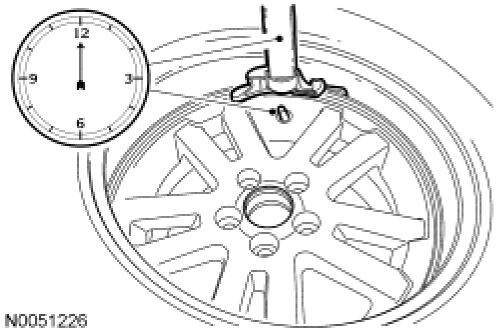


Fig. 23: Identifying Alignment Position Of Valve Stem With Machine Arm (Bottom Bead Of Tire)
Courtesy of FORD MOTOR CO.

3. Reposition the wheel to align the valve stem with the machine arm at the 12 o'clock position and mount the top bead of the tire.

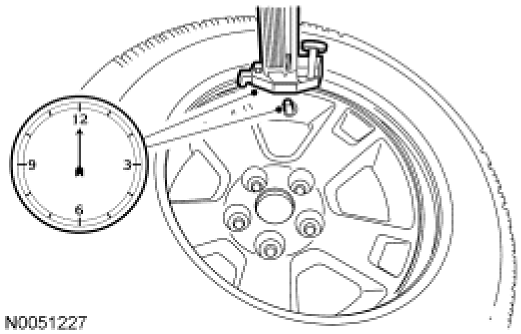


Fig. 24: Identifying Alignment Position Of Valve Stem With Machine Arm (Top Bead)
Courtesy of FORD MOTOR CO.

NOTE: Use only the Digital Tire Gauge any time tire pressures are measured to make sure that accurate values are obtained.

4. Using the Digital Tire Gauge, inflate the tire to the pressure specified on the Vehicle Certification (VC) label located on the driver door or door pillar.
   - Proceed to Step 5 if the tire beads do not seat at the specified inflation pressure.

   WARNING: If there is a need to exceed the maximum pressure indicated on the sidewall of the tire, in order to seat the beads, follow ALL the steps listed below. Failure to follow these steps may result in serious personal injury.

5. **The following steps should only be carried out if the tire beads cannot be seated by inflating the tire up to the maximum inflation pressure listed on the tire sidewall.**
   1. Re-lubricate the tire bead and wheel bead seat area.
   2. Install a remote valve and pressure gauge.
   3. Wear eye and ear protection and stand at a minimum of 3.65 m (12 ft) away from the wheel and tire

assembly.

4. Inflate tire using the remote valve and pressure gauge until the beads have seated or until the pressure gauge is 138 kPa (20 psi) more than maximum inflation pressure on tire sidewall. If beads have not seated, deflate the tire and proceed to the next step.
5. Place the wheel and tire assembly in an OSHA-approved tire safety cage.
6. Inflate the tire using the remote valve and pressure gauge until the beads have seated or until the pressure gauge is 276 kPa (40 psi) more than maximum inflation pressure on the tire sidewall. **Do not exceed 276 kPa (40 psi) above the maximum pressure on tire sidewall. Install a new tire if the beads do not seat at this pressure.**

6. Install the wheel and tire. For additional information, refer to **Wheel and Tire**.

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

TIRE PRESSURE MONITORING SYSTEM (TPMS) SENSOR

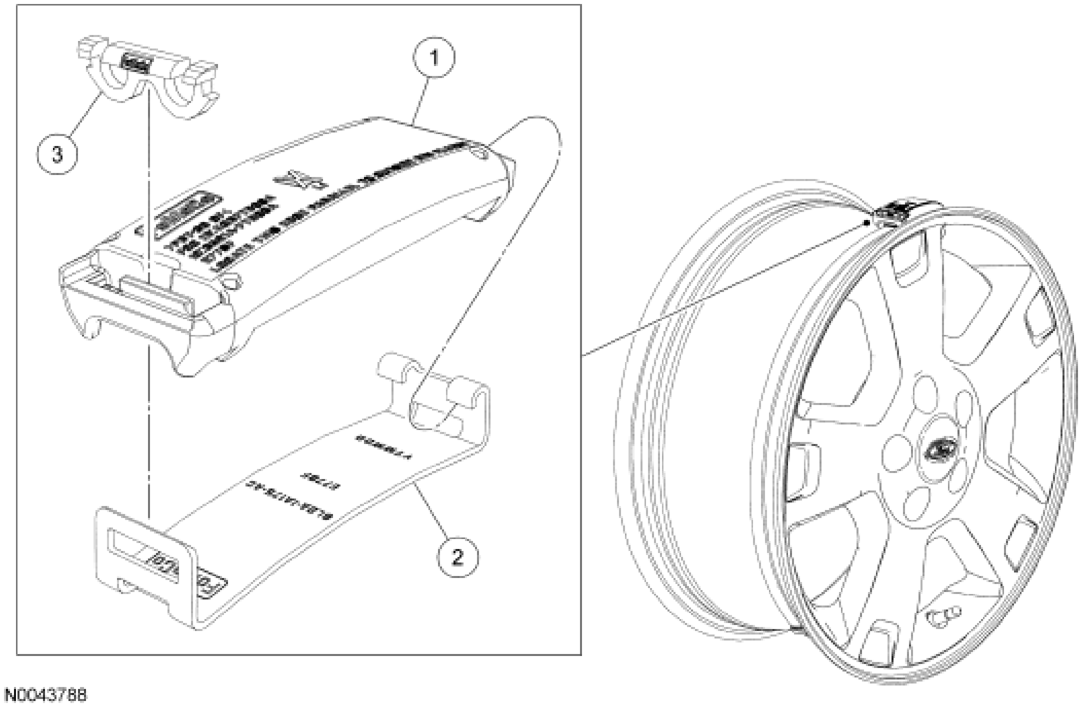


Fig. 25: Exploded View Of Tire Pressure Monitoring System (TPMS) Sensor
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	1A150/1A189	Tire pressure sensor/sensor kit
2	1A175	Sensor cradle
3	14C202	Locking clip (also part of 1A189)

DISASSEMBLY

WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor can be removed and installed without removing the strap or the cradle.

NOTE: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Dismount the tire only as instructed.

1. Remove the tire from the wheel. For additional information, refer to **Wheel and Tire**.

NOTE: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor locking clip may occur.

2. Using a pocket screwdriver or similar tool, remove the sensor locking clip.

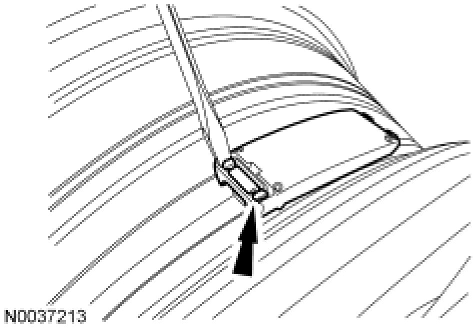


Fig. 26: Locating Sensor Locking Clip
Courtesy of FORD MOTOR CO.

NOTE: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor may occur.

3. Using a pocket screwdriver or similar tool, detach the sensor from the cradle.

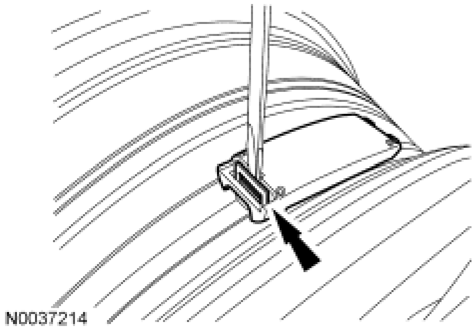


Fig. 27: Removing Sensor From Cradle
Courtesy of FORD MOTOR CO.

4. Remove the sensor.

ASSEMBLY

NOTE:	**Damage to the sensor may occur if excessive force is applied during sensor installation.**

NOTE:	**Make sure the sensor is fully seated into the cradle. The sensor will make a "click" noise when correctly seated.**

1. Position the sensor into the cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

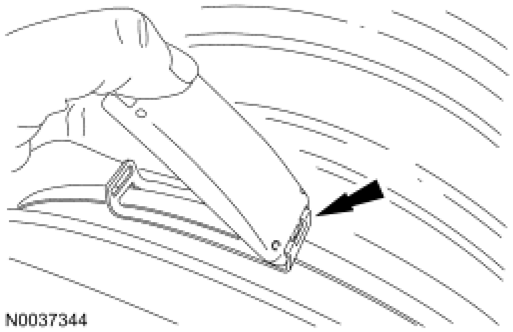


Fig. 28: Positioning Sensor Into Cradle
Courtesy of FORD MOTOR CO.

NOTE:	**The locking clip can only be fully seated when installed in the correct orientation. If the sensor locking clip cannot be fully inserted, then the sensor may not be fully seated on the cradle or the locking clip may be inserted backward.**

2. Insert a new locking clip into the sensor.

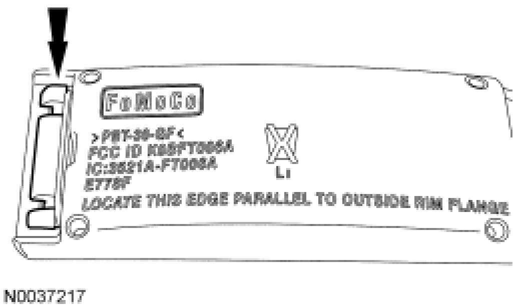


Fig. 29: Locating Locking Clip
Courtesy of FORD MOTOR CO.

NOTE: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

3. Install the tire onto the wheel. For additional information, refer to **Wheel and Tire**.

NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

4. Train the tire pressure sensor(s). For additional information, refer to **Tire Pressure Monitoring System (TPMS) Sensor Training**.

TIRE PRESSURE MONITORING SYSTEM (TPMS) STRAP AND CRADLE

Material

Item	Specification
Wheel and Tire Cleaner ZC-37-A	-

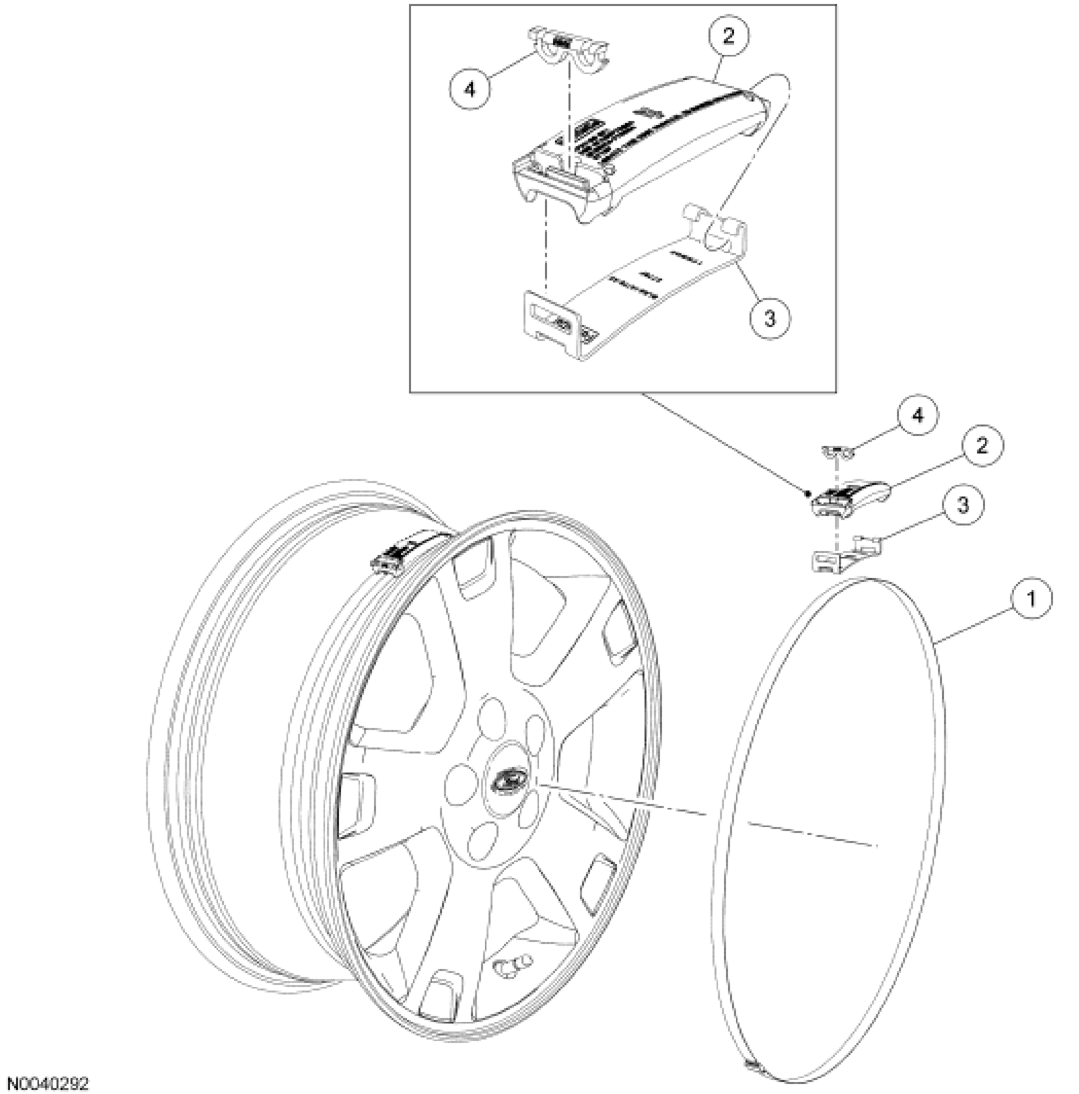


Fig. 30: Exploded View Of Tire Pressure Monitoring System (TPMS) Strap & Cradle
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	1A177/1A193	Strap/strap kit
2	1A150/1A189	Tire pressure sensor/sensor kit
3	1A175	Sensor cradle (also part of 1A193)
4	14C202	Locking clip (also part of 1A189)

DISASSEMBLY

WARNING: **The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of**

the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor is available separately, the cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter, but all strap kits share the same base part number.

1. Remove the Tire Pressure Monitoring System (TPMS) sensor. For additional information, refer to **Tire Pressure Monitoring System (TPMS) Sensor**.

   WARNING: **Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.**

   WARNING: **Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.**

2. Remove a factory-installed strap in the following sequence:
   1. Locate the strap buckle and secure the strap to the wheel using duct tape or a similar item on both sides of the buckle, approximately 25 mm (0.98 in) from the buckle.
   2. Using a large screwdriver and a twisting motion, unbuckle the strap.
   3. Discard the strap.

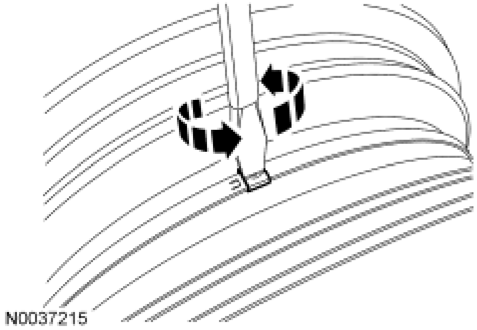


Fig. 31: Identifying Twisting Motion Using Large Screwdriver To Unbuckle Strap

Courtesy of FORD MOTOR CO.

3. To remove a dealer-installed strap, turn the worm gear screw until the strap is fully released from the worm gear.
    - Discard the strap.

NOTE: To aid assembly, mark the location of the cradle prior to disassembly.

4. Using a screwdriver, or similar tool, remove the cradle by inserting the screwdriver under the cradle and prying up.

ASSEMBLY

NOTE: Make sure the sensor is fully seated into the new cradle. The sensor will make a "click" noise when fully seated.

1. Position the sensor into the new cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

NOTE: Metal scrapers may damage the wheel. Use only plastic or non-metallic scrapers to remove the cradle adhesive strip residue.

NOTE: The sensor and cradle must be installed in the drop well of the wheel, 180 degrees from the valve stem.

2. Using wheel and tire cleaner, clean the area where the sensor and cradle are to be installed.

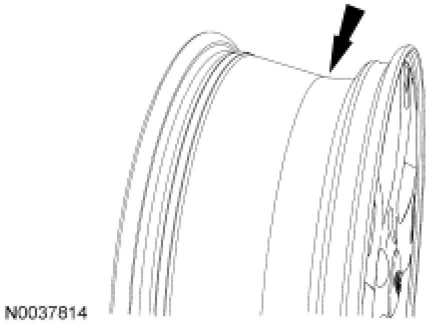


Fig. 32: Locating Sensor & Cradle Area
Courtesy of FORD MOTOR CO.

NOTE: The sensor and cradle must be positioned with the hinge side of the sensor on the RH side when viewed from the curb side (beauty side) of the wheel.

NOTE: The sensor has raised markings indicating how to position the sensor.

3. Remove the adhesive tape liner from the cradle and position the sensor and cradle into the wheel drop well 180 degrees from the valve stem.

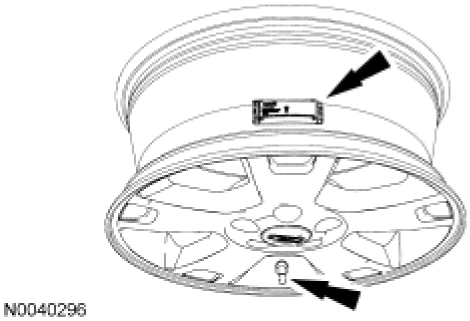


Fig. 33: Locating Sensor & Cradle Into Wheel Drop Well
Courtesy of FORD MOTOR CO.

4. Install the tapered end of the strap through the opening of the cradle on the hinge side of the sensor. This will position the worm gear on the locking clip side of the sensor.

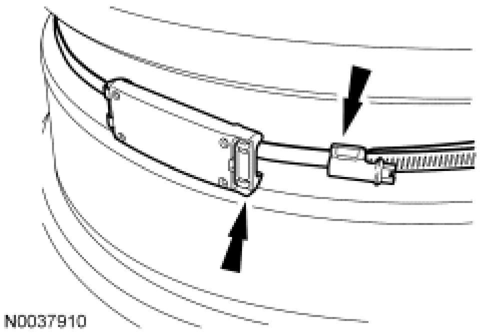


Fig. 34: Locating Worm Gear And Locking Clip
Courtesy of FORD MOTOR CO.

NOTE: **Steel wheels have a "high spot" along their circumference. Make sure the strap and sensor are mounted at the lowest spot possible to avoid damaging the sensor during wheel and tire disassembly and assembly.**

NOTE: **Keep the strap parallel with the wheel flange while tightening the worm gear.**

5. Position the worm gear 13-26 mm (0.5-1.0 in) away from the sensor and tighten the worm gear.
    - Tighten to 3 Nm (27 lb-in).

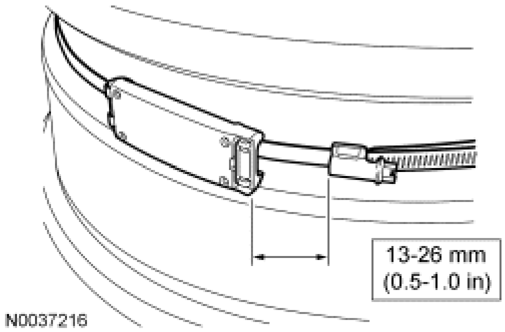


Fig. 35: Identifying Worm Gear Distance From Sensor With Specifications
Courtesy of FORD MOTOR CO.

NOTE:	**The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.**

6. Install the tire onto the wheel. For additional information, refer to **Wheel and Tire**.

NOTE:	**A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.**

7. Train the tire pressure sensor(s). For additional information, refer to **Tire Pressure Monitoring System (TPMS) Sensor Training**.

2008 ACCESSORIES & BODY, CAB

Wipers & Washers - Fusion, Milan & MKZ

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Premium Quality Windshield Washer Fluid (Canada) CXC-37-(A, B, C, D, E, F, G, H) (Canada)	-	-
Premium Windshield Washer Concentrate (US) ZC-32-A or B (US)	WSB-M8B16-A2	-

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
Windshield washer reservoir bolts	7	-	62
Windshield washer reservoir nut	7	-	62
Windshield wiper mounting arm and pivot shaft assembly bolts	5	-	44
Wiper pivot arm nuts	20	15	-
Wiper motor-to-wiper mounting arm bolts	8	-	71

DESCRIPTION AND OPERATION

WIPERS AND WASHERS

NOTE: The smart junction box (SJB) may also be identified as the generic electronic module (GEM).

The windshield wiper and washer system consists of the following:

- Windshield wiper blade
- Windshield wiper pivot arm
- Windshield wiper mounting arm and pivot shaft
- Windshield wiper motor
- Windshield washer reservoir
- Windshield washer pump
- Multi-function switch

- SJB

The washer system consists of the washer reservoir and washer pump. When the multi-function switch is placed into the wash mode, the SJB integral electronics activate the washer pump to direct washer fluid to the windshield. When the front windshield washer system is activated, the wipers will cycle 3 times with washer fluid followed by one final courtesy wipe a few seconds later to clear any remaining fluid that is dripping down from the top of the windshield.

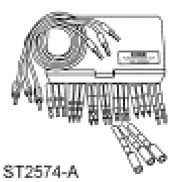
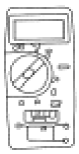
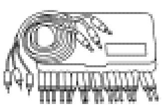
If equipped with automatic headlamps, the SJB will illuminate the exterior lamps, including the parking lamps, when the front wipers are on for more than 10 seconds.

When the wiper control is set on any intermittent setting except INT 1, the speed dependent wipers will automatically adjust with the vehicle speed. This feature decreases the time between wipes when the vehicle speed increases.

DIAGNOSTIC TESTS

WIPERS AND WASHERS

Special Tools

Illustration	Tool Name	Tool Number
 ST2574-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST1137-A	73III Automotive Meter	105-R00057 or equivalent
 ST1138-A	Flex Probe Kit	105-R025B or equivalent

Principles of Operation

Windshield Wiper Operation

NOTE: **The smart junction box (SJB) may also be identified as the generic electronic module (GEM).**

The multi-function switch controls the front wiper/washer portion and is wired to the SJB. When the switch is moved to the desired position, one or more of circuits CRW18 (VT/WH), CRW19 (BU/OG), CRW08 (VT/OG) or CRW17 (GN/VT) is grounded through circuit CD116 (BK/VT). This will provide the necessary inputs for the SJB to control the run/park relay and the high/low relay (integral to the SJB) coils. In order to achieve high-speed operation, both relays are energized. The SJB will respond to the multi-function switch inputs only when the ignition lock cylinder is in RUN or ACC.

The SJB includes a speed dependent feature which compensates for the extra moisture that accumulates on the windshield at higher vehicle speeds when the multi-function switch is in any intermittent setting except the INT 1 position. As vehicle speed increases, the speed dependent feature gradually shortens the delay between wipes.

The speed dependent feature is easiest to verify in the INT 2 position. With the vehicle at a standstill and the multi-function switch in the INT 2 position, the wipers should operate once every 10 seconds. As vehicle speed increases, the delay between wipes will gradually shorten. For example, by the time the vehicle reaches 100 km/h (62 mph), the wipers should operate every 5 seconds. Speed dependent operation is similar in INT 3, INT 4 and INT 5 modes.

Windshield Washer System

The washer pump relay is hard-wired to the SJB. The washer switch portion of the multi-function switch will ground circuit CRW07 (GY/BN) which will signal the SJB to energize the washer pump relay (integral to the SJB). The relay will then provide voltage to the windshield washer pump through circuit CRW14 (BU/WH). The windshield washer pump is grounded through circuit GD123 (BK/GY).

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical

• Windshield washer hoses
• Wiper linkage
	• Battery junction box (BJB) fuse 9 (20A)
	• SJB fuse(s):
	  ○ 23 (7.5A)
	  ○ 14 (15A)
	• Circuitry
	• Multi-function switch
	• Windshield wiper motor
	• Windshield washer pump
	• SJB

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool still does not communicate with the VCM:
   - check the VCM connection to the vehicle.
   - check the scan tool connection to the VCM.
   - refer to **MODULE COMMUNICATIONS NETWORK** article, No Power To The Scan Tool, to diagnose no communication with the scan tool.
6. If the scan tool does not communicate with the vehicle:
   - verify the ignition key is in the ON position.
   - verify the scan tool operation with a known good vehicle.
   - refer to **MODULE COMMUNICATIONS NETWORK** article to diagnose no response from the SJB.
7. Carry out the network test.
   - If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** article.
   - If the network test passes, retrieve and record continuous memory DTCs.
8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB and the Wiper Control Test.
9. If the DTCs retrieved are related to the concern, go to Smart Junction Box (SJB) DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** article.
10. If no DTCs related to the concern are retrieved, go to **Symptom Chart**.

SMART JUNCTION BOX (SJB) DTC CHART

DTC	Description	Action
B1432	Wiper Brake/Run Relay Circuit Short to Battery	Go to **Pinpoint Test A**.
B1433	Wiper Brake/Run Relay Circuit Short to Ground	Go to **Pinpoint Test B**.
B1447	Wiper Park Sense Circuit Open	Go to **Pinpoint Test F**.
B2179	Front Wiper Select Switch "A" Short to Ground	Go to **Pinpoint Test B**.
B2180	Front Wiper Select Switch "B" Short to Ground	Go to **Pinpoint Test B**.
B2181	Front Wiper Select Switch "C" Short to Ground	Go to **Pinpoint Test B**.
B2183	Front Wiper Select Switch "H" Short to Ground	Go to **Pinpoint Test C**.
	Front Wiper Select Switch "W"	

B2184	Short to Ground	Go to **Pinpoint Test E**.
U1900	CAN Communication Bus Fault - Receive Error	**NOTE:** **Do not install a new SJB module as part of a repair for a SJB DTC U1900 fault.** The SJB is not the source of the fault when DTC U1900 is present. REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the medium-speed controller area network (MS-CAN) network concern.

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
• The wipers are inoperative	• Fuse(s) • Relay • Circuitry • Multi-function switch • Windshield wiper motor • Smart junction box (SJB)	• Go to **Pinpoint Test A**.
• The wipers stay on continuously	• Relay • Circuitry • Windshield wiper motor • Multi-function switch • SJB	• Go to **Pinpoint Test B**.
• The high speed wipers do not operate correctly	• Circuitry • Multi-function switch • Windshield wiper motor • SJB	• Go to **Pinpoint Test C**.
• The low speed and intermittent wipers do not operate correctly	• Circuitry • Multi-function switch • Windshield wiper motor • SJB	• Go to **Pinpoint Test C**.
	• Fuse	

• The washer pump is inoperative	• Circuitry • Windshield washer pump • Multi-function switch • SJB	• Go to **Pinpoint Test D**.
• The wash and wipe function does not operate correctly	• Circuitry • Multi-function switch • SJB	• If the LOW speed wiper is inoperative, go to **Pinpoint Test C**. If the washer pump is inoperative, go to **Pinpoint Test D**.
• The wipers do not park at the correct position	• Pivot arm adjustment • Linkage	• ADJUST/REPAIR as necessary.
	• Relay • Circuitry • Multi-function switch • Windshield wiper motor	• Go to **Pinpoint Test F**.
• The speed dependent interval mode does not operate correctly	• SJB • Instrument cluster (IC)	• Go to **Pinpoint Test G**.
• The headlamps do not illuminate when the wipers are on	• Circuitry • SJB	• VERIFY the automatic headlamps operate correctly. If the automatic headlamps do not operate correctly, REFER to **EXTERIOR LIGHTING** article to diagnose the autolamp system. If the automatic headlamps do operate correctly, and no other DTCs are present in the SJB, INSTALL a new SJB. TEST the system for normal operation.

Pinpoint Tests

Pinpoint Test A: The Wipers are Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Wipers and Washers for schematic and connector information.

Normal Operation

When the smart junction box (SJB) receives input from the multi-function switch to activate the wipers, the SJB activates the RUN/PARK relay through circuit RRW24 (GN/VT). When the RUN/PARK relay is activated, voltage is supplied back to the SJB through circuit CRW03 (VT/WH) into the (integral) HIGH/LOW relay. The windshield wiper motor receives power from the HIGH/LOW relay (integral to the SJB) through circuit

CRW16 (GY/BN) for low speed and circuit CRW15 (BN/WH) for high speed. The windshield wiper motor is grounded through circuit GD121 (BK/YE). The multi-function switch is grounded through circuit GD116 (BK/VT).

- DTC B1432 Wiper Brake/Run Relay Circuit Short to Battery - Output shorted to battery when output is active.

This pinpoint test is intended to diagnose the following:

- Fuse(s)
- Wiring, terminals or connectors
- RUN/PARK relay
- Multi-function switch
- Windshield wiper motor
- SJB module

PINPOINT TEST A: THE WIPERS ARE INOPERATIVE

A1 RETRIEVE THE RECORDED SJB DTCs FROM THE WIPER CONTROL SELF-TEST

- Use the recorded SJB DTCs from the Wiper Control Self-Test.
- **Are any DTCs recorded?**

  YES : For DTC B1432, go to A7.

  NO : Go to A2.

A2 CHECK THE MULTI-FUNCTION SWITCH INPUTS TO THE SJB - MONITOR SJB PIDS FRNWIPER_A, FRNWIPER_B, FRNWIPER_C AND FRNWIPER_H

- Enter the following diagnostic mode on the scan tool: SJB DataLogger.
- Monitor the SJB PIDs FRNWIPER_A, FRNWIPER_B, FRNWIPER_C and FRNWIPER_H while turning the multi-function switch through all positions.
- Refer to table.

Multi-function Switch Position	FRN-WIPER_A	FRN-WIPER_B	FRN-WIPER_C	FRN-WIPER_H
INT 1	Active	Inactive	Inactive	Inactive
INT 2	Active	Active	Inactive	Inactive
INT 3	Inactive	Active	Inactive	Inactive
INT 4	Inactive	Active	Active	Inactive
INT 5	Inactive	Inactive	Active	Inactive
LOW	Active	Inactive	Active	Inactive
HIGH	Inactive	Inactive	Inactive	Active

- **Do the PID values agree with the multi-function switch positions?**

YES : Go to A5.

NO : Go to A3.

A3 CHECK THE MULTI-FUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multi-function Switch C202
- Carry out the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
- **Did the multi-function switch pass the component test?**

YES : Go to A4.

NO : INSTALL a new multi-function switch. REFER to **STEERING COLUMN SWITCHES** article.

A4 CHECK CIRCUIT GD116 (BK/VT) FOR AN OPEN

- Key in OFF position.

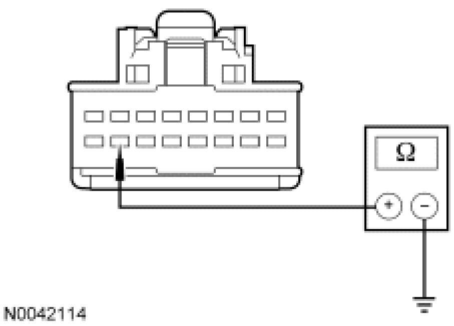


Fig. 1: Checking Circuit GD116 (BK/VT) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between multi-function switch C202-15, circuit GD116 (BK/VT), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to A5.

NO : REPAIR the circuit. TEST the system for normal operation.

A5 CHECK THE WINDSHIELD WIPER MOTOR CIRCUIT GD121 (BK/YE) FOR AN OPEN

- Disconnect: Windshield Wiper Motor C125

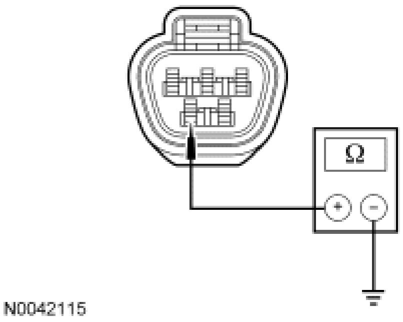


Fig. 2: Checking Windshield Wiper Motor Circuit GD121 (BK/YE) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between windshield wiper motor C125-4, circuit GD121 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : Go to A6.

  NO : REPAIR the circuit. TEST the system for normal operation.

A6 CHECK CIRCUIT CRW16 (GY/BN) FOR VOLTAGE

- Key in ON position.
- Place the multi-function switch into the low speed position.

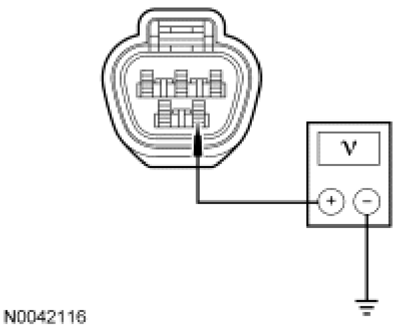


Fig. 3: Checking Circuit CRW16 (GY/BN) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between windshield wiper motor C125-5, circuit CRW16 (GY/BN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new windshield wiper motor. REFER to **Wiper Motor**.

  NO : Go to A7.

A7 CHECK THE WIPER RUN/PARK RELAY

- Disconnect: Windshield Wiper RUN/PARK Relay
- Carry out the Run/Park Relay Component Test. Refer to COMPONENT TESTING.
- **Did the RUN/PARK relay pass the component test?**

  YES : Go to A8.

  NO : INSTALL a new RUN/PARK relay. TEST the system for normal operation.

A8 CHECK CIRCUIT SBB09 (RD) FOR AN OPEN

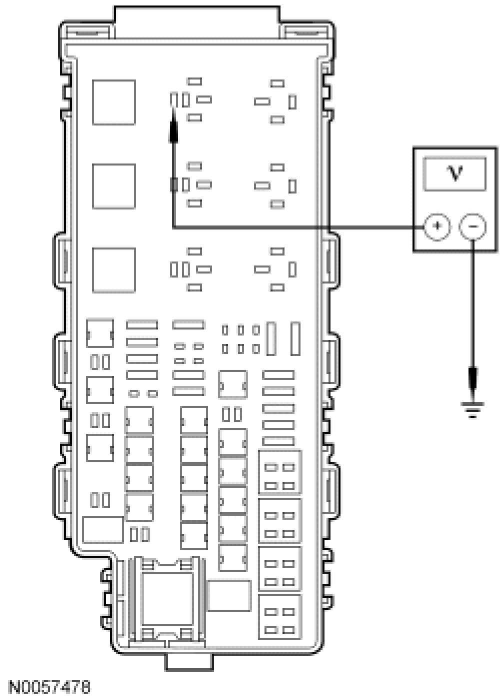


Fig. 4: Checking Circuit SBB09 (RD) For Open - MKZ
Courtesy of FORD MOTOR CO.

- Measure the voltage between windshield wiper RUN/PARK relay pin 87, circuit SBB09 (RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A9.

  NO : VERIFY the battery junction box (BJB) fuse 9 (20A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

A9 CHECK CIRCUIT CBP23 (BN/YE) FOR AN OPEN

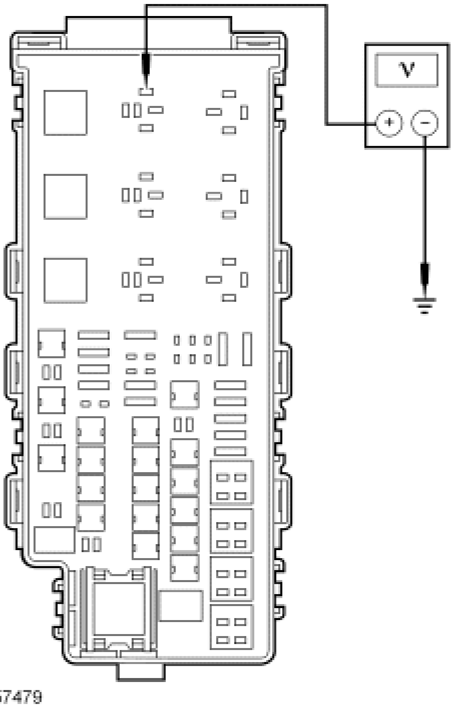


Fig. 5: Checking Circuit CBP23 (BN/YE) For Open - MKZ
Courtesy of FORD MOTOR CO.

- Measure the voltage between windshield wiper RUN/PARK relay pin 86, circuit CBP23 (BN/YE), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to A12.

  NO : Go to A10.

A10 CHECK CIRCUIT CBP23 (BN/YE) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280a

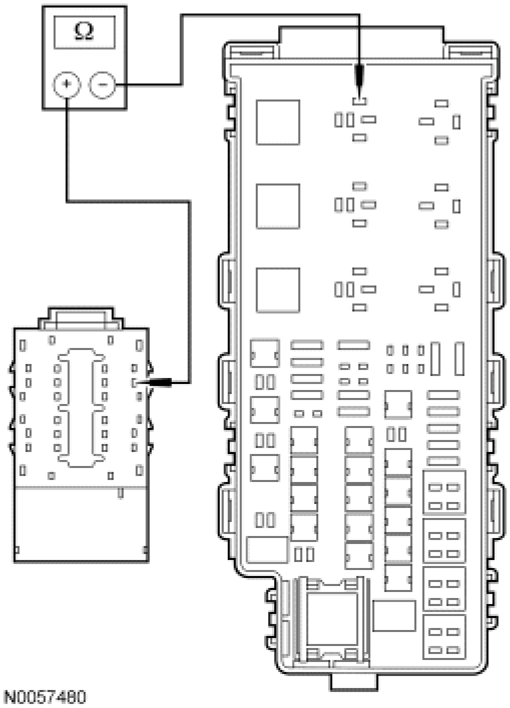


Fig. 6: Checking Circuit CBP23 (BN/YE) For Open - MKZ
Courtesy of FORD MOTOR CO.

- Measure the resistance between windshield wiper RUN/PARK relay pin 86, circuit CBP23 (BN/YE), harness side and SJB C2280a-24, circuit CBP23 (BN/YE), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A11.

  NO : REPAIR the circuit. TEST the system for normal operation.

A11 CHECK CIRCUIT CDC33 (VT/GN) FOR AN OPEN

- Disconnect: SJB C2280b
- Key in ON position.

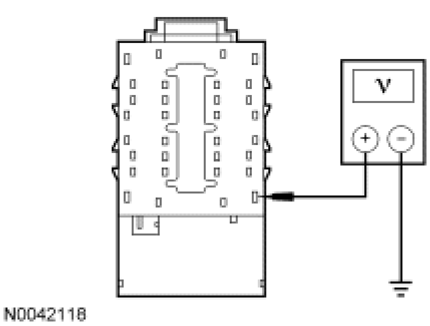


Fig. 7: Checking Circuit CDC33 (VT/GN) For Open
Courtesy of FORD MOTOR CO.

- Measure the voltage between SJB C2280b-4, circuit CDC33 (VT/GN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : VERIFY SJB fuse 23 (7.5A) is OK. If OK, go to A14.

  NO : DIAGNOSE the ignition switch circuit. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

A12 CHECK CIRCUIT RRW24 (GN/VT) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280a

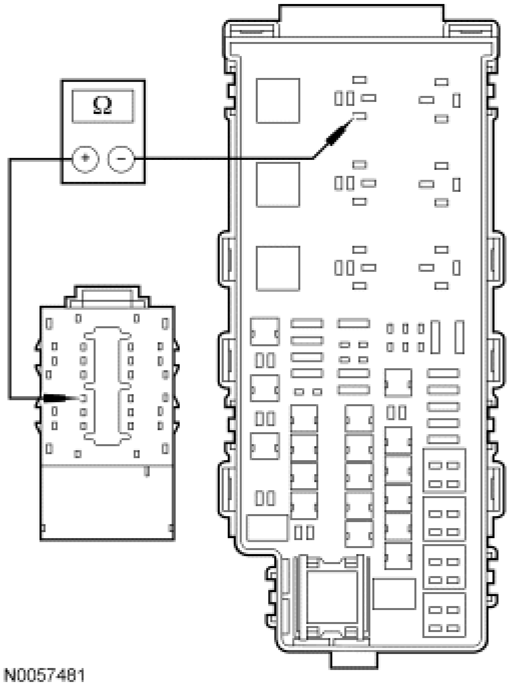


Fig. 8: Checking Circuit RRW24 (GN/VT) For Open - MKZ
Courtesy of FORD MOTOR CO.

- Measure the resistance between windshield wiper RUN/PARK relay pin 85, circuit RRW24 (VT/GN), harness side and SJB C2280a-14, circuit RRW24 (VT/GN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A13.

  NO : REPAIR the circuit. TEST the system for normal operation.

A13 CHECK CIRCUIT CRW03 (VT/WH) FOR AN OPEN

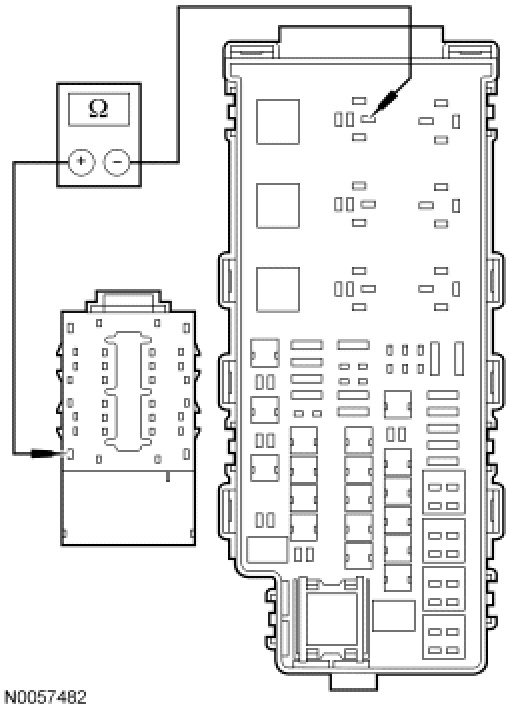


Fig. 9: Checking Circuit CRW03 (VT/WH) For Open - MKZ
Courtesy of FORD MOTOR CO.

- Measure the resistance between windshield wiper RUN/PARK relay pin 30, circuit CRW03 (VT/WH), harness side and SJB C2280a-1, CRW03 (VT/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to A14.

  NO : REPAIR the circuit. TEST the system for normal operation.

A14 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test B: The Wipers Stay On Continuously

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for

Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Wipers and Washers for schematic and connector information.

Normal Operation

The smart junction box (SJB) receives input from the multi-function switch through circuits CRW18 (VT/WH), CRW19 (BU/OG), CRW08 (VT/OG) and CRW17 (GN/VT). To enable the wipers, the SJB activates the RUN/PARK relay through circuit RRW24 (GN/VT). When the RUN/PARK relay is activated, voltage is supplied back to the SJB through circuit CRW03 (VT/WH) into the (integral) HIGH/LOW relay. The windshield wiper motor receives power from the HIGH/LOW relay (integral to the SJB) through circuit CRW16 (GY/BN) for low speed and circuit CRW15 (BN/WH) for high speed. The windshield wiper motor is grounded through circuit GD121 (BK/YE). The multi-function switch is grounded through circuit GD116 (BK/VT).

DTC Description	Fault Trigger Conditions
B1433 - Wiper Brake/Run Relay Circuit Short to Ground	Output shorted to ground or open circuit when output is off.
B2179 - Front Wiper Select Switch "A" Short to Ground	Switch input shorted to ground.
B2180 - Front Wiper Select Switch "B" Short to Ground	Switch input shorted to ground.
B2181 - Front Wiper Select Switch "C" Short to Ground	Switch input shorted to ground.

This pinpoint test is intended to diagnose the following:

- RUN/PARK relay
- Wiring, terminals or connectors
- Multi-function switch
- Windshield wiper motor
- SJB module

PINPOINT TEST B: THE WIPERS STAY ON CONTINUOUSLY

B1 RETRIEVE THE RECORDED SJB DTCs FROM THE WIPER CONTROL SELF-TEST

- Use the recorded SJB DTCs from the Wiper Control Self-Test.
- **Are any DTCs recorded?**

  YES : For DTC B1433, go to B4.

  NO : Go to B2.

B2 CHECK THE MULTI-FUNCTION SWITCH INPUTS TO THE SJB - MONITOR SJB PIDS FRNWIPER_A, FRNWIPER_B, FRNWIPER_C AND FRNWIPER_H

- Key in ON position.
- Enter the following diagnostic mode on the scan tool: SJB DataLogger.
- Monitor the SJB PIDs FRNWIPER_A, FRNWIPER_B, FRNWIPER_C and FRNWIPER_H while

turning the multi-function switch through all positions.

- Refer to table.

Multi-function Switch Position	FRN-WIPER_A	FRN-WIPER_B	FRN-WIPER_C	FRN-WIPER_H
INT 1	Active	Inactive	Inactive	Inactive
INT 2	Active	Active	Inactive	Inactive
INT 3	Inactive	Active	Inactive	Inactive
INT 4	Inactive	Active	Active	Inactive
INT 5	Inactive	Inactive	Active	Inactive
LOW	Active	Inactive	Active	Inactive
HIGH	Inactive	Inactive	Inactive	Active

- **Do the PID values agree with the multi-function switch positions?**

  YES : Go to B5.

  NO : Go to B3.

B3 CHECK THE MULTI-FUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multi-function Switch C202
- Carry out the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
- **Did the multi-function switch pass the component test?**

  YES : Go to B4.

  NO : INSTALL a new multi-function switch. REFER to **STEERING COLUMN SWITCHES** article.

B4 CHECK CIRCUITS CRW17 (GN/VT), CRW18 (VT/WH) AND CRW19 (BU/OG) FOR SHORT TO GROUND

- Disconnect: SJB C2280d

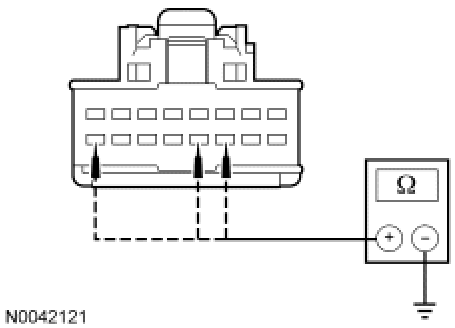


Fig. 10: Checking Circuit CRW17 (GN/VT), CRW18 (VT/WH) And CRW19 (BU/OG) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between multi-function switch C202-16, circuit CRW19 (BU/OG), harness side and ground; and between C202-11, circuit CRW18 (VT/WH), harness side and ground; and between C202-12, circuit CRW17 (GN/VT), harness side and ground.
- **Is the resistance for all measurements greater than 10,000 ohms?**

  YES : Go to B11.

  NO : REPAIR the circuit. TEST the system for normal operation.

B5 CHECK WIPER OPERATION WITH THE PARK RELAY REMOVED

- Disconnect: Wiper PARK Relay
- Observe the wiper operation with the PARK relay removed.
- **Are the wipers still operating?**

  YES : Go to B6.

  NO : INSTALL a new windshield wiper motor. REFER to **Wiper Motor**.

B6 CHECK WIPER OPERATION WITH THE RUN/PARK RELAY REMOVED

- Disconnect: Wiper RUN/PARK Relay
- Observe the wiper operation with the RUN/PARK relay removed.
- **Are the wipers still operating?**

  YES : Go to B9.

  NO : Go to B7.

B7 CHECK THE WIPER RUN/PARK RELAY

- Carry out the Run/Park Relay Component Test. Refer to COMPONENT TESTING.
- **Did the RUN/PARK relay pass the component test?**

  YES : Go to B8.

  NO : INSTALL a new RUN/PARK relay. TEST the system for normal operation.

B8 CHECK CIRCUIT RRW24 (GN/VT) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: SJB C2280a

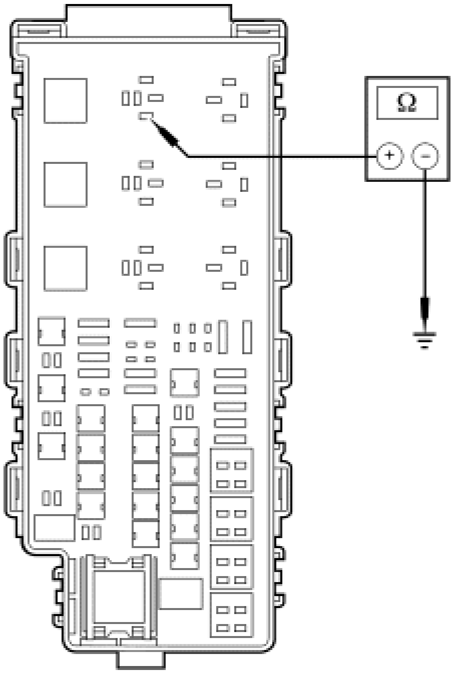


Fig. 11: Checking Circuit RRW24 (GN/VT) For Short To Ground - MKZ
Courtesy of FORD MOTOR CO.

- Measure the resistance between windshield wiper RUN/PARK relay pin 85, circuit RRW24 (GN/VT), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

  YES : Go to B11.

  NO : REPAIR the circuit. TEST the system for normal operation.

B9 CHECK CIRCUIT CRW03 (VT/WH) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: SJB C2280a
- Key in ON position.

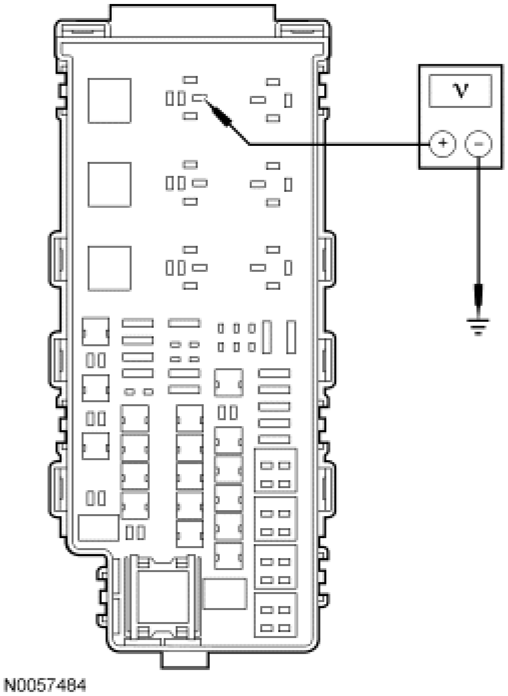


Fig. 12: Checking Circuit CRW03 (VT/WH) For Short To Voltage - MKZ
Courtesy of FORD MOTOR CO.

- Measure the voltage between wiper RUN/PARK relay pin 30, circuit CRW03 (VT/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to B10.

B10 CHECK CIRCUITS CRW15 (BN/WH) AND CRW16 (GY/BN) FOR A SHORT TO VOLTAGE

- Disconnect: Wiper Motor C125

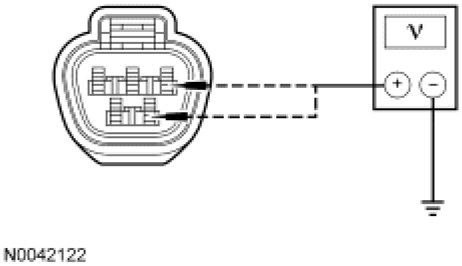


Fig. 13: Checking Circuit CRW15 (BN/WH) And CRW16 (GY/BN) For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between wiper motor C125-3, circuit CRW15 (BN/WH), harness side and

ground; and between C125-5, circuit CRW16 (GY/BN), harness side and ground.

- **Is the voltage greater than 10 volts for either measurement?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to B11.

B11 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test C: The High/Low Wiper Speeds Do Not Operate Correctly

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Wipers and Washers for schematic and connector information.

Normal Operation

The smart junction box (SJB) receives input from the multi-function switch through circuits CRW18 (VT/WH), CRW19 (BU/OG), CRW08 (VT/OG) and CRW17 (GN/VT). To enable the wipers, the SJB activates the RUN/PARK relay through circuit RRW24 (GN/VT). When the RUN/PARK relay is activated, voltage is supplied back to the SJB through circuit CRW03 (VT/WH) into the (integral) HIGH/LOW relay. The windshield wiper motor receives power from the HIGH/LOW relay (integral to the SJB) through circuit CRW16 (GY/BN) for low speed and circuit CRW15 (BN/WH) for high speed. The windshield wiper motor is grounded through circuit GD121 (BK/YE). The multi-function switch is grounded through circuit GD116 (BK/VT).

- DTC B2183 Front Wiper Select Switch "H" Short to Ground - Switch input shorted to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Multi-function switch
- Windshield wiper motor
- SJB module

PINPOINT TEST C: THE HIGH/LOW WIPER SPEEDS DO NOT OPERATE CORRECTLY

C1 RETRIEVE THE RECORDED DTCs FROM THE WIPER CONTROL SELF-TEST

- Key in ON position.
- Use the recorded SJB DTCs from the Wiper Control Self-Test.
- **Are any DTCs recorded?**

  YES : For DTC B1432, go to **Pinpoint Test A**.

  For DTC B1433, go to **Pinpoint Test B**.

  For DTC B1447, go to **Pinpoint Test F**.

  Go to C2.

  NO : Go to C2.

C2 CHECK THE MULTI-FUNCTION SWITCH INPUT TO THE SJB - MONITOR SJB PIDS FRNWIPER_A, FRNWIPER_B, FRNWIPER_C AND FRNWIPER_H

- Key in ON position.
- Enter the following diagnostic mode on the scan tool: SJB DataLogger.
- Monitor the SJB PIDs FRNWIPER_A, FRNWIPER_B, FRNWIPER_C and FRNWIPER_H while turning the multi-function switch through all positions.
- Refer to table.

Multi-function Switch Position	Wiper_A	Wiper_B	Wiper_C	Wiper_H
INT 1	Active	Inactive	Inactive	Inactive
INT 2	Active	Active	Inactive	Inactive
INT 3	Inactive	Active	Inactive	Inactive
INT 4	Inactive	Active	Active	Inactive
INT 5	Inactive	Inactive	Active	Inactive
LOW	Active	Inactive	Active	Inactive
HIGH	Inactive	Inactive	Inactive	Active

- **Do the PID values agree with the multi-function switch positions?**

  YES : Go to C5.

  NO : Go to C3.

C3 CHECK THE MULTI-FUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multi-function Switch C202
- Carry out the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
- **Did the multi-function switch pass the component test?**

  YES : Go to C4.

  NO : INSTALL a new multi-function switch. REFER to **STEERING COLUMN SWITCHES** article.

C4 CHECK CIRCUIT CRW17 (GN/VT), CRW18 (VT/WH), CRW08 (VT/OG) AND CRW19 (BU/OG) FOR AN OPEN OR SHORT TO GROUND

- Disconnect: SJB C2280d
- Measure the resistance between multi-function switch and SJB; and between the multi-function switch and ground as follows:

Multi-function Switch	SJB Connector	Circuit
C202-16	C2280d-21	CRW19 (BU/OG)
C202-11	C2280d-22	CRW18 (VT/WH)
C202-9	C2280d-32	CRW08 (VT/OG)
C202-12	C2280d-23	CRW17 (GN/VT)

- **Is the resistance between the multi-function switch and SJB less than 5 ohms; and greater than 10,000 ohms between the multi-function switch and ground?**

  YES : Go to C9.

  NO : REPAIR the circuit in question. TEST the system for normal operation.

C5 CHECK CIRCUIT CRW15 (BN/WH) FOR VOLTAGE

- Disconnect: Windshield Wiper Motor C125
- Place the multi-function switch to the HIGH speed position.

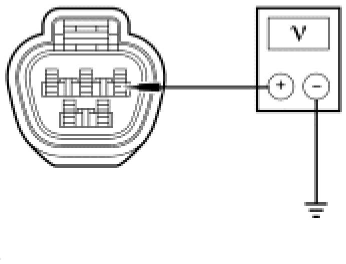


Fig. 14: Checking Circuit CRW15 (BN/WH) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between wiper motor C125-3, circuit CRW15 (BN/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to C7.

  NO : Go to C6.

C6 CHECK CIRCUIT CRW15 (BN/WH) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280a

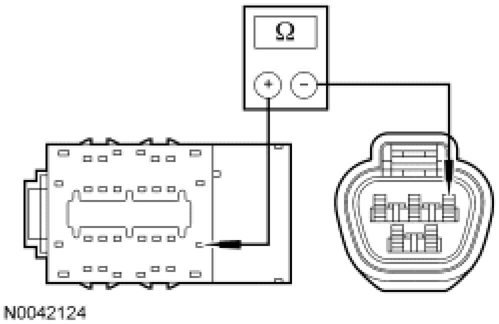


Fig. 15: Checking Circuit CRW15 (BN/WH) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between wiper motor C125-3, circuit CRW15 (BN/WH), harness side and SJB C2280a-2, circuit CRW15 (BN/WH), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to C9.

  NO : REPAIR the circuit. TEST the system for normal operation.

C7 CHECK CIRCUIT CRW16 (GY/BN) FOR VOLTAGE

- Disconnect: Windshield Wiper Motor C125
- Place the multi-function switch to the LOW speed position.

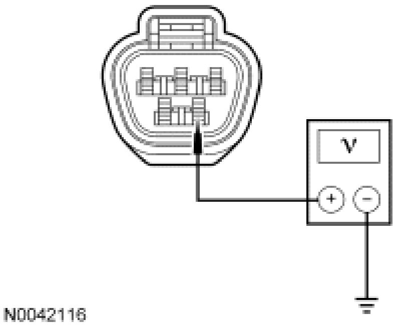


Fig. 16: Checking Circuit CRW16 (GY/BN) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between wiper motor C125-5, circuit CRW16 (GY/BN), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new windshield wiper motor. REFER to **Wiper Motor**.

  NO : Go to C8.

C8 CHECK CIRCUIT CRW16 (GY/BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: SJB C2280a

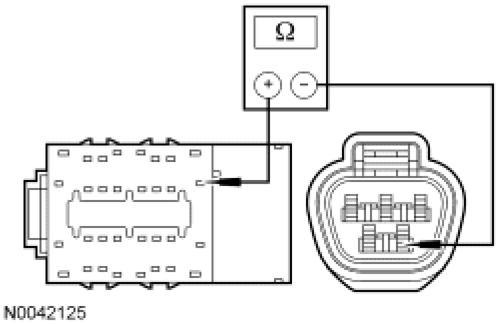


Fig. 17: Checking Circuit CRW16 (GY/BN) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between wiper motor C125-5, circuit CRW16 (GY/BN), harness side and SJB C2280a-3, circuit CRW16 (GY/BN), harness side.
- **Is the resistance less than 5 ohms?**

  YES : Go to C9.

  NO : REPAIR the circuit. TEST the system for normal operation.

C9 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: The Washer Pump is Inoperative

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Wipers and Washers for schematic and connector information.

Normal Operation

The windshield washer pump is grounded at all times through circuit GD123 (BK/GY). When WASH mode is

selected, the smart junction box (SJB) receives input from the multi-function switch through circuit CRW07 (GY/BN). The SJB then activates the washer pump relay (integral to SJB) which supplies voltage to the washer pump through circuit CRW14 (BU/WH).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Multi-function switch
- SJB module
- Windshield washer pump

PINPOINT TEST D: THE WASHER PUMP IS INOPERATIVE

D1 CHECK THE MULTI-FUNCTION SWITCH INPUT TO THE SJB - MONITOR SJB PID FRNWIPER_W

- Key in ON position.
- Enter the following diagnostic mode on the scan tool: SJB DataLogger.
- Monitor the SJB PID FRNWIPER_W while moving the multi-function switch to the WASH position.
- **Does the PID value agree with the multi-function switch position when WASH is selected?**

  YES : Go to D4.

  NO : Go to D2.

D2 CHECK THE MULTI-FUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multi-function Switch C202
- Carry out the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
- **Did the multi-function switch pass the component test?**

  YES : Go to D3.

  NO : INSTALL a new multi-function switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

D3 CHECK CIRCUIT CRW07 (GY/BN) FOR AN OPEN

- Disconnect: SJB C2280d
- Key in OFF position.

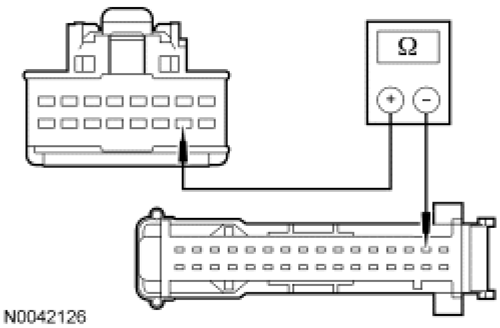


Fig. 18: Checking Circuit CRW07 (GY/BN) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between multi-function switch C202-10, circuit CRW07 (GY/BN), harness side and SJB C2280d-31, circuit CRW07 (GY/BN), harness side.
- **Is the resistance less than 5 ohms?**

YES : Go to D6.

NO : REPAIR the circuit. TEST the system for normal operation.

D4 CHECK CIRCUIT GD123 (BK/GY) FOR AN OPEN

- Key in OFF position.
- Disconnect: Washer Pump C137

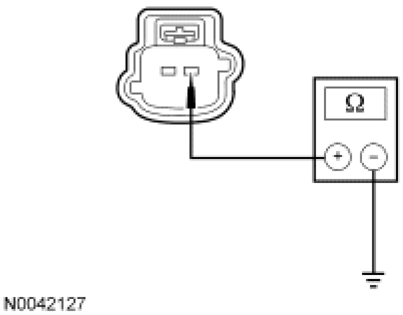


Fig. 19: Checking Circuit GD1230 (BK/GY) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between washer pump C137-2, circuit GD123 (BK/GY), harness side and ground.
- **Is the resistance less than 5 ohms?**

YES : Go to D5.

NO : REPAIR the circuit. TEST the system for normal operation.

D5 CHECK CIRCUIT CRW14 (BU/WH) FOR VOLTAGE

- Key in ON position.

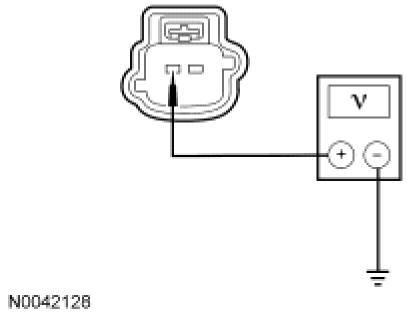


Fig. 20: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- While activating the front washer pump using the multi-function switch, measure the voltage between windshield washer pump C137-1, circuit CRW14 (BU/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : INSTALL a new windshield washer pump. REFER to **Washer Pump**. TEST the system for normal operation.

  NO : VERIFY SJB fuse 14 (15A) is OK. If OK, go to D6.

D6 CHECK FOR CORRECT SJB OPERATION

- Disconnect all the SJB connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: The Washer Pump is Inoperative - Continuously On

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Wipers and Washers for schematic and connector information.

Normal Operation

The windshield washer pump is grounded at all times through circuit GD123 (BK/GY). When WASH mode is selected, the smart junction box (SJB) receives input from the multi-function switch through circuit CRW07 (GY/BN). The SJB then activates the washer pump relay (integral to SJB) which supplies voltage to the washer pump through circuit CRW14 (BU/WH).

- DTC B2184 Front Wiper Select Switch "W" Short to Ground - Switch input shorted to ground.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Multi-function switch
- SJB module

PINPOINT TEST E: THE WASHER PUMP IS INOPERATIVE - CONTINUOUSLY ON

E1 CHECK THE MULTI-FUNCTION SWITCH

- Key in OFF position.
- Disconnect: Multi-function Switch C202
- Carry out the Multi-Function Switch Component Test. Refer to COMPONENT TESTING.
- **Did the multi-function switch pass the component test?**

YES : Go to E2.

NO : INSTALL a new multi-function switch. REFER to **STEERING COLUMN SWITCHES** article. TEST the system for normal operation.

E2 CHECK CIRCUIT CRW07 (GY/BN) FOR A SHORT TO GROUND

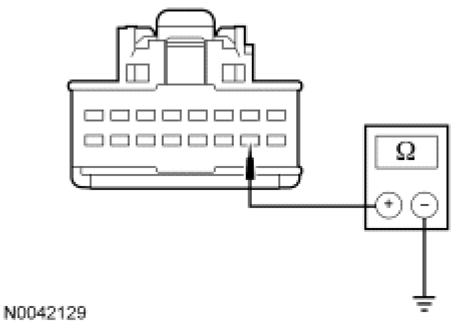


Fig. 21: Checking Circuit CRW07 (GY/BN) For Short To Ground
Courtesy of FORD MOTOR CO.

- Measure the resistance between multi-function switch C202-10, circuit CRW07 (GY/BN), harness side and ground.
- **Is the resistance greater than 10,000 ohms?**

YES : Go to E3.

NO : REPAIR the circuit. TEST the system for normal operation.

E3 CHECK CIRCUIT CRW14 (BU/WH) FOR A SHORT TO VOLTAGE

- Disconnect: SJB C2280a
- Disconnect: Washer Pump C137
- Key in ON position.

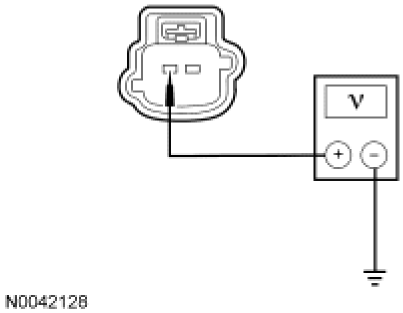


Fig. 22: Checking Circuit For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between washer pump motor C137-1, circuit CRW14 (BU/WH), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : REPAIR the circuit. TEST the system for normal operation.

  NO : Go to E4.

E4 CHECK FOR CORRECT SJB OPERATION

- Key in OFF position.
- Disconnect all the SJB connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test F: The Wipers Do Not Park at the Correct Position

Refer to **SYSTEM WIRING DIAGRAMS** article for Fusion, **SYSTEM WIRING DIAGRAMS** article for Milan or **SYSTEM WIRING DIAGRAMS** article for MKZ, Wipers and Washers for schematic and connector information.

Normal Operation

With the ignition key in RUN or ACC, the windshield wiper motor receives voltage at all times from the wiper PARK relay through circuit SBB09 (RD). When the wipers are commanded OFF, the smart junction box (SJB) deactivates the RUN/PARK relay. Voltage is supplied from the park switch (integral to the wiper motor) to the RUN/PARK relay through circuit CRW09 (BN/BU) to operate the wipers until they are parked. When the

wipers are parked, the park switch (integral to the wiper motor) supplies ground to the RUN/PARK relay and the wipers will stop. The SJB monitors circuit CRW09 (BN/BU) for voltage when wipers are not parked and ground when the wipers are parked.

- DTC B1447 Wiper Park Sense Circuit Open - Switch input open.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Windshield wiper motor
- PARK relay
- RUN/PARK relay
- SJB module

PINPOINT TEST F: THE WIPERS DO NOT PARK AT THE CORRECT POSITION

F1 RETRIEVE THE RECORDED DTCs FROM THE SJB WIPER CONTROL SELF-TEST

- Use the recorded SJB Wiper Control Self-Test DTCs.
- **Is DTC B1447 present?**

  YES : Go to F9.

  NO : Go to F2.

F2 CHECK CIRCUIT SBB09 (RD) FOR VOLTAGE

- Disconnect: Windshield Wiper Motor C125
- Key in ON position.

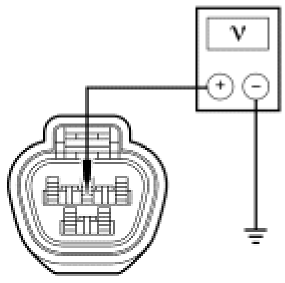


Fig. 23: Checking Circuit A_SBB09 (RD) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between wiper motor C125-2, circuit SBB09 (RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to F7.

  NO : Go to F3.

F3 CHECK THE WIPER PARK RELAY

- Disconnect: Windshield Wiper PARK Relay

- Carry out the Wiper Park Relay Component Test. Refer to COMPONENT TESTING.
- **Did the wiper PARK relay pass the component test?**

  YES : Go to F4.

  NO : INSTALL a new wiper PARK relay. TEST the system for normal operation.

F4 CHECK CIRCUIT SBB09 (RD) FOR VOLTAGE

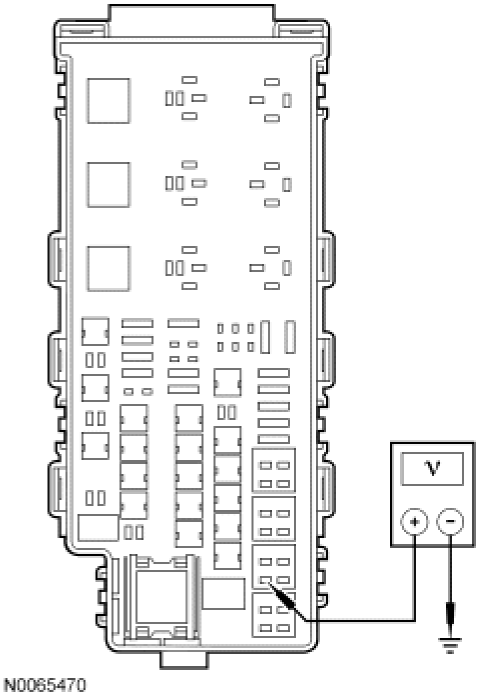


Fig. 24: Checking Circuit SBB09 (RD) For Voltage - MKZ
Courtesy of FORD MOTOR CO.

- Measure the voltage between windshield wiper PARK relay pin 30, circuit SBB09 (RD), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to F5.

  NO : VERIFY the battery junction box (BJB) fuse 9 (20A) is OK. If OK, REPAIR the circuit. TEST the system for normal operation.

F5 CHECK CIRCUIT CBP23 (BN/YE) FOR VOLTAGE

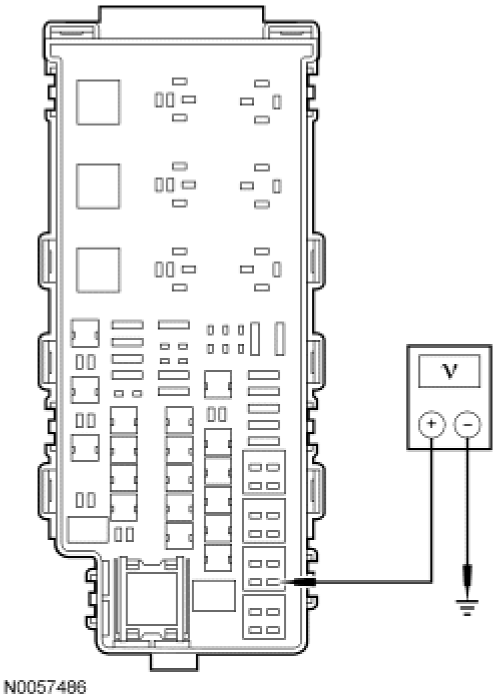


Fig. 25: Checking Circuit CBP23 (BN/YE) For Voltage - MKZ
Courtesy of FORD MOTOR CO.

- Measure the voltage between the windshield wiper PARK relay pin 86, circuit CBP23 (BN/YE), harness side and ground.
- **Is the voltage greater than 10 volts?**

  YES : Go to F6.

  NO : REPAIR the circuit. TEST the system for normal operation.

F6 CHECK CIRCUIT GD121 (BK/YE) FOR GROUND

- Key in OFF position.

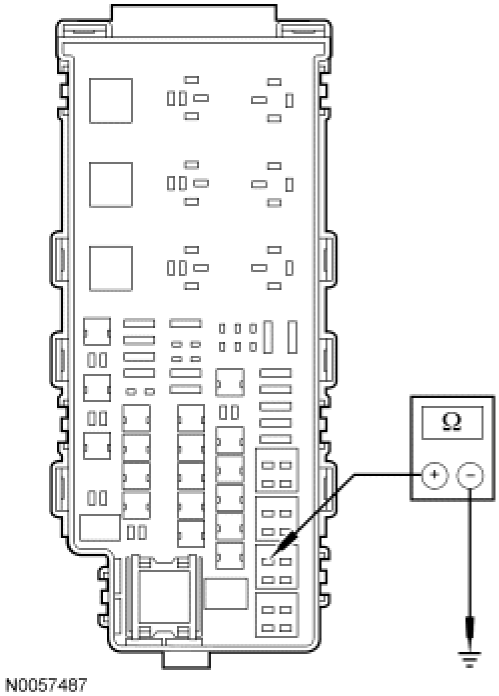


Fig. 26: Checking Circuit GD121 (BK/YE) For Ground - MKZ
Courtesy of FORD MOTOR CO.

- Measure the resistance between windshield wiper PARK relay pin 85, circuit GD121 (BK/YE), harness side and ground.
- **Is the resistance less than 5 ohms?**

  YES : REPAIR open in circuit SBB09 (RD). TEST the system for normal operation.

  NO : REPAIR the circuit. TEST the system for normal operation.

F7 CHECK THE WIPER RUN/PARK RELAY

- Disconnect: Windshield Wiper RUN/PARK Relay
- Carry out the Wiper Run/Park Relay Component Test. Refer to COMPONENT TESTING.
- **Did the RUN/PARK relay pass the component test?**

  YES : Go to F8.

  NO : INSTALL a new RUN/PARK relay. TEST the system for normal operation.

F8 CHECK CIRCUIT CRW09 (BN/BU) FOR AN OPEN

- Key in OFF position.

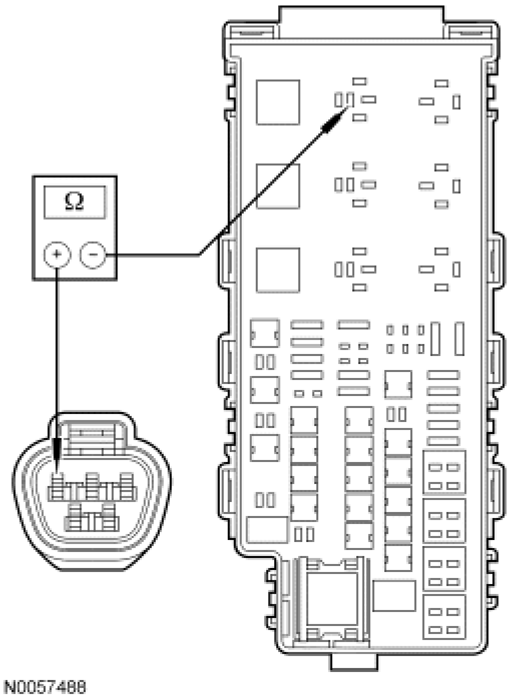


Fig. 27: Checking Circuit CRW09 (BN/BU) For Open - MKZ
Courtesy of FORD MOTOR CO.

- Measure the resistance between the windshield wiper RUN/PARK relay pin 87A, circuit CRW09 (BN/BU), harness side and wiper motor C125-1, circuit CRW09 (BN/BU), harness side.
- **Is the resistance less than 5 ohms?**

  YES : INSTALL a new windshield wiper motor. REFER to **Wiper Motor**.

  NO : REPAIR the circuit. TEST the system for normal operation.

F9 CHECK CIRCUIT CRW09 (BN/BU) FOR AN OPEN

- Key in OFF position.
- Disconnect: Windshield Wiper Motor C125
- Disconnect: SJB C2280a

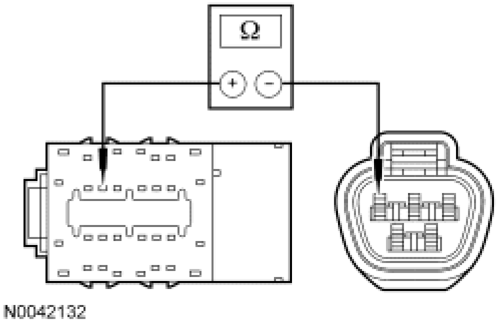


Fig. 28: Checking Circuit CRW09 (BN/BU) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between SJB C2280a-23, circuit CRW09 (BN/BU), harness side and windshield wiper motor C125-1, circuit CRW09 (BN/BU).
- **Is the resistance less than 5 ohms?**

  YES : If wipers park correctly but DTC B1447 was present, go to F10.

  If wipers do not park correctly, INSTALL a new windshield wiper motor. REFER to **Wiper Motor**.

  NO : REPAIR the circuit. TEST the system for normal operation.

F10 CHECK FOR CORRECT SJB OPERATION

- Key in OFF position.
- Disconnect all the SJB connectors.
- Check for:
  - corrosion.
  - pushed-out pins.
- Connect all the SJB connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

  YES : INSTALL a new SJB. REFER to **MULTIFUNCTION ELECTRONIC MODULES** article. TEST the system for normal operation.

  NO : The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test G: The Speed Dependent Interval Mode Does Not Operate Correctly

Normal Operation

The smart junction box (SJB) receives vehicle speed information from the instrument cluster (IC) over the communication network. When any intermittent wiper mode is selected except INT 1, the SJB will gradually increase or decrease the delay between wipes based on vehicle speed.

The speed dependent feature is easiest to verify in the INT 2 position. With the vehicle at a standstill and the multi-function switch in the INT 2 position, the wipers should operate once every 10 seconds. As vehicle speed increases, the delay between wipes will gradually shorten. For example, by the time the vehicle reaches 100 km/h (62 mph), the wipers should operate every 5 seconds. Speed dependent operation is similar in INT 3, INT 4 and INT 5 modes.

This pinpoint test is intended to diagnose the following:

- IC
- SJB

PINPOINT TEST G: THE SPEED DEPENDENT INTERVAL MODE DOES NOT OPERATE CORRECTLY

G1 CHECK FOR RELATED DTCs

- Carry out a self-test on the PCM, IC and SJB module.
- **Are any DTCs present?**

  YES : For PCM-related DTCs, REFER to the **Introduction - Gasoline Engines** article.

  For IC related DTCs, REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article.

  For SJB-related DTCs, REFER to the **Inspection and Verification**, Smart Junction Box (SJB) DTC Chart.

  NO : Go to G2.

G2 CHECK SPEEDOMETER OPERATION

- Verify the speedometer operates correctly.
- **Does the speedometer operate correctly?**

  YES : Go to G3.

  NO : REFER to **INSTRUMENT CLUSTER (IC), MESSAGE CENTER, AND WARNING CHIMES** article to diagnose the IC.

G3 CHECK THE SJB VSS_GEM PID

- Enter the following diagnostic mode on the scan tool: SJB DataLogger.
- While driving the vehicle at various speeds while monitoring the SJB module VSS_GEM PID and comparing with what is observed on the speedometer.
- **Does the VSS_GEM PID value agree with the observed speedometer readings?**

  YES : INSTALL a new SJB. TEST the system for normal operation.

  NO : REFER to **MODULE COMMUNICATIONS NETWORK** article to diagnose the IC communication fault.

GENERAL PROCEDURES

WIPER BLADE AND PIVOT ARM ADJUSTMENT

1. Cycle and park the windshield wipers.
2. Verify that the RH and LH wiper blades are located at the alignment marks on the glass.

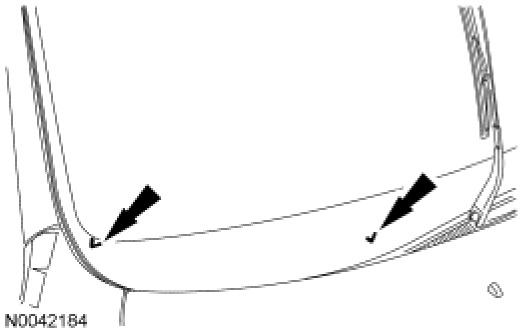


Fig. 29: Locating RH & LH Wiper Blade Alignment Marks
Courtesy of FORD MOTOR CO.

3. If necessary, remove the nuts and the windshield wiper pivot arms and reposition them to the correct locations.
   - To install, tighten to 20 Nm (15 lb-ft).

WASHER HOSE REPAIR

1. Locate and verify the leaking washer hose.
2. Cut the hose cleanly and remove the damaged portion of the washer hose.

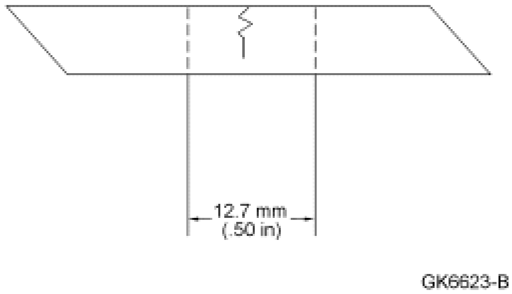


Fig. 30: Cutting Hose With Specifications
Courtesy of FORD MOTOR CO.

3. Install a windshield washer hose adapter between the cut ends of the hose.

NOTE: In difficult cases, clamping may be required.

4. Install a segment of 6.4 mm (0.25 in) inside diameter black rubber hose over the ends of the washer hose, and clamp both ends of the rubber hose using spring clamps.

REMOVAL AND INSTALLATION

WIPER AND WASHER SYSTEM - EXPLODED VIEW

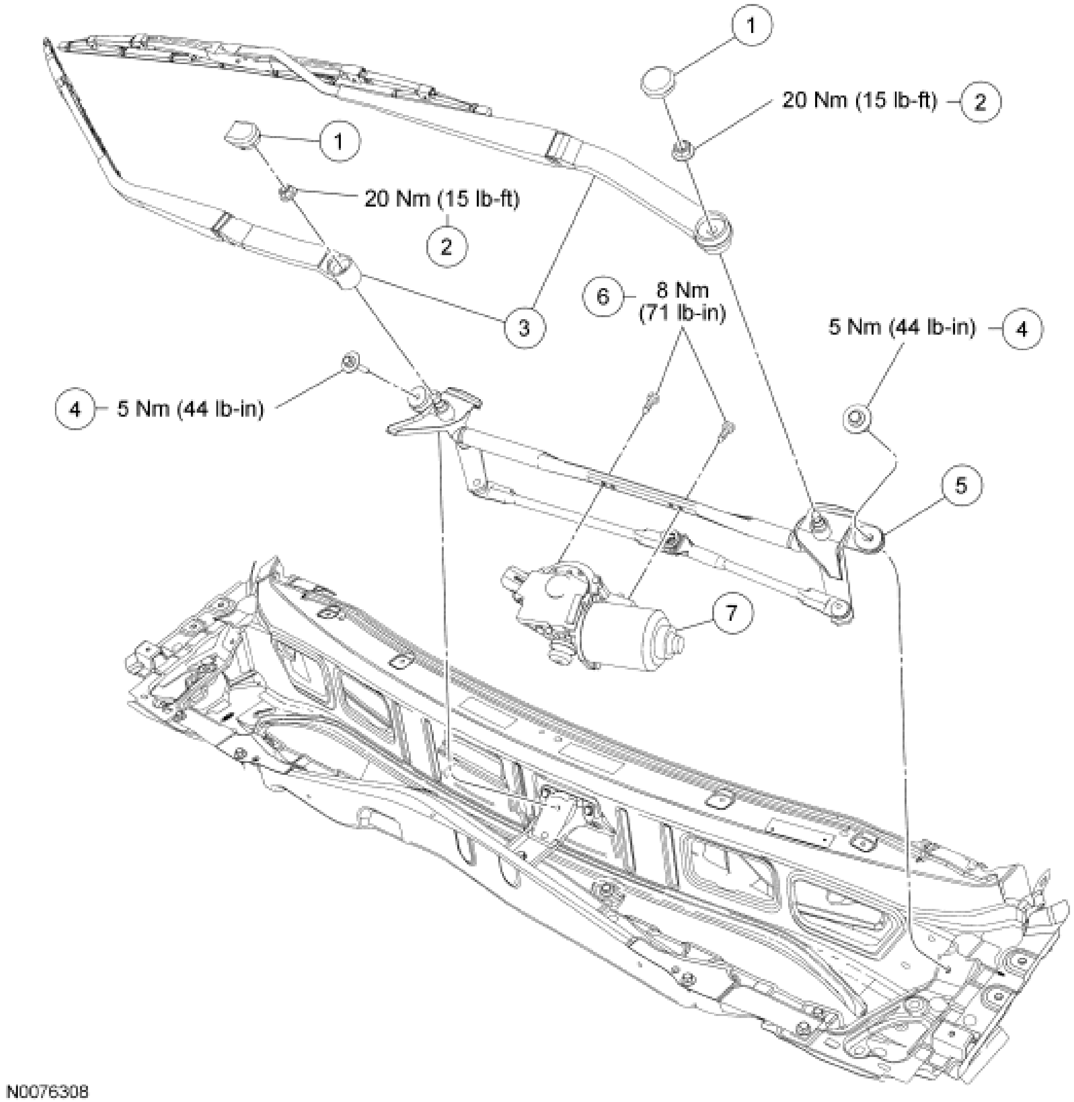


Fig. 31: Exploded View Of Windshield Wipers With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	17C526	Wiper pivot arm caps (2 required)
2	17D592	Wiper pivot arm nuts (2 required)
3	17C495 LH/ 17B589 RH	Wiper pivot arm assembly
4	W701121	Windshield wiper mounting arm and pivot shaft assembly bolts (2 required)
5	-	Windshield wiper mounting arm and pivot shaft assembly
6	-	Wiper motor-to-wiper mounting arm bolts (2 required)
7	-	Wiper motor assembly

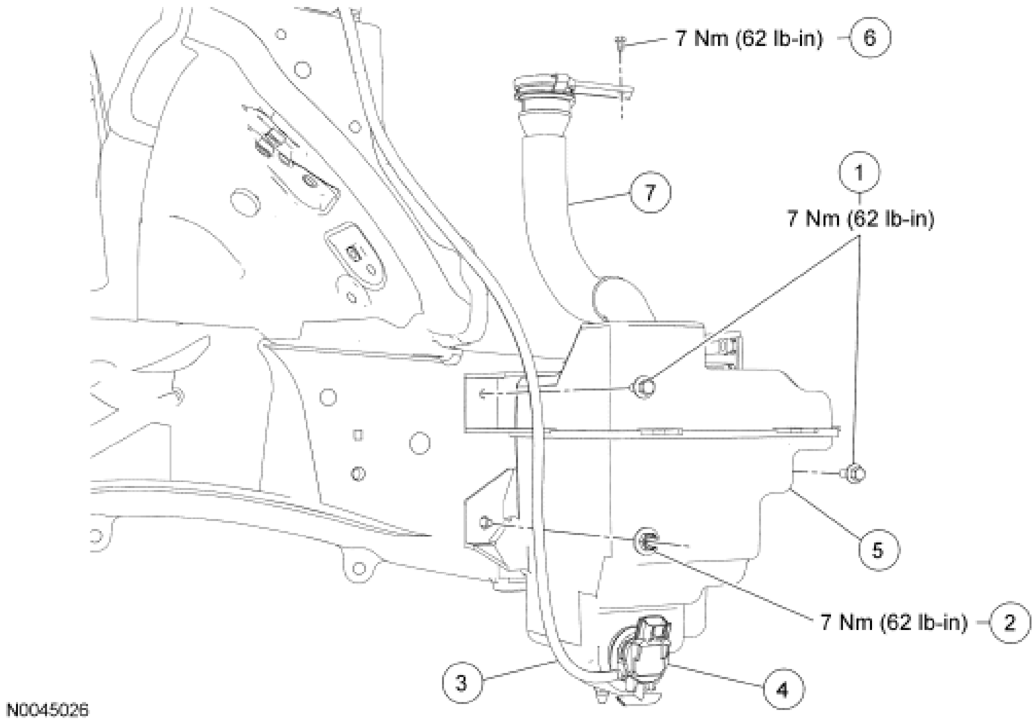


Fig. 32: Exploded View Of Washer Pump & Reservoir With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W505252	Windshield washer reservoir bolts (2 required)
2	W702751	Windshield washer reservoir nut
3	17A605	Windshield washer reservoir hose
4	-	Windshield washer pump
5	17618	Windshield washer reservoir
6	W500214	Windshield washer reservoir filler neck retaining bolt
7	N623332	Windshield washer reservoir filler neck

1. For additional information, refer to the procedures.

WIPER PIVOT ARM

REMOVAL AND INSTALLATION

1. Remove the wiper pivot arm cap.

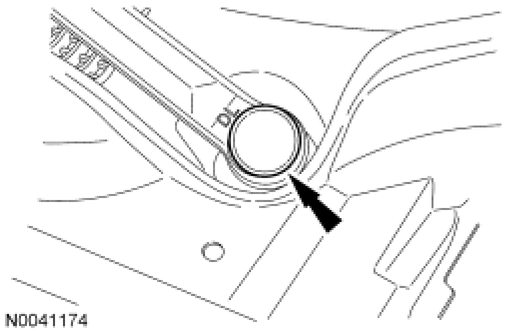


Fig. 33: Locating Wiper Pivot Arm Cap
Courtesy of FORD MOTOR CO.

2. Remove the wiper pivot arm retaining nut and the wiper pivot arm.
   - To install, tighten to 20 N.m (15 lb-ft).

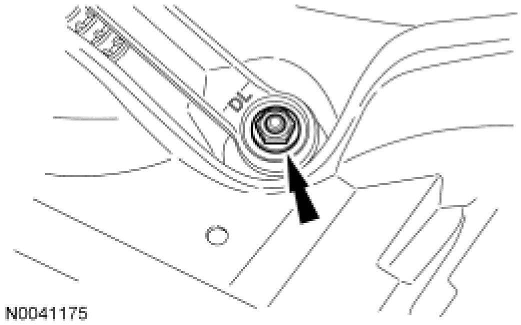


Fig. 34: Locating Wiper Pivot Arm Retaining Nut
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.

WIPER MOUNTING ARM AND PIVOT SHAFT

REMOVAL AND INSTALLATION

1. Remove the upper cowl panel grille. For additional information, refer to **FRONT END BODY PANELS** article.
2. Disconnect the windshield wiper motor electrical connector.
3. Remove the 2 windshield wiper mounting arm and pivot shaft assembly bolts and the windshield wiper mounting arm and pivot shaft assembly.
   - To install, tighten to 5 Nm (44 lb-in).

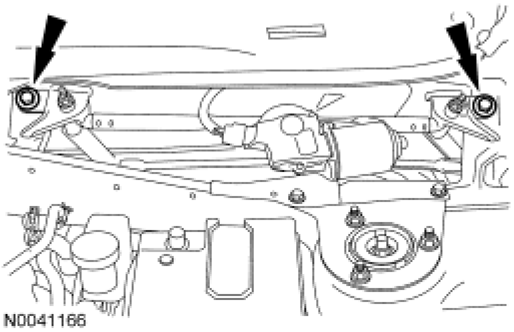


Fig. 35: Locating Pivot Shaft Assembly Bolts
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

WIPER MOTOR

REMOVAL AND INSTALLATION

1. Remove the wiper pivot arms. For additional information, refer to **Wiper Pivot Arm**.
2. Remove the windshield wiper mounting arm and pivot shaft. For additional information, refer to **Wiper Mounting Arm and Pivot Shaft**.
3. Remove the 2 drive rods from the motor crank arm ball joint.

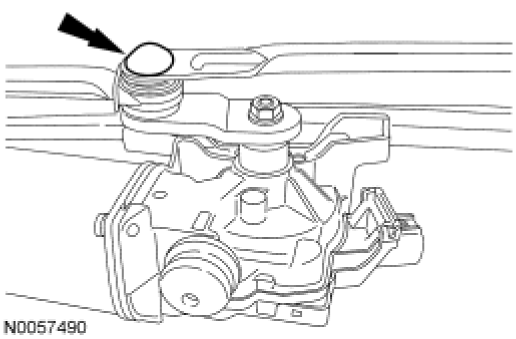


Fig. 36: Locating Motor Crank Arm Ball Joint
Courtesy of FORD MOTOR CO.

4. Remove the wiper motor-to-wiper mounting arm bolts and the wiper motor.
   - To install, tighten to 8 Nm (71 lb-in).
5. To install, reverse the removal procedure.

WASHER PUMP

Material

Item	Specification
Premium Quality Windshield Washer Fluid	

(Canada) CXC-37-(A, B, C, D, E, F, G, H) (Canada)	-
Premium Windshield Washer Concentrate (US) ZC-32-A or B (US)	WSB-M8B16-A2

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the RH front fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: When installing the windshield washer pump, be careful not to damage the rubber grommet.

NOTE: To prevent spilling windshield washer fluid, drain the windshield washer reservoir before washer pump removal.

3. Remove the windshield washer pump.
    1. Disconnect the electrical connector.
    2. Disconnect the hoses.
    3. Remove the windshield washer pump.

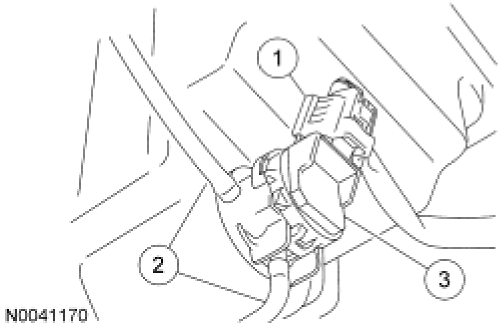


Fig. 37: Identifying Electrical Connector, Hoses And Windshield Washer Pump
Courtesy of FORD MOTOR CO.

CAUTION: Do not operate the windshield washer pump prior to filling the

windshield washer reservoir. Failure to follow these instructions may result in premature pump failure.

4. To install, reverse the removal procedure.
    - Fill the windshield washer reservoir with windshield washer fluid.

WASHER RESERVOIR

Material

Item	Specification
Premium Quality Windshield Washer Fluid (Canada) CXC-37-(A, B, C, D, E, F, G, H) (Canada)	-
Premium Windshield Washer Concentrate (US) ZC-32-A or B (US)	WSB-M816-A2

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the RH front fender splash shield. For additional information, refer to **FRONT END BODY PANELS** article.
3. Disconnect the windshield washer pump electrical connector.

WARNING: **Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.**

NOTE: **To prevent spilling windshield washer fluid, drain the windshield washer reservoir before removal.**

4. Disconnect the washer pump hose.
5. Remove the bolt and the windshield washer reservoir filler neck.
    - To install, tighten to 7 N.m (62 lb-in).
6. Remove the windshield washer reservoir fasteners and the windshield washer reservoir.
    - To install, tighten to 7 N.m (62 lb-in).

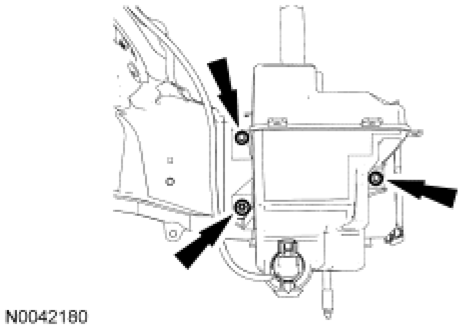


Fig. 38: Locating Windshield Washer Reservoir Fasteners
Courtesy of FORD MOTOR CO.

> **CAUTION: Do not operate the windshield washer pump prior to filling the windshield washer reservoir. Failure to follow these instructions may result in premature pump failure.**

7. To install, reverse the removal procedure.
   - Fill the windshield washer reservoir with windshield washer fluid.